

# RAJKOT MUNICIPAL CORPORATION

e - Tender No.RMC/ENGG/CZ/23-24/07



## Bid Documents For RENOVATION OF EXISTING ARVINDBHAI MANIYAR HALL, RAJKOT



| Milestone dates for e-tendering are as under                                                         |                                      |
|------------------------------------------------------------------------------------------------------|--------------------------------------|
| 1. Downloading of e-documents                                                                        | 13-09-23 To 03-10-23 upto 17.00 Hrs. |
| 2. Pre-bid meeting in the O/o CE                                                                     | 26-09-23 at 16:00 Hrs                |
| 3. Last date for online submission of e-Tender                                                       | 03-10-23 upto 17.00 Hrs.             |
| 4. Submission of EMD, Tender fee and other documents for verification by Regd.Post.A.D. / Speed Post | 06-10-23 Up to 18.00 Hrs.            |
| 5. Opening of Technical Bid                                                                          | 09-10-23 at 11.00 Hours onwards      |
| 6.Verification of submitted documents (EMD, e - Tender fee, etc.)                                    | 10-10-23 at 11.00 Hours onwards      |
| 7. Agency to remain present with original documents for verification                                 | 10-10-23 between 16.00 to 17.00 Hrs  |
| 8.Opening of Price Bid (For Technically qualified bidders only)                                      | 13-10-23 at 16.00 Hours onwards      |
| 9.Bid Validity                                                                                       | 180 Days                             |

**2023-24**

**ADDL. CITY ENGINEER  
RAJKOT MUNICIPAL CORPORATION  
DR. AMBEDKAR BHAWAN  
CENTRAL ZONE, DHEBARBHAI ROAD,  
RAJKOT - 360001 (GUJARAT)**

# **RAJKOT MUNICIPAL CORPORATION**

## **BID DOCUMENT FOR**

### **RENOVATION OF EXISTING ARVINDBHAI MANIYAR HALL, RAJKOT**

#### **PART-I**

- Section-1 Invitation to Bid, Instructions to Bidders and Formats.
- Section-2 General Conditions of Contract & Special Condition of contractor

#### **PART-II**

- Section-3 Technical Specifications

- a. Civil, Interior, Furniture & Plumbing Work
- b. Fire Fighting System
- c. Electrical & ELV Work
- d. HVAC Work

#### **PART-III**

- Bill of Quantities & Tender Drawing

#### **PART-IV**

- a. Nomination
- b. Operation & Maintenance (O&M - Electrical, ELV & HVAC 5 Years)
- c. Put to Tender, not put to tender, Above & Below Performa

## ABBREVIATIONS

Statement showing the details of abbreviations

| Full Form                                 | Abbreviation |
|-------------------------------------------|--------------|
| ADDL. CITY ENGINEER                       | ACE          |
| Operation and Maintenance                 | O&M          |
| Net Present Value                         | NPV          |
| Engineering Procurement and Construction  | EPC          |
| Paschim Gujarat Vij Co. Ltd.              | PGVCL        |
| Critical Path Method                      | CPM          |
| Reinforced Cement Concrete                | RCC          |
| High Ground Level Reservoir               | HGLR         |
| Kilometer                                 | KM           |
| Mild Steel                                | MS           |
| Bureau of Indian Standard                 | BIS          |
| American Water Works Association          | AWWA         |
| American Petroleum Industries             | API          |
| Million Liter per Day                     | MLD          |
| High Yield Strength Deformed bar          | HYSD         |
| Corrosion Resistance Steel                | CRS          |
| Ordinary Portland Cement                  | OPC          |
| American Standard for Testing of Material | ASTM         |
| Flux Compensated Magnetic Amplifier       | FCMA         |
| Cost Insurance and Freight                | CIF          |
| Free On Board                             | FOB          |
| EX – Works                                | EXW          |

# **PART - I**

## **SECTION - 1**

### **INVITATION FOR BIDS**

**RAJKOT MUNICIPAL CORPORATION**  
**e-TENDER NOTICE**

The e-Tenders are invited with two bid system by e-Tendering from the experienced contractors registered in GWSSB / State Government / Central Government / Semi Government in appropriate class for below mentioned work:

| Sr No | Name of work                                                                                                      | a) Estimated cost in Rs.<br>b) EMD<br>c) E-TENDER fee<br>d) Time limit for completion of work |
|-------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1     | RENOVATION OF EXISTING ARVINDBHAI MANIYAR HALL, RAJKOT (RE-TENDER)<br><br><b>e-TENDER No.RMC/ENGG/CZ/23-24/07</b> | a) Rs.3,49,00,000/-<br>b) Rs.3,49,000/-<br>c) Rs.7,500/-<br>d) 11 Months                      |

| Milestone dates for e-tendering are as under                                                         |                                      |
|------------------------------------------------------------------------------------------------------|--------------------------------------|
| 1. Downloading of e-documents                                                                        | 13-09-23 To 03-10-23 upto 17.00 Hrs. |
| 2. Pre-bid meeting in the O/o CE                                                                     | 26-09-23 at 16:00 Hrs                |
| 3. Last date for online submission of e-Tender                                                       | 03-10-23 upto 17.00 Hrs.             |
| 4. Submission of EMD, Tender fee and other documents for verification by Regd.Post.A.D. / Speed Post | 06-10-23 upto 18.00 Hrs.             |
| 5. Opening of Technical Bid                                                                          | 09-10-23 at 11.00 Hours onwards      |
| 6.Verification of submitted documents (EMD, e - Tender fee, etc.)                                    | 10-10-23 at 11.00 Hours onwards      |
| 7. Agency to remain present with original documents for verification                                 | 10-10-23 Between 16.00 to 17.00 Hrs  |
| 8.Opening of Price Bid (For Technically qualified bidders only)                                      | 13-10-23 at 16.00 Hours onwards      |
| 9.Bid Validity                                                                                       | 180 Days                             |

1. All bidders must submit Bid security (EMD) as above either directly deposited in ICICI Bank Account No.015305010638 (Rajkot Municipal Corporation) IFSC Code ICIC0000153 or submit at the below mentioned address in form of Demand Draft in favour of "Rajkot Municipal Corporation", Rajkot, from any Nationalized Bank or Scheduled Bank (except Co-operative Bank) in India. The receipt of professional tax paid for current year, address proof, tender appendix details and ID proof shall have to be submitted along with physical submission of required documents shall have to be done at the below mentioned address:

*Office of the* ADDL. CITY ENGINEER  
Rajkot Municipal Corporation,  
DR. AMBEDKAR BHAWAN,  
CENTRAL ZONE Office,  
DHEBARBHAI ROAD,  
Rajkot-360001 (Gujarat)

2. The e-tender fee will be accepted in form of Demand Draft only in favor of "Rajkot Municipal Corporation" Rajkot, from any Nationalized or Scheduled Bank (except Co-operative Bank) in India and must be delivered to above address.

3. **The prequalification requirement is as under:**

i) **Financial Criteria:**

1. An average annual turnover of seven years should not be less than 50% of tender amount.
2. Working capital should not be less than 25% of the estimated amount.
3. Bidder must have minimum "A" Class registration
4. Minimum amount of solvency should be Rs.75.00 lakhs

ii) **Experience Criteria:**

The bidder should possess following minimum experience:

1. Bidder should have completed at least one work of similar nature amounting to **60 % OR** two works amounting to **40 % OR** three works amounting to **30 %** of tender amount in last seven years either in government or Semi-government as a main contractor.
2. Successful experience Similar nature work (Renovation of Building Work or Construction of New Building).
3. Bidder should have enough machinery and experienced personnel to supervise the work.
4. Civil Agency (lead agency) must be do MOU with electrical contractor for the electrical/HVAC work/lift
  - ✓ Electrical contractor must have valid Electrical Contractor License.
  - ✓ The bidder must have valid registration in **"D and Above"** Class and above in the Electrical Department of R&B, Govt. of Gujarat.
  - ✓ Electrical contractor must have experience of the similar nature of work in the Govt. and/or Semi Govt. Dept.

Civil Agency (lead agency) must submit all above documents and MOU latter in physical submission, with duly sign and stamp.

Electrical Agency (lead agency) With HVAC Agency must submit all above documents and MOU latter in physical submission, with duly sign and stamp.

**Note:** Enhancement factor at 10 % per year will be applicable to arrive at average annual turnover and finalize the magnitude of work done in last seven years.

| Sr | Year                       | Enhance factor |
|----|----------------------------|----------------|
| 1  | Current Year (2023-24)     | 1.00           |
| 2  | Current Year - 1 (2022-23) | 1.10           |
| 3  | Current Year - 2 (2021-22) | 1.21           |
| 4  | Current Year - 3 (2020-21) | 1.33           |
| 5  | Current Year - 4 (2019-20) | 1.46           |
| 6  | Current Year - 5 (2018-19) | 1.61           |
| 7  | Current Year - 6 (2017-18) | 1.77           |
| 8  | Current Year - 7 (2016-17) | 1.95           |

4. The contractor shall have to quote their rates including GST and other taxes and the Invoice with break-up of GST is to be submitted accordingly, failing which, such amount will be deducted from the bill of the agency and deposited accordingly.

The contractor shall have to purchase the material required for this tender work, only from the supplier having registered GST Number. RMC will not be responsible to pay any amount towards GST if the material is purchased from the unregistered supplier / not having GST Number.

5. **The bidder(s) submitting the tender shall also have to submit the copy of ESIC & EPF Registration document along with the other documents, duly self-attested, failing which, the tender of such bidder(s) will be considered as non-responsive and their online price bid will not be opened.**
6. The Tender of those bidder(s) those who fails to submit the required documents for verification within the stipulated date and time, will be treated as non-responsive and their Price Bid will not be opened. The physical submission of required documents received after the prescribed date and time will be out rightly rejected.
7. The bidder should not have been Black Listed, suspended, terminated, backed out, debarred & delisted by any Municipal Body / Urban Local Body / Development Authority in any State Government Body or undertaking / any department or undertaking of Government of India, since inception of the firm / Company. Such a case will be rejected out rightly. A Declaration in this regard on Rs.300/- Stamp Paper duly Notarized shall have to be submitted as per Annexure along with the tender documents. Submission of the bid document without such Notarized declaration will be rejected out rightly.
8. The bidder should provide accurate information on any litigation history or arbitration resulting from contracts completed or under execution by him over the last ten years. This should also include such cases, which are in process / Progress. A consistent history of awards against the bidder may result in failure of the bid. In case the bidder has not provided such information and has come to the notice of the authority, the tender will be rejected at what so ever stage and in such case all the losses that will arise out of this issue will be recovered from the bidder and he will not have any defense for the same.
9. After opening of Technical Bid, the procedure for the pre-qualification shall be adopted and the Price Bid of only successful qualified bidder shall be opened for final evaluation of the contract. The decision of Municipal Commissioner regarding the pre- qualification shall be final and binding to all the bidders.
10. Conditional Tenders will be out rightly rejected.
11. If no agency remains present and are no points for Prebid meeting, "NIL" minutes to be considered and the same will not be uploaded.
12. Commissioner, Rajkot Municipal Corporation, Rajkot, reserves the right to accept / reject any or all e-tender(s) without assigning any reasons thereof.

**ADDL. CITY ENGINEER  
Rajkot Municipal Corporation**

# ELIGIBILITY CRITERIA



### 1. Experience Criteria:

The bidder should possess following minimum experience:

1. Bidder should have completed at least one work of similar nature amounting to **60% OR** two works amounting to **40% OR** three works amounting to **30%** of tender amount in last seven years either in or Semi-government as a main contractor.
2. Successful experience Similar nature work (Renovation of Building Work or Construction of New Building).
3. Bidder should have enough machinery and experienced personnel to supervise the work.

### 2. Financial Criteria

- (1) An average annual turnover of seven financial years should not be less than 50% of estimated tender amount.
- (2) Working capital should not be less than 25% of the estimated tender amount.
- (3) Solvency must not be less than Rs.75.00 Lakh
- (4) Available bid capacity- ABC must be more than the estimated tender amount. The bidding capacity shall be worked out using the following formula:

Bidding capacity =  $[2 * A * N] - B$  = \_\_\_\_\_ (to be filled by Applicant)

**Where,**

**A** = Maximum value of works executed in any one year during the last seven years (updated to .....\* price level) taking into account the completed as well as works in progress.

**N** = Number of years prescribed for completion of the works for which tenders are invited.

**B** = Value (...\* price level) of existing commitments and on-going works to be completed during that next **N** year (period of completion of the works for which the tenders are invited)

### 3. Enhancement Factor

Following enhance factor for respective year will be considered to arrive at current financial year:

| Sr | Year                       | Enhance factor |
|----|----------------------------|----------------|
| 1  | Current Year (2023-24)     | 1.00           |
| 2  | Current Year - 1 (2022-23) | 1.10           |
| 3  | Current Year - 2 (2021-22) | 1.21           |
| 4  | Current Year - 3 (2020-21) | 1.33           |
| 5  | Current Year - 4 (2019-20) | 1.46           |
| 6  | Current Year - 5 (2018-19) | 1.61           |
| 7  | Current Year - 6 (2017-18) | 1.77           |
| 8  | Current Year - 7 (2016-17) | 1.95           |

#### **4. Litigation History**

The bidder should provide accurate information on any litigation history or arbitration resulting from contracts completed or under execution by him over the last seven years. This should also include such cases, which are in process/progress. A consistent history of awards against the bidder or any partner of a joint venture may result in failure of the bid. In case the bidder has not provided such information and has come to the notice of the Authority, the tender will be rejected at whatsoever stage and in such case all the losses that will arise out of this issue will be recovered from the Bidder/contractor and he will not have any defense for the same.

#### **5. Even though the bidders meet the above criteria, they are subject to be rejected, if they have:**

Misleading or false representation made in the form, statements and attachments Submitted And / Or having poor performance record such as abandoning the work, improper completion of contract, inordinate delays in completion, litigation history, financial failures, etc.

#### **6. Brand names**

Specific reference in the specifications any materials by manufacturer's name (as per the prevailing list of GWSSB), or catalogue shall be constructed as establishing a standard or quality and performance and not as limiting competition, and the Bidder in such cases, will not at his option freely use only other product

**ADDL. CITY ENGINEER  
Rajkot Municipal Corporation**

**Name and signature of Bidder**

# **INSTRUCTIONS TO BIDDERS**

## **INSTRUCTIONS TO BIDDER**

### **IT 1. GENERAL**

The contract documents may be secured in accordance with the Notice Inviting E-TENDER for the work called. The work shall include supply of materials necessary for construction of the work.

### **IT 2. INVITATION TO E-TENDER**

The Rajkot Municipal Corporation hereinafter referred as the Corporation will receive e-Tenders for the work of as per the specifications and schedule of prices in the e-Tender document. The e-Tenders shall be opened online as specified in the e-Tender notice in the presence of interested Bidders or their representatives. The Corporation reserves the right to reject the lowest or any other or all e-Tenders or part of it which in the opinion of the Corporation does not appear to be in its best interest, and the Bidder shall have no cause of action or claim against the Corporation or its officers, employees, successors or assignees for rejection of his e-Tender.

### **IT 3. LANGUAGE OF e-TENDER**

E-TENDERS shall be submitted in English, and all information in the e-Tender shall also be in English, Information in any other language shall be accompanied by its translation in English. Failure to comply with this may make the e-Tender liable to rejection.

### **IT 4. QUALIFICATIONS OF BIDDERS**

- A. The Bidders shall abide by the laws of the Union of India and of Gujarat State and legal jurisdiction of the place where the works are located.
- B. The Bidder shall furnish a written statement of financial and technical parameters with details and documents along with his e-Tender which contains namely as below:
  - i. The Bidder's experience in the fields relevant to this contract.
  - ii. The Bidder's financial capacity/resources and standing over at least 7 (Seven) years.
  - iii. The Bidder's present commitments (Jobs on hand).
  - iv. The Bidder's capability and qualifications of himself and his regular staff etc.
  - v. Plants and Machinery available with the Bidder for the work e-Tendered.
- C. The Bidder shall furnish original documents on the date mentioned in tender notice. The bid for those bidders will be treated as non-responsive who failing to produce original documents on specified date.

### **IT 5. e -TENDER DOCUMENTS**

The e-Tender documents and drawings shall comprehensively be referred to as e-TENDER document. The several sections form in the document are the essential parts of the contract and a requirement occurring in one shall be as binding as though occurring in all, they are to be taken as mutually, explanatory and describe and provide for complete works.

### **IT 6. EXAMINATION BY BIDDERS**

- A. At this own expense and prior to submitting his e-Tender, each Bidder shall (a) examine the Contract Documents, (b) visit the site and determine local conditions which may affect the work including the prevailing wages and other pertinent cost factors, (c) familiarize, himself with all central, state and local laws, ordinance, rules regulations and codes affecting the material supply including the cost of permits and licenses required for the work and (d) correlate his observations, investigations, and determinations with the requirements of the e-TENDER Documents, site & subsoil investigation.

- B. The e-Tender is invited on. **% . rate** and contractor shall have to quote his price on % bases **above or below in the schedule -B. / Price Schedule**. The works shall have to be completed in all respect as stated in the e-Tender document to the satisfaction of the Corporation.
- C. The following comprises in Contract Documents at a price of **Rs.7,500-00**.

**e-TENDER Document:**

**Part-I**

1. Notice inviting Bidders.
2. Instructions to the Bidder.
3. Formats
4. General conditions of contract & Special Condition of Contractor

**Part-II**

Technical specifications

- a. Civil, Interior, Furniture & Plumbing Work
- b. Fire Fighting System
- c. Electrical & ELV Work
- d. HVAC Work

**Part-III**

- a. Bid Form (With Price)
- b. Preamble to Price schedule
- c. Price Schedule (Schedule-B)

**Part-IV**

- a. Nomination
- b. Operation & Maintenance (O&M – Electrical, ELV, & HVAC 5 Years)
- c. Put to Tender not put to tender, above & Below Performa

Copy of the E-TENDER Document should be completed, checked in a responsible manner, digitally signed, and submitted. Security Bond shall be submitted in person by the stipulate date, which shall form the e-Tender.

The e-Tender is required to complete with all the pages in which entries are required to be made by the Bidder are contained in the e-Tender documents and the Bidder shall not take out or add to or amend the text of any of the documents except in so far as may be necessary to comply with any addenda issued pursuant to Clause IT.17 hereof.

**IT 7. EARNEST MONEY DEPOSIT:**

- A. Each Bidder must submit a receipt of deposit as Tender guarantee towards **Earnest money** amounting to **Rs.3,49,000 /-** in the form of crossed Demand Draft in favor of "Rajkot Municipal Corporation", from any Scheduled bank (except Co-operative Bank) in India acceptable to owner payable at Rajkot. The Tender Bond, shall be valid for a period of not less than **180 Days** from the date the e-Tenders are opened and shall comply with the requirements for Bond as stipulated in the General conditions of contract. The Tender guarantee bond will be held by the owner as a guarantee that the Bidder, if awarded the contract, will enter into the contract agreement in good faith and furnish the required bonds. Any e-Tender not accompanied by a Tender guarantee in the form of earnest money deposited for the sum stipulated in the e-Tender Document will be summarily rejected.
- B. The Earnest Money Deposit will be refunded to the unsuccessful Bidders after an award has been finalized.

- C. The Earnest Money Deposit (Tender Guarantee) will be forfeited in the event, the successful Bidder fails to accept the contract and fails to submit the "Performance Guarantee Bonds to the Owner as stipulated in this e-Tender documents within ten days. (10) Days after receipt of notice of award of contract.
- D. The Earnest Money Deposit of the successful Bidder shall be returned after the performance guarantee bond, as required, is furnished by the contractor.
- E. No interest shall be paid by the owner on any e-Tender guarantee.

**IT 8. INCOME TAX CLEARANCE CERTIFICATE: (DELETED):**

Latest Income Tax Clearance Certificates must accompany with the e-Tender without which the e-Tender is liable to be summarily rejected. The Income Tax Clearance Certificate obtained from the Income Tax Officer shall clearly indicate the Income Tax Pan No/Circle/Ward, District and the reference number of the assessment along with the assessment year.

**IT 9. PREPARATION OF e-TENDER DOCUMENTS**

Bidders are required to note the following while preparing the e-TENDER Documents:

- A. e-TENDER shall be submitted on the e-TENDER form bound here in English. All statements shall be properly filled in. Numbers shall be stated both in words and in figures where so indicated.
- B. All entries or prices and arithmetic shall be checked before submission of the e-TENDER. If there is discrepancy between the rates quoted in figures and in words, the rates expressed in words shall be considered as binding.
- C. Each e-Tender shall be accompanied by the prescribed e-Tender security bond and other required documents and drawings. All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be stated below their signature.
- D. Variation to the contract Documents requested by the Bidder may be affixed and duly signed and stamped. Such variations may be approved or refused by the Corporation is not obliged to give reason for his decisions.

**IT 10. SUBMISSION OF e-TENDER DOCUMENTS**

Bidders are requested to submit the e-TENDER Documents on following lines.

- A. Volume containing following documents:
  - I. Earnest Money Deposit.
  - II. Certificates as registered contractor in appropriate class with Government of Gujarat or appropriate authority.
  - III. Bidder's financial capability statement including last three years Income tax returns, balance sheet, duly signed by registered chartered account.
  - IV. Bidder's experience in the field relevant to this contract.
  - V. A list of the equipment the Bidder possesses and that which he proposed to acquire and use for the purpose related to the work.

The time limit for receipt of e-Tender shall strictly apply in all cases. The Bidders should therefore ensure that their e-Tender is received by the competent authority **The Rajkot Municipal Corporation** at before expiry of the time limit. No delay on account of any cause for receipt of e-Tender shall be entertained.

The e-Tender must contain the name address of residence and place of business of the person or persons submitting the e-Tender and must be digitally signed.

e-TENDER by partnership firm must be furnished with the full names and addresses of all partners and be signed by one of the members of the partnership or by a legally authorized representative holding power of attorney followed by signature and designation of the person of person signing.

e-TENDER by Corporations/Companies must be signed with the legal name of the Corporation/Companies by the president/or by the secretary or other person or persons legally authorized to bind the Corporation/Company in the matter.

**IT 11 TENDER VALIDITY PERIOD**

The validity period of the e-Tender submitted for this work shall be of **180 Days** from the date of opening of the e-Tender and that the Bidder shall not be allowed to withdraw or modify the e-Tender offer on his own during the validity period. The Bidder will not be allowed to withdrawn the e-Tender or make any modifications or additions in the terms and conditions on his own e-Tender. If this is done then the owner shall, without prejudice to any other right or remedy, be at liberty to reject the e-Tender and forfeit the earnest money deposit in full.

**IT 12 GENERAL PERFORMANCE DATA**

Bidder shall present all the information which sought for in the e-Tender document in form of various schedules if given. e-TENDERS may not be considered if left blank or the schedules are not properly filled in.

**IT 13 SIGNING OF e-TENDER DOCUMENTS**

If the Tender is made by an individual, it shall be signed with his full name above his current address. If the Tender is made by a proprietary firm, it shall be signed by the proprietor above his name and the name of his firm with his current address.

If the e-Tender is made by a firm in partnership, it shall be signed by all the partners of the firm above their full names and current address, or by a partner holding the power of attorney for the firm, in which case a certified copy of the power of attorney shall accompany the e-TENDER. A certified copy of the partnership deed, current addresses of all the partners of the firm shall also accompany the e-Tender.

If the e-Tender is made by a limited company or a limited corporation, it shall be signed by a duly authorized person holding the power of attorney, shall accompany the e-Tender. Such limited company or corporation may be required to furnish satisfactory evidence of its existence before the contract is awarded.

If the e-TENDER is made by a group of firms, the sponsoring firm shall submit complete information pertaining to each firms in the group and state along with the bid as to which of the firms shall have the responsibility for e-Tendering and for completion of the contract documents and furnish evidence admissible in law in respect of the authority to such firms on behalf of the group of firms for e- Tendering and for completion of contract documents. The full information and satisfactory evidence pertaining to the participation of each member of the group of firms in the e-Tender shall be furnished along with the e-Tender.

All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be stated below their signatures. All the signatures in the e-Tender document shall be dated.

**IT 14 WITHDRAWAL OF TENDERS**

If, during the tender validity period, the Bidder withdraws his Tender, Tender security (Earnest Money) shall be forfeited and Bidder will be debarred for next three years to quote in R.M.C.

**IT 15 INTERPRETATIONS OF e-TENDER DOCUMENTS**

Bidders shall carefully examine the e-TENDER Document and fully inform themselves as to all the conditions and matters which may in any way affect the work or the cost thereof. If a Bidder finds discrepancies, or omission from the specifications or other documents or should be in doubt as to their meaning, he should at once address query to the ADDL. CITY ENGINEER, R.M.C. The result of interpretation of the e-TENDER will be issued as addendum.

**IT 16 ERRORS AND DISCREPANCIES IN e-TENDERS**

In case of conflict between the figures and words in the rates the rate expressed in words shall prevail and apply in such cases.

**IT 17 MODIFICATION OF DOCUMENTS**

Modification of specifications and extension of the closing date of the e-Tender, if required will be made by an addendum. Each addendum will be made available online to all Bidders. These shall form a part of e-Tender. The Bidder shall not add to or amend the text of any of the documents except in so far as may be necessary to comply with any addendum.

**ADDENDA**

Addenda form part of the Contract Documents, and full consideration shall be given to all Addenda in the preparation of e-Tender. Bidders shall verify the number of Addenda issued, if any and acknowledge the receipt of all Addenda in the e-TENDER Failure to so acknowledge may cause the e-Tender to be rejected.

A. The Owner may issue Addenda to advise Bidders of changed requirements. Such addenda may modify previously issued Addenda.

B. No addendum may be issued after the time stated in the notice inviting e - Tenders.

**IT 18 TAX AND DUTIES ON MATERIALS**

All charge on account of excise duties, Central / State, sales tax, work contract tax and other duties etc. on materials obtained for the works from any source shall be borne by the contractors. No (P) or 'C' or 'D' form shall be supplied.

**IT 19 EVALUATION OF E - TENDERS**

While comparing e-Tenders, the Rajkot Municipal Corporation shall consider factors like price offer is workable with the market price, efficiency and reliability of construction method proposed, compliance with the specifications, relative quality, work done in past with Rajkot Municipal Corporation or other Government Organizations, litigation issues etc. Evaluation criteria specifically mentioned in the specification will also be taken into consideration in the evaluation of e- Tenders.

**IT 20 TIME REQUIRED FOR COMPLETION**

The completion period mentioned in this schedule is to be reckoned from the date of notice to proceed. Total completion period is **11 Months** from the date of issue of notice to proceed and contractor should adhere to this completion time. Monsoon period from 1<sup>st</sup> July to 30<sup>th</sup> September will be considered as non-working period and hence excluded in time limit.

**IT 21 POLICY FOR TENDER UNDER CONSIDERATION**

TENDER shall be termed to be under consideration from the opening of the e - Tender until such time any official announcement or award is made.



While e-Tenders are under consideration, Bidders and their representative or other interested parties are advised to refrain from contacting by any means any corporations personnel or representatives on matters related to the e-Tenders under study. The Corporation's representatives if necessary, will obtain clarification on e-Tenders by requesting such information from any or all the Bidders, either in writing or through personal contact, as may be necessary. The Bidder will not be permitted to change the substance of his e-Tender after e-Tenders have been opened. This includes any post Tender price revision. Non-compliance with this provision shall make the Tender liable for rejection.

#### **IT 22 PRICES AND PAYMENTS**

The Bidder must understand clearly that the prices quoted are for the total works or the part of the total works quoted for and include all costs due to materials, labour, equipment, supervision, other services, royalties, taxes etc. and to include all extra to cover the cost. No claim for additional payment beyond the prices quoted will be entertained and the Bidder will not be entitled subsequently to make any claim on any ground.

#### **IT 23 PAYMENT TERMS**

The terms of payment are defined in the General Conditions of Contract and Technical specifications. The Corporation shall not under any circumstances relax these terms of payment and will not consider any alternative payment terms. Bidders should therefore in their own interest note this provision to avoid rejection of their e-Tenders.

#### **IT 24 AWARD**

Award of the contract or the rejection of e-TENDERS will be made during the Tender validity period. A separate Schedule-B (Price Schedule) is given. The contractors are requested to quote their price offer **in % below or above on the given price in the schedule-B of Price Schedule only.**

- A. After all contract contingencies are satisfied and the Notice of Award is issued, the successful Bidder shall execute the Contract Agreement within the time stated and shall furnish the Bond as required herein. The contract Agreement shall be executed, in form stipulated by the Owner.
- B. If the Bidder receiving the Notice of Award fails or refuses to execute the Contract Agreement within the stated time limit or fails or refuses to furnish the Bond as required herein. The Owner may annul his award and declare the e-Tender security forfeited and will take action as deemed fit.
- C. A corporation, partnership firm or other consortium acting as the Bidder and receiving the award shall furnish evidence of its existence and evidence that the officer signing the contract agreement and Bonds for the corporation, partnership firm or other consortium acting as the Bidder is duly authorized to do so.

#### **IT 25 SIGNING OF CONTRACT**

The successful Bidder shall be required to execute the contract agreement within 10 days of receipt of intimation to execute the contract, failing which the Corporation will be entitled to annul the award and forfeit the Earnest Money Deposit. The person to sign the contract document shall be person as detailed in Article IT.13 (signing of e-Tender documents).

**IT 26 DISQUALIFICATION**

- A e-Tender shall be disqualified and will not be taken for consideration if,
- (a) The Tender fee and Tender Earnest Money Deposit is not deposited in full and in the manner as specified as per Article IT.7 i.e., Earnest Money Deposit.
  - (b) The e-Tender is in a language other than English or does not contain its English Translation in case of other language adopted for e-Tender preparation.
  - (c) The e-Tender documents are not signed by an authorized person (as per Article IT. 13 i.e., signing of e-Tender documents).
  - (d) The general performance data for qualification is not submitted fully (as per Article IT 12 i.e., General performance Data).
  - (e) Bidder does not agree to payment terms defined as per Article IT. 23 i.e., payment terms.

**A. A e-Tender may further be disqualified if,**

- (a) Price variation is proposed by the Bidder on any principle other than those provided in the e-TENDER Documents.
- (b) Completion schedule offered is not consistent with the completion schedule defined and specified in e-Tender document.
- (c) The validity of e-Tender bond is less than that mentioned in Article IT. 11 i.e., e-Tender validity period.
- (d) Any of the page or pages of e-Tender is/are removed or replaced.
- (e) Any conditional tender.

**IT 27 PERFORMANCE GUARANTEE (SECURITY DEPOSIT)**

As a contract security the Bidder to whom the award is made shall furnish a performance guarantee (Security deposit) for the amount of **5%** of the contract price to guarantee the faithful performance, completion and maintenance of the works of the contract in accordance with all conditions and terms specified herein and to the satisfaction of the Engineer-in-charge and ensuring the discharge of all obligations arising from the execution of contract in the forms mentioned below:

A fixed deposit receipt of any Schedule Bank or Nationalized Bank (except Co-operative Bank) duly endorsed in favour of the **Rajkot Municipal Corporation, Rajkot.**

The performance guarantee shall be delivered to the Corporation within ten (10) days of the notice of award and at least three (3) days before the contract agreement is signed unless otherwise specified by the Engineer-in-charge. Alternatively, the contractor may at his option deposit an amount of **2.5%** of the value of the contract price within ten days and the balance **2.5%** to be recovered in installments through deduction @ the rate of 10% from the running account bills. It is further clarified that Performance Guarantee (SD) for extra work will also be recovered @ 10% from the bill of extra work i.e., works beyond tender amount.

On due performance and completion of the contract in all respects, **THE PERFORMANCE GUARANTEE (SECURITY DEPOSIT) WILL BE RELEASED TO THE CONTRACTOR WITHOUT ANY INTEREST AFTER DEFECT LIABILITY PERIOD IS OVER.**

**IT 28 STAMP DUTY**

The successful Tenderer shall have to enter into an agreement on a non-judicial stamp paper of amount as per Stamp Duty Act in the form of the agreement approved by the Corporation. The cost of stamp paper and adhesive stamp shall be borne by the contractor.

**IT 29 BRAND NAMES**

Specific reference in the specifications to any material by manufacturer's name, or catalogue shall be constructed as establishing a standard or quality and performance and not as limiting competition and the Bidder in such cases, may at his option freely use only other product, provided that it ensures an equal of higher quality than the standard mentioned and meets Corporation approval.

**IT 30 NON TRANSFERABLE**

e-TENDER documents are not transferable.

**IT 31 COST OF e-Tendering**

The owner will not defray expense incurred by Bidders in e - Tendering.

**IT 32 EFFECT OF e-Tender**

The e-Tender for the work shall remain for a period of 180 Days from the date of opening of the e-Tenders for this work and that the Bidder shall not be allowed to withdraw or modify the offer in his own during the period. If any Bidder withdraws or makes any modification or additions in the terms and conditions of his own e-Tender, then the Corporation shall, without prejudice to any other right or remedy, be at liberty to reject the e-Tender and forfeit the earnest money in full.

**IT 33 CHANGE IN QUANTITY**

The Corporation reserves the right to waive any information in any e-Tender and to reject one or all e-Tenders without assigning any reasons for such rejection and also to vary the quantities of items or group as specified in the scheduled of prices as may be necessary.

**IT 34 NEW EQUIPMENT AND MATERIAL**

All materials, equipment and spare parts thereof shall be new, unused and originally coming from manufacturer's plant to the Corporation. The rebuilt or overhauled equipment/materials will not be allowed to be used on works.

**IT 35 RIGHTS RESERVED**

The owner reserves the right to reject any or all e-Tenders, to waive any informality or irregularity in any e-Tender without assigning any reason. The owner further reserves the right to withhold issuance of the notice to proceed, even after execution of the contract agreement. No payment will be made to the successful Bidder on account of such withholding. The owner is not obliged to give reasons for any such action.

**IT 36 ADDITIONAL RIGHTS RESERVED**

The Commissioner, Rajkot Municipal Corporation, reserves right to reduce the scope of work & split the e-Tender on two or more parts without assigning any reason even after the awards of contract.

**IT 37 MOBILIZATION ADVANCE**

No mobilization advance or advance on machinery will be given.

**IT 38 CONDITIONAL e-Tenders**

The scope of work is clearly mentioned in the e-Tender documents. The contractor shall have to carry out the work in accordance with the detail's specifications. No condition will be accepted. The conditional e-Tender will liable to be rejected.

**IT 39 CESS & REGISTRATION:**

For the welfare of labour working under construction Industry, the agency shall have to take the registration with competent authority as per Circular No.CWA/2004/841/M-3 dated 30-01-2006 of Government of Gujarat. Rajkot Municipal Corporation will deduct prevailing CESS of the value of work and will deposit the same in Government.

**IT 40 ESI REGISTRATION:**

The contractors who are liable to be registered under ESI Act must possess ESI registration number at the time of filling of tender. The agency should follow all the rules and regulations of ESI Act as per prevailing norms.

**IT 41 PROFESSIONAL TAX**

The bidder shall have to pay the Professional Tax for current financial year imposed by Government of Gujarat, and also the bidder shall have to produce Enrollment Certificate for the same.

**IT 42 PF CODE:**

The contractors who are liable to be registered under EPF Act, 1950 must possess EFP code at the time of filling of tender. The agency should follow all the rules and regulations of the Act as prevailing currently.

**IT 43 LABOUR LICENSE:**

The contractors who are liable to be registered under Contract Labour Act, 1970 must possess online Labour License at the time of filling of tender. The agency should follow all the rules and regulations of the Act as prevailing currently.

**IT 44 FILLING OF e-TENDER**

The bidder shall have to fill all the details required in on-line bidding form of e-Tender. Incomplete OR inappropriate OR wrong information filled may cause the e-Tender to be rejected.

**Addl / Asst. Engineer**  
**R.M.C.**

**Dy.Ex.Engineer**  
**R.M.C.**

**ADDL. CITY ENGINEER**  
**R.M.C.**

**Signature of Contractor with Seal**

# **F O R M A T S**

Financial & Other Statements

**Information / Details to be submitted by the Bidders in the Performa mentioned under Statement no 1 to 9. All the documents submitted herewith as supporting documents shall be duly attested and certified true copy.**

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**STATEMENT NO-1**

**DECLARATION**

I / We \_\_\_\_\_ hereby declared that I am / We partner(s) are not black listed or Terminated or Debarred or suspended, backed out, delisted or connected with firm black listed or terminated or debarred or suspended or backed out or delisted in any States, CPWD/ MES/ Railways or any Government, Semi- Government or Private body since the inception of the firm / company. Also, no Police complaint is lodged against the firm / company or Staff deployed by me / us.

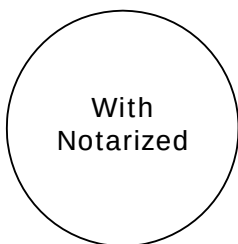
At present I am / we are registered as approved contractor(s), firms in \_\_\_\_\_ State, CPWD / MES / Railways.

I, owner / we, the partners of this firm, hereby give an undertaking that we are jointly and severally responsible to meet all the liabilities ever and above the business of this firm and make good the above financial loss sustained by the Rajkot Municipal Corporation as a result of our abandoning the works entrusted to us.

I further undertake that if above declaration proves to be wrong/ incorrect or misleading, our tender/ contract stands to be cancelled/ terminated.

Date:  
Place:

\_\_\_\_\_  
Signature of Authorized Person



## **STATEMENT NO-2**

### **APPLICABILITY OF PROVIDENT FUND AND MISCELLANEOUS PROVISIONS ACT 1952**

Successful bidder i.e. the agency whose tender is accepted by the RMC shall have to comply the necessary formalities under the employees provident fund and Miscellaneous Provisions Act, 1952 as Contributory Provident Fund Scheme is applicable to labourers engaged in construction activity and shall have to submit proofs regarding deduction of provident fund and other dues and depositing the same with government department under the act and the scheme regularly on monthly basis failing which no running / final bill payment will be made by the RMC to the contractor in any circumstances.

**A certificate to the above effect has to be given by the contractor as under.**

### **Declaration Of Depositing Provident Fund contribution**

This to certify that we have deducted the employees' P.F. and deposited the same along with employer's contribution towards provident fund on labour charges / Wages paid by us to the labourers engaged for the work of \_\_\_\_

\_\_\_\_\_. With Provident  
Fund Authority under our Provident Fund Code No. \_\_\_\_\_

We produce herewith the copies of the challans for the provident fund deduction and contribution deposited as mentioned above.

**Date:  
Bidder**

**Seal and Signature of the**

**STATEMENT NO. -3****CURRICULAM VITAE**

| <b>Sr.No.</b> | <b>Details of person</b>            |  |
|---------------|-------------------------------------|--|
| 1.            | Name                                |  |
| 2.            | Age                                 |  |
| 3.            | Qualifications                      |  |
| 4.            | Experience in Project Related field |  |
| 5.            | Other experiences                   |  |
| 6.            | Employment Record.                  |  |

| <b>Sr.No.</b> | <b>Period<br/>From - To</b> | <b>Organization<br/>under which<br/>work</b> | <b>Status<br/>/ position in<br/>the</b> |
|---------------|-----------------------------|----------------------------------------------|-----------------------------------------|
|               |                             |                                              |                                         |
|               |                             |                                              |                                         |
|               |                             |                                              |                                         |
|               |                             |                                              |                                         |



|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

**Note:**

- (1) Separate sheet for each person to be furnished as above.
- (2) The contractor's Project Team should consist of persons in the following disciplines.
  - a) Senior Engineer with experience of Building work
  - b) Senior material Engineer.
  - c) Senior Quantity Surveyor.
  - d) Project management expert.
  - e) Site in charge

**STATEMENT – 4****INFORMATION REGARDING FINANCIAL CAPACITY  
OF THE CONTRACTORS**

| <b>Sr.</b> | <b>Details</b>                     | <b>Amount (Rs. in lakhs)</b> | <b>Remarks</b>                                                           |
|------------|------------------------------------|------------------------------|--------------------------------------------------------------------------|
| 1.         | Solvency                           |                              | A Banker's Certificate of current financial year may please be attached. |
| 2.         | Annual Turnover for the last seven |                              | Certified true copy to be attached                                       |

**STATEMENT NO. – 4/A****BIDDER'S FINANCIAL CAPACITY**

| <b>Sr. No.</b> | <b>Financial Year</b> | <b>Annual<br/>Turnover in<br/>Engineering<br/>Project Rs.</b> | <b>Net<br/>worth<br/>Rs.</b> | <b>Net Cash<br/>Rs.</b> | <b>Working<br/>Capital<br/>Rs.</b> |
|----------------|-----------------------|---------------------------------------------------------------|------------------------------|-------------------------|------------------------------------|
| <b>1</b>       | <b>2022-2023</b>      |                                                               |                              |                         |                                    |
| <b>2</b>       | <b>2021-2022</b>      |                                                               |                              |                         |                                    |
| <b>3</b>       | <b>2020-2021</b>      |                                                               |                              |                         |                                    |
| <b>4</b>       | <b>2019-2020</b>      |                                                               |                              |                         |                                    |
| <b>5</b>       | <b>2018-2019</b>      |                                                               |                              |                         |                                    |
| <b>6</b>       | <b>2017-2018</b>      |                                                               |                              |                         |                                    |
| <b>7</b>       | <b>2016-2017</b>      |                                                               |                              |                         |                                    |

**Note:-**

- 1) *Figures to be taken from audited balance sheets. Duly certified attested true copy*
- 2) *Copies of the balance sheet to be attached..*
- 3) *The bidder shall have to provide that for a period of at least **11 Months** the bidder has ability to sustain negative cash balance and how he proposes to meet with the same.*
- 4) *Cash Plan / Cash flow Statement.*

**STATEMENT NO. – 4 / B****AVAILABLE BID CAPACITY**

|                                                           | <b>2016-<br/>17</b> | <b>2017-<br/>18</b> | <b>2018-<br/>19</b> | <b>2019-<br/>20</b> | <b>2020-<br/>21</b> | <b>2021-<br/>22</b> | <b>2022-<br/>23</b> |
|-----------------------------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| <b>Value of<br/>works<br/>executed in<br/>Rs. Crores.</b> |                     |                     |                     |                     |                     |                     |                     |

The available bid capacity will be worked out as follows.

**Available bid capacity = (A x N x 2) – B,**

**where**

**A** = Maximum of updated total amount of work executed in any one year of the last five financial years.

**B** = The amount of the existing commitments and ongoing works to be discharge during time interval of N years from the bid due date.

**N** = Number of years prescribed for completion of the proposed works

**STATEMENT NO. – 5**

**LIST OF SINGLE PROJECT WORK OF NOT LESS THAN 60 % OF THE ESTIMATED COST COMPLETED DURING THE LAST SEVEN YEARS.**

| <b>Sr. No .</b> | <b>Year of Construction work</b> | <b>Name of Project</b> | <b>Name of owner &amp; contact person of the project, address, phone</b> | <b>Total cost of the work</b> | <b>Total value of work done</b> | <b>Date of starting work</b> | <b>Date of Actual completion of work</b> |
|-----------------|----------------------------------|------------------------|--------------------------------------------------------------------------|-------------------------------|---------------------------------|------------------------------|------------------------------------------|
| <b>1</b>        | <b>2</b>                         | <b>3</b>               | <b>4</b>                                                                 | <b>5</b>                      | <b>6</b>                        | <b>7</b>                     | <b>8</b>                                 |
| <b>1</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>2</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>3</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>4</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>5</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>6</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>7</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>8</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>9</b>        |                                  |                        |                                                                          |                               |                                 |                              |                                          |
| <b>10</b>       |                                  |                        |                                                                          |                               |                                 |                              |                                          |

**Note:** Certificate from the owners in support of above works may be enclosed with this statement.

**STATEMENT NO. 5/ A**

**Detailed information of similar type of work costing not less than 50 % of tender amount completed with good quality and workmanship in the past seven years.**

Name of Contractor: \_\_\_\_\_

| Sr. No. | Name of work | Name of client | Estimated cost of work (Rs. Lakhs) | Tendered amount Rs. (Lakhs) | Date of award of contract | Target date of completion | Actual date of completion | Reason for delay | Amount of work done during last seven years preceding this tender (Rs. Lakhs). |      |      |      |      |      |      | Amount of work done after March 2021 (Rs. Lakhs) | Remarks |
|---------|--------------|----------------|------------------------------------|-----------------------------|---------------------------|---------------------------|---------------------------|------------------|--------------------------------------------------------------------------------|------|------|------|------|------|------|--------------------------------------------------|---------|
|         |              |                |                                    |                             |                           |                           |                           |                  | 2016                                                                           | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |                                                  |         |
|         |              |                |                                    |                             |                           |                           |                           |                  | -                                                                              | -    | -    | -    | -    | -    | -    |                                                  |         |
|         |              |                |                                    |                             |                           |                           |                           |                  | 17                                                                             | 18   | 19   | 20   | 21   | 22   | 23   |                                                  |         |
|         |              |                |                                    |                             |                           |                           |                           |                  |                                                                                |      |      |      |      |      |      |                                                  |         |
|         |              |                |                                    |                             |                           |                           |                           |                  |                                                                                |      |      |      |      |      |      |                                                  |         |
|         |              |                |                                    |                             |                           |                           |                           |                  |                                                                                |      |      |      |      |      |      |                                                  |         |
|         |              |                |                                    |                             |                           |                           |                           |                  |                                                                                |      |      |      |      |      |      |                                                  |         |
|         |              |                |                                    |                             |                           |                           |                           |                  |                                                                                |      |      |      |      |      |      |                                                  |         |

**Note:** Certificate from the owners in support of above works may be enclosed with this statement.

**STATEMENT NO – 5/B**  
**DETAILS OF IMPORTANT CONSTRUCTION PROJECTS**

| Sr.<br>No<br>. | Name of<br>Project | Estimat<br>ed<br>cost | Prescribed<br>time of<br>performance |                    | Actual Completion |                    | Actual<br>Completion<br>Cost Rs. | Name,<br>address<br>and |
|----------------|--------------------|-----------------------|--------------------------------------|--------------------|-------------------|--------------------|----------------------------------|-------------------------|
|                |                    |                       | Start<br>Date                        | Completion<br>Date | Start<br>Date     | Completion<br>Date |                                  |                         |
| 1              | 2                  | 3                     | 4                                    | 5                  | 6                 | 7                  | 8                                | 9                       |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |
|                |                    |                       |                                      |                    |                   |                    |                                  |                         |

**Note:** Certificate from the owners in support of above works may be enclosed with this statement.

**STATEMENT NO. – 5/C****DETAILS OF ONGOING PROJECT**

| <b>Sr.<br/>No</b> | <b>Name of project</b> | <b>Value of<br/>remaining<br/>work Rs. in<br/>lakhs.</b> | <b>Start<br/>date</b> | <b>Likely<br/>date of<br/>completi<br/>on</b> | <b>Name, address,<br/>telephone, fax no. of<br/>project authority and<br/>contact person.</b> |
|-------------------|------------------------|----------------------------------------------------------|-----------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------|
|                   |                        |                                                          |                       |                                               |                                                                                               |



**STATEMENT NO. 6**

**METHOD STATEMENT AND WORK PLAN**

The Bidder shall have to provide a brief write up to be enclosed with the “Technical Bids” covering his approach and methodology to handle the project construction activities including his details work plan. The brief shall include the following aspects.

| <b>Sr.<br/>No.</b> | <b>Components</b>                                           |  |
|--------------------|-------------------------------------------------------------|--|
| 1.                 | Methodology                                                 |  |
| 2.                 | Construction equipment availability and plan of deployment. |  |
| 3.                 | Construction chart / Bar chart.                             |  |

## Application Form (1)

### General Information

*All individual firms and each partner of a consortium applying for qualification are requested to complete the information in this form. Nationality information to be provided for all owners or applicants who are partnerships or individually-owned firms.*

*Where the Applicant proposes to use named subcontractors for critical components of the works, or for work contents in excess of 10 percent of the value of the whole works the following information should also be supplied for the specialist subcontractor(s).*

|    |                                     |                                        |
|----|-------------------------------------|----------------------------------------|
| 1. | Name of Firm                        |                                        |
| 2. | Head office address                 |                                        |
| 3. | Telephone                           | Contact                                |
| 4. | Fax                                 | Telex                                  |
| 5. | Place of incorporation/registration | Year of incorporation/<br>registration |

|    |                              |                    |
|----|------------------------------|--------------------|
|    | <b>Nationality of owners</b> |                    |
|    | <b>Name</b>                  | <b>Nationality</b> |
| 1. |                              |                    |
| 2. |                              |                    |
| 3. |                              |                    |
| 4. |                              |                    |
| 5. |                              |                    |

| Name of Bidders officers / Persons to be contacted |         |            |      |
|----------------------------------------------------|---------|------------|------|
| Name.                                              | Address | Phone Nos. | Fax. |
|                                                    |         |            |      |
|                                                    |         |            |      |
|                                                    |         |            |      |
|                                                    |         |            |      |
|                                                    |         |            |      |

## Application Form (1A)

### Structure and Organization

|                                                                                                                                                                                                                                                    |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>The applicant is</b><br>an individual<br>a proprietary firm<br>a firm in partnership<br>a Limited Company or Corporation<br>a group of firms/consortium (if yes, give completion information in respect of each partner)                        |  |
| Attach the Organization Chart showing the structure of the organization including the names of the Directors and position of officers                                                                                                              |  |
| Number of years of experience:<br>as a Prime Contractor (contractor shouldering major responsibility in own country<br>other countries (specify country)                                                                                           |  |
| in a consortium<br>in own country<br>other countries (Specify country)                                                                                                                                                                             |  |
| as a sub-contractor (specify main contractor)<br>in own country<br>other countries (Specify country)                                                                                                                                               |  |
| 4. Name and address of any associates the applicant has in India (in case the applicant happens to be from foreign country) who are knowledgeable in the procedures of customs, immigration, taxes and other information necessary to do the work. |  |
| For how many years has your organization been in business of similar work under its present name? What were your fields when your organization was established? Whether any new fields were added in your organization? And if so, when?           |  |
|                                                                                                                                                                                                                                                    |  |

|                                                                                                                                                                                  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 5. Were you ever required to suspend construction for a period of more than six months continuously after you started? If so, give the name of project and give reasons thereof. |  |
| 6. Have you ever left the work awarded to you incomplete? If so, give name of project and reasons for not completing work.                                                       |  |
| In which fields of civil engineering construction do you claim specialization and interest?                                                                                      |  |
| Give details of your experience in mechanized cement concrete lining and in modern concrete technology for manufacture and quality control.                                      |  |
| Give details of your experience in using heavy earth moving equipment and quality control in compaction of soils.                                                                |  |
| Give details of your experience in Underground Drainage work in rocky area.                                                                                                      |  |
| Give details of civil work for drainage pumping station                                                                                                                          |  |
| Give details for construction of sewerage treatment plant                                                                                                                        |  |
| Give details for pumping machinery in drainage pumping station                                                                                                                   |  |

# **GENERAL CONDITIONS OF CONTRACT**

**:: TABLE OF CONTESTS ::**

| <b>No.</b> | <b>Description</b>                                                  |
|------------|---------------------------------------------------------------------|
| GC-1       | Definitions and Interpretations                                     |
| GC-2       | Location of site and accessibility                                  |
| GC-3       | Scope of work                                                       |
| GC-4       | Ruling language                                                     |
| GC-5       | Interpretation of Contract Document                                 |
| GC-6       | Contractor to understand himself fully                              |
| GC-7       | Errors in submissions                                               |
| GC-8       | Sufficiency of E-TENDER                                             |
| GC-9       | Discrepancies                                                       |
| GC-10      | Performance Guarantee (Security Deposit)                            |
| GC-11      | Inspection of work                                                  |
| GC-12      | Defect Liability                                                    |
| GC-13      | Power of Engineer-In-Charge to give further instructions.           |
| GC-14      | Programme                                                           |
| GC-15      | Sub-letting of work                                                 |
| GC-16      | Sub-Contracts for temporary works, etc.                             |
| GC-17      | Time for completion                                                 |
| GC-18      | Extension of time                                                   |
| GC-19      | Contract Agreement                                                  |
| GC-20      | Liquidated damages                                                  |
| GC-21      | Forfeiture of Security Deposit                                      |
| GC-22      | Action of Forfeiture of Security Deposit                            |
| GC-23      | No compensation for alteration in or restriction in work            |
| GC-24      | In the event of death of contractor                                 |
| GC-25      | Members of the owner not individually liable                        |
| GC-26      | Owner not bound by personal representations                         |
| GC-27      | Contractor's office at site                                         |
| GC-28      | Contractor's subordinate staff and their conduct                    |
| GC-29      | Termination of sub-contract by owner                                |
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**GC-01****DEFINITIONS AND INTERPRETATIONS :**

- 1.0 In the contract (as hereinafter defined) the following words and expressions shall, unless repugnant to the subject or context thereof, have the following means as signed to them.
- 1.1 The "Owner / Corporation" shall mean Rajkot Municipal Corporation and shall include its Municipal Commissioner or other Officers authorized by the Corporation and also include owner's successors and assignees.
- 1.2 The "Contractor" shall mean the person or the persons, firm or Company whose e-Tender has been accepted by the Owner and includes the Contractors legal representative, his successors and permitted assigned.
- 1.3 DELETED**
- 1.4 The "Engineer-In-Charge" shall mean the person designated as such by the owner from time to time and shall include those who are expressly authorized by the Corporation to act for and on its behalf for all functions pertaining to the operation of this contract.
- 1.5 Engineer-In-Charge's Representative shall mean any resident Engineer or Assistant to the Engineer-In-Charge appointed from time to time by the owner to perform duties set forth in the E-TENDER Document whose authority shall be notified in writing to the Contractor by the Engineer-In-Charge.
- 1.6 "E-TENDER" – the offer or proposal of the Bidder submitted in the prescribed form setting for the prices for the work to be performed, and the details thereof.
- 1.7 "Contract Price" shall mean total money payable to the Contractor under the contract.
- 1.8 "Addenda" shall mean the written or graphic notices issued prior to submission of e-Tender which modify or interpret the contract documents.
- 1.9 "Contract Time" – the time specified for the completion of work.
- 1.10 "Contract" shall mean agreement between the parties for the execution of works including therein all contract documents.
- 1.11 "Contract Document" shall mean collectively the e-Tender documents, designs, drawings, specifications, agreed variations, if any and such other documents constituting the e-Tender and acceptance thereof.
- 1.12 "The Sub-Contractor" shall mean any person, firm or company (other than the Contractor) to whom any part of the work has been entrusted by the Contractor with the written consent of the Engineer-In-Charge and the legal representative successors and permitted assignee of such person, firm or company.
- 1.13 The "Specifications" shall mean all directions, the various Technical Specifications, provisions and requirements attached to the contract which pertains to the method and manner of performing the work, to the quantities and qualities of the work and the materials to be furnished under the contract for the work and any order(s) or instruction(s) there under. It shall also mean the latest Indian Standard Institute Specification relative to the particular work or part thereof, so far as they are not

contrary to the E-TENDER specifications and in absence of any other Country applied in Indian as a matter of standard engineering practice and approved in writing by the Engineer-In-Charge with or without modification.

- 1.14      The "Drawings" shall include maps, plans, tracings, or prints thereof with any modification approved in writing by the Engineer-In-Charge and as such other drawings as may, from time to time, be furnished or approved in writing by the Engineer-In-Charge in connection with the work.
  
- 1.15      The "Work" shall mean the works to be executed in accordance with the contract or the part thereof as the case may be and shall include extra, additional, altered or substituted works as required for the purpose of the contract. It shall mean the totality of the work by expression or implication envisaged in the contract and shall include all materials, equipment and labour required for or relative or incidental to or in connection with the commencement, performance and completion of any work and / or incorporation in the work.
  
- 1.16      The "Permanent Work" shall mean works which will be incorporated in and form part of the work to be handed over to the owner by the Contractor on completion of the contract.
  
- 1.17      The "Temporary Work" shall mean all temporary works of every kind required in or about the execution, completion and maintenance of the work.
  
- 1.18      "Site" shall mean the land and other places, on, under, in or through which the permanent works are to be carried out and any other lands or places provided by the Corporation for the purpose of the contract together with any other places designated in the contract as forming part of the site.
  
- 1.19      The "Construction Equipment" shall mean all appliances / equipment of whatever nature required in or for execution, completion or maintenance of works or temporary works (as herein before defined) but does not include materials or other things intended to form or forming part of the permanent work.
  
- 1.20      **"Notice in writing or written Notice"** shall mean a notice written, typed or in printed form delivered personally **OR** sent by Registered Post to the last known private or business address or Registered Office of the Contractor **OR** through e-mail **OR** mobile message shall be deemed to have been received in the ordinary course of post it would have been delivered.
  
- 1.21      The "Alteration / variation order" shall mean an order given in writing by the Engineer-In-Charge to effect additions or deletions from or alterations in the work.
  
- 1.22      "Final Test Certificate" shall mean the final test certificate issued by the owner within the provisions of the contract.
  
- 1.23      The "Completion Certificate" shall mean the certificate to be issued by the Engineer-In-Charge when the work has been completed and tested to his satisfaction.

- 1.24 The "Final Certificate" shall mean the final certificate issued by the Engineer-In-Charge after the period of defects liability is over and the work is finally accepted by the owner.
- 1.25 "Defects Liability Period" shall mean the specified period between the issue of Completion Certificate and the issue of final certificate during which the Contractor is responsible for rectifying all defects that may appear in the works.
- 1.26 "Approved" shall mean approved in writing including subsequent confirmation in writing of previous verbal approval and "Approval" means approved in writing including as aforesaid.
- 1.27 "Letter of Acceptance" shall mean an intimation by a letter to Bidder that his e-Tender has been accepted in accordance with the provisions contained therein.
- 1.28 "Order" and "Instructions" shall respectively mean any written order or instruction given by the Engineer-In-Charge within the scope of his powers in terms of the contract.
- 1.29 "Running Account Bill" shall mean a bill for the payment of "On Account" money to the Contractor during the progress of work on the basis of work done and the supply of non-perishable materials to be incorporated in the work.
- 1.30 "Security Deposit" shall mean the deposit to be held by the owner as security for the due performance of the contractual obligations.
- 1.31 The "Appointing Authority" for the purpose of Arbitration shall be the Municipal Commissioner, Rajkot Municipal Corporation.
- 1.32. "Retention Money" shall mean the money retained from R.A.Bills for the due completion of the "LET WORKS".
- 1.33 Unless otherwise specifically stated, the masculine gender shall include the feminine and neuter genders and vice-versa and the singular shall include the plural and vice-versa.

**GC-02 LOCATION OF SITE AND ACCESSIBILITY :**

The intending bidders should inspect the site & make thyself familiar with site conditions and available communication facilities.

Non-availability of access roads shall in no case be the cause to condone delay in the execution of the work and no claim or extra compensation will be paid.

**GC-03 SCOPE OF WORK :**

The scope of work is defined broadly in the special conditions of contract and specifications. The Contractor shall provide all necessary materials, equipment and labour etc. for the execution and maintenance of the work. All material that go with the work shall be approved by the Engineer-In-Charge prior to procurement and use.

**Power Supply :**

The Contractor shall make his own arrangement for power supply during installation.

**Land for Contractor's Field Office, Godown Etc.:**

Owner will not be in a position to provide land required for Contractor's field office, godown, etc. The Contractor shall have to make his own arrangement for the same.

**GC-04**

**RULING LANGUAGE :**

The language according to which the contract shall be construed and interpreted shall be English. All entries in the contract document and all correspondence between the contractor and the Corporation or the Engineer-In-Charge shall be in English/Gujarati. All dimensions for the materials shall be given in metric units only.

**GC-05**

**INTERPRETATION OF CONTRACT DOCUMENT :**

1. The provision of the General Conditions of Contract and Special Conditions of Contract shall prevail over those of any other documents of the contract unless specifically provided otherwise, should there be any discrepancy, inconsistency, error or omission in the several documents forming the contract, the matter may be referred to the Engineer-In-Charge for his instructions and decision. The Engineer-In-Charge's decision in such case shall be final and binding to the Contractor.
2. Works shown upon the drawings but not described in the specifications or described in the specifications without showing on the drawings shall be taken as described in the specifications and shown on the drawings.
3. The headings and the marginal notes to the clause of these General Conditions of Contract or to the specifications or to any other part of e-Tender documents are solely for the purpose of giving a concise indication and not a summary of contents thereof. They shall never be deemed to be part thereof or be used in the interpretation or construction of the contract.
4. Unless otherwise states specifically, in this contract documents the singular shall include the plural and vice-versa wherever the context so requires. Works imparting persons shall include relevant Corporations / Body of individual / firm of partnership.
5. Notwithstanding the sub-division of the documents into separate section and volumes every part of each shall be supplementary to and complementary of every other part and shall be read with and into the context so far as it may be practicable to do so.
6. Where any portion of the General Conditions of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, then, unless a different intention appears, the provisions of the special conditions of contract shall be deemed to override the provisions of General Conditions of Contract to the extent of each repugnancy of variance.
7. The materials, design, and workmanship shall satisfy the relevant IS, and codes referred to. If additional requirements are shown in the specifications, the same shall be satisfied over and above IS and other codes.

8. If the specifications mention that the Contractor shall perform certain work or provide certain facilities, it shall mean that the Contractor shall do so at his own cost.

**9. Contractor to Collect His Own Information -**

The details given in the e-Tender are arranged making necessary investigations for framing an estimate. However, when the work is being executed, changes in soil conditions are likely to be met with in view of the formation of soil, strata in Rajkot District. It is, therefore, desirable that the Contractor makes his own investigations or additional investigations as may be required for correctly assessing the cost of different items of work and submit his e-Tender accordingly. Any change in description or quantity of an item shall not vitiate the contract or release the Contractor from executing the work comprised in the contract according to the drawings and specifications at the e-Tendered rates.

He is deemed to have know the scope, nature and magnitude of the work and the requirements of materials and labour involved and as to whatever work he has to complete in accordance with the contract. The Contractor is expected to visit the site and surroundings to satisfy himself as to the nature of all existing structures, if any, and also as to the nature and the conditions of railways, roads, bridges and culverts, means of transport and communications whether by land, air or water and as to possible interruptions thereto and the access and gross from the site, to have examined and satisfied himself as to the sites for obtaining sand, stones, bricks and other materials, the site for disposal of surplus materials, the available accommodation and make such enquiries as may be necessary for executing and completing the work, to have local enquiries as to the sub-soil, subsoil water and variation thereof, storms, prevailing winds, climatic conditions and all other similar matters, effecting work. He is expected to be familiar with his liability for payment of Government taxes, customs and excise duty and other charges etc. in contract with the execution of this contract.

**GC-06 CONTRACTOR TO UNDERSTAND HIMSELF FULLY :**

The Contractor by e-Tendering shall be deemed to have satisfied himself, as to all considerations and circumstances affecting the e-Tender price, as to the possibility of executing the works as shown and described in the contract and to have fixed his prices according to his own view on these matters and to have understood that no additional allowances except as otherwise expressly provided, will afterwards be made beyond the contract price. The Contractor shall be responsible for any misunderstanding or incorrect information, however, obtained.

**GC-07 ERRORS IN SUBMISSIONS :**

The Contractor shall be responsible for any errors or omissions in the particulars supplied by him, whether such particulars have been approved by the Engineer-In-Charge or not.

**GC-08 SUFFICIENCY OF e-TENDER :**

The Contractor shall be deemed to have satisfied himself before e-Tendering as to the correctness of the e-Tender rates which rates shall, except as otherwise provides for, cover all the Contractor's liabilities and obligations set forth or implied in the contract for the proper execution of the work for compliance with requirements of Article GC-19 thereof.

**GC-09****DISCREPANCIES :**

The drawings and specifications are to be considered as mutually explanatory of each other, detailed drawings being followed in preference to small-scale drawings and figured dimensions in preference to scale and special conditions in preference to General Conditions. The special directions or dimensions given in the specifications shall supercede all else. Should any discrepancies however, appear or should any misunderstanding arise as to the meaning and intent of the said specifications or drawings, or as to the dimensions or the quality of the materials or the due and proper execution of the works, or as to the measurement or quality and valuation of the work executed under this contract or as extra there upon, the same shall be explained by the Engineer-In-Charge and his explanation shall be subject to the final decision of the Municipal Corporation in case reference be made to it, be binding upon the Contractor and the Contractor shall execute the work according to such explanation and without addition or to deduction from the contract price and shall also do all such works and things necessary for the proper completion of the works as implied by the drawings and specifications, even though such works and things are not specially shown and described in the said specifications. In cases where no particular specifications are given for any article to be used under the contract, the relevant specifications of the Indian Standard Institution shall apply.

**GC-10****PERFORMANCE GUARANTEE (SECURITY DEPOSIT) :**

1.

A sum of 5% of the contract price shall be deposited by the Bidder (hereinafter called the contractor when e-Tender is accepted) as security deposit with the owner for the faithful performance, completion and maintenance of the works in accordance with the contract documents and to the satisfaction of the Engineer-In-Charge and assuring the payment of all obligations arising from the execution of the contract. This shall be deposited in one of the forms mentioned below :

- a. By a Demand Draft on the Rajkot Branch of any Scheduled Bank except co-operative bank.
- b. A Fixed Deposit Receipt of a Schedule Bank duly endorsed in favour of the "**RAJKOT MUNICIPAL CORPORATION**", Rajkot.
- c. The Contractor may pay 2.5% of the value of works as initial security deposit and the balance 2.5% shall be recovered in installments through deductions at the rate of 10 (ten) percent of the value of each Running Account Bill till the total security execution exceeds the accepted value of e-Tender because of allotment of further work, further recoveries towards security deposit shall be effected at 10% of the R A Bills to make up the five percent security deposit of the revised value of contract. Alternatively, the Contractor may at his option deposit the full amount of 5 percent of security deposit within ten days of receipt by him of the notification accepting the e-Tender in the form as aforesaid.  
**PERFORMANCE GUARANTEE (SECURITY DEPOSIT) WILL BE RELEASED TO THE CONTRACTOR WITHOUT ANY INTEREST AFTER DEFECT LIABILITY PERIOD IS OVER.**

2.

If the Contractor, sub-contractor or their employees shall break, deface or destroy any property belonging to the owner or other agency during the execution of the contract, the same shall be made good by the contractor at his own expense and in default thereof, the Engineer-In-Charge may cause the same to be made good by other agencies and recover expense

from the Contractor (for which the certificate of the Engineer-In-Charge shall be final). These expenses can be recovered from the security deposit if recovery from other sources is not possible. The amount as reduced in security deposit will be made good by deduction from the next R A Bill of the Contractor.

**GC-11**

**INSPECTION OF WORK :**

1. The Engineer-In-Charge shall have full power and authority to inspect the work at any time wherever in progress either on the site or at the Contractor's or any other manufacturer's workshop or factories wherever situated and the Contractor shall afford to Engineer-In-Charge every facility and assistance to carry out such inspection, Contractor or his authorized representative shall, at all time during the usual working hours and all times when so notified, remain present to receive orders and instructions.

Orders given to Contractor's representative shall be considered to have the same force as if they had been given to the Contractor himself. Contractor shall give not less than ten (10) days notice in writing to the Engineer-In-Charge before covering up or otherwise placing beyond reach of inspection and measurement any work in order that the same may be inspected and measured. In the event of breach of the above, the same shall be uncovered at Contractor's expenses for carrying out such inspection or measurement.

2. The material shall be dispatched from Contractor's store on site of work before obtaining approval in writing of the Engineer-In-Charge. Contractor shall provide at all times during the progress of work and maintenance period of proper means of access with ladders, gangways, etc. and make necessary arrangement as directed for inspection or measurement of work by Engineer-In-Charge.

**GC-12**

**DEFECT LIABILITY :**

1. Contractor shall guarantee the work for a period of 24 months. Any damage or defect that may arise or that may remain undiscovered at the time of issue of Completion Certificate connected in any way with the equipment or materials supplied by him or in the workmanship shall be rectified or replaced by Contractor at his own expense as desired by Engineer-In-Charge or in default Engineer-In-Charge may cause the same to be made good by other agency and deduct expenses of which the certificate of Engineer-In-Charge shall be final from any sums that may then or any time thereafter become due to Contractor or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof.
2. From the commencement to completion of work Contractor shall take full responsibility for the care of the work including all temporary works and in case any damages, occur from any cause whatsoever he shall at his own cost, repair and make good the same so that on completion, work shall be in good order and in conformity, in every respect, with the requirements of contract and as per the instructions of the Engineer-In-Charge.
3. If at any time before the work is taken over, the Engineer-In-Charge -
  - a) Decide that any work done or materials used by the Contractor are defective or not in accordance with the contract or that work or any portion thereof is defective or do not fulfill the requirements of contract (all such materials being herein after called defects in this clause) he shall,



as soon as reasonably practicably, give notice to Contractor in writing of the said defect specifying particulars of the same then Contractor shall at his own expense and with all speed make good the defects so specified.

- b) In case Contractor fails to do so, owner may take, at the cost of the Contractor, such stops as may in all circumstances be responsible to make good such defects. The expenditure so incurred by owner will be recovered from the amount due to Contractor. The decision of Engineer-In-Charge with regard to the amount to be recovered from Contractor will be final and binding on the Contractor.

**GC-13      POWER OF ENGINEER-IN-CHARGE TO GIVE FURTHER INSTRUCTIONS:**

The Engineer-In-Charge shall have the power and authority from time to time and at all times to give further instructions and directions as may appear to him necessary or proper for the guidance of the Contractor and the works and efficient execution of the works according to the terms of the specifications, and the Contractor shall receive, execute, obey and be bound by the same, according to the true intent and meaning thereof, as fully and effectively as though the same had accompanied or had been mentioned or referred to in the specifications. No work which radically changes the original nature of the contract shall be ordered by the Engineer-In-Charge and in the event of any deviation being ordered, which in the opinion of the Contractor changes the original nature of the contract, he shall nevertheless carry it out and any disagreement as to the nature of the work and the rate to be paid to thereof shall be resolved.

The time of completion of works shall, in the event of any deviations being ordered resulting in additional cost or reduction in cost over the contract sum, be extended or reduced reasonably by the Engineer-In-Charge. The Engineer-In-Charge's decision in the case shall be final and binding.

**GC-14      PROGRAMME :**

The time allowed for execution of works shall be the essence of the contract. The contract period shall commence from the date of notice of intimation to proceed. The Bidder at the time of submitting his e-Tender shall indicate in the construction schedule his programme of execution of work commencement with the total time specified. The Contractor shall provide the Engineer-In-Charge a detailed programme of time schedule for execution of the works in accordance with the specifications and the completion date. The entire programme to be finalized by the Contractor, has to conform to the execution period mentioned along with the Bill of Quantities in the e-Tender documents. The Engineer-In-Charge upon scrutiny of such submitted programme by Contractor, shall examine suitability of it to the requirement of contract and suggest modifications, if found necessary.

**GC-15      SUB-LETTING OF WORK :**

No part of the contract nor any share of interest thereon shall in any manner or degree be transferred, assigned or sublet by the Contractor directly or indirectly to any person, firm or Corporation whosoever except as provided for in the succeeding sub-clause, without the consent in writing of the owner.

**GC-16      SUB-CONTRACTS FOR TEMPORARY WORKS ETC. :**

The owner may give written consent to sub-contractors for execution of any part of the works at the site, being entered upon the contractor provided each individual contract is submitted to the Engineer-In-Charge before being entered into and is approved by him. List of sub-contractors to be supplied.

Notwithstanding any subletting with such approval as aforesaid and notwithstanding the Engineer-In-Charge shall have received of any sub-contractors, the Contractor shall be and shall remain solely responsible for the quality and proper and expeditious execution of the works and the performance of all the conditions of contract in all respects as if such subletting or subcontracting had not taken place and as if such works had been done directly by the Contractor.

**GC-17      TIME FOR COMPLETION :**

1. The work covered under this contract shall be commenced from the date the Contractor is served with a notice to proceed with the work and shall be completed before the date as mentioned in the time schedule of work. The time is the essence of the contract and unless the same is extended as mentioned in Clause GC-18 "Extension of Time", the Contractor shall pay liquidated damages for the delay.
2. The general time schedule for construction is given in the e-Tender document. Contractor shall prepare a detailed weekly or monthly construction programme in consultation with the Engineer-In-Charge soon after the agreement and the work shall be strictly executed accordingly. The time for construction includes, the time required for testing, rectifications, if any, retesting and completion of the work in all respects to the entire satisfaction of the Engineer-In-Charge except the items which are not coming in the way to commission the project.
3. Monsoon period from 1st July to 30th September shall be considered as non-working period hence excluded in time limit.

**GC-18      EXTENSION OF TIME :**

Time shall be considered as the essence of the contract. If, however, the failure of the Contractor to complete the work as per the stipulated dates referred to above arises from delays on the part of Corporation in supplying the materials or equipment, it has undertaken to supply under the contract or from delays on the quantity of work to be done under the contract, or force majeure an appropriate extension of time will be given by the Corporation. The Contractor shall request for such extension within one month of the cause of such delay and in any case before expiry of the contract period.

**GC-19      CONTRACT AGREEMENT :**

The successful Bidder shall enter into and execute the contract agreement within 10 (ten) days of the notice of award, in the form shown in e-Tender documents with such modifications as may be necessary in the opinion of the Corporation. It shall be incumbent on the Contractor to pay the stamp duty and the legal charges for the preparation of the contract agreement.

**GC-20      LIQUIDATED DAMAGES :**

If the Contractor fails to complete the work or designated part thereof within the stipulated completion date for the work or for the part, he shall pay liquidated damages at 0.1 (zero point one) percent of contract value

for per day of delay subject to maximum of 10% of the contract value or as decided by Municipal Commissioner.

The Contractor shall complete one-sixth quantum of work within one fourth period, four-tenth quantum of work within one-half period and eight-tenth quantum of work within three-fourth period, failing which, the Contractor shall be liable to pay liquidated damages an amount as specified above, or as decided by Municipal Commissioner.

The amount of liquidated damages shall, however, be subjected to a maximum of 10 percent of the contract value.

**GC-21      FORFEITURE OF SECURITY DEPOSIT :**

Whenever any claim against the Contractor for the payment of a sum of money out of or under the contract arises, the Corporation shall be entitled to recover such sum by appropriating in part or whole, the security deposit of the Contractor. In case the security deposit is insufficient, the balance recoverable shall be deducted from any sum then due or which at any time thereafter may become due to the Contractor. The Contractor shall pay to the owner on demand any balance remaining due.

**GC-22      ACTION OF FORFEITURE OF SECURITY DEPOSIT :**

In any case in which under any Clause or Clauses of the contract, the Contractor shall committed a breach of any of the terms contained in this contract, the owner shall have power to adopt any of the following courses as he may deem best suited to his interest.

- a) To rescind the contract (of which recession notice in writing to the contractor under the hand of the owner shall be conclusive evidence) in which case the security deposit of the Contractor shall stand forfeited and be absolutely at the disposal of the owner.
- b) To employ labour and to supply materials to carry out the balance work debiting Contractor with the cost of labour employed and the cost of materials supplied for which a certificate of the Engineer-In-Charge shall be final and conclusive against the Contractor and 10% of costs on above to cover all departmental charges and crediting him with the value of work done at the same rates as if it has been carried out by the Contractor under the terms of his contract. The certificate of Engineer-In-Charge as to the value of the work done shall be final and conclusive against the Contractor.
- c) To measure up the work of the contractor and to take such part thereof as shall be unexecuted out of his hand and give it to another Contractor to complete, the same. in this case the excess expenditure incurred than what would have been paid to the original Contractor, if the whole work had been executed by him, shall be borne and paid by the original Contractor and shall be deducted from any money due to him by the owner under the contract or otherwise and for the excess expenditure, the certificate of the Engineer-In-Charge shall be final and conclusive.

In the event any of the above courses being adopted by the owner, the Contractor shall have no claims for compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any agreements or made any advance on account of or with a view to the execution of the work or the performance of the contract.

In purchase the Contractor shall not be entitled to recover or be paid any sum for any work actually performed under this contract unless the Engineer-In-Charge will certify in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

In the event of the owner putting in force the powers as stated in a, b, c, above vested in him under the proceeding clause, he may, if he so desires, take possession of all or any tools and plant, materials and stores in or upon the works or the site thereof belonging to the Contractor, or procured by him and intended to be used for the execution of the work or any part thereof paying or allowing for the same in account at the contract rates to be certified by the Engineer-In-Charge. The Engineer-In-Charge may give notice in writing to the Contractor or his representative requiring him to remove such tools, plant, materials or stores from the premises within the time specified in the notice and in the event of the Contractor failing to comply with any such notice, the Engineer-In-Charge may remove them at the Contractor's expenses or sell them by auction or private sale on account of the Contractor and his risks in all respects without any further notice as to the date, time or place of the sale and the certificate of Engineer-In-Charge as to the expense of any such removal and the amount of the proceeds and the expenses of any such sale shall be final and conclusive against the Contractor.

**GC-23**

**COMPENSATION FOR ALTERATION IN OR RESTRICTION IN WORK :**

If at any time from the commencement of the work, the owner shall for any reasons whatsoever not require the whole work or part thereof as specified in the e-Tender to be carried out, the Engineer-In-Charge shall give notice in writing of the fact to the Contractor, who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not derive in consequence of full amount of the work not having been carried out. He also shall not have any claim for compensation by reasons of any alterations having been made in original specifications, drawings, designs and instructions which shall involve any curtailment of the work as originally contemplated.

When the Contractor is a partnership firm, the prior approval in writing of the owner shall be obtained before any change is made in the Constitution of the firm. Where the Contractor is an individual or a Hindu Undivided Family or business concern, such approval as aforesaid shall, likewise be obtained before Contractor enters into an agreement with other parties where under, the reconstituted firm would have the right to carry out the work hereby undertaken by the Contractor. In either case, if prior approval as aforesaid is not obtained, the contract shall be deemed to have been allotted contravention of subletting clause hereof and the same action may be taken and the same consequence shall ensue as provided in the subletting clause.

**GC-24**

**IN THE EVENT OF DEATH OF THE CONTRACTOR :**

Without prejudice to any of the rights or remedies under the contract, if the Contractor dies, the owner shall have the option of terminating the contract without compensation to the Contractor.

- GC-25      MEMBERS OF THE OWNER NOT INDIVIDUALLY LIABLE :**  
 No official or employee of the owner shall in any way be personally bound or liable for the acts or obligation of the owner under the contract, or answerable for any default or omission in the observance or performance of any acts, matters or things, which are herein, contained.
- GC-26      OWNER NOT BOUND BY PERSONAL REPRESENTATIONS :**  
 The Contractor shall not be entitled to any increase on the schedule of rates or any other rights or claims whatsoever by reason of representation, promise or guarantees given or alleged to have been given to him by any person.
- GC-27      CONTRACTOR'S OFFICE AT SITE :**  
 The Contractor shall provide and maintain an office at the site for the accommodation of his agent and staff and such office shall remain open at all reasonable hours to receive information, notices or other communications.
- GC-28      CONTRACTOR'S SUBORDINATE STAFF AND THEIR CONDUCT :**
1. The Contractor on award of the work shall name and depute a qualified Engineer having experience of carrying out work of similar nature, whom equipments, materials, if any, shall be issued and instructions for work given. the Contractor shall also provide to the satisfaction of Engineer-In-Charge sufficient and qualified staff, competent sub-agents, foreman and loading hands including those specially qualified by previous experience to supervise the type of works comprised in the contract in such manner as will ensure work of the best quality and expeditious working. If, in the opinion of the Engineer-In-Charge additional properly qualified supervision staff is considered necessary, it shall be employed by the Contractor, without additional charge on account thereof. The Contractor shall ensure to the satisfaction of the Engineer-In-Charge that sub-contractors, if any, shall provide competent and efficient supervision over the work entrusted to them.
  2. If and whenever any of the Contractor's or sub-contractor's agents, sub-agents, assistants, foreman or other employees shall, in the opinion of the Engineer-In-Charge, be guilty of any misconduct or be incompetent or insufficiently qualified or negligent in the performance of their duties or that in the opinion of the owner or Engineer-In-Charge, it is undesirable for administrative or any other reason for person or persons to be employed in the works, the Contractor if so directed by the Engineer-In-Charge, shall at once remove such person or persons from employment thereon. Any person or persons so removed shall not again be re-employed in connection with the works without the written permission of the Engineer-In-Charge. Any person, so removed from the works shall be immediately replaced at the expense of the Contractor by a qualified and competent substitute. Should the Contractor be required to repatriate any person removed from the works he shall do so after approval of Engineer-In-Charge and shall bear all costs in connection therewith.
  3. The Contractor shall be responsible for the proper behavior of all the staff, foreman, workmen and others and shall exercise proper control over them and in particular and without prejudice to the said generality, the Contractor shall be bound to prohibit and prevent any employee from trespassing or acting in any way detrimental or prejudicial to the interest of the community or of the properties or occupiers of land and properties

in the neighborhood and in the event of such employees so trespassing, the Contractor shall be responsible therefore and relieve the owner of all consequent claims, actions for damages or injury or any other ground whatsoever. The decision of the Engineer-In-Charge upon any matter arising under this claim shall be final.

4. If and when required by the owner, the Contractor's personnel entering upon the owner's premises shall be properly identified by badges of a type acceptable to the owner which must be worn at all times on owner's premises.

**GC-29      TERMINATION OF SUB-CONTRACT BY OWNER :**

If any sub-contractor engaged upon the works at the site execute any work which in the opinion of Engineer-In-Charge is not accordance with the contract documents, the owner may by written notice to the Contractor request him to terminate such sub-contract and the Contractor upon the receipt of such notice shall terminate such sub-contracts and the latter shall forthwith leave the works, failing which, the owner shall have the right to remove such sub-contractors from the site.

No action taken by the owner under the above clause shall relieve the Contractor of his liabilities under the contract or give rise to any right to compensation, extension of time or otherwise.

**GC-30      POWER OF ENTRY :**

If the Contractor shall not commence the work in the manner previously described in the contract documents or if he shall at any time, in the opinion of Engineer-In-Charge –

- i) Fail to carry out works in conformity with the contract documents, or
- ii) Fail to carry out the works in accordance with the time schedule, or
- iii) Substantially suspend work or the works for a period of seven days without authority from Engineer-In-Charge, or
- iv) Fail to carry out and execute the work to the satisfaction of the Engineer-In-Charge, or
- v) Fail to supply sufficient or suitable construction plant, temporary works, labour, materials or things, or
- vi) Commit breach of any other provisions of the contract on his part to be performed or observed or persists in any of the above-mentioned breaches of the contract for seven days after notice in writing shall have been given to the Contractor by the Engineer-In-Charge requiring such breach to be remedied, or
- vii) Abandon the work, or
- viii) During the continuance of the contract becomes bankrupt, make any arrangement or compromise with his creditors, or permit any execution to be levied or go into liquidation whether compulsory or voluntary not being merely a voluntary liquidation for the purpose of amalgamation or reconstruction then in any such case.

The owner shall have the power to enter upon the works and take possession thereof and of the materials, temporary works, constructional plant and stores therein and to revoke the Contractor's license to use the same and to complete the works by his agents, other Contractor or workmen, to relate the same upon any terms to such other person firm or Corporation as the owner in his absolute discretion may think proper to employ, and for the purpose aforesaid to use or authorize the use of any materials, temporary works, constructional plant, and stores as aforesaid

with making payments or allowance to the Contractor for the said materials other than such as may be certified in writing by the Engineer-In-Charge to be reasonable and without making any payment or allowance to the Contractor for the use of said temporary works, constructional plant and stock or being liable for loss or damage thereto. If the owner shall be reason of his taking possession of the works or of the work being got completed by other Contractor incurred excess expenditure be deducted from any money which may be due for the work done by the Contractor under the contract and not paid for. Any deficiency shall forthwith be made good and paid to the owner by the Contractor and the owner shall have power to sell in such manner and for such price as he may think fit all or any of the constructional plant, materials etc., consist constructed by or belonging to and to recoup and retain the said deficiency or any part thereof out of the proceeds of the sale.

**GC-31      CONTRACTOR'S RESPONSIBILITY WITH THE OTHER CONTRACTOR AND AGENCIES :**

Without repugnance to any other conditions, it shall be the responsibility of the Contractor executing the work, to work in close co-operation and co-ordination with other Contractors or their authorized representatives and the Contractor will put a joint scheme with the concurrence of other contractors or their authorized representatives showing the arrangements for carrying his portion of the work to the Engineer-In-Charge and get the approval. The Engineer-In-Charge before approving the joint scheme will call the parties concerned and modify the scheme if required. No claim will be entertained on account of the above. The Contractor shall conform in all respects with the provisions of any statutory regulations, ordinances or bylaws of any local or duly constituted authorities or public bodies which may be applicable from time to time to works or any temporary works. The Contractor s shall keep the owner indemnified against all penalties and liabilities of every kind arising out of non-adherence to such statutes, ordinance, laws, rules, regulations etc.

**GC-32      OTHER AGENCIES AT SITE :**

The Contractor shall have to execute the work in such place and condition where other agencies will also be engaged for other works, such as site grading, filling and leveling, electrical and mechanical engineering works etc. No claim shall be entertained for works being executed in the above circumstances.

**GC-33      NOTICES :**

Any notice under this contract may be served on the Contractor or his duly authorized representative at the job site or may be served by Registered Post direct to the official address of the Contractor. Proof of issue of any such notice could be conclusive of the Contractor having been duly informed of all contents therein.

**GC-34      RIGHTS OF VARIOUS INTERESTS :**

The owner reserves the right to distribute the work between more than one Contractor. Contractor shall co-operate and afford reasonable opportunity to other Contractor s for access to the works, for the carriage and storage of materials and execution of their works. Whenever the work being done by department of the owner or by other Contractor employed by the owner is contingent upon work covered by this contract, the respective rights of the various interests shall be determined by the Engineer-In-Charge to secure the completion of various portions of the work in general harmony.

**GC-35      PRICE ADJUSTMENTS :**

No adjustment in price shall be allowed and no price escalation will be allowed.

**GC-36      TERMS OF PAYMENT :**

The payment of bills shall be made progressively according to the rules and practices followed by the Corporation. The progressive payment unless otherwise provided in the contract agreement or subsequently agreed to by the parties shall be made generally monthly on submission of a bill by the Contractor in prescribed form of an amount according to the value of the work performed less the price of materials supplied by owner aggregate of previous progressive payments and as required by Clause GC-37 (Retention of Money) herein. All such progressive payments shall be regarded as payments by way of advance against final payment. Payment for the work done by the Contractor will be based on the measurement at various stages of the work, in accordance with the condition at clause GC-81 (measurement of work in progress).

**GC-37      RETENTION MONEY :**

Pursuance to clause GC-36 (Terms of Payment) any on at money due to the Contractor for work done, Corporation will hold as Retention money five (5) percent of the value of work. The retention money will not normally be due for payment until the completion of the entire work and till such period the work has been finally accepted by the Corporation and a completion certificate issued by the Corporation in pursuant to Clause-GC 79 (Completion Certificate).

**GC-38      PAYMENTS DUE FROM THE CONTRACTOR :**

All costs, damages or expenses, for which under the contract, Contractor is liable to the Corporation, may be deducted by the Corporation from any money due or becoming due to the Contractor under the contract or from any other contract with the Corporation or may be recovered by action at law or otherwise from the Contractor.

**GC-39      CONTINGENT FEE :**

- i) The Contractor warrants that he has not employed a person to solicit or secure the contract upon any agreement for a commission, percentage, and brokerage contingent fee. Breach of this warranty shall give the Corporation the right to cancel the contract or to take any drastic measure as the Corporation may deem fit. The warranty does not apply to commissions payable by the Contractor to establish commercial or selling agent for the purpose of securing business.
- ii) No officer, employer or agent of the Corporation shall be admitted to any share or part of this contract or to any benefit that may rise there from.

**GC-40      BREACH OF CONTRACT BY CONTRACTOR :**

If the Contractor fails to perform the work under the contract with due diligence or shall refuse or neglect to comply with instructions given to him in writing by the Engineer-In-Charge in accordance with the contract, or shall contravene the provisions of the contract, the Corporation may give notice in writing to the Contractor to make good such failure, neglect, or contravention. Should the Contractor fail to comply with such written notice within 10 (Ten) days of receipt, it shall be lawful for the Corporation, without prejudice to any other rights the Corporation may have under the contract, to terminate the contract for all or part of the



works, and make any other arrangements it shall deem necessary to complete the work outstanding under the contract at the time of termination. In this event, the performance Bond shall immediately become due and payable to the Corporation. The value of the work done on the date of termination and not paid for shall be kept as deposit for adjustment of excess expenditure incurred in getting the remaining work completed and the Corporation shall have free use of any works which the Contractor may have at the site at the time of termination of the contract.

If Contractor fails to carry out the work in timely manner as mentioned in clause 20 (Liquidated damages), Rajkot Municipal Corporation may give notice in writing to the Contractor to expedite the work, so that the work can be completed as per time schedule. If Contractor fails to expedite the work within 10 days of receipt of notice, Rajkot Municipal Corporation may terminate the contract and debar the Contractor for three years and the remaining work will be executed through other agency at the risk and cost of the Contractor.

#### **GC-41**

##### **DEFAULT OF CONTRACTOR :**

- i) The Corporation may upon written notice of default to the Contractor terminate the contract circumstances detailed as under:
  - a) If in the opinion of the Corporation, the Contractor fails to make completion of works within the time specified in the completion schedule or within the period for which extension has been granted by the Corporation to the Contractor.
  - b) If in the opinion of the Corporation, the Contractor fails to comply with any of the other provisions of this contract.
- ii) In the event, the Corporation terminates the contract in whole or in part as provided in Article GC-50 (Termination of the Contract) the Corporation reserves the right to purchase upon such terms and in such manner as it may be deem appropriate, plant similar to one which is not supplied by the Contractor and the Contractor will be liable to the Corporation for any additional costs for such similar plant and / or for liquidated damages for delay until such time as may be required for the final completion of works.
- iii) If this contract is terminated as provided in this paragraph GC-40 AND/OR GC-30 (Power of Entry) (1) the Corporation in addition to any other rights provided in this clause, may require the Contractor to transfer title and deliver to the Corporation.
  - a) Any completed works
  - b) Such partially completed information and contract rights as the Contractor has specifically produced or acquired for the performance of the contract so terminated.
- iv) In the event, the Corporation does not terminate the contract as provided in the paragraph GC-50 (Termination of Contract) the Contractor shall continue performance of the contract, in which case, he shall be liable to the Corporation for liquidated damages for delay until the works are completed and accepted.

#### **GC-42**

##### **BANKRUPTCY :**

If the Contractor shall become bankrupt or insolvent or has a receiving order made against him, or compound with his creditors, or being the

Corporation commence to be wound up not being a member voluntary winding up for the purpose of amalgamation or reconstruction, or carry on its business under a receiver for the benefit of his creditors or any of them, the Corporation shall be at liberty to either (a) terminate the contract forthwith by giving notice in writing to the Contractor or to the receiver or liquidator or to any person or Organization in whom the contract may become vested and to act in the manner provided in Article GC-41 (Default of Contractor) as though the last mentioned notice had been the notice referred to in such article or (b) to give such receiver, liquidator or other persons in whom the contract may become vested the option of carrying out the contract subject to his providing a satisfactory guarantee for the due and faithful performance of the contract up to an amount to be agreed. In the event that the Corporation terminates the contract in accordance with this article, the performance bond shall immediately become due and payable on demand to Corporation.

**GC-43      OWNERSHIP :**

Works hand over pursuant to the contract shall become the property of the Corporation from whichever is the earlier of the following times, namely;

- a) When the works are completed pursuant to the contract.
- b) When the contractor has been paid any sum to which he may become entitled in respect thereof pursuant to Clause GC-36 (Terms of Payment).

**GC-44      DECLARATION AGAINST WAIVER :**

The condemnation by the Corporation of any breach or breaches by the Contractor or an authorized sub-contractor of any of the stipulations and conditions contained in the contract, shall in no way prejudice or affect or be construed as a waiver of the Corporation's rights, powers and remedies under the contract in respect of any breach or breaches.

**GC-45      LAWS GOVERNING THE CONTRACT :**

This contract shall be construed according to and subject to the laws of India and the State of Gujarat and under the jurisdiction of the Courts of Gujarat at Rajkot.

**GC-46      OVER PAYMENT AND UNDER PAYMENT :**

Whenever any claim for the payment of a sum to the Corporation arises out of or under this contract against the Contractor, the same may be deducted by the Corporation from any sum then due or which at any time thereafter may become due to the Contractor under this contract and failing that under any other contract with the Corporation (which may be available with the Corporation), or from his retention money or he shall pay the claim on demand. The Corporation reserves the right to carry out post payment audit and technical examinations of the final bill including all supporting vouchers, abstracts etc. The Corporation further reserves the right to enforce recovery of any payment when detected, notwithstanding the fact that the amount of the final bill may be included by one of the parties as an item of dispute before an Arbitrator, appointed under Article GC-49 (Arbitration) of this contract and notwithstanding the fact that the amount of the final bill figures in the arbitration award. If as a result of such audit and technical examinations any over payment is discovered in respect of any work done by the Contractor or alleged to have been done by him under the contract, it shall be recovered by the Corporation from the Contractor as prescribed above. If any under payment is discovered by the Corporation, the amount due to the Contractor under this contract,

may be adjusted against any amount then due or which may at any time thereafter become due before payment is made to the Contractor.

**GC-47      SETTLEMENT OF DISPUTES :**

Except as otherwise specifically provided in the contract, all disputes concerning questions of fact arising under the contract shall be decided by the Engineer-In-Charge subject to a written appeal by the Contractor to the Engineer-In-Charge and those decisions shall be final and binding on the parties hereto. Any disputes or differences including those considered as such by only one of the parties arising out of or in connection with this contract shall be to the extent possible settled amicably between the parties. If amicable settlement cannot be reached then all disputed issues shall be settled as provided in Article GC-48 (Disputes or differences to be referred to) and Article No.GC-49 (Arbitration).

**GC-48      DISPUTES OF DIFFERENCES TO BE REFERRED TO :**

If at any time, any question, disputes or differences of any kind whatsoever shall arise between the Engineer-In-Charge and the contractor upon or in relation to or in connection with this contract either party may forthwith give to the other, notice in writing of the existence of such question, dispute or difference as to any decision, opinion, instruction, direction, certificate or evaluation of the Engineer-In-Charge. The question, dispute or differences shall be settled by the Municipal Commissioner, Rajkot Municipal Corporation, who shall state his decision in writing and give notice of same to the Engineer-In-Charge and to the Contractor. Such decision shall be final and binding upon both parties. The contract and work on contract if not already breached or abandoned shall proceed normally unless and until the same shall be revised (or uphold) by any arbitration proceedings as hereinafter provided. Such decisions shall be final and binding on the Engineer-In-Charge and the Contractor unless the Contractor shall require the matter to be referred to an Arbitration panel as hereinafter provided.

**GC-49      ARBITRATION :**

In case of any dispute arising during the course of execution, the matter should be referred to Municipal Commissioner who will be sole Arbitrator whose decisions will be final and binding to the Contractor.

The word "Arbitration" or "Arbitration Clause" wherever mentioned in this tender document, is to be treated to be referred to GC-49. In this context, an Order bearing No. RMC/Legal/1858 dated 18-02-2017 of Legal Department of Rajkot Municipal Corporation is uploaded separately along with this tender, which Order, will hereafter referred and taken into consideration for Arbitration related purpose.

**GC-50      TERMINATION OF THE CONTRACT :**

- i) If the Contractor finds it impracticable to continue operation owing to force majeure reasons or for any reasons beyond his control and/or the Corporation find it impossible to continue operation, then prompt notification in writing shall be given by the party affected to the other.
- ii) If the delay or difficulties so caused cannot be expected to cease or become unavoidable or if operations cannot be resumed within two (2) months then either party shall have the right to terminate the contract upon ten (10) days written notice to the other. In the event of such termination of the contract, payment to the Contractor will be made as follows :

- a) The Contractor shall be paid for all works approved by the Engineer-In-Charge and for any other legitimate expenses due to him.
  - b) If the Corporation terminates the contract owing to Force Majeure or due to any cause beyond its control, the Contractor shall additionally be paid for any work done during the said two (2) months period including any financial commitment made for the proper performance of the contract and which are not reasonably defrayed by payments under (a) above.
  - c) The Corporation shall also release all bonds and guarantees at its disposal except in cases where the total amount of payment made to the Contractor exceeds the final amount due to him in which case the Contractor shall refund the excess amount within thirty (30) days after the termination and the Corporation thereafter shall release all bonds and guarantees. Should the Contractor fail to refund the amounts received in excess within the said period such amounts shall be deducted from the bonds or guarantees provided.
- iii) On termination of the contract for any cause the Contractor shall see the orderly suspension and termination of operations, with due consideration to the interests of the Corporation with respect to completion safeguarding of storing materials procured for the performance of the contract and the salvage and resale thereof.

**GC-51      SPECIAL RISKS :**

If during the contract, there shall be an outbreak of war (whether war is declared or not), major epidemic, earthquake or similar occurrence in any part of the world beyond the control of either party to the contract which financially or otherwise materially affects the execution of the contract, the Contractor shall unless and until, the contract is terminated under the provisions of this article use his best endeavors to complete the execution of the contract, provided always that the Corporation shall be entitled at any item after the onset of such special risks, to terminate the contract by giving written notice to the contractor and upon such notice being given this contract shall terminate but without prejudice to the rights of either party in respect of any antecedent breach thereof.

The Contractor shall not be liable for payment of compensation for delay or for failure to perform the contract for reasons of Force Majeure such as acts of public enemy, acts of Government, fires, floods, cyclones, epidemics, quarantine restrictions, lockouts, strikes, freight embargoes and provided that the Contractor shall within 10 (ten) days from the beginning of such delay notify the Engineer-In-Charge in writing, of the cause of delay, the Corporation shall verify the facts and grant such extension as the facts justify.

**GC-52      CHANGE IN CONSTITUTION :**

Where the Contractor is a partnership firm, the prior approval in writing of the owner shall be obtained before any change is made in the constitution of the firm. Where the Contractor is an individual or undivided family business concern such approval as aforesaid shall likewise be obtained before the Contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the Contractor. If prior approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of contract.

**GC-53      SUB-CONTRACTUAL RELATIONS :**

All works performed for the contract by a sub-contractor shall be pursuant to an appropriate agreement between the Contractor and the sub-contractor, which shall contain provision to –

- a) Protect and preserve the rights of the Corporation and the Engineer-In-Charge with respect to the works to be performed under the sub-contracting party will not prejudice such rights.
- b) Require that such work be performed in accordance with the requirements of contract documents.
- c) Require under such contract to which the contractor is a party, the submission to the Contractor of application for payment and claims for additional costs, extension of time, damages for delay or otherwise with respect to the sub-contracted portions of the work in sufficient time, that the Contractor may apply for payment comply in accordance with the contract documents for like claims by the Contractor upon the Corporation.
- d) Waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by the property insurance except such rights as they may have to the proceeds of such insurance held by the Corporation as trustee and,
- e) Obligate each sub-contractor specifically to consent to the provisions of this Article.

**GC-54      PATENTS AND ROYALTIES :**

1. Contractor, if licensed under any patent covering equipment, machinery, materials or composition of matter to be used or supplied or methods and process to be practiced or employed in the performance of this contract agrees to pay all royalties and license fees, which may be due with respect thereto. If any equipment, machinery, materials, composition matters, to be used or supplied or methods practiced or employed in the performance of this contract, is covered by a patent under which Contractor is not licensed, then the Contractor before supplying / using the equipment, machinery, materials, compositions, methods of process shall obtain such license and pay such royalties and license fees as may be necessary for performance of this contract. In the event Contractor fails to pay such royalty or to obtain any such license, any suit for infringement of such patents which is brought against the Contractor or the owner as a result of such failure will be defended by the Contractor at his own expenses and the Contractor will pay any damages and costs awarded in such suit. The Contractor shall promptly notify the owner if the Contractor has acquired knowledge of any plant under which a suit for infringement could be reasonably brought because of the use by the owner of any equipment machinery, materials, process methods to be supplied in hereunder. Contractor agrees to and does hereby grant to owner together with the right to extend the same to any of the subsidiaries of the owner an irrevocable royalty fee license to use in any Country, any invention made by the Contractor or his employees in or as a result of the performance of work under contract.
2. With respect to any sub-contract entered into by Contractor pursuant to the provisions of the relevant clause hereof, the Contractor shall obtain from the sub-contractor an understanding to provide the owner with the same patent protection that contracts is required to provide under the provisions of the clause.

3. The Contractor shall indemnify and save harmless the owner from any loss on account of claims against owner for the contributory infringement of patent rights arising out of and based upon the claim that the use by the Corporation of the process included in the design prepared by the Contractor and used in the operation of the plant infringes on any patent rights.

**GC-55      LIEN :**

If, at any time, there should be evidence of any lien or claim for which owner might have become liable and which is chargeable to the Contractor, the owner shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify the owner against such lien or claim or if such lien or claim be valid the owner may pay and discharge the same and deduct the amount as paid from any money which may be due or become due and payable to the Contractor. If any lien or claims remaining unsettled after all payments are made, the Contractor shall refund or pay to the owner all money that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses.

**GC-56      EXECUTION OF WORK :**

The whole work shall be carried out in strict conformity with the provisions of the contract document, detailed drawings, specifications and the instructions of the Engineer-In-Charge from time to time. The Contractor shall ensure that the whole work is executed in the most substantial, and proper manner with best workmanship using materials of best quality in strict accordance with the specifications to the entire satisfaction of the Engineer-In-Charge.

**GC-57      WORK IN MONSOON :**

When the work continues in monsoon if required, the Contractor shall maintain minimum labour force required for the work and plan and execute the construction and erection work according to the prescribed schedule. No extra rate will be considered for such work in monsoon. During monsoon and entire construction period, the Contractor shall keep the site free from water at his own cost. However, monsoon period from 1st July to 30th September will be excluded in time limit.

**GC-58      WORK ON SUNDAYS AND HOLIDAYS :**

No work except curing shall be carried out on Sunday and holidays. However, if the exigencies of the work need continuation of work on Sundays and Holidays, written permission of the Engineer-In-Charge shall be obtained in advance.

**GC-59      GENERAL CONDITIONS FOR CONSTRUCTION WORK :**

Working hours shall be eight every day. The over time work in two shifts could be carried out with the written permission of the Engineer-In-Charge but no compensation shall be paid for the same. The rate quoted shall include this. The Contractor shall plan his work in such a way that his labourers do not remain idle. The owner will not be responsible for idle labour of the Contractor. The Contractor shall submit to the owner progress report every week. The details and proforma of the report will be as per mutual agreement.

**GC-60      DRAWINGS TO BE SUPPLIED BY THE OWNER : (N.A.)**

The drawings attached with the e-Tender documents shall be for general guidance of the Contractor to enable him to visualize the type of work

contemplated and scope of work involved. Detail working drawings according to which the work is to be done shall be prepared by the Contractor for executing the work.

**GC-61****DRAWINGS TO BE SUPPLIED BY THE CONTRACTOR:**

Where drawings, data are to be furnished by the Contractor they shall be as enumerated in special conditions of contract and shall be furnished within the specified time. Where approval of drawings has been specified it shall be Contractor's responsibility to have these drawings got approved before any work is taken up with regard to the same. Any changes becoming necessary in those drawings during the execution of the work shall have to be carried out by the Contractor at no extra cost. All final drawings shall bear the certification stamp as indicated below duly signed by both the Contractor and Engineer-In-Charge.

Certified true for... .. Project  
Agreement No.....

Signed .....

**Contractor  
In-Charge**

**Engineer-**

Drawings will be approved within three (3 weeks of the receipt of the same by the Engineer-In-Charge.

**GC-62****SETTING OUT WORK :**

The Contractor shall set out the work on the site handed over by the Engineer-In-Charge and shall be responsible for the correctness of the same. The work shall be carried out to the entire satisfaction of Engineer-In-Charge. The approval thereof or partaking by Engineer-In-Charge or setting out work shall not relieve Contractor of any of his responsibilities. The Contractor shall provide at his own cost all necessary level posts, pegs, bamboos, flags, ranging rods, strings and other materials and labourers required for proper setting out of the work. The Contractor shall provide fix and be responsible for the maintenance of all stakes, templates, level markets, profiles and similar other things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for the consequences for such removal or disturbance. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, and distance marks and centerline marks either existing or face lines and cross lines shall be marked by small masonry pillars. Each pillar shall have distance mark at the center for setting up the theodolite. The work shall not be started unless the setting out is choked and approved by Engineer-In-Charge in writing but such approval shall not relieve the Contractor of his responsibilities about the correctness of setting out. The Contractor shall provide all materials, labour and other facilities necessary for checking at his own cost. Pillars bearing geodetic marks on site shall be protected by the Contractor. On completion of the work, the Contractor shall submit the geodetic documents according to which the work has been carried out.

**GC-63****RESPONSIBILITIES OF CONTRACTOR FOR CORRECTNESS OF THE WORK :**

The Contractor shall be entirely and exclusively responsible for the correctness of every part of the work and shall rectify completely any errors therein at his own cost when so instructed by Engineer-In-Charge. If any error has crept in the work due to non-observance of this clause,

the Contractor will be responsible for the error and bear the cost of corrective work.

**1. Materials to be supplied by the Contractor:**

Contractor shall procure and provide all the material required for the execution and maintenance of work including M S rods; all tools, tackles, construction plant and equipment except, the materials to be supplied by the owner detailed in the contract documents. Owner, shall make recommendations for procurement of materials to the respective authorities if desired by the Contractor but assumes no responsibility of any nature. Owner shall insist for procurement of materials with ISI marks supplied by reputed firms of the DGS & D list.

2. If however, the Engineer-In-Charge feels that the work is likely to be delayed due to Contractor's inability to procure materials, the Engineer-In-Charge shall have the right to procure materials, from the market and the Contractor will accept these materials at the rates decided by Engineer-In-Charge.

**GC-64 MATERIALS TO BE SUPPLIED BY THE OWNER :**

1. If the contract provided certain materials or stores to be supplied by the owner, such materials and stores transported by the Contractor at his cost from owner's stores or Railway Station. The cost from Contractor for the value of materials supplied by the owner will be recovered from the R.A.Bill on the basis of actual consumption of materials in the work covered and for which R A Bill has been prepared. After completion of the work, the Contractor has to account for the full quantity of materials supplied to him.
2. The value of store materials supplied by owner to the Contractor shall be charged at rates shown in the contract document and in case any other material not listed in the schedule of materials is supplied by the owner, the same shall be charged at cost price including carting and other expenses incurred in procuring the same. All materials so supplied shall remain the property of the owner and shall not be removed from the site on any account. Any material remaining unused at the time of completion of work or termination of contracts shall be returned to owner's store or any other place as directed by the Engineer-In-Charge in perfectly good condition at Contractor's cost. When materials are supplied free of cost for use in work and surplus and unaccounted balance thereof are not returned to the owner, recovery in respect of such balance will be effected at double the applicable issue rate of the material or the market rates whichever is higher.

**GC-65 CONDITIONS OF ISSUE OF MATERIALS BY THE OWNER: (N.A.)**

The materials specified to be issued by the owner to the Contractor shall be issued by the owner at his store and all expenses for it carting site shall be borne by the Contractor will be issued during working hours and as per rules of owner from time to time.

Contractor shall bear all expenses for storage and safe custody at site of materials issued to him before use in work.

Material shall be issued by the owner in standard / non-standard sizes as obtained from manufacturer.



Contractor shall construct suitable godowns at site for storing the materials to protect the same from damage due to rain, dampness, fire, theft etc.

The Contractor should take the delivery of the materials issued by the owner after satisfying himself that they are in good condition. Once the materials are issued, it will be the responsibility of the Contractor to keep them in good condition and in safe custody. If the materials get damaged or if they are stolen, it shall be the responsibility of the Contractor to replace them at his cost according to the instructions of the Engineer-In-Charge.

For delay in supply or for non-supply of materials to be supplied by the owner, on account of natural calamities, act of enemies, other difficulties beyond the control of the owner, the owner carries no responsibilities. In no case the Contractor shall be entitled to claim any compensation for loss suffered by him on this account.

None of the materials issued to the contractor, shall be used by the Contractor for manufacturing items which can be obtained from the manufacturer's. The materials issued by the owner shall be used for the work only and no other purpose.

Contractor shall be required to execute indemnity bond in the prescribed form for the safe custody and account of materials issued by the owner.

Contractor shall furnish sufficiently in advance a statement of his requirements of quantities of materials to be supplied by the owner and the time when the same will be required for the work, so as to enable Engineer-In-Charge to make arrangements to procure and supply the materials.

A daily account of materials issued by the owner shall be maintained by the contractor showing receipt, consumption and balance on hand in the form laid down by Engineer-In-Charge with all connected paper and shall be always available for inspection in the site office.

Contractor shall see that only the required quantities of materials are got issued and no more. The Contractor shall be responsible to return the surplus materials at owner's store at his own cost.

**GC-66**

**MATERIALS PROCURED WITH ASSISTANCE OF THE OWNER :**

Notwithstanding anything contained to the contrary in any of the clauses of this contract, where any materials for the execution of the contract are procured with the assistance of the owner either by issue from owner's stock or purchase made under orders or permits or licenses issued materials as trustees for owner, and use such materials not disposed them off without the permission of owner and unserviceable materials that may be left with him after completion of the contract or at its termination for any reason whatsoever on his being paid or credited such price as Engineer-In-Charge shall determine having due regard to the conditions of the materials. The price allowed to Contractor shall not exceed the amount charged to him excluding the storage of breach of the aforesaid condition, the Contractor shall in terms of license or permits and/or for criminal breach of trust be liable to compensate owner at double the rate or any higher rates. In the event of these materials at that time having higher rate or not being available in the market then any other rate to be

determined by the Engineer-In-Charge at his decision shall be final and conclusive.

**GC-67      MATERIALS OBTAINED FROM DISMANTLING :**

If the Contractor, in the course of execution of work, is called upon to dismantle any part of work for reasons other than on account of bad or imperfect work, the materials obtained from dismantling will be property of the owner and will be disposed off as per instructions of Engineer-In-Charge in the best interest of the owner.

**GC-68      ARTICLE OF VALUE OF TREASURE FOUND DURING CONSTRUCTION :**

All gold, silver and other minerals of any description and all precious stones, coins, treasures, relics, antiques and other similar things which shall be found in, under or upon site shall be the property of the owner and the Contractor shall properly preserve the same to the satisfaction of the Engineer-In-Charge and shall hand over the same to the owner.

**GC-69      DISCREPANCIES BETWEEN INSTRUCTIONS:**

If there is any discrepancy between various stipulations of the contract documents or instructions to the Contractor or his authorized representative or if any doubt arises as to the meaning of such stipulation or instructions, the Contractor shall immediately refer in writing to the Engineer-In-Charge and shall hand over the same to the owner.

**GC-70      ALTERATIONS IN SPECIFICATIONS & DESIGNS & EXTRA WORK :**

The Architect / Engineer-In-Charge shall have power to make any alterations in, omission from, addition to substitution for, the schedule of rates, the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of work and the Contractor shall be bound to carry out such altered / extra / new items of work in accordance with any instructions which may be given to him in writing signed by Engineer-In-Charge and such alteration omissions, additions or substitutions, shall not invalidate contract and any altered, additional or substituted work shall be carried out by the Contractor on the same conditions of contract. The time of completion may be extended by Architect as may be considered just and reasonable by him. The rates for such additional, altered or substitute work shall be worked out as under :

- a) If the rates for additional, altered or substitutes work are specified in the contract for work, the Contractor is bound to carry out such work at the same rates as specified in the contract.
- b) If the rates for additional, altered or substituted work are not specifically provided in the contract for the work, the rates will be derived from the rates of similar items of work in the contract work. The opinion of Engineer-In-Charge as to whether the rates can be reasonably so derived the items of contract will be final and binding to the Contractors.
- c) If the rates of altered, additional or substitute work cannot be determined as specified in (a) or (b) above, the rate shall be paid as per S.O.R. of RMC and if not available in RMC SOR than it will be paid according to SOR of R&B/GWSSB.
- d) If the rates of altered, additional or substitute work cannot be determined as specified in (a) or (b) or (c) above, the Contractor shall within seven

days of the receipt of order to carry out the work inform the Architect / Engineer-In-Charge of the rate which he intends to charge for such work supported by rate analysis and the Architect / Engineer-In-Charge will determine the rate on the basis of prevailing market rates of materials, labour cost at schedule of labour plus 15% there on as Contractor's supervision overheads and profit. The opinion of Architect / Engineer-In-Charge as to the market rates of materials and the quantity of labour involved per unit of measurement will be final and binding on Contractor.

But under no circumstances, the Contractor suspends work or the plea of non-settlement of items falling under this clause.

**GC-71      ACTION WHEN NO SPECIFICATIONS ARE ISSUED :**

In case of any class of work for which no specifications is supplied by the owner in the e-Tender documents, such work shall be carried out in accordance with relevant latest ISS and if ISS do not cover the same, the work shall be carried out as per General Technical Specification for building work; and if not covered in then it is to be with standard Engineering Practice subject to the approval of Engineer-In-Charge.

**GC-72      ABNORMAL RATES :**

Contractor is expected to quote rate for each item after careful analysis of cost involved for the performance of the completed item considering all specifications and conditions of contract.

**GC-73      ASSISTANCE TO ENGINEER-IN-CHARGE:**

Contractor shall make available to Engineer-In-Charge free of cost all necessary instruments and assistance in checking of any work made by the Contractor setting out for taking measurement of work etc.

**GC-74      TESTS FOR QUALITY OF WORK :**

1. All workmanship shall be of the best kind described in the contract documents and in accordance with the instructions of Engineer-In-Charge and shall be subjected from time to time to such tests at Contractor's cost as the Engineer-In-Charge may direct at the place of manufacture of fabrication or on the site or at any such place. Contractor shall provide assistance, instruments, labour and materials as are normally required for examining, measuring and testing of any work of workmanship as may be selected and required by Engineer-In-Charge.
2. All tests necessary in connection with the execution of work as decided by Engineer-In-Charge shall be carried out at an approved laboratory at Contractor's cost.
3. Contractor shall furnish the Engineer-In-Charge for approval when requested or if required by the specification, adequate samples of all materials and finished goods to be used in work sufficiently in advance to permit tests and examination thereof. All materials furnished and finished goods applied in work shall be exactly as per the approved samples.

**GC-75      ACTION AND COMPENSATION IN CASE OF BAD WORKMANSHIP :**

If it shall appear to the Engineer-In-Charge that any work has been executed with materials of inferior description, or quality or are unsound or with unsound, imperfect or unskilled workmanship or otherwise not in accordance with the contract, the Contractor shall, on demand in writing

from Engineer-In-Charge or his authorized representative specifying the work, materials or articles complained of, notwithstanding that the same may have been inadvertently passed, certified and paid for, forthwith rectify or remove and reconstruct the work, so specified. In the event of failure to do so within a period to be specified by the Engineer-In-Charge in his aforesaid demand, Contractor shall be liable to pay compensation at the rate of half a percent of the estimated cost of work for every work limited to a maximum of ten (10%) percent of the value of work while his failure to do so continues and in the case of any such failure, the Engineer-In-Charge may on expiry of the notice period rectify and remove and re-execute the work or remove and replace with others at the risk and cost of the Contractor. The decision of the Engineer-In-Charge as to any question arising under this clause shall be final and conclusive.

**GC-76**

**SUSPENSION WORK :**

Contractor shall, if ordered in writing by Engineer-In-Charge or his representative temporarily suspended the work or any part thereof for such time (not exceeding one month) as ordered and shall not after receiving such written notice proceed with the work until he shall have received a written order to proceed therewith. The Contractor shall not be entitled to claim compensation for any loss or damage sustained by him by reason of temporary suspension of work as aforesaid. An extension of time for completion of work will be granted to the Contractor corresponding to the delay caused by such suspension of work if he applies for the same provided the suspension was not consequent upon any default or failure on the part of the Contractor.

**GC-77**

**OWNER MAY DO PART OF THE WORK :**

When the Contractor fails to comply with any instructions given in accordance with the provisions of this contract, the owner has the right to carry out such parts of work as the owner may designate whether by purchasing materials and engaging labour or by the agency of another Contractor. In such case the owner shall deduct from the amount which otherwise might become due to Contractor, the cost of such work and materials with then (10) percent added to cover all departmental charges and should the total amount thereof exceed the amount due to contract, Contractor shall pay the difference to owner.

**GC-78**

**POSSESSION PRIOR TO COMPLETION :**

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

**GC-79**

**COMPLETION CERTIFICATE :**

As soon as the work has been completed in accordance with contract (except in minor respects that do not effect their use for the purpose for which they are intended and except for maintenance thereof) as per General Conditions of Contract the Engineer-In-Charge shall issue a certificate (hereinafter called completion certificate) in which shall certify the date on which work has been completed and has passed the said tests and owner shall be deemed to have taken over work on the date so

certified. If work has been divided in various groups in contract, owner shall be entitled to take over any group or groups before the other or others and there upon the Engineer-In-Charge will issue a completion certificate, which will, however, be for such group or groups so taken over.

In order that Contractor could get a completion certificate, he shall make good will all speed any defect arising from the defective materials supplied by Contractor of workmanship or any act or omission of Contractor that may have been discovered or developed after the work or groups of works has been taken over. The period allowed for carrying out such work will be normally, one month. If any defect be not remedied within the time specified, owner may proceed to do work at Contractor's (Agency, or Firm) risk and expenses and deduct from the final bill such amount as may be decided by owner. If by reason of any default on the part of the Contractor, a completion certificate has not been issued in respect of every portion of work within one month after the date fixed by contract for completion of work, owner shall be at liberty to use work or any portion thereof in respect of which a completion certificate has been issued, provided that work or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completion of that work or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completion of that work for the issue of completion certificate.

**GC-80**

**SCHEDULE OF RATES:**

1. The rates quoted by the Contractor shall remain firm till the completion of the work and shall not be subject to escalation. Schedule of rates shall be deemed to include and cover all costs, expenses and liabilities of every description and risks of every kind to be taken in executing, completing and handing over the work to owner by Contractor. The contractor shall be deemed to have known the nature, scope, magnitude and the extent of work and materials required though contract documents may not fully and precisely furnish them. He shall make such provision in the Schedule of Rates as he may consider necessary to cover the cost of such items of work and materials as may be reasonable and necessary to complete the work. The opinion of Engineer-In-Charge as to the item of work which are necessary and reasonable for completion of the work shall be final and binding on Contractor although the same may be not shown on drawings or described specifically in contract documents.
2. The Schedule of Rates shall be deemed to include and cover the cost of all constructional plant, temporary work, materials, labour and all other matters in connection with each item in Schedule of Rates and the execution of work or any portion thereof finished complete in every respect and maintained as shown or described in the contract document or as may be ordered in writing during the continuance of the contract.
3. The Schedule of Rates shall be deemed to include and cover the cost of all royalties and fees for the articles and processes, protected by letters patent or otherwise incorporated in or used in connection with work, also all royalties, rents and other payments in connection with obtaining material of whatsoever kind for work and shall include an indemnity to owner which Contractor hereby gives against all action, proceedings, claims, damages, costs and expenses arising from the incorporation in or use on the works of any such articles, processes or materials. Other Municipal or local Board charges if levied on material, equipment or machineries to be brought to site for use on work shall be borne by the Contractor.

4. No exemption or reduction of custom duties, excise duties, sales tax or any other taxes or charges of the Central or State Government or of any Local Body whatsoever will be granted or obtained and all such expenses shall be deemed to have been included in and covered by Schedule of Rates. Contractor shall also obtain and pay for all permits or other privileges necessary to complete the work.
5. The Schedule of Rates shall be deemed to include and cover risk on account of delay and interference with Contractor's conduct of work which may occur from any cause including orders of owner in the exercise of his powers and on account of extension of time granted due to various reasons.
6. For work under unit rate basis, no alteration will be allowed in the Schedule of Rates by reasons of work or any part of them being modified, altered, extended, diminished or omitted.

**GC-81****PROCEDURE FOR MEASUREMENT OF WORK IN PROGRESS:**

1. All measurements shall be in metric system. All the work in progress will be jointly measured by the representative of Engineer-In-Charge and Contractor's authorized agent. Such measurements will be got recorded in the Measurement Book by the Engineer-In-Charge or his authorized representative and signed by the Contractor or his authorized agent in token of acceptance. If the Contractor or his authorized agent fails to be present whenever required by the Engineer-In-Charge for taking measures for every reasons whatsoever, the measurement will be taken by the Engineer-In-Charge or his authorized representative notwithstanding the absence of Contractor and these measurements will be deemed to be correct and binding on the Contractor.
2. Contractor will submit a bill in approved proforma in quadruplicate to the Engineer-In-Charge of the work giving abstract and detailed measurements of various items executed during a month as mutually agreed. The Engineer-In-Charge shall verify the bill and the claim, as far as admissible, adjusted if possible, within 10 days of presentation of the bills.

**GC-82****RUNNING ACCOUNT PAYMENTS TO BE REGARDED AS ADVANCES:**

1. All running account payments shall be regarded as payments by way of advance against the final payment only and not as payment for work actually done and completed and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed or rejected or to be considered as an admission of the due performance of contract or any part thereof.
2. Five (5) percent of the gross R A Bill amount shall be retained from each bill as retention amount and the same will be paid with the final bill.

**GC-83****NOTICE FOR CLAIM FOR ADDITIONAL PAYMENT:**

If the Contractor considers that he is entitled to extra payment or compensation or any claim whatsoever in respect of work, he shall forthwith give notice in writing to the Engineer-In-Charge about his extra payment and / or compensation. Such notice shall be given to the Engineer-In-Charge within ten (10) days from the happening of any event upon which Contractor basis such claims and such notice shall contain full

Particulars of the nature of such claim with full details and amount claimed. Failure on the part of the Contractor to put forward any claim with the necessary particulars as above, within the time above specified shall be an absolute waiver thereof. No omission by owner to reject any such claim and no delay in dealing therewith shall waiver by owner or any rights in respect thereof.

**GC-84      PAYMENT OF CONTRACTOR'S BILL:**

1. The price to be paid by the owner to Contractor for the work to be done and for the performance of all the obligations undertaken by the Contractor under contract shall be based on the contract price and payment to be made accordingly for the work actually executed and approved by the Engineer-In-Charge.
2. No payment shall be made for work costing less than Rs.2,00,000/- till the work is completed and a certificate of completion for Construction is given. But in case of work estimated to cost more than Rs.2,00,000/-, Contractor on submitting the bill thereof will be entitled to receive a monthly payment proportionate to the part thereof, approved and passed by Engineer-In-Charge, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against contractor. This payment shall be made after necessary deductions as stipulated elsewhere in the contract documents for materials, security deposit etc. The payment shall be released to the Contractor within two (2) month of submission of the bill duly pre-occupied on proper revenue stamp. Payment due to Contractor shall be made by the owner by ECS/RTGS mode in Indian currency. Successful bidder must furnish his Bank details for RTGS/ECS with Account Branch of RMC.

**GC-85      FINAL BILL:**

The final bill shall be submitted by Contractor within one (1) month of the date of physical completion of work, otherwise the Engineer-In-Charge's certificate of the measurement and of total amount payable for work shall be final and binding on all parties.

**GC-86      RECEIPT FOR PAYMENT:**

Receipt for payment made on account of work when executed by a firm must be signed by a person holding Power of Attorney in this respect on behalf of Contractor except when described in the e-Tender as a limited company in which case the receipt must be signed in the name of the Company by one of its principal officers or by some person having authority to give effectual receipt for the Company.

**GC-87      COMPLETION CERTIFICATE:**

1. When the Contractor fulfils his obligation as per terms of contract, he shall be eligible to apply for Completion Certificate. Contractor may apply for separate Completion Certificate in respect of each such portion of work by submitting the completion documents along with such application for Completion Certificate.

The Engineer-In-Charge shall normally issue to Contractor the Completion Certificate within one (1) month after receiving an application thereof from Contractor after verifying, from the completion documents and satisfying himself that work has been completed in accordance with and as set out in the construction and erection drawings and the contract documents. Contractor after obtaining the Completion Certificate is eligible to present the final bill for work executed by him under the terms of contract.

2. Within one month of completion of work in all respects Contractor shall be furnished with a certificate by the Engineer-In-Charge of such completion but no certificate shall be given nor shall work be deemed to have been executed until all (i) scaffolding, surplus materials and rubbish is cleaned off site completely, (ii) until work shall have been measured by the Engineer-In-Charge whose measurement shall be binding and conclusive and, (iii) until all the temporary works, labour and staff colonies etc. constructed are removed and the work site cleaned to the satisfaction of the Engineer-In-Charge. If Contractor shall fail to comply with the requirements as aforesaid or before date fixed for the completion of work, the Engineer-In-Charge may at the expense of Contractor remove such scaffolding, surplus materials and rubbish and dispose of the same as he thinks fit.
  
3. The following documents will form the completion documents:-
  - a) Technical documents according to which the work has been carried out.
  - b) Three sets of construction drawings showing therein the modifications and corrections made during the course of execution signed by the Engineer-In-Charge.
  - c) Completion Certificate for "Embedded" or "Covered" up work.
  - d) Certificate of final levels as set out for various works.
  - e) Certificate of test performed for various work.
  - f) Material appropriation statement for the materials issued by owner for work and list of surplus materials returned to owner's store duly supported by necessary documents. (N.A.)
  
4. Upon expiry of the period of defect liability and subject to Engineer-In-Charge being satisfied that work has been duly maintained by Contractor during the defect liability period of fixed originally or as extended subsequently and that Contractor has in all respects made up any subsidence and performed all his obligations under contract, the Engineer-In-Charge (without prejudice to the rights of owner in any way) give final certificate to that effect. The Contractor shall not be considered to have fulfilled the whole of his obligation until final certificate shall have been given by the Engineer-In-Charge.
  
5. **Final Certificate only evidence of completion:**  
 Except the final certificate, no other certificate of payment against a certificate or on general account shall be taken to be an admission by owner of the due performance of contract or any part thereof of occupancy or validity or any claim by the Contractor.

**GC-88****TAXES, DUTIES, ETC.:**

1. Contractor agrees to and does hereby accept full and exclusive liability for the payment of any and all taxes including Sales Tax, Duties, etc., now or hereinafter imposed, increased or modified from time to time in respect of work and materials and all contributions and taxes for unemployment, compensation, insurance and old age pension or annuities now or hereinafter imposed by the Central or State Government authorities with



Respect to or covered by the wages, salaries or other compensation paid to the persons employed by Contractor.

If the Contractor is not liable to Sales Tax assessment, a certificate to that effect from the Competent Authority shall be produced without which final payment to the Contractor shall not be made. No. P, 'C' and 'D' Form shall be supplied by the owner, and the Contractor shall be required to pay full tax as applicable.

2. Contractor shall be responsible for compliance with all obligations and restrictions imposed by the labour law or any other law affecting employer-employee relationship.
3. Contractor further agrees to comply and to secure the compliance of all sub-contractors with applicable Central, State, Municipal and local laws and regulations and requirement. Contractor also agrees to defend, indemnify and hold harmless the owner from any liability or penalty which may be imposed by Central, State or local authority by reasons of any violation by Contractor or sub Contractor of such laws, regulations or requirements and also from all claims, suits or proceedings that may be brought against owner arising under, growing out of or by reasons or work provided for by this Contract by third parties or by Central or State Government authority or any administrative Sub-Division thereof.

The Sales Tax on work contract will be borne by Contractor.

#### **GC-89**

##### **INSURANCE:**

Contractor shall at his own expenses carry and maintain the reputable Insurance Companies to the satisfaction of owner as follows:

1. Contractor agrees to and uses hereby accept full and exclusive liability for compliance with all obligations imposed by the Employer's State Insurance Act, 1948 and Contractor further agrees to defend, indemnify and hold owner harmless from any liability or penalty which may be imposed by the Central or State Government or local authority by reasons of any assorted violation by Contractor or Sub-Contractor or the Employees State Insurance Act, 1948 and also from all claims, suits or proceedings that may be brought against owner arising under, growing out of or by reasons of the work provided for by this contract whether brought by employees of Contractor by third parties or by Central or State Government authority or any administrative Sub-division thereof.

Contractor agrees to fill in with the Employees State Insurance Corporation, the declaration form and all forms which may be required in respect of Contractor's or sub-Contractor's employees whose aggregate remuneration is Rs.400/- p.m. or less and who are employed in work provided for or those covered by ESI from time to time under the agreement. The Contractor shall deduct and secure the agreement of the sub-Contractor to deduct the employee's contribution as per the first schedule of the Employees State Insurance Act from wages. Contractor shall remit and secure the agreement of sub-contractor to remit to the State Bank of Indian Employees State Insurance Accounts, the employee's contribution as required by the Act. Contractor agrees to maintain all cards and records as required under the Act in respect of employees and payments and Contractor shall secure the agreements of the sub-contractors to maintain in such records, any expenses incurred for the contributions, making contributions or maintaining records shall be to

Contractors or sub-contractors own account. owner shall retain such sum as may be necessary from the contract value until Contractor shall furnish satisfactory proof that all contribution as required by the Employees State Insurance Act, 1948 have been paid.

2. **Workman's compensation and employee's liability insurance:** Insurance shall be effected for all Contractors employees engaged in the performance of this contract. If any part of work is sublet, Contractor shall require the sub-Contractor to provide workman's compensation and employer's liability insurance, which may be required by owner.
3. Other Insurance required under law or regulations or by owner Contractor shall also carry and maintain any and all other insurance which may be required under any law or regulation from time to time. He shall also carry and maintain any other insurance, which may be required by owner.

**GC-90      DAMAGE TO PROPERTY:**

1. Contractor shall be responsible for making good to the satisfaction of owner any loss of and any damage to all structures and properties belonging to owner or being executed or procured or being procured by owner or of other agencies within the premises of all work of owner, if such loss or damage is due to fault and / or the negligence of willful act or omission of Contractor, his employees, agent, representatives or sub-Contractor s.
2. Contractor shall indemnify and keep owner harmless of all claims for damage to properties other than property arising under by reasons of this agreement, such claims result from the fault and / or negligence or willful act or omission of Contractor, his employees, agent's representative or sub-contractor.

**GC-91      CONTRACTOR TO INDEMNIFY OWNER:**

1. The Contractor shall indemnify and keep indemnified the owner and every member, officer and employee of owner from and against all actions, claims, demands and liabilities whatsoever under the in respect of the breach of any of the above clauses and / or against any claim, action or demand by any workman / employee of the Contractor or any sub-contractor under any laws, rules or regulations having force of laws, including but not limited to claims against the owner under the workman compensation Act, 1923, the Employee's Provident Funds Act, 1952 and / or the contract labour (Abolition and Regulations) Act, 1970.
2. PAYMENTS OF CLAIMS AND DAMAGES : If owner has to pay any money in respect of such claims or demands aforesaid, the amount so paid and the cost incurred by the owner shall be charged to and paid by Contractor without any dispute notwithstanding the same may have been paid without the consent or authority of the Contractor.
3. In every case in which by virtue of any provision applicable in the workman's Compensation Act, 1923 or any other Act, owner be obliged to pay compensation to workmen employed by Contractor the amount of compensation so paid, and without prejudice to the rights of owner under Section-(12) Sub-section-(2) of the said Act, owner shall be at liberty to recover such amount from any surplus due to on to become due to the Contractor or from the security deposit. Owner will not be bound to contest any claim made under Section-(12) Sub-section-(2) of the said act

Except on written request of Contractor and giving full security for all costs consequent upon the contesting of such claim.

The Contractor shall protect adjoining sites against structural, decorative and other damages that could be caused to adjoining premises by the execution of these works and make good at his cost, any such damage, so caused.

**GC-92      IMPLEMENTATION OF APPRENTICE ACT 1954:**

Contractor shall comply with the provisions of the apprentice Act 1954 and the orders issued there under from time to time. If he fails to do so, it will be a breach of contract.

**GC-93      HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS:**

Contractor shall comply with all the rules and regulations of the local Sanitary Authorities or as framed by owner from time to time for the protection of health and provide sanitary arrangements of all labour directly or indirectly employed on the work of this contract.

**GC-94      SAFETY CODE:**

**General:**

Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with owner's rules as set forth herein.

**1.0      First Aid and Industrial Injuries :**

**1.1** Contractor shall maintain First-Aid facilities for its employees and those of his sub-contractors.

**1.2** Contractor shall make outside arrangements for ambulance service and for the treatment of industrial injuries. Name of those providing these services shall be furnished to Engineer-In-Charge prior to start of construction, and their telephone numbers shall be prominently posted in Contractor's field office.

**1.3** All injuries shall be reported promptly to Engineer-In-Charge and a copy of Contractor's report covering each personal injury requiring the attention of a physician shall be furnished to owner.

**2.0      General Rules :**

**2.1** Carrying and striking, matches, lighters inside the project area and smoking within the job site is strictly prohibited. Violators of smoking rules shall be discharged immediately. Within the operation area, no hot work shall be permitted, without valid gas, safety, fire permits. The Contractor shall also be held liable and responsible for all lapses of his sub-Contractors / employees in this regard.

**3.0      Contractor's Barricades :**

**3.1** Contractor shall erect and maintain barricades without any extra cost, required in connection with his operation to guard or protect during the entire phase of the operation of this contract for -

- i)      Excavation
- ii)     Hoisting areas
- iii)    Areas adjudged hazardous by Contractor's OR Owner's inspectors.
- iv)    Owner's existing property liable to be damaged by Contractor's operations, in the opinion of Engineer-In-Charge / Site Engineer.

**3.2** Contractor's employees and those of his sub-contractors shall become acquainted with owner's barricading practices and shall respect the provisions thereof.

**3.3** Barricades and hazardous areas adjacent to but not located in normal routes of travel shall be marked by red lantern at night.

**4.0 Scaffolding :**

**4.1** Suitable scaffolding shall be provided for workman for all works that cannot safely be done from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handholds shall be provided on the ladder and the same shall be given an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical).

**4.2** Scaffolding or staging, more than 3.6 M. (12') above the ground or floor, swing or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise fixed at least 1.0 M (3') high above the floor or platform or scaffolding or staging and extending along the entire length of the outside ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

**4.3** Working platforms, gangways, and stairways should be so constructed that they should not sag unduly or inadequately and if the height of the platform or the gangway of the stairway is more than 3.6 (12') above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in 4.2 above.

**4.4** Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1.0 M (3'.0").

**4.5** Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9.0 M. (30') in length while the width between the side rails in rung ladder shall in no case be less than 30 cms (12 inches) for ladder up to and including 3.0 M. (10'), in longer ladders this width would be increased at least 6 mm (1/4") for each addition 30 c.m. (1.0) of length. Uniform step spacing shall not exceed 30 cms. (12"). Adequate precaution shall be taken to prevent danger from electrical equipment. No materials on any of the side of work shall be so stacked or placed as to cause danger or inconvenience to any person or public. The Contractor shall also provide all necessary all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit action or other proceedings at law that may be brought by any persons for injury sustained owing to neglect of the above precautions and to pay damages and costs which may be awarded in any such suit or action or proceedings to any such person, or which, may be with the consent of the Contractor be paid to compromise any claim by any such person.

**5.0 Excavation :**

- 5.1** All trenches 1.2 M (4') or more in depth, shall at all-time be supplied with at least one ladder.
- 5.2** Ladder shall be extended bottom of the trench to at least 3" above the surface of the ground. The side of the trench which are 1.5 M (5') or more in depth shall be stopped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 M (5') of the trench of half of the trench depth whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or under cutting be done.
- 6.0 Demolition :**
- 6.1** Before any demolition work is commenced and also during the progress of the work all roads and open area adjacent to the work site shall either be closed or suitably protected.
- 6.2** No electric cable or apparatus which is liable to be a source of danger shall remain electricity charged.
- 6.3** All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor or other part of the building shall be so over loaded with debris or materials as to render it unsafe.
- 7.0 Safety Equipment :**
- 7.1** All necessary personal safety equipment as considered necessary by the Engineer-In-Charge should be made available for the use of persons employed on the site and maintained in a condition suitable for immediate use, and the Contractor should take adequate steps to ensure proper use of equipment by those concerned.
- 7.2** Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective gloves.
- 8.0 Risky Place :**
- 8.1** When the work is done near any place where there is a risk of drowning, all necessary safety equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work.
- 9.0 Hoisting Equipment :**
- 9.1** Use of hoisting machines and tackles including their attachments, and storage and supports shall conform to the following standards or conditions.
- 9.2** These shall be of good mechanical construction, sound material and adequate strength and free from patent defect and shall be kept in good condition and in good working order.
- 9.3** Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength and free from patent defects.
- 9.4** Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 215 Monthss should be in-charge of any hoisting machine including any scaffolding.
- 9.5** In case of every hoisting machine and of every chain ring hook, shackle, swivel and pulley block used in hoisting or lowering or as means of

Suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

**9.6** In case of departmental machine, the safe work load shall be notified by the Engineer-In-Charge, as regards Contractor's machine, the Contractor shall, notify, the safety working load of the machine to the Engineer-In-Charge. Whenever the Contractor brings any machinery to site of work he should get it verified by the Engineer-In-Charge concerned.

**10.0 Electrical Equipment:**

Motors, gears, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards, hoisting appliances should be provided with such means when will reduce to the minimum the risk of accidental descent of the load, adequate precautions shall be taken to reduce to the minimum the risk of any part or a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel such as gloves, and booths as may be necessary shall be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

**11.0 Maintenance of Safety Devices:**

All scaffolds, ladders and other safety devices as mentioned or described herein shall be maintained in sound condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near place of work.

**12.0 Display of Safety Instructions:**

The safety provisions should be brought to the notice of all concerned by display on a Notice Board at a prominent place at the work spot. The persons responsible for compliance of the safety code shall be named therein by the Contractor.

**13.0 Enforcement of Safety Regulations:**

To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangement made by the Contractor shall be open to inspection by the Welfare Officer, Engineer-In-Charge or Safety Engineer of the owner or their representatives.

**14.0 No Exemption :**

**14.1** Notwithstanding the above clause 1.0 to 13.0 there is nothing to exempt the Contractor from the operations of any other Act or Rules in force in the Republic of India.

**14.2** In addition to the above, the Contractor shall abide by the safety code provisions as per C.P.W.D. safety code framed from time to time.

**GC-95 ACCIDENTS:**

It shall be Contractor's responsibility to protect against accidents on the works. He shall indemnify the owner against any claim for damage or for injury to person or property resulting from, and in the course of work and also under the provisions of the workman's compensation Act. On the occurrence of an accident arising out of the works which results in death or which is so serious as to be likely to result in death, the Contractor shall within twenty-four hours of such accident, report in writing to the

Engineer-In-Charge, the facts stating clearly and in sufficient details the circumstances of such accident and the subsequent action. All other accidents on the works involving injuries to person or damage to property other than that of the Contractor shall be promptly reported to the Engineer-In-Charge, stating clearly and in sufficient details the facts and circumstances of the accidents and the action taken. In all cases, the Contractor shall indemnify the owner against all loss or damage resulting directly or indirectly from the Contractor's failure to report in the manner aforesaid. This includes penalties or fines, if any, payable by the owner as a consequence of failure to give notice under the Workman's Compensation Act, or failure to conform to the provisions of the said act in regard to such accidents.

In the event of an accident in respect of which compensation may become payable under the Workman's Compensation Act VIII of 1923 including all modification thereof, the Engineer-In-Charge may retain out of money due and payable to the Contractor such sum or sums of money as may in the opinion of Engineer-In-Charge be sufficient to meet such liability. On receipt of award from the Labour Commissioner in regard to quantum of compensation, the difference in amount will be adjusted.

**Addl / Asst. Engineer**  
**R.M.C.**

**Dy.Ex.Engineer**  
**R.M.C.**

**ADDL. CITY ENGINEER**  
**R.M.C.**

**Signature of Contractor with Seal**

# **SPECIAL CONDITIONS OF CONTRACTOR**



## **SPECIAL CONDITION OF CONTRACTOR**

- For this work the 'Architect' means the Government Architect employed by the Government.

- A set of sketch Design and Drawing is given along with the tender are only for the estimate purpose and they are very general. The actual work will have to be carried out by the tenderer as per detailed working drawing that will be given by the Architect. During the contract of the work and no compensation will be paid to the contractor for the changes and modification if done in the working drawing from the sketch design and drawings given along with the tender.

- Since the Building structure is more than 100 years old, Contractor to conduct various tests like NDT and other tests to ensure that the building is structurally stable to undergo the renovation work and is fit for public use for the next 50 years. Structural stability certificate is to be issued by Contractor to RMC after execution of work.

- Arvindbhai Manier Hall is an old and heritage building, if structural stability report is required for installation of electrical or HVAC equipment, it is carried out by contractor, this is contractor's scope, client (RMC) will not extra payment for this.

- The Electrical & HVAC contractor shall keep at least one technically skilled person at site to take care maintenance activities during visit of VVIPs, Electrical & HVAC Contractor will be informed by the authority in advance for the same.

- The electrical and HVAC contractor should ensure a break down call time of 48 hours (i.e. the total time between the complaint being registered by the electrical and HVAC contractor and the fault being rectified). This includes the time taken to reach the site, diagnose and repair/replace the defective component/module/equipment and equipment covered under the contract. If the contractor does not fulfill the break down call time of 48 hours as per the time limit then Rs. 2000/- will be deducted for each day of delay in rectifying the defect and Rs. 1000/- per day for not providing sufficient technical staff.

- An amount of 5% of the total cost of electrical and HVAC shall be deposited with the department as security deposit for 5 years during operation and maintenance period of 5 years.

- HT LIASONING WORK SHOULD BE DONE BY ELECTRICAL CONTRACTOR. 11 KV SUBSTATION WORK & D.G.SET APPROVAL SHOULD BE TAKEN BY ELECTRICAL CONTRACTOR AND RELATED FEES & PAYMENT DONE BY CONTRACTOR BUT

CONTRACTOR HAS TO BE SUBMITTED THE RECEIPT OF THE LIASONING WORK TO THE RMC.

- HT Connection work : work of HT connection by the contractor, including passing, licensing, installation, testing and commissioning, if the expenditure incurred by the contractor for this work, the contractor has to submit its documents like bills, receipts to the department. . The cost incurred in the work may be verified, if the cost increases, the increased cost will be paid by the department to the contractor, but if the cost decreases, the contractor will have to refund the amount to the department.

- The Contractor shall provide 48 hours advance notice of all civil/MEP equipment for factory testing, and any expenses (such as travel, accommodation, food, etc..) for the factory testing shall be borne by the Contractor, which shall not be paid separately by the Client.

### **EXTRA ITEM** (which are not part of tendered items)

Extra Item : Extra item of work shall not vitiate the contract. The contractor shall be bound to execute extra items of work as directed by Employer / Employer's Representative.

No payment shall be entertained for extra item until such executed quantity and the rates thereon are correctly derived and approved by the Employer.

The Contractor's quotation of costs for the Change of Scope/Extra Items shall be determined on the following principles:

(a) the latest available edition of Gujarat State Schedule of Rates (GSSR) Published by R&B applicable to Gujarat will be adopted for the valuation of any works which are not already covered by the items included in Bill of Quantity. Payments for the Extra Items shall be made in INR only.

(b) in the event that items are not covered in the GSSR, then the latest edition of the Gujarat Water Supply and Sewerage Board applicable for Gujarat and then the Delhi Schedule of Rates related to Gujarat will be used in that order.

(c) the market rates substantiated with 3 quotations, followed by work order and Tax Invoice shall be considered only when the executed items are not covered under Price Schedule or the above referred schedule of rates. A fixed percentage of 15% shall be added to cover the Contractor's Overhead and Profit for the rates evaluated under this category (c).

## **Payment Term & Condition**

The Contractor on submitting a monthly bill be entitled to receive payment proportionate to the part of the work then approved and at the rates quoted in Bill of Quantity (Schedule-B) and passed by the Employer's Representative, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the Contractor. Such payments made by the Employer shall form basis for determining progress achieved and imposing Liquidated damages if any.

The Contractor shall also be paid part payment between 60 percentage depending on type of materials as per reasonability to be determined by the Employer / Employer's representative on supply of materials and Plant brought by the Contractor to the Site for incorporation in the Permanent Works subject to following conditions:

- 60% Payment after material supply
- 10% Payment after installation
- 10% Payment after testing
- 20% payment on completion on the final project.

- a) The materials and Plant are in accordance with the specifications for the Works;
- b) The materials and Plant are properly stored and protected against loss, damage or deterioration;
- c) The materials and Plant are insured by the contractor during storage and construction for full value.
- d) The Contractor's records of the requirements, orders, receipts and use of materials and Plant are kept in a form approved by the Employer / Employer's representative and such records are available for inspection by the Employer / Employer's representative;
- e) The Contractor has submitted a statement of his cost of acquiring and delivering the materials and Plant to the Site, together with such documents as may be required for the purpose of evidencing such cost; and the Contractor has agreed to indemnify the Employer against loss or damage to the materials and Plant during the period between delivery to the site and incorporation into the Works.
- f) Payment by the Employer under this Clause for materials and Plant delivered to the Site does not, in any way, relieve the Contractor of his responsibility to ensure the safety and protection of such materials and Plant during the period between delivery to the site and their incorporation into the Permanent Works. In the event that any materials and Plant are lost, damaged or deteriorated between their delivery to the site and their incorporation into the Permanent Works, the Contractor shall be fully responsible to replace such materials and Plant, or to make such repairs as may be required to restore the materials and Plant to the specified condition, at his own cost.
- g) In case of unrealistically high price of any individual or more items, the contractor shall furnish proper justification with

breakup/backup calculation of the rates of such items and shall be subject to Employer / Employer's representative approval. If the Employer Engineer so determines may ask the contractor to furnish additional Bank Guarantee depending on risk perception of Employer / Employer's representative, as per Bank Guarantee format to be provided later during execution.

h) In any of the above conditions, price analysis provided by the bidder cannot be substantiated satisfactorily, the Employer reserves the rights to reject the bid of preferred bidder without assignment any reason whatsoever.

The balance payments after accounting of above part payments against supply of materials and plants shall be paid after incorporation in the permanent works. Such interim payments as above on supply of materials and plants and balance payments after incorporation in the permanent works shall also form basis for determining progress achieved and imposing Liquidated damages, if any.

All such intermediate payments shall be regarded as payments by way of advance against, the final payment only and not as payments for work actually done and completed and shall not preclude the Employer's Representative from requiring bad, unsound, imperfect or unskilled work to be removed and taken away and reconstructed or re-erected, nor shall any such payments be considered as an admission of the due performance of the contract or any part thereof in any respect or the accruing of any claims, not shall it conclude, determine or affect in any way the power of Employer's Representative as to the final settlement and adjustment of the accounts or otherwise or in any other way vary or affects the contract.

The rates for items of work shall be valid only when the item concerned is accepted as having been completed fully in accordance with the sanctioned specifications. In case where the items of work are accepted as not so completed, the Employer's Representative may make payment on account of such items at such reduced rates as he may consider reasonable in preparation of running account or final account bill.

A bill shall be submitted by the contractor each month on or before the date fixed by the Employer's Representative for all works executed in the previous month and the Employer's Representative shall take or cause to be taken the requisite measurements for the purpose of having the same verified and the claim so far as it is admissible, shall be adjusted within fifteen days from the submission of the bill.

The Contractor shall submit all the bills on the printed forms to be had on application at the office of the Employer's Representative. The charges to be made in the bills shall always be entered at the rates specified in the agreement or at the part / reduced rates

subject to the approval by the Employer's Representative in the case of items not completed/executed as per agreements.

Payment to the Contractor shall be made within 45 days of receipt of the invoice and certification of the work done by the Employer's Representative in the approved format. However, the final bill payment shall be made on Completion of Completion of Works within 75 days of receipt of invoice by the Employer.

Amount due for recovery on other facilities as well as also for other services, water supply and electricity charges and for other expenditure, if any, incurred by the Employer on Contractor's behalf on labours and materials which may become due from the Contractor as per the Contract as well as under any other laws prevailing which may become due, will be recovered from the payments to the Contractor, as and when due.

### **WATER SUPPLY:**

For all purpose connected with work the contractor is required to make his own arrangement for sufficient supply of water in such quantity and for such quality and such places on the work as may be necessary. The rates quoted in the tender are for completed item of works and shall cover the cost of water as aforesaid. Recovery at the rate of 0.50 percentage of value of work done from the contractor bill shall be made if the water is used from the Government sources.

### **ELECTRIC POWER SUPPLY:**

Electric Power supply at the work will have to be provided by the contractor. All charges for electrical shall have to be born by the Agency.

### **RETENTION OF 2.5 % SECURITY DEPOSIT:**

The Contractor shall be responsible for any leakages in the building observed during the first monsoon after taking possession of the building by the Department and for which 2.5% of the Security Deposit of the work shall be retained and will be refunded only after rectification of such leakages if any have been carried out by him. The contractor shall undertaking to rectify and arrange to stop such leakage on receipt of notice to do so from the Engineer-in-charge within reasonable times as indicated by him and to his satisfaction. If he fails to do so the department will be at liberty to carry out such rectifications at the contractor's cost. The cost of such rectifications shall be deducted from the detailed security deposit and the balance, if any will be refunded.

### **METHOD OF CARRYING OUT THE WORK:**

The contractor shall furnish for the approval of the Engineer-in-charge a schedule giving the program including details of the methods of execution proposed to be adopted. No work shall be carried out by the other methods of execution proposed to be adopted. No work shall be carried out by any other methods except that approved by the Engineer-in-charge. The Engineer-in-charge may suggest suitable modification in method proposed by the Contractor. Adoption of any such change shall not entitle the contractor for claiming any extra rate / amount.

### **RELATION WITH PUBLIC AUTHORITIES:**

The Contractor shall comply with all legal orders and directions given from time to time by local or public authorities and pay out of his own money. The fees or charges to which he may be liable.

### **TRESPASS:**

The contractor shall at the time be responsible for any damage and trespass committed by his agent and working people in carrying out the work unless such trespass is authorized by the Engineer-in-charge in writing.

### **OCCUPATION OF ADDITIONAL LANDS:**

In case when it becomes necessary for due fulfillment of the contract for the contractor to occupy land outside the limits the contractor shall make his own arrangement with the land owners and pay such amount as may be mutually agreed upon by them. The P.W.D. does not take any responsibilities to pay any charges, rent or acquisition cost etc. The department will tender the contractor all possible assistance to enable him to obtain land for such purpose.

### **OTHER PERMISSIONS:**

The contractor shall approach directly to the Municipal and other authorities by obtaining any type of permission required by law.

### **PATENT DEVICE, MATERIALS AND PROCESS:**

Whenever the contractor decides to use any design device materials or process covered by letters patent or copy Right. The right for such use shall be secured by suitable legal arrangement for patent power and copy of the agreement shall be filed with the Engineer-in-charge.

### **EMPLOYMENT OF RESIDENT ENGINEER:**

The Contractor shall employ and qualified skilled and experienced Resident Engineer for carrying out the work. Before employing Resident Engineer, the Contractor shall obtain approval of the Engineer-in-charge as to the suitability and eligibility of the Resident Engineer. In submitting such proposal the qualification and experience of person shall be fully listed. The resident Engineer shall be considered all time to be acting for the contractor with full responsibility in all respects.

### **FOREMEN, WATCHMEN AND WORKMEN:**

- Competent foremen and workmen shall be employed by the Contractor. The Engineer-in-charge shall at all times have the right to remove from the work foremen or workmen on ground of his unfitness or misconduct.

- There may be more than one agency simultaneously working the same site. The contractor had to co-operate (co ordinate) his work in such manner that they should not be dispute regarding stacking collect and safe guarding of material labour execution of the work workmanship etc. No compensation will be paid by the Government for any expenditure incurred, loss sustained, damages, inconvenience and delay caused to the contractor for allowing other agencies to work simultaneously.

- The work is to be executed by the Contractor as per instruction guidance and under close supervision and strictly as per the requirement of Engineer-in-charge.

**Dated Signature of  
the Contractor.**

## **GENERAL CONDITIONS FOR CIVIL WORKS**

The provisions detailed below are applicable to items of work and are deemed to be integral part of the detailed specification of items of works and are to be followed strictly:

A.It shall be distinctly understood that the contractor rate of the item is for the work completed in all respect and shall invariably be inclusive of the cost of following.

B.Fabricating, erecting handling, conveying, placing and keeping in position of materials.

C.Consolidations, vibrating, curing, finishing etc. wherever the nature of the item demands and it is obviously indicative of the same.

D.Racking, as directed to all concrete surface except those which are to remain of the form exposed surface", to provide proper bond to the abutting masonry or finishing as the case may be.

E.All fixtures and fastening required for satisfactory completion of the item of work even though not specifically indicated.

F.All works tests of materials required to be carried out as per specification or as required to be carried out in the opinion of the Engineer-in-charge.

G.Conveyance of materials provided in schedule-A from the place of delivery to the site of work and their preservation in good state while in use of till return to the department, if found surplus.

H.The contractor shall have to give an undertaking on appropriately stamped paper, guarantee for items of waterproofing to the Department in manner and form as prescribed in tender.

I.Reference to specification of material are given in the details specification of items of work in the form as mentioned below i.e. M-5 means M-5 of specification of materials.

J.The agency has to submit mix design for different grades of controlled concrete at his own cost and shall be got approved by the Engineer-in-charge.

K.The props use for centering shall be M.S. pipe and it should be braced with M.S. Angle or flats. In case of any error or commissions in such numbers the relevant specification of items should be adopted for execution of work at directed by the Engineer-in-charge without any extra cost of Government.



L.R.C.C. Design for the load bearing structures and other R.C.C. Members like Chjjas, Lintels, etc. shall be supplied by the Engineer-in-charge as received from R & B Design Circle, Gandhinagar.

M.The work shall be carried out in any floors as an when required immediately during tender tenure.

**Dated Signature of  
the Contractor.**

## **WATER SUPPLY**

For all purpose connected with work the contractor is required to make his own arrangement for sufficient supply of water quantity and for such quality and such places on the work as may be necessary. The rates quoted in the tender are for completed items of works and shall cover the cost of water as aforesaid. Recovery at the rate of 0.50 percentage of value of work done from the contractor bill shall be made if the water is used from the Government sources.

**Dated Signature of  
the Contractor.**

### **SPECIAL CONDITION**

Under the provision made in Govt. Labour & Employment Deptt.'s Resolution No. CWA-2004-841-M3, Dt. 30-1-2006 the labour cess is leviable from the Contractor's bill @ 1% of the Value of the work done under, Gujarat Building and other construction worker's welfare less Act, 1996 and the said amount is creditable to the receipt deed of labour and employment deptt.

**Dated Signature of  
the Contractor.**

**SPECIAL CONDITIONS FOR DISMANTLED  
MATERIALS**

**Condition No. Details**

1. For dismantling work carried out under relevant items, prior permission of Engineer in charge shall contain of the Contractor. All the necessary arrangements as directed Engineer in charge to avoid the difficulties of inconvenience of occupant of the building arising during the progress of work shall be made by the Contractor for no extra payment will be made.
2. Material obtained from demolished of work shall be the property of the Contractor and shall be disposed of as per instruction of Engineer in charge immediately and it shall not be issued in new work. Total amount of credit value of above dismantled materials as shown in Schedule shall be recovered from first R.A. Bill. While execution of work if variation in quantity of dismantling materials occurs necessary change in credit value shall be given considering tender bid finally offered by the Contractor.

**Dated Signature of the Contractor.**

## **SPECIAL CONDITIONS OF CONTRACT**

- (A) The Contractor shall have to demonstrate the experience and relevant machinery for execution of rehabilitation of Structures using construction chemicals like polymers, polymers bonded treatment, rementation polymer treatment, repairs to R.C.C. work using polymer compounds, low pressure grouting, gunniting over weld mesh jali, stitching and providing external and external bound for providing earthquake resistance, chemical damp proofing. Chemical water proofing etc. He should have experienced supervisory staff in this work and own labour or labour contractors of such work. He should produce proof of this type of work and machinery in the absence of such proof his offer is likely to be rejected.
- (B) Methodology to be adopted for safety of existing quarters during constriction activity.
1. During execution work if it is found that supports are required to be provided for safety of work, it is to be provided without any extra payment. Supports shall be got approved by Engineer in charge.
  2. No scaffolding shall be supported on wall either on inner or outer face of the wall. Double scaffolding is to be provided without any extra cost as per site condition.
  3. Demolition of plaster work shall be carried out in such a manner that either side i.e. outer or inner wall face, shall be demolished i.e. only one wall (Not all walls at a time). Plaster of whole Building is not to be demolished at a time and it should not be kept exposed for a long time. After demolishing plaster of one wall, new plaster is to be applied immediately. After plastering one wall, another wall should to be taken on hand.

4. During demolishing / dismantling procedure no sudden thrust should develop on wall or on slab. Work shall be done very carefully to avoid any accident during the work.
5. Walls shall not be wetted fully. (Completely saturated).
6. Outside plaster work shall be started from terrace to bottom. Construction sequence is given in the tender drawings and shall be followed accordingly.
7. Demolished / Dismantled material shall not be thrown on slab or outside through opening. Dismantled / Demolished material shall be put slowly on slab so that no jerk is developed. This material shall be disposed off through staircase by manually carrying material downstairs slowly.
8. Shrubs shall be removed in such a way that no quantity of brick work or concrete work shall come out along with shrubs.
9. While replacing and providing water supply sanitary items, joints shall be checked properly. No leakage shall be observed at the time of testing and later on.
10. Safety shall be assured around the blocks to avoid any accident.
11. Care shall be taken during the grouting and gunniting so that thrust is not produced on wall.
12. Plastering / Grouting should be done at least up to the length of 30 cm. below the ground level on the outer side of wall.
13. All dismantled and scrapped material should be removed from the site at regular interval as directed by Engineer

in charge. So that no obstruction is caused during execution of works.

14. Area of work shall be covered with tarpaulin while execution in rainy seasons to avoid any damage to structure due to rain.
15. As the work is of special nature it shall be carried out as directed by Engineer in charge / Consultant if appointed by the Govt.

**Dated Signature of  
the Contractor.**

### **WATER SUPPLY**

- (1) For all purposes connected with the work the contractor is required to make his own arrangement for sufficient supply of water in such quantity and of such quality and at such places on the work as may be necessary. The rates quoted in the tender are for completed items of works and shall cover cost of water as aforesaid.

The Department may supply the water to the Contractor, if so requested to him and if available near by department source. However, if his request is accepted, the department will is not may be found to continue supply, if arranged, till completion of work and it may be discontinued at any time after giving twenty four hours notice.

If the water is supplied by the department the charges will be levied at Rs. 50, Rs. 10000 of the cost of work done. The amount of water charges will be deducted by the department.

The Department will give one water supply connection free of cost from the main line or place as it is convenient to the Department. The Contractor shall have to make his own arrangement for laying the required pipeline from the connection, the same will be given if possible, on payment of necessary charges for the additional connection, as may be decided by the department.



### **GENERAL CONDITIONS FOR CIVIL WORKS**

The provisions detailed below are applicable to items of work and are deemed to be integral part of the detailed specification of items of works and are to be followed strictly:

- A. It shall be distinctly understood that the contractor rate of the item is for the work completed in all respect and shall invariably be inclusive of the cost of following.
- B. Fabricating, erecting handling, conveying, placing and keeping in position of materials.
- C. Consolidations, vibrating, curing, finishing etc. wherever the nature of the item demands and it is obviously indicative of the same.
- D. Racking, as directed to all concrete surface except those which are to remain of the form exposed surface", to provide proper bond to the abutting masonry or finishing as the case may be.
- E. All fixtures and fastening required for satisfactory completion of the item of work even though not specifically indicated.
- F. All works tests of materials required to be carried out as per specification or as required to be carried out in the opinion of the Engineer-in-charge.
- G. Conveyance of materials provided in schedule-A from the place of delivery to the site of work and their preservation in good state while in use of till return to the department, if found surplus.
- H. The contractor shall have to give an undertaking on appropriately stamped paper, guarantee for items of

waterproofing to the Department in manner and form as prescribed in tender.

- I. Reference to specification of material are given in the details specification of items of work in the form as mentioned below i.e. M-5 means M-5 of specification of materials.
- J. The agency has to submit mix design for different grades of controlled concrete at his own cost and shall be got approved by the Engineer-in-charge.

In case of any errors or omissions in such numbers the relevant specification of items should be adopted for execution of work as directed by Engineer in charge without any extra cost of Government.

The props use for centering shall be M.S. pipe and it should be pressed with M.S. Angle or flats.

The materials to be used for the items of the work shall be as per approved samples kept in the sample house.

**Dated Signature of  
the Contractor.**

FORM OF BANK GUARANTEE (CONDITIONAL)  
FOR SECURITY FOR PERFORMANCE  
(INITIAL AND ADDITIONAL SECURITY DEPOSIT)

TO: (Name \_\_\_\_\_ of \_\_\_\_\_ Employer)

(Address of Employer) \_\_\_\_\_

WHEREAS (Name and address of Contractor) \_\_\_\_\_

Hereinafter called "The Contractor" has undertaken, in pursuance of  
Contract NO. : \_\_\_\_\_ Dated \_\_\_\_\_ to  
execute (Name of Contractor and brief Description of Work)  
(Hereinafter called "The Contractor").

AND WHERE AS you have stipulated it in the said contract that the  
contractor shall furnish you with a Bank Guarantee by a recognized  
Bank for the sum specified there in as security for compliance with  
his obligation in accordance with the contract.

NOW THEREFORE, we hereby affirm that we are the Guarantee and  
responsible to you, on behalf of the Contractor, upto a total of  
(Amount of Guarantee) \_\_\_\_\_ (In Words)

Such sum being payable in the types of proportions of currencies in  
which the contract price is payable a new we undertake to pay,  
upon first written the demand and without oval or argument, any  
sum of sums within the limits of (Amount of Guarantee)  
\_\_\_\_\_ as aforesaid without laying needing to  
prove of to show grounds or reasons for your demand for the sum  
specified therein.

We hereby waive the necessity of your demanding the said debt  
from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification  
of the terms on the contract or of the works to be performed there  
under or any of the Contract documents which may be made  
between you and the Contractor shall in any such change, addition  
or modification.

This guarantee is valid until the date (twelve months) after the issuing of the Maintenance Certificate.

SIGNATURE AND SEAL OF THE GUARANTOR

Name \_\_\_\_\_ of \_\_\_\_\_ Bank:

Address : \_\_\_\_\_

Date : \_\_\_\_\_

\_\_\_\_\_

Bidders are NOT required to complete this form,  
An amount in to be inserted by the Guarantor representation the  
percentage of the Contractor price specified in the Contract. And  
denominated either in the currency (i.e.) of the Contractor of in a  
freely convertible / acceptable to the Employer.

**FORM OF GUARANTEE BOND**  
**(FOR COLOUR WORK)**

I ..... hereby guarantee that the colour work shall be done as per specification and not be in any way defective later on for the period of three years after the expiry of defect liability as per terms and conditions of the contract and I / We hereby identify and agree to serve hermits to Govt. of Gujarat from any loss and / or damages that might be cause to colour work due to any defects and hereby guarantee to rectify colour work due to any defects and hereby guarantee to rectify colour work.

This guarantee shall remain in force for a period of three years from the date of expiry of defect liability period. It shall remain binding to me / us for the said period of three years after the expiry of defect liability period.

The deposit at the rate of 10% of the cost of these item from the running and final bills be recovered over and above S.D. and be refunded only after the completion of the guarantee period as aforesaid.

**Dated Signature of  
the Contractor.**

# **PART-II**

## **SECTION - 3**

# **TECHNICAL SPECIFICATIONS**

**PART-II**  
**SECTION – 3**  
**TECHNICAL SPECIFICATIONS**

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## **:: TECHNICAL SPECIFICATIONS::**

### **A. GENERAL**

#### **1. SCOPE OF CONTRACT:**

The work entitled comprise of excavation of trenches with shoring and strutting wherever required bailing out water wherever necessary, laying of pipes, jointing including supply of material and material required for jointing, testing as per specifications, Construction of appurtenances such as brick Masonry Manholes, house chambers etc. as per the type design specified entirely of the specification of various works stipulated in the e- Tender. The work includes supply of sewer pipes i.e. stone ware pipes of ISI Marked and R.C.C. precast manhole frames & covers which shall have to be supplied at site or Municipal store by the contractor at specified and shown in schedule "B". Other material like cement etc shall have to supply by the contractor from open market.

#### **2. e-TENDER PRICE:**

The rates quoted in the bill of quantities shall cover everything necessary for the due and complete execution of the work according to the drawings and other condition and stipulations of the contract including specifications of the evident, intend and meaning of all or either of them or according to customary usage and for periodical and final inspection and test and proof of the work in every respect and for measuring, numbering or weighing the same, including setting out and laying or fixing in position and the provision of all materials, power, tools, rammers, labour, tackle, platforms with impervious lapped joints for scaffolding, ranging roads, straight edged, cantering and boxing, wedges, moulds, templates, posts, straight rods, straight edged, cantering and boxing, wedges, moulds, templates, posts, straight rails, boning staves strutting, barriers, fencing lighting pumping apparatus, temporary arrangement for passage of traffic access to premises and continuance to drainage water supply and lighting (if interrupted by contractor's work) temporary sheds, painting, varnishing, polishing establishment for efficient supervision and stating arrangements for the efficient protective of life and property and all requisite plant and machinery of every kind.

The contractor shall keep every portion of the work clear of accumulation from time to time and shall leave every portion of the work clean, clear, perfect and at the conclusion of whole, providing at their own cost all such material implement, appliances and labour as the Engineer in charge may require to prove if it to be so.

### **3. COMPLETION SCHEDULE:**

The contract period shall be as prescribed in tender document, from the date of notice to proceed. The Contractor shall submit his completion schedule and the program of works together with this e-Tender in conformity with completion schedule given in the documents.

### **4. GENERAL TECHNICAL GUIDELINE:**

- 4.1 All the items occurring in the work and as found necessary during actual execution shall be carried out in the best workman like manner as per specifications and the written order of the Engineer in charge
- 4.2 Extra Claim in respect of extra work shall be allowed only if such work is ordered to be carried out in writing by the Engineer in charge
- 4.3 The contractor shall engage a qualified Engineer for the Execution of work who will remain present for all the time on site and will receive instructions and orders from the Engineer in charge or his authorized representative. The instruction and orders given to the contractor representative on site shall be considered as it given to the contractor himself.
- 4.4 The work order book as prescribed shall be maintained on the site of the work by the contractor and the contractor shall sign the orders given by the inspecting officers and shall carry out them properly.
- 4.5 Quantities specified in the e-Tender may vary at the time of actual execution and the contractor shall have no claim for compensation on account of such variation
- 4.6 Unexcavated lengths shall be left wherever required and so directed by the Engineer in charge during the currency of the contract and shall be tackled. If required, before completion of work.
- 4.7 Diversion of road, if necessary, shall be provided and maintained during the currency of the contract by the contractor at his cost.
- 4.8 Figured Dimensions of drawing shall supersede measurements by scale, special dimensions or directions in the specifications shall supersede all other dimensions.
- 4.9 All levels are given on drawings and the contractor shall be responsible to take regular level on the approved alignment before actually starting the work. The levels shall be commence to the G.T.S. levels and shall be got approved from the Engineer in charge

- 4.10 If the arrangement of temporary drainage is required to be made during any work of this Contract, this shall be made by the Contractor without claiming any extra cost.

## **5. CLASSIFICATION OF STRATA:**

- 5.1 All materials encountered in excavation will be classified in the following groups irrespective of mode of excavating the materials and the decision of the Engineer in charge in this regard shall be final and binding to the contractor.
- 5.2 Soils :  
Soils of all sorts, silt, sand, gravel, soft murrum, stiff clay, kunkar and other soft excavation not covered in the items mentioned hereunder.
- 5.3 Hard Murrum :  
Hard Materials comprising of all kinds of disintegrated rock or shale or indurate conglomerate interspersed with boulders, weathered and decomposed rock which could be removed with pick, bar, shove, wedges and hammers, though not without some difficulties.
- 5.4 Soft – Rock:  
This shall include all materials which is rock but which does not need blasting and can be removed with a pick bar, wedges, pavement breakers, pneumatic tools etc.
- 5.5 Hard Rock:  
This shall include rock occurring in mass or boulders which need blasting, this will also include rock to be removed by chiseling or any other method where blasting is not permissible.
6. The rates are inclusive of dewatering, if required.
7. Regarding water supply for hydro testing, necessary water, power, labour, etc. required for necessary test shall be arranged by the contractor at his own cost.
8. During construction activity, proper care must be taken for labour safety and must follow the provisions of the Labour laws.
9. TMT bars of Fe-500 should be conforming to IS:1786. The approved makes shall be TATA, SAIL, Vizag, Gallent, Electrotherm or other equivalent make as approved by engineer-in-charge.
10. Cement shall be ordinary Portland cement 53 Grade conforming to

IS:269, IS:8112 or IS:12269 for all the works as per the instructions of engineer-in-charge. The approved makes shall be Ambuja, Ultratect, LOTUS, Hathi or as per IS confirming. Minimum Cement content for the work should be as per attached circular No.RMC/C/Vigi.(Tech)/231 dt. 11/03/2022.

- 11.** Testing of the materials like Brick, Sand, Aggregate, Reinforcement steel, etc. should have to be tested periodically as suggested by the Engineer-in-charge at Government approved material testing Laboratory and testing charges for the same has to be borne by the contractor.
- 12.** In case of any ambiguity found in inspections / drawings etc, the decision of engineer-in-charge shall be final and binding to the contractor

**a.**

**TECHNICAL SPECIFICATION FOR CIVIL, INTERIOR FURNITURE &  
PLUMBING WORK**

## TECHNICAL SPECIFICATION (CIVIL, INTERIOR, FURNITURE & PLUMBING)

**Item No. 01 : Excavation of Foundation in Soft Murrum, Soil or Sand from 0.0 mtr. to 1.50 mtr depth including lifting and laying in 90 mtr. lead area as instructed**

### 1. Workmanship:

- Work complete as per relevant specification of Item No: 4.0.0.(A) page No -21 in General specification R & B booklet for building works.

### 2. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labor, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Cubic Meter.

### **Item No. 02 : PCC**

**Foundation filling with CC work in proportion of 1:3:6 using 1.5 cm to 2.0 cm aggregate including Raming, Curing etc**

### 1. Material:

- Cement, sand and stone aggregate shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

### 2. Workmanship:

- Work complete as per relevant specification of Item No: 5.3.2 (B), page No -31 in General specification R & B booklet for building works.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Cubic Meter.

**Item No. 03 : CC work M25 for RCC slab using aggregate of size 10-20 mm, centring, curing, finishing etc. complete (without reinforcement)**

**1. Material:**

- Cement, sand and stone aggregate shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Item No: 5.8.3, page No -40 in General specification R & B booklet for building works.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The relevant specifications of item No. 5.8.1. shall be followed.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Cubic Meter.

**Item No. 04 : Supplying, Cutting, Bedding, Binding and Hooking and binding with wire for RCC work Tor steel TMT round bar including all cost**

**1. Material:**

- TMT Fe 500 D shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Item No: 5.4.11, page No -37 in General specification R & B booklet for building works.

**3. Measurements:**

- The rate shall be consolidated for all above items.

- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Kg.

**Item No. 05 : Brick Masonry work in Cement:Mortar 1:6**

**1. Material:**

- Brick shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Item No: 6.13(B) page No- 44 in General specification R & B booklet for building works.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Cubic meter.

**Item No. 06 : Brick Masonry Partition Wall in Cement:Mortar 1:4 (3.5 to 4.5 inch thick)**

**1. Material:**

- Half Brick shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Item No: 6.30(B) page No- 46 & 47 in General specification R & B booklet for building works.



### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one sq. meter.

### **Item No. 07 : Cement Plaster 12 mm thick using Cement:Mortar in proportion 1:3 with Niru Finishing curing, etc. complete**

#### 1. Material:

- Cement and sand shall be used for mortar of plaster work as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### 2. Workmanship:

- Work complete as per relevant specification of Item No: 17.58 page No- 104 in General specification R & B booklet for building works.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square meter.

### **Item No. 08 : Supplying the material Dr Fixit/Forsroc new coat and Dr Fixit / Forsroc primeseal as per the required quantity with applying and primer coat with Dr Fixit/ Forsroc primeseal and applying three coats of Dr Fixit/ Forsroc new coat with fiber mesh.**

#### 1. Material:

- Dr Fixit / Forsroc new Coat and Dr Fixit / Forsroc Primeseal shall be used for Cement item us Waterproofing System as per approval by EIC/ Architect

#### 2. Workmanship:

- The Whole work is to be completed as per design; sample material & any other

requirement shall be as per instruction Office/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall be for a unit of One Square Meter

#### **Item No. 09 : Water proof plaster**

**Water Proof Cement Plaster 20 mm thick using Water Proofing Compound and in the ratio of 1:3 with necessary finishing**

#### 1. Material:

- Cement and sand shall be used for mortar of 20 mm thick plaster work with Water proof material as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### 2. Workmanship:

- Work complete as per relevant specification of Item No: 17.95 page No- 107 in General specification R & B booklet for building works shall be follow except that the proportion and thickness and cement mortar as per above specification work.

#### **WATERPROOF CEMENT PLASTER:**

- The cement mortar shall consist of two parts of fine river sand free from any dust and other organic matter and one part of approved quality of cement. The mortar shall be properly mixed on watertight platform. The mortar shall be used within half an hour after mixing. The water proofing materials weighting 1.5 kg of powder in one bag of cement shall be added.
- The plaster shall be applied in uniform thickness of 20 mm and shall be properly smoothened with wooden & finished with cement finishing of required. The curing shall be done at least for week by sprinkling the water over the wall. The wall shall be tested for waterproof ness. The rate includes the cost of waterproofing materials. The test for waterproof ness shall be carried out by the contractor at his own cost by filling the contractor with water and it shall be checked out that there is no percolation of water from the wall. Payment shall be made per sq. m. of plaster done.
- After completion & testing of work the contractor shall have provide & fix the Marble 'Takti' of required size with necessary writings, as directed by the Engineer-in-charge.
- RCC work of shaft, container and staircase should be of well finished condition if the same is not satisfactory than contractor since have to finish the surface with 12 mm

thick plaster C.M. without any extra cost.

- The contractor shall have to make arrangement for testing of steel bars brought on site and concrete cubes, for different mix at different stage like foundation, shaft, column, cube should be cast on site and send Govt. or Govt, approved laboratory for compressive strength at 28 days. Results must be produced in office before taking payment of work done. Testing charge must bear by contractor.
- Conditions: The paint is supplied in two packs, fine zinc dust mixed with epoxy resin as base and liquid hardener. They are to be mixed in following ratio.
- Mixed Paint Properties
- Application: By Brush/Spray (Air and Airless)
- Thinner: Epoxy thinner shall be used if required.
- Coverage: 10 Sq. m./liter at 25 microns.
- High build black paint.
- Surface dry not more than 4 hours Hard dry not more than 18 hours Film thickness per coat 75 micron.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square meter.

### **Item No. 10 : Cutting and repairing Wall:**

**Making zari by Chasing upto 75mm wide x 50mm deep with mechanical cutter in plastered brick wall and making good after work is completed in white cement and POP for electrical works for changes. The item shall be measured in Rmt. Rate shall be inclusive of providing & fixing chicken mesh on conduits before repairing.**

#### 1. Material:

- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### 2. Workmanship:

- The Whole work is to be completed as per design; sample material & any other requirement shall be as per instruction Office/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.

- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Running meter.

**Item No. 11 : P & L 24" x 24" vitrified 8 mm thick tile flooring over 20 mm (average) base of cement mortar 1:6 ( 1 cement: 6 coarse sand) on new surface or fixing on existing flooring by adhesive material including dismantling of existing flooring and jointed with color cement slurry including finished with flush pointing & cleaning the surface etc. complete for antiskit**

#### **1. Materials:**

- 8 mm thick Vitrified tiles shall be used and as per sample approved by EIC/ Architect.
- Epoxy grouting shall be used of Laticrete or equivalent approved material by EIC/ Architect.
- All type of material shall be used for flooring work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### **2. Workmanship:**

- **Bedding:**
- Bedding shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface tamped and corrected to desired level and allowed to harden enough to offer a rigid cushion to tiles and to enable the monsoon to place wooden planks across and squat on it.
- The Vitrified tiles shall be laid on cement mortar bedding of 20 mm. thick in CM.1:6. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The bedding shall be cleared and well wetted. The mortar shall then be spread in thickness not less than 20 mm. at any place and average 20 mm thickness. The proportion of the cement mortar shall be as specified in the item.
- **Fixing tiles:**
- The tiles before laying shall be soaked in water for at least two hours. Neat grey cement grout at 33 kg/Cement/Sqmt. 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 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 in straight line or as per pattern as per detailed drawing.
- The tiles shall not have staggered joints. The joints shall be true to centre 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 (Swan) to the required size and the edges rubbed smooth to ensure straight and true joints. The joints shall be filled with laticrete grouting with wire brush or trowel to a depth of 6 mm. and loose material removed. Laticrete shall be used for pointing the joints. After fixing the tiles finally in an even plane the flooring shall be kept wet and allowed to nature undisturbed for 7 days.

**Cleaning:**

- The surplus grouting material that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, it shall be carefully washed, cleared 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.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in square meter for visible area of work done. The length and width of the flooring shall be measured between the faces of Skirting or dedo or plastered face of wall as the case may be. The paving under dedo or skirting shall not be measured. No deduction shall be made not extra paid for any opening in the floor of area up to 0.1 sqmt. Nothing extra shall be paid for laying the floors at different levels in the same rooms. The rate shall be for a unit of one square meter.

**Item No. 12 : Providing and laying Vitrified tiles 8 to 10 mm thick , 24" x 24" in skirting risers of steps and dedo on 10mm thick cement plaster 1:3 (1-cement : 3-coarse sand) and jointed with white cement slurry**

**1. Material:**

- Sand shall be used for filling as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Item No: 14.42, page No -84 in General specification R & B booklet for building works.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 13 : Supply, Fixing & Polishing for Granite Flooring work 18mm thick & 200 mm Base of Lime:Mortar in proportion of 1:2**

**1. Materials:**

- 18 mm thick Granite with finish shall be used as per sample approved by EIC/Architect.
- Matching Pigment shall be used of approved material by EIC/Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

**2. Workmanship:**

- **Dressing of slabs :** stone shall be cut to require size and fine chisel dressed to give a smooth and even surface on all sides to full depth. A straight edge laid along the sides of the stone shall be fully in contact with it Chisel dressing shall also be done on top surface to remove any waviness. The sides and top surface of marble slabs shall be machined rubbed or table rubbed with coarse sand before using. All angles and edges or slabs shall be true, square and free from chipping. The thickness of stone shall be 18 mm. The allowable tolerance shall be 2 mm. allowable. The 'tolerance shall + 5 mm. in length and breadth.
- **Bedding :** Granite slab shall be laid on Bedding of cement mortar 1:6 (1 cement : 6 coarse sand) of including 35mm to 70 mm thick (Average thickness 50 mm) as given in description of item.
- **Laying :** The surface of sub-grade shall be cleared, wetted and mopped. Mortar of specified mix and thickness shall then be spread on an area sufficient to receive one slab. The slab be washed clean before laying. It tie laid on top pressed and tapped gently to bring it in level with other slabs. It shall then be lifted and a side. 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 it over this surface cement slurry or honey like consistency at 4.4 Kg. of cement per sq. meter. The edges of slabs already paved shall be buttered with gray 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 slab shall be removed. The slab fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster skirting or dedo. The junction between the walls and floors shall be finished neatly. The finished surface shall be true to level and

slopes as directed. The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in square meter for visible area of work done. The length and width of the flooring shall be measured between the faces of Skirting or dedo or plastered face of wall as the case may be. The paving under dedo or skirting shall not be measured. The rate shall be for a unit of one square meter.

### **Item No. 14 : Supply & Fixing of Granite Stone (Telephone Black Color) on wall after rough cast Cement Plaster in proportion of 1:3 and fixing grainage in Cement Paste.**

#### 1. Materials:

- 18 mm thick Granite with finish shall be used as per Basic rate is Rs. 150/Sqft and sample approved by EIC/ Architect.
- Epoxy adhesive shall be used of approved material by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### 2. Workmanship:

- **Bedding** : Granite slab shall be laid on Bedding on 10 mm thick cement mortar 1:1 (1 cement : 1 Fine sand) as given in description of item. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The bedding shall be cleared and well wetted. The mortar shall then be spread in thickness not less than 10 mm. at any place and average 10 mm thickness. The proportion of the cement mortar shall be as specified in the item.
- **Laying** : The surface of sub-grade shall be cleared, wetted and mopped. Mortar of specified mix and thickness shall then be spread on an area sufficient to receive one slab. The slab be washed clean before laying. It tie laid on top pressed and tapped gently to bring it in level with other slabs. It shall then be lifted and a side. 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 it over this surface cement slurry or honey like consistency at 3.3 Kg. of cement per sq. meter. The edges of slabs already paved shall be buttered with gray 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 slab shall be removed. The slab fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster skirting or dedo. The junction between the walls and floors shall be finished neatly. The finished surface shall be true to level and slopes as directed. The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one square meter.

**Item No. 15 : Providing & laying approved quality prepolished machine cut average 18mm thick first quality Granite of approved shade, (selected and sorted for its uniform colour and thickness), for stair tread, sill, jambs, coping etc. in required sizes and shapes, including average 40 mm thick cement mortar bedding in 1:5 laid and jointed with white cement and matching pigment including rubbing, re-polishing (if required) with different grades of Emery, refilling of open joints, curing, daily cleaning and mopping etc. all complete. The rate includes machine cut edges of uniform thickness and beveling and mirror polishing of edges, groove for anti skid surface. Sample shall be approved by Architect before execution.**

### 1. Materials:

- 18 mm thick Granite with finish shall be used as per Basic rate is Rs. 150/Sqft and sample approved by EIC/ Architect.
- Epoxy adhesive shall be used of approved material by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

### 2. Workmanship:

- **Bedding :** Granite slab shall be laid on Bedding on 10 mm thick cement mortar 1:1 (1 cement : 1 Fine sand) as given in description of item. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The bedding shall be cleared and well wetted. The mortar shall then be spread in thickness not less than 10 mm. at any place and average 10 mm thickness. The proportion of the cement mortar shall be as specified in the item.
- **Laying :** The surface of sub-grade shall be cleared, wetted and mopped. Mortar of specified mix and thickness shall then be spread on an area sufficient to receive one slab. The slab be washed clean before laying. It tie laid on top pressed and tapped



gently to bring it in level with other slabs. It shall then be lifted and a side. 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 it over this surface cement slurry or honey like consistency at 3.3 Kg. of cement per sq. meter. The edges of slabs already paved shall be buttered with gray 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 slab shall be removed. The slab fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster skirting or dedo. The junction between the walls and floors shall be finished neatly. The finished surface shall be true to level and slopes as directed. The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one square meter.

### **Item No. 16 : Granite - wash basin counter, urinal partition**

**Providing & laying 18mm thick both side mirror polished granite of approved shade and quality, selected and sorted for uniform color for urinal partition/ wash basin counter/ platform as per design and in required sizes and shapes after chasing /cutting of dado/ paster with cutter machine fixing shall be carried out in white cement sand mortar (1:1) with matching pigment and/ or necessary adhesive. (Only finished granite work shall be measured). All expose edges shall be chamfered and polished. The rate includes making hole, cutting/ chasing, rounding champhering, edge polishing of edges. Sample shall be approved by Architect before execution.**

#### 1. Materials:

- 18 mm thick Granite shall be used as per sample approved by EIC/Architect.
- Epoxy adhesive shall be used of approved material by EIC/Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

#### 2. Workmanship:

- Workmanship as per above relevant Item No - specification of 32.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in Square meter for visible area of work done.

#### Item No. 17 : Sandwich Platform

Providing & laying sandwich platform comprising of

1. Sandwich of 18 mm the Granite of approved shade and sample on top and 30 mm the polished kota in bottom with 20mm thick cement mortar 1:4 bedding in between & neat cement float.

2. At centre vertical sandwich supports of 30 mm the two kadappa/ kota stone on sides, cement mortar 1:4 bedding in between and at both end walls vertical supports of 18 mm the granite.

3. 75 mm raised platform at bottom with kota on top and screed (1:2:4) at bottom with necessary cement mortar, Granite stone skirting as per design and approved sample.

All expose side stone shall be of granite and same in shade and as per approved sample.

The rate includes rounding, champhering and mirror polishing of edges, fascias of granite, including necessary bonding adhesive (if required) of approved make. Rate shall be also inclusive of stone arrangement for fixing of sink or wash basin, Pillar tap/ Bib tap etc. as directed by engineer in charge. Only plan area of platform shall be measured & paid for. Sink, basin, taps etc shall be paid in relevant items

#### 1. Materials:

- Granite shall be used as per approved by EIC/ Architect.
- Tile adhesive and Pigments shall be used of as per approved by EIC/ Architect.
- All type of material shall be used for basin counter work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### 2. Workmanship:

- Two layers of wash basin counter, first layer using 30 mm thick Kotastone of approved shade and second layer using approved shade and sample of Mirror finish Granite, joined together with 1:4 Cement mortar bedding / approved tile adhesive, to true plane & level or to slopes, or close jointed with cement slurry with pigment of matching shade and colour and finishing with the same,
- Work including dedo 1'6" ht, cutting kotah & tile as per required shape & size to fit Wash basin, & 3" to 9" fascia with moulding, nosing, chamfered front edges, fixing, disposal of debris etc.
- Work complete including all type of joining material, tools, tackles, with finishing,

proper even surface etc as per specification and suggestion.

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour ,etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of Square Meter.

**Item No. 18 : Supply & Fixing of Broken Glazed (China Mosaic) tiles size 5-6 mm thick of different size and shade (approved crazy pattern) in Cement:Mortar 1:2 and joint filling with White Cement/ Coloured Cement including Ramping, Watering, Curing etc. complete.**

### 1. Material:

- China mosaic shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

### 2. Workmanship:

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 19 : Supply & Fixing of 60mm M-30 Grade cement concrete rubber mold paving inter locking paving block (Grey colour) after bedding of Bhogavo sand in line and CC on the edge in proportion of 1:2:4 with curing etc. complete**

### 1. Materials:

- Rubber mold paving inter locking concrete block shall be used and sample approved

by EIC/Architect.

- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

## **2. Workmanship:**

- The sub base, either PCC or other shall be properly cleaned , leveled and prepared to lay the paver blocks.
- The blocks shall be fixed as per approved design, pattern and detailed drawing.
- The interlocking blocks shall be fixed by the skilled and experience laborers' only.
- Necessary cutting of blocks as required shall be done without any extra cost at edges, ends of walls as per site conditions.
- No extra cost shall be paid for wastage.
- After laying the blocks the finished job shall be thoroughly compacted/vibrated by means of mechanical vibration.
- If any settlement /dislocation is found after vibration, the same will be got rectified without any extra cost.
- After completion of the work the pavements shall be made neat and clean.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

## **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour,etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Square meter. any opening /chamber whose area is more than 0.25 square meter shall be deducted.

**Item No. 20 : Providing and fixing pre-cast concrete kerb stone of gray cement based concrete block 30cm length,30cm height and 15cm thick of M250 grade concret as per approved design and including excavation for fixing in proper line and level,filling the joint with C:M 1:3 (1cement:3fine sand) etc complete.**

## **1. Materials:**

- Kerb stone shall be used and sample approved by EIC/Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

## 2. Workmanship:

- The sub base, either PCC or other shall be properly cleaned , leveled and prepared to lay the paver blocks.
- The blocks shall be fixed as per approved design, pattern and detailed drawing.
- The pre-cast blocks shall be fixed by the skilled and experience laborers' only.
- Necessary cutting of blocks as required shall be done without any extra cost at edges, ends of walls as per site conditions.
- No extra cost shall be paid for wastage.
- After laying the blocks the finished job shall be thoroughly compacted/vibrated by means of mechanical vibration.
- If any settlement /dislocation is found after vibration, the same will be got rectified without any extra cost.
- After completion of the work the pavements shall be made neat and clean.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

## 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour,etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of Running Meter.

**Item No. 21 : Flush door shutter + both side laminates + WPC frame + Hardware Providing and fixing 35mm thick flush door shutters, solid core construction with frame of first class hardwood with cross board and face veneer or plywood face panels, including butt hinges with necessary screws fixed on with WPC door frame of 70 to 100mm in size with single rebate for door/ window shutter with required number of Dash fastener of approved make and size. 6mm thick teak wood lipping shall be fixed on periphery of shutter. External side of lipping shall be finished with lacqured polish/ paint in required coat and of approved make and shade. Shutter shall be finished (both side) with 1mm thick laminates of approved make and shade. - Non-decorative type and block board core with SS 304 grade butt hinges, tower bolt, both side aldrop, pair of handle of required size (200mm to 300mm long) in flush door shutters**

**All sample shall be approved before execution.**

## 4. Material & Workmanship:

- 35 mm thick flush door shutter shall be used as per sample approved by EIC/Architect.
- Waterproof ply shall be used for door as per approved make list and confirming to

relevant IS codes and approved by EIC/ Architect.

- WPC door frame (70 to 100 mm) size shall be used as per approved sample by EIC/ Architect.
- 1 mm thick laminate shall be used for finish of door as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.
- Hardware shall used of as per approved by EIC/ Architect.
- All type of material shall be used for Door as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.
- Fixing of Hardware system of Geze/Dorma like Hinges , Concealed door closer , Door handle, Euro profile , lock , Door stop as per selection work complete.
- All door should be properly leveled without any sagging and with smooth opening and closing. There should be no variation or deviation of any kinds.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.
- The relevant specification for this item shall be followed as per Item Description and instruction given by Engineer in charge.

## 5. Measurements:

- The Rate shall be for a unit of one Square Meter.

### **Item No. 22 : Flush door shutter + both side veneer + WPC frame + Hardware**

**Providing and fixing 35mm thick flush door shutters, solid core construction with frame of first class hardwood with cross board and face veneer or plywood face panels, including butt hinges with necessary screws fixed on with WPC door frame of 70 to 100mm in size with single rebate for door/ window shutter with required number of Dash fastener of approved make and size. 6mm thick teak wood lipping shall be fixed on periphery of shutter. External side of lipping shall be finished with lacqured polish in required coat and of approved make and shade. Shutter shall be finished (both side) with 4mm thick veneer of approved make and shade, type, finish.**

**- Non-decorative type and block board core with SS 304 grade butt hinges, tower bolt, both side aldop, pair of handle of required size (450mm to 600mm long) in flush door shutters**

**All sample shall be approved before execution.**

## 1. Materials:

- 35 mm thick flush door shall be used as per sample approved by EIC/ Architect.
- Waterproof ply/ WPC board shall be used for door as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.
- WPC frame (50 x 150 mm) shall be used as per approved sample by EIC/ Architect.
- 4mm thick Veneer shall be used for finish of door as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.
- Hardware shall used of as per approved by EIC/ Architect.

- All type of material shall be used for Door as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

## 2. Workmanship:

- Fixing of 35 mm thick solid core wooden single leaf flush doors of approved make having Waterproof ply facing on both sides as per approved sample.
- Fixing of WPC frame (150x65mm) shall be used as per approved sample by EIC/Architect.
- Fixing of Both side 4 mm thick veneer finishes as per selection.
- Fixing of Hardware system of Geze/Dorma like Hinges, Concealed door closer, Door handle, Euro profile , lock , Door stop as per selection work complete.
- All doors should be properly leveled without any sagging and with smooth opening and closing. There should be no variation or deviation of any kinds.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

## 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour,etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors. Clear opening area shall be measured & paid in Square meter.

**Item No. 23 : SS plate signage : Providing and fixing SS 304 grade Internal signage of size 100mm x 100mm x 1.2mm thick with laser print/ etching and filled with duco paint of approved make and as specified type including fixing etc complete as directed by engineer in charge.**

## 1. Material:

- Signage's shall be used as per approved make and sample by EIC/Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

## 2. Workmanship:

- Work complete as per above manufacturer's specification.
- Work complete including all types of tools, tackles, labour etc complete at any level and height.
- The whole work is to be completed as per design; sample material & any other

requirement shall be as per instruction of EIC/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in Nos for area of work done. The rate shall be for a unit of one Nos.

**Item No. 24 : Providing and fixing signage made of 4mm ACP sheet of approved make and shade (high intensity grade sheeting) and acrylic letter of required size as per drawing, fixed with SS 304 screws, fastner on any surface including lettering (vinyl printing, stickering and lamination) and signs etc complete for all level all height and as directed by Engineer in charge.**

#### 1. Material:

- 4mm ACP Sheert shall be used as per approved make and sample by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### 2. Workmanship:

- Work complete as per above manufacturer's specification.
- Work complete including all types of tools, tackles, labour etc complete at any level and height.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one square meter.

**Item No. 25 : Iron round gate as per drawing with colour incuding all**

#### 1. Material:



- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

## **2. Workmanship:**

- Work complete as per above manufacturer's specification.
- Work complete including all types of tools, tackles, labour etc complete at any level and height.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

## **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Kg.

**Item No. 26 : providing, fabricating, erecting and placing in position stainless steel pipe(304 grade) including cutting welding and bolting wherever necessary including accessories fixing hardware. All welded joints to be grinded and cleaned and finished as satin finish including buffing. All ss to 304 grades**

## **1. Material:**

- SS Brush finish dustbin shall be used as per approved make and sample by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

## **2. Workmanship:**

- Work complete as per above specification.
- Work complete including all types of tools, tackles, labour etc complete at any level and height.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

## **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the

whole work satisfactorily as per instruction of EIC/Architect.

- No extra payment will be given for any of the reasons.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one Number.

**Item No. 27 : Dash fastener 12.5 mm dia 50 mm long**

**1. Material:**

- Dash Fastener 12.5 mm dia 50 mm Long shall be used as per approved make and sample by EIC/Architect.

**2. Workmanship:**

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall be for a unit of one Number.

**Item No. 28 : Fixing 24 guage galvanized iron sheets.**

**1. Materials:**

- 24 Gauge Galvanized Iron Sheets shall conform to M-24.

**2. Workmanship:**

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- No deductions in measurements shall be made for openings for chimney stacks, sky light etc., of area up to 0.40 sq. mt. nor extra be paid for extra labor in cutting and for wastage etc., in forming such openings.
- The rate shall include the cost of all materials, finishing, labor, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.

- The rate shall be for a unit of one sq. meter.

**Item No. 29 : Providing and fixing of Ridge flashing for roof panel shall be made out of 0.5 mm thick pre coated GI sheet . The Precoated sheet shall be of minimum 240 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS:277:1992 , 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron. The PPGI Sheet shall have plastic protective guard film of minimum 25 microns to avoid scratches during transportation. The ridge shall be fixed to the steel members by pop rivet or self drilling/self stitching fastners @ maximum 450 mm c/c along length of capping/flashing etc complete .**

#### **1. Material:**

- Ridge flashing for roof panel shall be used as per approved make and sample by EIC/Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

#### **2. Workmanship:**

- Work complete as per above specification.
- Work complete including all types of tools, tackles, labour etc complete at any level and height.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

#### **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Running Meter.

**Item No. 30 : Providing & fixing 0.60×x 0.60 size tiles & galvanized frame on gypsam board, false ceiling with moulding & designed patta.**

#### **1. Material:**

- 0.60 x 0.60 Size Tiles shall be used as per approved make and sample by EIC/Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

## 2. Workmanship:

- Work complete as per above specification.
- Work complete including all types of tools, tackles, labour etc complete at any level and height.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

## 3. Measurements:

- The rate shall be consolidated for all above items.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Square Meter.

### Item No. 31 : Gypsum perforated ceiling

Providing and fixing perforated gypsum ceiling system of approved make includes perimeter channel to be fixed along the perimeter of existing wall with the help of (6x40) impact anchor at 600mm centres. Ceiling angle shall be suspended by fixing it to the soffit cleat. Soffit cleat and Rawlplug (Ø8 x 45mm, as per IS 513 CR1 grade, Zinc coating (7 to 8 microns), pull out load- 6.8kN for M30 concrete grade) creating 1200mm x 1200mm grid. Intermediate channel shall be fixed to the ceiling angle with M6 x 12mm Hex Bolt & nut arrangement, as per EN 10083, Zinc Plating or with 2 Nos of Ø4.2 x 13 metal to metal screw made of carbon steel as per EN-ISO 7049/50, Zinc Coating. The ceiling section shall be fixed to the intermediate channel with the help of connecting clip and in direction perpendicular to the Intermediate channel at 600mm c/c. Framing member shall be GI as per IS 513, serrated/ knurled/ ribbed in pattern, YS-260Mpa, finish-Galvanised 150GSM as per IS277. Single layer 12.5mm board of size 1200 x 2400mm having all four tapered edges, 16% perforation area of board & hole size of 12mm of any shape, having 8 perforation sets per board and each set of size 487mm x 487 mm, 56.5mm border and 113mm center band, backed with acoustic tissue, having NRC values 0.65, shall be screw fixed to ceiling section with 25mm drywall screws made of carbon steel (as per EN-ISO 7049/50 and finish - Grey Phosphating), at 230mm centres. Resin bonded glass wool of 24kg/M3 and 50mm thick shall be placed on top of the board. Finally all tapered edges of the boards are to be jointed and finished so as to have a flush look which includes filling and finishing with Pro-Fill Jointing compound (Conforms to ASTM C475), Joint Paper tape. Contractor shall co-ordinate with all services for making cutout for light fixtures, grill, diffuser, fire equipment, AV system, etc including additional framing member if required. Contractor shall prepare shop drawing and get approval from Architect. Rate shall be for all level, all height including scaffolding etc complete and as directed by Engineer in charge.

## 1. Material:

- Gypsum board FRMR grade ceiling shall be used as per approved make and sample by EIC/ Architect.

- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

## 2. Workmanship:

- Work complete as per above manufacturers specification.
- Work complete including all type of tools, tackles, scaffolding etc complete at any level and height
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

## 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in square meter for area of work done. The rate shall be for a unit of one square meter.

**Item No. 32 : Acoustic Panelling : Providing and fixing panelling as per drawing with acoustic panel boards of approved make and fire retardant fabric over frame work as per detailed drawing. Providing & fixing acoustical infill material of 25 mm th Synth directly between wooden frame Synth shall be held in position by using adhesive tape Providing and Fixing vinyl grippers directly on plywood base approx at 1200mm centers by using pneumatic stapler or suitable metal fasteners as per manufacturers specifications. Vinyl grippers must have base tapes for better grip. Providing and fixing wood wool board Sound Smooth of size 1200 x 600 x 15mm thick having density 400Kg/ m3 fixed in between Vinyl grippers and again pasting Synth of 10mm thick on the acoustical panel by using adhesive as per specifications of manufacturer. Supplying and laying FR grade fabric then cut into required size and shape.and stretched, inserted inside the gripper by using tools recommended by manufacturer. Rate shall include cost of making of all cut-outs for light fixtures, switch boards gadgets, gizmo, pelmets, grooves, beads cut out as per EIC instruction at site. The rate shall be in sq.mt for all floors and at all heights including all costs. The shop drawing shall be prepared by Contractor and approved from EIC and Architect. Basic rate of fabric 1400/-Rmt for 54" wide. Panelling item including openable shutter wherever required area and finish with the same material. Only the clear elevation area of the acoustic panel shall be measured and paid.**

## 1. Material:

- Acoustic panel board for paneling shall be used as per approved make and sample by EIC/ Architect.

- FR fabric shall be used as approved make and sample by EIC/Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

## **2. Workmanship:**

- Installation: Acoustical infill material of 25 mm th Synth manufactured by approved equivalent make directly between wooden frame Synth shall be held in position by using adhesive tape Providing and Fixing vinyl grippers directly on plywood base approx at 1200mm centers by using pneumatic stapler or suitable metal fasteners as per manufacturers specifications. Vinyl grippers must have base tapes for better grip.
- Providing and fixing wood wool board Sound Smooth of size 1200 x 600 x 15mm thick having density 400Kg/ m<sup>3</sup> manufactured by approved equivalent fixed in between Vinyl grippers and again pasting Synth of 10mm thick on the acoustical panel by using adhesive as per specifications of manufacturer.
- Supplying and laying FR grade fabric (for 54" wide) then cut into required size and shape. and stretched, inserted inside the gripper by using tools recommended by manufacturer Rate shall include cost of making of all cut-outs for light fixtures, switchboards gadgets, gizmo, pelmets, grooves, beads cut out as per EIC instruction at site.
- Paneling should be in complete level without any variation and deviation. There shall be no tolerance in regard to wall finish. Wherever required proper framing has to be executed to make the surface level.
- Work complete including all type of tools, tackles, scaffolding etc complete at any level and height
- Work complete as per above manufacturers specification.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

## **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- Only the clear elevation area of the fabric shall be measured and paid. 3rd Party certificate for performance is require to be submitted for the proposed and installed system. Contractor shall submit system application certificate from the manufacturer
- The work done shall be measured in square meter for area of work done. The rate shall be for a unit of one square meter.

**Item No. 33 : Ply + veneer**

Providing and fixing 19mm thick plywood (IS 303) and 4mm thick veneer for window/ door jamb/ panelling/ palmet etc including provision of teak wooden beading/ frame as per design, lacquer polish on veneer and wooden surface, sacolding etc for all level all height and as directed by Engineer in charge. Sample shall be approved by Architect before execution.

**1. Material:**

- 19mm Thick Plywood and 4mm Thick Veneer shall be used as per approved make and sample by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per above specification.
- Work complete including all types of tools, tackles, labour etc complete at any level and height.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one square Meter.

**Item No. 34 : Laminated Wooden flooring**

Supplying and fixing 12mm thick Laminated wooden Flooring Work conforming to EN13329:2006 with plank size not less than 1200 mm X 190 mm (with unilin/tongue-groove locking arrangement) having 0.2mm thk top abrasive layer over a decorative layer followed by a High-density fibreboard (HDF) having density > 850 kg/m<sup>3</sup> substrate core over a resin saturated backing layer and installing through unilin or tongue- groove system (having locking strength not less than 1000 kg/m) over a 2 mm thk underlayer polyurethane foam on polythene sheet 250 micron, over a smooth, flat, hard subfloor free from moisture (< 8%), grease etc. complete in all respect with requisite accessories like end profile, transition profile, reducer 'T' profile, skirting (wherever required) etc. wherever required and preparation of base including all other incidental works as per direction & satisfaction of Engineer in charge.

**1. Materials:**

- 12 mm thick Laminated Wooden shall be approved by Employer's representative/employer
- Adhesive and underlay foam shall be used as per approved by Employer's representative/employer
- All type of material shall be used for flooring work as per approved make list and confirming to relevant IS codes and approved by Employer's representative/employer

## **2. Workmanship:**

- The Planks will be fixed over underlay foam of required thickness as per drawing. The joists of the wooden framing on which the planks shall be fixed shall be checked and corrected to levels.
- The end boards shall be accurately fixed with the sides parallel and close to the walls. Each adjoining board shall be carefully jointed and shall be tightened in position and screwed.
- For fixing the boards to the joists, two screws shall be used at each end of the boards and one screw at each of the intermediate joists in a zig zag manner. The screws shall be countersunk and screw holes filled with approved stopping.
- The flooring shall be truly level and plane. The joints shall be truly parallel and or perpendicular to the walls, unless otherwise specified. The floor shall be planned in both directions and made perfectly even, true and smooth.
- Finishing: The surface of the floor shall be bees waxed otherwise as directed by the EMPLOYER'S REPRESENTATIVE/EMPLOYER.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of Employer's representative/employer

## **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of Employer's representative/employer
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one square meter.

### **Item No. 35 : Auditorium chair**

**Providing and fixing in position Chair's for auditorium made in mild steel powder coated frame for gang arrangemen. Seat to be of foldable mechanism. Seat shall be fixed on floor with required size of anchors. The rates to be inclusive of transportation, loading, unloading, installation at site with necessary hardware at all floors and levels etc. complete as approved by Architect / EIC. Contractor to get loose and installed sample approved by Architect/ EIC before mass procurement.**



**1. Workmanship:**

- Auditorium chair with support including all type of tools, tackles, scaffolding etc complete as per suggestion of EIC/ Architect.
- Including all type fixing materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of EIC/Architect.

**2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Number.

**Item No. 36 : Green room chair**

**Providing and fixign Low back leatherette chair with cushioned back and seat, multilock mechanism/multiple recline lock and knee tilt mechanism, chrome plated fixed arms, gas lift, chrome plated metal base and relavant specifications of approved make and as approved by Architect. Contractor to get loose and installed sample approved by Architect before mass procurement.**

**1. Workmanship:**

- Green Room chair with support including all type of tools, tackles, scaffolding etc complete as per suggestion of EIC/ Architect.
- Including all type fixing materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of EIC/Architect.

**2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Number.

**Item No. 37 : Auditorium Stage Curtain of central opening - Providing and fixing Auditorium Curtain (double layered curtain) with Manual Cord Operated Split Channel with central opening. The rates shall be inclusive of installation, material cost, labor, wastage, operating system all tools tackles, scaffoldings, hardware at all floors, all levels and heights, necessary edge binding with approved fabric and thread of colour similar to the colour of the blinds controller system having chain pulley arrangement with chain of required length and compatible locking arrangement. Minimum 2 ties and 2 clamps shall be provided per 1 m length of the curtain and maximum length of curtain shall not exceed 1.50m. Same rate shall be applicable for all heights and for all floors. Both layered curtain shall be measured for payment**

#### **1. Materials:**

- Auditorium Curtain (double layered curtain) with Manual Cord Operated Split Channel with central opening shall be used as per sample approved by EIC/Architect.
- All type of framing work shall be used as per sample approved by EIC/Architect.
- All type of material shall be used for glazing work as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

#### **2. Workmanship:**

- Work complete as per standard manufactures specification as described above.
- Work should be properly leveled without any sagging and with smooth opening and closing. There should be no variation or deviation of any kinds.
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

#### **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors. Clear opening area shall be measured & paid in Square meter.

#### **Item No. 38 : Polish on old wooden**

**Providing and applying lacquer polish on existing wooden surface after proper cleaning including sand papering, protection, scaffolding etc compete for all level, all height and as directed by Engineer in charge.**

**1. Material:**

- Lacquer Polish shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square meter.

**Item No. 39 : Double coat oil paint on wall surface with remove all dirt & dust without first hand primer.**

**1. Materials:**

- Two coats Paint finish shall be used as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect

**2. Workmanship:**

- 2 or more coats to the new steel surface after and including preparing the surface by thoroughly cleaning. with the help of sand paper of 60, 80, 100, 120 nos etc including surface preparation, sanding, cleaning of steel after completion of job etc. complete to the satisfaction & as directed by the EIC.
- Work complete as per specification and instructions of the EIC/ Architect. Work complete including all type of finishing.
- The whole work is to be completed as per suggestion& instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.

- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors. Area shall be measured & paid in Square Meter

**Item No. 40 : Applying two coats of putty & two coats of primer of approved brand and manufacture on new wall surface to give an even shade including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth.**

**1. Material:**

- Birla or Asian acrylic putty shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Sr. No: 19.59 page No -124 in General specification R & B booklet for building works except that the Putty work.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labor, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 41 : Plastic Emulsion Paint (Two coats) (Asian Paint, ICI, Dulux, Nerolac, Berger etc. of approved type) (without Prime Coat)**

**1. Material:**

- Plastic emulsion paint shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Sr. No: 18.57 page No -120 in General specification R & B booklet for building works except that the Putty work.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labor, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 42 : Designer paint on ceiling**

**Providing and applying designer paint nwith pattern as per concepth design with plastic emulsion paint/ special paint of approved make. Item shall be executed by special agency. Sample shall be approved by Architect. Work shall be carried out by any means for all level, all height and as directed by Engineer in charge.**

**1. Material:**

- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in Square meter for visible area of work done.

**Item No. 43 : Apex Color work on Outer side of Wall (Two coats) (with Base Coat)**

**1. Material:**

- Weather proof exterior emulsion paint shall be used as per approved sample and confirming to relevant IS codes and approved by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Work complete as per relevant specification of Sr. No: 18.51 page No -119 in General specification R & B booklet for building works except that the Putty work.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labor, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 44 : Providing and applying water based, low VOC, breathable and biodegradable, water, oil and stain repellent coating with of approved make on natural stone surface (suitable product according to sand stone/ lime stone) of approved make having acrylic fluoropolymer technology at all heights & leads and wherever instructed by Engineer-In-Charge. The treatment shall be in two coats wet-on-wet or as recommended by approved manufacturer including cleaning the dirt, dust, bird dropping, grease, oil, algae, fungus, vegetable growth, preparation of surfaces by cleaning with Ammonia water with the help of required scrubbers and also cleaning with machine operated water jet without causing any scratching/ damage to the stone surface, finally washing the surface with clean water, curing, protecting, scaffolding including taking all precautions to safeguard ventilators, windows, doors etc. by suitable covering so as to avoid any damage to the building/structure, all as per direction of Engineer in-charge.**

#### 1. Material:

- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### 2. Workmanship:

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labor, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 45 : Removal of Flooring of type Shabadi Ladi / Cement / Tiles flooring**

#### 1. Workmanship:

- The demolition shall consist of demolition of one or more parts of the building as specified or shown in the drawings. Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown in the drawings.
- The demolition shall always be planned before hand shall be done in reverse order to the one in which the structure was constructed. This scheme shall be got approved from the Engineer-in-charge before starting the work. This however will not absolve the contractor from the responsibility of proper and safe demolition.
- Necessary propping, shoring and under pinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining property.
- Wherever required, temporary enclosures or partitions shall also be provided. Necessary precautions shall be taken to keep the dust nuisance down as and where necessary.
- Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roof, masonry etc. shall be carefully dismantled first. The dismantled articles shall be properly stacked as directed.
- All materials obtained from demolition shall be the property of Government unless otherwise specified and shall be kept in safe custody until handed over to the Engineer-in-charge.
- Any serviceable materials, obtained during dismantling or demolition shall be separated out and stacked properly as directed with all lead and lift. All unserviceable materials, rubbish etc., shall be stacked as directed by the Engineer-in-charge.
- On completion of work, the site shall be cleared of all debris rubbish and cleaned as directed.
- The relevant upper points shall be followed except the dismantling of tiled or stone floors laid
- on mortar shall be done. Dismantling implies carefully taking up or down or removing without damage.
- The articles shall be passed by hand where necessary and lowered and where these are fixed by nail, screws, bolts etc., these shall be taken out with proper tools.

## **2. Measurements:**

- Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed. The demolition of lime concrete shall be measured under this item. Specification for deduction for voids, openings etc. shall be on same basis as that employed for construction of work.
- All work shall be measured in decimal system as fixed in its place subject to the following limits; unless otherwise stated here in after : (a) Dimensions shall be

measured to the nearest 0.01 mt. (b) Area shall be worked out to the nearest 0.01 sq. mt.(c) Cubical contents shall be worked out to the nearest 0.01 Cu.m.

- The rate shall include cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable materials properly and disposing the unserviceable materials with all lead and lift. The rate also includes for temporary shoring for the safety of the portion not required to be pulled down or of adjoining property and providing temporary enclosures or portions where considered necessary.
- The rate shall be for a unit of one cubic meter.
- In measuring thickness of plastered walls, the thickness of plaster shall be included. The unserviceable materials shall be disposed off with all lead and lift. Ashlars face stones dressed stone etc., if required to be taken down intact shall be dismantled and measured separately in cubic meters.
- The rate is exclusive of cleaning of bricks or stones. Honey comb works or hollow block walling shall be measured as solid.
- The rate shall be for a unit of one sq. meter.

#### **Item No. 46 : Removal work of Interlocking block**

##### **1. Workmanship:**

- Removal of Interlocking block with mortar including all type of tools, tackles, scaffolding etc complete as per suggestion of EIC/Architect.
- Including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of EIC/Architect.

##### **2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of Square Meter.

#### **Item No. 47 : Removal of Sheet/ Wooden foyer with removal of flooring**

##### **1. Workmanship:**

- Removal of Sheet/Wooden foyer with mortar including all type of tools, tackles,



scaffolding etc complete as per suggestion of EIC/ Architect.

- Including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of EIC/ Architect.

## **2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of Square Meter.

### **Item No. 48 : Removal of Cement/ Lime Plaster (with excavation of vatta)**

#### **1. Workmanship:**

- Work complete as per relevant specification of Item No: 20.002 page No -134 in General specification R & B booklet for building works.

#### **2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

### **Item No. 49 : Removing dry or oil bound distemper by a washing and scraping and sand papering the wall surface smooth including necessary repairs to scratches complete.**

#### **1. Workmanship:**

- The whole work is to be completed as per sample material & any other requirement shall be as per instruction of EIC/ Architect.

#### **2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.

- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 50 : Removing old colour as a oil paint, distemper etc.**

**1. Workmanship:**

- The whole work is to be completed as per sample material & any other requirement shall be as per instruction of EIC/ Architect.

**2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 51 : Removal / Fixing of Cement Sheet Or Iron Sheet**

**1. Workmanship:**

- The whole work is to be completed as per sample material & any other requirement shall be as per instruction of EIC/ Architect.

**2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Square Meter.

**Item No. 52 : Removal of Door / Window / Cup Board**

**3. Workmanship:**

- Work complete as per relevant specification of Sr. No: 20.1(I) page No -133 in General specification R & B booklet for building works.

**4. Measurements:**

- The rate shall be consolidated for all above items.

- The doors, windows, ventilators etc. not exceeding 3 sq. ml. in area (each) including shutters and chowkhats, Architrave, holdfasts and other attachment to frames etc. will be dismantled and measured under this item.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one number.

**Item No. 53 : Cleaning and high gloss mirror polishing of existing marble flooring as per satisfaction of Architect and Engineer in charge.**

**1. Material:**

- High Gloss mirror Polish shall be used as per sample approved by EIC/Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

**2. Workmanship:**

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in Square meter for visible area of work done.

**Item No. 54 : Cleaning of glass window from both side and repaint/ repolish of existing wooden/metal member of window as per satisfaction of Architect and Engineer in charge.**

**1. Material:**

- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/Architect.

**2. Workmanship:**

- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/Architect.

### 3. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in Square meter for visible area of work done.

### **Item No. 55 : Dismantling steel work including dismembering and stacking the materials with all lead and lift.**

#### 1. Workmanship:

- Dismantling steel work including all type of tools, tackles, scaffolding etc complete as per suggestion of EIC/ Architect.
- Including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of EIC/ Architect.

#### 2. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Kg.

### **Item No. 56 : Dismantling false ceiling/ wall panelling/ partition made of any material including framing, sub structure, anchor, etc. complete and stacking them within all lead and lift**

#### 1. Workmanship:

- Dismantling False Ceiling/ wall panelling/ partition work including all type of tools, tackles, scaffolding etc complete as per suggestion of EIC/ Architect.
- Including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of EIC/ Architect.

## 2. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One square meter.

**Item No. 57 : Removing auditorium chair including foundation bolt/ fixing arrangement etc complete and stacking them within all lead and lift as directed by Engineer in charge.**

### 1. Workmanship:

- Removing Auditorium chair including foundation Bolt, all type of tools, tackles, scaffolding etc complete as per suggestion of EIC/ Architect.
- Including all type fixing materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of EIC/ Architect.

## 2. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Number.

**Item No. 58 : Removing of auditorium curtain, pelmat, sign box, arrangement for equipments etc complete and stacking them within all lead and lift as directed by Engineer in charge.**

### 1. Workmanship:

- Removing of Auditorium curtain, pelmant, sign box, arrangement for equipment including all type of tools, tackles, scaffolding etc complete as per suggestion of EIC/ Architect.
- Including all type fixing materials and disposal of unserviceable materials with all lead and lift.
- Bidder shall be responsible for the any type of damage work at the time of execution.
- All work should be carried out as per detailed drawing and instruction of

EIC/Architect.

## 2. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of one Lot.

**Item No. 59 : Dismantling sanitary fittings like wash basin . W.C. pan Indian and European type, flushing tank etc. including stacking the materials with all lead and lift.**

## 1. Workmanship:

- Work complete as per relevant specification of Sr. No: 20.23page No -133 in General specification R & B booklet for building works.

## 2. Measurements:

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all labor, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/Architect.
- No extra payment will be given for any of the reasons.
- The relevant specifications of item No. 20.1 (I) shall be followed.
- The-rate shall be for a unit of one number.

**Item No. 60 : Dismantling C.I. pipes G.S.W.pipes and A.C. rain water pipes with fittings and clamps including stacking the materials with all lead and lift ( for any dia, of pipe)dismantling sanitary fittings like wash basin . W.C. pan Indian and European type, flushing tank etc. including stacking the materials with all lead and lift.**

## 1. Workmanship:

- Work complete as per relevant specification of Sr. No: 20.23page No -133 in General specification R & B booklet for building works.

## 2. Measurements:

- The rate shall be consolidated for all above items.
- No extra payment will be given for any of the reasons.
- Water pipe lines, including rain water pipes; with clamps and specials, sewer pipe lines, (Salt glazed ware or concrete) etc. shall be measured in running metre inclusive of joints (The measurements shall be taken along the centre line of pipe and fittings.)

- The rate shall be for a unit of one running meter.

**Item No. 61 : Dismantling of all MEP services item including wire, cable, conduit, duct, cable tray, light fixture, grills, AC unit, fan, fire pipes, equipments, accessories etc, for all level, all height as directed by Engineer in charge.**

**1. Workmanship:**

- The relevant specification for this item shall be followed as per Item Description and instruction Given by Engineer In charge.

**2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall be for a unit of one Job.

**Item No. 62 : Core cutting :**

**Providing and wet drilling accurate and clean holes of required diameter in RCC walls, slabs, beam or any other RCC member without vibration by core cutting (diamond drilling) machine of approved make for laying service lines including scaffolding, disposing the debris, cleaning, making good, providing epoxy mortar/ micro concrete/ patch repair mortar/ Non shrink grout for concrete for grouting the gaps around the pipes for all levels/ all height, after approval of engineer in charge etc compete. Measurement shall be taken for the depth of holes in running meter for specified diameter. Holes shall made by authorized approved agency.**

**1. Material and Workmanship:**

- Marking of holes is to be approved by EIC/ Architect. Holes in RCC walls, slabs, beams or any other RCC member by Core cutting machine of approved list of make is to be done.
- RCC surface is cleaned after drilling including disposing of debris as specified in the disposal item. Necessary platform for the machine location and electrical wire management shall be adhere to safety standards. Bidder shall be responsible for the any type of damage work at the time of execution.
- The work include for epoxy based waterproofing compound for sealing the joints around the pipes at all heights as per instruction of EIC/ Architect.
- All work should be carried out as per detailed drawing and instruction of EIC/ Architect
- Bidder shall be responsible for the any type of damage work at the time of execution.
- The whole work is to be completed as per design & any other requirement shall be as per instruction of EIC/ Architect.

**2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, fixtures, joineries, labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Running Meter.

**Item No. 63 : INTERNAL PLUMBING WORK : Providing, fixing, jointing and testing in position of various Bathroom C.P. Fixtures with hydraulic testing complete as per design, drawing and instruction of site incharge. 25mm Dia Control Valve (Make: Zoloto, VB,SANT)**

**1. Materials:**

- Control Valve shall be used as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- Control Valve shall be fixed with necessary fittings, accessories etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

**Item No. 64 : Providing and fixing screw down bib taps of following size. (B) Brass chromium plated screws down Bib Tap. (i) 15mm dia. Jaquar - CON-049NKN (Make :- Jaquar, Hindware , Parryware or Equivalent).**

**1. Materials:**

- Bib tap shall be used as per approved sample by EIC/ Architect.



- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

## **2. Workmanship:**

- Bib tap shall be fixed with necessary fittings, accessories etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

## **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

**Item No. 65 : Providing and fixing health faucet with 1 m PVC tube and swivel hook including all fittings complete. (Jaquar Code : ALD-573)(Make :- Jaquar, Hindware , Parryware or Equivalent).**

## **1. Materials:**

- Health faucet with 1mt PVC tube and swivel hook shall be used as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

## **2. Workmanship:**

- Health faucet with 1mt PVC tube and swivel hook shall be fixed with necessary fittings, accessories etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

## **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to

complete the whole work satisfactorily as per instruction of EIC/ Architect.

- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

#### **Item No. 66 : Nahni trape 7.6cm of PVC fitting and fixing**

##### **1. Materials:**

- PVC SWR Nahni trap IS 14735 for drain - 7.6 Cm diameter with jali by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

##### **2. Workmanship:**

- Nahni trap IS 14735 for drain shall be fixed with necessary fittings, accessories etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

##### **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

**Item No. 67 : Providing and fixing white glazed vitreous china wall mounting type (European type) water closet with C.P. bolts, nuts, C.I. Chair or other hanging arrangement, white solid plastic seat with lid, C.P. brass hinges and rubber buffers, Metropole flush valve regular 40mm size (concealed body) with exposed shut off provision , C.P. brass screws and washers complete, including cutting and making good the walls floors where required. Wall hung EWC (Jaquar - VGS-WHT-81953UF), (FLV-1093N - Metropole Flush Valve) & (FLV-1071 - Concealed Flush Valve Complete) matching white plastic seat with lid & CP brass hinges & CP push plate . (Make :- Jaquar, Hindware , Parryware or Equivalent).**

**1. Material:**

- wash down water closet (European type, W.C. Pan) with integral P or S trap as per approved make and sample by EIC/ Architect.
- Metro pole flush valve as per approved make and sample by EIC/ Architect.
- All type of material shall be used as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- jointing the trap with soil pipe in Cement Mortar 1:1 (1-Cement : 1-fine sand) (Seal and cover to be measured and paid for separately)
- Work complete as per above specification.
- Work complete including all type of tools, tackles, scaffolding etc complete at any level and height
- The whole work is to be completed as per design; sample material & any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in square meter for area of work done. The rate shall be for a unit of one number.

**Item No. 68 : White porselein wash bassin 560/410mm indian make c.i. bracket with fitting cromium platted topes 25cm plastic waste pipe and 12mm pillar cock with comp.i)**

**1. Materials:**

- washbasin with single hole for pillar tap with C.I. or M.S. brackets painted white as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- holes and making good the same but excluding fittings as per detailed drawing.
- Wash basins shall be of white vitreous china of best quality manufactured by an approved firm and sizes, and as specified in the Bills of Quantities.

- Wash basin shall be of table top / under counter drop in type shall be supported on a pair of rolled steel brackets of approved design and shall be mounted on a countertop so that rim and basin bowl are exposed from top.
- Wash basin shall be provided with single lever mixer with chain and rubber plug, chromium plated brass bottle trap of approved quality, design and make, where hot water required. Single tap where hot water is not required.
- Wash basin shall be fixed at proper location and height and truly horizontal as shown on drawing or as directed by Client's Representative.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

### **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

### **Item No. 69 : White Porselin Urinal with require plastic waste pipe fitting and fixing.**

#### **1. Materials:**

- Urinal including connection with trap and integral longitudinal flush pipe shall be used as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

#### **2. Workmanship:**

- Urinal including connection with trap and integral longitudinal flush pipe shall be fixed with necessary fittings, accessories etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

### **3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.

- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

**Item No. 70 : Providing, fixing, jointing and testing in position Urinal stop cock including all fittings complete with hydraulic testing complete. (Code : Jaquare CON-1081KN) (Make: Jaquare, Cera, Hindware, Somani)**

**1. Materials:**

- C.P. fixture Urinal stop cock shall be used as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- C.P. fixture Urinal stop cock shall be fixed with necessary fittings, accessories etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

**Item No. 71 : Providing & fixing in position 15 mm C.P. brass angle cock of best quality with 1.2 Rmt Long pvc Tube and accessories with necessary fittings etc. complete. (Make : Jaquar, Hindware, Cera, Somani)**

**1. Materials:**

- C.P. brass Angle cock shall be used as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- C.P. brass Angle cock shall be fixed with necessary fittings, accessories etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

**Item No. 72 : Providing & fixing in position 15 mm C.P. brass pillar cock of best quality with necessary fittings etc. complete.[Jaquar FLR - CHR-5011N)**

**1. Materials:**

- C.P brass pillar tap as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- 15mm dia tap, screws, shanks and back nuts etc complete as per detailed drawing.
- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be

for a unit of one number.

**Item No. 73 : Providing and fixing soap dispenser as approved by the architect. Work complete including all type of fittings , etc complete as per suggestion of Architect/EIC.**

**1. Materials:**

- Soap dispenser as per approved sample by EIC/ Architect.
- All type of material shall be used for work as per approved make list and confirming to relevant IS codes and approved by EIC/ Architect.

**2. Workmanship:**

- The whole works is to be completed as per design, sample material, and any other requirement shall be as per instruction of EIC/ Architect.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, finishing, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- Rate to be inclusive of all material, wastage, necessary tools tackles etc for fixing at all heights and for all floors.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one number.

**Item No. 74 : Providing, laying and jointing in true line and level 110 diameter U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 110 mm diameter x 149 mm length x 145 mm height at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials.**

**1. AIM AND FIELD OF APPLICATION**

- This specification has the aim to regulate the modalities of delivery and testing of UPVC pipes. for conduction of water and food- fluids under pressure, conforming to Dlgs 06/04/2004 n. 174 “ regulation . concerning materials and objects which can be used within fixed plants of purification, treatment, conduction, and distribution of water used for human consumption”.

## 2. STANDARDS OF REFERENCE

- UNI EN 1452 pipes systems of plastic material for conduction – unplasticized Polyvinyl-chloride – UPVC.

## 3. REQUIREMENT PRESCRIBED

- **RAW MATERIAL** The blend has mainly to be made of PVC (polyvinyl-chloride) with the sole addition of not toxic fluidification material and stabilizers, inert charges and other additives in quantities necessary to extrusion and to give a guarantee of stability of the characteristics of the polymer both during the working process and the life of the product.
- The blend used for the production of pipes, either in granules or powder, must not be used for any other utilization or working process than the required for the production of pipes.

**The use of the following materials is not admitted:**

- plastifiers and/or mineral charges which may alter the mechanical and hygienical characteristics of the pipe.
- PVC from regeneration of already used polymers, even if selected.
- The use of material having been extruded once, obtained from grinding of pipes and fittings, which had already been extruded, even if they have the characteristics which conform to this specification.
- The characteristics from PVC powder have to be conform to the requirements of UNI EN 1452-1 and satisfy the data indicated in the following table:

| Characteristics                        | Requirements                     |
|----------------------------------------|----------------------------------|
| K Value                                | 65 ÷ 70                          |
| apparent specific weight               | 0,5 ÷ 0,6                        |
| Particle size measurement              | > 250 mm 5% max. < 63 mm 5% max. |
| Residual VCM (Vinylchloride - Monomer) | <1 ppm (1mg/kg max.)             |
| Volatile substances                    | ≤ 0,3%                           |

## CARACTERISTICS OF U - PVC BLEND

- The characteristics of the blend in shape of a pipe, must correspond to the requirements of UNI EN 1452-1 and satisfy the following table

| Characteristics | Requirements |
|-----------------|--------------|
|-----------------|--------------|



|                                         |                                   |
|-----------------------------------------|-----------------------------------|
| M.R.S. (according to ISO/TR 9080)       | $\geq 25$ MPa                     |
| specific weight                         | $1,35 \pm 1,46$ g/cm <sup>3</sup> |
| unitary yeld point                      | $\geq 48$ MPa                     |
| yield                                   | $< 10\%$                          |
| coefficient of elasticity               | $> 3.000$ MPa                     |
| coefficient of linear thermal expansion | $0,06 \pm 0,08$ mm/m°C            |
| thermal conductivity                    | $0,13$ kcal/mh°C                  |

## PIPES

- The pipes have to be produced with raw material (PVC blend) corresponding to the requirements as indicated in the previous table and as follows:

|               |                                                                                                                                                                                                                                                                   |                    |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| <b>Colour</b> | <b>Grey</b><br>considering that pipes may be exposed to sun-rays, a minimum fading of the colour on one part of the pipe must not compromise the quality of the pipe to be used and therefore may not be a reason of rejection of the same, on delivery. RAL 7011 | <b>RAL 7011</b>    |
| <b>Aspect</b> | the inside and outside surfaces of the pipes must be smooth, clean and without cavities, impurities and porosities or any other irregularity on the surfaces which might hinder their conformity to the norms of reference and these specifications. UNI EN 1452  | <b>UNI EN 1452</b> |

## MECHANICAL AND PYSICAL CHARACTERISTICS

- The characteristics of the pipes must conform to the requirements of UNI EN 1452-2 and satisfy the requirements of the following table:

| Characteristics                     | Requirement                                                                                                                  |                       | Methods              |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|
| shock resistance                    | T = 0°C - TIR < 10%<br>conform to schedule 6 of UNI EN 1452-2                                                                |                       | UNI EN 1452-2 744    |
| Resistance to interior pressure     | No yeld during the test<br>20 °C / 1h / sigma= 42 Mpa 921<br>20 °C / 100h / sigma= 35 MPa<br>60 °C / 1000h / sigma= 12.5 MPa |                       | UNI EN 921           |
| Temperature of softening Vicat(VST) | $\geq 80$ °C                                                                                                                 | Conform to UNI EN 727 | UNI EN 727           |
| Longitudinal                        | $\leq 5\%$                                                                                                                   | Testing Temperature   | 150 °C<br>UNI EN 743 |

|                                                          |                                                          |                                                                                         |                            |                                   |
|----------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------|-----------------------------------|
| shrinkage                                                | the pipe must non show delimitation, blister or breakage | Time of immersion<br>For :<br>$e \leq 8 \text{ mm}$<br>$e > 8 \text{ mm}$               | 15 min<br>30 min           | Method A:<br>Bath liquid          |
|                                                          |                                                          | Or                                                                                      |                            |                                   |
|                                                          |                                                          | Testing Temperature<br>Time of immersion<br>$e \leq 8 \text{ mm}$<br>$e > 8 \text{ mm}$ | 150 °C<br>30 min<br>60 min | UNI EN 743<br>Method B:<br>In air |
| Resistance to dichloromethane at a specified temperature | No attack in any part of the surface of the test piece   | Testing Temperature<br>Time of immersion                                                | 150 °C<br>30 min           | UNI EN 580                        |

### CONNECTIONS SOCKET / GASKETS

- the connections are made by means of sockets with elastomeric gasket. Gaskets have not to be toxic at all according to the present norms for this subject (sanitary discipline) and conforming to norm UNI EN 681/1.
- The system of connection has to correspond to the requirements of UNI EN 1452-5 for every single class of pressure (PN) and has to be tested according to:
- a) EN ISO 13844 elastomeric gaskets for socket connections to be used with UPVC pipes – testing method for tightness of negative pressures;
- b) EN ISO 13845 elastomeric gaskets for socket connections to be used with UPVC pipes – testing method for tightness of internal pressure with angular deflection of the connection.

### MINIMUM MARKING

- the minimum marking on each meter of pipe must be indelible and show at least the following data:
  - name of the producer and/or trade mark of the product
  - number of the norm of the system (UNI EN 1452)
  - quality mark of the product - raw material (U-PVC)
  - outside diameter of the pipes x wall thickness
  - nominal pressure (PN) and SDR and/or series (s ...)
  - day, month, year and shift of production
  - number of the extrusion line
  - date of production

Customers may anytime ask further information's to the producer

## GEOMETRICAL CHARACTERISTICS - DIMENSION OF PIPES

- Diameters, thickness and tolerances :  
pipes have to be formed (SDR) as for seen by the National Introduction of UNI EN 1452 and have dimensions conforming to schedules 1,2,3 of Chapter 6 of UNI EN 1452-2 "geometrical characteristics".

Particularly in this discipline there is shown the prospectus including minimum wall thicknesses indicated in mm

| Nominal outside diameter | Nominal Wall thicknesses (minimum) (mm) |           |           |           |
|--------------------------|-----------------------------------------|-----------|-----------|-----------|
| (MM)                     | PN 6 bar                                | PN 10 bar | PN 16 bar | PN 20 bar |
| 20                       |                                         |           | 1.5       | 1.9       |
| 25                       |                                         |           | 1.9       | 2.3       |
| 32                       |                                         |           | 1.6       | 2.4       |
| 40                       | 1.5                                     | 1.9       | 3.0       | 3.7       |
| 50                       | 1.6                                     | 2.4       | 3.7       | 4.6       |
| 63                       | 2.0                                     | 3.0       | 4.7       | 5.8       |
| 75                       | 2.3                                     | 3.6       | 5.6       | 6.8       |
| 90                       | 2.8                                     | 4.3       | 6.7       | 8.2       |
| 110                      | 2.7                                     | 4.2       | 6.6       | 8.1       |
| 125                      | 3.1                                     | 4.8       | 7.4       | 9.2       |
| 140                      | 3.5                                     | 5.4       | 8.3       | 10.3      |
| 160                      | 4.0                                     | 6.2       | 9.5       | 11.8      |
| 180                      | 4.4                                     | 6.9       | 10.7      | 13.3      |
| 200                      | 4.9                                     | 7.7       | 11.9      | 14.7      |
| 225                      | 5.5                                     | 8.6       | 13.4      | 16.6      |
| Nominal outside diameter | Nominal wall thickness (minimum) (mm)   |           |           |           |
| (MM)                     | PN 6 bar                                | PN 10 bar | PN 16 bar | PN 20 bar |
| 250                      | 6.2                                     | 9.6       | 14.8      | 18.4      |
| 280                      | 6.9                                     | 10.7      | 16.6      | 20.6      |
| 315                      | 7.7                                     | 12.1      | 18.7      | 23.2      |
| 355                      | 8.7                                     | 13.6      | 21.1      | 26.1      |
| 400                      | 9.8                                     | 15.3      | 23.7      | 29.4      |
| 450                      | 1.0                                     | 17.2      | 26.7      | 33.1      |
| 500                      | 12.3                                    | 19.1      | 29.7      | 36.8      |
| 630                      | 15.4                                    | 24.1      |           |           |
| 710                      | 17.4                                    | 27.2      |           |           |
| 800                      | 19.6                                    | 30.6      |           |           |
| 900                      | 22.0                                    |           |           |           |
| 1000                     | 24.5                                    |           |           |           |

### Lengths

- pipes have to be delivered for all outside - diameters asked for in lengths of 6 meters (socket included).

### **Ends of pipes**

- the pipe has to have plain ends, sharply cut and must be perpendicular to the axis of the same pipe, having an outside chamfer of about 15°.

### **CONTROLS AND RESPONSABILITY**

- The contractor reserves the right to himself and to the person he is going to uncharged to assist the tests and controls carried out to check if the requirements prescribed by the norms of production and by these specifications are fulfilled.
- The supplier, therefore, will do his best to favor the free access of the persons uncharged by the contractor to the production plants of the pipes in a moment whatever during the different phases of production and to the laboratories during the phases of control and testing, communicating within a reasonable period of time the beginning date of production of the pipes ordered. He will further give to the persons in charge, full liberty of actions to make the controls necessary, in line with the requirements of production.
- The contractor reserves himself the right to check by means of taking samples of pipes and/or of the the raw material, the correspondence of the same to the present specifications and to the supplier's declarations.
- It is understood that the presence of the persons uncharged, during the tests, will not be a substitute of the controls to be carried out by the seller, who is the only one responsible for the quality of the pipes he produces.
- The seller will bear any costs deriving from the delivery of pipes not conforming to the requirements of these specifications.

### **DOCUMENTS AND CERTIFICAZIONS OF QUALITY**

- the supplier has to enclose to his offer:
- the certification of conformity of the Internal Quality System conforming to UNI EN ISO 9000, issued by an independ Institute or Company in conformity with UNI CEI EN 45012;
- a signed declaration regarding the use of vergin raw material (blend), which does not contain already worked material or substances which can damage the human body;
- a certificate of conformity of the product to norm UNI EN 1452 for pipes, issued by an independent Istitute, Body or Company, in conformtiy with UNI CEI EN 45011.

### **AFTER SALE ASSISTANCE**

- If agreed upon , when the order had been made, the supplier has to guarantee as follows:
  - assistance by means of qualified technicians at the begin of work within the building yard in order to check the correct way of installation (recommendations according to UNI EN 1452-6 and ENV 1046).

- Assistance of competent personnel regarding the procedures of testing the laying within the building yard (in case of water conducts, for seen by the law according the the Ministerial Decree DM 12.12.85) of buried pipe-lines for fluids under pressure (execution according to method UNI EN 805, hydraulic test of conducts with a viscoelastic behavior).

## **HANDLING AND TRASPORT OF MATERIALS**

- For the handling and transport of the pipes there have to be adopted all those procedures which are idoneous to make sure that the same reach at destination completely integral. A possible deterioration of the pipes, ascertained on delivery of the same, will turn out into a claim of defect material. The pieces claimed will remain at the disposal of the supplier. Possible repairing or controls will be at the supplier's charge. As for loading, transport, unloading and storing of the pipes and special pieces, reference will be made to the prescription of the Ministerial Decree (D. M.) 12.12.1985 (and successive modifications and integration) .

## **TRANSPORT OF PIPES**

- When transporting pipes, the loading surface must not be rough. It is necessary to support pipes for their whole length, thus avoiding the possibility that pipes get damaged due to vibration. In order to fix the load, straps of hemp, nylon or similar material can be used, taking care that the pipes will not get damaged.

## **LOADING; UNLOADING AND HANDLING**

- if loading and unloading of a means of transport or, anyway the handling of the material is done by means of a crane or the arm of an excavator, pipes have to be lifted in the center by an equalizing rocker arm of at least 3 meters. If these works are done by hand, it has to be avoided to slide pipes on to the side boards of the mean of transport or, anyway, on hard and sharp objects. The person in charge of the building site has to check all working processes of unloading in order to be sure of their regularity. Each damaged product will be identified by writing " not to be used" and will be isolated in an extra area. The person in charge has to communicate as soon as possible, the existence of a damaged product to the Contractor's Director of Work, who then will take the actions necessary, according his unobjectionable opinion. If a crane is used, there has to be an efficient system of communication between the worker inside the crane and the worker beside the mean of transport.

## **STORING OF PIPES**

- the best solution for the storage of pipes would be to use wooden crates or crates of other materials, to be able to resist to the weight of the pallet put on top. The storage has to be carried out with great care and the pallets have to be aligned. The supporting surface of the pallets stored hs to be levelled, not to be rough and must not have stones

with sharp edges. Every possible idoneous solution has to be adopted in order to avoid any interference with the local traffic, both Vehicles and pedestrians, and with any other already existing structure. The pipes have to be stored in a way to avoid possible accidents due to an unforeseen movement of the same.

### CONSERVATION OF THE MATERIALS

- It is absolutely necessary to adopt measures, that in case of long term storage, pipes of UPVC and plastic fittings can be put inside, away from sun-rays, in order to avoid the risk of degradation of the polymers and the decay of their chemical, physical, and mechanical properties. Fittings may be packed in different ways according to their shape, dimensions and type of transport. If they are delivered without packaging, it has to be taken care not to pile them up without method, thus avoiding a collision between the single pieces or between the fittings and other heavier materials. In any case they cannot be put near heating devices or exposed to direct sun-rays until they are used. Similar indications have to be followed for the conservation of lubricants.

### MODALITY AND PROCEDURES OF LAYING IN SITE

- Tipologies of trenches : The type of trench required by the project based on the evaluation of loads, the type of soil and the organization of the building yard, has to be scrupulously carried out in the next phase of execution. During the phase of execution it is therefore important to have a scrupulous correspondence between the project and its effective realization. In the table below there are some main typologies of trenches showing the relationship between the diameter of the pipes ( $D$  indicated in meters), the width of the trench at the level of the upper part of pipe ( $B$  in meters) and the height of filling on the upper part of the pipes ( $H$  in meters).

| Type of Trench | B(width of the trench) |
|----------------|------------------------|
| Small Trench   | $\leq 3 D$ $< H/2$     |
| Large Trench   | $3 < D$ $< 10 < H/2$   |
| Embankment     | $\geq 10 D$ $\geq H/2$ |

#### Small Trench

- this is the best way to lay a U-PVC pipes. The pipe does not have to bear all the load from above, as it transmits part of it to the surrounding soil depending on the deformation due to the deflection, the product is submitted to.

#### Large Trench

- the load the pipe has to bear will be more than the one it has to support in a small trench. For this reason this has to be considered during the planning. This hypothesis has to be born in mind in order to obtain a certain security when making the calculations of the dimensions.

### **Embankment (positive position)**

- the upper part of the pipe is put on a natural level of the soil. If there is much load passing through, this typology has not to be adopted due to sinking of the soil in absence of excavations on the sides.

### **Terrapieno (negative position)**

- The pipe is put at a lower level than the natural one of the soil. Due to friction, even if a very light one, between the filling material put on the embankment and the natural sides of the trench, the pipes can support slightly more load than those in the positive position, but in any case less than those laid in a small and large trench. Therefore, even this typology is not advisable.

### **Depth of the trench**

- The depth of the pipes H (in meters) understood as distance between the soil and the upper part of the pipes must satisfy the most protective of the following requirements, where D is the outside diameter expressed in meters.

$$H \geq 1,0$$

$$H \geq 1,5 D$$

### **Width of the trench**

- This is determined by the laying depth and by the diameter of the pipe, as it has to allow the settlement of the bottom, the connection of the pipes and the movement of the workers. The minimum width of the soil B (in meters ) is normally:

$$B = D + 0,5 \text{ with } D \leq 0,4 \text{ m}$$

$$B = 2D \text{ with } D \geq 0,5 \text{ m.}$$

- On the other side, the inferior limit values have not to be exceeded very much as the efficiency of the trench is higher when the width is smaller.

### **Bottom of the trench**

- The trenches have to be made without bumps or unevenness in order to establish a continuous support for the pipes. It is not advisable to use a bottom with a concrete bed or similar as this will make the structure rigid.
- When the trenches are open on heterogeneous soil, situated on hills or in the mountains, it is necessary to anchor in order to avoid possible sliding of the soil.
- If there might be an instability of the soil due to water within the trench, it is necessary

to re-inforce the soil bottom by means of draining pipes under the canalization.

- Around these pipes has to be put a compact strata of gravel or other material suitable to this purpose.
- In other words, it is necessary to make sure that there won't be any possibility that the filling material could move due to ground water.

#### Laying Bed

- There has to be a stabil laying bed on an even level, for canalization of U-PVC pipes. It has to be free from pebbles, heap of stones and possible other materials. The laying bed must not be build before having a complete stabilization of the trench bottom. The material used in normal laying conditions is sand mixed with gravel of a maximum diameter of 20 mm. If the soil has slopes, it is advisable to avoid sand, giving preference to gravel or crushed stones without edges, cut to pieces of maximum 10/15 mm. The material has then to be accurately compacted and has to achieve a thickness of minimum  $(10 + 1/10 D)$  cm.

#### Norms of compacting and quality control

- As U-PVC pipes are flexible, the uniformity of the surrounding soil is basically for a correct construction of a carrying structure, because the soil, deformed by the pipes, reacts in a way to give a help in supporting the load. In order to assure stability and integrity of the pipes laid, within the time, it is pointed out that the contractor has to take a great care regarding the laying of the pipe bed, the support and the first covering of U-PVC and has to apply scrupulously the present norms.
- The degree of compacting of the material, which forms the supports, has a determining influence on the value of diametric deformations ( $\times / D$ ) of the pipes. This value, which must not exceed the limits permitted, can be deduced by the formula of Spangler,

$$X = \frac{0,125 \cdot Q}{E \cdot (s/D)^3 + 0,0915 \cdot E_1}$$

with:

Q = total external load on the pipe [kg/m];

E = modulus of elasticity of the pipe [kg/m<sup>2</sup>];

s = thickness of the pipe [m]; D = diameter of the pipe [m];

E<sub>1</sub> = modulus of elasticity of the soil [kg/m<sup>2</sup>].

Particularly E<sub>1</sub> depends on the factor of compacting  $\alpha'$  according to the relation:

$$E_1 = \frac{9.10^4}{a} (H+4),$$

- where H [m] is the height of filling measured from the upper side of the pipe. Furthermore  $\alpha'$  is connected to the Proctor index as indicated in the following table:

| Proctor Test | $\alpha'$ |
|--------------|-----------|
| 95%          | 1,0       |



|     |                  |
|-----|------------------|
| 90% | 1,5              |
| 85% | 1,5 <sup>2</sup> |
| 80% | 1,5 <sup>3</sup> |
| 75% | 1,5 <sup>4</sup> |

- The Proctor index defines normally the degree of compacting of the soil. For U-PVC pipes a Proctor index of at least 90% has to be considered. The achievement of the value required for the Proctor index has to be verified by means of appropriate tests and respective certifications, the number of which is fixed during the planning.
- The above mentioned tests, defined as tests of compaction and determination of the characteristics of density of materials, must be carried out with the standard method AASHO with 4 points of the curve density/content of water. In order to obtain the density required methods of compacting are used (by hand with flat presses or with light mechanical apparatus).

#### Laying of the pipe

- before laying the pipes, they have to be checked one by one in order to discover possible defects; the end part and the socket of the pipes have to be integral. The pipes and fittings must be put on the laying bed in a way to have a continuous contact with the bed.
- The niches, excavated before, for the accommodation of the sockets (even if the dimension of the socket is minimum, it is normal to find a niche in correspondence of its support), if necessary, have to be accurately filled in order to avoid possible empty spaces under the sockets.

#### Procedure of filling

- The filling of a trench and generally of the excavation, is fundamental for the laying. As we are dealing with UPVC pipes, the uniformity of the soil is absolutely necessary in order to have a perfect construction of the carrying structure, as the soil reacts in a way, giving a contribution to support the given load. The material already used for the construction of the bed is put around the pipe and solidated by hand in order to form successive strata of 20 cm. up to half height of the pipe. It has to be taken care that there won't remain any empty spaces under the pipes and that the strata L1 of the filling material between the pipe and the wall will be continuous and compact.
- The second strata of filling L 2, reaches the upper part of the pipe. Its compactness has to be carried out with maximum care. The third strata L3 reaches 15 cm over the upper part of the pipe. Compactness has to be only at the sides of the pipes, never vertically on the same.
- The solidation of filling around the pipe must be uniform and reach 90% of the optimal value determined by the modified Proctor test. The support with turfy, muddy, clayly, or frozen soil is not allowed as this kind of soil cannot be solidated as it contains too much water.

- Further filling is made (strata L4 and L5) by material obtained from excavation. This material is cleaned from elements having a bigger diameter than 10 cm and from vegetal and animal fragments. The filling has to be made for the following strata up to 20 cm. It has to be compacted and eventually watered for a thickness of 1 m (measured from the upper part of the pipe), so that the density of the soil, once solidated, reaches 90% of the optimal value determined by the modified Proctor test. The bigger material (stones of a diameter > 2 cm) must not exceed the limit of 30%. At last there has to be a free space for the last strata of vegetal soil.

#### Special laying conditions

- If there is a ground water table, it has to be ascertained that this table does not cause any movement of the filling material surrounding the pipe. The surrounding soil has therefore to be solidated by means of draining, operating under the level of excavation, and thus avoiding every possible instability of the laying soil and brickworks.
- If during the work, for limited distances, there will appear some harder laying conditions than those foreseen by the project (enlargements of walls, landslides etc) works of protection have to be carried out in order to come back to laying conditions as described. There must be extra-walls of heaps of stones or concrete in order to reduce the length of the section of excavation or there must be adopted other solutions authorized by the Direction of Work.
- In case, for technical reasons the height H of recovering is in some points lower than the minimum prescribed, it is necessary to absorb vertical loads by using appropriate protection devices (rigid diaphragms of protection and distribution of the loads, to be put above the last compact strata of material), following the input of the Direction of Work.
- In case of crossing railways, it is possible to:
  - For see a steel covered protective pipe (casing)
  - Lay pipes in a tunnel of re-in forced concrete

#### ESECUTIONS OF CONNECTIONS

- Connections are made, respecting the indications given in the following, both for pipes and special pieces. An accurate cleaning of the parts to be joint is foreseen making sure that they are integral. The gasket has to be inserted (if not already inserted during production) in it seat, situated in the internal side of the socket. Successive steps are:
- Lubrification of the external surface of the end of the pipe (plain ended side of the pipe) and the internal surfact of the socket, using an appropriate lubricant (grease of silicone-oil, Vaseline, soapy water, etc.) Avoid the use of mineral oils or greases which may damage the gasket.
- Insert the head of the pipe until the end of the socket and do not force further. The perfect execution of this working process depends only on a precise alignment of the pipes and on an accurate lubrication.

**Item No. 75 : Providing laying and jointing in true line and level 65 mm dia. U.P.V.C. Pipe ( SCH- 80) for cold water including fittings of make PRINCE / SUPREME / ASTRAL / FINOLEX as approved by Engineer In Charge. Pipe shall be fixed on the wall with the help of clamp at every two metre C/C or shall be cancelled as directed including necessary fittings etc. including testing of pipe and joints and fixing the same with adhesive solvent, including cost of all materials**

### **1. AIM AND FIELD OF APPLICATION**

- This specification has the aim to regulate the modalities of delivery and testing of UPVC pipes. for conduction of water and food- fluids under pressure, conforming to Dlgs 06/04/2004 n. 174 “ regulation . concerning materials and objects which can be used within fixed plants of purification, treatment, conduction, and distribution of water used for human consumption”.

### **2. STANDARDS OF REFERENCE**

- UNI EN 1452 pipes systems of plastic material for conduction – unplastified Polyvinyl-chloride – UPVC.

### **3. REQUIREMENT PRESCRIBED**

- **RAW MATERIAL** The blend has mainly to be made of PVC (polyvinyl-chloride) with the sole addition of not toxic fluidification material and stabilizers, inert charges and other additives in quantities necessary to extrusion and to give a guarantee of stability of the characteristics of the polymer both during the working process and the life of the product.
- The blend used for the production of pipes, either in granules or powder, must not be used for any other utilization or working process than the required for the production of pipes.

**The use of the following materials is not admitted:**

- plastifiers and/or mineral charges which may alter the mechanical and hygienical characteristics of the pipe.
- PVC from regeneration of already used polymers, even if selected.
- The use of material having been extruded once, obtained from grinding of pipes and fittings, which had already been extruded, even if they have the characteristics which conform to this specification.
- The characteristics from PVC powder have to be conform to the requirements of UNI EN 1452-1 and satisfy the data indicated in the following table:

| <b>Characteristics</b> | <b>Requirements</b> |
|------------------------|---------------------|
| K Value                | 65 ÷ 70             |

|                                        |                                  |
|----------------------------------------|----------------------------------|
| apparent specific weight               | 0,5 ±0,6                         |
| Particle size measurement              | > 250 mm 5% max. < 63 mm 5% max. |
| Residual VCM (Vinylchloride - Monomer) | <1 ppm (1mg/kg max.)             |
| Volatile substances                    | ≤ 0,3%                           |

### CARACTERISTICS OF U - PVC BLEND

- The characteristics of the blend in shape of a pipe, must correspond to the requirements of UNI EN 1452-1 and satisfy the following table

| Characteristics                         | Requirements                |
|-----------------------------------------|-----------------------------|
| M.R.S. (according to ISO/TR 9080)       | ≥ 25 MPa                    |
| specific weight                         | 1,35÷1,46 g/cm <sup>3</sup> |
| unitary yield point                     | ≥ 48 MPa                    |
| yield                                   | < 10%                       |
| coefficient of elasticity               | > 3.000 MPa                 |
| coefficient of linear thermal expansion | 0,06±0,08 mm/m°C            |
| thermal conductivity                    | 0,13 kcal/mh°C              |

### PIPES

- The pipes have to be produced with raw material (PVC blend) corresponding to the requirements as indicated in the previous table and as follows:

|               |                                                                                                                                                                                                                                                                   |                    |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| <b>Colour</b> | <b>Grey</b><br>considering that pipes may be exposed to sun-rays, a minimum fading of the colour on one part of the pipe must not compromise the quality of the pipe to be used and therefore may not be a reason of rejection of the same, on delivery. RAL 7011 | <b>RAL 7011</b>    |
| <b>Aspect</b> | the inside and outside surfaces of the pipes must be smooth, clean and without cavities, impurities and porosities or any other irregularity on the surfaces which might hinder their conformity to the norms of reference and these specifications. UNI EN 1452  | <b>UNI EN 1452</b> |

### MECHANICAL AND PHYSICAL CHARACTERISTICS

- The characteristics of the pipes must conform to the requirements of UNI EN 1452-2 and satisfy the requirements of the following table:

| Characteristics | Requirement | Methods |
|-----------------|-------------|---------|
|-----------------|-------------|---------|

|                                                          |                                                                                                                              |                       |                      |                                            |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|--------------------------------------------|
| shock resistance                                         | T = 0°C - TIR < 10%<br>conform to schedule 6 of UNI EN 1452-2                                                                |                       |                      | UNI EN<br>1452-2 744                       |
| Resistance to interior pressure                          | No yeld during the test<br>20 °C / 1h / sigma= 42 Mpa 921<br>20 °C / 100h / sigma= 35 MPa<br>60 °C / 1000h / sigma= 12.5 MPa |                       |                      | UNI EN<br>921                              |
| Temperature of softening Vicat(VST)                      | ≥ 80 °C                                                                                                                      | Conform to UNI EN 727 |                      | UNI EN 727                                 |
| Longitudinal shrinkage                                   | ≤ 5%<br>the pipe must non show delimitation, blister or breakage                                                             | Testing Temperature   | 150 °C               | UNI EN 743<br><br>Method A:<br>Bath liquid |
|                                                          |                                                                                                                              | Time of immersion     | 15 min<br>30 min     |                                            |
|                                                          |                                                                                                                              | Or                    |                      |                                            |
|                                                          |                                                                                                                              | Testing Temperature   | 150 °C               | UNI EN 743<br><br>Method B:<br>In air      |
|                                                          |                                                                                                                              | Time of immersion     | 30 min<br>60 min     |                                            |
| Resistance to dichloromethane at a specified temperature | No attack in any part of the surface of the test piece                                                                       | Testing Temperature   | 150 °C<br><br>30 min | UNI EN 580                                 |

### CONNECTIONS SOCKET / GASKETS

- the connections are made by means of sockets with elastomeric gasket. Gaskets have not to be toxic at all according to the present norms for this subject (sanitary discipline) and conforming to norm UNI EN 681/1.
- The system of connection has to correspond to the requirements of UNI EN 1452-5 for every single class of pressure (PN) and has to be tested according to:
- a) EN ISO 13844 elastomeric gaskets for socket connections to be used with UPVC pipes – testing method for tightness of negative pressures;
- b) EN ISO 13845 elastomeric gaskets for socket connections to be used with UPVC pipes – testing method for tightness of internal pressure with angular deflection of the connection.

### MINIMUM MARKING

- the minimum marking on each meter of pipe must be indelible and show at least the following data:
  - name of the producer and/or trade mark of the product
  - number of the norm of the system (UNI EN 1452)

- quality mark of the product - raw material (U-PVC)
- outside diameter of the pipes x wall thickness
- nominal pressure (PN) and SDR and/or series (s ...)
- day, month, year and shift of production
- number of the extrusion line
- date of production

Customers may anytime ask further information's to the producer

## GEOMETRICAL CHARACTERISTICS - DIMENSION OF PIPES

- Diameters, thickness and tolerances :  
pipes have to be formed (SDR) as for seen by the National Introduction of UNI EN 1452 and have dimensions conforming to schedules 1,2,3 of Chapter 6 of UNI EN 1452-2 "geometrical characteristics".

Particularly in this discipline there is shown the prospectus including minimum wall thicknesses indicated in mm

| Nominal outside diameter | Nominal Wall thicknesses (minimum) (mm) |           |           |           |
|--------------------------|-----------------------------------------|-----------|-----------|-----------|
| (MM)                     | PN 6 bar                                | PN 10 bar | PN 16 bar | PN 20 bar |
| 20                       |                                         |           | 1.5       | 1.9       |
| 25                       |                                         |           | 1.9       | 2.3       |
| 32                       |                                         |           | 2.4       | 2.9       |
| 40                       | 1.5                                     | 1.9       | 3.0       | 3.7       |
| 50                       | 1.6                                     | 2.4       | 3.7       | 4.6       |
| 63                       | 2.0                                     | 3.0       | 4.7       | 5.8       |
| 75                       | 2.3                                     | 3.6       | 5.6       | 6.8       |
| 90                       | 2.8                                     | 4.3       | 6.7       | 8.2       |
| 110                      | 2.7                                     | 4.2       | 6.6       | 8.1       |
| 125                      | 3.1                                     | 4.8       | 7.4       | 9.2       |
| 140                      | 3.5                                     | 5.4       | 8.3       | 10.3      |
| 160                      | 4.0                                     | 6.2       | 9.5       | 11.8      |
| 180                      | 4.4                                     | 6.9       | 10.7      | 13.3      |
| 200                      | 4.9                                     | 7.7       | 11.9      | 14.7      |
| 225                      | 5.5                                     | 8.6       | 13.4      | 16.6      |
| Nominal outside diameter | Nominal wall thickness (minimum) (mm)   |           |           |           |
| (MM)                     | PN 6 bar                                | PN 10 bar | PN 16 bar | PN 20 bar |
| 250                      | 6.2                                     | 9.6       | 14.8      | 18.4      |
| 280                      | 6.9                                     | 10.7      | 16.6      | 20.6      |
| 315                      | 7.7                                     | 12.1      | 18.7      | 23.2      |
| 355                      | 8.7                                     | 13.6      | 21.1      | 26.1      |
| 400                      | 9.8                                     | 15.3      | 23.7      | 29.4      |
| 450                      | 1.0                                     | 17.2      | 26.7      | 33.1      |
| 500                      | 12.3                                    | 19.1      | 29.7      | 36.8      |
| 630                      | 15.4                                    | 24.1      |           |           |

|      |      |      |  |  |
|------|------|------|--|--|
| 710  | 17.4 | 27.2 |  |  |
| 800  | 19.6 | 30.6 |  |  |
| 900  | 22.0 |      |  |  |
| 1000 | 24.5 |      |  |  |

### Lengths

- pipes have to be delivered for all outside - diameters asked for in lengths of 6 meters (socket included).

### Ends of pipes

- the pipe has to have plain ends, sharply cut and must be perpendicular to the axis of the same pipe, having an outside chamfer of about 15°.

### CONTROLS AND RESPONSABILITY

- The contractor reserves the right to himself and to the person he is going to uncharged to assist the tests and controls carried out to check if the requirements prescribed by the norms of production and by these specifications are fulfilled.
- The supplier, therefore, will do his best to favor the free access of the persons uncharged by the contractor to the production plants of the pipes in a moment whatever during the different phases of production and to the laboratories during the phases of control and testing, communicating within a reasonable period of time the beginning date of production of the pipes ordered. He will further give to the persons in charge, full liberty of actions to make the controls necessary, in line with the requirements of production.
- The contractor reserves himself the right to check by means of taking samples of pipes and/or of the the raw material, the correspondence of the same to the present specifications and to the supplier's declarations.
- It is understood that the presence of the persons uncharged, during the tests, will not be a substitute of the controls to be carried out by the seller, who is the only one responsible for the quality of the pipes he produces.
- The seller will bear any costs deriving from the delivery of pipes not conforming to the requirements of these specifications.

### DOCUMENTS AND CERTIFICAZIONS OF QUALITY

- the supplier has to enclose to his offer:
- the certification of conformity of the Internal Quality System conforming to UNI EN ISO 9000, issued by an independ Institute or Company in conformity with UNI CEI EN 45012;
- a signed declaration regarding the use of vergin raw material (blend), which does not contain already worked material or substances which can damage the human body;

- a certificate of conformity of the product to norm UNI EN 1452 for pipes, issued by an independent Institute, Body or Company, in conformity with UNI CEI EN 45011.

#### **AFTER SALE ASSISTANCE**

- If agreed upon , when the order had been made, the supplier has to guarantee as follows:
  - assistance by means of qualified technicians at the begin of work within the building yard in order to check the correct way of installation (recommendations according to UNI EN 1452-6 and ENV 1046).
  - Assistance of competent personnel regarding the procedures of testing the laying within the building yard (in case of water conducts, for seen by the law according the the Ministerial Decree DM 12.12.85) of buried pipe-lines for fluids under pressure (execution according to method UNI EN 805, hydraulic test of conducts with a viscoelastic behavior).

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- if loading and unloading of a means of transport or, anyway the handling of the material is done by means of a crane or the arm of an excavator, pipes have to be lifted in the center by an equalizing rocker arm of at least 3 meters. If these works are done by hand, it has to be avoided to slide pipes on to the side boards of the mean of transport or, anyway, on hard and sharp objects. The person in charge of the building site has to check all working processes of unloading in order to be sure of their regularity. Each damaged product will be identified by writing " not to be used" and will be isolated in an extra area. The person in charge has to comunicate as soon as



possible, the existence of a damaged product to the Contractor's Director of Work, who then will take the actions necessary, according his unobjectionable opinion. If a crane is used, there has to be an efficient system of communication between the worker inside the crane and the worker beside the mean of transport.

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- the best solution for the storage of pipes would be to use wooden crates or crates of other materials, to be able to resist to the weight of the pallet put on top. The storage has to be carried out with great care and the pallets have to be aligned. The supporting surface of the pallets stored has to be levelled, not to be rough and must not have stones with sharp edges. Every possible idoneous solution has to be adopted in order to avoid any interference with the local traffic, both Vehicles and pedestrians, and with any other already existing structure. The pipes have to stored in a way to avoid possible accidents due to an unforeseen movement of the same.

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- It is absolutely necessary to adopt measures , that in case of long term storage, pipes of UPVC and plastic fittings can be put inside, away from sun-rays, in order to avoid the risk of degradation of the polymers and the decay of their chemical, physical, and mechanical properties. Fittings may be packed in different ways according to their shape, dimensions and type of transport. If they are delivered without packaging, it has to be taken care not to pile them up without method, thus avoiding a collision between the single pieces or between the fittings and other heavier materials. In any case they cannot be put near heating devices or exposed to direct sun-rays until they are used. Similar indications have to be followed for the conservation of lubricants.

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- Typologies of trenches : The type of trench required by the project based on the evaluation of loads, the type of soil and the organization of the building yard, has to be scrupulously carried out in the next phase of execution.. During the phase of execution it is therefore important to have a scrupulous correspondence between the project and its effective realization. In the table below there are some main typologies of trenches showing the relationship between the diameter of the pipes (  $D$  indicated in meters), the width of the trench at the level of the upper part of pipe (  $B$  in meters) and the height of filling on the upper part of the pipes ( $H$  in meters).

| Type of Trench | B(width of the trench) |
|----------------|------------------------|
| Small Trench   | $\leq 3 D$ $< H/2$     |
| Large Trench   | $3 < D$ $< 10 < H/2$   |
| Embankment     | $\geq 10 D$ $\geq H/2$ |

### Small Trench

- this is the best way to lay a U-PVC pipes. The pipe does not have to bear all the load from above, as it transmits part of it to the surrounding soil depending on the deformation due to the deflection, the product is submitted to.

### Large Trench

- the load the pipe has to bear will be more than the one it has to support in a small trench. For this reason this has to be considered during the planning. This hypothesis has to be born in mind in order to obtain a certain security when making the calculations of the dimensions.

### Embankment (positive position)

- the upper part of the pipe is put on a natural level of the soil. If there is much load passing through, this typology has not to be adopted due to sinking of the soil in absence of excavations on the sides.

### Terrapieno (negative position)

- The pipe is put at a lower level than the natural one of the soil. Due to friction, even if a very light one, between the filling material put on the embankment and the natural sides of the trench, the pipes can support slightly more load than those in the positive position, but in any case less than those laid in a small and large trench. Therefore, even this typology is not advisable.

### Depth of the trench

- The depth of the pipes H (in meters) understood as distance between the soil and the upper part of the pipes must satisfy the most protective of the following requirements, where D is the outside diameter expressed in meters.

$$H \geq 1,0$$

$$H \geq 1,5 D$$

### Width of the trench

- This is determined by the laying depth and by the diameter of the pipe, as it has to allow the settlement of the bottom, the connection of the pipes and the movement of the workers. The minimum width of the soil B (in meters ) is normally:

$$B = D + 0,5 \text{ with } D \leq 0,4 \text{ m}$$

$$B = 2D \text{ with } D \geq 0,5 \text{ m.}$$

- On the other side, the inferior limit values have not to be exceeded very much as the efficiency of the trench is higher when the width is smaller.

#### Bottom of the trench

- The trenches have to be made without bumps or unevenness in order to establish a continuous support for the pipes. It is not advisable to use a bottom with a concrete bed or similar as this will make the structure rigid.
- When the trenches are open on heterogeneous soil, situated on hills or in the mountains, it is necessary to anchor in order to avoid possible sliding of the soil.
- If there might be an instability of the soil due to water within the trench, it is necessary to re-inforce the soil bottom by means of draining pipes under the canalization.
- Around these pipes has to be put a compact strata of gravel or other material suitable to this purpose.
- In other words, it is necessary to make sure that there won't be any possibility that the filling material could move due to ground water.

#### Laying Bed

- There has to be a stabil laying bed on an even level, for canalization of U-PVC pipes. It has to be free from pebbles, heap of stones and possible other materials. The laying bed must not be build before having a complete stabilization of the trench bottom. The material used in normal laying conditions is sand mixed with gravel of a maximum diameter of 20 mm. If the soil has slopes, it is advisable to avoid sand, giving preference to gravel or crushed stones without edges, cut to pieces of maximum 10/15 mm. The material has then to be accurately compacted and has to achieve a thickness of minimum  $(10 + 1/10 D)$  cm.

#### Norms of compacting and quality control

- As U-PVC pipes are flexible, the uniformity of the surrounding soil is basically for a correct construction of a carrying structure, because the soil, deformed by the pipes, reacts in a way to give a help in supporting the load. In order to assure stability and integrity of the pipes laid, within the time, it is pointed out that the contractor has to take a great care regarding the laying of the pipe bed, the support and the first covering of U-PVC and has to apply scrupulously the present norms.
- The degree of compacting of the material, which forms the supports, has a determining influence on the value of diametric deformations ( $x/D$ ) of the pipes. This value, which must not exceed the limits permitted, can be deduced by the formula of Spangler,
- 

$$X = \frac{0,125 \cdot Q}{E \cdot (s/D)^3 + 0,0915 \cdot E}$$

with:

$Q$  = total external load on the pipe [kg/m];

$E$  = modulus of elasticity of the pipe [kg/m<sup>2</sup>];

$s$  = thickness of the pipe [m];  $D$  = diameter of the pipe [m];

$E_1$  = modulus of elasticity of the soil [kg/m<sup>2</sup>].

Particularly  $E_1$  depends on the factor of compacting  $\alpha'$  according to the relation:

$$E_1 = \frac{9,10^4}{a} (H+4),$$

- where  $H$  [m] is the height of filling measured from the upper side of the pipe. Furthermore  $\alpha'$  is connected to the Proctor index as indicated in the following table:

| Proctor Test | $\alpha'$        |
|--------------|------------------|
| 95%          | 1,0              |
| 90%          | 1,5              |
| 85%          | 1,5 <sup>2</sup> |
| 80%          | 1,5 <sup>3</sup> |
| 75%          | 1,5 <sup>4</sup> |

- The Proctor index defines normally the degree of compacting of the soil. For U-PVC pipes a Proctor index of at least 90% has to be considered. The achievement of the value required for the Proctor index has to be verified by means of appropriate tests and respective certifications, the number of which is fixed during the planning.
- The above-mentioned tests, defined as tests of compaction and determination of the characteristics of density of materials, must be carried out with the standard method AASHO with 4 points of the curve density/content of water. In order to obtain the density required methods of compacting are used (by hand with flat presses or with light mechanical apparatus).

#### Laying of the pipe

- before laying the pipes, they have to be checked one by one in order to discover possible defects; the end part and the socket of the pipes have to be integral. The pipes and fittings must be put on the laying bed in a way to have a continuous contact with the bed.
- The niches, excavated before, for the accommodation of the sockets (even if the dimension of the socket is minimum, it is normal to find a niche in correspondence of its support), if necessary, have to be accurately filled in order to avoid possible empty spaces under the sockets.

#### Procedure of filling

- The filling of a trench and generally of the excavation, is fundamental for the laying. As we are dealing with UPVC pipes, the uniformity of the soil is absolutely necessary in order to have a perfect construction of the carrying structure, as the soil reacts in a way, giving a contribution to support the given load. The material already used for the construction of the bed is put around the pipe and solidated by hand in order to form

successive strata of 20 cm. up to half height of the pipe. It has to be taken care that there won't remain any empty spaces under the pipes and that the strata L1 of the filling material between the pipe and the wall will be continuous and compact.

- The second strata of filling L 2, reaches the upper part of the pipe. Its compactness has to be carried out with maximum care. The third strata L3 reaches 15 cm over the upper part of the pipe. Compactness has to be only at the sides of the pipes, never vertically on the same.
- The solidation of filling around the pipe must be uniform and reach 90% of the optimal value determined by the modified Proctor test. The support with turfy, muddy, clayly, or frozen soil is not allowed as this kind of soil cannot be solidated as it contains too much water.
- Further filling is made (strata L4 and L5) by material obtained from excavation. This material is cleaned from elements having a bigger diameter than 10 cm and from vegetal and animal fragments. The filling has to be made for the following strata up to 20 cm. It has to be compacted and eventually watered for a thickness of 1 m (measured from the upper part of the pipe), so that the density of the soil, once solidated, reaches 90% of the optimal value determined by the modified Proctor test. The bigger material (stones of a diameter  $> 2$  cm) must not exceed the limit of 30%. At last there has to be a free space for the last strata of vegetal soil.

#### Special laying conditions

- If there is a ground water table, it has to be ascertained that this table does not cause any movement of the filling material surrounding the pipe. The surrounding soil has therefore to be solidated by means of draining, operating under the level of excavation, and thus avoiding every possible instability of the laying soil and brickworks.
- If during the work, for limited distances, there will appear some harder laying conditions than those for seen by the project (enlargements of walls, landslides etc) works of protection have to be carried out in order to come back to laying conditions as described. There must be extra-walls of heaps of stones or concrete in order to reduce the length of the section of excavation or there must be adopted other solutions authorized by the Direction of Work.
- In case, for technical reasons the height H of recovering is in some points lower than the minimum prescribed, it is necessary to absorb vertical loads by using appropriate protection devices (rigid diaphragms of protection and distribution of the loads, to be put above the last compact strata of material), following the input of the Direction of Work.
- In case of crossing railways, it is possible to:
  - For see a steel covered protective pipe (casing)
  - Lay pipes in a tunnel of re-in forced concrete

#### ESECUTIONS OF CONNECTIONS

- Connections are made, respecting the indications given in the following, both for pipes

and special pieces. An accurate cleaning of the parts to be joint is for seen making sure that they are integral. The gasket has to be inserted (if not already inserted during production) in it seat, situated in the internal side of the socket. Successive steps are:

- Lubrification of the external surface of the end of the pipe (plain ended side of the pipe) and the internal surfact of the socket, using an appropriate lubricant (grease of silicone-oil, Vaseline, soapy water, etc.) Avoid the use of mineral oils or greases which may damage the gasket.
- Insert the head of the pipe until the end of the socket and do not force further. The perfect execution of this working process depends only on a precise alignment of the pipes and on an accurate lubrication.

**Item No. 76 : Providing and fixing to wall ceiling and floor 6.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low density, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(B) 25mm**

## **SECTION-01 : BASIS OF DESIGN**

### **1. BASIS OF DESIGN**

- The Plumbing, Sanitary, Drainage System for the project is designed keeping in view the following:
- Requirement of adequate and equal pressure availability of hot and cold water lines in Public Toilets, Kitchen and other identified areas.
- Adequate storage of water in under ground raw + overhead treated domestic water tanks.
- Provision of firefighting appurtenance such as fire hydrants, hose reel, sprinklers and portable extinguishers.
- Levels of roads / pavements and other services in the area.

#### **Landscape layout.**

- The execution of works and materials used shall be as per the latest relevant I.S. specifications.
- Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

### **2. CONCEPT OF THE SYSTEM**

**The following services are envisaged for the complex:**

- Water Treatment System for meeting the domestic water quality requirement with chemical parameters in acceptable limits as per SP: 35(S&T) 1987 which is considered safe for human consumption.
- Domestic/Flushing water supply through Hydropneumatics system.
- Sewage and Sullage collection system based on IS: 1742 and applicable standards for domestic drainage and connected to Sewage Treatment Plant.
- Storm / Rain water drainage system from various levels of the building and disposal to Rain Water Harvesting System / storm water drain.

### **3. WATER STORAGE & DISTRIBUTION SYSTEM**

#### **Water Requirement**

- The water requirement for the project is proposed to be based on the provisions of IS: 1172 and prevalent practice.

#### **Source of Water**

- It is expected that part of the daily domestic water requirement for the Complex shall be through municipal mains supply. The rest will be obtained from bore wells.

#### **Appurtenant**

- Following components shall be included in the water supply system for efficient functioning:
  - i. Automatic air vent
  - ii. Pressure Gauge.

### **4. SEWAGE, SULLAGE AND STORM WATER**

- The soil and waste shall be carried down through one pipe drainage system. Independent vent pipe for common soil & water stack is also provided to avoid foul smell entering through trapped gully in WC. Provision of grease trap shall be made for waste water from Kitchen.

#### **Design Limitations**

- The system is designed considering the following:
  - a. Termination of vent cowl at terrace level.
  - b. Provision of adequate slope for horizontal header pipes for achieving self-cleaning velocity in the pipes.
  - c. Provision of cleanout plug.

## 5. WORKMANSHIP

- The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Owner's Site Representative. All materials and/or Workmanship which in the opinion of the Owner's Site Representative / Architect / Consultant is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith.

## 6. MATERIALS

- All materials shall be best of their kind and shall conform to the latest Indian Standards.
- All materials shall be of approved quality as per samples and origins approved by the Owner's Site Representative / Architect / Consultants.
- As and when required by the Owner's Site Representative / Consultant, the contractor shall arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions or work are found defective or unsound by the Owner's Site Representative / Consultant, the contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Owner's Site Representative / Consultant. To prove that the materials used are as specified the contractor shall furnish the Owner's Site Representative with original vouchers on demand.

## SECTION-02 : SANITARY FIXTURES & FITTINGS

### 1. SCOPE

- The scope of this section consists of but is not necessarily limited to supply, installation, testing and commissioning of following items:
  - a. Sanitary appliances and fixtures for toilets.
  - b. Chromium plated brass fittings
  - c. Stainless steel sinks
  - d. Accessories e.g. towel rods, toilet paper holders, soap dish, liquid soap dispensers, towel rails, coat hooks etc.
  - e. Hand driers etc.
- Whether specifically mentioned or not the Contractor shall provide for all appliances and fixtures all fixing devices, nuts, bolts, screws, hangers as required.
- 
- All exposed pipes within toilets and near appliances/fixtures shall be of chromium plated brass or copper unless otherwise specified.

### 2. GENERAL REQUIREMENT

- Sanitary appliances and fixtures for toilets, chromium plated brass fittings, stainless



steel sinks, bathroom accessories like towel rods, toilet paper holders, soap dish, liquid soap dispensers, towel rails coat hooks, hand driers, drinking water fountains etc as listed in the relevant items in the Schedule of Quantities shall be supplied, installed, tested and commissioned by the contractor. The rates shall be inclusive of accessories (in such case) required for installation.

- All appliances, fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications, drawings. Accessories shall include proper fixing arrangements, brackets, nuts, bolts, washers, screws and required connection pieces.
- The sanitary fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Architect / Owner's Site Representative and shall fully meet with the aesthetic and symmetrical requirements as demanded by the Architect / Interior Designer
- All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Architect requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern as called for.
- Fixing screws shall be half round head chromium plated (CP) brass screws, with CP brass washers unless otherwise specified.
- Fixtures shall be installed by skilled workman with appropriate tools according to the best trade practice.
- All appliances, fittings and fixtures shall be fixed in a neat workmanlike manner true to level and to heights shown on the drawings and in accordance with the manufacturers recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling, plaster, paint, insulation or terrace shall be made good by the Contractor at his own cost. Fixtures shall be mounted rigid, plumb and true to alignment.
- All materials shall be rustproof; materials in direct or indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.
- Wall flanges shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pierce through them. These wall caps shall be or chromium plated brass fittings and the receiving pipes and shall be large enough to cover the punctures properly.
  - i. Sanitary appliances, subject to the type of appliance and specific requirements, shall be fixed in accordance with the relevant standards and the following:
  - ii. Contractor shall, during the entire period of installation and afterwards protect the appliances by providing suitable cover or any other protection so as to absolutely prevent any damage to the appliances until handing over (The original protective wrapping shall be left in position for as long as possible)
  - iii. The appliances shall be placed in correct position or marked out in order that pipe work can be fixed or partially fixed first.
  - iv. The appliance shall be fixed in a manner such that it will facilitate subsequent removal if necessary.
  - v. The appliance shall be securely fixed. Manufacturer's brackets and fixing

methods shall be used wherever possible. Compatible rust-proofed fixings shall be used. Fixing shall be done in a manner that minimize noise transmission.

- vi. Appliances shall not be bedded (e.g. WC pans, pedestal units) in thick strong mortar that could crack the unit (e.g. ceramic unit)
  - vii. Pipe connections shall be made with demountable unions. Pipe work shall not be fixed in a manner that it supports or partially supports and appliance.
  - viii. Appliances shall be fixed true to level firmly fixed to anchor or supports provided by the manufacturer and additional anchors or supports where necessary.
- Sizes of sanitary fixtures given in the Specifications or in the Schedule of Quantities are for identification with reference to the catalogues of make considered. Dimensions of similar models of other makes may vary within + 10% and the same shall be provided and no claim for extra payment shall be entertained no shall any payment be deducted on this account.
  - The contractor shall fix all plumbing fittings such as water faucets, shower fittings, mixing valves etc. in accordance with manufacturer's instructions and connect to piping system. The contractor shall supply all fixing materials such as screws, rawl plugs, unions, collars, compression fittings etc., as required.
  - Joints / gaps between all sanitary appliances / fixtures and the floor / walls shall be caulked with an approved mildew resistant sealant, having antifungal properties, of color and shade to match that of the appliances / fixture and the floor / wall to the extent possible.

#### **Water Closet**

- Water Closet shall be wash down or siphonic wash down type floor or wall mounted set, as shown in the drawings, designed for low volume flushing from 5-7 litres of water, flushed by means of plastic cistern installed in shaft. Flush pipe / bend shall be connected to the WC by means of a suitable rubber adaptor. Wall hung WC shall be supported by CI floor mounted chair which shall be fixed in a manner as approved by the Owners Site Representative.
- Each WC set shall be provided with approved quality of seat, rubber buffers and chromium plated hinges. Seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the WC.
- Each WC shall be provided with 110 mm dia (OD) PVC Pan connector connecting the ceramic outlet of WC to CI pipe.

#### **Urinals**

- Urinals shall be lipped type half stall with glazed vitreous China of size as called for in the Bill of Quantities.
- Half stall urinals shall be provided with 15mm dia CP spreader, 32mm dia CP domical waste and CP cast brass bottle trap with pipe and wall flange and shall be fixed to wall by CI brackets, CI wall clips and CP brass screws as recommended by manufacturer

complete as directed by the Owner's Site Representative.

- Flushing for urinals shall be by means of no hand operation, infrared electric flush valve with complete kit of plumbing, electrical and electronic items, infrared photo cells, solenoid valve transformer and electrical connection. The automatic flush sensor plate shall be flush and press fitted and be of high quality mirror polish finish. Each urinal shall be provided with one flush valve unit.
- Flush pipes shall be GI pipes concealed in wall chase but with chromium plated bends at inlet and outlet.

#### **Urinal Partitions**

- Urinal partitions shall be white glazed vitreous china of size specified in the Schedule of Quantities.
- Porcelain partitions shall be fixed at proper heights with CP brass bolts, anchor fasteners and MS clips as recommended by the manufacturer and directed by the Owner's Site Representative.

#### **Wash Basin**

- Wash basins shall be cast in situ, however in public areas it shall be white glazed vitreous china of size, shape and type specified in the Schedule of Quantities.
- Each basin shall be provided with painted MS angle or CI brackets and clips and the basin securely fixed to wall/counter slab. Placing of basins over the brackets without secure fixing shall not be accepted. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's Site Representative. The cost of fixing the basin shall be inclusive of supply and installation of brackets as described above.
- Each basin shall be provided with 32mm dia. CP waste with overflow, pop-up waste or rubber plug and CP brass chain as specified in the Schedule of Quantities.
- Each basin shall be provided with hot and cold water mixing fitting or as specified in the Schedule of Quantities.

#### **Sinks**

- Sinks shall be stainless steel or any other material as specified in the Schedule of Quantities.
- Each sink shall be provided with painted MS or CI brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable painted angle iron brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40mm dia. CP waste and rubber plug with CP brass chain as given in the Schedule of Quantities. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand and colour as approved by the Owner's site representative.
- Sanitary fittings for sinks shall be deck mounted or wall mounted CP swivel faucets

with or without hot and cold water mixing fittings as specified in the Schedule of Quantities. Installation of fittings shall be measured and paid for separately.

#### **Shower Set**

- of diverter assembly, adjustable type over-head shower with CP shower arm, all with CP wall Shower set shall comprise flanges of approved quality all as specified in the Schedule of Quantities. Bath spout, hand showers and pop up wastes shall also be provided wherever, specified. Wall flanges shall be kept clear off the finished wall. Wall flanges embedded in the finishing shall not be accepted.

#### **Toilet Paper Holder**

- Toilet paper holder shall be white glazed vitreous china or chrome plated of size, shape and type specified in the Schedule of Quantities.
- Porcelain toilet paper holder shall be fixed in walls and set in cement mortar 1:2 (1 cement : 2 coarse sand) and fixed in relation to the tiling work.
- The latter (chrome) shall be fixed by means of screws/capping having finish similar to the toilet paper holder in wall/temper partitions with raw l plugs or nylon sleeves. When fixed on timber partition, it shall be fixed on a solid wooden base member provided by the Owner's Site Representative.

#### **Towel Rail**

- Towel rail shall be chromium plated brass or of stainless steel or powder coated brass of size, shape and type specified in the Schedule of Quantities.
- Towel rail shall be fixed with screws/capping having finish similar to the towel rail in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed by the Owner's Site Representative.

#### **Janitor's Sink**

- Janitor's sink shall be stainless steel, single bowl type of size as called for in the Schedule of Quantities , provided with painted R.S. or CI brackets and clips and securely fixed. Each sink shall be provided with 40mm dia CP waste. Fixing shall be as directed by the Owner's Site Representative.
- The supply fittings for Janitor's sink shall be wall mounted type of size as mentioned in Schedule of Quantities.

#### **Drinking Water Fountain**

- Drinking water fountain shall be wall mounting type made of vitreous china, stainless steel or any other material as given in the Schedule of Quantities.

## **TOILETS FOR THE DISABLED**

- Where specified, in washroom facilities designed to accommodate physically disabled, accessories shall be provided as directed by the Owner's Site Representative.
- Stainless steel garb brass of required size suitable for concealed or exposed mounting and peened non-slip gripping surface shall be provided in all washroom. The flushing cistern/valve shall be provided with chromium plated long handles.

## **MOCKUP AND TRIAL ASSEMBLY**

- The installation of the sanitary fixtures and fittings shall be as per the shop drawings approved by the Architect/Consultant.
- The contractor shall have to assemble at least one set of each type of sanitary fixtures and fittings in order to determine precisely the required supply and disposal connections. Relevant instructions from manufacturers shall be followed as applicable. This trial assembly shall be developed to determine the location of puncture holes, holding devices etc. which will be required for final installation of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Architect / Interior Designer.
- The fixtures in the trial assembly can be re-used for final installation without any additional payments for fixing or dismantling of the fixtures.

## **SUPPORTING AND FIXING DEVICES**

- The contractor shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly appearance in the final assembly. Where the location demands, the Architect may instruct the contractor to provide chromium plated or other similarly finished fixing devices. In such circumstances the contractor shall arrange to supply the fixing devices and shall be installed complete with appropriate vibration isolating pads, washers and gaskets.

## **FINAL INSTALLATION**

- The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.
- Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on

the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflows shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.

#### **PROTECTION AGAINST DAMAGE**

- The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, cracking, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

#### **MEASUREMENT**

- Rate for supply and fixing of sanitary fixtures accessories, CP fittings shall etc. include all items, and operations stated in the respective specifications and bill of quantities and nothing extra is payable.
- Rates for all items under specifications para above shall be inclusive of cutting holes and chases and making good the same, CP screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning and making good to the satisfaction of the Owner's Site Representative.

#### **TESTING**

- All appliances, fixtures and fittings shall be tested before and after installation. Water seals of all appliances shall be tested. The contractor shall block the ends of waste and ventilation pipes and shall conduct an air test.

- **SECTION-03 :: WATER SUPPLY (COLD & HOT)**

## **1 SCOPE**

- The scope of this section comprises the supply, installation, testing and commissioning of piping network for water supply for internal & external services as follows:

- i. Municipal Water supply.
- ii. Drinking Water Supply.
- iii. Flushing Water Supply

- The Contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities.
- The Contractor shall be solely responsible for obtaining the Authorities approval of his works prior to the handing over of the complete water supply / distribution installation to the Owner.

## **2 PIPING MATERIALS**

- The piping system shall consist of heavy class galvanized iron pipes and fittings conforming to IS:1239. The piping system shall also consist of CPVC pipes and fittings. The sizes and makes are specified in the Schedule of Quantities.
- For any internal works, the pipes and fittings shall be embedded in the wall chase or run on the floor/ceiling unless otherwise specified. No unsightly exposed runs shall be permitted. Outside the building the piping shall be installed at least 1.0 m below the finished grade level.

### **Galvanized Iron Pipes & Fittings**

- The pipes shall be galvanized mild steel welded (ERW) or (HFW) screwed and socketed conforming to the requirements of IS: 1239. The Galvanizing shall conform to IS:4736, the zinc coating shall be uniform, adherent reasonably smooth and free from such imperfections as flux, ash and drop inclusions, bare patches, black spots, pimples, lumpiness, runs, rust strains, bulky white deposits and blisters. The pipes and sockets shall be cleanly finished, well galvanized in and out and free from cracks, surface flaws laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and square with the axis of the pipe.
- The fittings shall be malleable iron and comply with all the requirements of the pipes. The sizes of pipes and fitting is specified in the schedule of quantities.

### **Laying And Jointing Of GI Pipes**

- The galvanized pipes and fittings shall run in wall chase or ceiling or as specified. The fixing shall be done by means of standard pattern holder bat clamps keeping the pipes about 1.5 cm clear of the wall where to be laid on surface. Where it is specified to conceal the pipes, chasing may be adopted for pipes fixed in the shafts, ducts etc. there should be sufficient space to work on the pipes with the usual tools. As far as possible, pipes may be buried for short distances provided adequate protection is given against damage and where so required special care to be taken at joints. Where directed by the Owner's Site Representative, pipe sleeves shall be fixed at a place the pipe is passing through a wall or floor for reception of the pipe and allow freedom for expansion and contraction and other movements. In case of pipe is embedded in walls or floors it shall be painted with anticorrosive bitumastic paints of approved quality. Under the floors the pipes shall be laid in layer of sand filling.
- Galvanized iron pipes shall be jointed with threaded and socket joints, using threaded fittings. Pipes will be made by applying suitable grade of TEFLON tape used for drinking water supply. (Use of red or white lead and sutli will not be permitted for screwed joints). All pipes shall be fixed in accordance with layout and alignment shown on drawings. Care shall be taken to avoid air pocket.

### 3 PIPING INSTALLATION SUPPORT (VALID FOR GI PIPING ONLY)

- Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.
- Piping shall be properly supported on , or suspended from , on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability.
- Pipe work and fittings shall be supported by hangers or brackets so as to permit free expansion and contraction. To permit free movement of common piping, support shall be from a common hanger bar.

Pipe hangers shall be provided at the following maximum spacing:

| Pipe Dia<br>(mm) | Hanger Rod Dia<br>(mm) | Spacing between Supports<br>(m) |
|------------------|------------------------|---------------------------------|
| Up to 25         | 6                      | 2                               |
| 32 to 50         | 10                     | 2.7                             |
| 80 to 100        | 12                     | 2.7                             |
| 125 to 150       | 16                     | 3.6                             |



|            |    |     |
|------------|----|-----|
| 200 to 300 | 19 | 5.3 |
|------------|----|-----|

- Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation. 14 gauge metal sheet shall be provided between the insulation and the clamp, saddle or roller, extending atleast 15 cm. on both sides of the clamps, saddles or roller.
- All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area can be carried out in one stretch.
- Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements.
- The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified / approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.
- All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter.
- All buried pipes for CWS shall be protected against corrosion by applying two layers of 2 mm thick multi-layer anticorrosive polymeric mix tape applied over a coat of primer as per recommendations of the manufacturers.
- Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall be of 15mm pipe size and shall be associated with an equal size isolation ball valve. Automatic air valves shall also be provided on hot water risers.
- Discharge from the air valves shall be piped through a galvanized steel pipe to the nearest drain or sump. All pipes shall be pitched towards drain points.
- Pressure gauges shall be provided as shown on the approved drawings and include in Bill of Quantities. Care shall be taken to protect pressure gauges during pressure testing.

#### 4 WATER METERS

- Water meters of approved make and design shall be supplied for installation at locations as shown. The water meters shall meet with the approval of local supply authorities. Suitable valves and chambers or wall meter box to house the meters shall also be provided along with the meters.
- The meters shall conform to Indian Standard IS:779 and IS:2373.
- Provision shall also be made to lock the water meter. The provision shall be such that the lock is conveniently operated from the top. Where the provision is designed for use in conjunction with padlocks, the hole provided for padlocks shall be a diameter not

less than 4mm.

#### **4.1 Installation of Water Meter and Stop Cock**

- The G.I. lines shall be cut to the required lengths at the position where the meter and stop cock are required to be fixed. Suitable fittings shall be attached to the pipes. The meter and stop cock shall be fixed in a position by means of connecting pipes, jam nut and socket etc. The stop cock shall be fixed near the inlet of the water meter. The paper disc inserted in the ripples of the meter shall be removed. And the meter installed exactly horizontal or vertical in the flow line in the direction shown by the arrow cast on the body of the meter. Care shall be taken that the factory seal of the meter is not disturbed. Wherever the meter shall be fixed to a newly fitted pipe line, the pipe line shall have to be completely washed before fitting the meter.

### **5. TESTING**

- The Contractor shall notify the Architect three days in advance of any test so that the Architect can witness the tests if he so wishes.
- All water supply system shall be tested to hydrostatic pressure test of atleast one and a half (1.5) times the maximum pressure but not less than 10Kg/Sq.cm for a period of not less than 8 hours. All leaks and defects in joints revealed during the testing shall be rectified and got approved at site by retest. Piping required subsequent to the above pressure test shall be retested in the same manner.
- System may be tested in sections and such sections shall be entirely retested on completion.
- The Contractor shall make sure that proper noiseless circulation of fluid is achieved through the entire piping network of the system concerned. In case of improper circulation, the contractor shall rectify the defective connections. He shall bear all expenses for carrying out the above rectifications including the tearing up and refinishing of floors and walls as required.
- In addition to the sectional testing carried out during the construction, contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and fixtures shall be made good by the contractor during the defects liability period without any cost.
- After commissioning of the water supply system, contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.
- A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and Owner's site representative.

## 6. **DISINFECTION OF PIPING SYSTEM AND STORAGE TANKS**

- Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.
- The water storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water.
- If ordinary bleaching powder is used, the proportions will be 150 gm of power to 1000 liters of water. The power shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be specified by the manufacturer. When the storage tanks are full, the supply shall be stopped and all the taps on the distributing pipes are opened successively working progressively away from the storage tank. Each tap shall be closed when the water discharged begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose.
- The pipe work shall be thoroughly flushed before supply is restored.

## 7. **STERILIZATION OF MAIN**

- After the pipe work has been tested and approved, but before it is coupled, it shall be sterilized with a solution of chloride of lime.

## 8. **CUTTING CHASES IN MASONRY WALLS**

- Cold water distribution pipes to fixtures and equipment exposed to view in the bathrooms, kitchens, and sanitary compartments shall be chased into walls or floors or placed in wall cavities. The Contractor shall be responsible for cutting all notches, chases, and recesses in walls and floors and only a diamond cutter shall be used. The maximum size of conduit or pipe permitted to be concealed in floor slabs shall be 32 mm diameter unless otherwise approved by the Architect.
- The chases upto 7.5 x 7.5 cm shall be made in the walls for housing GI pipes etc. These shall be provided in correct positions as shown in the drawings or directed by the Architects. Chases shall be made by chiselling out the masonry to proper line and depth. After the pipes etc are fixed in chases, the chases shall be filled with cement mortar 1:2:4 or as may be specified, and made flush with the masonry surface. The concrete surface shall be roughened with wire brush to provide a key for plastering.
- Where pipes pass through beams or structural walls, subject to the approval of the Structural Consulting Engineer, the Contractor shall ensure that sizes and locations of

openings required are formed in when the relevant beams or walls are cast.

## 9 VALVES

- All valves (gate, globe, check, safety) shall be of gun metal suitable for the particular service as specified. All valves shall be of the particular duty and design as specified. Valves shall either be of screwed type or flanged type, as specified, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Gate, globe and check valves shall conform to Indian Standard IS:776 and non-return valves and swing check type reflux to IS:5312.
- Sluice valves, where specified shall be flanged sluice valves of cast iron body. The spindle, valve seat and wedge nuts shall be gunmetal. They shall generally have non-rising spindle and shall be of the particular duty and design as specified. The valves shall be supplied with suitable flanges, non-corrosive bolts and asbestos fiber gaskets. Sluice valves shall conform to Indian standard IS:780 and IS:2906.

### (a) BALL VALVES:

- Valves 50mm dia and below shall be screwed type ball valves with stainless steel balls spindle Teflon seating and gland packing tested to a hydraulic pressure of 20 Kg/Sq.cm. and accompanying couplings and steel handles to BIS – 5351.

### (b) Valves above 50mm dia. shall be Butterfly Valves.

- Cast iron (IS 210), grade FG 260 butterfly valves conforming to PN 1.0, heavy duty cast iron disc with anti corrosive nickel plating, nitrile seat and stainless steel 410 stem with lever/gear operation and powder coated finish.
- Float Valves to be fixed in storage tanks shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system. Where called for brass valves shall be supplied with brass hexagonal back nuts to secure them to the tanks and a socket to connect to supply pipe.
- All valves shall be suitable for the working pressure involved.

## 9.1 Pressure Gauge

- The pressure gauge shall be constructed of die cast aluminium and stove enamelled. It shall be weather proof with an IP 55 enclosure. It shall be a stainless steel Burden tube type pressure gauge with a scale range from 0 to 16 Kg / cm square and shall be constructed as per IS:3524. Each pressure gauge shall have a siphon tube connection. The shut off arrangement shall be by Ball Valve.

## 10 WATER FITTINGS

- Unless otherwise specified all Gunmetal fittings such as gate, globe, check & safety valves shall be fitted in pipe line in workman like manner. Necessary unions shall be provided on both ends of the valves for easy replacement. The joints between fittings and pipes shall be leak-proof when tested to desired pressure rating. The defective fittings and joints shall be replaced or redone.

## 11 CONNECTIONS TO VARIOUS MECHANICAL EQUIPMENT SUPPLIED BY OTHER AGENCIES

- All inlets, outlets, valves, piping and other incidental work connected with installation of mechanical equipment supplied by other agencies all be carried out by the contractor in accordance with the drawings, requirements for proper performance of equipment, manufacturers instructions and the directions of the Owner's site representative / Architect. The equipments to be supplied by the other agencies consist mainly for Kitchen, Back-of-the-House area and other similar areas. The work of connections to the various equipments shall be effected through proper unions and isolating valves. The work of effecting connections shall be executed in consultation with and according to the requirement of equipment suppliers, under the directions of the Owner's site representative / Architect. The various aspects of connection work shall be executed in a similar way to the work of respective trade mentioned elsewhere in these specifications.

## 12 CONNECTIONS TO RCC WATER TANKS

- The contractor shall provide all inlets, outlets, washouts, vents, ball cocks, overflows control valves and all such other piping connections including level indicator to water storage tanks as called for. All pipes crossing through RCC work shall have puddle flanges fabricated from MS/GI pipes of required size and length and welded to 6/8 mm thick MS plate. All puddle flanges must be fixed in true alignment and level to ensure further connection in proper order.
- Full way gate valves of a approved make shall be provided as near the tank as practicable on every outlet pipe from the storage tank except the overflow pipe. Overflow and vent pipes shall terminate with mosquito proof grating.
- The overflow pipe shall be so placed to allow the discharge of water being readily seen. The overflow pipe shall be of size as indicated. A stop valve shall also be provided in the inlet water connection to the tank. The outlet pipes shall be fixed approximately 75mm above the bottom of the tank towards which the floor of the tank is sloping to enable the tank to be emptied for cleaning.

## 13. MEASUREMENTS

- The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include pipe and fittings such as coupling, bends, tees,

elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions. Deductions for length of valves shall be made. Rate quoted shall be inclusive of all fittings, clamps, cutting holes chased and making good the same and all items mentioned in the specifications and Bill of Quantities.

- All pipes below ground shall be measured per linear meters (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends, elbows, unions, deduction for valves shall be made rate quoted shall be inclusive of all fittings, excavation, back filling and disposal of surplus earth, cutting holes and chase and making good all item mentioned in Bill of Quantities.

**14. PIPE PROTECTION (FOR COLD WATER PIPES BURIED IN TRENCHES / GROUND / EARTH)**

- All buried pipes shall be cleaned and protected against corrosion by applying two layers of 2 mm thick multi-layer anticorrosive polymeric mix tape applied over a coat of primer as per recommendations of the manufacturers and placed on concrete blocks with PUF saddles dipped in bitumen at every 2 meters. The pipes where laid under floor shall be encased with 100 mm thick all kind of sand all around in addition to protective coating as described above.

**15. THRUST BLOCKS**

- In case of bigger pipes (80 mm dia and above), thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) shall be constructed on all bends as directed by the Owner's site representative.

**16. MASONRY CHAMBER**

- All masonry chambers for stop cocks, sluice valves and meter etc. shall be built as per supplied drawings.
- The excavation for chambers shall be done true to dimension and level indicated on plans or as directed by the Owner's site representative.
- Concrete shall be of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size).
- Brick shall be of class designation 75 in cement mortar 1:5 (1 cement : 5 fine sand)
- Inside Plastering not less than 12 mm thick shall be done in cement mortar 1:3 (1 cement : 3 fine sand) finished with a floating coat of neat cement.

**17. SHIFTING OF EXCAVATED SURPLUS MATERIAL**

- Contractor shall make his own arrangement to shift the surplus excavated material within the site limits as directed by Owner's site representative at free of cost within time limit.

## 18 HOT WATER PIPING INSULATION

### MATERIAL

- Insulation material for Pipe insulation shall be Closed Cell Elastomeric Nitrile Rubber or closed cell cross linked polyethylene foam. Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.038 W/moK or 0.0313 Kcal / Mhr oC or 0.212 BTU / (Hr-ft<sup>2</sup>-oF/inch) at an average temperature of 30oC. The product shall have temperature range of -40 oC to 105oC. Density of material shall not be less than 0.06 gm/cm<sup>3</sup>. The insulation shall have fire performance such that it passes minimum CLASS 1 as per BS476 part 7 for surface spread of flame. Water vapour permeability shall not exceed 0.024 perm inch (3 x 10<sup>-14</sup> Kgs / m.sec.Pa). The material shall have approval from the Chief Fire Officer.
- Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer test certificate for thermal conductivity values. Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost all joints shall be sealed properly with adhesive, which shall provide similar vapour barrier as the original insulating material.
- All hot water piping shall be insulated in the manner specified herein. Before applying insulation, all pipes shall be brushed and cleaned. Thermal insulation shall be applied as follows or as specified in drawings or schedule of quantity:

| Pipe size (mm)  | Thickness of Nitrile rubber insulation |
|-----------------|----------------------------------------|
| 15 mm to 25 mm  | 9 mm                                   |
| 32 mm to 50 mm  | 13 mm                                  |
| 65 mm and above | 19 mm                                  |

### Insulation for pipes in wall chase and for pipes in shaft / plant room.

- Insulating material in tube form shall be sleeved on the pipes. On existing piping, slit opened tube from insulating material shall be placed over the pipe and adhesive (as recommended by the manufacturer) shall be applied as suggested by the manufacturer. Adhesive must be allowed to tack dry and then press surface firmly together starting from butt end and working towards centre.
- Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. The insulation shall be continuous over the entire run of piping, fittings and valves. All valves, fittings, joints, strainers etc. in hot water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

- All insulation work shall be carried out by skilled workmen specially trained in this kind of work. All insulated pipes shall be labeled (HWS / HWR / HWRR) and provided with 300 mm wide band of paint along circumference at every 1200 mm for colour coding. Direction of fluid shall also be marked. All painting shall be as per relevant BIS codes.

#### **Protective Coating Over Insulation**

- To provide mechanical strength and protection from damage & UV rays all exposed pipe insulated with nitrile rubber as indicated in BOQ shall be covered with fibreglass fabric. The fibreglass fabric shall be applied with one coat of fire proof epoxy or acrylic compound. The coat shall be allowed to cure to non stick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface.

#### **Measurement Of Insulation**

- Unless otherwise specified measurement for pipe insulation for the project shall be on the basis of centre line measurements described herewith
- Pipe Insulation shall be measured in units of length along the centre line of the installed pipe, strictly on the same basis as the piping measurements. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers shall not be separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including valves, orifice plates and strainers etc. shall be considered strictly by linear measurements along the centre line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.



**SECTION-04 :: INTERNAL DRAINAGE (SOIL, WASTE, VENT & RAIN WATER PIPES)**

**1 SCOPE**

- The scope of this section comprises the supply, installation, testing and commissioning of internal drainage services.
- Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as required by the drawings, and given in the schedule of quantities.

**2 BASIC PIPING SYSTEM**

- Soil, waste and vent pipes in shafts, ducts and in concealed areas i.e. false ceilings etc. shall consist of cast iron pipes & fittings as called for. In general wastes and vents smaller than and upto 50mm dia shall be of GI.
- The soil pipes shall be circular with a minimum diameter of 100mm. Pipes shall be fixed by means of stout GI clamps in two sections, bolted together, built into the walls, wedged and neatly jointed as directed and approved by the Owner's site representative / Architect. All bends, branches, swan neck and other parts shall conform to the requirement and standards as described for the pipes. Pipes shall be rested against the walls on suitable wooden cradles. Local authority regulations applicable to the installations shall be strictly followed.
- Where indicated, the soil pipes shall be continued upwards without any diminution in its diameter, without any bend or angle to the height shown in the drawings. Joints throughout shall be made with molten lead as described under jointing of cast iron pipes. Soil pipes shall be painted as provided under 'painting'. The soil pipes shall be covered on top with cast iron terminal outlets as directed and approved. All vertical soil pipes shall be firmly fixed to the walls with properly fixed clamps, and shall as far as possible be kept 50mm clear of wall. Waste pipes and fittings shall be of cast iron or galvanized mild steel pipes. Pipes shall be fixed, jointed and painted as described in installation of soil, waste & vent pipes.
- Every waste pipe shall discharge above the grating of properly trapped gully. The contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided, it shall be ensured that atleast one wash is connected to such floor traps to avoid drying of water seal in the trap. Ventilating pipes shall be of cast iron or galvanized mild steel pipes, conforming to the requirements laid down earlier. Anti-siphon vent pipes/relief vent pipes where called for on the drawings shall be of cast iron or galvanized mild steel pipes as specified. The pipes shall be of the diameter shown on the drawings.
- All traps on branch soil and waste pipes shall also be ventilated at a point not less than 75mm or more than 300mm from their highest part and on the side nearest to the soil pipe or waste pipes.

- Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the Owner in the form of shop drawings so that other agencies are instructed to provide the same.
- All the fittings used for connections between soil, waste and ventilation pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3mm thick rubber insertion packing and when closed and bolted shall be air and water tight.
- Where soil, waste and ventilating pipes are accommodated in shafts ducts, adequate access to cleaning eyes shall be provided.
- Head (starting point) of drains and sewage / waste water sumps (as and where applicable) having a length of greater than 4 m upto it connection to the main drain or manhole shall be provided with an 80 / 100 mm vent pipe.

### **3. PIPING MATERIALS**

#### **3.3.1 Soil, Waste and Vent Pipes**

- The soil and waste pipe system above ground has been planned as a "Two pipe system" having separate pipes for waste for kitchen sinks, wash basins, AHU's, condensate drains and floor drains and soil from the WCs and Urinals, and or a "Single stack system" where all waste and soil pipes are connected to the same stack. Necessary venting shall be done by using Air Admittance valves, to be installed based on manufacturers recommendations.
- All waste water from AHU's plant and pump rooms, floor channels in basements will be provided with a deep seal trap before connecting to the main drain or vertical stack.
- Vertical soil and waste stacks shall be connected to a separate horizontal drain / single horizontal drain at basement ceiling generally as shown on the drawings.
- Toilet layouts have been so arranged that the W.C outlets shall be with "P" trap above ground level.
- All soil/waste from areas in basement areas will be collected in sumps and pumped into sewer lines or as specifically designed.
- Head (Starting point) of drains and sewage/waste water sumps (as and where applicable) having a length of greater than 4m upto connection to the main drain or manhole shall be provided with a 80/100mm vent pipe terminating above roof / a Maxi-Filtra with an ACF cartridge shall be provided close to the MH as directed by the Project Manager.

### **5. INSTALLATION OF SOIL, WASTE & VENT PIPES**

- Soil, waste & vent pipes in shafts under the floors / suspended below slab shall consist of cast iron pipes as described earlier. Waste pipes from bottle trap to floor/urinal traps for wash basin, urinal and sink shall be GI pipes and fittings.
- All Horizontal pipes running below the slab and along the ceiling shall be fixed on

structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

- All cast iron pipes and fittings shall be jointed with best quality soft pig lead free from all impurities conforming to IS 27.
- Before joining, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten pig lead shall be poured to fill the remainder of the socket in one pouring. The lead then shall be solidly caulked with suitable tools by hammering right round the joints to make up for the shrinkage of the molten metal on cooling and preferably finish 3mm behind the socket face.
- The depth of the lead joints for the cast iron pipes shall be 45mm for the pipes upto 100mm dia and 50mm for the pipes beyond 100mm dia respectively.
- The joint shall not be covered till the pipe line has been tested under pressure. Rest of pipe line shall be covered so as to prevent the expansion and contraction due to variation in temperature.

### **Rainwater Pipes**

- All open terraces shall be drained by rain water down takes.
- Rainwater down takes are separate and independent of the soil and waste system and will discharge into the underground storm water drainage system of the complex.
- Rainwater in open courtyards shall be collected in catch basins and connected to the Storm Water Drains.
- Any dry weather flow from waste appliances, e.g. AHU's pump rooms, waste water sumps shall connected to sewers after traps and not in the storm water drainage systems.

### **Balcony/ Planter drainage**

- Wherever required, all balconies, terraces, planters and other frontal landscape areas

will be drained by vertical down takes or other type of drainage system shown on the drawings and directed by the Project Manager.

## **6. Soil Waste and Vent Pipes and Fittings above Ground**

### **3.7 Noise Insulated Piping System (POLOPLAST - POLO-KAL NG)**

#### **3.7.1 SOCKET PIPES**

- Three Layer sound insulated Polypropylene piping (PP) system as per ON EN 1451-Part 1-6 & EN 12056 Part 1-5 with 3 layer pipe made of PP-C + PP-MV + PP-C in Blue Ral 5014 (halogen and calcium free) colour, push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 21 dBA with POLO clip HS/ 22 dBA with Bismat 2000 clamp /equivalent and 16 dBA with Bismat 1000 clamp/equivalent as per DIN 4109 at a flow rate of 4 l/s and having pipe ring stiffness as per ISO/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density = 1.25gms/cm<sup>3</sup>, elongation = 0.05mm/m0K and tensile strength > 24 N/mm<sup>2</sup>, with all necessary fittings in blue colour, fitted with factory fitted lip ring, having 3 layers, pipes to be painted with ordinary cement paint for external installation:
- INTERNAL LAYER:
- Of PP-C, hot water resistant to 97 degree C, tested in accordance to ON EN 1451-1 and DIN 19560, good heat and corrosion ageing stability as well as high chemical resistance and a smooth pipe inner-surface.
- Color: Blue (halogen and calcium free)
- INTERMEDIATE LAYER:
- Of PP-MV compound reinforced with mineral aggregate, which guarantees greater stiffness and stability.
- Color: Grey.
- EXTERNAL LAYER:
- Of PP-C. With high impact resistance and good weathering resistance.
- Color: Blue (halogen and calcium free).

#### **3.7.2 PIPE RING STIFFNESS:**

- Pipe ring stiffness would be in accordance with ISO/DIS 9969 and TIGHTNESS as per EN 1277/B and C and DIN 19560.

#### **3.7.3 MARKINGS:**

- All pipes shall carry the following markings: Batch number; year and week of manufacture; company name; dimension application class; stiffness class, test mark and material details.

### 3.7.4 FITTINGS:

- Single- Layered fitting reinforced with mineral aggregate, made of a Halogen free PP-C-KV synthetic material, a reinforced wall and factory fitted lip ring, hot water resistant upto 95 degree c in accordance to ON EN 1451-PART 1-6 EN 12056 PART 1-5.
- Color: Blue (halogen and calcium free)

### 3.7.5 INSTALLATION:

- The piping system must be clamped properly as required, pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material internally (between pipe and sleeve) covering the pipe to avoid transfer of body and structural borne sounds (refer manufacturer's installation guide lines). The

#### Minimum supporting:

| Nominal outer diameter<br>DN/OD<br>mm | Bracket distance                                      |                                     |
|---------------------------------------|-------------------------------------------------------|-------------------------------------|
|                                       | Horizontal pipe routing*)<br>D max. m (max. 1.5 x da) | Vertical pipe routing*)<br>D max. m |
| 32                                    | 0,5                                                   | 1,50                                |
| 40                                    | 0,6                                                   | 1,50                                |
| 50                                    | 0,75                                                  | 1,50                                |
| 75                                    | 1,10                                                  | 2,00                                |
| 90                                    | 1,35                                                  | 2,00                                |
| 110                                   | 1,65                                                  | 2,00                                |
| 125                                   | 1,85                                                  | 2,00                                |
| 160                                   | 2,40                                                  | 2,00                                |
| 200                                   | 3,00                                                  | 2,00                                |
| 250                                   | 3,00                                                  | 2,00                                |

piping must not touch any wall, structure, paneling, false ceiling etc.

## 3.8 Traps

### 3.8.1 Floor Traps

- Floor traps where specified shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

### 3.8.2 Urinal Traps

- Urinal traps shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

### 3.8.3 Cleanout Plugs

- Floor Clean Out and line clean out plugs
- Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, "Y" and on straight runs at such intervals as required as per site conditions. Clean out plugs shall terminate flush with the floor levels. Line clean outs shall be supported with manufacturer provided bracket. They shall be of push fit type of PKNG mane (Poloplast)

**3.9 Drainage under floor/above floor (service floors, basement ceiling etc.) (POLOPLAST - POL-KAL NG (upto 250mm dia / ECO-PLUS Premium above 250mm dia)**

- All drainage lines passing under building, in exposed position above ground e.g. service floors, basement ceiling etc. shall be Multilayered as per details given in sub-clause 3.10 above or shall be as per details given below. Position of such pipes shall generally be shown on the drawings.

**3.10.1 SOCKET PIPES**

- 3 layer technology Polo-Eco Plus Premium 10 pipes and fittings for underground/ misc. drainage applications having external layer of PP-Blend + mineral reinforcement, supporting layer of PP + magnesium silicate and internal in PP with chemical resistance between 2-13pH and ring rigidity of  $\geq 10\text{kN/m}^2$  having OFI certification for longitudinal stability & impermeability of pie connection in line with EN 14741.

**3.10.2 FITTINGS**

- 3-layered reinforced polypropylene (PP) sewage pipes, halogen and lead free, with integral push-fit socket and factory-fitted lip ring, tested and monitored according to the Product Standard EN 1852 - 1. Fittings upto dimension DN/OD 200 are manufactured by injection molding (1-layer), above DN/OD 200 (250 and above)
- the fittings are butt or extrusion welded by the manufacturer. Fabrication of fittings at site shall not be permitted.

**3.10.3 Pipe Joints**

- Field-proven push-fit connection with improved and modified lip ring of high ageing-resistant shall be provided with the pipes and fittings for easy push-fit installation, installation procedure as given in clause 3.10 above shall be followed.

**SECTION-05 :: EXTERNAL DRAINAGE**  
**(SEWAGE & STORM WATER DISPOSAL)**

## 1 SCOPE

The scope of this section comprises the supply, installation, testing and commissioning of external drainage & sewage disposal services.

### 1.1 General Scheme

The contractor shall install a drainage system to effectively collect; drain and dispose all soil and waste water from various parts of the buildings, appurtenances and equipment. The piping system shall finally terminate and discharge into the Sewage sump and finally discharge by pumping to Municipal Sewer line. The piping work mainly consists of laying of Salt glazed stoneware pipes, reinforced cement concrete pipes and cast iron soil pipes as called for on the drawings. All piping shall be installed at depth greater than 80 cm below finished ground level. The disposal system shall include construction of gully traps, manholes, intercepting chambers as indicated. The piping system shall be vented suitably at the starting point of all branch drains, main drains, the highest/lowest point of drain and at intervals as shown. All ventilating arrangements shall be unconstructive and concealed. The work shall be executed strictly in accordance with IS: 1742. The sewage system shall be subject to smoke test for its soundness as directed by the Project Manager. Wherever the sewerage pipes run above water supply lines, same shall be completely encased in cement concrete 1:2:4 all round with the prior approval of the Project Manager.

Without restricting to the generality of the foregoing, the drainage system shall inter-alia include:

- a. Sewer lines including earth work for excavation, disposal, back filling and compaction, pipe lines, manholes, drop connections and connections to the municipal or existing sewer.
- b. Storm water drainage, earth works for excavation, disposal, backfilling and compaction, pipe lines, manholes, catch basins and connections to the existing municipal storm water drain or connected as indicated by the Project Manager.

### General Requirements

- All materials shall be new and of quality conforming to specifications and subject to the approval of the Owner's site representative. Wherever particular makes are mentioned, the choice of selection shall remain with the Architect / Consultant / Owner's site representative.
- Drainage lines and open drains shall be laid to the required gradients and profiles.
- All drainage work shall be done in accordance with the local municipal bye-laws.
- Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority.
- Location of all manholes, etc shall be got confirmed by the Project Manager before the actual execution of work at site. As far as possible, no drains or sewers shall be laid in the middle of road unless otherwise specifically shown on the drawings or directed by the Project Manager in writing.

- All materials shall be rust proofed; materials in direct or indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.

## **2. TRENCHING FOR PIPES AND DRAINS**

### **2.1 General**

- All the material shall be new of best quality conforming to specifications and subject to the approval of the Architects. Drainage lines shall be laid to the required gradients and profiles. All drainage work shall be done in accordance with the local municipal by-laws.
- Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority. Location of all manholes, catch basins etc. shall be finalized and shown in approved shop drawings before the actual execution of work at site. All work shall be executed as directed by the Project Manager.

### **2.2 Alignment & Grade**

- The sewer and storm water drainage pipes shall be carefully laid to levels and gradients shown in the plans and sections but subject to modifications as shall be ordered by the Architects from time to time to meet the requirements of the works. Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in straight lines without vertical or horizontal undulations. The body of the pipes shall rest on an even bed in the trench for its length and places shall be excavated to receive collar for the purpose of jointing. No deviations from the lines, depths of cuttings or gradients as called for on the drawings shall be permitted without the written approval of the Architect. All pipes shall be laid at least 60cms below the finished ground level or as called for on the drawings.

### **2.3 Setting out Trenches**

- The contractor shall set out all trenches, manholes, chambers and such other works to true grades and alignments as called for. He shall provide the necessary instruments for setting out and verification for the same. All trenches shall be laid to true grade and in straight lines and as shown on the drawings. The trenches shall be laid to proper levels by the assistance of boning rods and sight rails which shall be fixed at intervals not exceeding 10 meters or as directed by the Project Manager.

### **2.4 Trench Excavation**

- The trenches for the pipes shall be excavated with bottoms formed to level and gradients as shown on the drawings or as directed by the Project Manager. In soft and filled in ground, the Project Manager may require the trenches to be excavated to a greater depth than the shown on the drawings and to fill up such additional excavation



with concrete (1:4:8) consolidated to bring the excavation to the required levels as shown on the drawings.

- All excavations shall be properly protected where necessary by suitable timbering, piling and sheeting as approved by the Project Manager. All timbering and sheeting when withdrawn shall be done gradually to avoid falls. All cavities be adequately filled and consolidated. No blasting shall be allowed without prior approval in writing from the Architect. It shall be carried out under thorough and competent supervision, with the written permission of the appropriate authorities taking full precautions connected with the blasting operations. All excavated earth shall be kept clear of the trenches to a distance equal to 75 cms.

## **2.5 Timbering of Sewer and Trenches**

- The Contractor shall at all times support efficiently and effectively the sides of all the trenches and other excavations by suitable timbering, piling and sheeting and they shall be close timbered in loose or sandy starta and below the surface of the sub soil water level.
- All timbering, sheeting and piling with their wallings and supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.
- The Contractor shall be held responsible and shall be accountable for the sufficiency of all timbering, bracings, sheeting and piling used and also for, all damage to persons and property resulting from improper quality strength placing, maintaining or removing of the same.

## **2.6 Shoring of Buildings**

- The Contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to persons or property resulting from any accident.

## **2.7 Obstruction Road**

- The contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient space shall then be left for public and private transit. He shall remove the materials excavated and bring them back again when the trench is required to be refilled. The contractor shall obtain the consent of the Project Manager in writing before closing any road to vehicular traffic and the foot walks must be clear at all times.

## **2.8 Protection of Pipes etc.**

- All pipes, water mains, cables etc. met in the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the cables, the removal of

which shall be arranged by the contractor with the written consent from the Project Manager.

## **2.9 Trench Back Filling**

- Refilling of the trenches shall not be commenced until the length of pipes therein has been tested and approved. All timbering which may be withdrawn safely shall be removed as filling proceeds. Where the pipes are unprotected by concrete hunching, selected fine material shall be carefully hand-packed around the lower half of the pipes so as to buttress them to the sides of the trench.
- The refilling shall then be continued to 150mm over the top of the pipe using selected fine hand packed material, watered and rammed on both sides of the pipes with a wooden hammer. The process of filling and tamping shall proceed evenly in layers not exceeding 150mm thickness, each layer being watered and consolidated so as to maintain an equal pressure on both sides of the pipe line. In gardens and fields the top solid and turf if any, shall be carefully replaced.

## **2.10 Contractor to restore settlement and Damages**

- The contractor shall at his own costs and expenses, make good promptly during the whole period for the works in hand if any settlement occurs in the surfaces of roads, beams, footpaths, gardens, open spaces etc. in the public or private areas caused by his trenches or by his other excavations and he shall be liable for any accident caused thereby. He shall also, at his own expense and charges, repair (and make good) any damage done to building and other property. If in the opinion of the Project Manager he fails to make good such works with all practicable dispatch, the Project Manager shall be at his liberty to get the work done by other means and the expenses thereof shall be paid by the contractor or deducted from any money that may be or become due to him or recovered from him by any other manner according to the laws of land.
- The contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled, surplus soil shall be immediately removed, the surface shall be properly restored and roadways and sides shall be left clear.

## **2.11 Removal of Water from Sewer, Trench etc.**

- The contractor shall at all times during the progress of work keep the excavations free from water which shall be disposed by him in a manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any road or streets, nor cause any interference with the use of the same by the public.
- If any excavation is carried out at any point or points to a greater width of the specified cross section of the sewer with its cover, the full width of the trench shall be filled with concrete by the contractor at his own expense and charges to the requirements of the Project Manager.

### **2.12 Removal of Filth**

- All night soil, filth or any other offensive matter met with during the execution of the works, shall not be deposited on the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be immediately, after it is taken out of any trench, sewer or cess pool, put into the carts and removed to a suitable place to be provided by the Contractor.

### **2.13 Width of Trench**

- The Project Manager shall have power by giving an order in writing to the Contractor to increase the maximum width/depth for excavation and backfilling in trenches for various classes of sewer, manholes and other works in certain length to be specifically laid down by him, where on account of bad ground or other unusual conditions, he considers that such increased width/depths are necessary in view of the site conditions.

## **3 PIPING MATERIAL**

### **3.1 RCC pipes**

- All pipes shall be centrifugally spun RCC pipes NP2. Pipes shall be true and straight with uniform bore throughout. Cracked, warped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, prior to use on site, a certificate to that effect from the manufacturer.
- The pipes shall be with or without reinforcement as required and of the class as specified. These shall conform to IS:458-1971.
- All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding.

#### **Laying**

- RCC spun pipes shall be laid on cement concrete bed of cradles as specified and shown on the detailed drawings. The cradles may be precast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12 mm below the invert level of the pipe and properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the Project Manager.

#### **Jointing**

- Semi flexible type collar joint.
- Hemp rope soaked in neat cement wash shall be passed round the joint and inserted in it by means of caulking tool. More skein of yarn shall be added and rammed home. Cement mortar with one part of cement and two part of sand and with minimum water content but on no account soft or sloppy, shall be carefully inserted, punched and caulked into the collar and more cement mortar added until the space of the collar has been filled completely with tightly caulked mortar. Provision of rubber sealing ring in the collar joint shall also be made. The joint shall then be finished off neatly outside the socket at an angle of 45 deg.

#### **Curing:**

- The joint shall be cured for at least seven days. Refilling at joints will be permitted only on satisfactory completion of curing period.

#### **Cement Concrete for Pipe Supports:**

- Unless otherwise directed by the Project Manager cement concrete for bed, all round or in haunches shall be in the mix 1:4:8(1cement : 4 coarse sand :8 graded stone aggregate 40 mm nominal size):

| Description                              | Upto 1.4 m | Upto 3 m    | Beyond 3 m  |
|------------------------------------------|------------|-------------|-------------|
|                                          | Depth (5') | Depth (10') | Depth (10') |
| Pipes in open ground (no sub soil water) | all round  | in haunches | all round   |
| RCC/C.I pipes in sub soil water          | all round  | in haunches | in haunches |
| RCC/C.I pipes (in all Conditions)        | all round  | in haunches | in haunches |
| RCC/C.I pipes under Road or building     | all round  | all round   | all round   |

- R.C.C. pipes or CI pipes may be supported on brick masonry or precast RCC or in situ cradles. Cradles shall be as shown on the drawings.
- Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

#### **Measurement:**

- Excavation
- Measurement for excavation of pipes trenches shall be made per linear meter.
- Trenches shall be measurement between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth upto 1.5 metre or as given in the Bill of Quantities.

- Payment for trenches more than 1.5 m in depth shall be made for extra depth as given in the Bill of Quantities and above the rate for depth upto 1.5 m.

RCC pipes shall be measured for length of the pipe line per linear meter.

- Length between manholes shall be recorded from inside of one manhole or inside of other manhole.
- Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

### 3.2 Cast Iron Class (LA) Pipe:

- All drainage line passing under building, floors and roads with heavy traffic shall be Cast Iron Class (LA) Pipe.
- Cast Iron Class (LA) pipe shall be such that they could be cut, drilled or machined. Pipe centrifugally cast in unlined water cooled moulds shall be heat treated in order to achieve the necessary mechanical properties and to relieve casting stresses; provide that the specified mechanical properties are satisfied.

#### Material

- Cast iron pipe shall be centrifugally spun cast iron pipes and conforming to IS:1536-1976.

#### Fittings

- Fittings shall be used for Cast Iron Class (LA) Pipes shall conform to IS:1538-1976. Whenever possible junction from branch pipe shall be made by Wyes.

#### Laying

- Fittings used for C.I drainage pipe shall conform to IS:1538-1976. Whenever possible junction from branches pipes shall be made by a Wyes.

All cast iron pipes and fittings shall be jointed with best quality soft pig lead (conforming to IS 782-1966) which shall be free from impurities. In wet trenches joints shall be made from lead wool. Nothing extra will be paid for lead wool joints. Depth of pig lead and weight for joints shall be as given in table below:

#### Lead caulked Joints with Pig Lead

The approximate depth and weights of Pig Lead for various diameters of C I pipes and specials shall be as follows:

| <u>Nominal Size of Pipe mm</u> | <u>Lead per joint Kg</u> | <u>Depth of Lead Joint mm</u> |
|--------------------------------|--------------------------|-------------------------------|
|--------------------------------|--------------------------|-------------------------------|

|     |     |    |
|-----|-----|----|
| 80  | 1.8 | 45 |
| 100 | 2.2 | 45 |
| 125 | 2.6 | 45 |
| 150 | 3.4 | 50 |
| 200 | 5.0 | 50 |
| 250 | 6.1 | 50 |

The spigot of pipe or fittings shall be centred in the adjoining socket by caulking. Sufficient turns of tarred gasket shall be given to leave a depth of 45 mm when the gasket has been caulked tightly home. Joining ring shall be placed round the barrel and against the face of the socket. Molten pig lead shall then be poured to fill the remainder of the socket. This shall then be done in one pouring. The lead shall then be solidly caulked with suitable tools and hammers weighting not less than 2 Kgs.

**Measurement:**

- Excavation : Measurement for excavation of pipes trenches shall be made per linear meter.
- Trenches shall be measurement between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth upto 1.5 metre or as given in the Bill of Quantities.
- Payment for trenches more than 1.5 m in depth shall be made for extra depth as given in the Bill of Quantities and above the rate for depth upto 1.5 m.
- C.I class (LA) pipes shall be measured for the length of the pipe line per linear meter i.e:
  - i. Length between manholes shall be recorded from inside of one manhole or inside of other manhole.
  - ii. Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

**3.3 Salt Glazed Stoneware Pipes**

- Stoneware pipes shall be new and of First Class quality salt glazed and free from rough texture inside and outside and straight. All pipes shall comply with IS:651 and have the manufacturers name marked on them.

**Laying of Salt Glazed Stoneware Pipes:**

- Pipes are liable to be damaged in transit and notwithstanding tests that may have been made before dispatch each pipe shall be examined carefully on arrival at site. Each pipe shall be lightly struck with a wooden hammer or mallet and those that do not ring true

and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes shall be segregated, marked in a conspicuous manner and their use in the works prevented by expeditiously removing them from the work site.

- The pipes shall be laid with sockets leading uphill and shall rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe jointer room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made.
- Where pipes are not bedded on concrete the trench bottom shall be left slightly high and carefully bottomed up as pipes laying proceeds so that the pipe barrels rest on firm ground. If excavation has been carried to low it shall be made up with cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 stone aggregate 20mm nominal size) at the Contractor's cost and charges

#### **Jointing of Salt Glazed Stoneware Pipes:**

- Tarred gaskin shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid, the pipe shall then be adjusted and fixed in its correct position and the gaskin caulked tightly home so as to fill not more than one quarter of the total length of the socket.
- The remainder of the socket shall be filled with stiff mix of cement mortar (1cement: 1 clear sharp washed sand). When the socket is filled, a fillet shall be of 45 degrees with the barrel of that pipe. The mortar shall be mixed as needed for immediate use and no mortar shall be beaten up and used after it has begun to set.
- After the joint has been made any extraneous materials shall be removed from the inside of the joint with a suitable scarper of "badger". The newly made joints shall be protected until set, from the sun, drying winds, rain or dust. Sackling or other materials which can be kept damp shall be used. The joints shall be exposed and space left all around the pipes for inspection by the Project Manager. The inside of the sewer must be left absolutely clear in bore and free from cement mortar or other obstructions throughout its entire length, and shall efficiently drain and discharge.

#### **S.W. Gully Trap**

- Gully trap shall be stoneware conforming to IS:651. These shall be sound and free from visible defects such as fire cracks, or hair cracks. The glaze of the traps shall be free from cracks. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters. Each gully trap shall have one CI grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight CI cover with frame inside dimensions 300 x 300mm the cover weighing not less than 4.5 kg and the frame not less than 2.7kg. The grating cover and frame shall be of good casting and shall have truly square machined seating faces.

#### **Fixing of S.W. Gully Trap**

- The excavation for gully traps shall be done true to dimensions and levels as indicated

on plans or as directed by the Project Manager / Consultant / Architect. The gully traps shall be fixed on cement concrete foundation 65cm square and not less than 10cm thick. The mix for the concrete will be 1:4:8. The jointing of gully outlet to the branch drain shall be done similar to the jointing of S.W. Pipes described earlier. After fixing and testing gully and branch drain, a brick work of specified class in cement mortar 1:5 shall be built with a half brick masonry work round the gully trap from the top of the bed concrete upto ground level. The space between the chamber and trap shall be filled in with cement concrete 1:3:6. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside the cement mortar 1:3 finish with a floating coat of neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating.

- The C.I. cover 300 x 300 mm. size without frame shall be fixed on top of the brick masonry with cement concrete 1:2:4 (1 cement: 2 sand : 4 graded stone aggregate 20 mm. nominal size) 40 mm. thick and rendered smooth. The finished top of the cover shall be left about 40 mm. above the adjoining ground level so as to exclude the surface water from ring the gully trap.
- CI cover with frame 300 x 300 mm (inside) shall then be fixed on the top of the brick masonry with cement concrete 1:2:4 and rendered smooth. The finished top cover shall be so as to prevent the surface water from entering the gully trap.

#### **Measurements**

- Gully traps shall be measured by the number and rate which shall include all excavation, foundation, concrete, brick masonry, cement plaster inside and outside, C I grating and sealed cover and frame.
- The relevant specifications of item 24.19 shall be followed.
- The rate shall be for a unit of one number.

#### **4. CONSTRUCTION OF MANHOLE**

- Where manholes are to be constructed, the excavation, filling back and ramming, disposal of surplus earth, preparation of bottom and sides etc. shall be carried out as described earlier under trench excavation. Manhole shall be sized and depths as called for in the drawings and Bill of Quantities.
- The manhole shall be built on a base concrete 1:3:6 of 150mm thickness for manholes upto 1500mm depth and 250mm thickness for manholes from 1500 to 2500mm depth and 300mm thickness manholes of depth greater than 2500mm. Reinforcement as shown shall be provided in the base slabs.
- The walls shall be of brick work of thickness as shown in drawings built in cement mortar 1:5. The joints of brick work shall be raked and plastered internally in cement mortar 1:3 (at least 12 mm thick) and finish with a coat of neat cement, external plaster shall be rough plaster in 1:3, PCC benching & semi circular channels of the same diameter as the pipes shall be provided and finished with neat cement coating.



- Above the horizontal diameter, the sides of channel shall be extended vertically to the same level as the crown of the outgoing pipe and the top edge shall be suitably rounded off. The branch channels shall also be similarly constructed with respect to the benching but at their junction with the main channel an appropriate fall suitably rounded off in the direction of flow in the main channel shall be given. All manholes / sumps shall be provided with poly propylene coated steel reinforced foot rest. The polypropylene shall conform to ASTM D-4101 specification, injection moulded around 12 mm dia IS-1786 grade FE-415 steel reinforcing bar. These rungs shall be set at 30cms interval in two vertical runs at 380mm apart horizontally. The top rung shall be 450mm below the manhole cover. Unless otherwise mentioned, manholes shall be constructed to the requirements of Indian Standard IS: 4111 (Part I). All manholes shall be constructed so as to be water tight under test. All angles shall be rounded to a 75mm radius with cement plaster 20mm thick. The benching at the side shall be carried out in such a manner so as to provide no lodgment for any splashing in case of accidental flooding. Manhole cover with frame shall be of cast iron of an approved make. The covers and frame shall generally be double seal as specified in the Bill of Quantities.

#### 4.1 Measurements

- **Manhole shall be measured in numbers as indicated in the Bill of Quantity.** The **depth** of manhole shall be measured from invert of channel to the top of manhole cover.
- Manhole with depth greater than specified under the main item shall be paid for under 'Extra Depth' and shall include all items as given for manholes depth will be measured to the nearest cm. Depth of the manholes shall be measured from top of the manhole cover to bottom of channel. The following are inclusive in the cost of manhole viz;
  - i. Bed concrete
  - ii. Brick work.
  - iii. Plastering (inside & outside)
  - iv. R.C.C. top slab, benching and channeling including drop connections.
  - v. Supply and fix foot rests.
  - vi. Keeping holes and embedding pipes for all the connections.
  - vii. Excavation, refilling, necessary de-watering and disposing off surplus soil to a places as directed by Project Manager.
  - viii. Curing.
  - ix. Cost of angle frame and embedding the frame in concrete bed.
  - x. Testing.
  - xi. De-watering of chambers.

#### 4.2 Drop Connection

- Drop connection shall be provided between branch sewer and main sewer in the main sewer itself in steep ground when the difference in invert level of two exceeds 60 cms of the required sizes. Drop connections from gully traps to main sewer in rectangular

shall be made inside the manholes and shall have CI special types door bend on to top and heel rest bend at bottom connected by a CI pipe. The pipe shall be supported by holder bat clamps at 180 cms intervals with atleast one clamp for each drop connection. All joints shall be lead caulked joints 25mm deep.

- Drop connections from branch sewer to main sewer shall be made outside the manhole wall with CI / CI class LA pipe, connection, vertical pipe and bend at the bottoms. The top of the tee shall be finished upto the surface level and provided with a CI hinges type frame and cover 30cms x 30cms. The connection and tee upto the surface chamber of the tee.
- Drop connection made from vertical stacks directly into manholes shall not be considered as drop connections.

#### **4.3 Making Connections**

- Contractor shall connect the new sewer line to the existing manhole by cutting the walls benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manhole for the new connection. Contractor shall remove all sewage and water if encountered in making the connection without additional cost.

### **5. GREASE TRAP**

#### **5.1 Size of Grease Trap**

- The size given in Bill of Quantities and drawings shall be internal size of chamber. The work shall be done strictly as per standard drawing and following specifications.

#### **5.2 Bed Concrete**

- Shall be in 1:4:8 cement concrete 150 mm thick.

#### **5.3 Brick work**

- Brick work shall be with best quality bricks in 1:5 CEMENT MORTAR.

Baffle walls shall be of R.C.C and of size as mentioned in Bill of Quantities. Brick partition constructed of best quality table moulded bricks in cement mortar 1:5 shall be provided for the entire height of chamber.

#### **5.4 Plaster**

- The walls of chamber shall be plastered from inside with 12 mm thick cement plaster 1:3 and finished smooth with a floating coat of neat cement & rough plaster on outside in cement mortar 1:3.

### 5.5 Chamber Covers

- Covers shall be of size and duty as mentioned in Bill of Quantities. Covers shall be of cast iron as per the details given in the drawing and shall be fixed on frame embedded in concrete.
  - i. C. I steps shall be provided at two corners of the chamber.
  - ii. All Cast Iron and MS items shall be painted with two coats of bitumastic paint.

### 5.6 Cast iron Manhole cover and Frame

- The Cast Iron Manhole Cover and Frame shall conform to IS:1726 and the grade and types have been specified in the Bill of Quantities. The cover and frames shall be cleanly cast and they shall be free from air and sand holes and from cold shuts. They shall be neatly dressed and carefully trimmed. All castings shall be free from voids whether due to shrinkage, gas inclusion or other causes. Covers shall have a raised checkered design on the top surface to provide an adequate non-slip grip.
- The sizes of covers specified shall be taken as the clear internal dimensions of the frame.
- The covers and frames shall be coated with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to a temperature of 63° C and shall not brittle as to chip off at a temperature of 0° C.

## 6. TESTING

- All rights of the sewer and drain shall be carefully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subject to a test pressure of 1.5 meter head of water. The test pressure will however, not exceed 6 meters head at any point. The pipes shall be plugged preferably with standard design plugs or with rubber plugs on both sides, the upper end shall, however, be connected to a pipe for filling with water and getting the required head poured at one time.
- Sewer lines shall be tested for straightness by :
- Inserting a smooth ball 12 mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball shall roll down the invert of the pipe and emerge at the lower end.
- means of a mirror at one end a lamp at the other end. If the pipe is straight the full circle of light will be seen otherwise obstructions or deviations will be apparent.
- The contractor shall give a smoke test to the drain and sewer at his own expense and charges, if directed by the Owner's site representative.
- A test register shall be maintained which shall be signed and dated by contractor and Owner's site representative.

## SECTION - 9

### COMMISSIONING & GUARANTEE

## 1. SCOPE OF WORK

- Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.
- Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.
- On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.
- All tests shall be made in the presence of the Architect or his representative or any inspecting authority. At least five working days notice in writing shall be given to the inspecting parties before performing any test.
- Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.
- Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in water supply lines for ease of installing pressure gauge, temperature gauge & rotameters. Contractor shall also supply all required pressure gauge, temperature gauge & rotameter for system commissioning and balancing. The balancing shall be to the satisfaction of Consultant / Project Manager.
- Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

## 2 PRECOMMISSIONING

- On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:
- Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fittings and pipework and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
- All strainers shall be inspected and cleaned out or replaced.
- When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
  - i. Remove oil, grease and foreign residue from the pipe work and fittings;
  - ii. Pre-condition the metal surfaces to resist reaction with water or air.
  - iii. Establish an initial protective film;
  - iv. After pre-treatment, the system shall be drained and refilled with fresh water

and left until the system is put into operation.

- v. Details and procedures of the pre-treatment shall be submitted to the Architect for approval.
- a. Check all clamps, supports and hangers provided for the pipes.
- b. Check all the equipment, piping and valves coming under hot water system and operate each and every valve on the system to see if the valves are functioning properly. Thereafter conduct & hydro test of the system as for (b) above.
- c. Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

#### **4 FINAL ACCEPTANCE TESTS**

- Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Architect.
- Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained.
- Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

#### **5 REJECTION OF INSTALLATION / PLANT**

- Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Architect.
- After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Architect/Employer.

#### **6. WARRANTY AND HANDOVER**

- The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

## 7. HANDING OVER OF DOCUMENTS

- All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner's site representative and all testing and commissioning documents shall be handed over to the Owner's site representative.
- The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.

## 8. PIPE COLOUR CODE:

| Sr. No                                 | Pipe Lines                                            | Ground / Base Color | First Color Band | Second Color Band |
|----------------------------------------|-------------------------------------------------------|---------------------|------------------|-------------------|
| 1                                      | Drinking Water<br>(All cold water lines after filter) | Sea Green           | French Blue      | Single Red        |
| 2                                      | Treated Water (Soft Water)                            | Sea Green           | Light Orange     |                   |
| 3                                      | Domestic Hot Water                                    | Sea Green           | Light Grey       |                   |
| 4                                      | Drainage                                              | Black               |                  |                   |
| Colour Code to Conform to IS:2379:1990 |                                                       |                     |                  |                   |

**Item No. 77 : Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm<sup>2</sup> working pressure poluthene pipes of the following outside Dia. Low density, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(C) 32mm**

## SECTION-01 : BASIS OF DESIGN

### 1. BASIS OF DESIGN

- The Plumbing, Sanitary, Drainage System for the project is designed keeping in view the following:
- Requirement of adequate and equal pressure availability of hot and cold-water lines in Public Toilets, Kitchen and other identified areas.
- Adequate storage of water in underground raw + overhead treated domestic water tanks.
- Provision of firefighting appurtenance such as fire hydrants, hose reel, sprinklers and

portable extinguishers.

- Levels of roads / pavements and other services in the area.

#### **Landscape layout.**

- The execution of works and materials used shall be as per the latest relevant I.S. specifications.
- Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

## **2. CONCEPT OF THE SYSTEM**

**The following services are envisaged for the complex:**

- Water Treatment System for meeting the domestic water quality requirement with chemical parameters in acceptable limits as per SP: 35(S&T) 1987 which is considered safe for human consumption.
- Domestic/Flushing water supply through Hydropneumatics system.
- Sewage and Sullage collection system based on IS: 1742 and applicable standards for domestic drainage and connected to Sewage Treatment Plant.
- Storm / Rain water drainage system from various levels of the building and disposal to Rain Water Harvesting System / storm water drain.

## **3. WATER STORAGE & DISTRIBUTION SYSTEM**

#### **Water Requirement**

- The water requirement for the project is proposed to be based on the provisions of IS: 1172 and prevalent practice.

#### **Source of Water**

- It is expected that part of the daily domestic water requirement for the Complex shall be through municipal mains supply. The rest will be obtained from bore wells.

#### **Appurtenant**

- Following components shall be included in the water supply system for efficient functioning:

iii. Automatic air vent

- iv. Pressure Gauge.

#### **4. SEWAGE, SULLAGE AND STORM WATER**

- The soil and waste shall be carried down through one pipe drainage system. Independent vent pipe for common soil & water stack is also provided to avoid foul smell entering through trapped gully in WC. Provision of grease trap shall be made for waste water from Kitchen.

#### **Design Limitations**

- The system is designed considering the following:
  - d. Termination of vent cowl at terrace level.
  - e. Provision of adequate slope for horizontal header pipes for achieving self-cleaning velocity in the pipes.
  - f. Provision of cleanout plug.

#### **5. WORKMANSHIP**

- The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Owner's Site Representative. All materials and/or Workmanship which in the opinion of the Owner's Site Representative / Architect / Consultant is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith.

#### **6. MATERIALS**

- All materials shall be best of their kind and shall conform to the latest Indian Standards.
- All materials shall be of approved quality as per samples and origins approved by the Owner's Site Representative / Architect / Consultants.
- As and when required by the Owner's Site Representative / Consultant, the contractor shall arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions or work are found defective or unsound by the Owner's Site Representative / Consultant, the contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Owner's Site Representative / Consultant. To prove that the materials used are as specified the contractor shall furnish the Owner's Site Representative with original vouchers on demand.

### **SECTION-04 :: INTERNAL DRAINAGE (SOIL, WASTE, VENT &**

### **RAIN WATER PIPES)**

#### **1 SCOPE**



- The scope of this section comprises the supply, installation, testing and commissioning of internal drainage services.
- Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as required by the drawings, and given in the schedule of quantities.

## 2 BASIC PIPING SYSTEM

- Soil, waste and vent pipes in shafts, ducts and in concealed areas i.e. false ceilings etc. shall consist of cast iron pipes & fittings as called for. In general wastes and vents smaller than and upto 50mm dia shall be of GI.
- The soil pipes shall be circular with a minimum diameter of 100mm. Pipes shall be fixed by means of stout GI clamps in two sections, bolted together, built into the walls, wedged and neatly jointed as directed and approved by the Owner's site representative / Architect. All bends, branches, swan neck and other parts shall conform to the requirement and standards as described for the pipes. Pipes shall be rested against the walls on suitable wooden cradles. Local authority regulations applicable to the installations shall be strictly followed.
- Where indicated, the soil pipes shall be continued upwards without any diminution in its diameter, without any bend or angle to the height shown in the drawings. Joints throughout shall be made with molten lead as described under jointing of cast iron pipes. Soil pipes shall be painted as provided under 'painting'. The soil pipes shall be covered on top with cast iron terminal outlets as directed and approved. All vertical soil pipes shall be firmly fixed to the walls with properly fixed clamps, and shall as far as possible be kept 50mm clear of wall. Waste pipes and fittings shall be of cast iron or galvanized mild steel pipes. Pipes shall be fixed, jointed and painted as described in installation of soil, waste & vent pipes.
- Every waste pipe shall discharge above the grating of properly trapped gully. The contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided, it shall be ensured that atleast one wash is connected to such floor traps to avoid drying of water seal in the trap. Ventilating pipes shall be of cast iron or galvanized mild steel pipes, conforming to the requirements laid down earlier. Anti-siphon vent pipes/relief vent pipes where called for on the drawings shall be of cast iron or galvanized mild steel pipes as specified. The pipes shall be of the diameter shown on the drawings.
- All traps on branch soil and waste pipes shall also be ventilated at a point not less than 75mm or more than 300mm from their highest part and on the side nearest to the soil pipe or waste pipes.
- Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the Owner in the form of shop drawings so that other agencies are instructed to provide the same.
- All the fittings used for connections between soil, waste and ventilation pipes and

branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3mm thick rubber insertion packing and when closed and bolted shall be air and water tight.

- Where soil, waste and ventilating pipes are accommodated in shafts ducts, adequate access to cleaning eyes shall be provided.
- Head (starting point) of drains and sewage / waste water sumps (as and where applicable) having a length of greater than 4 m upto it connection to the main drain or manhole shall be provided with an 80 / 100 mm vent pipe.

### **3. PIPING MATERIALS**

#### **3.3.1 Soil, Waste and Vent Pipes**

- The soil and waste pipe system above ground has been planned as a “Two pipe system” having separate pipes for waste for kitchen sinks, wash basins, AHU’s, condensate drains and floor drains and soil from the WCs and Urinals, and or a “Single stack system” where all waste and soil pipes are connected to the same stack. Necessary venting shall be done by using Air Admittance valves, to be installed based on manufacturers recommendations.
- All waste water from AHU’s plant and pump rooms, floor channels in basements will be provided with a deep seal trap before connecting to the main drain or vertical stack.
- Vertical soil and waste stacks shall be connected to a separate horizontal drain / single horizontal drain at basement ceiling generally as shown on the drawings.
- Toilet layouts have been so arranged that the W.C outlets shall be with “P” trap above ground level.
- All soil/waste from areas in basement areas will be collected in sumps and pumped into sewer lines or as specifically designed.
- Head (Starting point) of drains and sewage/waste water sumps (as and where applicable) having a length of greater than 4m upto connection to the main drain or manhole shall be provided with a 80/100mmvent pipe terminating above roof / a Maxi-Filtra with an ACF cartridge shall be provided close to the MH as directed by the Project Manager.

### **5. INSTALLATION OF SOIL, WASTE & VENT PIPES**

- Soil, waste & vent pipes in shafts under the floors / suspended below slab shall consist of cast iron pipes as described earlier. Waste pipes from bottle trap to floor/urinal traps for wash basin, urinal and sink shall be GI pipes and fittings.
- All Horizontal pipes running below the slab and along the ceiling shall be fixed on structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating

pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

- All cast iron pipes and fittings shall be jointed with best quality soft pig lead free from all impurities conforming to IS 27.
- Before joining, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten pig lead shall be poured to fill the remainder of the socket in one pouring. The lead then shall be solidly caulked with suitable tools by hammering right round the joints to make up for the shrinkage of the molten metal on cooling and preferably finish 3mm behind the socket face.
- The depth of the lead joints for the cast iron pipes shall be 45mm for the pipes upto 100mm dia and 50mm for the pipes beyond 100mm dia respectively.
- The joint shall not be covered till the pipe line has been tested under pressure. Rest of pipe line shall be covered so as to prevent the expansion and contraction due to variation in temperature.

### **Rainwater Pipes**

- All open terraces shall be drained by rain water down takes.
- Rainwater down takes are separate and independent of the soil and waste system and will discharge into the underground storm water drainage system of the complex.
- Rainwater in open courtyards shall be collected in catch basins and connected to the Storm Water Drains.
- Any dry weather flow from waste appliances, e.g. AHU's pump rooms, waste water sumps shall connected to sewers after traps and not in the storm water drainage systems.

## **6. Soil Waste and Vent Pipes and Fittings above Ground**

### **3.7 Noise Insulated Piping System (POLOPLAST - POLO-KAL NG)**

#### **3.7.1 SOCKET PIPES**

- Three Layer sound insulated Polypropylene piping (PP) system as per ON EN 1451-Part 1-6 & EN 12056 Part 1-5 with 3 layer pipe made of PP-C + PP-MV + PP-C in Blue Ral 5014 (halogen and calcium free) colour, push-fit type, food safe, having high

impact and stiffness, offering sound levels of not more than 21 dBA with POLO clip HS/ 22 dBA with Bismat 2000 clamp /equivalent and 16 dBA with Bismat 1000 clamp/equivalent as per DIN 4109 at a flow rate of 4 l/s and having pipe ring stiffness as per ISO/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density = 1.25gms/cm<sup>3</sup>, elongation = 0.05mm/m0K and tensile strength > 24 N/mm<sup>2</sup>, with all necessary fittings in blue colour, fitted with factory fitted lip ring, having 3 layers, pipes to be painted with ordinary cement paint for external installation:

- INTERNAL LAYER:
- Of PP-C, hot water resistant to 97 degree C, tested in accordance to ON EN 1451-1 and DIN 19560, good heat and corrosion ageing stability as well as high chemical resistance and a smooth pipe inner-surface.
- Color: Blue (halogen and calcium free)
- INTERMEDIATE LAYER:
- Of PP-MV compound reinforced with mineral aggregate, which guarantees greater stiffness and stability.
- Color: Grey.
- EXTERNAL LAYER:
- Of PP-C. With high impact resistance and good weathering resistance.
- Color: Blue (halogen and calcium free).

### 3.7.2 PIPE RING STIFFNESS:

- Pipe ring stiffness would be in accordance with ISO/DIS 9969 and TIGHTNESS as per EN 1277/B and C and DIN 19560.

### 3.7.3 MARKINGS:

- All pipes shall carry the following markings: Batch number; year and week of manufacture; company name; dimension application class; stiffness class, test mark and material details.

### 3.7.4 FITTINGS:

- Single- Layered fitting reinforced with mineral aggregate, made of a Halogen free PP-C-KV synthetic material, a reinforced wall and factory fitted lip ring, hot water resistant upto 95 degree c in accordance to ON EN 1451-PART 1-6 EN 12056 PART 1-5.
- Color: Blue (halogen and calcium free)

### 1.7.5 INSTALLATION:

#### Minimum supporting:

| Nominal outer diameter<br>DN/OD<br>mm | Bracket distance                                     |                                     |
|---------------------------------------|------------------------------------------------------|-------------------------------------|
|                                       | Horizontal pipe routing*)<br>D max. m (max. 15 x da) | Vertical pipe routing*)<br>D max. m |
| 32                                    | 0,5                                                  | 1,50                                |
| 40                                    | 0,6                                                  | 1,50                                |
| 50                                    | 0,75                                                 | 1,50                                |
| 75                                    | 1,10                                                 | 2,00                                |
| 90                                    | 1,35                                                 | 2,00                                |
| 110                                   | 1,65                                                 | 2,00                                |
| 125                                   | 1,85                                                 | 2,00                                |
| 160                                   | 2,40                                                 | 2,00                                |
| 200                                   | 3,00                                                 | 2,00                                |
| 250                                   | 3,00                                                 | 2,00                                |

- The piping system must be clamped properly as required, pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material internally (between pipe and sleeve) covering the pipe to avoid transfer of body and structural borne sounds (refer manufacturer's installation guide lines). The piping must not touch any wall, structure, paneling, false ceiling etc.

### 3.8 Traps

#### 3.8.1 Floor Traps

- Floor traps where specified shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

#### 3.8.2 Urinal Traps

- Urinal traps shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

#### 3.8.3 Cleanout Plugs

- Floor Clean Out and line clean out plugs
- Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, "Y" and on straight runs at such intervals as required as per site conditions. Clean out plugs shall terminate flush with the floor levels. Line clean outs shall be supported with manufacturer provided bracket. They shall be of push fit type of PKNG mane (Poloplast)

**3.9 Drainage under floor/above floor (service floors, basement ceiling etc.) (POLOPLAST - POL-KAL NG (upto 250mm dia / ECO-PLUS Premium above 250mm dia)**

- All drainage lines passing under building, in exposed position above ground e.g. service floors, basement ceiling etc. shall be Multilayered as per details given in sub-clause 3.10 above or shall be as per details given below. Position of such pipes shall generally be shown on the drawings.

**3.10.1 SOCKET PIPES**

- 3 layer technology Polo-Eco Plus Premium 10 pipes and fittings for underground/ misc. drainage applications having external layer of PP-Blend + mineral reinforcement, supporting layer of PP + magnesium silicate and internal in PP with chemical resistance between 2-13pH and ring rigidity of  $\geq 10\text{kN/m}^2$  having OFI certification for longitudinal stability & impermeability of pie connection in line with EN 14741.

**3.10.2 FITTINGS**

- 3-layered reinforced polypropylene (PP) sewage pipes, halogen and lead free, with integral push-fit socket and factory-fitted lip ring, tested and monitored according to the Product Standard EN 1852 - 1. Fittings upto dimension DN/OD 200 are manufactured by injection molding (1-layer), above DN/OD 200 (250 and above)
- the fittings are butt or extrusion welded by the manufacturer. Fabrication of fittings at site shall not be permitted.

**3.10.3 Pipe Joints**

- Field-proven push-fit connection with improved and modified lip ring of high ageing-resistant shall be provided with the pipes and fittings for easy push-fit installation, installation procedure as given in clause 3.10 above shall be followed.

**4.00** The work done shall be measured in running meter for area of work done. The rate shall be for a unit of Running Meter.

**Item No. 78 : Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm<sup>2</sup> working pressure poluthene pipes of the following outside Dia. Low density, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(D) 40mm**

**SECTION-01 : BASIS OF DESIGN**

**1. BASIS OF DESIGN**

- The Plumbing, Sanitary, Drainage System for the project is designed keeping in view

the following:

- Requirement of adequate and equal pressure availability of hot and cold-water lines in Public Toilets, Kitchen and other identified areas.
- Adequate storage of water in underground raw + overhead treated domestic water tanks.
- Provision of firefighting appurtenance such as fire hydrants, hose reel, sprinklers and portable extinguishers.
- Levels of roads / pavements and other services in the area.

#### **Landscape layout.**

- The execution of works and materials used shall be as per the latest relevant I.S. specifications.
- Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

## **2. CONCEPT OF THE SYSTEM**

**The following services are envisaged for the complex:**

- Water Treatment System for meeting the domestic water quality requirement with chemical parameters in acceptable limits as per SP: 35(S&T) 1987 which is considered safe for human consumption.
- Domestic/Flushing water supply through Hydropneumatics system.
- Sewage and Sullage collection system based on IS: 1742 and applicable standards for domestic drainage and connected to Sewage Treatment Plant.
- Storm / Rain water drainage system from various levels of the building and disposal to Rain Water Harvesting System / storm water drain.

## **3. WATER STORAGE & DISTRIBUTION SYSTEM**

### **Water Requirement**

- The water requirement for the project is proposed to be based on the provisions of IS: 1172 and prevalent practice.

### **Source of Water**

- It is expected that part of the daily domestic water requirement for the Complex shall be through municipal mains supply. The rest will be obtained from bore wells.

**Appurtenant**

- Following components shall be included in the water supply system for efficient functioning:
  - v. Automatic air vent
  - vi. Pressure Gauge.

**4. SEWAGE, SULLAGE AND STORM WATER**

- The soil and waste shall be carried down through one pipe drainage system. Independent vent pipe for common soil & water stack is also provided to avoid foul smell entering through trapped gully in WC. Provision of grease trap shall be made for waste water from Kitchen.

**Design Limitations**

- The system is designed considering the following:
  - g. Termination of vent cowl at terrace level.
  - h. Provision of adequate slope for horizontal header pipes for achieving self-cleaning velocity in the pipes.
  - i. Provision of cleanout plug.

**5. WORKMANSHIP**

- The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Owner's Site Representative. All materials and/or Workmanship which in the opinion of the Owner's Site Representative / Architect / Consultant is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith.

**6.MATERIALS**

- All materials shall be best of their kind and shall conform to the latest Indian Standards.
- All materials shall be of approved quality as per samples and origins approved by the Owner's Site Representative / Architect / Consultants.
- As and when required by the Owner's Site Representative / Consultant, the contractor shall arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions or work are found defective or unsound by the Owner's Site Representative / Consultant, the contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Owner's Site Representative / Consultant. To prove that the materials used are as specified the contractor shall furnish the Owner's Site Representative with original vouchers on demand.



**SECTION-04 :: INTERNAL DRAINAGE (SOIL, WASTE, VENT & RAIN WATER PIPES)**

**1 SCOPE**

- The scope of this section comprises the supply, installation, testing and commissioning of internal drainage services.
- Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as required by the drawings, and given in the schedule of quantities.

**2 BASIC PIPING SYSTEM**

- Soil, waste and vent pipes in shafts, ducts and in concealed areas i.e. false ceilings etc. shall consist of cast iron pipes & fittings as called for. In general wastes and vents smaller than and upto 50mm dia shall be of GI.
- The soil pipes shall be circular with a minimum diameter of 100mm. Pipes shall be fixed by means of stout GI clamps in two sections, bolted together, built into the walls, wedged and neatly jointed as directed and approved by the Owner's site representative / Architect. All bends, branches, swan neck and other parts shall conform to the requirement and standards as described for the pipes. Pipes shall be rested against the walls on suitable wooden cradles. Local authority regulations applicable to the installations shall be strictly followed.
- Where indicated, the soil pipes shall be continued upwards without any diminution in its diameter, without any bend or angle to the height shown in the drawings. Joints throughout shall be made with molten lead as described under jointing of cast iron pipes. Soil pipes shall be painted as provided under 'painting'. The soil pipes shall be covered on top with cast iron terminal outlets as directed and approved. All vertical soil pipes shall be firmly fixed to the walls with properly fixed clamps, and shall as far as possible be kept 50mm clear of wall. Waste pipes and fittings shall be of cast iron or galvanized mild steel pipes. Pipes shall be fixed, jointed and painted as described in installation of soil, waste & vent pipes.
- Every waste pipe shall discharge above the grating of properly trapped gully. The contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided, it shall be ensured that atleast one wash is connected to such floor traps to avoid drying of water seal in the trap. Ventilating pipes shall be of cast iron or galvanized mild steel pipes, conforming to the requirements laid down earlier. Anti-siphon vent pipes/relief vent pipes where called for on the drawings shall be of cast iron or galvanized mild steel pipes as specified. The pipes shall be of the diameter shown on the drawings.
- All traps on branch soil and waste pipes shall also be ventilated at a point not less than 75mm or more than 300mm from their highest part and on the side nearest to the soil pipe or waste pipes.

- Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the Owner in the form of shop drawings so that other agencies are instructed to provide the same.
- All the fittings used for connections between soil, waste and ventilation pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3mm thick rubber insertion packing and when closed and bolted shall be air and water tight.
- Where soil, waste and ventilating pipes are accommodated in shafts ducts, adequate access to cleaning eyes shall be provided.
- Head (starting point) of drains and sewage / waste water sumps (as and where applicable) having a length of greater than 4 m upto it connection to the main drain or manhole shall be provided with an 80 / 100 mm vent pipe.

### **3. PIPING MATERIALS**

#### **3.3.1 Soil, Waste and Vent Pipes**

- The soil and waste pipe system above ground has been planned as a "Two pipe system" having separate pipes for waste for kitchen sinks, wash basins, AHU's, condensate drains and floor drains and soil from the WCs and Urinals, and or a "Single stack system" where all waste and soil pipes are connected to the same stack. Necessary venting shall be done by using Air Admittance valves, to be installed based on manufacturers recommendations.
- All waste water from AHU's plant and pump rooms, floor channels in basements will be provided with a deep seal trap before connecting to the main drain or vertical stack.
- Vertical soil and waste stacks shall be connected to a separate horizontal drain / single horizontal drain at basement ceiling generally as shown on the drawings.
- Toilet layouts have been so arranged that the W.C outlets shall be with "P" trap above ground level.
- All soil/waste from areas in basement areas will be collected in sumps and pumped into sewer lines or as specifically designed.
- Head (Starting point) of drains and sewage/waste water sumps (as and where applicable) having a length of greater than 4m upto connection to the main drain or manhole shall be provided with a 80/100mm vent pipe terminating above roof / a Maxi-Filtra with an ACF cartridge shall be provided close to the MH as directed by the Project Manager.

### **5. INSTALLATION OF SOIL, WASTE & VENT PIPES**

- Soil, waste & vent pipes in shafts under the floors / suspended below slab shall consist of cast iron pipes as described earlier. Waste pipes from bottle trap to floor/urinal traps for wash basin, urinal and sink shall be GI pipes and fittings.
- All Horizontal pipes running below the slab and along the ceiling shall be fixed on

structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

- All cast iron pipes and fittings shall be jointed with best quality soft pig lead free from all impurities conforming to IS 27.
- Before joining, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten pig lead shall be poured to fill the remainder of the socket in one pouring. The lead then shall be solidly caulked with suitable tools by hammering right round the joints to make up for the shrinkage of the molten metal on cooling and preferably finish 3mm behind the socket face.
- The depth of the lead joints for the cast iron pipes shall be 45mm for the pipes upto 100mm dia and 50mm for the pipes beyond 100mm dia respectively.
- The joint shall not be covered till the pipe line has been tested under pressure. Rest of pipe line shall be covered so as to prevent the expansion and contraction due to variation in temperature.

#### **Rainwater Pipes**

- All open terraces shall be drained by rain water down takes.
- Rainwater down takes are separate and independent of the soil and waste system and will discharge into the underground storm water drainage system of the complex.
- Rainwater in open courtyards shall be collected in catch basins and connected to the Storm Water Drains.
- Any dry weather flow from waste appliances, e.g. AHU's pump rooms, waste water sumps shall connected to sewers after traps and not in the storm water drainage systems.

### **6. Soil Waste and Vent Pipes and Fittings above Ground**

#### **3.7 Noise Insulated Piping System (POLOPLAST - POLO-KAL NG)**

### 3.7.1 SOCKET PIPES

- Three Layer sound insulated Polypropylene piping (PP) system as per ON EN 1451-Part 1-6 & EN 12056 Part 1-5 with 3 layer pipe made of PP-C + PP-MV + PP-C in Blue Ral 5014 (halogen and calcium free) colour, push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 21 dBA with POLO clip HS/ 22 dBA with Bismat 2000 clamp /equivalent and 16 dBA with Bismat 1000 clamp/equivalent as per DIN 4109 at a flow rate of 4 l/s and having pipe ring stiffness as per ISO/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density = 1.25gms/cm<sup>3</sup>, elongation = 0.05mm/m0K and tensile strength > 24 N/mm<sup>2</sup>, with all necessary fittings in blue colour, fitted with factory fitted lip ring, having 3 layers, pipes to be painted with ordinary cement paint for external installation:
- INTERNAL LAYER:
- Of PP-C, hot water resistant to 97 degree C, tested in accordance to ON EN 1451-1 and DIN 19560, good heat and corrosion ageing stability as well as high chemical resistance and a smooth pipe inner-surface.
- Color: Blue (halogen and calcium free)
- INTERMEDIATE LAYER:
- Of PP-MV compound reinforced with mineral aggregate, which guarantees greater stiffness and stability.
- Color: Grey.
- EXTERNAL LAYER:
- Of PP-C. With high impact resistance and good weathering resistance.
- Color: Blue (halogen and calcium free).

### 3.7.2 PIPE RING STIFFNESS:

- Pipe ring stiffness would be in accordance with ISO/DIS 9969 and TIGHTNESS as per EN 1277/B and C and DIN 19560.

### 3.7.3 MARKINGS:

- All pipes shall carry the following markings: Batch number; year and week of manufacture; company name; dimension application class; stiffness class, test mark and material details.

### 3.7.4 FITTINGS:

- Single- Layered fitting reinforced with mineral aggregate, made of a Halogen free PP-C-KV synthetic material, a reinforced wall and factory fitted lip ring, hot water resistant upto 95 degree c in accordance to ON EN 1451-PART 1-6 EN 12056 PART 1-5.
- Color: Blue (halogen and calcium free)

### 3.7.5 INSTALLATION:

- The piping system must be clamped properly as required, pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material internally (between pipe and sleeve) covering the pipe to avoid transfer of body and structural borne sounds (refer manufacturer's installation guide lines). The piping must not touch any wall, structure, paneling, false ceiling etc.

#### Minimum supporting:

| Nominal outer diameter<br>DN/OD<br>mm | Bracket distance                                       |                                     |
|---------------------------------------|--------------------------------------------------------|-------------------------------------|
|                                       | Horizontal pipe routing*)<br>D max. m (max. 1.5 x dia) | Vertical pipe routing*)<br>D max. m |
| 32                                    | 0,5                                                    | 1,50                                |
| 40                                    | 0,6                                                    | 1,50                                |
| 50                                    | 0,75                                                   | 1,50                                |
| 75                                    | 1,10                                                   | 2,00                                |
| 90                                    | 1,30                                                   | 2,00                                |
| 110                                   | 1,65                                                   | 2,00                                |
| 125                                   | 1,85                                                   | 2,00                                |
| 160                                   | 2,40                                                   | 2,00                                |
| 200                                   | 3,00                                                   | 2,00                                |
| 250                                   | 3,00                                                   | 2,00                                |

## 3.8 Traps

### 3.8.1 Floor Traps

- Floor traps where specified shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

### 3.8.2 Urinal Traps

- Urinal traps shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

### 3.8.3 Cleanout Plugs

- Floor Clean Out and line clean out plugs
- Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, "Y" and on straight runs at such intervals as required as per site conditions. Clean out plugs shall terminate flush with the floor levels. Line clean outs shall be supported with manufacturer provided bracket. They shall be of push fit type of PKNG mane (Poloplast)

**3.9 Drainage under floor/above floor (service floors, basement ceiling etc.) (POLOPLAST - POL-KAL NG (upto 250mm dia / ECO-PLUS Premium above 250mm dia)**

- All drainage lines passing under building, in exposed position above ground e.g. service floors, basement ceiling etc. shall be Multilayered as per details given in sub-clause 3.10 above or shall be as per details given below. Position of such pipes shall generally be shown on the drawings.

**3.10.1 SOCKET PIPES**

- 3 layer technology Polo-Eco Plus Premium 10 pipes and fittings for underground/ misc. drainage applications having external layer of PP-Blend + mineral reinforcement, supporting layer of PP + magnesium silicate and internal in PP with chemical resistance between 2-13pH and ring rigidity of  $\geq 10\text{kN/m}^2$  having OFI certification for longitudinal stability & impermeability of pie connection in line with EN 14741.

**3.10.2 FITTINGS**

- 3-layered reinforced polypropylene (PP) sewage pipes, halogen and lead free, with integral push-fit socket and factory-fitted lip ring, tested and monitored according to the Product Standard EN 1852 - 1. Fittings upto dimension DN/OD 200 are manufactured by injection molding (1-layer), above DN/OD 200 (250 and above)
- the fittings are butt or extrusion welded by the manufacturer. Fabrication of fittings at site shall not be permitted.

**3.10.3 Pipe Joints**

- Field-proven push-fit connection with improved and modified lip ring of high ageing-resistant shall be provided with the pipes and fittings for easy push-fit installation, installation procedure as given in clause 3.10 above shall be followed.

**4.00** The work done shall be measured in running meter for area of work done. The rate shall be for a unit of Running Meter.

**Item No. 79 : Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm<sup>2</sup> working pressure poluthene pipes of the following outside Dia. Low density, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(E) 50mm**

**SECTION-01 : BASIS OF DESIGN**

**1. BASIS OF DESIGN**

- The Plumbing, Sanitary, Drainage System for the project is designed keeping in view the following:
- Requirement of adequate and equal pressure availability of hot and cold water lines in Public Toilets, Kitchen and other identified areas.
- Adequate storage of water in underground raw + overhead treated domestic water tanks.
- Provision of firefighting appurtenance such as fire hydrants, hose reel, sprinklers and portable extinguishers.
- Levels of roads / pavements and other services in the area.

#### **Landscape layout.**

- The execution of works and materials used shall be as per the latest relevant I.S. specifications.
- Wherever reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

## **2. CONCEPT OF THE SYSTEM**

**The following services are envisaged for the complex:**

- Water Treatment System for meeting the domestic water quality requirement with chemical parameters in acceptable limits as per SP: 35(S&T) 1987 which is considered safe for human consumption.
- Domestic/Flushing water supply through Hydropneumatics system.
- Sewage and Sullage collection system based on IS: 1742 and applicable standards for domestic drainage and connected to Sewage Treatment Plant.
- Storm / Rain water drainage system from various levels of the building and disposal to Rain Water Harvesting System / storm water drain.

## **3. WATER STORAGE & DISTRIBUTION SYSTEM**

### **Water Requirement**

- The water requirement for the project is proposed to be based on the provisions of IS: 1172 and prevalent practice.

### **Source of Water**

- It is expected that part of the daily domestic water requirement for the Complex shall

be through municipal mains supply. The rest will be obtained from bore wells.

#### **Appurtenant**

- Following components shall be included in the water supply system for efficient functioning:
  - vii. Automatic air vent
  - viii. Pressure Gauge.

#### **4. SEWAGE, SULLAGE AND STORM WATER**

- The soil and waste shall be carried down through one pipe drainage system. Independent vent pipe for common soil & water stack is also provided to avoid foul smell entering through trapped gully in WC. Provision of grease trap shall be made for waste water from Kitchen.

#### **Design Limitations**

- The system is designed considering the following:
  - j. Termination of vent cowl at terrace level.
  - k. Provision of adequate slope for horizontal header pipes for achieving self-cleaning velocity in the pipes.
  - l. Provision of cleanout plug.

#### **5. WORKMANSHIP**

- The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Owner's Site Representative. All materials and/or Workmanship which in the opinion of the Owner's Site Representative / Architect / Consultant is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith.

#### **6. MATERIALS**

- All materials shall be best of their kind and shall conform to the latest Indian Standards.
- All materials shall be of approved quality as per samples and origins approved by the Owner's Site Representative / Architect / Consultants.
- As and when required by the Owner's Site Representative / Consultant, the contractor shall arrange to test the materials and/or portions of works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions or work are found defective or unsound by the Owner's Site Representative / Consultant, the contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Owner's Site Representative /



Consultant. To prove that the materials used are as specified the contractor shall furnish the Owner's Site Representative with original vouchers on demand.

**SECTION-04 :: INTERNAL DRAINAGE (SOIL, WASTE, VENT & RAIN WATER PIPES)**

**1 SCOPE**

- The scope of this section comprises the supply, installation, testing and commissioning of internal drainage services.
- Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as required by the drawings, and given in the schedule of quantities.

**2 BASIC PIPING SYSTEM**

- Soil, waste and vent pipes in shafts, ducts and in concealed areas i.e. false ceilings etc. shall consist of cast iron pipes & fittings as called for. In general wastes and vents smaller than and upto 50mm dia shall be of GI.
- The soil pipes shall be circular with a minimum diameter of 100mm. Pipes shall be fixed by means of stout GI clamps in two sections, bolted together, built into the walls, wedged and neatly jointed as directed and approved by the Owner's site representative / Architect. All bends, branches, swan neck and other parts shall conform to the requirement and standards as described for the pipes. Pipes shall be rested against the walls on suitable wooden cradles. Local authority regulations applicable to the installations shall be strictly followed.
- Where indicated, the soil pipes shall be continued upwards without any diminution in its diameter, without any bend or angle to the height shown in the drawings. Joints throughout shall be made with molten lead as described under jointing of cast iron pipes. Soil pipes shall be painted as provided under 'painting'. The soil pipes shall be covered on top with cast iron terminal outlets as directed and approved. All vertical soil pipes shall be firmly fixed to the walls with properly fixed clamps, and shall as far as possible be kept 50mm clear of wall. Waste pipes and fittings shall be of cast iron or galvanized mild steel pipes. Pipes shall be fixed, jointed and painted as described in installation of soil, waste & vent pipes.
- Every waste pipe shall discharge above the grating of properly trapped gully. The contractor will ensure that this requirement is adequately met with. Wherever floor traps are provided, it shall be ensured that atleast one wash is connected to such floor traps to avoid drying of water seal in the trap. Ventilating pipes shall be of cast iron or galvanized mild steel pipes, conforming to the requirements laid down earlier. Anti-siphon vent pipes/relief vent pipes where called for on the drawings shall be of cast iron or galvanized mild steel pipes as specified. The pipes shall be of the diameter shown on the drawings.
- All traps on branch soil and waste pipes shall also be ventilated at a point not less than

75mm or more than 300mm from their highest part and on the side nearest to the soil pipe or waste pipes.

- Access doors for fittings and clean outs shall be so located that they are easily accessible for repair and maintenance. Any access panel required in the civil structure, false ceiling or marble cladding etc. shall be clearly reported to the Owner in the form of shop drawings so that other agencies are instructed to provide the same.
- All the fittings used for connections between soil, waste and ventilation pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. The doors shall be provided with 3mm thick rubber insertion packing and when closed and bolted shall be air and water tight.
- Where soil, waste and ventilating pipes are accommodated in shafts ducts, adequate access to cleaning eyes shall be provided.
- Head (starting point) of drains and sewage / waste water sumps (as and where applicable) having a length of greater than 4 m upto it connection to the main drain or manhole shall be provided with an 80 / 100 mm vent pipe.

### **3. PIPING MATERIALS**

#### **3.3.1 Soil, Waste and Vent Pipes**

- The soil and waste pipe system above ground has been planned as a "Two pipe system" having separate pipes for waste for kitchen sinks, wash basins, AHU's, condensate drains and floor drains and soil from the WCs and Urinals, and or a "Single stack system" where all waste and soil pipes are connected to the same stack. Necessary venting shall be done by using Air Admittance valves, to be installed based on manufacturers recommendations.
- All waste water from AHU's plant and pump rooms, floor channels in basements will be provided with a deep seal trap before connecting to the main drain or vertical stack.
- Vertical soil and waste stacks shall be connected to a separate horizontal drain / single horizontal drain at basement ceiling generally as shown on the drawings.
- Toilet layouts have been so arranged that the W.C outlets shall be with "P" trap above ground level.
- All soil/waste from areas in basement areas will be collected in sumps and pumped into sewer lines or as specifically designed.
- Head (Starting point) of drains and sewage/waste water sumps (as and where applicable) having a length of greater than 4m upto connection to the main drain or manhole shall be provided with a 80/100mm vent pipe terminating above roof / a Maxi-Filtra with an ACF cartridge shall be provided close to the MH as directed by the Project Manager.

### **5. INSTALLATION OF SOIL, WASTE & VENT PIPES**

- Soil, waste & vent pipes in shafts under the floors / suspended below slab shall consist

of cast iron pipes as described earlier. Waste pipes from bottle trap to floor/urinal traps for wash basin, urinal and sink shall be GI pipes and fittings.

- All Horizontal pipes running below the slab and along the ceiling shall be fixed on structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.
- All cast iron pipes and fittings shall be jointed with best quality soft pig lead free from all impurities conforming to IS 27.
- Before joining, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten pig lead shall be poured to fill the remainder of the socket in one pouring. The lead then shall be solidly caulked with suitable tools by hammering right round the joints to make up for the shrinkage of the molten metal on cooling and preferably finish 3mm behind the socket face.
- The depth of the lead joints for the cast iron pipes shall be 45mm for the pipes upto 100mm dia and 50mm for the pipes beyond 100mm dia respectively.
- The joint shall not be covered till the pipe line has been tested under pressure. Rest of pipe line shall be covered so as to prevent the expansion and contraction due to variation in temperature.

### **Rainwater Pipes**

- All open terraces shall be drained by rain water down takes.
- Rainwater down takes are separate and independent of the soil and waste system and will discharge into the underground storm water drainage system of the complex.
- Rainwater in open courtyards shall be collected in catch basins and connected to the

Storm Water Drains.

- Any dry weather flow from waste appliances, e.g. AHU's pump rooms, waste water sumps shall connected to sewers after traps and not in the storm water drainage systems.

## **6. Soil Waste and Vent Pipes and Fittings above Ground**

### **3.7 Noise Insulated Piping System (POLOPLAST - POLO-KAL NG)**

- **3.7.1 SOCKET PIPES**
- Three Layer sound insulated Polypropylene piping (PP) system as per ON EN 1451-Part 1-6 & EN 12056 Part 1-5 with 3 layer pipe made of PP-C + PP-MV + PP-C in Blue Ral 5014 (halogen and calcium free) colour, push-fit type, food safe, having high impact and stiffness, offering sound levels of not more than 21 dBA with POLO clip HS/ 22 dBA with Bismat 2000 clamp /equivalent and 16 dBA with Bismat 1000 clamp/equivalent as per DIN 4109 at a flow rate of 4 l/s and having pipe ring stiffness as per ISO/DIS 9969 and tightness as per EN 1277/B and C and DIN 19560, density = 1.25gms/cm<sup>3</sup>, elongation = 0.05mm/m0K and tensile strength > 24 N/mm<sup>2</sup>, with all necessary fittings in blue colour, fitted with factory fitted lip ring, having 3 layers, pipes to be painted with ordinary cement paint for external installation:
- **INTERNAL LAYER:**
- Of PP-C, hot water resistant to 97 degree C, tested in accordance to ON EN 1451-1 and DIN 19560, good heat and corrosion ageing stability as well as high chemical resistance and a smooth pipe inner-surface.
- Color: Blue (halogen and calcium free)
- **INTERMEDIATE LAYER:**
- Of PP-MV compound reinforced with mineral aggregate, which guarantees greater stiffness and stability.
- Color: Grey.
- **EXTERNAL LAYER:**
- Of PP-C. With high impact resistance and good weathering resistance.
- Color: Blue (halogen and calcium free).

#### **3.7.2 PIPE RING STIFFNESS:**

- Pipe ring stiffness would be in accordance with ISO/DIS 9969 and TIGHTNESS as per EN 1277/B and C and DIN 19560.

#### **3.7.3 MARKINGS:**

- All pipes shall carry the following markings: Batch number; year and week of manufacture; company name; dimension application class; stiffness class, test mark and material details.

### 3.7.4 FITTINGS:

- Single- Layered fitting reinforced with mineral aggregate, made of a Halogen free PP-C-KV synthetic material, a reinforced wall and factory fitted lip ring, hot water resistant upto 95 degree c in accordance to ON EN 1451-PART 1-6 EN 12056 PART 1-5.
- Color: Blue (halogen and calcium free)

### 3.7.5 INSTALLATION:

- The piping system must be clamped properly as required, pipes passing through walls, beams, slabs, columns should pass through sleeves which are padded with insulation material internally (between pipe and sleeve) covering the pipe to avoid transfer of body and structural borne sounds (refer manufacturer's installation guide lines). The piping must not touch any wall, structure, paneling, false ceiling etc.

#### Minimum supporting:

| Nominal outer diameter<br>DN/OD<br>mm | Bracket distance                                      |                                     |
|---------------------------------------|-------------------------------------------------------|-------------------------------------|
|                                       | Horizontal pipe routing*)<br>D max. m (max. 1.5 x da) | Vertical pipe routing*)<br>D max. m |
| 32                                    | 0,5                                                   | 1,50                                |
| 40                                    | 0,6                                                   | 1,50                                |
| 50                                    | 0,75                                                  | 1,50                                |
| 75                                    | 1,10                                                  | 2,00                                |
| 90                                    | 1,35                                                  | 2,00                                |
| 110                                   | 1,65                                                  | 2,00                                |
| 125                                   | 1,85                                                  | 2,00                                |
| 160                                   | 2,40                                                  | 2,00                                |
| 200                                   | 3,00                                                  | 2,00                                |
| 250                                   | 3,00                                                  | 2,00                                |

## 3.8 Traps

### 3.8.1 Floor Traps

- Floor traps where specified shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

### 3.8.2 Urinal Traps

- Urinal traps shall be siphon type full bore PP (WHITE), McAlpine, UK having a minimum 50 mm deep seal. All traps are under slung from the slab and shall be adequately supported.

### 3.8.3 Cleanout Plugs

- Floor Clean Out and line clean out plugs
- Clean out plug for soil, waste or rain water pipes laid under floors shall be provided near pipe junctions bends, tees, "Y" and on straight runs at such intervals as required as per site conditions. Clean out plugs shall terminate flush with the floor levels. Line clean outs shall be supported with manufacturer provided bracket. They shall be of push fit type of PKNG mane (Poloplast)

### 3.9 Drainage under floor/above floor (service floors, basement ceiling etc.) (POLOPLAST - POL-KAL NG (upto 250mm dia / ECO-PLUS Premium above 250mm dia)

- All drainage lines passing under building, in exposed position above ground e.g. service floors, basement ceiling etc. shall be Multilayered as per details given in sub-clause 3.10 above or shall be as per details given below. Position of such pipes shall generally be shown on the drawings.

#### 3.10.1 SOCKET PIPES

- 3 layer technology Polo-Eco Plus Premium 10 pipes and fittings for underground/ misc. drainage applications having external layer of PP-Blend + mineral reinforcement, supporting layer of PP + magnesium silicate and internal in PP with chemical resistance between 2-13pH and ring rigidity of  $\geq 10\text{kN/m}^2$  having OFI certification for longitudinal stability & impermeability of pie connection in line with EN 14741.

#### 3.10.2 FITTINGS

- 3-layered reinforced polypropylene (PP) sewage pipes, halogen and lead free, with integral push-fit socket and factory-fitted lip ring, tested and monitored according to the Product Standard EN 1852 - 1. Fittings upto dimension DN/OD 200 are manufactured by injection molding (1-layer), above DN/OD 200 (250 and above)
- the fittings are butt or extrusion welded by the manufacturer. Fabrication of fittings at site shall not be permitted.

#### 3.10.3 Pipe Joints

- Field-proven push-fit connection with improved and modified lip ring of high ageing-resistant shall be provided with the pipes and fittings for easy push-fit installation, installation procedure as given in clause 3.10 above shall be followed.

**4.00** The work done shall be measured in running meter for area of work done. The rate shall be for a unit of Running Meter.

**Item No. 80 : Providing and fixing S.W. gully trap with C.I. grating brick masonry chamber and water tight C.I. cover with frame of 300mm x 300mm size (inside) with standard**

**weight.(i) Square mouth traps.(B) 150mm x 100mm size P or R type**

**1. Workmanship:**

- The relevant specification for this item shall be followed as per Item No. 24.19 (I), Page No. 156 of G.T.S Booklet for building works.

**2. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall be for a unit of one Number.

**Item No. 81 : Providing and fixing 6mm thick frame less mirror of approve make in any shape and sizes as per drawing. Mirror shall be fixed on 12mm thick cement fiber board backing. Cement fiber board shall be fixed to wall with approved SS 304 fastener. All edges of glass shall be sharp grinded, cute corner and polished. Glass shall be fixed with silicon sealant/ 3M tape etc complete at all floors/ all levels/ all heights as directed by EIC. Installed area of mirror shall be considered for payment without wastage.**

**1. Material:**

- The 600 x 450 mm. size mirror shall be of superior glass with edge rounded off or bevelled as specified. It shall be free from flaws specks, or bubbles and its thickness shall not be less than 6 mm. The glass for the mirror shall be uniformly silver plated at the back and shall be free from silvering defects. Silvering shall have a protective uniform covering of red-lead paint. The 6 mm. thick plywood shall conform to M-37.
- The 6 mm. thick A. C. Sheets shall conform to M-24.

**2. Workmanship:**

- The mirror of 500 mm.x450mm. size mounted on A.C. sheet orplywood6mm. thick with. C.P.brass clips shall be fixed as directed, by fixing wooden plugs in wall and C. P. brass screws and washers. The work shall be carried out in best workman like manner.

**3. Measurements:**

- The rate shall be consolidated for all above items.
- The rate shall include the cost of all materials, labour, scaffolding etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The work done shall be measured in Number for area of work done. The rate shall be for a unit of one Number.

- The rate shall be consolidated for all above items.
- The relevant specifications of item No. 5.8.1. shall be followed.
- The rate shall include the cost of all labour, scaffolding, etc. to complete the whole work satisfactorily as per instruction of EIC/ Architect.
- No extra payment will be given for any of the reasons.
- The rate shall be for a unit of One Cubic Meter.



**APPROVED MAKES**  
**CIVIL-INTERIOR-PLUMBING**

| Sr. No. | Details of Materials /Equipment                   | Manufacture's Name                                                                                                                                                                          |
|---------|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | ANTI - TERMITE TREATMENT                          | BAYER-PREMISE, RALLIS INDIA-TERMEX, PEST CONTROL INDIA LTD., IN CASE PCI IS NOT ABLE TO UNDERTAKE THE WORK, IT SHOULD BE DONE BY PERMANENT MEMBERS OF IPCA AS APPROVED BY ENGR -IN- CHARGE. |
| 2       | CONCRETE ADDITIVE                                 | SIKA/ / FOSROC / BASF / THERMAX LIMITED / SUPREME                                                                                                                                           |
| 3       | GLASS                                             | AIS / ST.GOBIAN / PILKINTON / GOLD PLUS                                                                                                                                                     |
|         | GLASS PROCESSOR                                   | GOLD PLUS / TPRS / FUSO                                                                                                                                                                     |
| 4       | ADHESIVE FOR DOOR WORK                            | FEVICOL/VAMICOL/DUNLOP / ARALDITE                                                                                                                                                           |
| 5       | CURTAIN ROD/ DARPI ROD                            | VISTA / DECOR / DECK / HUNTER DOUGLAS                                                                                                                                                       |
| 6       | ROLLER BLINDS                                     | VISTA / DECOR / DECK / HUNTER DOUGLAS                                                                                                                                                       |
| 7       | DASH FASTENERS                                    | HILTI / KONCEPT M / FISCHER / BOSCH                                                                                                                                                         |
| 8       | DOOR LOCKS                                        | DORMA / GEZE / KICH                                                                                                                                                                         |
| 9       | DOORS & WINDOWS FIXTURES/ FITTING                 | DORMA / GEZE / KICH                                                                                                                                                                         |
| 10      | FLUSH DOOR SHUTTERS NON-DECORATIVE TYPE           | SHARDA / GREEN PLY / AIROLAM                                                                                                                                                                |
| 11      | FLUSH DOOR SHUTTERS DECORATIVE TYPE               | SHARDA / GREEN PLY / AIROLAM                                                                                                                                                                |
| 12      | HARDWARE                                          | DORMA / GEZE / KICH                                                                                                                                                                         |
| 13      | LAMINATES                                         | MARINO/GREENLAM/CENTURY/GREEN/ AIROLAM                                                                                                                                                      |
| 14      | VINEER                                            | DURO/ GREENLAM / AIROLAM                                                                                                                                                                    |
| 15      | PLYWOOD/ BLOCKBOARD/ PLY BOARD                    | DURION / CENTURY / GREEN / AIROLAM                                                                                                                                                          |
| 16      | PRE- LAMINATED PARTICLE BOARD                     | DURO/ GREENLAM / ARCHIDPLY                                                                                                                                                                  |
| 17      | MDF BOARD                                         | DURO/ GREENLAM / ARCHIDPLY                                                                                                                                                                  |
| 18      | STAINLESS STEEL D- HANDLES                        | D- LINE / KONCEPT / DORMA / KICH / GEZE                                                                                                                                                     |
| 19      | VENEERED PARTICLE BOARD                           | DURO/ GREENPLY/ ARCHIDPLY                                                                                                                                                                   |
| 20      | DEAD LOCK                                         | DORMA / GEZE / HAFFLE / KICH / BECKAR                                                                                                                                                       |
| 21      | PANIC DEVICE 1 & 2 POINT                          | DORMA / GEZE / HAFFLE / KICH / BECKAR                                                                                                                                                       |
| 22      | ACOUSTICAL SEAL                                   | DORMA / GEZE / HAFFLE / KICH / BECKAR                                                                                                                                                       |
| 23      | DOOR CLOSER                                       | DORMA / GEZE / HAFFLE / KICH / BECKAR                                                                                                                                                       |
| 24      | DOOR STOPPER                                      | DORMA / GEZE / HAFFLE / KICH / BECKAR                                                                                                                                                       |
| 25      | TOP & BOTTOM PATCH                                | DORMA / GEZE / HAFFLE / KICH / BECKAR                                                                                                                                                       |
| 26      | UPVC DOOR & WINDOW                                | PSP / NCL WINTech / LOTUS / ENCRFT / DECK                                                                                                                                                   |
| 27      | M.S. STRUCTURAL WORKS                             | TATA/ RINL/SAIL/ JSPL                                                                                                                                                                       |
| 28      | ANTISTATIC EPOXY FLOOR                            | FOSROC/ BASF/ CICO/ SIKA/ PIDILITE / THERMAX                                                                                                                                                |
| 29      | CERAMIC TILES                                     | JOHNSON / RAK / EMCER / SIMPOLO (SUPPLY TO BE MADE FROM THEIR AUTHORIZED WHOLSALE DEALER)                                                                                                   |
| 30      | PVC FLOORING                                      | POLYFLOR / ARMSTRONG / GERFLOOR / FORBO                                                                                                                                                     |
| 31      | VITRIFIED TILES                                   | JOHNSON / RAK / EMCER / SIMPOLO (SUPPLY TO BE MADE FROM THEIR AUTHORIZED WHOLSALE DEALER)                                                                                                   |
| 32      | ENGINEERED WOODEN FLOORING / BAMBOO WOOD FLOORING | INTERCRAFTS INDIA / GREENLAM / JUNKER / ARMSTRONG / SQUERFOOT / EPITOME / FLOOR INDIA / ECO PRODUCTS INTERNATIONAL LTD.                                                                     |
| 33      | POLYCARBONATE SHEETS                              | DPI / GE / Polygel (ALL STANDING SEAMLESS TYPE)                                                                                                                                             |

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| 34 | CEMENT BASED PAINTS                             | ALL TYPES OF PAINTS I.E. CEMENT BASED PAINTS, OIL BOUND DISTEMPER, ACRYLIC PAINTS, PLASTIC EMULSION PAINTS ETC SHALL BE FIRST QUALITY OF MAKES BERGER, NEROLAC, ULTRATECH, JOTUN, SHIRWIN WILLIAMS MAKE, FOR CEMENT BASED PAINT ADD SNOWCEM PLUS AND TATACEM MAKE. |
| 35 | CEMENT PAINT                                    |                                                                                                                                                                                                                                                                    |
| 36 | DRY DISTEMPER                                   |                                                                                                                                                                                                                                                                    |
| 37 | OIL BOUND DISTEMPER/ ACRYLIC WASHABLE DISTEMPER |                                                                                                                                                                                                                                                                    |
| 38 | OTHER PAINTS/ PRIMER                            |                                                                                                                                                                                                                                                                    |
| 39 | SYNTHETIC ENAMEL PAINTS                         |                                                                                                                                                                                                                                                                    |
| 40 | RESIN BASED PAINTS                              |                                                                                                                                                                                                                                                                    |
| 41 | EXTERNAL EMULSION PAINT                         | BERGER, NEROLAC, ULTRATECH, JOTUN, SHIRWIN WILLIAMS                                                                                                                                                                                                                |
| 42 | TEXTURE PAINT                                   | BERGER, NEROLAC, ULTRATECH, JOTUN, SHIRWIN WILLIAMS                                                                                                                                                                                                                |
| 43 | PLASTIC EMULSION PAINT                          | BERGER, NEROLAC, ULTRATECH, JOTUN, SHIRWIN WILLIAMS                                                                                                                                                                                                                |
| 44 | EPOXY PAINT                                     | BERGER, NEROLAC, ULTRATECH, JOTUN, SHIRWIN WILLIAMS                                                                                                                                                                                                                |
| 45 | GYPSUM BOARD                                    | ST. GOBAIN (GYPROC)/ GYPSUM INDIA LTD./ INDIA GYPSUM / LAFFARGE / BORAL / KNOF / GYPSTONE / BERAL GYPSUM                                                                                                                                                           |
| 46 | METAL FALSE CEILING                             | INTERCRAFT INDIA / NEWAGE / DURLUM / LINDNER / HUNTEDUGLAS / DEXUNE                                                                                                                                                                                                |
| 47 | CALCIUM CILICATE CEILING                        | INTERCRAFT INDIA / AEROLITE, KNOF-AQUATECH, NEWTONE, MYLAR                                                                                                                                                                                                         |
| 48 | MINERAL FIBRE CEILING                           | INTERCRAFT INDIA / NEWAGE / DURLUM / LINDNER / HUNTEDUGLAS / DEXUNE                                                                                                                                                                                                |
| 49 | MODULAR SS RAILING SYSTEM                       | D Line/Q Line / JINDAL/KONCEPT/RINOX/DORMA                                                                                                                                                                                                                         |
| 50 | POLYSULPHIDE SEALANT                            | BASF / PIDILITE/ FOSROC/ CHOKSEY/ CICO /SIKA                                                                                                                                                                                                                       |
| 51 | MODULAR TOILET CUBICALS                         | GREENLAM / SONEAR / CENTURY / TRAESPA                                                                                                                                                                                                                              |
| 52 | FIRE DOOR (WOODEN / METAL)                      | NAVAIR / GODREJ / PROMATE                                                                                                                                                                                                                                          |
| 53 | FIRE RATED GLASS                                | SANTGOBAIN GLASS / PILKINGTON / ASAHI / MODIGUARD / GUARDIAN                                                                                                                                                                                                       |
| 54 | GRC                                             | BIRLA / SANDERSON / TERRA FIRMA DEVELOPMENTS PVT.LTD. / NITCO                                                                                                                                                                                                      |
| 55 | REINFORCEMENT BAR                               | TATA/ RINL/ SAIL/ JSPL                                                                                                                                                                                                                                             |
| 56 | WATER PROOFING COMPOUND                         | BASF / THERMAX / FOSROC / SIKA / SUPREME                                                                                                                                                                                                                           |
| 57 | WEATHER SEALANT                                 | BASF / THERMAX / FOSROC / SIKA / SUPREME                                                                                                                                                                                                                           |
| 58 | EPOXY GROUTING                                  | MYK LATIKRATE / DUBOND / SEMITRONE                                                                                                                                                                                                                                 |
| 59 | CLADDING STONE                                  | AS PER APPROVED SAMPLE BY CLEINT/ .ITECT/EIC                                                                                                                                                                                                                       |
| 60 | COMPOSITE MARBLE                                | NITCO/JOHNSON/CLASSIC/STONEX                                                                                                                                                                                                                                       |
| 61 | MOSAIC                                          | BISAZZA / PERL / NITCO                                                                                                                                                                                                                                             |
| 62 | HPL SHEET WITH ALL ALUMINUM FIXTURES            | ARCHIEDLAM / CENTURLAM / FUNDERMAX / GREENLAM                                                                                                                                                                                                                      |
| 63 | CARPET FLOORING                                 | FLOTEX / MODULYSS / CARUS                                                                                                                                                                                                                                          |
| 64 | FALSE FLOORING                                  | UNITILE / ARMSTRONG / FORBO                                                                                                                                                                                                                                        |
| 65 | PAVER BLOCK                                     | KK MANHOLES / UNI STONE PRODUCTS (INDIA) PVT. LTD/ HINDUSTAN TILES                                                                                                                                                                                                 |
| 66 | CEMENT SHEET                                    | EVEREST / RAMCO / KAMDHENU                                                                                                                                                                                                                                         |
| 67 | ACOUSTICS PANELLING                             | HIMALYAN ACOUSTICS / HERA DESIGEN / BAUX                                                                                                                                                                                                                           |
| 68 | FABRIC                                          | D- DECOR / PHIFER / MAK                                                                                                                                                                                                                                            |
| 69 | GLASS FILM                                      | 3M DINOC FILM, AVERY, GARVEY                                                                                                                                                                                                                                       |
| 70 | ARTIFICIAL GRASS                                | ECOSOFT, NAMGRASS, ETURRF                                                                                                                                                                                                                                          |
| 71 | INSULATION BOARD                                | STYOF OAM, ISO BOARD, FOAMULAR                                                                                                                                                                                                                                     |
| 72 | EXTRUDED POLYSTYRENE INSULATION BOARDS          | OWENS CORNING, DOW CORNING, STYROFOAM, SIKKA                                                                                                                                                                                                                       |

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| 73  | ALUMINIUM SECTIONS                                            | HINDALCO /DOMAL/SAPA                                                                                               |
| 74  | DOOR CLOSER / FLOOR SPRING                                    | DORMA / GEZE / KICH                                                                                                |
| 75  | GLASS DOORS (MOTORISED)                                       | MODI GUARD , ST.GOBIAN, AIS                                                                                        |
| 76  | NIGHT LATCH                                                   | DORMA / GEZE / . / KICH                                                                                            |
| 77  | CEMENT (OPC)                                                  | ACC (ASSOCIATED CEMENT CO.)/ULTRA TECH /GUJRAT AMBUJA CEMENT/JK/L&T /JP/CEMENT                                     |
| 78  | READY MIX CONCRETE                                            | ACC (ASSOCIATED CEMENT CO.) RMC / ULTRA TECH RMC / NUVOCO RMC (Laffarge Cement) / PRISM RMC (QCI CERTIFIED PLANTS) |
| 79  | WHITE CEMENT                                                  | BIRLA WHITE / J.K. / GRASIM                                                                                        |
| 80  | ACP                                                           | ALUCOBOND / RENUBOND / ALPOLIC / ALSTONE                                                                           |
| 81  | MODULAR FURNITURE                                             | FEATHERLITE / HOF / GODREJ / HAWORTH / VITRA / BENE / SPACE DESIGN                                                 |
| 82  | CHAIR                                                         | FEATHERLITE / HOF / GODREJ / HAWORTH / VITRA / BENE / SPACE DESIGN                                                 |
| 83  | CUSTOMIZE FURNITURE                                           | CASA PARADOX / K2 INDIA / HOUSE OF RARO / CONCEPTS & CREATION                                                      |
| 84  | COMPACTORS                                                    | WIPRO,FEATHERLITE,GODREJ, WALDNER,HNI                                                                              |
| 85  | EXPANSION JOINT FILLING                                       | THREE R JOINT & SEALS / SAND FIELD / KANTA FLEX / VEXKOLT / CONSTRUCTION SPECIALTIES                               |
| 86  | LAB FURNITURE                                                 | KEWAUNEE / WALDNER /CITIZEN / GODREJ / HNI                                                                         |
| 87  | CEMENT BOARD / CEMENT FIBER BOARD                             | VISAKA INDUSTRIES / HIL / EVREST                                                                                   |
| 88  | GLASS WOOL                                                    | U.P.TWIGA/KIMMCO/ISOVER/JHON MANWILS                                                                               |
| 89  | ROCKWOOL                                                      | LLOYD INSULATION / DHANBAD ROCK WOOL INSULATION PVT.LTD./ROXUAL ROCK WOOL                                          |
| 90  | ANCHOR FASTNER                                                | HILTI / FISCHER / BOSCH                                                                                            |
| 91  | CALCIUM SILICATE BOARDS                                       | HILUX / AEROLITE                                                                                                   |
| 92  | CALCIUM SILICATE TILES                                        | AEROLITE / HILUX                                                                                                   |
| 93  | TILES / GRANITE ADHESIVE                                      | FERROUSCRETE / THERMAX / PIDLITE / ULTRATECH / KRRAKOLL                                                            |
| 94  | COMPRESSED CHEQUERED TILES                                    | JOHNSON / ORIENT / RAK / ASIAN                                                                                     |
| 95  | DOOR SEAL - WOOLPILE WEATHER STRIP                            | ANAND REDDIPLEX/ ENVIROSEAL                                                                                        |
| 96  | E.P.D.M GASKETS                                               | ANAND REDDIPLEX / ENVIRO SEALS                                                                                     |
| 97  | EPOXY SLF FLOORING                                            | SIKA / STONHARD / STP / PIDILITE                                                                                   |
| 98  | FIRE RETARDANT PAINT                                          | VIPER FRS 881 / NULLIFIRE / BURGER / JOPUN / ACKZONODEL                                                            |
| 99  | FIRE SEAL                                                     | SEALZ / ALSTROFLAM / ABACUS / NUPRIN / DORMA                                                                       |
| 100 | FIRE: D-TYPE PULL HANDLES                                     | DORMA / GEZE / INGERSOL / HAFELE / KICH                                                                            |
| 101 | FIRE: HINGES,                                                 | DORMA / GEZE / INGERSOL / HAFELE / KICH                                                                            |
| 102 | FIRE: PANIC EXIT DEVICE                                       | DORMA / GEZE / INGERSOL / HAFELE / KICH                                                                            |
| 103 | FIRE: PANIC EXIT TRIM                                         | DORMA / GEZE / INGERSOL / BECKAR FS / HAFELE / KICH                                                                |
| 104 | FIRE: TOWER BOLTS                                             | DORMA / GEZE / INGERSOL / BECKAR FS                                                                                |
| 105 | GLASS : MIRROR                                                | MODIGUARD / SAINT GOBAIN/ ASAHI INDIA SAFETY / MODI FLOAT / PILKINGTON                                             |
| 106 | METALIC LAMINATES                                             | METLAM, HOMAPAL, DEKODUR                                                                                           |
| 107 | PRESSED STEEL DOORS FRAME                                     | SUKRI / GODREJ / NAVAIR                                                                                            |
| 108 | SILICON SEALANTS /WEATHER SEALANT /STRUCTURAL GLAZING SEALANT | GE- SILICON / PIDILITE / CHOKSEY /WACKER / FORSOC / CICO/DOW CORNING / SIKA                                        |
| 109 | STAINLESS STEEL                                               | SALEM STEEL OR AS APPROVED E-IN-CHARGE                                                                             |
| 110 | STAINLESS STEEL BOLTS, WASHERS AND                            | KUNDAN / PUJA / KONCEPT                                                                                            |

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|     | NUTS                                                        |                                                                                                         |
| 111 | STAINLESS STEEL CLAMPS                                      | HILTI /INTELLOTECH /KONCEPT                                                                             |
| 112 | STAINLESS STEEL CP GRATING                                  | CHILLY / CAMRY / KONCEPT                                                                                |
| 113 | STAINLESS STEEL FRICTION STAY                               | EARL BIHARI / SECURISTYLE / EBCO                                                                        |
| 114 | STAINLESS STEEL PRESSURE PLATE SCREWS                       | KUNDAN/ PUJA/ ATUL/KONCEPT                                                                              |
| 115 | STAINLESS STEEL SCREW FOR FABRICATION AND FIXING OF WINDOWS | KUNDAN / PUJA / ATUL/KONCEPT                                                                            |
| 116 | SUPER PLASTICIZER                                           | CICO/PIDILITE INDUSTRIES                                                                                |
| 117 | SUNKEN PORTION TREATMENT                                    | CHOKSEY / SIKA / CICO                                                                                   |
| 118 | TILES: GLASS MOSAIC TILES                                   | ITALIAS/ BISAZZA/ PACE INDIA                                                                            |
| 119 | TILES: GLAZED TILES                                         | JOHNSON / RAK / ASIAN / SIMPOLO / NITCO<br>(SUPPLY TO BE MADE FROM THEIR<br>AUTHORIZED WHOLSALE DEALER) |
| 120 | VACUUM DEWATERED FLOORING                                   | THREMAX / SUN BUILD / AVCON TECHNICS                                                                    |
| 121 | P U WATER PROOFING                                          | SIKA, PHOSROC                                                                                           |
| 122 | T.P.O LAXER W.P.                                            | PHOSROC, SIKA, FIRESTONE                                                                                |
| 123 | ALUMINIUM LOUVERS / FACADES                                 | HUNTER DOUGLAS/LINDNER/CHICAGO/METALS                                                                   |
| 124 | APPROVED INSTALLERS FOR FACADES WORK                        | GLASS WALL SYSTEMS / AGV ALFAB / HEIGHT<br>CONSULTANTS / ALKARMA / SP FAB                               |
| 125 | WPC ( HYBRID)                                               | MAPAC TECHNOLOGY / ATLANTA / ALSTONE                                                                    |
| 126 | AAC BLOCK                                                   | FINE CREATE / ULTRATECH / ECOGREEN /<br>INSTABLOCK / INFRABLOCK                                         |
| 129 | HOSPITAL CUBICAL TRACKS AND CURTAINS                        | TRACKS 2 CURTAINS / MPS / ARISTRA HELTHCARE                                                             |
| 130 | LOUVRE                                                      | HARSONS GREEN / HUNTER DOUGLAS /<br>ARMSTRONG / USG                                                     |
| 131 | PUF OVER DECK INSULATION                                    | LLOYD INSULATION / HONEYWELL / ISOLLOYD /<br>BAYER                                                      |
| 132 | ITALIAN MARBLE                                              | NITCO / CMC KALINGA STONE / A-CLASS MARBLE                                                              |
| 133 | CORIAN STONE                                                | DUPONT / CRAYON / AVANOITC                                                                              |
| 134 | LINOLEUM FLOORING                                           | ARMSTRONG / TARKETT / DUPOINT / FORBO                                                                   |
| 135 | R.C.C PIPES                                                 | OM JI / INDIAN HUME PIPE / PRAGATI CONCRETE<br>UDYOG /ISI MARKED PIPES/DAYA/KK / JSP                    |
| 136 | SFRC MANHOLE COVER                                          | KKM / KK / ARZOO                                                                                        |
| 137 | GRASS GRID PAVERS                                           | KKM / KK / ARZOO                                                                                        |
| 138 | PVC STRETCHER GUARD                                         | SIO / ARKO / GRADUS                                                                                     |
| 139 | PVC CORNER GUARD                                            | SIO / ARKO / GRADUS                                                                                     |
| 140 | SS CORNER GOURD                                             | MADE IN INDIA                                                                                           |
| 141 | TERRAZZO TILES                                              | NITCO, MODERN, HINDUSTAN.                                                                               |
| 142 | CEMENT CONCRETE TILES                                       | ULTRA, EUROCON, NITCO, DURACRETE                                                                        |
| 143 | PAVEMENT TILES                                              | PAVIT, ASIAN, ULTRA DESIGNER TILES                                                                      |
| 144 | GLASS MOSAIC TILE                                           | CORAL, BISAZZA.                                                                                         |
| 145 | WALL PUTTY                                                  | BIRLA / J.K / HAWKS PAINTS                                                                              |
| 146 | NON METALLIC HARDENER COMPOUND                              | CICO, RECRON, FAIRMATE.                                                                                 |
| 147 | FRP DOORS                                                   | FIBERWAYS TECHNOLOGY / ROOFCLAD INFRA /<br>RV INFRA / FIBREFILL SYSTEM ENGINEERS                        |
| 148 | ART WORK                                                    | ART INC / ART C / SIMRAN ARTS                                                                           |
| 149 | CURING AGENTS                                               | SIKA/ / FOSROC / BASF / THERMAX LIMITED /<br>SUPREME                                                    |
| 150 | SHUTRING OIL                                                | SIKA/ / FOSROC / BASF / THERMAX LIMITED /<br>SUPREME                                                    |
| 151 | GYPSTUM PLASTER                                             | FERROUSCRETE / ULTRATECH / KRRAKOLL                                                                     |
| 152 | ALUMINIUM GLASS PARTITION                                   | OTIC / JEB / BENE / LINDNER                                                                             |

|                 |                                                  |                                                                     |
|-----------------|--------------------------------------------------|---------------------------------------------------------------------|
| 153             | SIGNAGES INTERNAL                                | HENRICH / PROTEK / MARC / HARMAN                                    |
| 154             | SIGNAGES EXTERNAL                                | HENRICH / PHILLIPS / GE / PROTEK / HARMAN                           |
| 155             | TOILET CUBICLES                                  | GREENLAM / TRESPA / CENTURY                                         |
| <b>PLUMBING</b> |                                                  |                                                                     |
| 1               | VITREOUS CHINA SANITARY WARE                     | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN      |
| 2               | CONCEALED CISTERN                                | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN      |
| 3               | PLASTIC W.C. SEATS COVERS                        | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN      |
| 4               | STAINLESS STEEL SINKS                            | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN      |
| 5               | C.P. FITTINGS & ACCESSORIES                      | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN      |
| 6               | CPVC PIPES/FITTINGS AND VALVES                   | FLOW GUARD / SFMC / ASTERAL / AKG                                   |
| 7               | G.I. PIPES / M.S. PIPES IS 1239/3589             | JINDAL HISSAR / TATA STEEL / SFMC / SAIL                            |
| 8               | G.I. FITTINGS (MALLEABLE CAST IRON)              | ZOLOTO-M / SWASTIK / JINDAL HISSAR                                  |
| 9               | SOIL, WASTE WATER PIPES & FITTINGS-              | NICO / SFMC PVC UPVC PIPE / KAGECO / FINOLEX                        |
| 10              | SOIL, WASTE & RAIN WATER PIPES & FITTINGS -UPVC. | SUPREME / SFMC PVC UPVC PIPE / FLOW GUARD / ASTERAL / FINOLEX / AKG |
| 11              | CHECK VALVES (DUAL SLIM TYPE)                    | ZOLOTO / AUDCO / CASTLE / ADVANCE                                   |
| 12              | BUTTERFLY VALVE                                  | ZOLOTO / AUDCO / CASTLE / ADVANCE                                   |
| 13              | BALL VALVES (15 TO 40MM)                         | ZOLOTO / AUDCO / CASTLE / ADVANCE                                   |
| 14              | GATE VALVE                                       | ZOLOTO / AUDCO / CASTLE / ADVANCE                                   |
| 15              | GUNMETAL VALVE (FULL WAY VALVE) CLASS-I          | ZOLOTO / AUDCO / CASTLE / ADVANCE                                   |
| 16              | FOOT VALVE                                       | ZOLOTO / AUDCO / CASTLE / ADVANCE                                   |
| 17              | PRESSURE REDUCING VALVE (PRVS)                   | ZOLOTO / AUDCO / CASTLE / ADVANCE                                   |
| 18              | SFRC MANHOLE COVERS ETC                          | KK MANHOLES / PRAGATI / SUPER WIRE/ADVENT                           |
| 19              | ANTI CORROSIVE TAPE FOR PIPE PROTECTION          | PYPKOTE/MAKPOLYKOTE / JONSON                                        |
| 20              | GARDEN IRRIGATION SYSTEM                         | JAIN / HARVEL / TORO / RAINBIRD                                     |
| 21              | PUMPS                                            | ARMSTRONG / . / WILLO / . / KIRLOSKAR                               |
| 22              | CLEAR WATER PUMPS                                | ARMSTRONG/ . / WILLO / . / KIRLOSKAR                                |
| 23              | SUBMERSIBLE DRAINAGE PUMPS                       | GRUNDFOSS / WILO / . / KIRLOSKAR                                    |
| 24              | FILTER/SOFTENER                                  | IONEXCHANGE, MAHLE FILTER SYSTEM, DENSO                             |
| 25              | PH METER                                         | VATS/ HANNA (ITALY), SENSOREX                                       |
| 26              | WATER METER                                      | KAYCEE /SANT/ ZENNER                                                |
| 27              | PRESSURE GAUGE                                   | FIEBIG / H GURU / ALTOP                                             |
| 28              | AUTOMATIC AIR VENT                               | DANFOSS / COMFORT / GIACOMINI                                       |
| 29              | SOLAR WATER HEATER                               | GREENTEK / BHEL / EMMVEE / TATA                                     |
| 30              | NO- TOUCH SS HAND ELECTRIC HAND DRIER            | EURONICS / KOHLAR / ROCA                                            |
| 31              | AIR RELEASE VALVE                                | KIRLOSKAR / VENUS / ZOLOTO                                          |
| 32              | BALL COCK                                        | ZOLOTO / L&T / ADVANCE                                              |
| 33              | BRASS STOP & BIB COCK                            | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN      |
| 34              | C. I FITTING                                     | ELECTROSTEEL/ KESORAM/ NECO/SKF                                     |
| 35              | C.I SLUICE VALVE & NON RETURN VALVE              | KIRLOSKAR / IVC/ LEADER / ZOLOTO / L&T / AUDCO / ADVANCE / AIP      |
| 36              | C.I VALVES (FULL WAY, CHECK AND GLOBE VALVES     | KIRLOSKAR / SKF / ZOLTO                                             |
| 37              | C.I. MANHOLE COVERS                              | NECO / HEPCO / SKF                                                  |



|    |                                                                                                 |                                                                                                 |
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| 38 | C.P. WASTE, SPREADERS, URINAL                                                                   | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN                                  |
| 39 | CENTRIFUGALLY CAST C.I RAINWATER FITTING /BRONZE GRATINGS ETC.                                  | ELECTRO STEEL / KESORAM / NECO                                                                  |
| 40 | CENTRIFUGAL PUMP                                                                                | CROMPTON / KIRLOSLAR/ ./ WILLO                                                                  |
| 41 | CENTRIFUGALLY C.I RAINWATER INTEL FITTING ,BRONZE GRATINGS                                      | ELECTRO STEEL / KESORAM / NECO                                                                  |
| 42 | CENTRIFUGALLY CASTED C.I. PIPES                                                                 | NECO / HEPSCO / SKF                                                                             |
| 43 | CHLORINATOR                                                                                     | THERMAX LTD / LON EXCHANGE / SIEMENS / SUPREME                                                  |
| 44 | COCKROACH TRAP                                                                                  | CHILLY / GMGR / CAMRY /SFCM                                                                     |
| 45 | COPPER FITTINGS (CAPILLARY)                                                                     | YORKSHIRE IMPERIAL, U.K./ MEXFLOW / RAJCO METAL WORKS MUMBAI / CONEX -BENNINGER                 |
| 46 | COPPER PIPES                                                                                    | MEXFLOW, RAJCO METAL WORKS, MUMBAI / CONEX -BENNINGER                                           |
| 47 | DUCTILE IRON FITTINGS (IS:9523)                                                                 | ELECTROSTEEL/KESORAM/TISCO/JINDAL                                                               |
| 48 | DUCTILE IRON PIPES (IS:8329)                                                                    | ELECTROSTEEL/KESORAM/TISCO/JINDAL                                                               |
| 49 | FILTRATION PLANT / SOFTENING PLANT                                                              | BIKON WATER / ION EXCHANGE / THERMAX LIMITED /EUREKA FORBES                                     |
| 50 | FLUSH VALVES                                                                                    | ZOLOTO / AUDCO / CASTLE / ADVANCE                                                               |
| 51 | GRAB BARS AND DISABLED HARDWARE                                                                 | DORMA / OZONE / D-LINE / SIO                                                                    |
| 52 | HDPE PIPES / MOULDED FITTINGS                                                                   | EMCO /POLYEFINS/PIONEER<br>PLYFAB/SUPREME/JAIN IRRIGATION                                       |
| 53 | HDPE SOLUTION TANK                                                                              | WATCON / ION EXCHANGE / WATER SUPPLY SPECIALIST PVT. LTD.                                       |
| 54 | HYDRO-PNEUMATIC SYSTEM                                                                          | WILLO/ GRUNDFOSS / SALMSON / NOCCHI / XYLLUM                                                    |
| 55 | INSULATION OF HOT WATER PIPES                                                                   | VIDOFLEX INSULATION / SUPERION INSULATION<br>KAIFLEX – KAIMANN/ARMOFLEX/THERMAFLEX/<br>ARMACELL |
| 56 | LIQUID LEVEL CONTROLLERS / INDICATORS                                                           | ADVANCE AUTO / SRIDHAN INTERNATIONAL / MINILEC / RADAR / FEMAC / SWITZER                        |
| 57 | LIQUID SOAP DISPENSER                                                                           | CHILLY/EURONICS/CAMRY/UTEC/KOPAL                                                                |
| 58 | MAINLINE ISOLATION VALVE                                                                        | ZOLOTO / AUDCO / CASTLE / ADVANCE                                                               |
| 59 | MS SADDLE WITH G.I. RISER                                                                       | HARVEL/ALPRENE/RAIN BIRD, USA                                                                   |
| 60 | NON RETURN VALVE                                                                                | SANT /LEADER /ZOLOTO/AUDCO/ADVANCE                                                              |
| 61 | PIPE COAT MATERIAL (PIPE PROTECTION)                                                            | RPG RAYCHEM/PYPKOTE/MAKPHALT                                                                    |
| 62 | PP-R PIPES (PN – 16)                                                                            | SFMC / SUPREME / RELIANCE WETFLOW                                                               |
| 63 | PRE-COATED GALVANISED STEEL SHEET                                                               | TATA BLUESCOPE / LLYOD INSULATIONS INDIA LTD / S.R.METALS                                       |
| 64 | PVC CONTINUOUS FILLET FOR PERIPHERY PACKING OF GLAZINGS / STRUCTURAL / GLAZING                  | ROOP / ANAND / FOREX PLASTIC/ AKG /NAGALIA/TRADING COMPANY                                      |
| 65 | PVC FLUSHING CISTERN                                                                            | COMMANDER /JOHNSON PEDDER / DURALITE/ GEBERIT                                                   |
| 66 | PVC PIPES & FITTING SWR SOIL, WASTE & VENT PIPES AND FITTINGS, TYPE B PVC CASING & SCREEN PIPES | PRINCE / SUPREME / FINOLEX /PRAKASH SURYA / AKG                                                 |
| 67 | PVC WATER STOPS                                                                                 | PRINCE / SUPREME / FINOLEX                                                                      |
| 68 | POLYETHYLENE STORAGE TANK                                                                       | SINTEX / SFMC / SUPREME                                                                         |
| 69 | R.O. SYSTEM                                                                                     | SSRE Engineering / Thermax / Ion_Exchange / C-Tech / Siemens                                    |
| 70 | SENSOR OPERATED AUTO FLUSHING SYSTEM URINALS                                                    | KOHLAR / HINDWARE / JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN                                  |

|    |                                        |                                                                |
|----|----------------------------------------|----------------------------------------------------------------|
| 71 | SLUICE VALVE / NRV                     | ZOLOTO / AUDCO / CASTLE / ADVANCE                              |
| 72 | SOLENOID VALVE                         | RAIN BIRD, USA/TORO/NELSON                                     |
| 73 | SS GRATINGS, SOAP DISH TOWEL RAIL ETC. | CAMRY/GLACIER/GEM                                              |
| 74 | STONE WARE PIPES & GULLY TRAPS         | PERFECT / R.K/ HIND / ANAND                                    |
| 75 | SUBMERSIBLE DRAINAGE PUMP              | CROMPTON/ KIRLOSKAR/ . /GRUNDFOS/ MATHER & PLATT / WILO/XYLLUM |
| 76 | VALVE BOX                              | RAIN BIRD, USA/CARSON BROOK, USA/DURA,                         |
| 77 | WATER COOLER                           | VOLTAS/USHA/GODREJ/EUREKA FOBES                                |
| 78 | WHITE GLAZED FIRE CLAY SINK            | KOHLAR / HINDWARE /JAQUAR/SOMANY/CERA/ ESSCO/ DURAVIT / BOLAN  |

**NOTE : ALL MAKES SHALL FURTHER CONFIRM TO STANDARD SPECIFICATIONS OF EACH ITEMS AS MENTIONED IN TECHNICAL SPECIFICATIONS OF TENDER DOCUMENTS.**

b.

**FIRE FIGHTING WORK**



## **TECHNICAL SPECIFICATION FOR**

### **(FIRE FIGHTING SYSTEM)**

- 1.0** The scope of work consists of the Equipment design, supply, inspection, transportation to site, installation, testing and commissioning of the following systems of Fire Fighting works conforming to National Building Code and Tariff Advisory Committee (where details in National Building Code not available), but is not limited to the same:
- 1.1 Hydrant System
  - 1.2 Pumping System
  - 1.3 Sprinkler System
  - 1.4 Fire Extinguishers
  - 1.5 **Conformity with statutory act, regulations, standards and safety codes**
    - The Firefighting system's equipment, materials, accessories and their installation shall conform to relevant Indian Standard amended upto date the National Building Code part IV Fire protection and in conformity with the local Fire Regulations and Rules there under where they are in force. Provisions in local by-laws, if any, shall be complied with.
    - All electrical works in connection with fire fighting works shall be carried out in accordance with the provision of Indian Electricity Act, 1910 and the Indian Electricity Rules, 1956 amended upto date and to CPWD General specifications for Electrical works Part I (internal) 1994 Part II External - 1995 as amended upto date of receipt of tenders.
  - 1.6 **Inspection and testing of materials**
    - Contractor shall be required, to produce manufacturer's test certificate for equipment and particular batch of materials supplied to him. The tests carried out shall be as per the relevant Indian Standards.
    - For examination and testing of equipment materials and works at the site Contractor shall provide all testing and gauging equipment necessary but not limited to the following:
      - a. Theodolite
      - b. Dumpy level
      - c. Steel tapes
      - d. Weighing machines
      - e. Plumb bobs, spirit levels, hammers
      - f. Micrometers, Tachometers

- g. Thermometers
- h. Hydraulic test machine
- i. Smoke test machine
- j. Any other item required for testing and commissioning.

- All such equipment shall be tested for calibration at any approved laboratory, if required by consultant.
- All testing equipment shall be preferably located in special room meant for the purpose.
- Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with consultant.

#### 1.7 Data to be furnished by contractor

- After Award of work – The contractor shall submit the following data / drawings within a fortnight of the award of work, for approval by consultant.
  - (i) G.A & foundation drawings for equipment and weight of assembled equipment like pump set, valves, hydrants, hose cabinets etc.
  - (ii) Control and protection schematics, wiring diagrams and control wiring diagrams of equipment showing the sequence operation.
  - (iii) Bar chart indicating general program for supply, installation, testing and commissioning and handing over and also the related works to be done by other agencies to ensure timely completion.
  - (iv) Any other data that may be necessary for the satisfactorily completion of work.
- The above documents shall be furnished in 4 sets to consultant. One set will be returned with comments and approval. The document shall be modified incorporating the comments indicated by consultant and 4 sets of corrected documents shall be given in 15 days' time.
- The contractor shall follow the drawings issued to him for installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed. Maximum head room and space conditions shall be maintained at all points. Where Head Room appears inadequate, the contractor shall notify the Architect / Engineer before proceeding with the installation. In case the installation

is carried out without notifying, the work shall be rejected and Contractor shall rectify the same at his own cost.

- The Contractor shall examine all architectural, structural, plumbing, air conditioning electrical and other services drawings and check the as-built works before starting the work, report to the Owner's site representative any discrepancies and obtain clarification. Any changes found essential to co-ordinate installation of his work with other services and trades, shall be made with prior approval of the Architect / Engineer without additional cost to the client.
- Each item of equipment / material proposed shall be a standard catalogue product of an established manufacturer strictly from the approved manufactures.
- Manufacturers drawings, catalogues, pamphlets and other documents submitted for approval shall be in four sets. Each time in each set shall be properly labeled indicating the specific services for which material or equipment is to be used giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.
- Before commencement of installation – The contractor shall also furnish 3 copies of detailed installation, operation and maintenance manuals of manufacturers for all items of equipment together with all relevant data sheet spare parts catalogue, repairs assembly and adjustment procedures etc.

#### 1.8 **Bar Chart**

- The contractor shall provide within 3 weeks of award of work a complete bar chart based on the time period of the completion of the project. The Bar Chart shall elaborate the following:
  - ii) Procurement & Installation of piping
  - iii) Procurement and installation of Pump Sets.
  - iv) Procurement and installation of Valves.
  - v) Pressure testing of piping.
  - vi) Testing and commissioning of pump sets.
  - vii) Testing and commissioning of all systems.
- The contractor will be required to give during Pre-Tender (as well as Post Tender) period the time frame of major activities including Bar Chart, time when the activity shall be executed as well as the co-ordination linkages required.
- The sequence of erection of Pumps, the stage when it shall be executed, what is required from Owner, lead period for pump procurement and time schedules as well as payment.
- Procurement period of end items such as Hydrants etc., when they shall be procured, cash flow requirement as well as when installation shall be done.

- Commissioning of Systems, what requirements are needed from other services and period of completion.

#### 1.9 **Quality of Material and workmanship**

- All or part of equipment shall be of such design, size and material as to function satisfactorily under all rated conditions of loading and operation. All components of the equipment's shall have adequate factor of safety. Materials components which are not covered by standards laid down by Indian Standard Institution shall be got approved from consultant / client before use on the work.
- The entire work of fabrication, assembly and installation shall conform to sound engineering practice and on the basis of "fail safe" design. The mechanical parts subject to wear and tear shall be of easily replaceable type.
- The construction shall be such as to facilitate ease of operation, inspection, maintenance and repairs. All apparatus shall be also be designed to ensure satisfactory operation under working conditions as specified.
- All connections and contacts shall be designed to minimize the risk of accidental short circuit caused by animals, birds, vermin. Surfaces which are in contact with oil shall not be galvanized or cadmium plated.

#### 1.10 **Inspection and testing at Manufacturer's Works**

The contractor shall furnish such facilities as will be necessary for inspection and witnessing of special tests, if any, of the equipment before dispatch at his or associates works as are done at the works, if so required by consultant.

#### 1.11 **Test Certificates**

Copies of all documents of routine test certificates of the equipment carried out at the manufacture's premises shall be furnished to consultant before dispatch of the equipment.

#### 1.12 **Dispatch of Materials and Storage**

The contractor should dispatch all materials to site in consultation with consultant. For this purpose the programme of dispatch of materials shall be framed, keeping in view the building progress. Safe custody of all machinery and equipment supplied by the contractor shall be his own responsibility till the final taking over by client.

#### 1.13 **Care of buildings**

Care shall be taken, while handling/installing the equipment to avoid damage to the buildings. On completion of the installation, the contractor shall arrange to repair all damages to the building caused during installation so as to bring to the original condition. He shall also arrange to remove all unwanted waste materials from the buildings, pump room and other areas used by him.

#### **1.14 Painting and Protection**

All equipment supplied shall be given final coat of paint over the primer after necessary treatment at the works before dispatch. All damages to painting during transport and installation shall be set right or repainted to the satisfaction of the consultant before handing over.

#### **1.15 Completion Drawings**

10 sets of equipment drawings shall be submitted by the contractor while handing over the installation.

- i. Equipment drawings.
- ii. Electrical power and control wiring drawings for the entire electrical equipment showing cable sizes, equipment capacities, switchgears ratings, control components, control wiring etc.

#### **1.16 Final Inspection, Testing and Approvals**

When the installation is deemed by the contractor to be complete, he shall arrange with consultant for inspection and testing of the installation by the concerned local fire authorities. Test results obtained shall be recorded and installation shall not be accepted until consultant/client is satisfied about its compliance with the requirement of these specifications. It shall be the responsibility of the contractor to carry out any rectification / modification as may be suggested by the Fire Officer and get the installation passed by the concerned local fire authorities, as may be required by the local by-laws.

Contractor shall ensure that equipment installed complies with specification in all respects and is of the correct rating for the duty and site connections.

Contractor shall ensure that all electrical circuits are correctly protected and that protective devices are properly co-coordinated. Contractor shall ensure that general requirement of inspection & testing shall be read in conjunction with any particular requirement specified elsewhere in the document.

### 1.17 **Guarantee**

The contractor shall guarantee the entire fire fighting installation as per specifications & drawings. All equipment shall be guaranteed for one year from the date of taking over against unsatisfactory performance or break down due to defective design, manufacture and installation. The installation shall be covered by the conditions that whole installation or any part thereof found defective within one year from the date of taking over shall be replaced or repaired by the contractor free of charge as decided by consultant. The warranty shall cover the following: -

- a. Quality, strength and performance of materials use.
- b. Safe mechanical and electrical stress on all parts under all specified conditions of operation.
- c. Satisfactory operation during the maintenance period.

## 2.0 **HYDRANT SYSTEM**

- 2.1 Hydrant system consisting of Internal Hydrants Risers, internal Hydrant Ring, Hydrant Stations with all accessories such as Hydrants, Hoses, First Air Hose Reel, Branch Pipe.
- 2.2 On each floor with each riser there shall be Hydrant Station having one number of Hydrant, 2 nos. RRL Hose and a Branch pipe. The reinforced Rubber Lined Hose shall be of 15 meters length. They shall be provided with gunmetal quick jointing couplings. The Hydrant shall be of stainless steel and shall be provided with a stainless-steel orifice plate to reduce water pressure to 3.5 bar.
- 2.3 The Hydrant Station shall also be provided with a First Aid Hose Reel consisting of a 30-meter length 20mm dia. double braided rubber hose wound on a drum bracket with aluminum alloy bracket and piping. This set shall be connected to the Hydrant Riser through a 25mm dia. Ball Valve.
- 2.3 Four-way fire brigade inlet connection shall be provided at the underground fire water tank, hydrant system ring main and sprinkler system mains.
- 2.4 The Terrace shall have an Air vessel with drain and pressure gauge to absorb pressure surges and water hammer effect when any of the main pump start.
- 2.5 The delivery header shall also have a fire brigade inlet connection (four way) outside the building. In case of any eventuality additional water if required, it may be pumped directly into the riser by the fire brigade.
- 2.6 All internal piping shall be Mild Steel Black Heavy Grade and shall have welded jointing for pipes above 50mm dia.
- 2.7 All fittings shall be mild steel (heavy class) and cut off valves shall be as per IS: 14846.

**3.0 PUMPING SYSTEM**

3.1 Existing

**4.0 SPRINKLER SYSTEM**

4.1 The Sprinkler System shall be operated from the existing pumping system.

4.6 The flow switch shall be connected to addressable fire alarm system for giving the floor indication.

4.7 The hydrant riser shall be terminated with air vessel and air release valve at the highest points to release the trapped air in the pipe work.

## **SECTION - 2**

### **1.0 HYDRANT AND SPRINKLER SYSTEM DESCRIPTION**

- 1.1 The Hydrant system shall be connected to existing hydrant system.
- 1.2 The Hydrant system shall be kept pressurized all the times.
- 1.3 The pressure in the Hydrant pipe work shall be kept constant at 8.0 Kg/cm<sup>2</sup>. In the event of fire, when any of the hydrant valves in the network is opened, the resultant fall in header pressure shall start the Fire Hydrant Pump through pressure switches automatically.
- 1.4 Single headed Hydrant valves with Hose Cabinets shall be provided. Hose box shall be pedestal type.
- 1.5 The scope of work for internal hydrant system covers providing, fixing and jointing MS pipe including testing, cutting and threading etc., with heavy class fittings like bends, tees, reducers as required, on walls, ceilings, beams, floors with suitable clamps, for installation of various sizes of pipes for Hydrant System and hydrant valve in hose cabinets as per NBC norms.
- 1.6 To compensate for losses of pressure in the system and to provide an air cushion for counteracting pressure surges / water hammer in the underground pipe work, an air vessel shall be provided in the pump room near the fire pumps. The air vessels shall be normally partly filled with water and the remaining being filled with air which shall be under compression when the system is in normal operation. The Sprinkler System shall be fed from the same tank and pumping system. However, piping shall be independent.
- 1.7 All components of the Hydrant and Sprinkler systems shall be of a type and makes approved by TAC.
- 1.8 For Sprinkler system there shall be flow switches for all floors which shall be connected to the Fire Alarm System.
- 1.9 The areas of the Basement, Stores and areas without false ceiling shall have pendant / upright sprinklers. Area with False Ceiling shall have powder coated sprinkler with powder coated rosette.

#### **1.2 Flushing of hydrant system:**

After installation of complete system flushing of hydrant system shall be done as under:

- 1.2.1 Underground mains and lead-in connections to system risers shall be flushed before connections made to piping in order to remove foreign materials which may have entered underground during the course of installation. For hydrant system the flushing operation shall be continued until water is clear.
- 1.2.2 Underground mains and connections shall be flushed at a flow rate of not less than 1000 ltrs. per minute. The pump and other equipment necessary for the flushing shall be arranged by the contractor without any extra charges.



- 1.2.3 The water coming out from the outlet will be connected to storm water drain or any other receiver reservoir by means of suitable hose. Hose for the purpose shall be arranged by the contractor.

**1.3 TESTING OF THE HYDRANT SYSTEM**  
**Testing of the Piping**

- 1.3.1 After laying and jointing, the entire piping shall be tested to hydrostatic test pressure. The pipes shall be slowly charged with water so that the air is expelled from the pipes. The pipes shall be allowed to stand full of water for a period of not less than 24 hours and then tested under pressure. The test pressure shall be at least 1.5 times the operating pressure. The test pressure shall be applied by means of an electrical test pump to be provided by the contractor. Precautions shall be taken to ensure that the required test pressure is not exceeded.
- 1.3.2 The open end of the piping shall be temporarily closed for testing.
- 1.3.3. All leaks and defects in the pipes, joints, valves etc. noticed during the testing and before commissioning shall be rectified to the satisfaction of consultant.

**2.0 FUNCTIONAL REQUIREMENTS**

- 2.1 There shall be a test valve, operation of which will simulate the operation of the landing valve / external hydrant. This will enable testing the healthiness of the equipment, availability and its control.

**7.0 FIRE FIGHTING ACCESSORIES**

**7.1 Piping**

- 7.1.1 Pipes of the following types (depending upon the description of item) shall be used:
- 7.1.2 MS pipes conforming to IS:1239, ISI marked (heavy grade) for pipes of sizes 150mm NB and below suitably treated on the outside to prevent soil corrosion as per IS : 10221.
- 7.1.3 MS pipes conforming to IS: 3589, 6.35mm thick for pipes of sizes above 150mm dia.
- 7.1.4 The pipes shall be manufactured by Electric Resistant Welded (ERW), Electric Fusion Welding or Induction Welding process. The weld shall be continuous. The pipes shall conform to the Tensile Test, Hydraulic Pressure Test and Mechanical test as per IS: 3589. The pipes shall also conform to the requirements of the Outside pipe dia. as laid down in IS:3589. Pipes shall be supplied with bevel edging.
- 7.1.5 MS Pipe up to 150 mm dia. shall have all fittings as per IS: 1239, part -II (heavy grade) while pipes above 150mm dia. shall be as per IS: 3589 inclusive of IS Marking.

7.1.6 For MS Pipes up to 50mm dia screwed jointing shall be adopted, while for pipes above 50mm dia welded or flanged connections shall be used. Only electro galvanized nuts/ bolts shall be used.

7.1.7 The different types of pipes/fittings shall conform to the following:

| Type of Pipes / Dia | Size                              | Grade                                                  | Ends / Fitting               | Code               |
|---------------------|-----------------------------------|--------------------------------------------------------|------------------------------|--------------------|
| MS Pipes            | Upto 50mm dia.                    | Heavy                                                  | Screwed                      | IS: 1239 (Part-1)  |
| MS Fittings         | -do-                              | Heavy                                                  | -do-                         | IS: 1239 (Part-1I) |
| MS Pipes            | Above 50mm dia and upto 150mm dia | Heavy                                                  | Bevel, Butt Welded, 3 layers | IS: 1239 (Part-1)  |
| MS Fittings         | -do-                              | Heavy, machine formed from IS marked Heavy Grade Pipes | -do-                         | IS: 1239 (Part-1I) |
| MS Pipes            | Above 150mm dia                   | 6.35mm wall thickness minimum                          | Bevel, Butt Welded, 3 layers | IS : 3589          |
| MS Fittings         | -do-                              | Schedule 40                                            | -do-                         | IS: 3589           |

7.1.8 Hangers and supports shall be capable of carrying the sum total of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipelines movements as necessary. All guides, anchors, braces, dampeners, expansion joints and structural steel to be attached to the building /structure, trenches etc. shall be provided by the Contractor. Hangers and components for all piping shall be approved by the Engineers. Anchoring fasteners shall be rated to take minimum 2 ton load and shall be as per approved make. Hangers shall be at 3.0 M intervals. Additional supports shall be provided at bends etc. Angles for pipe supports should not be less than 40x40x6mm size. Cutting shall be by gas cutter. All cut edges and weld surfaces shall be grounded to a smooth finish.

7.1.9 The piping system and components shall be capable of withstanding 150 per cent of the working pressure including water hammer effects and test pressure upto 15.0 Kg/cm<sup>2</sup>.

7.1.10 Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipeline of strategic points to facilitate erection and subsequent maintenance work.

7.1.11 The piping for the hydrant system in the yard shall be laid in soil 1.2M deep, the pipe line shall have wrapping in 2 layers of coal tar tape each 2mm thick. The scope of work includes necessary excavation of trench and back filling the same. The scope of work also includes necessary watering, ramming, removing the surplus earth from the site etc. Coating and wrapping shall be done after completion of hydro test of pipe lines.

- 7.1.12 Coat tar shall be applied as a final coat at the rate of 4.5 kg. per square metre of surface area of the pipe. The coal tar shall be hot blown and applied immediately. Layer to layer overlap shall be a minimum of 25 cm. The anti corrosive treatment shall be carried out over ground.
- 7.1.13 All pipes treated for anti corrosive treatment shall also be checked for line leakage by Holiday test. The test shall be carried out for the complete length and diameter of the pipe. The test shall be carried out under the supervision of the Architect / Engineer. All M.S. pipes below ground shall be laid on a layer of 7.5 cm coarse sand (Zone IV) and filled upto 15 cm above the pipes.
- 7.1.14 Pipe to pipe jointing by welding shall be carried out over-ground. A maximum of 4 lengths shall be jointed after which flanged connection with asbestos gaskets shall be used. Welding shall be carried out as per related item given elsewhere. Pipe lowering into the trench shall be carried out with utmost care to avoid damage to the joints. No backfilling shall be carried out unless the pipes have been pressure tested for joint leakages and coating and wrapping as per rules.
- 7.1.15 All welding shall be carried out by a certified welder only. The Contractor must produce the Welder's Certificate.
- 7.1.16 All pipe to pipe receiving edges shall be bevel finished to a clean edge by an electric grinder. A requisite gap determined by the thickness of the weld electrode shall be given between the joints before start of welding.
- 7.1.17 Weld Electrodes shall be of approved make, of grade and type as suitable for the job. This shall be satisfied by the Consultant before start of work.
- 7.1.18 Joints shall be given a first weld in full width without burrs on the full dia of the pipe. Welding shall be carried out vertically from the surface to be welded. Weld fluxes shall not be so plastic such as to fall or drip down.
- 7.1.19 After application of first coat of the weld shall be ground and then another layer of welding shall take place. The weld shall also be cleaned by grinding. Similarly, a third weld shall also be applied.
- 7.1.20 All pipe cutting shall be by oxy acetylene gas only. The cut surface shall be cleaned and ground by an electric grinder before further welding.
- 7.1.21 Pipe cutting or welding in inaccessible areas shall be avoided. Pipes shall not be welded in trenches unless the bottom edge of the pipe does not have clear space for working with electrode.
- 7.1.22 For supports angle pieces shall be cut by oxy acetylene gas and cleaned by electric grinder. All cutting for bolt inserts shall be by electric drill.

## **7.2 Valves**

- 7.2.1 Valves in the building shall be Cast iron (IS 210), grade FG 260 butterfly valves conforming to PN 1.0/1.6, heavy-duty cast-iron disc with anti-corrosive nickel plating, nitrile seat and stainless steel 410 stem with lever/gear operation and powder coated finish for firefighting application.
- 7.2.2 Valves 50 mm and below shall be brass ball valves with brass body (nickel body), brass ball (hard chrome plated) and Teflon seat. Valves shall be tested at manufacturer's works.
- 7.2.2 Non-return valves shall be cast iron of grade FG 260 swing check type. An arrow mark in the direction of flow shall be marked on the body of the valve. These valves shall conform to IS:5312. The flap shall be of cast iron and flap seat ring of leaded gun metal.
- 7.2.3 Valves below 50mm size shall have screwed ends while those of 50mm and higher sizes shall have flanged connections. Drain lines will have valves for draining.

## **7.3 Hydrant**

- 7.3.1 Hydrant valve shall be as per IS: 5290 of Stainless steel and inlet of 80mm dia with 63 mm dia outlet. The valve shall be oblique type complete with hand wheel, quick coupling connection, spring and S.S 304 blank cap as per IS : 5290. The hydrant shall be laid on 100 mm dia main teed off to 100mm dia and Stand Post of 80mm dia, at approx. 1.2 mtr. from ground level. The Hydrant shall be IS marked. Orifice plate in 6mm thick stainless steel with orifice of 32/40/50 mm dia shall be provided with each Hydrant.
- 7.3.3 The Hydrant shall be tested to 25Kg/cm<sup>2</sup> test pressure. All threaded joints shall be sealed with "Holdtite". The lug shall be wing type.

## **7.4 First Air Hose Reel**

- 7.4.1 The Hose reel shall be drum type with hub wheel ties. The drum shall rotate freely on the assembly. The drum shall be fabricated from GI sheet of minimum 18 gauge thickness. Length of Hose Reel shall be 36 metres.
- 7.4.2 The hose reel shall be directly tapped from the riser through 25mmdia pipe, the drum and the reel being firmly held against the wall by use of dash fasteners. The hose reel shall be swinging type (180 degree) and the entire Drum, Reel etc. shall be as per and IS:884 including marking. The rubber tubing shall be of IS:444 marked and double braided. The nozzle shall be 6mm dia. ABS plastic rotating head shut off type. A Ball valve shall be used to shut off the water supply to the Hose Reel.

## **7.5 External Hose Cabinets**

- 7.5.1 Each Hydrant /Fire Brigade inlet shall be housed in a Hose Cabinet of minimum 0.75 m x 0.6 m x 0.25 m. The Hydrant Cabinet shall hold single headed hydrant, 2 nos. Hoses and 1 No. Branch pipes or Fire Brigade inlets.

- 7.5.2 The cabinet shall be 16 gauge MS sheet with sides being folded back through machine. The Box shall have a single shutter with glass of 5mm thickness. The cabinet shall be supported on a 40x40x6mm thick angle.
- 7.5.3 The cabinet shall be powder coated with red paint. The words "Yard Hydrant", "Hydrant" etc. shall be painted in white (or red on the glass) in 75 mm high letters. The hose box shall be lockable with socket spanner. All horizontal surfaces shall be sloped adequately with water discharge holes. Vents shall also be located on sides of the Hose Box.

## **7.6 Air Vessel**

- 7.6.1 The Air Vessels shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter acting pressure surges whenever the pumping set comes into operation. It shall be normally partly full of water, the remaining being filled with air which will be under compression when the system is in normal operation. Air vessel shall be fabricated from 8mm thick MS plate with dished ends and suitable supporting legs. It shall be provided with a 100 mm dia flanged connections from pump, one 50mm drain with valve, one water level gauge and 25mm sockets for pressure switches. The air vessel shall be hydraulically tested to 21.0 Kg/cm<sup>2</sup> pressure for 30 minutes. All valves shall be ball valves gun metal.
- 7.6.2 The air vessels in the pump room shall be 2000 m long (excluding dished ends) and shall be of 450mm dia.

## **7.8 System Drainage**

- 7.8.1 The system shall be provided with suitable drainage arrangements with GI piping of 50 mm dia, complete with all accessories, and provided with 50mm dia butterfly valve.

## **7.11 Painting**

- 7.11.1 All Hydrant and Sprinkler pipes shall be painted with post office red colour paint. All pipes shall first be cleaned thoroughly before application of primer coat. After application of two primer coats, two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the flow in pipe and its purpose such as "TO RISER NO.1" etc. All necessary protection to adjacent objects shall be taken by the contractor. Flanges, Nuts, bolts, Gate and Non Return Valves shall be painted light grey. Nuts and bolts shall not be painted. Before painting, grease shall be applied to nuts and bolts so that it does not attract paint.

## **7.12 Couplings**

- 7.12.1 Couplings shall be of gun metal, machined and polished to requirements. Both male and female couplings shall be fitted into each other smoothly and without any unnecessary force. Couplings shall be IS:903 marked with the name of the manufacturer. The coupling shall be tested to 25 Kg/cm<sup>2</sup> test pressure. The male couplings shall be provided with lugs for inserting female coupling.

### **7.13 Branch Pipe**

- 7.13.1 The branch pipe shall be constructed from stainless steel and finished to a smooth polish. The branch pipe shall be able to give straight stream and shall be IS marked. The branch pipe shall be tested to 20 Kg/cm<sup>2</sup> pressure. The inlet bore shall be 63mm dia for quick coupling joint to the Hose and the nozzle side shall be 20mm dia.

### **7.15 Pendant type Sprinkler Head**

- Sprinkler head shall be of quartzoid bulb type with bulb, valve assembly, yoke and the deflector. The sprinkler head shall be forged from brass. The Sprinkler shall be of approved make and type with 15mm nominal dia. outlets.
- The bulb shall be made of corrosion free proprietary frangible glass material strong enough to withstand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches at 68 °C.
- The nominal bore shall be 15mm dia. and colour of liquid shall be Red.
- The Sprinkler head shall be UL listed.
- The sprinkler below false ceiling shall also be provided with a double plate captive rosette assembly to seal the junction between the pipe and the false ceiling.

### **7.16 Upright type Sprinkler Head**

Upright sprinkler heads shall be similar to Pendant type in material construction and performance but designed to throw water Droplates upwards in umbrella fashion, to cool the underside of ceiling and extinguish any fire involving combustibles above false ceiling.

The sprinkler head shall be from approved makes. The nominal bore shall be 15mm dia. and the colour of liquid shall be red.

### **7.17 Powder coated Sprinkler with Powder coated Twin Plate Rosette**

The sprinkler head shall be same as pendant type above but powder coated white. The Sprinkler head shall be provided with a double plate powder coated rosette that shall seal the gap between the false ceiling and the sprinkler head.

The adjustment allowable shall be 12mm. The lower part shall have flared ends that shall fit tightly into the upper piece.

### **7.18 Extended Coverage Sidewall Sprinkler**

The intent of use of this Sprinkler Head is to reduce piping within office and shop spaces as well as to provide complete sprinkler coverage.

- 7.18.1** The Sprinkler head shall be fast response quartzoid bulb type with bulb, valve assembly, yoke and top mounted deflector. The Sprinkler shall be of approved make and type with 20mm nominal dia outlet. The water spray shall be equally distributed along the axis of the Sprinkler head with a minimum reach of 6.0 M at 3 Kg. Sqm. Pressure.

## **8.0 Flow Switch**

- Flow switch shall have a paddle of suitable width to fit within the pipe bore. The terminal box shall be mounted over the paddle / pipe through a connecting socket. The switch shall have potential free contact of suitable rating with N O or N C position as required. The switch shall be able to trip and make / break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Annunciation panel. The seat shall be stainless steel. The flow switch enclosure shall have IP:65 protection.
- The flow switch shall work at a minimum flow rate of 100 LPM. Further, it shall have a 'Retard' to compensate for line leakage or intermittent flows.

## **9.0 Orifice Plates**

- Orifice plates shall be of 6mm thick gun metal to reduce pressure on individual hydrants to operating pressure of 3.5 kg/cm<sup>2</sup>. Design of the same shall be given by the contractor as per location and pressure condition of each hydrant.

## **10.0 Fire Extinguishers**

- Fire Extinguishers shall be provided as per the bill of quantities, based on TAC manual.

### **SECTION - 3** **COMMISSIONING & GUARANTEE**

#### **1. SCOPE OF WORK**

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

All tests shall be made in the presence of the Architect or his representative or any inspecting authority. At least five working days notice in writing shall be given to the inspecting parties before performing any test.

Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.

Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in water supply lines for ease of installing pressure gauge, temperature gauge & rotameters. Contractor shall also supply all required pressure gauge, temperature gauge & rotameter for system commissioning and balancing. The balancing shall be to the satisfaction of Consultant / Project Manager.

Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

#### **2 PRECOMMISSIONING**

On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:

- a. Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fitments and pipework and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
- b. All strainers shall be inspected and cleaned out or replaced.



- c. When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
  - i. Remove oil, grease and foreign residue from the pipe work and fittings;
  - ii. Pre-condition the metal surfaces to resist reaction with water or air.
  - iii. Establish an initial protective film;
  - iv. After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation.
  - v. Details and procedures of the pre-treatment shall be submitted to the Architect for approval.
- d. Check all clamps, supports and hangers provided for the pipes.
- f. Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

### **Fire Protection System**

- Check all hydrant valves by opening and closing : any valve found to be open shall be closed.
- Check all the piping under hydro test.
- Check that all suction and delivery connections are properly made for all pump sets.
- Check rotation of each motor after decoupling and correct the same if required.
- Test run each pump set.
- All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).

### **Commissioning and Testing**

- a. Pressurize the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump , then
- b. Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.
- c. Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However the jockey pump shall cut-out as soon as the main pump starts,
- d. Switch off the main fire pump and test check the Diesel engine driven pump in the same manner as the electrically driven pump,

- e. When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage.
- f. Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replaced by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.
- g. Check all annunciations by simulating the alarm conditions at site.

### **3 STATUTORY AUTHORITIES' TESTS AND INSPECTIONS**

As and when notified in writing or instructed by the Architect, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authorities, Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect as a result of such tests and inspections where these indicate non-compliance with Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect.

The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.

The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Architect for checking before submission.

The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Architect without delay.

#### **4 FINAL ACCEPTANCE TESTS**

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Architect.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

#### **5 REJECTION OF INSTALLATION / PLANT**

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/ Architect.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Architect/Employer.

#### **6. WARRANTY AND HANDOVER**

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

#### **7. HANDING OVER OF DOCUMENTS**

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner's site representative and all testing and commissioning documents shall be handed over to the Owner's site representative.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.

**APPROVED MAKES**  
**FIRE FIGHTING**

| Sr. No. | Details of Materials/Equipment                                                                                    | Manufacture's Name                  |
|---------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1.      | Pipes                                                                                                             | Tata / Jindal Hissar                |
| 2.      | Single headed Hydrant valves, three way Fire Brigade inlet, branch pipe & shut off nozzle, all other Accessories. | Padmini / Omex / Guards             |
| 3.      | 20mm dia rubber pipe for hose reel                                                                                | Padmini / Omex / Guards             |
| 4.      | Starters, switches, T.P.N switch                                                                                  | L&T / Siemens / GE Power/ Schneider |
| 5.      | Pressure switch.                                                                                                  | Indfoss / Switzer                   |
| 6.      | Pressure Gauges.                                                                                                  | H Guru / Fiebig                     |
| 7.      | Pump                                                                                                              | KSB/ M&P / Kirloskar / Grundfos/DP  |
| 8.      | Motor                                                                                                             | ABB / Siemens / Kirloskar           |

(Note : Pump and motor shall be assembled in Pump Manufacturer's works)

|     |                                         |                               |
|-----|-----------------------------------------|-------------------------------|
| 9.  | Enamel Painting of pipes etc.           | Asian / Goodlas/ Nerolac/ ICI |
| 10. | Paint Primer                            | Asian / Jenson Nicholson.     |
| 11. | Fasteners                               | Hilti / Fischer/ Bosch        |
| 12. | Coal Tar Treatment for pipes            | IWL / Coatek.                 |
| 13. | Weld Rods                               | Advani                        |
| 14. | Fire Extinguishers                      | Superex / Omex / Guards       |
| 15. | RRL Hose                                | Superex / Omex / Guards       |
| 16. | Rubber Gaskets                          | CIC / Varuna.                 |
| 17. | Engine                                  | Cummins/ Caterpillar/ KOEL.   |
| 18. | Hose Drum                               | Superex / Omex / Guards       |
| 19. | Mechanical Seal                         | Durametallic / Burgmann       |
| 20. | Strainer                                | Emerald / Kirloskar           |
| 21. | Installation Control Valve              | Central/HD/Grinell /Tyco.     |
| 22. | Pipe Supports (Band Hanger )            | Chilly / Targa                |
| 23. | Flow Switch                             | System Sensor / Potter        |
| 24. | Pipe Fittings                           | Unik / VS                     |
| 25. | Sluice, Butterfly and Non Return Valves | Kirloskar/Zolloto / SKS / Cim |
| 26. | Anti Vibration Mounting                 | Dunlop/Resistoflex            |
| 27. | Electronic Level Indicator              | Minilec/Pumptcol              |
| 28. | Fire Sealant                            | Birla 3M,Hilti                |

**NOTE : ALL MAKES SHALL FURTHER CONFIRM TO STANDARD SPECIFICATIONS OF EACH ITEMS AS MENTIONED IN TECHNICAL SPE**

**c.**

**ELECTRICAL & ELV WORK**

## SPECIFICATIONS FOR ELECTRICAL WORKS

| SR.NO | PARTICULARS                                                         |
|-------|---------------------------------------------------------------------|
| 1     | General Instructions for Electrical Works                           |
| 2     | General Instructions for HT DP Structure.                           |
| 3     | General Instructions for HT Cable.                                  |
| 4     | Technical Specification for Oil Type Transformer.                   |
| 5     | Technical Specification for Silent D.G. Set.                        |
| 6     | Technical Specification for LT Panels & APFC Panel.                 |
| 7     | Technical Specification for LDBs & PDBs.                            |
| 8     | Technical Specification for LT Cables & Cable Tray.                 |
| 9     | Technical Specification for Internal Wiring.                        |
| 10    | Technical Specification for Lighting Fixtures & Lighting Automation |
| 11    | Technical Specification for Data, TV & Telephone wiring.            |
| 12    | Technical Specification for Earthing System.                        |

## **1 GENERAL INSTRUCTIONS FOR ELECTRICAL WORKS**

### **1) PREAMBLE :**

The scope of this section is to describe materials and systems for electrical installation works which form together with the project documents, a complete volume of work and quality description.

All electrical installations shall be of high quality, safe, complete and fully operational including all necessary items and accessories whether or not specified in details. All electrical works shall be completed in accordance with the regulations and standards as per the statutory requirement to the satisfaction of the Employer. The general provisions, special provisions and general requirements apply to all items of this specification.

The work shall be carried out simultaneously with building work, civil work, etc. and shall be continued till it is completed satisfactorily along with the completion of essential portions of the building works.

During the progress of work, completed portion of the building may be occupied and be put to use by Employer but the contractor will remain fully responsible for the maintenance of electrical installations till the entire work covered by this contract is satisfactorily completed by him and handed over to Employer.

It is the intention of the specification and drawings to call for finished work, tested and ready for operation. Whenever the words "Supply" or "Provide" are used, it shall mean delivery of material as specified in an assembled manner, ready for installation. Any apparatus, material or work not shown on drawings but mentioned in the specification or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the contractor without additional expenses to Employer. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work and in the contract.

Electrical contractor shall be Class A licensed Contractor registered with R&B Department of Gujarat and shall have completion certificate of three similar project Electrical jobs completed of same cost in last 3 years.

Civil Contractor shall provide the MOU signed with Electrical contractor (Class A) with Technical bid during bidding process.

### **2) INTERPRETATION OF PROJECT DOCUMENTS :**

The Specification, Drawings and Bill of quantity shall be interpreted in accordance with good installation practice defined in the appropriate regulations and standards whether specifically referred to or not. If there are any discrepancies or shortfall in the application of the regulations to any aspect of this contract or the contractor considers there is anything detrimental to the standards or inconsistent with his obligations and guarantees, Employer shall be informed prior to signing the contract and thereafter inform the contractor in writing the course to be followed. Where the drawings are to a small scale or are expressed in symbolic terms or are in the form of a diagram, then exact location of items shall not be inferred and in all cases, the work shall be fully integrated with the work of other traders and with the fabric of the building. The contractor shall appraise the duties of all plants and equipments taking account of any additions or variations and shall inform the Employer of any matters which may

affect the design. In all cases the equipment installed shall be of appropriate rating for the duty it performs.

The Specifications and bill of quantity shall be considered as part of this contract and any work or material shown on BOQ and not called for in the specification or vice versa, shall be executed as if specifically called for in both. The drawings indicate the extent and general arrangement of the Transformer, L.T. panel, H.T. & L.T. cable route layout etc. and are essentially diagrammatic.

The work shall be installed as indicated on the drawings, however, any minor changes found essential to co-ordinate the installations of this work with other services shall be made without any additional cost to the Employer. The drawings are for the guidance of the contractor, exact locations, distances and levels will be governed by the building. The contractor shall examine all structural and electrical drawings before starting the work, and report to Employer or its representative, any discrepancies, which in his opinion appear on them, and get them clarified.

If any discrepancy is noticed between General Conditions of Contract, specification, Bill of quantity and Drawings, the most stringent of the above shall apply. Bill of quantities, for electrical items, shall be read in conjunction with respective specification. However, in case of conflict between bill of quantities and the specification, former shall govern.

### 3) SYSTEM PARTICULARS :

|                  |   |                                |
|------------------|---|--------------------------------|
| LV               | : | 433 V, 3 Phase, 4 wire, 50 Hz. |
| Neutral earthing | : | Solid                          |

### 4) ABBREVIATIONS :

The following abbreviations have been used in the accompanying specifications, drawings and bill of quantity.

|     |   |                         |
|-----|---|-------------------------|
| IS  | : | Indian Standard         |
| BS  | : | British Standard        |
| HRC | : | High Rupturing Capacity |
| GI  | : | Galvanised Iron         |
| CU  | : | Copper                  |
| MS  | : | Mild Steel              |
| MV  | : | Medium Voltage          |
| LV  | : | Low Voltage             |
| PVC | : | Polyvinyl Chloride      |
| AMP | : | Amperes                 |
| V   | : | Volts                   |
| KV  | : | Kilo Volts              |



|        |   |                                                 |
|--------|---|-------------------------------------------------|
| HV     | : | High Voltage                                    |
| KW     | : | Kilo Watt                                       |
| KVA    | : | Kilo Volt Ampere                                |
| PF     | : | Power Factor                                    |
| Hz     | : | Frequency                                       |
| KWH    | : | Kilo Watt Hour                                  |
| XLPE   | : | Cross Linked Polyethylene                       |
| ACB    | : | Air Circuit Breaker                             |
| LED    | : | Light Emitting Diode                            |
| PLC    | : | Programmable Logic Controller                   |
| UPS    | : | Uninterrupted Power Supply                      |
| DP     | : | Double Pole                                     |
| IEE    | : | Institute of Electrical Engineers, London       |
| MCB    | : | Miniature Circuit Breaker                       |
| TPN    | : | Triple Pole and Neutral                         |
| SP     | : | Single Pole                                     |
| MCCB   | : | Moulded Case Circuit Breaker                    |
| CT     | : | Current Transformer                             |
| DB     | : | Distribution Board                              |
| DG     | : | Diesel Generator                                |
| BOQ    | : | Bill of quantity                                |
| SITC   | : | Supply, Installation, Testing and Commissioning |
| L.O.I. | : | Letter of Intent / Acceptance letter            |
| ELV    | : | Extra Low Voltage System                        |
| MP     | : | Mega Pixels                                     |
| CCTV   | : | Close Circuit Television                        |
| PA     | : | Public Address System                           |

FACP : Fire Alarm Control Panel  
 NVR : Network Video Recorder

NVMS : Network Video Monitoring Software

## 5) REGULATIONS AND STANDARDS :

The installation shall conform in all respects to Indian Standard Code of Practice for Electrical Wiring Installation IS: 732-1983 and IS: 2214 – 1983 (Silver Nitrate Pure and analytical reagent). It shall also be in conformity with the current Indian Electricity, Rules, Indian Electricity Act, National Electrical Code and Regulations of the Local Electrical Supply Authority in so far as these become applicable to the installation. Wherever this specification calls for a higher standard of material and/or workmanship than those required by any of the above regulations then this specification shall take precedence over the said regulations and standard. In general, the materials equipment and workmanship not covered by the above shall conform to the relevant Indian Standards.

The electrical installation work shall follow Codes, Indian Standard specifications and rules (Within the best meaning of the same) under this contract.

The following list is given for general guidance only in addition to list given in each individual section, however all other latest editions of Codes, Indian Standard specifications and Rules shall also be followed when it is required.

|           |                                                                                                                    |
|-----------|--------------------------------------------------------------------------------------------------------------------|
| IS: 8623  | Low voltage switchgear & control gear assemblies                                                                   |
| IS: 10118 | Code of Practice for selection, installation and maintenance<br>Of switchgear and control gear                     |
| IS: 4237  | General requirement for switch gear and control gear for<br>Voltage not exceeding 1000 Volt A.C. or 1200 Volt D.C. |
| IS: 13947 | Low voltage switchgear and control gear                                                                            |
| IS: 9224  | Low voltage fuses                                                                                                  |
| IS: 8828  | Circuit breakers for out protection for household and<br>Similar installations                                     |
| IS: 12640 | Earth leakage circuit breaker                                                                                      |
| IS: 1248  | direct acting indicating analog electrical measuring<br>Instruments                                                |
| IS: 2705  | Current transformers                                                                                               |
| IS: 4201  | Application guide for voltage transformers                                                                         |
| IS: 6875  | Control switches for voltage up to and indicating 1000 V<br>A.C. and 1200 V D.C.                                   |
| IS: 5578  | Guide for marking of insulated conductors                                                                          |
| IS: 11353 | Guide for uniform system of marking and identification of                                                          |

## Conductors and apparatus transmission

|          |                                                                                               |
|----------|-----------------------------------------------------------------------------------------------|
| IS: 8197 | Terminal markings for electrical measuring instruments<br>And their accessories               |
| IS: 694  | Specifications for PVC insulated cables for working<br>Voltage up to and including 1100 volts |
| IS: 2551 | Danger notice plates                                                                          |
| IS: 3043 | Code of practice for earthing                                                                 |
| IS: 5216 | Guide for safety procedures and practices in electrical work                                  |
| IS: 1646 | Code of practice for fire safety of building: Electrical<br>Installation                      |

Indian Electricity Act as amended up to date

Indian Electricity Rules as amended up to date

Rules and Regulations of Bombay Regional Council of Fire Insurance & Association of India for Electrical wiring.

**6) FEES, PERMITS AND TESTS :**

The Contractors shall pay for any and all fees and obtain permits required for the installation work. On completion of the work, the contractor shall obtain and deliver to the Employer, certificates of final inspection and approval by the local electric supply authority and the Electrical Inspector.

**7) ACTUAL ROUTE OF CABLE :**

The location of the cables, panel boards etc. is only indicative, therefore, the actual route of cables and the location of panel boards may differ from the plans according to the details of the building construction and the conditions of executions of the installations.

The contractor shall supply and install at his expense all secondary materials and special fittings found necessary to overcome the interference and to supply the modifications on the route of cables and conduits that are found necessary during the work, to the complete satisfaction of the Employer's representative.

**8) MATERIAL AND EQUIPMENT :**

All material and equipment shall conform to the relevant standards and shall be new, good quality, of the approved make and design. The materials and equipment shall conform to relevant Indian Standards. The Contractor shall be responsible for the safe custody of all materials and shall insure them against theft, damage by fire, earthquake etc. A list of items of materials and equipment, together with sample of each shall be submitted to the Employer within 10 days of the award of the contract. Any item which is proposed as a substitute, shall be accompanied by all technical details giving sizes, particular of materials and the manufacturer's name and shall be submitted along with the tender or bid offer. At the time of the submission of proposed substitute the Contractor shall state the credit, if any due to the Employer. In the event the substitution is approved, all changes and substitutions shall be requested in writing

and approvals obtained in writing from Employer. Employer's decision in the matter shall be final.

All materials of the same kind of service shall be identical and made by the same manufacturers. Any deviation to this rule shall be approved by the Consultant. Top priority shall be given to the products that have a permanent agent providing spare parts and maintenance facilities in the same city where the project is situated.

The makes of electrical equipments, components, accessories etc. have been mentioned in Tender document. However, Client / Electrical Consultant reserves the right to select from the specified make. Contractor shall clearly indicate in the bid document, the make they have considered. No extra claim shall be applicable if client / consultant suggests from the alternative make specified in the tender document.

#### **9) MANUFACTURERS :**

Where manufacturers have furnished specific instructions relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.

Where manufacturer's names and/or catalogue numbers are given, this is an indication of the quality, standards and performance required.

When interfacing occurs, equipment shall be mutually compatible in all respects.

#### **10) RATING :**

Rating of all items shall be appropriate for the conditions on the particular site on which the items will be used. All the equipment shall be fit for continuous work under the worst conditions of site and shall be rated for the following ambient condition.

- Outdoor temperature 50 deg.c.
- Temperature under shed 45 deg.c.
- Salty, dusty and humid
- Coastal area

#### **11) INSPECTION AND TESTING :**

Employer's representative reserves the right to request inspection and testing at manufacturer's works at all reasonable times for this contract. Tests on site of completed works shall demonstrate, among other things:

1. That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions.
2. That all items operate efficiently and quietly to meet the specified requirements.
3. That all circuits are correctly fused and protected and that protective devices are properly co-ordinated.
4. That all non current carrying metal work is properly and safely grounded in accordance with the specifications.

5. The contractor shall provide all necessary instruments and labour for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Employer and shall provide test certificates signed by a properly authorised person. Such test certificates shall cover all works.
6. If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements or re-testing will be considered. Employer's decision as to what constitutes a satisfactory test shall be final.
7. The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

#### **12) TEST CERTIFICATES :**

The contractor shall submit test certificates for all the electrical material / system installed. These shall be issued by a government recognized inspection office certifying that all equipment, materials, construction and functions are in agreement with the requirements of these specifications, ISI and when ISI is not applicable other approved certifying agencies.

#### **13) INSTRUCTION MANUAL :**

The contractor shall prepare and produce instruction, operation and maintenance manuals in English for the use, operation and maintenance of the supplied equipment and installations, and submit 3 sets to Employer, at the time of handing over.

#### **14) SAMPLES AND CATALOGUES :**

Before ordering the material necessary for these installations, the contractor shall submit to Employer for approval, a sample of every kind of material such as cables, conductors, conduits, switches, socket outlets, circuit breakers, lighting fixtures, boxes etc. along with the catalogues.

For big items such as switchboards, the submission of catalogues shall be enough. Prior to ordering any electrical equipment / material / system, the contractor shall submit to Employer, the catalogues, along with the samples, at least from three different manufacturers. After the selection of manufacturer by Employer, the contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the Electrical consultant & Data sheets shall be signed and stamped by consultant and one copy to be submitted to Client.

#### **15) VENDOR AND SHOP DRAWINGS :**

The contractor shall prepare and submit to Employer, for his approval, two sets of vendor detailed drawings of all distribution boards, switch boards, outlet boxes, special pull boxes and other likewise material, equipment to be fabricated by the contractor, or other vendor within 15 days of signing of the contract.

Before starting the work, the contractor shall submit to Employer for his approval in the prescribed manner, the shop / execution drawings for the entire installation, specially the main connections and junctions, the route of conduits and cables, no. and size of wires drawn through the conduits, location of all the outlet points, and switch boards and distribution boards and any other information required by Employer. Employer reserves the right to alter or modify these drawings if they are found to be insufficient or not complying with the established technical standards or if they do not offer the most satisfactory performance or accessibility for maintenance.

**16) AS BUILT DRAWINGS :**

At the completion of work and before issuance of certificate of virtual completion the contractor shall submit to Employer, three sets of layout drawing drawn at appropriate scale indicating the complete wiring system "as installed". These drawings must provide (in plan, folded elevation and section)

- a. Location and details of distribution boards, main switches, switchgear and other particulars.
- b. Location of all earthing stations, route and size of all earthing conductors, manholes etc.
- c. Route and particulars of all cables.
- d. Lighting layout plans with conduit routing layout/cable tray for all the floors along with circuit distribution details.
- e. External Area Lighting Plan

**17) GUARANTEE :**

At the close of the work and before issuance of final certificate of virtual completion by Employer, the contractor shall furnish written guarantee indemnifying Employer against defective materials and workmanship for a period of one year after completion. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to Employer, the following:

- a. Any defective work or material supplied by the contractor.
- b. Any material or equipment supplied by Employer, which is damaged or destroyed as a result of defective workmanship by the contractor.
- c. Any material or equipment damaged or destroyed as a result of defective workmanship by the contractor.

**18) SPECIAL NOTES FOR BIDDER :**

- a. All the major electrical components like Transformers, DGs, HT MV LT switchgears, DBs, UPS, etc including the external & internal electrical distribution system, earthing systems & various equipments (which is supplied &/or installed by the contractor) shall be maintain for 2 years from the date of virtual completion of work at free of cost.
- b. The contractor should co-operate & coordinate for LT connections to LT panel board of various blocks, so that day to day work should not suffer.
- c. It is in the scope of Contractor to preparing necessary drawing submitting to authorities (i.e. Local supply co., pollution control board, Electrical Inspector, etc), getting their approval / sanction and final certificate to energize the sub-station equipment's. Filling the necessary application to supply co. following up and getting the supply filling the necessary test report to the supply co. inclusive. All official / statutory fees shall be paid by clients & all other required expenses shall be on the contractors account; no extra payment shall be paid to contractor for said job.

- d. LT Panels shall be approved on site by Engineer in Charge & Electrical Consultant.
- e. Contractor shall submit Shop drawings for approval to Electrical consultant based on tender drawings before execution which shall not be on chargeable basis.
- f. The MCB and MCB DBs must be of same make.
- g. Make of components required to be used by contractor to complete the installation, if not mentioned anywhere, shall be required to GOT IT APPROVED by Client/Architect/Consultant before installation in writing manner.
- h. Within a week of work order, the contractor shall submit the sample of each item / component of above mentioned approved make for the approval of the Client/Architect/Consultant.

## **2 TECHNICAL SPECIFICATION FOR HT DP STRUCTURE:-**

### **HT GOD & HT WORK**

#### **1. 11 KV SWITCHYARD**

##### **2.1 TWO POLE STRUCTURE**

The scope of work includes fabrication, supply, erection, painting as per the drawing and IS, and getting the two pole as well as four pole structure approved from I.M & E department. The pole structure comprising of following items. All M.S. elements of channels, angles, and flat shall be painted with two coats of primer and further painted with two coats of Aluminium paint. All nut & bolts, washer etc. used shall be hot dip galvanized.

2.1.1 Vertical pole of minimum ISMB - 175 (175 mm x 90 mm) size of approximately 9.0 / 10.0 mtr. Length as indicated in the drawing, with 400 x 400 x 8 mm size base plate welded to one end of both the joists.

2.1.2 Cross member of minimum ISMC - 100 (100 mm x 50 mm) size channels approximately 3.5 mtr. Each Length wherever required as indicated in the drawing.

2.1.3 Cross bracing angle of minimum ISA - 50 (50 mm x 50 mm x 6 mm) size of 4.5 mtr. Each Length wherever required as indicated in the drawing.

2.1.4 Side clamps, stay clamps, cleats, patties, etc. Fabricated from minimum 50 mm x 6 mm size M.S flats as per actual requirement.

2.1.5 All nuts, bolts, washers etc. shall be of minimum 15 mm size.

2.1.6 Erection of poles and fixing of all structural members as per drawing and instruction of Site engineer. The structure shall be erected in plumb, line level, properly facing the incoming and outgoing lines. Cross member shall be firmly tightened.

2.1.7 All member shall be fabricated to suit the mounting / fixing of GOD, L.A, DOF, DISC /PIN /POST insulators, cable end termination kit / box etc. as per the drawing.

2.1.8 All necessary hardware, nut-bolts, extra members, sundry items are included in the scope of work.

2.1.9 All M.S parts shall be painted with primer and aluminium paint.

2.1.10 Earthing terminal shall be provided by welding 12 mm size bolt / cleat of 50 x 6 mm size M.S flat shall be fixed to each joist with a hole of 15 mm size and cadmium coated nuts, bolts, washers shall be provided as Earthing terminals. Fixing or joining of any members is allowed by nut and bolt only welding is strictly not allowed.

2.1.11 Suitable M.S. flat supports and cleats shall be fixed to ISMB poles for supporting / fixing the Earthing protection strip in the manner approved by the Client.

2.1.12 all drawing shall be prepared and submitted to Industry Mines & energy Dept. for approval. Obtain the approval from I.M. & E. Dept.

2.1.13 Vitreous enamelled caution boards or any other requirements shall be provided.

2.1.14 C.T.P.T. mounting channels, clamps, bracing angles, nut-bolts, hardware's, etc. shall be supplied and erected.

## **2.2 AIR BREAK SWITCH:**

The air break switch should be constructed as per IS: 9920 / 1985. Are provided with test certificate.

The A.B. switch should be triple pole type with movable center pole. All the poles should be opened / closed simultaneously by a lockable operating mechanism.

The porcelain insulator shall be sound free from defects, thoroughly vitrified and smoothly glassed. Insulators shall have compressing type glassed with a good luster and of uniform brown colour.

The air break switch should be provided with 1 year guarantee and the test report.

The A.B. switch should be manually operated and shall be able to:

- Carry rated current without excessive temperature rise.
- Withstand the short circuit forces developed during fault.
- Carry the inrush current of transformer.
- Interrupt small inductive / capacitive current.

The contacts shall be of silver faced copper ensuring sufficient contact pressure. The male & female contacts should be of self-aligning type to ensure trouble free operation during opening and closing. Mild steel arcing horn capable of breaking the magnetizing current shall be provided.

## **2.3 DROP OUT FUSE**

The D.O. Fuse assembly should be suitable for 11 KV supply and in accordance with IS 9385 / 1985 and provided with a test certificate.

The assembly shall be mounted on double pole structure complete with 3 fuse elements of required ampere rating. The fuse link shall consist of iron channel base, stack insulator per phase, fuse carrier Bakelite tube, non-ferrous metal parts and spring loaded phosphor bronze contacts. The insulator shall comply with impulse voltage test in accordance with IS 3106.

## **2.4 LIGHTNING ARRESTOR**

### **2.4.1 TYPE AND RATING:**



Lightning arrestor shall be station class, heavy duty, and non-linear resistance type with rating as 11 KV.

The arrestor shall have adequate thermal discharge capacity for severe switching surges, long duration surges and multiple strokes.

#### **2.4.2 CONSTRUCTIONAL FEATURES**

The arrestor shall be single pole and hermetically sealed off. It shall be of robust construction with excellent electrical and mechanical characteristics.

Insulators must be non-hygrosopic and shall be wet process porcelain, brown glazed and free from imperfection. All metal parts and hardware shall be hot dip galvanized. Creepage distance shall correspond to heavily polluted atmosphere. Grading ring if required shall be provided to maintain voltage gradient within permissible limit. The arrestor shall be provided with pressure relief device if applicable to prevent shattering of approach in case excessive gas pressures build up.

#### **2.4.3 ACCESSORIES**

Lightning arrestor shall be furnished complete with insulating base, surge counter and anchoring hardware for mounting on steel structure.

A surge counter shall be mounted at a convenient height for reading counter Terminals shall be such as to permit connections with minimum bends.

A leakage current detector shall be furnished with the counter as an integrate part. This is for monitoring the leakage to indicate any possible breakdown.

A suitable sized bypass shunt along with necessary terminals shall be furnished for bypassing the discharge counter if required.

#### **2.4.4 TERMINALS**

All connection terminals shall be of corrosion resistant material and shall be provided with complete connection hardware.

High voltage line terminal connector suitable for ACSR conductor.

#### **2.4.5 RELATED CIVIL WORK**

Foundation require for two pole structure in switch yard area shall be carried out by vendor with respective civil material as required to complete the job successfully as mentioned in our drawing.

#### **2.1.7 EARTHING SWITCH**

Cable Earthing switch shall be provided in the cable chamber and shall be operated from the front of the panel. The ON/OFF position of switch shall be indicated by mechanical indicator. The Earthing switch shall be suitably interlocked with the breaker, so that it can be operated only when the breaker is in OFF position.

Earthing switch shall also be provided on bus bar side. The ON/OFF Switch shall be indicated by mechanical indicator. The Earthing switch shall be suitably interlocked with the breaker, so that it can be operated only when the breaker is in OFF position.

### **2.1.8 ISOLATING CONTACTS**

The breaker isolating contacts shall consist of two parallel flat silver plated copper bars with ball point contacts to give a vertical tolerance of  $\pm 10$  mm.

### **2.1.9 LOW VOLTAGE PLUG AND SOCKET CONNECTOR**

A twenty pin plug and socket connection along with flexible leads shall be provided to connect control instrumentation and interlock circuits on the breaker truck and in the panel. The plug and socket assembly shall be suitably interlocked with the truck positions like service and test/isolated position.

### **2.1.10 INTERLOCKS AND SAFETY DEVICES**

The following interlocks shall be provided:

- a. The truck cannot be moved from either test to service position or vice versa, when the circuit breaker is 'ON'.
- b. The circuit breaker cannot be switched 'ON' when the truck is in any position between test and service position.
- c. Front part of the truck cannot be removed when the breaker in 'ON' position.
- d. The low voltage plug and socket cannot be disconnected in any position except test/isolated position.
- e. The truck cannot be moved inside the panel, when the LT plug and socket is disconnected.
- f. Earthing switch cannot be switched 'ON' when the truck is inside the panel.
- g. The truck cannot be inserted when the earthing switch is 'ON'.

### **2.1.11 SAFETY DEVICES**

The following Safety devices shall be provided for the safety of the operating personnel:

- a. Individual explosion vents shall be provided for breaker/bus bar/cable chambers on the top of the panel to let out the gases under pressure generated in case of fault inside the panel.
- b. Cubicle with front plate to withstand the pressure for internal arc fault as per PEHLA recommendation.
- c. Circuit breaker and sheet metal enclosure shall be fully earthed.
- d. Self-locking shutters shall be provided which shall close automatically when the truck is withdrawn to 'Test position' and no separate padlocking of the shutter shall be required.

### **2.1.12 PROTECTIVE EARTHING**

The earthing connection between the truck and the cubicle shall be by means of sliding contacts so that the truck is earthed in the isolated position when inserted and remains earthed when the truck is pushed further into the connected position or when the truck is being withdrawn until the truck has moved part the isolated position.

### **2.1.13 CURRENT TRANSFORMER**

**I. GENERAL REQUIREMENTS**

Accommodation shall be provided in the circuit breaker panel, to mount one set of dual ratio CT. Access to the CTS for cleaning, testing or changing shall be from the front, back or top of the panel.

**II. RATING**

Dual ratio CTS of suitable burden (but each not less than 15 VA) shall be preferred with 5 amps secondary.

Instrument Security Factor (ISF) of each CT shall not be more than 5.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. CT terminals shall be shorting type. Current & voltage circuits shall be laid in separate wire ways. Secondary terminals of CTS shall be brought out to a suitable terminal block which will be easily accessible for terminal connections. Test terminal block shall be provided in the front side of the panel for testing purpose.

CT'S shall have 2 Nos. of cores for following application:

Core -1 for metering

Core -2 for over current & earth fault protection.

Class of accuracy of each winding

Metering class 1

Protection class 5P10

**2.1.14 POTENTIAL TRANSFORMERS**

The potential transformers shall be confirming to IS 3156/ IEC 60185. The primary windings of the potential transformers shall be insulated and shall be of the cast rest in type. Potential transformer (PT'S) shall be mounted on a draw out trolley and housed in separate metal compartment and shall have control fuses on the H.V. side and a miniature circuit breaker on the L.V. side of the windings. HT HRC Control fuses shall be confirming to IS - 9385/ IEC - 60282. Miniature Circuit breaker shall comply with IS - 8828/ IEC - 60898.

Padlocking facilities shall be provided for both service and isolated position.

The potential transformer shall be as specified below:

Ratio: 11000 V3/ 110/ V3/ 110 V

V A Burden: 100 V A for 100/V3 and 110 V winding

Class: CL -1 for both the windings.

Basic Insulation level: Same as mentioned.

Over voltage factor: 1.2 Continuous

Single phase PT'S shall be used and shall be connected in Star/ Star.

**2.1.15 PROTECTION AND TRIPPING ARRANGEMENT & DEVICES****PROTECTION**

All protection relay shall be numeric type of approved make.

The protection and tripping arrangement of circuit breaker shall be:

- i. Numeric type instantaneous short circuit protection Device No.50 Range 500 – 2000% shall be provided on all phases.
- ii. Numeric type back up over current protection for Phase faults Device No.51 Range 50 – 200% shall be provided on all phases.
- iii. Numeric type ground fault protection Device No.50G. CT's. Range 20 – 80% shall be provided.
- iv. Lockout and trip supervisory relays etc shall be provided with manual reset facility.
- v. Auxiliary relay for transformer fault like OT & WT.
- vi. Surge Arrestor

## BREAKER TRIPPING & CLOSING DEVICE

Breaker tripping and closing devices shall be operated on D.C. supply. The rated D.C. voltage shall 110 V D.C. through power pack with storage facility for one tripping and one closing. The supply for breaker opening, closing and indication devices shall be provided as under:

- a) One D.C. feeder shall be provided for each bus section. The Bus coupler panel may be fed from any of the two supplies.
- b) One separate 240 V AC supply shall be provided for space heater, motor auxiliary supply etc. Mechanical indication for breaker positions such as ON, OFF, spring charged, test position/Service position shall be provided. Various Electrical indication with colours are indicated below shall be provided.
- a) Breaker 'ON' - Red lamp
- b) Breaker 'OFF' - Green Lamp
- c) Breaker 'Auto Trip' - White lamp
- d) Trip circuit healthy - White lamp
- e) DC fail - Blue lamp.
- f) Red phase ON - Red
- g) Yellow phase ON - Yellow
- h) Blue phase ON - Blue

### 2.1.16 CONTROL WIRING

The control wiring shall be carried out with minimum 2.5 sq. mm. PVC insulated copper conductor cables. The wiring shall be securely fixed and neatly arranged to enable easy tracing of wires. Identification PVC ferrules shall be fitted to all wire terminals to render easy identification and facilitate checking in accordance with IS 5578 and 11353.

### 2.1.17 METERING INSTRUMENT PANEL ACCESSORIES

#### I. METERING

Digital type Tri vector meter of approved make (Smart demand controller) shall be provided on the incomer feeder. Specification of the meter shall be as follows:

Accuracy: Class 0.5, compliant to revenue class certification.

: Real time measurement per phase & average V, I, PF, KW, KVAR, KVA

: Peak demand, sliding window. Protected.

: V & I unbalance, Phase reversal

: Time of Use (TOU)

Power Quality Measurement:

: Total Harmonics

Logging & recording for all measurements:

: Interval or event-based, 32 channel measurement

. & recording

: Event logging

: "Bust" data recording

: Min/ Max recording

Alarming: Over & under measurement detection by 24 set point functions.

Multi-port

Communication: One each of RS 485 and RS 232 ports.

## II. INSTRUMENT PANELS

The instrument panel shall be part of the housing. Relays, meters and instruments shall be mounted as per general arrangement drawings to be submitted by the vendors. They shall be of flush mounting type.

### **III. INSTRUMENTATIONS**

- a) Digital type Voltmeter of class 1.0 accuracy and Suitable in size as per IS-1248 shall be provided at incomer panel, with selector switch. The instrument shall be calibrated for the ranges specified.
  - b) Digital type Power factor meter of class of 1.0 accuracy conforming to IS: 1248 shall be provided at incomer panel.
  - c) Digital type Ammeter with Inbuilt Selector Switch of specified range to class 1.0 accuracy and Suitable in size as per IS - 1248 shall be provided at both incomer and outgoing panels along with necessary selector switches.
  - d) Digital type frequency meter class of 1.0 accuracy conforming to IS: 1248 shall be provided at incomer panel.
  - e) Digital Type Load Manager of Schneider make PM 210 with RS 485 port.
- IV. The following minimum indication lamps shall be provided in the front of cubicle.  
Breaker open / closed / tripped, spring charged, trip circuit healthy and control supply healthy.  
Lamps shall be clustered LED type and trip circuit supervision scheme shall be of continuous supervision type.
- V. After meeting all necessary control and indication requirements 2 nos. NO and 2 nos. NC auxiliary of the breaker shall be made available for the owner, wired up to terminal block.
- VI. Separate MCB's shall be provided for lamps, heaters and other instrumentation etc. on each panel.
- VII. Anti-condensation space heaters suitable for operation on 240 V single phase, 50 Hz A.C. for each cubicle and with thermostat control one incandescent lamp with switch and 3 pin 5 amps plug socket.
- VIII. Earthing Conductor of 30 x 6 mm should be provided in continuous length of the panel.

#### **2.1.18. DRAWINGS/DOCUMENTS REQUIRED FOR REVIEW/APPROVAL**

Following drawings documents shall be submitted by the manufacturer for approval.

- a. General arrangement (GA) of equipment layout.
- b. Equipment list.
- c. Relay and metering system schematics.
- d. Supply and erection schedule.
- e. Catalogue and specification sheets.

#### **2.1.19. INSPECTION AND TESTING**

After manufacturing of switchgear panels tests shall be carried out on the equipment as per relevant IS and Electricity Regulations.

#### **2.1.20. QUALITY ASSURANCE**

Vendor shall submit in substantial detail a quality assurance plan indicating all activities step by step at various manufacturing/fabrication stages to meet the requirement of this specification and various standards/regulations/practices to enable comprehensive assessment of its merits and reliability.

### **2. TECHNICAL DATA FOR SWITCHGEAR CUBICLE TYPE WITH LBS BREAKER**

#### **TENDERER MUST FILL IN THE FOLLOWING TECHNICAL DATA**

##### **2.1 SWITCHGEAR CUBICLE**

- i. Make
- ii. Type
- iii. Reference Standard
- iv. Voltage (System/Rated)
- v. Phase/Frequency
- vi. Short Circuit Rating

- a. Interrupting Symmetrical
- b. Short time for 1/3 sec.

**2.2 CONSTRUCTION**

- i. Drawout feature for Circuit Breaker with Service Test & Disconnected
- ii. Minimum clear space required at :
  - a. Front for breaker withdrawal
  - b. Rear
- iii. Overall dimension & Operating weight

**2.3 BUS BAR**

- i. Material & grade ( Cu. Only )
- ii. Reference standard
- iii. Cross sectional area size
- iv. Continuous current at 40 deg C
- v. Max temp rise over for 40 deg C
- vi. Short time current for 1/3 sec.
- vii. Min clearance of bare bus bar & connection
  - a. Phase to phase
  - b. Phase to ground

**2.4 CIRCUIT BREAKER**

- i. Make
- ii. Type
- iii. Rated voltage
- iv. Rated frequency
- v. No. of poles
- vi. Rated current
  - a. Continuous at 40 deg C & within cubicle
  - b. Short time current for 1 sec/3 sec

**2.5 Max. temp rise over 40 deg C ambient****2.6 Rated operating duty****2.7 Interrupting capacity at rated voltage and operating duty**

- a. Symmetrical

**2.8 Rated making current****2.9 No. of breaker operations permissible Without requiring inspection for refilling SF6 gas replacement of contacts & other Not Applicable main parts.**

- a. At 100% rated current
- b. At 100% rated short circuit current

**2.10 Type of contacts**

- a. Main
- b. Arcing

**2.11 Min clearance in air**

- a. Between poles
- b. Between live parts & ground

**2.12 Operating mechanism**

- a. Type
- b. No. of breaker operations stored
- c. Trip free or fixed trip?
- d. Antipumping features provided

**2.13 Closing Coil**

- a. Voltage
- b. Permissible voltage variation
- c. Power required at rated voltage

**2.14 Breaker/breaker cubicle provided with the following:**

- a. Mech. safety interlocks
- b. Automatic safety shutter
- c. Emergency manual trip
- d. Mech. ON/OFF indicator
- e. Operation counter
- f. Spring charge/discharge indications
- g. Manual spring charging facility
- h. Mechanical Anti pumping

**2.15 Net weight of the breaker****2.16 Impact load for foundation design****2.17 Overall dimensions in mm****1) METHOD OF MEASUREMENT**

- All the items will be measured as mentioned in Bill of quantity.

**3 TECHNICAL SPECIFICATION FOR HT CABLE****1) SCOPE**

1. The scope shall cover supplying, laying, testing and commissioning of 3 core H.T cables which shall be capable of operating at a sustained conductor temperature of 90°C and suitable for a maximum conductor short-circuit temperature of 250°C.
2. This specification gives the general requirement of cables. However, it is the responsibility of the vendor to take the joint measurement and obtain client's approval before the placement of orders to the main supplier / manufacturer. Cut lengths will not be accepted.

**2) REFERENCE CODES & STANDARDS:**

- |                       |                                                                                           |
|-----------------------|-------------------------------------------------------------------------------------------|
| 1.1. IS : 8130 – 1984 | Conductors of Insulated Cables.                                                           |
| 1.2. IEC : 228 -      | Conductors of Insulated Cables.                                                           |
| 1.3. IS : 10810 -     | Methods of various tests on cables and their accessories                                  |
| 1.4. IEC : 502 -      | Extruded solid dielectric-insulated power cables for rated voltage from 1 KV up to 30 KV. |
| 1.5. IEC : 287 -      | Calculations of continuous current rating of cables (100% load factor).                   |

1.6.IS : 7098 (Part II) - Cross-linked polyethylene insulated PVC sheathed cable for Voltage from 1.3 KV up to 33 KV.

1.7.IS : 5831 - 1984 PVC insulation & sheath of electrical cables.

### 3) OPERATING CONDITIONS

#### Electric system

- System Voltage : 11 KV/1.6 KV
- Frequency : 50 Hz.

#### Environment

- Ground temperature : 40°C.
- Ambient air temperature : 50°C.
- Solar gain : 1100 w/m<sup>2</sup>
- Earth resistivity : [The bidder shall confirm the Earth Resistivity Test]
- Atmospheric conditions : Humid, salty and dusty

### CONSTRUCTION

#### 4) CONDUCTORS

1. The conductor shall be of circular stranded Aluminium to IS : 8130 & IEC : 228. It shall be clean, reasonably uniform in size & shape smooth & free from harmful defects. Any other form of conductor may also be accepted if in line with modern trends.

#### 5) CONDUCTOR SCREEN

1. The conductor screen shall consist of an extruded layer of thermosetting semi-conducting compound which shall be extruded simultaneously with the core insulation.

#### 6) INSULATION

1. The insulation shall be super clean XLPE compound applied by extrusion and vulcanized to form a compact homogenous body.

#### 7) INSULATION SCREEN

1. Each insulation have an insulation screen in two parts consisting of :
2. Non-metallic semi-conducting compound tape part and a metallic screen part.
3. The non-metallic part shall be directly applied upon the insulation of each core and may consist of an extruded semi-conducting material extruded simultaneously with the conductor screen and insulation (triple extrusion).
4. The semi-conductor shall be readily strippable and must not be bonded in such a manner that it has to be shaved or scraped to remove.



5. The metallic part shall consist of a copper tape helical applied with a 10% overlap. A binder tape of copper shall be applied over the copper wire metallic screen.

## **8) LAYING UP**

1. The cores shall be identified on the non-metallic part of the insulation screen by legible printing on the length of each conductor or, by the inclusion of a marker tape.
2. The cores shall be laid up with a right hand direction of lay.
3. No cables shall be directly buried in the ground. They shall be laid in trenches, trays, racks or in conduits or pipes. The cables of different voltage grade shall be laid in different trays. 2 mtr loop to be provided on both the sides.

### **Binder tape / Moisture barrier:**

4. During layup, a suitable open spiral binder may be applied, at the manufacturer's discretion, before the application of an extruded inner covering.

## **9) FILLERS**

1. Fillers shall be PVC.

## **10) INNER COVERING / SHEATH**

1. The inner covering shall be extruded over the laid up cores to form compact and circular bedding for the metallic layer.

## **11) METALLIC LAYER**

1. The metallic layer shall be galvanized steel wire.

## **12) OUTER SHEATH**

1. The tough outer sheath, black coloured best resisting PVC polyethylene compound type ST-2 as per IS : 5831 for the operating temperature of the cable shall be provided over the armour as specified in relevant standards by extrusion process.

## **13) CABLE MARKING**

### **Embossing on outer sheath:**

1. The PVC outer sheath shall be legibly embossed with the legend: "ELECTRIC CABLE 11000 VOLT "etc.
2. The letter and figures shall be raised and shall consist of upright block characters. The maximum size of the characters shall be 13 mm. And the minimum size 15% of the cable circumference or 3 mm. whichever be the greater. The gap between the end of one set of embossed characters as above and the beginning of the next shall not exceed 150 mm.

### **Identification of Manufacturer and year of manufacture:**

3. An identification of the manufacturer, the year of manufacturing, cable size shall be embossed at regular intervals on the PVC outer sheath. This shall not affect the spacing between repetitions of the legend as given above.

#### 14) SEALING AND DRUMMING

1. After tests at the manufacturers works, both ends of the cable shall be sealed to prevent the ingress of moisture during transportation and storage.
2. Cable shall be supplied in lengths of 500 mtrs. Or as required in non-returnable drums of sufficiently sturdy construction.
3. The spindle hole shall be 110 mm. minimum diameter.
4. Each drum shall bear on the outside flange, legibly and indelibly in the English language, a distinguishing number, the manufacturer's name and particulars of the cable viz. voltage, length, conductor size, cable type, insulation type and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow.

#### 15) TESTING

1. Type tests and Routine tests shall be carried out in accordance with the relevant IEC standards / IS. The copies of routine test results shall be submitted along with each drum length or part thereof.

#### 16) TRANSPORTATION & DELIVERY

1. The cable shall be supplied in the actual length as per joint measurement at site.
2. The cable shall be dispatched at client's store or at site as per detailed instructions given by Client at later stage.
3. The cables shall be loaded from the main vendor's store, transported, unloaded at Client's stores and properly stocked as per instruction of client's local representative.

#### TECHNICAL DATA SHEET FOR H. T. XLPE CABLE:

| Sr. No.    | Particulars                    | Description                    |
|------------|--------------------------------|--------------------------------|
| <b>1.0</b> | <b>ENVIRONMENT DETAILS</b>     |                                |
| 1.1        | Ambient Temp In Degree Celsius | 50 Degree Celsius              |
| 1.2        | Ground Temp In Degree Celsius  | 35 Degree Celsius              |
| 1.3        | Relative Humidity              | 90 % At 35 Degree Celsius      |
| 1.4        | Altitude                       | < 1000 Meter Above MSL         |
| 1.5        | Atmosphere                     | Non Corrosive, Humid and Dusty |
| <b>1.0</b> | <b>SYSTEM DETAILS</b>          |                                |
| 1.1        | System Voltage                 | AS PER OEM                     |
| 1.2        | System Frequency               | AS PER OEM                     |
| 1.3        | Grounding                      | AS PER OEM                     |

| Sr. No.    | Particulars                                            | Description                                                                                  |
|------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 1.4        | Fault Level                                            | AS PER OEM                                                                                   |
|            |                                                        | AS PER OEM                                                                                   |
| <b>1.0</b> | <b>CABLE</b>                                           |                                                                                              |
| 1.1        | No. of Cores                                           | 3 (Three)                                                                                    |
| 1.2        | CABLE CONDUCTOR                                        |                                                                                              |
| 1.1.1      | Size Of Conductor                                      | As per BOM                                                                                   |
| 1.1.2      | Material                                               | High Purity Aluminium                                                                        |
| 1.1.3      | Construction                                           | Stranded                                                                                     |
| 1.1.4      | Shape                                                  | Compacted Circular                                                                           |
| 1.1.5      | Confirming To                                          | Is-8130                                                                                      |
| 1.3        | Conductor Screen                                       | Extruded Semi-conducting Material                                                            |
| 1.4        | <b>CONDUCTOR INSULATION</b>                            |                                                                                              |
| 1.4.1      | Material                                               | High Purity Void And Moisture Free Cross Linked Polyethylene (XLPE) Using Gas Curing Process |
| 1.4.2      | Thickness                                              | > = 5.5mm                                                                                    |
| 1.5        | INSULATION SCREEN                                      | EXTRUDED SEMI-CONDUCTING MATERIAL HAVING COPPER TAPE OVER IT                                 |
| 1.6        | CORE IDENTIFICATION TAPE                               | Yes Required                                                                                 |
| 1.7        | CORE LAYING                                            | Right Hand Direction                                                                         |
| 1.8        | INNER SHEATH / COVER                                   | Extruded                                                                                     |
| 1.9        | <b>ARMOURING</b>                                       |                                                                                              |
| 1.9.1      | Material                                               | Flat Steel GI Strip                                                                          |
| 1.9.2      | No Of Strip                                            | 4                                                                                            |
| 1.9.3      | Size Of Strip                                          | 0.8 mm                                                                                       |
| 1.10       | <b>OUTER SHEATH</b>                                    |                                                                                              |
| 1.10.1     | Material                                               | PVC                                                                                          |
| 1.10.2     | Type                                                   | St-2 As Per Is-5831-1984                                                                     |
| 1.10.3     | Thickness                                              | > = 1.4 Mm                                                                                   |
| 1.10.4     | Colour                                                 | Black                                                                                        |
| 1.11       | MARKING ON OUTER SHEATH                                | YES                                                                                          |
| 1.11.1     | Voltage Grade                                          | Yes                                                                                          |
| 1.11.2     | No. of Cores/Size of Conductor / Material of Conductor | Yes                                                                                          |
| 1.11.3     | Type Of Insulation                                     | Yes                                                                                          |
| 1.11.4     | Details About Armour                                   | Yes                                                                                          |

| Sr. No.    | Particulars            | Description                              |
|------------|------------------------|------------------------------------------|
| 1.11.5     | Details Of Standards   | Yes                                      |
| 1.11.6     | Year Of Manufacturer   | Yes                                      |
| 1.11.7     | Any Other Details      | Yes                                      |
| <b>4.0</b> | <b>TESTING</b>         |                                          |
| 4.1        | Type Test As Per Is    | Certificate To Be Provided for each drum |
| 4.2        | Routine Test As Per Is | Yes To Be Witnessed By Client            |
| 4.3        | Acceptance Test        | Yes To Be Witnessed By Client            |
| <b>5.0</b> | <b>CABLE DRUM</b>      | <b>Non Returnable</b>                    |
| 5.1        | Material               | Wooden / Steel                           |
| 5.2        | Marking On Cable Drum  | As Per Manufacturer's Standard           |

## 17) MODE OF MEASUREMENTS

- The cables will be measured in meters. The unit rate shall include cutting the cable into required lengths, packing, loading, unloading, insurance, transportation, delivery to stores/site as per work order, stocking in stores, testing of cables at stores etc. of medium voltage cable. Total quantity in meters shall be measured lug to lug basis.

## 4 TECHNICAL SPECIFICATION FOR OIL TYPE TRANSFORMER

### 1) SCOPE OF WORK

Design, manufacture, testing and inspection at places of manufacturer, painting, supply, delivery to site, the transformers with all related accessories and specifications as specified below with technical data sheet and bill of quantity.

### 2) CODES & STANDARDS

- The design, material, construction, manufacture, inspection, testing and performance of power transformers shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable standards and codes of practice.
- Transformers shall conform to the current applicable standards and codes of practice as specified as under. In case of conflict between the applicable reference standards and this specification, this specification shall govern.

| SR. | ITEM                   | RELEVANT IS | RELEVANT IEC |
|-----|------------------------|-------------|--------------|
| 1   | Power transformer      | IS 2026     | IEC 76       |
| 2   | Fittings & Accessories | IS 3639     |              |
| 3   | Climate Proofing       | IS 3202     | IEC 354      |
| 4   | Loading of Transformer | IS 6600     | IEC 296      |

|    |                                               |          |         |
|----|-----------------------------------------------|----------|---------|
| 5  | Oil                                           | IS 335   | IEC 137 |
| 6  | Bushings                                      | IS 20650 | IEC 144 |
| 7  | Degree of Protection                          | IS 2147  | IEC 76  |
| 8  | Testing, Tolerances on guaranteed Particulars | IS 2026  | IEC 76  |
| 9  | Buchholz Relay                                | IS 3637  |         |
| 10 | Electrical Insulation                         | IS 1271  | IEC 85  |

### 3) CONSTRUCTION

#### 3.1 GENERAL CONSTRUCTIONAL FEATURES

- All material used shall be of best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions without distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform.
- Similar parts, particularly removable ones, shall be interchangeable. Pipes and pipe fittings, screws, studs, nuts and bolts used for external connections shall be as per the relevant standards. Bolts and nuts exposed to atmosphere shall be galvanized.
- Nuts, bolts and pins used inside the transformers and tap changer compartments shall be provided with lock washers or locknuts.
- Exposed parts shall not leave pockets where water can collect.
- Internal design of transformer shall ensure that air is not trapped in any location.
- Facility shall be provided for lubrication of bearings and mechanisms.
- Materials in contact with oil shall be such as not to contribute to the formation of acid in oil. Surface in contact with oil shall not be galvanized or cadmium plated.
- Labels shall be provided for all identifiable accessories like relays, switches, fans, current transformers etc. All label plates shall be of non-corrosive material.
- All internal connections and fastenings shall be capable of operating under overloads and over-excitation allowed as per specified standards without injury.

#### 3.2 PAINTING

- The interior of all transformer tanks and other oil filled chambers and internal structural steel work shall be cleaned of all scale and dust by shot blasting unless otherwise approved. These surfaces shall be painted with not less than two coats of heat resistant, oil insoluble and insulating varnish. Steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The

second coat shall be of an oil and weather resistant nature, preferably of distinct colour from the prime and finish coats. The final coat shall be of a glossy oil and weather resisting non fading paint of specified shade.

- Metal parts not accessible for painting shall be made of corrosion-resistant material.
- Interior surfaces of mechanism chambers and marshalling kiosks shall receive three coats of paint after proper cleaning. The final coat shall be of a light colour anti-condensation paint.

### 3.3 ELECTRICAL AND PERFORMANCE REQUIREMENTS

- Transformers shall operate without injurious heating at the rated kV at any voltage within +10 % to -15 % of the rated voltage of that particular tap.
- Transformers shall be capable of delivering the rated current at a voltage equal to 105 percent of the rated voltage without exceeding the limiting temperature rise.
- Unless otherwise specified, transformers shall be designed for operation at a frequency of 50 Hz.
- The maximum flux density in any part of the core and yokes, at normal voltage and frequency shall be such that the flux density under over voltage conditions shall not exceed the maximum permissible values for the type of core and yoke material used. The type of material and values of flux density in the core/ yoke for the 100%, 125% and 140% and the hysteric characteristic curves shall be included in the Bid, and shall be subject to approval. In case of transformers with variable flux density the voltage variation which affects the flux density at every tap shall be kept in view while designing transformers.
- Unless otherwise specified, transformers shall be designed for the following over fluxing withstand capability:
  - 110% - Continuous for all transformers.
  - Transformers shall operate below the knee of the saturation curve at 110 percent voltage to reduce ferro resonance and non-linear oscillations.
- Unless otherwise stated, transformers shall be capable of operation continuously, in accordance with the applicable standard loading guide at their rated kVA and at any of the specified voltage ratios.
- Overloads shall be allowed within the conditions defined in the loading guide of the applicable standard. Under these conditions, no limitations by terminal bushings, on-load tap changers or other auxiliary equipment shall apply.
  - Transformer core shall be built up of low loss non-ageing grain oriented silicon steel insulated laminations. Adequate cooling ducts shall be provided. Transformer tanks shall be of robust construction fabricated out of M.S. plate. All welded joints and valves shall be tested after fabrication of the tank to withstand up pressure of 1.0 kg/sq.cm. in excess of the static head of oil. Bolted joints shall carry non-deteriorating -gaskets.

- Transformer cooling shall be as specified under equipment schedule with fixed or removable radiator tubes of seamless construction and adequately braced to the tank.
- All normal fittings required under section 14 of IS: 2026 - Part I shall be provided. Additional fittings shall also be provided as stipulated in the Datasheet.
- The transformer shall be supplied with oil conforming to IS: 335. The transformer shall be delivered after drying out and ready to put into commissioning without further drying out at site.
- The thermal ability to withstand short circuit shall be demonstrated by the calculations.
- The dynamic ability to withstand short circuit shall be demonstrated by reference to tests on similar transformers.
- Every care shall be taken to ensure that the design and manufacture of all transformers shall be such as to reduce noise and vibration to the level obtained in good modern practice.
- The transformers shall be designed with particular attention to the suppression of harmonic voltage, especially the third and fifth, so as to eliminate wave form distortion and from any possibility of high frequency disturbances reaching such a magnitude as to cause interference with communication circuits.
- All rated quantities subject to the guarantees shall be within the tolerances given in applicable standards.
- The finally assembled core with all the clamping structures shall be free from deformation and shall not vibrate during operation.
- All internal metal parts of the transformer, with the exception of individual laminations, core bolts and their individual laminations, core bolts and their individual clamping plates shall be earthen.
- Windings shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.
- Materials used in the insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil, and shall not soften or be otherwise affected under the operating conditions.
- The completed core and coil assembly shall be dried in vacuum at not more than 0.5 mm of mercury absolute pressure and shall be immediately impregnated with oil after the drying process to ensure the elimination of air and moisture within the insulation. Vacuum may be applied in either vacuum oven tank or in the transformer tank.

### 3.4 VALVES

- Valves shall be of forged carbon steel upto 50 mm size and of gun-metal or of cast iron bodies with gun-metal fittings for sizes above 50 mm. They shall be of full-way type with screwed ends and shall be opened by turning counter clockwise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.
- Every valve shall be provided with an indicator to show the open and closed positions and shall be provided with facility for padlocking in either open or closed position. All screwed valves shall be furnished with pipe plugs for protection.
- All valves shall be provided with flanges having machined faces drilled to suit the applicable requirements. Oil- tight blank flanges shall be provided for each connection for use when any radiator is detached and for all valves opening to atmosphere. If any special radiator valve tools are required, the same shall be provided.

### 3.5 TRANSFORMER COOLING EQUIPMENT

- Radiators and coolers shall be designed to withstand the vacuum and pressure conditions specified for the tank. They shall be so designed as to avoid pockets in which moisture may collect, to completely drain oil into the tank and to prevent formation of gas pockets when the tank is being filled.
- The clearance between all pipe work and live parts shall be more than the clearance for live parts to earth.

### 3.6 BUILT-ON RADIATORS

- Unless otherwise approved, for transformers rated 500 kVA and above, tank mounted radiators / coolers shall be of the detachable type with bolted and gasketed flanged connections.

### 3.7 TAPS AND TAP CHANGE GEAR

- Tapings shall be On Load / Off Load (where ever applicable as mention in data sheets) and brought out from HV winding and terminated in an external motor operated tap switch with position indicator. Transformer output shall remain unaffected for any tap position.

### 3.8 ON-LOAD TAP CHANGE GEAR

- The tap changers shall be of ON circuit type mechanically rugged and arranged to provide for convenient inspection and maintenance without necessity for un-tanking. The position indicators shall be positive and there shall not be any ambiguity resulting into incomplete tap change with respect to the mechanical tap position indication. The operating handle of tap exchanger shall be brought out of the tank at the side at an accessible height from ground level. Tap changer operating switch mounted on the top of the transformer tanks will not be acceptable. Provision of padlocking the tap changers without interfering with visual tap position indicator shall be provided.

### 3.9 LOSSES

- Bids will be evaluated based on the formula furnished.



- For the purpose of evaluation of Bids, the quoted load losses and iron losses shall be increased to take into consideration tolerance as permitted by applicable standards.

### 3.10 REJECTION

- The client may reject any transformer if during tests or service any of the following conditions arise:
  - No load loss exceeds the guaranteed value by 20% or more.
  - Load loss exceeds the guaranteed value by 20% or more.
  - Impedance value exceeds the guaranteed value by + or - 10% or more.
  - The difference in impedance values of any two phases during single phase short circuit impedance test exceeds 2 percent of the average value guaranteed by the BIDDER.
  - Oil or winding temperature rise exceeds the specified value by 5 Deg.Cent.
  - Transformer fails on impulse test.
  - Transformer fails on power frequency voltage withstand test.
  - Transformer is proved to have been manufactured not in accordance with agreed specification.
  - The client reserves the right to retain the rejected transformer and take it into service until the BIDDER replace, at no extra cost , the defective transformer by a new transformer. Alternatively, the BIDDER shall repair or the replace the transformer within a reasonable period to the client satisfaction at no extra cost.

### 3.11 DRAWINGS & INFORMATION

#### ALONGWITH OFFER

- The bidder shall submit completely filled data sheet as per the given format along with GA drawing indicating list of accessories.

#### 4) HANDING OVER DOCUMENTS

The supplier shall submit following:

- GA drawing
- HV / LV Cable Box
- Foundation layout
- Rating and Diagram Plate
- Data sheet indicating results of tests
- Test reports

#### 5) INSPECTION AND TESTING

Following tests should be preformed as acceptance test at manufacturing place,

- Measurement of winding resistance
- Measurement of voltage ratio and check' of voltage vector relationship
- Measurement of impedance volt age/short-circuit impedance (principal tapping) and load loss
- Measurement of no-load loss and current
- Measurement of insulation resistance
- Tests on on-load tap-changers, where appropriate
- Any other special test, if asked for in data sheet

## 6) MODE OF MEASUREMENT

- Supply of the transformer including transport to site, loading and unloading etc. as specified will be treated as one unit for measurement and payment.

## 7) TRANSPORT, DELIVERY AND STORAGE

- The quoted price must include all the costs for necessary mode of transportation upto the final location of transformer or site store. The transformer should be supplied with required storage arrangements suitable for placing in open storage yard. All incidental expenses during transportation shall be part of quoted prices including insurance.
- The transportation for any auxiliary item or detachable part of equipment should be simultaneous and carry necessary instructions for assembling and storage requirements.
- The extra transformer oil, if asked for, shall be supplied in sealed non returnable drums.

## 8) GUARANTEE OF PERFORMANCE

- The quotes values of parameters shall be within given tolerance for given period of service life.

## 9) SPARES

- The bidder shall quote for minimum spares required for two years safe operation of transformer along with the offer separately.

## 10) MAKE OF COMPONENTS

- The bidder should indicate the list of manufactures for bought out items. The client / Consultant reserve the right to select or change the make of material from the submitted list.

## TECHNICAL DATA SHEET FOR OIL TYPE TRANSFORMER

| SR.        | PARTICULAR              | DESCRIPTION |
|------------|-------------------------|-------------|
| <b>1.0</b> | <b>GENERAL FEATURES</b> |             |
| 1.1        | Make                    |             |
| 1.2        | Installation            | AS PER OEM  |
| 1.3        | Service                 | Continuous  |

| SR.              | PARTICULAR                                                                         | DESCRIPTION                                                                                                                   |
|------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 1.4              | Climate                                                                            | Non Corrosive                                                                                                                 |
| 1.5              | Type of cooling                                                                    | ONAN                                                                                                                          |
| 1.7              | Allowable temperature rise                                                         | Oil - 50 deg.c.<br>Winding - 55 deg.c.                                                                                        |
| 1.8              | Painting                                                                           | Epoxy, shade no. 631 as per IS : 5                                                                                            |
| 1.9              | Oil type                                                                           | Mineral oil                                                                                                                   |
| 1.10             | Position                                                                           | Plinth mounted                                                                                                                |
| <b>1.0</b>       | <b>ELECTRICAL DATA :</b>                                                           |                                                                                                                               |
| 1.1              | Earthing :<br>L.V. side                                                            | Solid                                                                                                                         |
| 1.2              | No. of windings                                                                    | Two                                                                                                                           |
| 1.3              | Phase                                                                              | 3                                                                                                                             |
| 1.4              | Frequency                                                                          | 50 Hz.                                                                                                                        |
| 1.5              | Voltage ratio                                                                      | AS PER OEM                                                                                                                    |
| 1.6              | Phase connection                                                                   | AS PER OEM                                                                                                                    |
| 1.7              | Vector group                                                                       | AS PER OEM                                                                                                                    |
| 1.8              | % impedance                                                                        | Max. 5% without IS tolerance                                                                                                  |
| 1.9              | Rating in KVA                                                                      | AS PER TENDER                                                                                                                 |
| 1.10             | Winding insulation class                                                           | "A"                                                                                                                           |
| 1.11<br>a)<br>b) | Terminations :<br>H.V. side<br>L.V. side                                           | Cable box<br>Disconnecting Type cable box with rain coated<br>protected system at Horizontal / Vertical joints.<br>AS PER OEM |
| <b>1.0</b>       | <b>TAP CHANGER :</b>                                                               |                                                                                                                               |
| 1.1              | Tapings                                                                            | H.V.                                                                                                                          |
| 1.2              | Tap changer                                                                        | AS PER OEM                                                                                                                    |
| 1.3              | Tapping range                                                                      | -10 % to +15%                                                                                                                 |
| 1.4              | No. of steps                                                                       | in steps of 1.5%                                                                                                              |
| <b>4.0</b>       | <b>Limit for transformer<br/>operation under over load<br/>condition as per IS</b> | Required                                                                                                                      |
| <b>5.0</b>       | <b>ACCESSORIES :</b>                                                               |                                                                                                                               |

| SR.        | PARTICULAR                                                                                                                                                                                                                                                                                                                                            | DESCRIPTION |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
|            | Double float Buchholz relay with alarm & trip contacts<br>Marshalling box<br>Sampling valve<br>Plain oil level gauge<br>Conservator & conservator drain valve<br>Bidirectional rollers<br>Oil temp. indicator with alarm & trip contacts<br>Bottom drain / Filter valve<br>Double diaphragm Explosion vent<br>Silica-gel breather<br>Air release plug | Required    |
|            | Separate neutral bushing<br>Top oil filter valve<br>Jacking pads<br>Lifting lug<br>Earthing terminal<br>1 set of detachable radiator with shutoff valve<br>Winding temp. indicator with alarm & trip contacts<br>Rating and diagram plate<br>HV & LV gland plate                                                                                      | Required    |
| <b>6.0</b> | <b>PERFORMANCE DATA :</b>                                                                                                                                                                                                                                                                                                                             |             |
| 6.1        | Rated guaranteed losses without tolerance                                                                                                                                                                                                                                                                                                             |             |
| a)         | No load at 100% voltage                                                                                                                                                                                                                                                                                                                               | Required    |
| b)         | No load at 110% voltage                                                                                                                                                                                                                                                                                                                               | Required    |
| c)         | Full load Cu. Loss                                                                                                                                                                                                                                                                                                                                    | Required    |
| 6.2        | Rated No load current                                                                                                                                                                                                                                                                                                                                 | Required    |
| a)         | No load at 100% voltage                                                                                                                                                                                                                                                                                                                               |             |
| 6.3        | Rated efficiency at 0.8 P.F.                                                                                                                                                                                                                                                                                                                          | Required    |
| a)         | At full load                                                                                                                                                                                                                                                                                                                                          |             |
| b)         | At 75% load                                                                                                                                                                                                                                                                                                                                           |             |
| c)         | At 50% load                                                                                                                                                                                                                                                                                                                                           |             |
| 6.4        | Rated regulation                                                                                                                                                                                                                                                                                                                                      | Required    |
| a)         | At 0.9 P.F. lag                                                                                                                                                                                                                                                                                                                                       |             |
| b)         | At 0.8 P.F. lag                                                                                                                                                                                                                                                                                                                                       |             |
| c)         | At unity P.F.                                                                                                                                                                                                                                                                                                                                         |             |
| 6.5        | Impedance voltage                                                                                                                                                                                                                                                                                                                                     | Required    |
| a)         | Primary – Secondary                                                                                                                                                                                                                                                                                                                                   |             |
| 6.6        | Load at which max. efficiency occurs                                                                                                                                                                                                                                                                                                                  | Required    |
| 6.7        | Maximum efficiency                                                                                                                                                                                                                                                                                                                                    | Required    |

| SR.        | PARTICULAR                                                                        | DESCRIPTION |
|------------|-----------------------------------------------------------------------------------|-------------|
| 6.8        | Maximum flux density                                                              | Required    |
| 6.9        | Current density                                                                   | Required    |
| <b>7.0</b> | <b>MECHANICAL DATA :</b>                                                          | Required    |
| 7.1        | Weight :                                                                          | Required    |
| a)         | Core & windings                                                                   |             |
| 7.2        | Dimensions (mm.) :<br>(Dimensions should be considered including all accessories) | Required    |

**Note :** All routine tests as per 'IS' shall be carried out in presence of purchaser / consultant's representative

## 5) TECHNICAL SPECIFICATIONS D.G SET

### DIESEL GENERATOR SET

#### 1.1 SCOPE:

This specification covers the design, construction features, manufacture and performance of emergency diesel generator. The scope includes supply, installation, testing and commissioning of D.G. set along with fuel pipeline, residence type exhaust pipe, acoustic enclosure, AMF control panel and all the accessories required for trouble free operation.

#### 1.2 CODES AND STANDARDS:

The DG set shall meet the requirements of the following standards and rules:

IS : 2253 Designation for type of construction and mounting arrangement of rotating electrical machines.

IS : 4691 Degree of protection providing by enclosures of rotating electrical machinery.

IS : 4728 Terminal marking of rotating electrical machines.

IS : 7132 Guide for testing 3 Phase Synchronous Machines.

IS : 5422 Turbine type generators.

IS : 4889 Methods of determination of efficiency of rotating electrical machines.

IS : 1271 Insulating materials for Electric machinery and apparatus in relation to their thermal stability service, classification.

IS : 4722 Specification for rotating electrical machines.

IS : 13947 AC circuit breakers.

#### 1.3 DESIGN CONDITIONS :

All equipment and materials will be selected and rated for use at the following site conditions.

Summer outdoor design temperature

50° C. Surface temperature

80° C. Relative Humidity

95% Max.

#### 1.4 DESIGN & CONSTRUCTION :

##### 1.4.1 GENERAL:

- (a) The diesel engine offered shall be of the regular production models of the manufacturer for industrial applications and already type tested either at the manufacturer's works or outside. The type test report shall be furnished to the purchaser for his review if so desired. In case the proposed engine model has not been type tested, vendor shall furnish with the offer, a reference list of its existing industrial installation and at least three of these engines should have completed, 5000 hours of running at site.
- (b) Unless otherwise specified in the equipment data sheets, the diesel engine shall be provided with class A2 governing as per the latest edition of B.S. 5514.
- (c) The "Cyclic irregularity" of the diesel engine for direct coupling to an electric generator, "angular deviation of A.C. generators" given by diesel engine for parallel operation, and the "engine governor speed droop characteristics", shall be restricted to the values specified under the latest edition of B.S. 5514.
- (d) The vendor shall be responsible for carrying out torsional analysis of the dynamic system as specified in the latest edition of British Standard-5514. The results in the form of a report shall be submitted to the purchaser for scrutiny and reference, if desired.
- (e) Vendor shall provide the flexible exhaust connections to connect the engine exhaust to the exhaust piping. The required size of the exhaust piping should be clearly specified by the vendor.
- (f) The common base plate for mounting the diesel engine and the driven equipment as well as the flexible coupling, shall be supplied by the vendor.
- (g) Vendor shall indicate in the bid, the IS Noise Level rating of the diesel engine with the offered exhaust silencer, which should not exceed more than 105 db without acoustic enclosure and 75 db with acoustic enclosure at 3 Mtrs. distance.

##### 1.4.2 ENGINE STARTING:

- (a) Diesel engines shall be capable of starting without the use of cold starting aids so long the ambient temperature at the site is not below 4° c.
- (b) Where the diesel engine is specified / offered with battery starting arrangement, the starter motor shall be capable of starting the engine without having to disengage the driven machine with the help of a clutch. Where the diesel engine is equipped with a dual starter the synchronizing switch and the corresponding wiring / connection with the starter motor shall be provided by the vendor.
- In case of diesel engines driving the engine mounted battery charging alternator, the Vendor shall also provide Battery, automatic Electronics float & boost type battery charger suitable for taking power from supply authority's power source and mounted on a free standing type of a panel.
- The battery charger as specified in the equipment data sheet, shall be capable of delivering a current equal to 100% of the 20 hour discharge rate of the battery and also equipped with charging rate selector device.
- As specified in the data sheets, the diesel engine is required to start / stop automatically, the vendor shall provide the necessary controls (automatic - cum - manual) in the engine panel and the interconnecting wiring and piping from the panel to the engine and starting equipment. A pilot lamp shall be provided in the line side of the starting equipment circuit to indicate that the controller is in the automatic position. In the event the engine does not start after three attempts have been made, the controller shall stop all further cranking and operate the audio-

visual alarm. Shaft driven lubrication system is acceptable, alternatively D.C. motor driven lubrication pump with timer suitably interlocked with the starting system is acceptable.

#### 1.4.3 ENGINE COOLING:

Vendor shall supply radiator based cooling system.

#### 1.4.4 ENGINE FUEL SYSTEM:

Engine fuel system shall be complete in all respects but not limited to following:

(a) The daily service fuel tank shall be equipped with shielded level gauge, strainer and a hand hole of not less than 150mm diameter, besides the required fuel connections and a drain plug. One tanks of suitable capacity to be provided.

(b) The inside surfaces of the fuel tank and the float tank shall be coated with Enamel Red or Black of I.C.I. or its equivalent and the outside surface to be given two coats of the oil resistant primer paint. The fuel tank shall be hydrostatically tested at a pressure not less than 0.35 g./Cm.<sup>2</sup>

(c) Fuel oil transfer pump to transfer oil from barrels to day tank shall also be provided.

(d) All piping, valves, fittings and supports inside D.G. house shall be part of supply.

### Instruments

An instrument panel mounted on the engine shall be provided and shall comprise the following flush-mounted instruments and gauges:

- Cooling water inlet and outlet temperature ( In Case of Water Cooled Engine )
- Cooling water inlet temperature to lubricating oil cooler ( In Case of Water Cooled Engine )
- Lubricating oil inlet and outlet temperature
- Lubricating oil pressure gauge Tachometer,
- Positive driven Hour counter.

### Protection Devices

Warning indication and automatic shut-down shall be provided for the following:

Low oil pressure shutdown and alarm  
Low and high coolant temperature alarm  
High coolant temperature shutdown  
Fail to crank shutdown  
Over cranking shutdown  
Over speed shutdown  
Low & high DC voltage alarm  
Low battery alarm  
Low fuel-day tank alarm  
High and Low AC voltage shutdown  
Under frequency shutdown  
Over current and alarm and shutdown  
Short circuit shutdown  
Ground fault alarm  
Overload alarm  
Emergency stop

Failure indication lights and alarm for all fault conditions shall be provided on control panel for restoring the operation to normal.

The starting circuit shall be disconnected in the event of any of the above shutdowns.

#### 1.4.5 INSPECTION & TESTING:

(a) The vendor shall have the responsibility of providing purchaser's representative with all requisite facilities / equipment for carrying out satisfactory testing.

(b) The diesel engines shall be tested in the presence of purchaser's representative accordance with latest edition of B.S. 5514 or any other equipment standard as agreed to with the purchaser before the finalization of order.

(c) The routine load and fuel consumption test shall be of the 4 hours.

(d) Unless otherwise specified, 10% overload provision shall be kept while setting the fuel limit for the site running.

(e) The engine control panel/s after assembly and wiring, shall be functionally tested in the presence of the client's / consultant's representative.

#### 1.4.6 ALTERNATOR:

(a) This specification define the requirements of design, manufacture, testing and supply of self-excited emergency generator complete with automatic voltage regulator, control panel, isolator and other accessories as specified in the material requisition.

(b) Unless otherwise specified the emergency generator shall be supplied complete with:

- i. Brush less excitation system complete with AVR.
- ii. Electric panel including control cubicle and associated auxiliary devices, relay panel and generator breaker / isolator, battery and battery charger.
- iii. Air inlet and outlet for generator cooling (inlet shall be oriented to suit total plant layout).
- iv. Lifting arrangement for the machine.
- v. Foundation frame complete with foundation bolts to install along with engine on common base frame.
- vi. Lub. oil system integral with the prime mover lub. Oil system.
- vii. Spares for commissioning.
- viii. Spare part list along with price shall be submitted along with main offer for two years of operation and maintenance.
- ix. Any other part / accessories not specifically mentioned above but considered necessary for safe and reliable operation.

#### (c) DESIGN AND CONSTRUCTION:

The alternator design shall meet the requirement specified in data sheet and shall be suitable for the site conditions specified therein.

The alternator shall be mounted on a common base frame together with the Prime mover unless otherwise agreed. The generator shall be provided with necessary lifting hooks and two earth terminals for connection to main earth grid.

The alternator winding shall be class "F" insulation with temperature limitation to Class "H".

The stator windings shall be brought out to six insulated terminals in two separate terminal boxes. The alternator shall, therefore, be provided with three separate terminal boxes i.e. for the line and neutral stator connection and for control connection. The terminal box for the line



terminal shall have 40 % free space and each segregated for easy cable end connection of cable size specified in data sheet. The neutral box shall in addition to the space for neutral earthing cable shall have sufficient room for the current transformers used for the protection of the generator. Star connection shall be formed in the neutral side of terminal box. The terminal box for control cable shall contain properly marked terminals for all internal equipment e.g. Embedded temp. Detectors etc. All terminals shall be stud type. The terminal boxes shall be complete with lugs and double compression type cable glands. Current transformers shall be as specified in data sheet.

All parts and accessories shall be suitable to withstand stresses due to over speed / overload / short circuit conditions specified.

Bearings if applicable shall be double shielded and pre lubricated. Grease in the bearing Enclosure shall provide additional lubrication to bearings as well as provide sealing against dust and moisture. On line greasing facility with excess grease expulsion system shall also be provided.

The alternator shall be air cooled unless otherwise agreed, alternator enclosure shall be as specified in data sheet.

The direction of rotation of the rotor of the machine shall be compatible with that of the prime mover. A clear indication of the direction of rotation shall be given on either end of the machine.

Space heaters shall be installed within the enclosure **if required as per site condition.**

Location and max. Surface temperature of the heaters shall be such that no damage can be caused to any insulation. Heaters shall suitable for operation on a single phase 240v AC supply unless otherwise specified with thermostatic control.

Operational logic =When Generator "ON "Heater "OFF ". Also monitoring of " HEATER HEALTHY " shall be provided.

Field winding shall have class "F" insulation with excellent electrical and mechanical properties.

The field winding shall be capable of operating at a field voltage with Excitation capacity  $E_{max} / E_n = 1.6$  for at least two minute to meet improved stability requirements.

A rating plate of S.S material shall be fixed on the generator frame and shall give the following information:

- a ) Manufacturer's name.
- b ) Serial Number, Type and frame reference
- c ) Rated output in KVA & KW
- d ) Rated power factor, frequency and voltage
- e ) Rated stator current and speed in Rev. / Min.
- f ) Class of insulation
- g ) Phase rotation ( CW or CCW )
- h ) Customer's indent no.
- i ) Year of manufacture
- j ) Weight of rotor and stator in Kg.

#### 1.4.7 EXCITATION SYSTEM:

The generator shall be provided with brush less type solid state excitation system. The field of the exciter shall be either permanent magnet type or externally excited through external power, transformer and AVR. AC voltage generated in the exciter shall be rectified by the rotary rectifier assembly and feed power to the main field circuits of the generator.

The exciter capacity shall be at least 20% more than the maximum requirement at any time. The exciter winding shall be insulated with class "F" insulation.

Automatic solid state voltage shall be provided with the following features as a minimum.

- Short circuit protection.

- Manual voltage control switch with adjuster.
- Cross current compensation for parallel operation.
- Voltage build up circuitry.
- Stator current limiter.
- Field current limiter.

The current and potential transformers required to feed the AVR from the generator terminal shall be adequately rated.

### **1.5 SYSTEM OPERATION:**

The emergency generator set shall normally be in an unattended area. The control system shall operate in fail safe mode and shall include all controls and protection necessary for the safe operation of the package. The generator set shall function as per one of the following schemes:

- Manual start in service mode.
- Manual test mode.

### **1.6 GENERATOR CONTROL PANEL:**

1.6.1 The local generator control panel for the generator set shall comprise the following unless otherwise specified in the attached data sheet.

- a ) Metering equipments.
- b ) Indicating instruments.
- c ) Local switchgear ( MCCB ) for receiving DG set power and outgoing to main panel.
- d) Battery charger
- e) Lub. Oil motor start / stop, if motor driven lub. Oil system

Any other accessory require to make the generator set operational as a package shall be included in scope of supply. If required the generator control panel shall be split into various functional sections viz. protection, metering and control, regulation etc.

All motor starters for generator set auxiliaries shall be DOL type if applicable.

1.6.2 The panel shall be free standing, metal enclosed, dust and vermin proof type with a hinged door and having a degree of protection IP 51 as per IS : 13947 unless otherwise specified. Power and control equipment shall be segregated inside the panel as far as practicable. The maximum height of the operation handle/ switches shall not exceed 1500 mm. and the minimum height not below 300 mm. All hardware shall be corrosion resistant and bolts, nuts and washers shall be made of galvanized zinc passivated or cadmium plated high quality steel.

Unless otherwise specified the panel shall be suitable for bottom cable entry. Necessary double compression glands shall be provided with the panel.

All auxiliary devices for control, indicator, measurement and alarm such as push buttons control / selector switches, indicating lamps, metering instruments, annunciations etc. shall be mounted on the front door of the panel.

Adequate number of potential free contacts shall be provided in the control panel for any remote control, monitoring of the generator set.

1.6.3 All switches shall be load-break, heavy duty type. All fuses shall be no deteriorating HRC cartridge pressure fitted, link type. The contactor shall be air- break type having AC-3 duty rating. Thermal overload relays shall be three element, positive acting, ambient temperature compensated type with adjustable setting range and built in protection feature against single

Phasing. All indicating instruments shall be digital type with communication port, flush, mounting type and of 96 mm. x 96 mm. square pattern. All control / selector switches shall be rotary back connected type having a cam-operated contact mechanism with knob type handle. "STOP" push buttons shall be stay put type.

1.6.4 Wiring for power, control and signalling circuits shall be done with FRLS insulated copper conductors having 660 / 1100 V grade insulation. Minimum size of control wires shall be 1.5 mm. Terminals shall be acceptable for wires up to 10 mm.<sup>2</sup> size and for conductors larger than 10 mm.<sup>2</sup> bolted type terminals with crimping lugs shall be provided. A minimum of 10% spare terminals shall be provided on each terminal block.

1.6.5 An adequately sized earth bus shall be provided in the panel for connection to the main earth grid. All non-current carrying metallic parts of the mounted equipments shall be earthed. Doors and movable parts shall be earthed using flexible copper connections.

1.6.6 Engraved nameplates shall be provided for all devices mounted on the front of the panel. Name plate or polyester adhesive stickers shall be provided for each equipment mounted inside the panel.

#### **1.6.7 Generator Control Panel**

The generator control panel shall have all necessary instruments and accessories for operation and control of the generating set. On sensing the utility mains voltage dip to below said voltage volts, the control panel shall send a signal to start the generator. After 5 successive start and if the diesel generator is not started up, the alarm signal shall be activated.

The generator control panel shall consist of all Auto-transfer switch, circuit breakers, protective relays if applicable and accessories required to control the generator operation and shall include but not limited to the following:

Voltmeters

Ammeter

Frequency Meter

Power factor meter

Kilowatt meter with maximum demand indicator

Kilowatt hour meter

Hour run meter

Start-stop and automatic mains monitoring system

Emergency off push button

Manual speed adjusting control reset for overload, alarm muting.

Fully automatic trickle battery charger with voltmeter

Indicating lamps for 'Mains Available', 'Mains on Load', 'Standby Available', 'Standby on Load', 'Alarm', 'Mains Fail', etc.

Audio and visual (flasher) alarm.

The start-stop and automatic mains monitoring system shall be equipped with the following:

Duty selector switch for 'off-automatic-test-manual' operation

Manual start-stop push button switch

Manual alternator circuit breaker 'On-Off' switch

Cancel alarm switch

Reset switch

Indicating lamps

Battery Status

**B. AMF Panel**

AMF LOGIC FOR TRANSFER OF POWER FROM NORMAL TO GENERATOR POWER SUPPLY AND FROM GENERATOR SUPPLY TO NORMAL POWER AUTOMATICALLY

Also note that there should be 2 incomer (1 main & 1 from Generator and 1 no. outgoing) which is interlocked, when mains fails then automatically breaker (ACB/MCCB) should be transfer from mains to DG incomer and when reinstalled the mains then DG set should be off and power to be transferred to mains incoming Breaker.

**A. In the case of failure of normal power supply**

1. Generator 1 to start after a prefixed time of three second on any of the following conditions

- a. Total absence of voltage.
- b. Failure of one or two phases.
- c. Under voltage below said volts.

2. After a lapse of 10-12 seconds normal power supply breaker to open and Generator supply breaker to close.

3. All auxiliaries (Cooling Tower Fan, Pump etc.) to run automatically.

**B. In the case of Failure of Generator 1 to start:**

1. It Should Give Alarm & Show the reason of Failure

**C. In the case of Resumption of Normal Power supply:**

1. Generator 1 breaker to open and normal power supply breaker to close after three minute on resumption of normal power on the following conditions. (Conditions apply with change over design logic. To consider for manual change over through PLC control)

a. All the three phases available at the normal supply breaker.

b. 400-415 volts available at the normal supply breaker.

1. Generator to over run for the three minutes and stop automatically.
2. All auxiliaries to stop automatically.
3. Generator to be ready for the next operation automatically.

**BATTERY CHARGER****GENERAL**

The battery charger shall be Float cum Boost type IGBT controlled. The charger shall have selector switch for Auto Float – Boost / Manual Float / Manual Boost Mode of operation. During Auto Float – Boost Mode, Automatic Changeover shall take place from Float Mode to boost mode and Vice-Versa. This means that when the Batteries are fully charged the charging shall automatically change from Boost charge to trickle charge.

**CONSTRUCTION FEATURE**

The battery charger shall be housed in sheet steel cubicle of Angle Iron frame work with sheet steel panels of 1.6 mm thickness. Louvers shall be provided in the cabinet for the ventilation.

The cubicle shall be painted in Siemens Grey shade RAL7032 of IS-5. Four wheels shall be provided at the base.

## PERFORMANCE

The D.C output voltage of Float / Boost charger shall be stabilized within + 2% for AC input variation of 230 V + 10%, frequency variation of 50 Hz + 5% and DC load variation of 0-100%. The voltage regulation shall be achieved by a constant voltage regulator having fast response IGBT control. The ripple content will be within 3% of DC output nominal voltage. There shall be provision to select Auto Float / Manual Float / Manual Boost modes. During Auto Float Mode the battery charging shall automatically changeover from Boost Mode to Float Mode and Vice Versa. During Manual Float / Boost modes it shall be possible to set the output volts by separate potentiometers. The battery charger shall have automatic output current limiting feature.

## COMPONENTS

The battery charger shall essentially comprise of the following

- 1 No. double pole ON/OFF MCB at AC input.
- 1 No. pilot lamp to indicate charger ON.
- 1 No. Main Transformer: Double wound, naturally air cooled, having copper winding.
- 1 set single phase full wave bridge rectifier consisting of 4 Nos. IGBTs, liberally rated, mounted on heat sinks and complete with resistor / condenser network for surge suppression.
- 1 No. rotary switch to select auto float / manual float / manual boost.
- During auto float mode automatic changeover shall take place from float mode to boost mode and vice versa.
- 1 set solid state constant potential controller to stabilize the DC output voltage of the float cum boost charger at + 2% of time set value for AC input voltage variation of 230 V + 10%, frequency variation of + 5% from 50 Hz and simultaneous load variation of 0- 100% and also complete with Current Limiting Circuit to drop the Float Charger output voltage upon overloads to enable the battery to take over.
- 1 No. electronic controller to automatically changeover battery charging from boost to float and vice versa..
- 1 No. DC ammeter and toggle switch to read charger output current and battery charge / discharge current.
- 1 No. moving coil DC voltmeter to read the DC output voltage.
- 2 set potentiometer to adjust the output voltage during manual /auto float and boost modes.
- 2 No. double pole ON/OFF MCB at DC output, 1 No. at charger output and the other at load.
- 2 set DC output terminals. 1 set for the load and the other set for the battery.
- Alarm Annunciation: Visual and audible alarm with manual accept reset facility shall be provided for the following for BMS Connectivity

- a. AC mains fail
- b. Charger Fail
- c. Load / Output over volt.

## Rating

AC Input : 230 V + 10% AC 50 Hz single phase.

DC Output : To float / boost charge batteries and also supply a continuous load.

Current Rating : 30.0 Amps

Float Mode : 27.0 V nominal (Adjustable) between 24-28.0 V.

Boost Mode : 29.0 V nominal (Adjustable) between 24-32.0 V.

Voltage Regulation : + 2% for AC input variation of 230 V

+ 10%. Frequency Variation of 50 Hz + 5% and DC load variation 0-100%

**Performance Tests**

The schedule of tests to be performed in the Factory Acceptance Test shall include the following:

On each of three separate days and before any other operation of the diesel- alternator on that day three successful manual start-up operations to be accomplished.

Three separate manual start-up operations each within one minute of the diesel alternator being shut down after running continuously for not less than one hour and attaining normal engine running temperatures.

Three separate automatic start-up operations with simulation of “mains failure”. In all or any of these tests the diesel-alternator may be out on load by the automatic closing of the emergency power supply circuit breaker.

Three separate automatic shutdown operations, each initiated by mechanical simulation of a “low pressure” condition.

Three separate automatic shutdown operations, each initiated by manual instigation of an “over-speed” condition.

Three separate abortive start-up operations, each inducing “failure to start” shutdown.

**1.7 Acoustic Enclosure:**

The Generating sets should be housed inside a high quality acoustic enclosure having salient features & constructional features such as:

1. Compact, modular construction & sleek design with low noise level 75 to 82 dBA – just whisper soft.
2. Soundproof, weatherproof & environment-friendly silent set.
3. Ready-to-use silent set, eliminates need for foundation or grouting.
4. The acoustic enclosure is manufactured & powder coated & lined with Fireproof Acoustic Material light resin rock wool as per IS: 8518. The material shall be of 48- kg/m<sup>3</sup> density & the layer shall be 75-mm thick.
5. It is made of compact sleek design conforming to international standards to provide insertion loss of 25 dBA meeting CPCB norms. (2-mm thick CRCA sheet)
6. Steel outer construction with heavy-duty fabricated base frame & inbuilt fuel tank.
7. Attenuators are placed in the hot air outlet & cooling air inlet.
8. Exhaust silencer – Residential type mounted on the enclosure, exhausting to atmosphere.
9. All joints are sealed with fireproof neoprene gaskets, which withstand high temperature & pressure.
10. All high temperature exposed surfaces are insulated by glass wool with aluminium cladding.
11. Painted with weatherproof, acid proof, heat-resistant, powder-coated after pre-treatment for degreasing, degusting, pickling, phosphate & passivation for durability & better look.

**1.8 Fuel Tank:**

The daily fuel tank should be suitably designed so as to provide long hours of uninterrupted and continuous power. For ease of monitoring the fuel level in the fuel tank, a sophisticated fuel level gauge should be provided in the control panel. For ease of operation, there is a provision for fuel inlet, which has accessibility from outside the acoustic enclosure, and designed so that the refuelling is possible even when the generating set is in operation. The tank should be Fabricated from 14 swg M.S. Sheet.

## **1.9 PAINTING, PACKING AND TRANSPORT:**

All metal surfaces shall be thoroughly cleaned of scale, rust and grease etc. Prior to painting. Cleaned surfaces shall be given two coats of primer and prepared for final painting. Final finish shall be free from all sorts of blemishes.

The equipment shall be shipped to site suitably packed to prevent any damage. Each package shall have labels to show purchaser's name, purchase order and equipment no. suitable lifting lugs etc. shall be provided and lifting points shall be clearly marked on the package. Packing shall be suitable for storage at site for a minimum period of 6 months.

## **1.10 TESTS AND INSPECTION:**

1.10.1 The owner or his authorised representative may visit the works during manufacture of equipment to assess the progress of work as well as to ascertain that only quality raw materials are used for the same. He shall be given all assistance to carry out the inspection.

1.10.2 Detailed test procedure along with the facilities available at vendors works shall be furnished along with the bid. Owner's representative shall be given minimum four weeks advance notice for witnessing the final testing. Test certificates including test records and performance curves etc. shall be furnished for the complete D.G. individual test certificates of engine / alternator / common panel should be submitted, only thereafter complete D.G. would be tested.

### **1.10.3 TESTS:**

Equipment shall be tested to conform to the appropriate standards and the following tests shall be conducted in the presence of purchaser's:

- (a) Functional tests, continuity tests and high voltage test on control panel to establish the performance called for in the specification.
- (b) Power frequency voltage test on switch gear and mechanical / electrical operational check.
- (c) Routine tests for alternator as per IS : 4722.
- (d) Over speed test ( 1.2 times the rated speed for 2 minutes.)
- (e) Transient response tests for sudden application and rejection of loads of 25% , 50%, 75% and 100% of rated capacity.
- (f) Phase sequence test.
- (g) Vibration test.
- (h) Noise level test.
- (i) Dimensional and alignment test.
- (j) Wave from test.

## **1.11 Requirement of Certification**

Every manufacturer or importer of Power Generating set must have valid certificates of Type Approval and also valid certificates of conformity of production for each year, for all the product models being manufactured or imported after 1st July, 2003 with the specified noise limit.

All Power Generators shall have a valid Type Approval certificate and conformity of Production certificate.

All Power Generator shall have conformance label meeting the requirements.

The conformance label shall contain the following information:

- Name and address of the supplier (if the address is described in the Owner's manual, it may not be included in the label).
- Statement "This product conforms to the Environment (Protection) Rules, 1986"
- Noise limit viz. 75 dB(A) at 1 m.



- Type approval certificate number.
- Date of manufacturer of the product.

Authorized agencies for certification

The following agencies are authorized to carry out such tests as they deem necessary for giving certificates for Type Approval and Conformity of production testing of Generator and to give such certificates :

- Automotive Research Association of India, Pune.
- National Physical Laboratory, New Delhi.
- Naval Science & Technology Laboratory, Palghat
- National Aerospace Laboratory, Bangalore

## **Part B: DATA SHEET**

### **PRIME MOVER FOR D.G. SET**

1. Prime mover Diesel Engine
2. Qty required One No. for each alternator.
3. Service Prime mover for generating set.
4. Horse power as specified in BOQ
5. RPM 1500 RPM
6. Type Air cooled
7. Flywheel Require
8. Vibration damper Require
9. Fuel pump air cleaner require
10. Fuel pump Require
11. Radiator Require
12. Oil filter, fuel Filter etc. Require
13. Lub oil pump Require
14. 24 DC V electrical System Require
15. Safety controls 1.LLOP, 2.HWT, 3. OS, 4.Cooldown timer
5. Low cool out level.
16. Silencer Required – Residential Type
17. Coupling Require
18. Instrument panel consist of as specified in Panel.
  - a) Meter 1.Voltage, 2.Current, 3 frequency, 4.Engine hours.
- 19 Fuel tank in built: Required of 990 Ltr. Capacity.
- 20 Battery charger Require
- 20A Battery charging Alternator 24V DC, 45 Amp.
21. Engine testing
  - a) At shop require
  - b) At site require
22. Tool kits list of tools req. to be maintain at site.
23. Literature Require
  - a) Operation & maintenance manual

#### **Note:**

- a) Parts catalogue/list

### **ALTERNATOR**

#### **DATA SHEET - A**

1. Make: As mentioned in Make of Material
2. Rating: As per schedule of quantities.
3. Power factor: 0.8
4. Rated voltage: 415 V



5. Voltage regulation: 5 %
6. Rated current: As per SOQ
7. Speed: 1500 RPM.
8. Frequency: 50 Hz.
9. Method of excitation and Regulation: Self
10. Class of insulation: A) Stator - H with temp. rise of B  
B) Rotor - H --- do -----
11. Degree of protection: Screen protected, drip proof.
12. Base plate: The Engine & alternator shall be mounted and aligned on a Common base plate fabricated from steel.
13. AMF Panel: As per specification
14. PMG excitation: Required.

**DATA SHEET- B (To be furnished by the bidder)**

**I. ENGINE**

1. Make:
2. Model:
3. No. of cylinders:
4. Arrangement of cylinders:
5. No. of stroke:
6. Speed RPM:
7. B.H.P Standard rating:
8. S.H.P. Standard rating:
9. Max. BHP at site: (Over load)
10. Engine over load:  
Operations hrs. :
11. Recommended fuel oil:
12. Compression ratio:
13. Firing order:
14. Sp. fuel oil consumption  
(LTR / HR) @ 0.85 spec. gravity.
15. Recommended Lub-oil:
16. Method of starting:
  - a) Battery details:
  - b) Charger details:
  - c) Make of battery &: charger.
17. Silencer type:
18. Cooling system:
19. Fuel system:
  1. Filters:
    - a) Type:
    - b) Nos. :
  2. Injection pump:
    - a) Type:
    - b) Nos. :
  3. Injector:
    - a) Type:
    - b) Cooling:
  4. Day tank:
    - a) Capacity:
    - b) Location:
- 20.
21.  
Lubricating system:

1. Type :
2. Filters:
  - a) Type:
  - b) No's :
3. Lub oil pump:
  - a) Type:
  - b) Rating:
22. Instrument panel: Consist of:
23. Safety control:
- 24 Max. Period for which engine can operate without raw cooling
- Water supply. :
25. Other accessories:
26. Exhaust system:
27. Literature:
28. Diesel engine auxiliary  
(Materials of Construction)

## **6 TECHNICAL SPECIFICATION FOR LT PANELS**

### **1) SCOPE OF WORK**

1. Main Distribution Panels, Sub-Distribution Panels and Final Distribution shall be covered under this section. Panels/Boards shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, 4 wire system with neutral grounded at transformer. All Distribution panels shall be CPRI tested design and manufactured by an approved manufacturer. CPRI certificate shall be made available.
2. Distribution panels shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1991.

### **2) CONSTRUCTION FEATURES:**

1. Distribution panels shall be 2 mm thick sheet steel cabinet for indoor installation, dead front, floor mounting/wall mounting type and shall be form as per site construction requirements.
2. The Distribution panels shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors and folded covers, Neoprene gasket, padlocking arrangement and bolted back.
3. All removable/ hinged doors and covers shall be grounded by flexible standard connectors.
4. Distribution panel shall be suitable for the climatic conditions as specified in Special Conditions. Steel sheets used in the construction of Distribution panels shall be 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components.
5. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal.
6. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage up to and including 1100 V AC.
7. All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned.

8. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts.
9. Self threading screws shall not be used in the construction of Distribution panels.
10. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels.
11. Minimum operating clearance of 300 mm shall be provided between the floor of Distribution panels and the lowest feeder compartment.
12. Distribution panels shall be of adequate size with a provision of spare switchgear as indicated on the Single Line Diagram. Feeders shall be arranged in multi-tier.
13. Knockout holes of appropriate size and number shall be provided in the Distribution panels in conformity with the location of cable/conduit connections.
14. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.
15. Every cabinet shall be provided with Trifoliate or engraved metal name plates.
16. All panels shall be provided with circuit diagram engraved on PVC sheet.
17. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

### **3) BUSBAR CONNECTIONS:**

1. Bus bar and interconnections shall be of high conductivity electrolytic grade aluminium / copper as indicated in the bill of quantities complying with requirement of IS : 5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side.
2. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded.
3. Bus bars shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system.
4. All bus bars shall be provided in a separate chamber and all connections shall be done by bolting.
5. Additional cross sectional area to be added to the bus bar to compensate for the holes.
6. All connections between bus bars and breakers shall be through solid copper / aluminium strips of proper size to carry full rated current and insulated with insulating sleeves.
7. Maximum current density for the bus bars shall be 0.8-1A/sq.mm for aluminium and 1.4 A/sq.mm for copper bus bars.
8. The busbar shall be housed in a separate compartment. The busbar shall be isolated with 3 mm. thick bakelite sheet to avoid any accidental contact. The busbar shall be arranged such that minimum clearance between the busbar are maintained as below :

|                            |   |                |
|----------------------------|---|----------------|
| Between phases             | : | 25 mm. minimum |
| Between phases and neutral | : | 25 mm.         |
| Between phases and earth   | : | 25 mm.         |
| Between neutral and earth  | : | 20 mm. minimum |

**Maximum allowable temperature for the Bus bar to be restricted to 85 deg C**

#### **4) TEMPERATURE – RISE LIMIT**

1. Unless otherwise specified, in the case of external surface of enclosures of bus bar compartment which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per IS 8623(Part-2) 1991.
2. All main distribution panels and sub distribution panels shall be provided with MCCB of appropriate capacity as per Single Line Diagram.
3. All final Distribution boards shall be provided with Miniature Circuit Breakers.
4. Final Single Phase Distribution boards shall be connected to the incoming supply through double pole MCB units & earth leakage circuit breakers.
5. All wiring for final distribution boards shall be concealed behind 5 mm thick bakelite sheet or M S sheet cover.
6. All Distribution boards shall be completely factory wired, ready for connection.
7. All the terminals shall be of proper current rating and sized to suit individual feeder requirements.
8. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram.
9. All the switches and circuits shall be distinctly marked with a small description of the service installed.
10. Continuous earth bus sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames shall be connected to earth through adequately sized flexible braids.

#### **5) CABLE COMPARTMENTS**

1. Cable compartment of adequate size shall be provided in the Distribution panels for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables.

#### **6) SWITCHGEARS**

##### **6.1 MOULDED CASE CIRCUIT BREAKER (MCCB)**

- 6.1.1 The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab.
- 6.1.2 MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses
- 6.1.3 The breaking capacity of MCCB shall be as specified in the schedule of quantities.
- 6.1.4 The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu).
- 6.1.5 MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-1.
- 6.1.6 The breaker as supplied with ROM should meet IP54 degree of protection.

## 6.2 CURRENT LIMITING & COORDINATION

- 6.2.1 The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables and let-through energy curves for all.

### Protection Functions

- 6.2.2 MCCBs with ratings up to 200 A shall be equipped with Thermal-magnetic (thermal for overload and magnetic for short-circuit protection) trip units (as per Single line diagram).
- 6.2.3 Microprocessor MCCBs with ratings 250A and above shall be equipped with microprocessor based trip units (as per Single line diagram).
- 6.2.4 Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorised access to the settings
- 6.2.5 Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility, etc.)
- 6.2.6 Protection settings shall apply to all poles of circuit breaker.
- 6.2.7 All Microprocessor components shall withstand temperatures up to 125 °C.
- 6.2.8 Rotary handles to be provided for operation where ever required as indicated in Single line diagram.

## 6.3 TESTING

- 6.3.1 Original test certificate of the MCCB as per IEC 60947-1 &2 or IS13947 shall be furnished.

- 6.3.2 Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

#### **6.4 INTERLOCKING**

- 6.4.1 Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.
- o Handle interlock to prevent unnecessary manipulations of the breaker.
  - o Door interlock to prevent the door being opened when the breaker is in ON position.
  - o Defeat-interlocking device to open the door even if the breaker is in ON position.
  - o PLC controller to operate the Motorized Breakers in sequence as indicated logic diagram in SLD.
- 6.4.2 The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable over load & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.
- 6.4.3 All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit and earth fault protection with time delay.
- 6.4.4 The trip command shall override all other commands.

#### **6.5 MINIATURE CIRCUIT BREAKER (MCB)**

- 6.5.1 Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection.
- 6.5.2 The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B, C, D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer.
- 6.5.3 The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.
- 6.5.4 The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

#### **6.6 RESIDUAL CURRENT CIRCUIT BREAKER CURRENT OPERATED TYPE (RCCB)**

##### **System of Operation**

- 6.6.1 Residual Current Circuit Breaker shall confirm to IEC 61008. RCCB shall work on the principle of core balance transformer.
- 6.6.2 The incoming shall pass through the toroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer.
- 6.6.3 In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage, current sensitivity shall be of 30 mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.

#### **Mechanical Operation**

- 6.6.4 The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing /opening of all the three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

#### **Neutral Advance Feature**

- 6.6.5 The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact First before the phases; and at the time of opening, the neutral shall breaks last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

#### **Testing Provision**

- 6.6.6 A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB / RCCB and the operating handle shall move to the "OFF" position.

### **7) ELECTRICAL POWER AND CONTROL WIRING CONNECTION :**

- 1. Terminal for both incoming and outgoing cable connections shall be suitable for 1100 V grade, aluminium / copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solderless sockets for the cable size as indicated on the appended drawings for the Panels.
- 2. Power connections for incoming feeders of the main Panels shall be suitable for 11000 V grade aluminium conductor (XLPE) cables.
- 3. Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.
- 4. Both control and power terminals shall be properly shrouded.
- 5. 10% spare terminals shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block, so that not more than one outgoing wire is connected to per terminal.

6. Terminal strips for power and control shall preferably be separated from each other by suitable barriers of enclosures.
7. Wiring inside the modules for power, control, protection and instruments etc. shall be done with use of 660 / 1100 V grade, PVC insulated copper conductor cables conforming to IS : 694 and IS : 8130. Power wiring inside the starter module shall be rated for full current rating of respective contactor, but not less than 4.0 sq.mm. cross-section area. For current transformer circuits, 2.5 sq.mm. copper conductor wire shall be used. Other control wiring shall be done with 1.5 sq.mm. copper conductor wires. Wires for connections to the door shall be flexible. All conductors shall be crimped with solderless sockets at the ends before connections are made to the terminals. All wires shall be FRLS grade.
8. Control power for the Motor starter module shall be taken from the respective module switchgear outgoing. Control power wiring shall have control fuses, (HRC fuse type) for circuit protection. All indicating lamps shall be protected by HRC fuses.
9. Particular care shall be taken to ensure that the layout of wiring is neat and orderly. Identification ferrules shall be filled to all the wire termination for ease of identification and to facilitate checking and testing.
10. "CUPAL" washers shall be used for all copper and aluminium connections.
11. Final wiring diagram of the Panels power and control circuit with ferrules numbers shall be submitted alongwith the Panels as one of the documents against the contracts.

#### **8) TERMINALS :**

1. The outgoing terminals and neutral link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformers for instruments metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming or outgoing cables to internal components of the distribution board is permitted, only one conductor may be connected in one terminal.

#### **9) WIREWAYS :**

1. A horizontal PVC wire way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

#### **10) LABELS :**

1. Engraved PVC labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

#### **11) NAME PLATE :**

1. A name plate with the Panels designation in bold letters shall be fixed at top of the central panel. A separate name plate giving feeder details shall be provided for each feeder module door.
2. Inside the feeder compartments, the electrical components, equipments, accessories like switchgear, control gear, lamps, relays etc. shall suitably be identified by providing stickers.



3. Engraved name plates shall preferably be of 3 ply,(Red-White-Red or Black-White-Black) lamincold sheet. However, black engraved perpex sheet name plates shall also be acceptable. Engraving shall be done with square groove cutters.
4. Name plate shall be fastened by counter sund screws and not by adhesives.

#### **12) DANGER NOTICE PLATES :**

1. The danger notice plate shall be affixed in a permanent manner on operating side of the Panels.
2. The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.
3. The danger notice plate, in general, meet the requirements of local inspecting authorities.
4. Overall dimensions of the danger notice plate shall be 200 mm. wide x 150 mm. high.
5. The danger notice plate shall be made from minimum 1.6 mm. thick mild steel sheet and after due pre-treatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.
6. The letters, the figures, the conventional skull and bones etc. shall be positioned on plate as per recommendation of IS : 2551-1982.
7. The said letters, the figures and the sign of skull and bones shall be painted in signal red colour as per IS : 5-1978.
8. The danger plate shall have rounded corners. Location of fixing holes for the plate shall be decided to suit design of the Panels.
9. The danger notice plate, if possible, be of ISI certification mark.

#### **13) EARTHING**

1. Earthing shall be provided as per IS: 3043-1987.

#### **14) PAINTING**

12. All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating).
13. The shade of colour of panel inside/outside shall be as per BOQ confirming to IS Code No.5.

#### **15) LABELS**

1. Engraved PVC labels shall be provided on all incoming and outgoing feeder.
2. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

#### **16) METERS**

1. All voltmeters and indicating lamps shall be through MCB's.
2. Meters and indicating instruments shall be flush type.
3. All CT's connection for meters shall be through Test Terminal Block (TTB).
4. CT ratio and burdens shall be as specified on the Single line diagram/BOQ.

### **17) CURRENT TRANSFORMERS**

1. Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps.
2. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering.
3. The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits.
4. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections.
5. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

### **18) POTENTIAL FREE CONTACTS**

1. Potential free contacts shall be provided for connection to Building Automation System in panels indicated in Schedule of Quantities.

### **19) INDICATING PANEL**

1. All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/MPCB as per relevant fault level and toggle switch.

### **20) TESTING**

1. Testing of panels shall be as per following codes:
  - I. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.
  - II. IS: 13947 : 1993 Degree of protection
  - III. IS: 5578 & 11353:1985 Arrangement of bus bars.

### **21) WIRING**

1. In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

### **22) INSTALLATION**

1. Installation of all LT panels shall include but not limited to the following to complete the installation, testing and commissioning:
2. Transporting materials from stores to exact location of installation.
3. Supply and installation of required base frame made of MS angle or channel sections and duly painted with black paint.
4. Positioning, aligning, fixing, assembling, and installation of LT panel issued free of cost by Client after carrying out proper cleaning and inspection.
5. Site supervision, testing for proper functioning / operation, and pre-commissioning tests.

### **23) COMMISSIONING & ONSITE TESTING**

1. All switchboards shall be tested for dielectric test with 1000V megger.
2. All earth connections shall be checked for continuity.
3. All busbar connections shall be checked and tightened properly.
4. All cable terminations and terminal shrouding shall be checked if they are properly done.
5. The operation of protective devices shall be tested by secondary injection test.
6. The operation of circuit breaker shall be tested for all interlocks.
7. Functional test shall be done for all ACBs, MCCBs and other components.
8. Indicating lamps and meters shall be checked for proper working.

### **24) WORKMANSHIP:**

1. The contractor shall erect the panel at site in co-ordination with the supplier if required.
2. He should check for loose ends on the part of the supplier and shall inform client and consultant for the same.
3. Physical and continuity tests shall be carried out by contractor.
4. Also the field tests carried out by the supplier shall be recorded by the contractor.

### **25) MODE OF MEASUREMENT:**

1. Contractor shall be paid for one panel erection as per BOQ Quantities part.

## 26) APFC Panel

### i. SCOPE

This specification covers the requirements for Low Voltage Capacitors and Control Panel to be used for power factor improvement.

### ii. CODES AND STANDARDS

1. IS: 2834 - Shunt capacitor of power system.
2. IS : 13947 - Low voltage switchgear and control gear.(Part 1 to 5)
3. IS: 4237 - General Requirements for switchgear and control gear for voltages Not exceeding 1000 Volts A.C.
4. IS : 8623 - Specifications for factory built assemblies of switchgear for and Control gear up to 1000 Volts A.C.
5. IS: 9224 - Low voltage fuses.

### iii. GENERAL REQUIREMENTS

- Capacitors shall have two layers of polypropylene film with high purity aluminum foil conductors. The films shall be impregnated with bio-degradable, non-PCB, non-hazardous oil with internal fuses on each element.
- Capacitors shall be of long life (minimum 100,000 operating hours) without degradation or loss of capacitance.
- Capacitors shall have low energy loss (less than 0.5W/KVAr) and totally tropicalized. Each capacitor shall have a discharge resistor to bring down the residual voltage to 50V within 60 sec.
- The capacitance output shall be guaranteed for a period of 2 years @ +10% & -5% of the rated value. All capacitors shall be type tested for dielectric strength, IR value (min. 50 mega -ohms), losses, surge protection etc. in accordance with the IS standards. Capacitor elements shall be canned in enclosure and sealed to meet IP 52 class. All capacitors shall operate at 135% overload (over voltage or harmonics) without deterioration.
- The control section shall contain Automatic Power Factor Controller Relay to switch the capacitors ON or OFF. The system PF shall be monitored constantly and the switching sequence regulated. The switching sequence shall be capable of being changed or modified so as to ensure that all the capacitor units will have equated run hours. Provision shall be available for manual override through multiple push buttons.
- Capacitor duty contactors to be used for switching operation of the capacitors.
- The capacitor section shall house the capacitors with proper and adequate ventilation so that the capacitors will not be overheated. The enclosure shall also provide easy access to each capacitor unit for maintenance.
- The switch section shall consist of switch fuses, Thyristers, voltmeter, PF meter.

- LV Harmonic Filters shall be used with harmonic filter duty power capacitors to mitigate harmonics, improve power factor and avoid electrical resonance in LV electrical networks

## **7 TECHNICAL SPECIFICATION FOR LDB & PDB**

### **1) SCOPE OF WORK**

1. Distribution Boards (DBs) shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum dielectric strength of 1.5 KV / Sec. All Distribution Boards shall be manufactured by a manufacturer listed in Appendix-I.
2. LDB's shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1991.

### **2) CONSTRUCTION FEATURES**

1. DB's shall be made out of 1.6 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of LDB shall be folded and braced as necessary to provide a rigid support for all component.
2. DB shall be suitable for indoor / outdoor installation, wall mounting free standing type, in double door construction.
3. The Final Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement.
4. All removable/ hinged doors and covers shall be grounded by 1.0 sqm tinned stranded copper connectors.
5. Final Distribution Boards shall be suitable for the climatic conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal.
6. The general construction shall conform to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage up to and including 1100 V AC.
7. All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of LDBs.
8. Knockout holes of appropriate size and number shall be provided in the LDB's in conformity with the location of cable/conduit connections. Detachable sheet steel gland plates shall be provided at the top / bottom to make holes for additional cable entry at site if required.

### **3) DISTRIBUTION BOARDS SHALL COMPRISE OF THE FOLLOWING:**

- 3.1 A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.

- 3.2 Installations accessories shall be part of the DB for fixing conductor and rails for mounting MCB's and RCCB's etc. Neutral bus bars & earthing bus bars required in the circuit. All busbars in the LDB shall be insulated type.
- 3.3 Service cable /interconnection shall be part of the Distribution Boards.
- 3.4 The board shall be installed at a height such that the operating is within reach of the normal human height i.e. 1.2 to 1.8 meters from finish floor level.
- 3.5 Degree of protection shall be IP-52 for indoor application, IP-54 for kitchen & laundry and IP-55 for outdoor application.
- 3.6 All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB's and RCCB's unless noted otherwise.
- 3.7 Phase segregation to be maintained in all three phase distribution boards.
- 3.8 Earthing shall be provided in each LDB's.

### **3.9 MINIATURE CIRCUIT BREAKER (MCB)**

- 3.9.1 MCB's shall have quick make and break no welding self-wiping silver alloy contacts for 10 KA short circuit both on the manual and automatic operation.
- 3.9.2 Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip free mechanism.
- 3.9.3 In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common. Breakers must confirm to BS 3871 with facility for locking in OFF position.
- 3.9.4 Pressure clamp terminals for stranded/solid conductor insertion are acceptable up to 4 sq.mm. Aluminium or 1.5 sq.mm.
- 3.9.5 Copper and for higher ratings, the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements.

### **3.10 RESIDUAL CURRENT CIRCUIT BREAKER CURRENT OPERATED TYPE (RCCB)**

- 3.10.1 The RCCB should suffices all the requirements of IS as per code IS - 12640 - 1988. The RCA should be current operated and not on line voltage.
- 3.10.2 The RCCB should ensure mainly the following functions:
  - o Measurement of the fault current value.
  - o Comparison of the fault current with a reference value.
  - o The RCCB should have a torroidal transformer which has the main conductors of primary (P - N) which check the sum of the current close to zero.
  - o All metal parts should be inherently resistant to corrosion and treated to make

them corrosion resistant.

- o It should be truly current operated.
- o It should operate on core balance toroidal transformer.
- o Its accuracy should be  $\pm 5\%$ .
- o It should operate even in case of neutral failure.
- o It should trip at a present leakage current within 100 mA
- o Its enclosure should be as per IP 30.
- o Its mechanical operation life should be more than 20,000 operations.
- o It should provide full protection as envisaged by IE rules - 61-A, 71 - ee, 73 - ee, 1985 and also rule 50 of IE rule 1956.
- o It should conform to all national and international standards like IS: 8828-1993, IS: 12640-1988, BS 4293 - 1983, CEE 27 (International commission Rules for the approved of electrical equipment).

#### **4) EARTHING**

1. Earthing shall be provided as per IS:3043-1987.

#### **5) PAINTING**

1. All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be of Siemens gray paint shade no. RAL-7032 of IS Code No.5.

#### **6) LABELS**

1. Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

#### **7) TESTING**

1. Testing of panels shall be as per following codes:
  - i. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.
  - ii. IS: 13947 : 1993 Degree of protection

#### **8) WIRING**

1. In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

**9) WORKMANSHIP:**

1. The D.B. shall be properly grouted in the wall in concealed manner taking care that the powder coating is not scratched and dents are not formed on the D.B., MCBs and ELCBs.
2. In the distribution boards shall be fixed as per the circuit details provided.
3. All the wires terminating in the MCBs and the ELCBs shall be lugged for proper contact and ferrules depicting the circuit nos shall be provided. D.B.s mounted in concealed manner shall have a groove around it so as to save the finish of the plaster and colour during future opening of the door.
4. The distribution boards shall have circuit chart tagged on the door for future maintenance. Danger notice plates shall be fitted to the distribution boards with screws and not stuck so as to assure its presence for a longer duration.

**10) MODE OF MEASUREMENT:**

1. The distribution boards shall be measured in Nos as per BOQ Quantities.

**8 TECHNICAL SPECIFICATION FOR LT CABLES & CABLE TRAY.****1) SCOPE OF WORK**

1. The Medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions. The cables shall be delivered at site in the original drums with manufacturer's name, size and type clearly written on the drums.
2. All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.
3. The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client.
4. The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practise.

**2) MATERIAL**

1. The MV cables shall be cross linked polyethylene (XLPE) insulated PVC sheathed of 1100 volts grade as asked for in the schedule of quantities. Cables upto 10 sq.mm shall be with copper conductor and 16 sq.mm and above shall be with aluminium conductor.

**3) Technical Requirements:**

1. All XLPE Aluminium/Copper Power cables shall be 1100 Volts grade, multi core constructed as per IS : 7098 Part-I of 1988 as follows :



- 1.1 Stranded Aluminium /Copper conductor in case of 10 sq.mm. and above whereas solid conductor in case of 10 sq.mm. and below.
- 1.2 Cores laid up.
- 1.3 The inner sheath should be bonded over with thermo-plastic material for protection against mechanical and electrical damage.
- 1.4 Armoring should be provided over the inner sheath to guard against mechanical damage. Armouring should be Galvanised steel wires or galvanised steel strips. (In single core cables used in A.C. system armouring should be non-magnetic hard aluminium Wires/Strips. Round steel wires should be used where diameter over the inner sheath does not exceed 13 mm; above 13 mm flat steel armour should be used. Round wire of different sizes should be provided against specific request.)
- 1.5 The outer sheath should be specially formulated heat resistant black PVC compound conforming to the requirement of type ST2 of IS : 5831-1984 extruded to form the outer sheath.
2. Conductor shall be of electrolytic Aluminium/Copper conforming to IS : 8130 and are compact circular or compact shaped.
3. Insulation shall be of XLPE type as per latest IS general purpose insulation for maximum rated conductor temperature 70 degree centigrade.
4. In Inner sheath laid up cores shall be bonded over with thermoplastic material for protection against mechanical and electrical damage.
5. Insulation, inner sheath and outer sheath shall be applied by extrusion and lapping up process only.
6. Uncoated, annealed copper / aluminium, of high conductivity, upto 4 mm<sup>2</sup> size the conductor shall be solid and above 4 mm<sup>2</sup> the conductors shall be concentrically stranded as per IEC: 228.
7. Repaired cables shall not be used.
8. Current ratings of the cables shall be as per IS: 3961.
9. The XLPE insulated cables shall conform to latest revision of IS and shall be read along with this specifications. The Conductor shall be stranded Aluminium/Copper circular/ sector shaped and compacted. In multi core cables the core shall be identified by red, yellow, blue and black coloring of insulation.
10. The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.
11. Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables.
12. Cables shall be supplied in non returnable wooden drums as per IS: 10418.
13. Both ends of the cables shall be properly sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation, storage and erection.
14. The product should be coded as per IS: - 7098 Part-I as follows:-

|                                      |    |
|--------------------------------------|----|
| Aluminium Conductor                  | A  |
| XLPE Insulation                      | 2X |
| Steel round wire armour              | W  |
| Steel strip armour                   | F  |
| Steel Double round wire armour       | WW |
| Steel Double strip armour            | FF |
| Non-magnetic (Al.) round wire armour | Wa |
| Non-magnetic (Al.) strip armour      | Fa |
| PVC outer sheath                     | Y  |

#### 4) Core Identifications:

|                                         |   |                             |
|-----------------------------------------|---|-----------------------------|
| Two core                                | : | Red and Black               |
| Three core                              | : | Red, Yellow and Blue        |
| Four core                               | : | Red, Yellow, Blue and Black |
| Single core                             | : | Green, Yellow for earthing. |
| Black shall always be used for neutral. |   |                             |

#### 5) Inspection

1. All cables shall be inspected by the contractor upon receipt at site and checked for any damage during transit.

#### 6) Joints in Cables

1. The Contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoid cable jointing.
2. This apportioning shall be got approved by the Owner's site representative before the cables are cut to lengths.
3. Where joints are unavoidable heat shrinkable type joints shall be made.
4. The location of such joints shall be got approved from the Owner's site representative and shall be identified through a marker.

#### 7) Jointing Boxes for Cables

1. Cable joint boxes shall be installed with heat shrinkable sleeve and of appropriate size, suitable for XLPE armoured cables of particular voltage rating.

#### 8) Jointing of Cables

1. All cable joints shall be made in suitable, approved cable joint boxes and the filling in of compound shall be done in accordance with manufactures' instructions and in an approved manner. All straight through joints shall be done in epoxy mould boxes with epoxy resin.
2. All cables shall be joined colour to colour and tested for continuity and insulation resistance before jointing commence.
3. The seals of cables must not be removed until preparations for jointing are completed.
4. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged.

5. The conductors shall be efficiently insulated with high voltage insulating tape and by using of spreaders of approved size and pattern.
6. The joints shall be completely topped up with epoxy compound so as to ensure that the box is properly filled.

#### **9) Cable End Terminations**

1. Cable end termination shall be done in cable terminal box using crimping sockets and proper size of glands of double compression type.
2. Solderless crimping type Aluminium/Cu lugs conforming to IS suitable for cable size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.

#### **10) Bonding of Cables**

1. Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armour clamp and gland.
2. The clamps must grip the armouring firmly to the gland or casing, so that no undue stress is passed on to the cable conductors.

#### **11) Cable Installation in Cable Trays and Cable Trenches.**

1. Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable.
2. The cable drums shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks.

#### **12) Laying of Cables on Cable Trays**

1. The relative position of the cables, laid on the cable tray shall be preserved and the cables shall not cross each other.
2. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius as recommended by the manufacturers.
3. All cables shall be laid with minimum one diameter gap and shall be clamped at every meter to the cable tray.
4. Cables shall be tagged for identification with aluminium tag and clamped properly at every 20M.
5. Tags shall be provided at both ends and all changes in directions both sides of wall and floor crossings.
6. All cable shall be identified by embossing on the tag the size of the cable, place of origin and termination.
7. All cables passing through holes in floor or walls shall be sealed with fire retardant Sealant and shall be painted with fire retardant paint upto one meter on all joints, terminations and both sides of the wall crossings by "VIPER CABLE RETARD".

8. This method may be adopted in places like indoor substations, air-conditioning plantrooms, generator rooms etc. or where long horizontal runs of cables are required within the building and where it is not convenient to carry the cable in open ducts.
9. This method is preferred where heavy sized cables or a number of cables are required to be laid. The cable trays may be either of perforated sheet type or of ladder type.

#### **PERFORATED TYPE CABLE TRAY**

10. The cable tray shall be fabricated out of slotted/perforated MS sheets as channel sections, single or double bended. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanised or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mmX50mmX6mm as two longitudinal members, with cross bracings between them by 50mmX5mm flats welded/bolted to the angles at 1 m spacing. 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.
11. Typically, the dimensions details to be considered as per BOQ.
12. The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler plates and cable tray shall be scraped and removed before the installation.
13. The width of the cable tray shall be chosen so as to accommodate all the cables in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 800mm.
14. Factory fabricated bends, reducers, tee/cross junctions, etc. shall be provided as per good engineering practice. (Details are typically shown in figure 3). The radius of bends, junctions etc. shall not be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.
15. The cable tray shall be suspended from the ceiling slab with the help of 10mm dia MS rounds or 25mmX5mm flats at a span spacing of 1mtr.
16. Flat type suspenders may be used for channels upto 450mm width bolted to cable trays.
17. Round suspenders shall be threaded and bolted to the cable trays or to independent support angles 50mmX50mmX5mm at the bottom end as specified. These shall be grouted to the ceiling slab at the other end through an effective means, as approved by the Engineer-in-Charge, to take the weight of the cable tray with the cables.
18. The entire tray (except in the case of galvanized type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.
19. The cable tray shall be bonded to the earth Terminal of the switch bonds at both ends.
20. The cable trays shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross joints, etc. and paid for accordingly

#### **LADDER TYPE CABLE TRAY**

21. The ladder type of cable tray shall be fabricated of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a center to center spacing of 250cm.
22. Alternatively, where specified, ladder type cable trays may be fabricated out of 50mmX50mmX6mm (minimum) angle iron for longitudinal members, and 30mmX6mm flat for rungs.
23. Typical details of fabrication and dimensions of both the types of trays are shown in figure 4A,B,C and D.
24. The maximum permissible loading, jointing of channel sections, width of the cable tray, provision of elbows, bends, reducers, horizontal tee/ cross junctions etc. suspension of cable tray from the ceiling slab; painting and measurement of the cable tray shall be as per sub-clauses (ii) to (x) below clause 2.6.11.2, except that the overall width of one cable tray may be limited to 800mm.

### **13) Laying of Cables in Ground**

1. Cable trench shall be dug to the minimum depth of 1 mtr and the width shall dependent on the no of cables to be kept with the layer of brick in between two cables.

#### **EXCAVATION OF TRENCHES :**

2. The trenches shall be excavated in reasonably straight lines.
3. Wherever there is a change in direction, suitable curvature shall be provided.
4. Where gradients and changes in depth are unavoidable, these shall be gradual.
5. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.
6. The bottom of the trench shall be levelled and shall be made free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 100 mm in depth.
7. Prior to laying of cables, the cores shall be tested for continuity and insulation resistance. The cable drum shall be properly mounted on jacks, at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum and the spindle is horizontal.
8. Cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains. The entire drum length shall be laid in one stretch.
9. However, where this is not possible the remainder of the cable shall be removed by 'Flaking' i.e. by making one long loop in the reverse direction.
10. After the cable has been uncoiled and laid into the trench over the rollers, the cable shall be lifted off the rollers beginning from one end by helpers standing about 10 meters apart and laid in a reasonably straight line.
11. Cable laid in trenches in a single tier formation shall have a cover of clean, dry sand of not less than 150 mm. above the base cushion of sand before the protective cover is laid.

12. In the case of vertical multi-tier formation after the first cable has been laid, a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid.
13. Finally the cables shall be protected by second class bricks before back filling the trench. The buried depth of uppermost layer of cable shall not be less than 750mm.
14. **Back Filling** : The trenches shall be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 300 mm. Unless otherwise specified, a crown of earth not less than 50 mm in the centre and tapering towards the sides of the trench shall be left to allow for subsidence.

#### **14) Route Marker**

1. Route marker shall be provided along straight runs of the cables not exceeding 30 meters also for change in the direction of the cable route and underground joints.
2. Route marker shall be of cast iron painted with aluminium paint.
3. The size of marker shall be 100 mm dia with "Cable" and voltage grade inscribed on it.

#### **15) Testing of Cables**

1. Cables shall be tested at works for all routine tests as per IS including the following tests before being dispatched to site by the project team.
  - a) Insulation Resistance Test.
  - b) Continuity resistance test.
  - c) Sheathing continuity test.
  - d) Earth test.(in armoured cables)
  - e) Hi Pot Test.
2. Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing.
3. On completion of cable laying work, the following tests shall be conducted in the presence of the Owner's site representative.
  - f) Insulation Resistance Test( Sectional and overall)
  - g) Continuity resistance test.
  - h) Sheathing continuity test.
  - i) Earth test.
4. All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules.
5. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests.
6. All tests shall be carried out in the presence of the Owner's site representative, results will be noted and signed by all present and record be maintained.

#### **16) WORKMANSHIP**

1. Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the Contractor shall mark it out on the drawings and also on the site and obtain the approval of the CLIENT AND/OR ITS ARCHITECT before laying the cable.
2. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.
3. Cables shall be laid on walls, cable trays, inside shafts or trenches.
4. Saddling or support for the cable shall not be more than 500 mm apart. Plastic identification tags shall be provided at every 30 m.
5. Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher.
6. In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc unless marked on drawing by architect / consultant.
7. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion.
8. Cables shall be protected with brick or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings.
9. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 10 meters and at all loop points.
10. All cables shall be full runs from panel to panel without any joints or splices.
11. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid.
12. Cable termination for conductors up to 4 sq.mm. may be insertion type and all higher sizes shall have compression type lugs.
13. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armouring shall be earthed at both ends.
14. In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position, so that no rainwater may enter the building.
15. After the cables are tested the pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making the entry watertight.
16. Testing : MV cables shall be tested upon installation with a 500 V Meggar and the following readings established:
  - 16.1 Continuity on all phases.
  - 16.2 Insulation Resistance.
  - 16.3 between conductors.
  - 16.4 all conductors and ground.
  - 16.5 All test readings shall be recorded and shall form part of the completion documentation.
  - 16.6 Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care

that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool. Proper insulation tape shall be applied at the cable and lug joint.

17. Format for cable testing certificate :

- a. Drum no. from which cable is taken :
- b. Cable from \_\_\_\_\_ to \_\_\_\_\_
- c. Length of run of this cable \_\_\_\_\_ mtr
- d. Insulation resistance test
  - between core 1 to earth \_\_\_\_\_mega-ohm
  - between core 2 to earth \_\_\_\_\_mega-ohm
  - between core 3 to earth \_\_\_\_\_mega-ohm
  - between core 1 to core 2 \_\_\_\_\_mega-ohm
  - between core 2 to core 3 \_\_\_\_\_mega-ohm
  - between core 1 to core 3 \_\_\_\_\_mega-ohm
  - duration used:
- e. High voltage test: Voltage Duration
  - between core and earth
  - between individual cores

18. The cable shall be laid side by side in trench with brick covering on all the three sides.

19. The trench shall be such that sharp bends shall be avoided while laying the cable.

20. The bedding of fine sand under the cable shall be not less than 6 mm. The trench shall be terminated in Manholes with specified size of R.C.C. hume pipes as shown in drawing. Cable markers shall be provided through out the route of cable at 10 mtrs distance.

21. The trenches shall be refilled after the cable are laid and the Ground level shall be done as per original after pressing the same. The cables shall be checked for insulation resistance and continuity tests shall be carried out.

### **17) MODE OF MEASUREMENT:**

#### **17.1 Mode of Measurement for Cable Trench & Cable Tray.**

The cable laying shall be measured in rmt. The trenches dug and refilled shall be measured in cu. Mtr. The bricks and sand bedding shall be measured in rmt. The cable trays shall be measured in rmt.

#### **17.2 Mode of Measurement for Cable and Cable End Terminations.**

The cables shall be measured in rmt and terminations on unit basis.

## **9 TECHNICAL SPECIFICATION FOR INTERNAL WIRING.**

### **1) SYSTEM OF WIRING**

1. The system of wiring shall consist of PVC insulated copper stranded conductor flexible FRLS wires in metallic / non metallic (Rigid heavy/Medium Duty ISI -marked fire retarded PVC Conduits of minimum 2mm Wall thickness and Sizes of conduits shall be 25 mm dia. conduits for both mains and point wiring and shall be concealed or surface mounted above false ceiling as called for.



## 2) GENERAL DESCRIPTION

1. Prior to laying and fixing of conduits, the contractor shall mark the conduit route, carefully examine the working drawings prepared by him and approved by the Consultant indicating the layout, satisfy himself about the non interference in the route, sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details.
2. Any discrepancy found shall be brought to the notice of the Owner's site representative.
3. Any modifications suggested by the contractor should get written approval before the actual laying of conduits is commenced.
4. In laying of conduits it is important that not more than two right angle bends are provided for each circuit without a pull box.
5. No junction box shall be provided in the entire length of conduit run for drawing of wires.
6. Only switch outlets, lighting fixture outlets, equipment power outlets and socket outlets shall be considered for drawing of wires.

## 3) LIGHTING & POWER WIRING

1. All final branch circuits for lighting and appliances shall be single conductor/ stranded/ flexible wires run inside conduits.
2. The conduit shall be properly connected or jointed into sockets, bends, and junction boxes.
3. Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.
4. All circuits shall preferably be kept in a separate conduit up to the Distribution Board. No other wiring shall be bunched in the same conduit except those belonging to the same phase.
5. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits.
6. Flexible cords for connection to appliances, fans and pendants shall be 650/1100 V grade (three or four cores i.e. with insulated neutral wire of same size) with tinned stranded copper wires, insulated, twisted and sheathed with strengthening cord. Colour of sheath shall be subject to the CLIENT AND/OR ITS ARCHITECT'S approval.
7. Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors.
8. No such joints shall be made unless the length of the sub-circuit, sub-main or main is more than the length of the standard coil.
9. Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in 3 mm. thick painted or galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.
10. Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm. and wires not less than 1.0 sq.mm. copper shall be used.

11. Every conductor shall be provided with identification ferrules at both ends matching the drawings.

#### 4) TESTING

1. The entire installation shall be tested for:
  - Insulation resistance.
  - Earth continuity.
  - Polarity of single pole switches.
2. All the wiring switch board, outlet points shall be done in a concealed manner in wall & slab in PVC conduit of minimum 25 mm dia. (medium gauge) & with 650v / 1100v grade PVC insulated flexible copper conductor wire.
3. The switches should be modular with moulded cover plates, blank plates for outlet boxes.
4. The accessories, connectors, sockets, should be fixed with brass chrome / cadmium plated machine screw. For fan points the rates should be with hum -free type 300 W regulators as required to complete the point wiring.
5. The wiring shall be as per IS: 732 and IS: 4648. The wiring shall be done in a looping manner so as to avoid junction boxes at any place.
6. All the looping shall be done only in the switchboard and outlet points. The size of the wire shall be as per the specification. Colour code shall be strictly followed.
7. The size of wires shall as follow as per BOQ and as per clients requirements:
8. Light, fans, exhaust fan, 5 Amp. On board plug point, two way light points, bell point etc from switch to outlet.

|                 |                      |
|-----------------|----------------------|
| Phase / Neutral | 1.5 m m <sup>2</sup> |
| Earth           | 1.5 m m <sup>2</sup> |

9. From D.B. to switch board – lighting / 5 A socket etc – i.e. circuit mains part of point wiring

|                 |                      |
|-----------------|----------------------|
| Phase / Neutral | 2.5 m m <sup>2</sup> |
| Earth           | 1.5 m m <sup>2</sup> |

10. From D.B. to 16A power point etc – i.e. circuit mains part of point wiring

|                 |                      |
|-----------------|----------------------|
| Phase / Neutral | 4.0 m m <sup>2</sup> |
| Earth           | 1.5 m m <sup>2</sup> |

11. Separate pipes shall be laid for off wires and circuit mains.
12. Circuit mains of same phase shall be drawn in one pipe with prior permission/discussion with the consultant.
13. Separate phase, neutral and earthing wire of sizes recommended by consultant shall be drawn for each and every circuit mains.
14. Mains for lighting and on board plug points shall be of one-size higher wires than those used in off.

**5) COMPUTER WIRING :**

1. Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. Otherwise rigid conduits shall be used. No flexible extension shall exceed 1.25 m.
2. Conduits run on surfaces shall be supported on metal 12 mm. thick G.I. pressure saddles which in turn are properly screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm.
3. Fixing screws shall be with round or cheese head and of rust-proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building.
4. Unseemly conduit bends and offsets shall be avoided by using fabricated mild steel junction/pull through boxes for better appearances.
5. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.
6. Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm. intervals. Chases in the walls shall be neatly made and refilled after laying the conduit and brought to the finish of the wall but the building Contractor will do final finish.
7. Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the CLIENT AND/OR ITS ARCHITECT, before the concrete is poured.
8. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete suitable fish wires shall be drawn in all conduits before they are embedded.
9. Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement.
10. Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed conduits. Inspection boxes shall be spaced at not more than 12 meters apart or two 90° solid bends or equal.
11. All junction and switch boxes shall be covered by 6 mm clear plate. These junction boxes shall form part of point wiring or conduit wiring as the case may be including the cost of removing the cover for painting and re-fixing. No separate charges shall be allowed except where specially mentioned.
12. Conduits shall be free from sharp edges and burrs and the threading free from grease or oil. The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32 mm. deep.
13. An insulated earth wire of copper rated capacity shall be run in each conduit.

**The point definition shall be conduiting and wiring from D.B. to S.B. and there from to final outlet point including switches and accessories, junction boxes, fan boxes, zarri work with cement -sand etc of approved make.**

**6) CONDUCTORS**

1. All PVC insulated copper conductor flexible FRLS wires shall conform in all respects to Standards as listed under sub-head Indian Standards and shall be IS approved and ISI marked.

#### **7) BUNCHING OF WIRES**

1. Wires carrying current shall be so bunched that the outgoing and return wires are drawn into the same conduit.
2. Wires originating from two different phases shall not run in the same conduit. All wires shall have ferrules for identification.
3. Lighting and power circuits shall be separate. Each Power/ Light Circuit's Neutral shall be individual per Circuit and shall not be looped from any other Circuit.

#### **8) LOAD BALANCING**

1. Balancing of circuits in three phase installation shall be as planned by the Consultants in the tender drawings and shall be checked by the contractor before the commencement of wiring and shall be strictly adhered to.

#### **9) COLOUR CODE OF CONDUCTORS**

1. Colour code shall be maintained as indicated by the Consultant for the entire wiring installations. Red, yellow, blue shall be for three phases, black for neutral and green with yellow band shall be for earthing.

#### **10) WORKMANSHIP**

##### **Drawing Conductors**

1. The drawing and jointing of PVC insulated copper conductor wires shall be executed with due regard to the following precautions.
2. While drawing wires through conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors.
3. There shall be no sharp bends. Wire reel stands to be used for pulling of wires to avoid kinks.
4. Care shall be exercised while drawing the wires from reels, by taking appropriate measures to ensure that wires are not spread on ground, causing dust and dirt accumulation on the new wires.
5. Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into rigid non metallic or PVC Conduits are given below:

| Size of wires Nominal Cross Section Area (Sq. mm.) | Maximum number of wires within conduit size(mm) |    |    |    |    |
|----------------------------------------------------|-------------------------------------------------|----|----|----|----|
|                                                    | 20                                              | 25 | 32 | 40 | 50 |
| 1.5                                                | 7                                               | 12 | 16 | -- | -- |
| 1.5                                                | 5                                               | 10 | 14 | -- | -- |
| 4                                                  | 4                                               | 8  | 12 | -- | -- |
| 6                                                  | 3                                               | 6  | 8  | -- | -- |
| 10                                                 | --                                              | 4  | 5  | 6  | -- |
| 16                                                 | --                                              | 3  | 3  | 6  | 6  |
| 25                                                 | --                                              | -- | 2  | 4  | 6  |
| 35                                                 | --                                              | -- | -- | 3  | 5  |

6. Insulation shall be removed by insulation stripper only. Few Strands of wires shall not be cut/reduced for convenience in connecting into terminals.
7. The terminals shall have sufficient cross sectional area to take all strands and it's connecting brass screws shall have flats ends.
8. All looped joints shall be connected through terminal block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. All light points shall be terminated through a connector.
9. Only licensed wiremen (Before doing the work or before appointing him on site contractor has to submit his wiring licence to Owner) and cable jointers shall be employed to do jointing work.
10. Before entrusting cable jointing work to any technician, or before appointing Cable Jointers or Wiremen on Site, Contractor has to submit such Technicians' / Wireman's / Cable Joints's licence to Owner.
11. All wires and cables shall be embossed with the manufacturer's label with ISI mark and shall be brought to site in original packing. For all internal wiring. PVC insulated wires of 1100 volts grade (FRLS) shall be used.
12. The sub-circuit wiring for point shall be carried out in loop system and no joints shall be allowed in the length of the conductors.
13. No wire shall be drawn into any conduit until all defective work of conduit installation of any nature that may cause injury to wire is completed.
14. Care shall be taken while pulling out the wires so that no damage occurs to conduits/wire itself, the conduits shall be thoroughly cleaned of moisture, dust , dirt or any other obstruction.
15. The minimum size of PVC insulated copper conductor wires for all sub-circuit wiring for light points shall be minimum 1.0 sq.mm copper. Separate neutral to be pulled for each circuit.
16. Conduits shall be kept at a minimum distance of 100 mm. from the pipes of other non-electrical services. And maintain minimum 300 mm distance between telephones, TV & Computer piping.
17. Separate conduits/raceways shall be used for following points as applicable and as requirements of site conditions:

- 17.1 Normal lights and 5 A 3 pin sockets on lighting circuit.
- 17.2 Separate conduit shall be laid from D.B. to switch board.
- 17.3 Power outlets - 15 A 3 pin 20 A/30 A, 2 pin scraping earth metal clad sockets.
- 17.4 Emergency lighting.
- 17.5 Telephones.
- 17.6 Fire alarm system.
- 17.7 Public address system & Music system.
- 17.8 For all other voltages higher or lower than 230 V.
- 17.9 T.V. Antenna.
- 17.10 Water level guard.

### **11) FISH WIRE**

1. To facilitate subsequent drawing of wires in the conduit, GI fish wires of 1.0 mm (14 SWG) shall be provided along with the laying of recessed conduit.

### **12) MODE OF MEASUREMENT**

1. The items shall be measured on unit basis or on mtr basis as per BOQ.

## **10 TECHNICAL SPECIFICATION FOR LIGHT FIXTURES & ACCESSORIES.**

### **1) SCOPE :**

- 1 The scope of work shall cover the supply, installation and testing of various types of LED light fixtures.

### **2) STANDARDS :**

The following standards and rules shall be applicable :

- (a) IS 3646 - 1960 Code of practice for interior illuminator.
- (b) IS 1913 - 1969 General and Safety requirements for  
Electric lighting fittings.

- (c) Indian Electricity Act and Rules issued thereunder.

- 1 All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the relevant British Standard Code of Practice in the absence of Indian Standard.

### **3) GENERAL REQUIREMENTS :**

- Tube Light with integral/ non-integral driver 20-22 Watts, Surge - 4KV, IP-20 LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion

resistance with diffuser and/or Polycarbonate optics with company mark/name 120 to 300 V, Power Factor more than 0.9, THD < 10 %,CCT 4000 K to 6500K, Uniformity ratio >0.7,Luminaire efficacy> 100 lumens/watt ,LED driver efficiency > 85 %

- LED Lamps integral type, cool white with PC diffuser suitable for B22 LAMP holder 5 to 8 watts LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion resistance with diffuser and/or Polycarbonate optics with company mark/name 120 to 300 V,Power Factor more than 0.9, THD < 10 %,CCT 4000 K to 6500K, Uniformity ratio >0.7,Luminaire efficacy> 100 lumens/watt ,LED driver efficiency > 85 %
- LED Panel Light with provision for Plane front frame with translucent cover fixed to housing complete 24 watts, 300 x 300 mm, Surge-4 KV LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion resistance with diffuser and/or Polycarbonate optics with company mark/name 120 to 300 V, Power Factor more than 0.9, THD < 10 %,CCT 4000 K to 6500K, Uniformity ratio >0.7,Luminaire efficacy> 100 lumens/watt ,LED driver efficiency > 85 %
- LED Panel Light with provision for Plane front frame with translucent cover fixed to housing complete up to 36 watts, 600 x 600 mm, Surge- 4KV LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion resistance with diffuser and/or Polycarbonate optics with company mark/name 120 to 300 V, Power Factor more than 0.9, THD < 10 %,CCT 4000 K to 6500K, Uniformity ratio >0.7,Luminaire efficacy> 100 lumens/watt ,LED driver efficiency > 85 %

#### 4) DRAWINGS AND DATA:

As per of the proposal the bidder furnish relevant descriptive and illustrative literature on lighting fixtures and accessories and following drawings/ data for the respective lighting fixtures :-

- i) Dimensional Drawings.
- ii) Mounting details cable entry facilities and weights.
- iii) Light distribution diagrams (Zonal & Isokandora)
- iv) Light absorption and utilisation factors.
- v) Lamp output V/S temp. Curves.

#### 5) WORKMANSHIP:

- The fixture shall be installed on wall / ceiling as directed and as per manufacturer's instruction, with necessary accessories for surface, concealed, suspended from ceiling, bracket mounting etc.
- The job also includes connection of fixture with respective outlet point with heat resistant wires through heat resistance sleeve and PVC connector. The exhaust fan shall be installed complete with M.S. angle iron mounting frame/ ring, G.I. louvers, wire mesh and plug at the end of the cord including wiring & earthing etc. Proper earthing shall be provided to the fixtures.

**6) MODE OF MEASUREMENT:**

The unit rate shall be considered for fitting one fixture. The rate shall include following

- 1 All fixing accessories, mounting bracket, ballast condensers and control gear wherever applicable.
- 2 Supplying and fixing Ball and socket joints wherever required.
- 3 Earthing of fittings.
- 4 Electrical connections to fittings/fans from the junction box/ceiling rose.
- 5 Installation and interconnection of Electronic regulators for ceiling fans.
- 6 Supplying and fixing 300 mm. GI down rod for ceiling fans.

**7) LIGHTING AUTOMATION**

Lighting Automation is required for stage lighting of Auditorium for the particular event. For the same we go through Dali Automation system.

**DALI Advantages to Lighting Designers**

The DALI technology provides several key benefits for lighting designers:

*Simple wiring of controls.* Hardwire control groups are eliminated; each individual device has only a power input and digital control input – which are non-polarized, eliminating potential costly installation errors. Controls are wired using the same type of standard wire as is used for power.

*Control of individual lights.* Up to sixteen (16) different light levels, fade times and rates can be programmed and stored in the ballast memory. Each DALI loop can support up to sixty-four (64) individual addresses.

*Flexible group control.* Each DALI loop can support up to sixteen (16) individual groups and each ballast may belong to any or all of the sixteen available groups for unparalleled lighting scene definitions. Simultaneous control of all units is possible at any time through broadcast addressing.

*Software control allows easy configuration and modification.* Dimming specifications can be finalized much later in a project and buildings can be adapted more easily to meet clients' future needs. Lighting designs can be programmed and simulated on a PC for later downloading into the installation. This commissioning method also offers the flexibility of room layout changes without rewiring.

**DALI Technology and Connectivity**

DALI is an open architecture that allows interchangeability of manufacturers' devices to create a lighting system.

Each DALI loop can control up to 64 devices, each of which is individually addressable (unlike analog interface systems which can only be addressed in common).

Ballasts are connected with standard building wire to a DALI controller, which can be connected to other controllers for centralized control of larger areas. A DALI system can be standalone



Or a sub-system to Building Management Systems (BMS), communicating bi-directionally via a gateway or transmitter.

One DALI system allows the creation of up to 16 groups with individual ballasts being in any or all of the groups. Each group can also have up to 16 settings for various lighting scenes.

A DALI system configuration can be readily modified without any modification of the installation itself.

### **Ballasts**

DALI ballasts utilize standard open communication protocol. Within a DALI system, each ballast has its own address - comparable to a house number assigned to an individual house on the Same Street. Carrying this analogy further, the DALI interface line (or "loop"), is like the street. This loop includes as many as 64 addresses and each one of the addresses individually communicates with the control device. All units, however, can be contacted at the same time by way of a broadcast.

Group addresses are also possible. Up to 16 groups can be configured to meet the varying Lighting requirements of occupants, workspace needs, room functionality, and time of day or ambient light levels. Ballasts can also be individually configured and the parameters are held in the memory of the ballast itself.

These parameters are:

- Light levels
  - Power on
  - Maximum
  - System failure
- Fade time and rate
- Address
- Groups assigned to the ballast
  - Light scene values assigned to the ballast (up to 16)
- Ballasts can be part of multiple scenes
- Scenes can be selected by wall box devices

Two-way communication enables bi-directional information flow, enabling the ballasts to provide feedback to the network on information such as:

- Luminaire state (on/off)
- Lamp energy level
- Lamp and ballast condition

The dimming range of DALI ballasts is 0.1% - 100%, the lower limit depending upon the manufacturer. The logarithmic dimming curve is standardized and adapted to the sensitivity of the eye. When electronic ballasts of different manufacturers are used, the overall brightness Effect is very similar if the lower limit of the dimming range is equal for all units belonging to the same power class (lamp power).

The central interface power supply powers the loop and may also function as the control unit/communications hub, depending on system design and the chosen components. A maximum current input of 250 mA is allowed on each DALI loop. Each device connected to the interface may consume a maximum of 2 mA. A maximum voltage drop of up to 2 Volts is allowed across the connecting wires from the interface supply to each system component. Due to the Low transmission rate, there is no need to use special cables or wires such as twisted or shielded cables. As a rule, a distance of 984 feet (300 meters) should not be exceeded between two communicating units.

### **Control Units**

DALI was developed to make the many benefits of lighting control systems more accessible for a wide range of local room control applications. Before DALI, control systems were either inflexible, hardwired local systems or complex, costly BUS-based Building Management Systems. DALI bridges the gap between these two worlds. Local room control applications include occupancy sensors, photo sensors, local PCs for individual occupant control and wall-mounted controls that enable manual switching to select programmed dimming scenes. DALI can also be interfaced to various Building Management System (BMS) architectures. A basic application would be simple central overrides such as timed on/off switching or dimming. DALI can also add extra flexibility to existing applications using 0-10V luminaire interfaces by simply replacing the standard 0-10V ballasts with DALI ballasts. In this retrofit application, feedback of lighting system information is provided to the BMS, such as failed lamps and ballasts and central monitoring of ballast power and dimming levels. (Note, however, that without a DALI control unit, ballasts would not be individually addressable.) The functionality of a DALI system is defined mainly by the controls. Control units supply the logic coordination between sensors, switch panels and DALI operating equipment. This can be done through a stand-alone unit or by an interface that receives commands from a master system. Intelligent sensors or switch panels with integrated controls are also possible.

#### **Technical Characteristics of the Digital Interface:**

- Data transfer rate of 1,200 bits per second (bps). Enables an interference-free operation. The physical low level has been defined with the interface voltage at 0V (-4.5V to +4.5V) on the receiver's side. The high level condition is an interface voltage of 16V (9.5V to 22.5V). A maximum voltage decrease of 2V between the sender and receiver is admissible on the leads of the interface.
  - Safety distance of interference voltage. A safe operation is guaranteed by the large-scale interference voltage distance between the sender and the receiver side.
  - Maximum system current input of 250mA. Each component connected to the interface may consume a maximum of 2mA. This must be taken into consideration when selecting the power supply.
  - Maximum number of 64 units with an individual address.
  - Revertive signals of information. Diagnostic feedback from the connected lamps is provided (on/off, brightness, lamp state, etc.)
  - Two-wire control lead. Control and supply leads can be wired together, depending on local codes. The maximum lead length between two connected systems must not exceed 984 feet (300 meters).
  - Potential-free control input. The control input is separated galvanically from the power voltage.
- Consequently, all components may be operated with different outer conductors (phases).
- No termination resistors are required.
  - Dimming range of 0.1% - 100%.
  - Programmable dimming times.
  - Interruption of the data transfer. Fixed light adjustments are interpreted automatically (emergency operation).
  - Storage of up to 16 lighting scenes.
  - Connection to Building Management Systems via converters.

DALI's simple control integration is cost effective for new installations as well as retrofits and future modifications. Compared to traditional hardwired analog interfaces, DALI allows on-site defining and adjusting of ballasts and groups of ballasts without rewiring. Layout changes can now be made just by software alterations via remote control, PC or PDA.

### **Wiring**

DALI system wiring is extremely simple and allows maximum flexibility in system design and installation. Standard cable and wires may be used. Unlike analog systems, DALI requires no hardwired power circuit control groups. Installation is easier and more economical. The combination of individual ballast addressing with digital switching eliminates vertical switch wiring.

All the luminaires in a room are connected to the nearest UN switched power supply and to a single two-wire control cable from the DALI-compliant lighting controller. Low-voltage wiring can be installed in the same conduit as the power feed wire if local codes allow, or can be run individually as open wire following local codes as per the type of cable needed.

If the layout changes, reconfiguration can be done without changing the luminaire wiring. This allows the use of a single five-wire cable/conduit to install all the luminaires and lighting controls (subject to local codes).

### **DALI Installation**

***Installation of a lighting control system with a DALI interface must be done in accordance with applicable local building and electrical codes.***

Compared with the 0-10V interface, the DALI control line requires no other electrical installation tool, auxiliary device, or measuring and testing equipment.

There is no requirement for special data wire. However, a clear method of identification is necessary. Both the power supply and the DALI control line can be run through a 5-wire cable/conduit, depending on local code.

The DALI system provides flexibility in layout and connection of the individual DALI components to the DALI control line.

However, it is recommended for the sake of clarity that a uniform wiring system be utilized throughout one building.

Power and DALI lines – as well as the associated installation equipment – may be installed in parallel in terminal blocks.

The maximum voltage drop on the DALI line may not exceed 2V. The resulting maximum line length is 300 meters (984 feet), the largest permissible distance between two DALI components, as illustrated below:

### **Commissioning**

Commissioning is the process of assigning addresses and storing the system control information. The commissioning of DALI systems depends primarily on the control device used, so the respective manufacturer's instructions must be followed. The control device software will determine most of the technical characteristics. This section outlines the basic commissioning procedures as defined by the DALI standard.

**11 TECHNICAL SPECIFICATION FOR DATA, TELEVISION & TELEPHONE WIRING.****1) GENERAL DESCRIPTION**

1. The work shall cover the supply and installation of the TV, Telephone and Computer data points including laying of Cables in 19/20 mm dia PVC Conduit.

**2) SCOPE****TELEPHONE CABLES AND WIRES:**

1. The type of cables and the services shall be as follows:
2. Indoor – Multipair PVC sheath armoured / un-armoured as specified 0.6 mm tin Cu. Cable.
3. Outside -- Multipair PVC sheath armoured / jelly filled as specified 0.6 mm tin Cu. Cable.
4. All multi core cables and wires shall be of tinned copper conductor of not less than 0.6 mm dia and shall be colour coded twisted pairs with rip cord.
5. The conductor resistance shall be less than 150 ohms per KM and the insulation resistance between the conductors not less than 50 mega ohms and the nominal capacitance of about 0.1 microfarad per kilometre.
6. Cables laid underground or locations subject to dampness and flooding shall be filled with polyethylene compound and shall have sufficient protection against moisture and water ingress.
7. All armouring shall be of galvanized steel wires and protected against corrosion by an outer sheath of PVC in the case of indoor cables and polyethylene in the case of outdoor cables. Outer sheathing must be fire retarding and anti-termite.
8. All un-armoured single core cables and inner sheath of armoured cables shall be provided with ripcord.

**TELEPHONE TAG BLOCKS:**

9. The telephone tag blocks shall be suitable for the multi core telephone cables and shall have two terminal blocks, cross connect type. All incoming and outgoing cables shall be terminated on separate terminal blocks and termination shall be silver soldered. The cross connecting jumpers shall be insulated wires of same diameter and screw connected.
10. The tag blocks shall be mounted inside fabricated sheet steel boxes with removable hinged covers and shall be fully accessible. The enclosure shall be painted with 2 coats of red oxide and stove enamelled.

**TELEPHONE OUTLET SOCKET:**

11. Telephone outlet socket shall be of the same make as that of the switches and accessories. The outlet sockets shall consist of 2 A 2 Pair polyethene connector in M.S.I / PVC boxes with switch plate of the same make as that of switches and telephone socket. The telephone outlet socket unless and otherwise specified shall be jack type and not pin type.

#### **COMPUTER WIRES:**

12. The computer wires shall be of 4 pair enhanced Cat 6 category and shall be of the makes as specified in the tender.

#### **COMPUTER DATA OUTLET SOCKETS:**

13. The computer sockets shall be of e Cat 6 category and of the make specified in the tender. The sockets shall be installed in the plates of the modular switches range to be used. The sockets shall be crimped using crimping tool with the Cat 6e wire.
14. For clean room application the plates shall be of SS 316 with no sharp edges.

#### **TELEVISION WIRING & SOCKETS:**

15. The Co-axial cable shall be of wide band type with operation capability upto 500 MHz.as of Delton type.
16. The Co-axial cable shall comprise of inner conductor of solid bare copper insulated with Foam PE & Secondary Conductor made of poly-Aluminium film bonded Aluminium braids and having coverage of 65%, overall sheathed with black PVC Insulation.
17. Twisted cables shall be electrolytic grade annealed copper conductor insulated with PE insulation twisted in to pairs with colour combination bunched together in concentric layers so as to minimise cross-talk & wrapped with FR PVC taps and sheathed with FR PVC or HFFR outer jacket suitable for indoor telephone wiring and confirming to C-DOT S/WS-113 / IEC 60189-2, UL-1581 SECTION 1080.
18. The ageing resistance of the co-axial cable shall comply with DIN 47252, Part 2, i.e. max. 5% increase in attenuation at 200 MHz. measured by artificial ageing (14 days at 80 deg. C)

### **3) WORKMANSHIP**

1. All cables shall be on cable racks and neatly stitched together.
2. The connection at the tag blocks shall be silver soldered so as to achieve minimum contact resistance.
3. The final branch connections with single pair cables in conduits and the maximum number of cables in each conduit shall be as follows:

| Conduit<br>Inch | diameter<br>mm. | Max. No. of cables  |
|-----------------|-----------------|---------------------|
| 3/4"            | 20              | 2 Nos. single pair  |
| 1"              | 25              | 6 Nos. single pair  |
| 1¼"             | 32              | 12 Nos. single pair |
| 1½"             | 40              | 18 Nos. single pair |

4. The tag blocks shall be mounted inside fabricated sheet steel boxes with removable hinged covers and shall be fully accessible. The enclosure shall be painted with 2 coats of red oxide and stove enamelled.

#### **4) MODE OF MEASUREMENT**

1. The wires, conduits and raceways shall be measured in rmt whereas the outlet sockets, junction boxes and tag blocks shall be measured in units.

### **12 TECHNICAL SPECIFICATION FOR EARTHING SYSTEM.**

#### **1) GENERAL DESCRIPTION**

1. All the non-current carrying metal parts of the electrical installation and mechanical equipments shall be earthed properly.
2. The metal conduits, trunking, cables armour and sheath, electric panels' boards, lighting fixtures, ceiling and exhaust fan and all other parts made of metal shall be bonded together and connected by means of specified earthing system.
3. An earth continuity conductor shall be installed with all the feeders and circuits and shall be connected from the earth bar of the panel boards to the conduit system, earth stud of the switch box, lighting fixture, earth pin of the socket outlets and to any metallic wall plates used.
4. All the enclosures of motors shall be also connected to the earthing system.

#### **2) SCOPE OF WORK**

1. The scope of work shall cover supply, laying, installation, connecting, testing and commissioning of:
  - 1.1 Earthing station.
  - 1.2 Earthing Aluminium/copper strips from earthing station to equipotential bar.
  - 1.3 Earthing Aluminium / copper strips / wires from equipotential bar to lay feeder mains and circuit to connect power panels, DBs, switchboards etc.
  - 1.4 Bonding of Non-current carrying parts, and metallic parts of the electrical installation.

#### **3) STANDARDS**

1. The following standards and rules shall be applicable:
  - 1) IS: 3043 - 1966 Code of practice for Earthing.
  - 2) Indian Electricity Act and Rules

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the British Standard Codes of Practice in absence of Indian standard.

**4) TYPE OF EARTHING STATION , CHEMICAL PIPE-IN-PIPE EARTHING**

1. The substation earthing shall be with copper plate earthing station unless otherwise specified & earthen pit of minimum bore dia. 225mm size ASH or approved make Safe Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free G.I.Pipes.
2. The earthing station shall be as shown on the drawing. The two earth electrodes shall be 80mm & 40 mm dia GI pipes plate. The earth resistance shall be maintained with a suitable crystalline conductive materials and back fill compound.
3. The resistance of each earth station should not exceed 1 ohms.
4. The earth lead shall be connected to the earth pipe through copper/brass bolts.
5. The pipe-in -pipe earth station shall be as shown on the drawing and shall be used for equipment protective earth grid.
6. The earth electrodes shall be galvanized pipes 3.0 long with outer pipe 80 mm dia & inner pipe 40 mm dia. The outer pipe shall be plated with 80-200 microns & inner pipe shall be plated with 200-250 microns with connection terminal dia of 14 mm.
7. Crystalline Conductive material-Mixture of nature minerals and a chemical compound, highly conductive and non corrosive, which prevents the inner pipe from corrosion and dissipates the current evenly.
8. Back fill compound - Moisture retaining compound having 13 times more (Hygroscopic) water retaining capacity than its dry volume & shall be 2 bags of 25 kgs.
9. The earth lead shall be fixed to the pipe with a clamp and safety set screws. The clamps shall be permanently accessible.

**5) WORKMANSHIP****INSTALLATION AND CONNECTION**

1. The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case less than 3 M below finished ground level.
2. The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column.
3. The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.
4. 20 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber.
5. Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe.

6. The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing.
7. The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.
8. Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS: 3043, Code of Practice for Earthing Installation.
9. The earth conductors (Strips / Wires, Hot dip G.I.) Inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Hot Dip GI screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.
10. The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.
11. Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.
12. The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

#### **EARTH LEADS AND CONNECTIONS**

1. Earth lead shall be bare copper or Galvanised steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. Galvanised steel buried in the ground shall be protected with bitumen and hessian wrap or polythene faced hessian and bitumen coating. At road crossing necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface.
2. The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.
3. Wherever crossing is required, earthing jumper shall be of insulated wires.

#### **EQUIPMENT EARTHING**

1. All apparatus and equipment transmitting or utilising power shall be earthed in the following manner. Copper /G.I. Earth strips/wires shall be used unless other-wise indicated in the Schedule.

#### **6) TEST**

1. The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3041.



2. The following earth resistance values shall be measured with an approved earth megger and recorded.
  - 2.1 Each earthing station
  - 2.2 Earthing system as a whole
  - 2.3 Earth continuity conductors
3. Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 ohm in each case.
4. Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.
5. All tests shall be carried out in presence of the consultant / client.

## 7) MODE OF MEASUREMENT

1. Provision of earthing station complete with excavation, electrode, watering pipe, soil treatment, masonry chamber with cast iron cover etc. shall be treated as one unit of measurement.
2. The following items of work shall be measured and paid per unit length covering the cost of the earth wires / strips, clamps, labour etc.
  - a) Main equipment earthing grid and connection to the earthing station.
  - b) Connection to the switch board, power panels, DB etc.
3. The cost of Earthing the boq. items shall become part of the cost of the item itself and no separate payment for earthing shall be made.

Signature of Contractor

Deputy Executive Engineer

Executive Engineer

Superintending Engineer

R & B Electrical Circle

| Fire Alarm System (ELV) Technical Specification |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sor No                                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Technical Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 7-10-11                                         | SITC of Microprocessor based Net-workable Analogue Addressable Fire Alarm Control Panel. The Panel shall be compliant with EN54-2, EN54-4 and approved by LPCB. The Fire Alarm Control Panel shall have expandable capacity upto 4 loops. The Panel must have large graphic display. The Panel must also have the capability to take Addressable Intelligent Wired and Wireless Devices on same loop. Each loop shall have a capacity of 127 analogue Addressable devices and 127 Base sounders/Base Sounder Beacons. The Panel shall have 240 V AC power supply along with automatic Battery Charger.<br>Approved by LPCB (Including Five year free maintenance with guarantee)<br>Approved makes-Esser , autronica,Notifier | UL Standards<br>NFPA 72<br>International Building Code (IBC)<br>California Building Code (CBC)<br><br><ul style="list-style-type: none"> <li>Complies with UL 2572 Mass Notification Systems.</li> <li>Up to 159 detectors and 159 modules per SLC; 318 devices per loop.</li> <li>Large 16 line, 640 character LCD backlit display or use displayless as a network node</li> <li>Backlit, 640-character display.</li> <li>Program keypad: full QWERTY keypad</li> </ul> <b>VOICE AND TELEPHONE FEATURES</b> <ul style="list-style-type: none"> <li>Up to eight channels of digital audio.</li> <li>35 watt, 50 watt, 75 watt, and 100/125 watt digital amplifiers</li> </ul> |
| 7-10-16                                         | SITC of Analogue Addressable Multi- Sensor which is fully compatible with Analogue Addressable Protocol,having removable high performance chamber with Twin fire LED's allow 360 degree viewing. User selectable sensitivity modes 1% to 4.5% obs/m, Incorporate Optical and dual Heat elements, lock mechanism (sensor to base), Electronically addressed, Pulsing/non-pulsing controlled from panel. Approved by LPCB & VdS. (Including Five year free maintenance with guarantee)<br>Approved makes-Esser , autronica,Notifier                                                                                                                                                                                             | UL 268 listed for Open Air Protection<br>UL 521 listed for Heat Detectors<br><br>Operating Voltage Range: 15 to 32 VDC<br>The sensor's LEDs can operate in three ways—on, off, and blinking<br>Devices are point addressable up to 159 addresses                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 7-10-25                                         | SITC of Optical Beam Detector with transmitter and receiver set. The detector shall have 5 - 100 m range, Automatic compensation, Maximum coverage 1500m2, Automatic Signal strength adjustment, Emitter unit can be powered directly from zone (or loop), Features a Latching or Non-Latching fault relay, Full line continuity options, Approved by LPCB & VdS (Including Five year free maintenance with guarantee)<br>Approved makes-Esser , autronica,Notifier                                                                                                                                                                                                                                                           | UL Listed<br>CSFM<br>FM Approved<br><br>Operating Temperature: 32°F to 100°F (0°C to 37.8°C)<br>16 to 328 foot protection range<br>Single-ended, reflected type design<br>Paintable cover                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 7-10-37                                         | SITC of Analogue Addressable Manual Call Point with Integral Short Circuit Isolator, Analogue Addressable Protocol having, Bi-coloured status LED (red for alarm, amber for (short-circuit), Non-frangible element fitted as standard (conforms to EN54), pulsing/non-pulsing can selectable via panel, Electronically addressed, Approved by LPCB. (Including Five year free maintenance with guarantee)<br>Approved makes-Esser , autronica,Notifier                                                                                                                                                                                                                                                                        | UL/ULC Listed<br>CSFM<br>FM Approved<br><ul style="list-style-type: none"> <li>Normal operating voltage: 24 VDC.</li> <li>Maximum SLC loop voltage: 28.0 VDC.</li> <li>Maximum SLC standby current: 375 A.</li> <li>Maximum SLC alarm current: 5 mA.</li> <li>Temperature Range: 32°F to 120°F (0°C to 49°C)</li> <li>Relative Humidity: 10% to 93% (noncondensing)</li> </ul>                                                                                                                                                                                                                                                                                                |
| 7-10-21                                         | SITC of Analogue addressable loop powered Base Sounder, variable sound output 50 ~ 98 dB(A) (±2 dB(A)) output at 1 metre, 51 user-selectable tones (all tones EN54-3 compatible), Auto shutdown feature prevents noise-pollution, Approved by LPCB & VdS (Including Five year free maintenance with guarantee)<br>Approved makes-Esser , autronica,Notifier                                                                                                                                                                                                                                                                                                                                                                   | UL Listed<br><br>12 and 24V operation<br>High and low volume settings<br>Compatible with MDLsunc module<br>Standard Operating Temperature:32°F to 120°F (0°C to 49°C)<br>Humidity Range :10 to 93% non-condensing                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| NON-SOR                                         | Supplying and drawing of cable FRLS PVC insulated copper conductor cable in the existing surface / recessed conduit of following pairs, cores and size including connections and interconnections etc. as required.<br>Single pair, 2-core, 1.5 sqmm, For Fire Alarm & Detection System. as per site requirement. as per technical specification etc. as required.                                                                                                                                                                                                                                                                                                                                                            | BS 5467<br>EN 60228<br>BS 7655-1.3<br><br>The Oxygen index of cables shall be more than 30 % at 270 C + 20C<br>Cables shall have smoke density of less than 50 % Max.<br>Conductor temperature at short circuit : Max.: 250°C                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

**LIST OF APPROVED MAKES FOR ELECTRICAL & ELV WORKS**

| <b>Item Description</b>                              | <b>Make</b>                                                                                                                                          |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Electrical Works</b>                              |                                                                                                                                                      |
| Transformer                                          | Voltamp                                                                                                                                              |
|                                                      | Schneider                                                                                                                                            |
|                                                      | Kirloskar                                                                                                                                            |
|                                                      | Crompton                                                                                                                                             |
| H.T.VCB / PANEL                                      | ABB/SIEMENS/ Schneider Electric / L&T                                                                                                                |
| PROTECTION REALY FOR H.T PANEL                       | GE/ABB/ L&T/ SIEMENS/ Schneider                                                                                                                      |
| H.T.XLPE CABLE                                       | Finolex/ KEI Cable/ PolyCab/Havells                                                                                                                  |
| H.T. Joint (Heat Shrinkable)                         | RAYCHEM / 3-M                                                                                                                                        |
| LT PANELS                                            | CPRI/ERDA Approved Panel Builder. 70KA Short Circuit withstands Strength. Accessories as per Mentioned in make List. Subject to Client Confirmation. |
| Distribution Board                                   | Legrand/L&T/ SIEMENS/ Schneider                                                                                                                      |
| Cable & Wire                                         | Finolex/ KEI Cable/ PolyCab/Havells                                                                                                                  |
| Cable Tray (All Type)                                | Profab/ Precision/ Universal/ Indiana                                                                                                                |
| LT Switchgear (All Range)                            | ABB/ Legrand/L&T/ SIEMENS/ Schneider                                                                                                                 |
| LT MCCB, MCB, ELCB                                   | ABB/ Legrand/L&T/ SIEMENS/ Schneider                                                                                                                 |
| LTSFU                                                | ABB/SIEMENS/ Schneider Electric / L&T                                                                                                                |
| LT Contactors                                        | ABB/SIEMENS/ Schneider Electric / L&T/ Legrand                                                                                                       |
| Auto Change over Switch                              | ABB/SIEMENS/ Schneider / L&T/ Legrand                                                                                                                |
| Starter (Star-Delta/Dol)                             | ABB/SIEMENS/ Schneider / L&T/ Legrand                                                                                                                |
| Submersible Motor/Mono Block pump set                | Crompton / KBL                                                                                                                                       |
| Meters (Digital)                                     | ABB/Schneider / L&T/ Secure / Enercon                                                                                                                |
| Relays - Earth Fault                                 | SIEMENS/ Schneider Electric / L&T/ Legrand                                                                                                           |
| Indicating Lamp                                      | SIEMENS/ Schneider Electric / ABB/KAPPA/TEKNIC                                                                                                       |
| Electric Meter                                       | ABB/ SIEMENS/ Legrand                                                                                                                                |
| Rotary Switch                                        | SIEMENS/ Schneider Electric / KEYCEE/ SALZER                                                                                                         |
| Push Button and Push Button set                      | SIEMENS/ Schneider Electric / L&T/BCH                                                                                                                |
| Selector Switch                                      | SIEMENS/ Schneider / KEYCEE/ SALZER                                                                                                                  |
| Annunciator                                          | Proton / EAPL                                                                                                                                        |
| Lugs                                                 | Dowell's / 3D / Jainson / Comet / HMI                                                                                                                |
| Bimetallic Lugs                                      | ISMAL / HMI / Dowell's                                                                                                                               |
| Cable Gland                                          | 3D / Jainson / Comet / HMI                                                                                                                           |
| PVC conduit & accessories                            | Precision / Nihir / PolyCab / Finolex                                                                                                                |
| Casing Capping                                       | Precision / Nihir / PolyCab / Finolex                                                                                                                |
| Modular Switches, Socket outlets & other accessories | Legrand / MK / Havells / Anchor                                                                                                                      |
| PVC tape                                             | Anchor / Steel Grip                                                                                                                                  |
|                                                      |                                                                                                                                                      |
| Wires For Internal Wiring                            | Finolex/ RR/ PolyCab/Havells                                                                                                                         |

| Item Description                                           | Make                                                        |
|------------------------------------------------------------|-------------------------------------------------------------|
| TV Co-axial Cable                                          | Delton / National / Havells / Finolex                       |
| Connectors (Colors As per Phase & Neutral)                 | Salzer / Elemex / L&T/ Connect well / Phoenix               |
| LED Light Fixture                                          | Philips / Havells / Wipro / Crompton / Bajaj                |
| Lighting Controller                                        | Dynalitte / Atco / Anchor / Legrand / C&S                   |
| Ceiling Fan / Exhaust Fan                                  | Crompton / Usha / Havells / Orient                          |
| Sensors                                                    | MK / Creston /Lutron / Legrand                              |
| Computer                                                   | HP / Dell /Lenovo / IBM                                     |
| Cat 6 / RJ45 / Cat 6 jack panel                            | Tyco / Systimax / Digi link / Lrgrand / Schneider           |
| Under Floor metal trucking cable management system on wall | MK / Legrand / Schneider                                    |
| UPS                                                        | Emerson / Eaton / Numeric / Mitsubishi / Schneider Electric |
| Lightening Protection                                      | Ashlok / LPI / Alstorm                                      |
| DG set                                                     | Cummins / Sudhir / Koel / Volvo / Crompton greaves          |
| DG set AMF Panel                                           | As Per DG set supplier. (Switch gear as per make list)      |
| Bus duct                                                   | Schneider Electric / L&T/ Legrand                           |
| Digital Multi-Function Meter                               | Secure / AE/ Conzerv / Enercon                              |
| LT cable Lugs                                              | Dowell's / 3D / Comet                                       |
| Chemical Earthing                                          | Ashlok / LPI                                                |
| Fire Alarm System (ELV Work)                               | Esser                                                       |
|                                                            | Autronica                                                   |
|                                                            | Notifier                                                    |

- Client has all right to check the challans of supplier.
- MCB and MCB DBs Must be of same make.
- Contractor has to take prior approval for all the make of material from Client/Consultant/PMC before execution.
- The Client/Consultant/PMC reserves the right to select the manufacture or approved make from the above list.
- Any make not mentioned in the above list must be approved from Client/Consultant before execution.
- All ISI marked items shall be supplied with type test certificates suitable to the ratings marked for the application.
- All approved makes shall be supplied with serial nos. cross referred with OEM Approved test certificates.
- All equivalent makes shall be prior approved before dispatch to site by Engineer in charge/ Architect in charge.
- All makes mentioned above and in item description shall further confirm to standard specifications of each items as mentioned in technical specifications of tender documents.

**d.**

**HVAC WORK**

## **SPECIAL CONDITIONS OF CONTRACT**

### **GENERAL**

These special conditions are intended to amplify the General Conditions of Contract, and shall be read in conjunction with the same. For any discrepancies between the General Conditions and these Special Conditions, the more stringent shall apply.

### **SCOPE OF WORK**

The general character and the scope of work to be carried out under this contract is illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner's site representative. The contractor shall furnish all labour, materials and equipment (except those to be supplied by the owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete air conditioning system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The central Ventilation and Air-Conditioning system shall comprise of following:-

- VRV Outdoor Unit
- Tube axial& Propeller fans for mechanical ventilation systems.
- Variable Frequency Drives
- Motor control centers.
- Automatic balancing valve& thermostats for AHUs.
- GI ducts inclusive of external insulation, acoustic lining, canvas connections, volume control dampers, and smoke dampers, motorized fresh air dampers as required.
- Supply and return air registers and diffusers & Grill.
- Insulation of refrigerant pipes.
- Vibration isolators for all Air-Conditioning and Ventilation equipment.
- Automatic controls and instruments.
- Wiring and earthing from MCC panels to various refrigeration, air conditioning, and mechanical ventilation equipment, control wiring and interlocking.
- Cutting holes, chases and the like through all types of nonstructural walls, and finishing for all services crossings, including sealing, frame work, fire proofing, providing sleeves, cover plates, making good structure and finishes to an approved standard. No additional payment shall be made by Owners on this account.
- Balancing, testing, and commissioning of the entire Air-Conditioning and mechanical ventilation installation.
- Test reports, list of recommended spares, as-installed drawings, operation, and maintenance manual for the entire Air-Conditioning and Ventilation installation.
- Training of Owner's Staff.

## **PROJECT EXECUTION AND MANAGEMENT**

The Contractor shall ensure that senior planning and erection personnel from his organization are assigned exclusively for this project. They shall have minimum 10 years' experience in this type of installation. The Contractor shall appoint one Project Director holding senior management position in the organization. He shall be assisted on full time basis by a minimum of two erection engineers & three senior supervisors. The entire staff shall be posted at site on full time basis.

The project management shall be through modern technique. The Contractor's office at site shall be fully equipped with fax, internet facility, computers, plotter, and photocopier. Erection engineer and supervisors shall be provided with mobile communication system so that they can always be reached.

For quality control & monitoring of workmanship, contractor shall assign at least one full-time engineer who would be exclusively responsible for ensuring strict quality control, adherence to specifications and ensuring top class workmanship for the air conditioning installation.

The Contractor shall arrange to have mechanized & modern facilities of transporting material to place of installation for speedy execution of work.

## **PERFORMANCE GUARANTEE**

The contractor shall carry out the work in accordance with the Approved shop drawings, Specifications, Schedule of Quantities and other documents forming part of the Contract.

The contractor shall be fully responsible for the performance of the selected equipment (installed by him) at the specified parameters and for the efficiency of the installation to deliver the required end result.

The contractor shall guarantee that the HVAC system as installed shall maintain the inside conditions in the air-conditioned spaces as described under "Basis of Design" in the specifications.

Complete set of architectural drawings is available in the Architect/Consultant's office and reference may be made to same for any details or information. The contractor shall also guarantee that the performance of various equipment individually, shall not be less than the quoted capacity; also actual power consumption shall not exceed the quoted rating, during testing and commissioning, handing over and guarantee period.

## **BYE-LAWS AND REGULATIONS**

The installation shall be in conformity with the Bye-laws, Regulations, and Standards of the local authorities concerned, in so far as these become applicable to the installation. But if these Specifications and Drawings call for a higher standard of materials and / or workmanship than those required by any of the above regulations and standards, then these Specifications and Drawings shall take precedence over the said regulations and standards. However, if the Drawings and specifications require something which violates the Bye-laws

and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

### **FEES AND PERMITS**

The contractor shall obtain all permits/ licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation. However any receipted amount shall be reimbursed on presentation of proof of payment.

### **QUIET OPERATION AND VIBRATION ISOLATION**

All equipment shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Owner's site representative. In case of rotating machinery sound or vibration noticeable outside the room in which it is installed, or annoyingly noticeable inside its own room, shall be considered objectionable. Such conditions shall be corrected by the Contractor at his own expense. The contractor shall guarantee that the equipment installed shall maintain the specified at dB / NC levels.

### **ACCESSIBILITY**

The Contractor shall verify the sufficiency of the size of the shaft openings, clearances in cavity walls and suspended ceilings for proper installation of his ducting and piping. His failure to communicate insufficiency of any of the above shall constitute his acceptance of sufficiency of the same. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed control damper, valve or other devices requiring attendance, shall be finalized and communicated in sufficient time, to be provided in the normal course of work. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense. Access panel shall be standardized for each piece of equipment / device / accessory and shall be clearly nomenclature / marked.

### **MATERIALS AND EQUIPMENT**

All materials and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. Makes shall be strictly in conformity with list of approved manufacturers as per Architect/EIC/Client.

### **MANUFACTURERS INSTRUCTIONS**

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, such instructions shall be followed in all cases.

### **ELECTRICAL INSTALLATION**

The electrical work related to air conditioning services, shall be carried out in full knowledge of, and with the complete coordination of the contractor. The electrical installation shall be in total conformity with the control wiring drawings prepared by the contractor and approved by the Architect/Consultant. All air conditioning equipment shall be connected and tested in the presence of an authorised representative of the contractor.



The air conditioning system shall be commissioned only after the contractor has certified in writing that the electrical installation work for air conditioning services has been thoroughly checked, tested and found to be totally satisfactory and in full conformity with the contract Drawings, Specifications and manufacturers instructions. It is to be clearly understood that the final responsibility for the sufficiency, adequacy, and conformity to the contract requirements, of the electrical installation work for air conditioning services, lies solely with the contractor.

### **COMPLETION CERTIFICATE**

On completion of the Electrical installation for air conditioning, a certificate shall be furnished by the contractor, counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority.

The contractor shall be responsible for getting the entire electrical installation for air conditioning system duly approved by the local authorities concerned, and shall bear expenses if any, in connection with the same.

### **BALANCING, TESTING AND COMMISSIONING**

Balancing of all air and water systems and all tests as called for the Specifications shall be carried out by the contractor through a specialist group, in accordance with the Specifications and ASHRAE Guide lines and Standards. Performance test shall consist of three days of 10 hour each operation of system for each season.

The results for summer, monsoon, and winter air conditioning in quadruplicate, shall be submitted for scrutiny. Four copies of the certified manufacturers performance curves for each piece of equipment, high lighting operational parameters for the project, shall be submitted alongwith the test certificates. Contractor shall also provide four copies of record of all safety and automatic control settings for the entire installation.

The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Owner's site representative. All tests shall be carried out in the presence of the representatives of the Architect/Consultant and Owner's site representative.

### **COMPLETION DRAWINGS**

Contractor shall periodically submit completion drawings as and when work in all respects is completed in a particular area. These drawings shall be submitted in the form of two sets of CD's and four portfolios (A-1 or A-0 size) each containing complete set of drawings on approved scale indicating the work as - installed. These drawings shall clearly indicate complete plant room layouts, ducting and piping layouts, location of wiring and sequencing of automatic controls, location of all concealed piping, valves, controls, dampers, wiring and other services. Each portfolio shall also contain consolidated control diagrams and technical literature on all controls. The contractor shall frame under glass, in the air-conditioning plant room, one set of these consolidated control diagrams.

## **OPERATING INSTRUCTION & MAINTENANCE MANUAL**

Upon completion and commissioning of part HVAC system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Owner's site representative and two for Owners Operating Personnel.

These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4 year period of maintenance of each equipment.

## **ON SITE TRAINING**

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labour and helpers for operating the entire installation for a period of fifteen (15) working days of ten (10) hours each, to enable the Owner's staff to get aquatinted with the operation of the system. During this period, the contractor shall train the Owner's personnel in the operation, adjustment, and maintenance of all equipment installed.

## **MAINTENANCE DURING DEFECTS LIABILITY PERIOD**

### **Complaints**

The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 10 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.

### **Repairs**

All equipment that requires repairing shall be immediately serviced and repaired. Since the period of Mechanical Maintenance runs concurrently with the defects liability period, all replacement parts and labour shall be supplied promptly free-of-charge to the Owner.

## **UPTIME GUARANTEE**

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defects liability period, the contract for Operation and Maintenance shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all temperatures, pressures, humidity, and power consumption. Starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance, and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule. Each tenderer shall submit along with the tender, a detailed operation assistance proposal for the Owner's site

representatives/Consultant's review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tendered shall include a list of other projects where such an Operation Assistance has been provided.

## **OPERATION AND MAINTENANCE**

Contractor may be required to carry out the operation of the HVAC installation for the defects liability period. Further, he may also be required to carry out operation and all inclusive maintenance of the entire system for a period of four years beyond the defects liability period.

### **Operation contract (HVAC System)**

- i. 24 hours a day, year round.
- ii. All stand-by equipment to be operated as per mutually agreed programme.
- iii. Proper entry and upkeep of relevant log books.
- iv. Maintain complaints register. Submit weekly report.
- v. Proper housekeeping of all areas under the contract.
- vi. Prepare daily consumption report and summary of operation.

### **Terms of payment**

- i. Monthly at the end of each month on pro-rata basis.

### **All Inclusive Maintenance Contract**

- a. Routine Preventive Maintenance Schedule to be submitted
  - i. Schedule to cover manufacturer's recommendation and/or common engineering practice (for all plant and machinery under contract).
  - ii. Plant and machinery history card giving full details of equipment and frequency of checks and overhaul.
  - iii. Monthly status report.
  - iv. Entire HVAC installation to be painted in fourth year (from commissioning) before the expiry of operation and maintenance contract.
- b. Uptime during maintenance contract
  - i. 98% uptime of all systems under contract.
  - ii. Up time shall be assessed every month and in case of shortfall during any month the contract shall be extended by a month.
  - iii. There shall be no reimbursement for the extended period.
  - iv. Break-downs shall be attended to within ten hours of reporting.
  - v. Spare compressor/motor assembly to be made available within seven calendar days in case of total breakdown/burnout.

c. Manpower

- i. Adequate number of persons to the satisfaction of the Owner's site representative shall be provided including relievers.
- ii. Statutory requirements of EPF, ESIC and other applicable labour legislations to be complied with; and monthly certification to that effect to be submitted.
- iii. Duty allocation and Roaster control shall be contractor's responsibility.
- iv. No overtime shall be payable by Owner for any reason whatsoever.

d. Shut Downs

- i. Routine shut downs shall be permitted only during winter season.
- ii. Contractor shall be at liberty to carry out routine maintenance as and when required but with prior permission of the Owner.

e. Payment Terms

- i. Quarterly payment at the beginning of each quarter on pro-rata basis.

## **PARTIAL ORDERING**

Owner through the Architect/Consultant/ Owner's site representative reserves the right to order equipment and material from any and all alternates, and /or to order high side and /or low side equipment and materials or parts thereof from one or more tenderers.

## **SOFT WATER AND POWER REQUIREMENT**

The contractor shall submit with their tender, their requirement of soft make-up water and power requirement.

### **Contract:**

1.1.1 These special conditions shall be considered as an extension and not as limitation of the obligations of the contractor other than mentioned in "Special conditions".

1.1.2 The said contract comprises furnishing of all labour, materials, equipment and transportation and to do all things necessary to the proposed construction, completion and putting in operation of a system of the type and extent described in the description of work drawings and specifications including any necessary adjustment or correction. The work shall be complete in every respect, including painting. All necessary precautions shall be taken against damage from leakage and condensation. The installation shall be tested and approved, satisfactory to the Engineer in-Charge and in accordance with local laws covering the installation of the type and extent described in the drawings and specifications.

1.1.3 The contractor shall provide without any extra charge all items whether specifically mentioned or not but which are usual or required to make a complete working plant and to ensure safe and satisfactory operation. All apparatus, appliances, materials or labour which may be necessary to complete the work in accordance with the intent or purpose of these specifications shall be furnished without extra charges, as if fully described and called for in these specifications and or shown on plans. In case of doubt the tenderer shall clearly point out his interpretation of specifications and drawings.

1.1.4 The contractor shall include in their tender, works contract tax, sales tax, octroi or any other charges or fees liable by the local authorities and it shall be assumed that the contractor's rates cover all such taxes and separate claim for these shall not be entertained.

1.1.5 Time shall be considered as the essence of the contract. The contractor shall agree to commence and complete the work as provided in the time schedule for procurement, installation, commissioning and testing as per conditions of contract.

### **1.2 Drawings & Literature:**

1.2.1 Drawings have been prepared for showing the areas allocated for various equipments. The equipment layout shown on the floor wise building plans and terrace plan along with the schematic layout drawing represent a feasible scheme for HVAC. Equipment may be rearranged by the contractor, based on the actual site conditions, within the space allocated subject to the approval of Engineer-in-Charge.

1.2.2 The tenderer shall point out all deviations from the drawings and specifications in their tenders.

1.2.3 Drawings are made on the basis of Certain Specific Brands of equipment / material. The contractor shall ensure that equipment / material offered by him shall fit in the space provided in layout.

1.2.4 The drawings prepared by the Consultant are not meant as working drawings. The contractor shall prepare working / shop drawings and get them approved from the Engineer in-Charge as required.

1.2.5 Before proceeding with the work, the contractor shall submit for approval, general layout and assembly drawings and such additional assembly and subassembly detailed

drawings as necessary to demonstrate fully that all parts of the apparatus to be furnished will conform to the specifications.

1.2.6 The contractor shall furnish for check and scrutiny advance sets of prints of the layout, assembly and erection drawings as per the Bar Chart. Final sets of drawings based on approval accorded by Engineer in-Charge shall be submitted by the Contractor for final approval. No modifications shall be made in the drawings after they have been approved by the Engineer in-charge without his prior consent. All drawings necessary for assembly, erection maintenance, repair and operation of the equipment shall be furnished. Different parts shall be suitably numbered for identification and ordering of spare parts.

1.2.7 Approval of drawings by the Engineer in-charge shall not relieve the contractor of any part of his obligation to meet all the requirements of the contract or of the correctness of his drawings. The contractor shall be responsible for and pay for all alterations of the works due to discrepancies or omissions in the drawings or other particulars supplied by him, whether such drawings have been approved by the Engineer in-Charge or not.

1.2.8 After approval of the drawings, the contractor shall furnish a set of tracings of the approved drawings.

### **1.3 Maintenance & Training :**

1.3.1 The contractor shall, without any extra cost, carry out for a period of 12 months after the installation is taken over by the owner, all routine and special maintenance of the plant and attend to any difficulties and defects that may arise in the operation of plant.

1.3.2 The contractor shall associate with him during erection and during defects liability period, the owner's maintenance staff to familiarize them with the operation and maintenance of EQUIPMENTS.

1.3.3 If required by Engineer in-charge the contractor shall agree to train members of the owner's maintenance staff either at his or sub contractor's work or at such other place or places as may be considered suitable by Engineer in charge.

### **Rejection of Defective Plant:**

1.3.4 If the completed plant or any portion thereof, before it is taken over, or during the defects liability period, be found defective, or fails to fulfill the intent of these specifications, the contractor shall on receipt of notice from the Engineer in-charge forthwith make defective plant good. Should he fail to do so within the time considered reasonable by the Engineer in-Charge, the Engineer-in-Charge may reject or replace at risk and expense of contractor the whole or any portion of plant, which is defective or fails to fulfill the requirements of contract.

### **1.4 Inspection & Testing :**

1.4.1 The Engineer in-charge or his authorized representative shall have full power to inspect the materials and workmanship of the plant at contractor's works or at any place from which the materials or equipment are obtained. Acceptance of any material or equipment shall in no way relieve the contractor of his responsibility for meeting requirements of specifications.

1.4.2 Routine and type tests for the various items of equipment shall be performed at contractor's works and tests certificates furnished. If required by Engineer in-charge, the contractor shall permit Engineer in charge's authorized representative to be present during any of the test. After installation has been virtually completed, the contractor shall carryout under the directions and in the presence of Engineer in charge, such tests and inspection as have been specified, or as the Engineer in-charge shall consider necessary to determine whether or not the full intent of requirements of plan and specifications has been met and further tests are considered necessary, the contractor shall carry them and bear expenses thereof.

1.4.3 All equipment shall be tested as per tender specifications. Where test results indicate capacity less than that specified, the contractor shall be responsible for replacing the equipment with a new equipment of the specified capacity and specifications and shall bear the extra cost, if any, incurred on account of this replacement. All instruments shall be of the required accuracies and shall be organized by the contractor at no extra cost.

1.4.4 The contractor shall operate, test, and adjust all air conditioning units, fans, motors, provided in connection with this installation, and shall make all necessary adjustments and corrections thereof.

1.4.5 Dampers shall be adjusted to supply to or withdraw from each and every air opening the quantity of air as called for, the velocity of air through the openings to be determined by anemometer or other approved method. Every damper, deflector or diffuser necessary to secure the correct quantity or direction of air flow at each opening, whether specially shown or specified or not shall be provided by the contractor.

## **INTRODUCTION**

The Project Renovation of Existing Arvindbhai Maniyar Hall, Rajkot comprises of 1 Buildings named Green room, Entry area. Auditorium Building has one auditorium with double height.

A separate Outdoor unit location is proposed for the MEP equipments like outdoor unit Transformer, DG sets, Pumps for Plumbing and Fire Fighting etc.

This section outlines the Air-conditioning requirements, design parameters, System selections & scheme descriptions for Arvind Maniyar hall which have cafeteria at Ground floor, Green room.

Air conditioning system required to maintain the comfort level for the occupants in the space. It is done by treating of air to control its temperature, humidity, indoor air quality, and air distribution etc. with help of efficient & economical systems.

## **SCOPE OF WORKS**

Being an earlier designed building the scope is limited to provide energy efficient air-conditioning system to mitigate and cater the required load and temp. within the building with efficiently designing of air distribution system such as Duct, air distribution terminals, insulation etc. have been also covered in this design report.

## DESIGN PHILOSOPHY

- Continuity & reliability.
- Flexibility of Operation.
- Safety of personnel and equipment.
- Ease of maintenance.
- Simplicity of operation.
- Conservation of energy.

The following points have been explained in this Report:

- Design Parameters
- Air-conditioning Load
- Overview of different type of air-conditioning systems
- Recommendation & selection of air-conditioning system
- Schemes of Air-conditioning system

## DESIGN PARAMETERS FOR VRF SYSTEM

### Variable Refrigerant Flow System

Performance rating shall be based on following design parameters:

|                                          |                   |
|------------------------------------------|-------------------|
| Max face velocity across pre-filters     | : 500 FPM         |
| Max face velocity across cooling coils   | : 500 FPM         |
| Max fan outlet velocity                  | : 1800 FPM        |
| Max fan speed for fans upto 300 mm dia   | : 1450 RPM        |
| ( Ductable Units)                        |                   |
| Refrigerant                              | : R 134 a, R 410a |
| Type of compressor                       | : Scroll          |
| Outdoor design temp for condensing units | : 95°F            |

### Design parameter for duct design shall be:

|                                       |                            |
|---------------------------------------|----------------------------|
| Maximum flow velocity                 | : 1650 FPM                 |
| <b>Maximum friction</b>               | : 0.1 Inches WG/100 ft.Run |
| Maximum velocity at supply air outlet | : 500 FPM                  |

### Assumptions:

- Single glass pane : Solar 1.1 /BTU/Hr. Sft. Deg.F.
- Wall 'U' value. : 0.34 BTU / Hr.sf.deg.F
- Roof 'U' value (considering underdeck insulation others). : 0.12 BTU / Hr.sf.deg.F.



**Estimated Air Conditioned Loads :**

| <b>HEAT LOAD -SUMMER CONDITIONS</b> |                                             |                               |        |                   |                        |                   |               |                   |          |  |
|-------------------------------------|---------------------------------------------|-------------------------------|--------|-------------------|------------------------|-------------------|---------------|-------------------|----------|--|
| <b>PROJECT:</b>                     | <b>Arvindbhai Maniyar Hall At Rajkot</b>    |                               |        |                   |                        | <b>Date :-</b>    |               | <b>28-12-2022</b> |          |  |
| <b>CLIENT</b>                       | <b>Client: Rajkot Municipal Corporation</b> |                               |        |                   |                        | <b>BLOCK NO:-</b> |               |                   |          |  |
| <b>Site:</b>                        | <b>Rajkot</b>                               |                               |        |                   |                        | <b>FLOOR :-</b>   |               | <b>ALL</b>        |          |  |
| <b>AREA</b>                         | <b>HALL,STAGE &amp; GREEN ROOM</b>          |                               |        |                   |                        | <b>REV NO:</b>    |               |                   |          |  |
|                                     |                                             |                               |        |                   |                        |                   |               |                   |          |  |
| AREA:<br>(Sq.Ft)                    | 6725                                        | HEIGHT:<br>(FT)               | 23.0   | VOLUME<br>(Cu.Ft) | 154406                 |                   |               |                   |          |  |
|                                     | Area/<br>Qty                                | Sun<br>Gain/<br>Temp<br>Diff. | Factor | BTU/<br>HOUR      | time of day            | 4:00 PM           | month<br>year | JULY              | MAY      |  |
| <b>ROOM<br/>SENSIBLE<br/>LOADS</b>  |                                             |                               |        |                   | latitude               | 23.02N            | altitude      | 55                | MTERES   |  |
| GLASS<br>EXP                        |                                             |                               |        |                   | <b>SUMMER</b>          | <b>CONDITIONS</b> |               |                   |          |  |
| N                                   | 0                                           | 23                            | 0.25   | 0                 |                        | DBT               | WBT           | % RH              | GR/LB    |  |
| E                                   | 30                                          | 12                            | 0.25   | 89                | OUTSIDE                | 110               | 78            | 24.1              | 94       |  |
| S                                   | 88                                          | 12                            | 0.25   | 263               | ROOM                   | 71.6              | 61.1          | 55                | 64       |  |
| W                                   | 30                                          | 163                           | 0.25   | 1214              |                        | 38.4              | 16.9          | -30.9             | 29.91    |  |
| NE                                  | 0                                           | 12                            | 0.25   | 0                 |                        |                   |               |                   |          |  |
| SE                                  | 0                                           | 12                            | 0.25   | 0                 |                        |                   |               |                   |          |  |
| SW                                  | 0                                           | 85                            | 0.25   | 0                 | Occupancy              | 650               |               | 10.3              | sqft/per |  |
| NW                                  | 0                                           | 138                           | 0.25   | 0                 | CFM/ PER               | 7.5               |               | 4875              | CFM      |  |
| SKYLIGHT                            | 0                                           | 251                           | 0.25   | 0                 | CFM/SQFT               | 0.06              |               | 404               | CFM      |  |
| WALLS<br>EXP                        |                                             |                               |        |                   |                        |                   |               |                   |          |  |
| N                                   | 1160                                        | 31                            | 0.10   | 3595              |                        |                   |               |                   |          |  |
| E                                   | 2560                                        | 33                            | 0.10   | 8450              | <b>F.A. CFM</b>        | <b>5147</b>       |               |                   |          |  |
| S                                   | 1636                                        | 47                            | 0.10   | 7691              |                        |                   |               |                   |          |  |
| W                                   | 2560                                        | 47                            | 0.10   | 12034             | <b>Bypass Factor</b>   |                   |               | 0.1               |          |  |
| NE                                  | 452                                         | 33                            | 0.10   | 1491              |                        |                   |               |                   |          |  |
| SE                                  | 0                                           | 39                            | 0.10   | 0                 | <b>SENSIBLE FACTOR</b> |                   | HE            | 0.86              |          |  |
| SW                                  | 0                                           | 53                            | 0.10   | 0                 |                        |                   |               |                   |          |  |
| NW                                  | 452                                         | 33                            | 0.10   | 1491              | INDICATED ADP °F       |                   |               | 52.8              |          |  |
|                                     |                                             |                               |        |                   | SELECTED ADP °F        |                   |               | 54                |          |  |
| ROOF EXP                            | 0                                           | 38.4                          | 0.05   | 0                 | Dehumidified Rise °F   |                   |               | 15.84             |          |  |
| ALL<br>GLASS                        | 147                                         | 38.4                          | 0.3    | 1698              |                        |                   |               |                   |          |  |
| PARTITION                           | 22960                                       | 33.4                          | 0.30   | 230059            | <b>SUPPLY AIR</b>      |                   |               |                   |          |  |

|                             |       |        |                             |         |                                                |      |  |           |     |
|-----------------------------|-------|--------|-----------------------------|---------|------------------------------------------------|------|--|-----------|-----|
| CEILING                     | 6725  | 33.4   | 0.40                        | 89846   | ACPH                                           | 2    |  |           |     |
| FLOOR                       | 6725  | 33.4   | 0.40                        | 89846   | SA CFM                                         | 5147 |  |           |     |
| OUTSIDE AIR                 | 5147  | 38.4   | 0.1080                      | 21345   |                                                |      |  |           |     |
| PEOPLE                      | 650   | 1      | 240                         | 156000  |                                                |      |  |           |     |
| LIGHTS (W)                  | 7398  | 1      | 4.27                        | 31578   |                                                |      |  |           |     |
| MACHINE (W)                 | 150   | 1      | 3.42                        | 512     |                                                |      |  |           |     |
| REHEAT (W)                  | 0     | 1      | 3.42                        | 0       |                                                |      |  |           |     |
|                             |       |        | Room Sensible Heat Sub-Load | 657204  | Dehumidified Air CFM                           |      |  | 45140     |     |
| Fan HP %                    | 7.50% | Safety | 10%                         | 115011  |                                                |      |  |           |     |
|                             |       |        | EFFECTIVE ROOM SENSIBLE HE  | 772214  |                                                |      |  |           |     |
| ROOM LATENT LOADS           |       |        |                             |         |                                                |      |  |           |     |
| OUTSIDE AIR                 | 5147  | 29.91  | 0.068                       | 10468   | TONNAGE                                        |      |  | 98.27     |     |
| PEOPLE                      | 650   | 1      | 160                         | 104000  | CFM / SQFT                                     | 6.7  |  | CFM / TR  | 459 |
| MACHINE (W)                 | 150   | 1      | 3.42                        | 512     | NOTE :-                                        |      |  | sqft / tr | 68  |
|                             |       |        | Room Latent Heat Sub-Load   | 114980  | 1. Persons =AS PER ARCH LAYOUT                 |      |  |           |     |
|                             |       | Safety | 5%                          | 5749    | 2. 7.5 CFM/PERSON AS PER ASHRAE 62.1/6.1 X 1.3 |      |  |           |     |
|                             |       |        | EFFECTIVE ROOM LATEN HEAT   | 120729  | 3. light load = 1.1 W /sqft                    |      |  |           |     |
|                             |       |        | ROOM TOTAL HEAT             | 892944  | 4. People Load consider SH=240 btu/hr          |      |  |           |     |
| OUTSIDE AIR SEN / LAT LOADS |       |        |                             |         | & LH=160 btu/hr FOR SEATED LIGHT WORK          |      |  |           |     |
| SENSIBLE                    | 5147  | 38.4   | 0.972                       | 192106  | 5. Machine load SH=150 W/PC/WRK STN            |      |  |           |     |
| LATENT                      | 5147  | 29.91  | 0.612                       | 94213   | 6. FACTORS AS PER NBC 2016                     |      |  |           |     |
|                             |       |        | GRAND TOTAL HEAT (BTU/HR)   | 1179263 |                                                |      |  |           |     |

**LIST OF STANDARDS AND OTHER CODES**

|                                |                                                                                                                                                                                                                                                                                |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BS: EN: 779 – 1993             | Filters                                                                                                                                                                                                                                                                        |
| NBC                            | National Building Code-2016                                                                                                                                                                                                                                                    |
| ASHRAE Hand Books              | American Society of Heating Refrigeration<br>& Air-conditioning.<br>Application 2011.<br>Fundamentals 2013.<br>Refrigeration 2010.<br>Systems & Equipment 2012.<br>ASHRAE Indoor air quality Standard 62.1-2016.<br>ASHRAE 90.1-2010<br>ASHRAE 55-2004<br>ASHRAE 52.1 and 52.2 |
| ECBC                           | ECBC 2017                                                                                                                                                                                                                                                                      |
| IEC                            | Relevant Sections.                                                                                                                                                                                                                                                             |
| IS: 277-2003                   | Galvanized Steel Sheet (Revised)                                                                                                                                                                                                                                               |
| IS: 655-2006                   | Metal Air Ducts (Revised)                                                                                                                                                                                                                                                      |
| IS: 659-1964 (Reaffirmed 1991) | Air-conditioning (safety codes)                                                                                                                                                                                                                                                |
| IS: 325 -1996                  | 3 phase induction motor                                                                                                                                                                                                                                                        |
| IS: 822 -1970                  | Code of procedure for inspection of welds                                                                                                                                                                                                                                      |
| IS: 900 -1992                  | Code of practice for installation and<br>maintenance of motors                                                                                                                                                                                                                 |
| IS: 13947, Part 4              | Motor starters for voltage not exceeding 1000 Volts                                                                                                                                                                                                                            |
| IS: 996 -2009                  | Single phase small A.C. Motors                                                                                                                                                                                                                                                 |
| IS: 4894-1987                  | Centrifugal Fans                                                                                                                                                                                                                                                               |
| IS: 4985-2000                  | PVC Pipes                                                                                                                                                                                                                                                                      |
| IS: 13947-2004                 | MCCBs/MCBs                                                                                                                                                                                                                                                                     |
| JISH-3300: 1997                | Copper Refrigerant pipes                                                                                                                                                                                                                                                       |

## **SCHEDULE OF TECHNICAL DATA**

Contractor should furnish technical data as mentioned below, of the equipment and accessories offered by him as per scheme, specification, and bill of quantities given in the tender.

### **GENERAL**

- i. Manufacturer
- ii. Type of unit (Double/Single skin) (draw-thru/blow thru)
- iii. Material and thickness of casing (inner/outer)
- iv. Material and thickness of drain pan.
- v. Material and thickness of sandwiched insulation for drain pan
- vi. Type of flexible connection
- vii. Type of vibration isolator

### **VRF Outdoor Unit:**

- i. Make :
- ii. Model :
- iii. Cooling Capacity Nominal, TR :
- iv. Cooling Capacity Actual, TR :
- v. Heating Capacity Nominal, KW :
- vi. Heating Capacity Actual, KW :
- vii. Compressor Motor, KW :
- viii. Sound level at distance of 3m, DB (A) :
- ix. Total No. of Compressor :
- x. No. of Fixed Speed Type Compressor :
- xi. No. of Variable Speed Type Compressor :
- xii. Power Supply requirement , 3PH/1PH :
- xiii. Power consumption at nominal capacity, KW :

xiv. Type of refrigerant :

VRF Indoor Unit:

- i. Make :
- ii. Model :
- iii. Cooling Capacity Nominal, TR  
:
- iv. Cooling Capacity Actual at 24.0 Deg. C, TR :
- v. Heating Capacity Nominal, KW :
- vi. Heating Capacity Actual at 21.0 Deg. C, KW :
- vii. Air Quantity, CFM :
- viii. Sound level at a distance of 1m, DB (A) :
- ix. Power supply requirement, 3PH/1PH :
- x. Power consumption at rated capacity, KW

Refrigerant Pipes (Ductable/Cassette/Hi Wall):

- i. Make :
- ii. Class / Type :
- iii. Diameter, mm :
- iv. Wall thickness, mm :

Refrigerant pipe Insulation:

- i. Manufactures Name :
- ii. Material :
- iii. Density Kg. per Cmt :
- iv. Thermal Conductivity Kcal / Hr. Deg. C. :
- v. Thickness of insulation, mm :
- vi. Mechanical protection for exposed pipe, Yes/No:

## FAN SECTION

- a. Manufacturer.
- b. Type of fan and model number
- c. Material and thickness of fan wheel blades
- d. Material and thickness of housing.
- e. Confirm statically and dynamically balanced to grade 6.3 (complete fan motor assembly)
- f. Type of bearings.
- g. Fan RPM

Drain Pipes:

- i. Make :
- ii. Class :
- iii. Wall thickness, mm :

Drain Pipe Insulation:

- i. Manufactures Name :
- ii. Material :
- iii. Density Kg. Per sqmt :
- iv. Thermal Conductivity Kcal / Hr. Deg. C. :
- v. Thickness of insulation, mm :

Ducting:

- i. Duct Construction :
- ii. Material :
- iii. Thickness of Duct :

iv. SMACNA standard for factory made, Yes/NO :

Grills / Diffusers / Dampers:

- i. Duct Dampers Make and Material :
- ii. Grills / Diffusers Make and Material :
- iii. Motorized Dampers Make and Material :
- iv. Volume Control Dampers Make and Material :
- v. Fire Dampers Make and Material :
- vi. Smoke & Temperature Sensor Make and Material :

MOTORS

- a. Manufacturer
- b. Type
- c. Electrical characteristics ( $\pm 10\%$  voltage variation)
- d. Motor speed (RPM)
- e. Motor Efficiency
- f. Class of Insulation
- g. Motor operated through VFD, confirm following :
  - i. Motors do not get derated
  - ii. Higher size motor is not required.

DXCOOLING COIL

- a. Manufacturer
- b. Material of tubes
- c. Material of fins
- d. No of fins/inch
- e. Test pressure.

## **VRF/VRV OUTDOOR UNIT**

### **Scope of Work**

The specification for VRF/VRV Units covers the general design, materials, constructional features, supply, and installation, testing, commissioning & carrying out performance test at site.

### **Codes & Standard**

The design, materials, manufacture, inspection, testing & performance of VRF shall comply with all currently applicable codes, regulation & standards in the locality where the equipment is to be installed.

### **General**

Each VRF Unit shall be air cooled, split type multi-system air conditioner consisting of outdoor units and number of indoor units, each having capability to cool for the requirements of the individual area to be air-conditioned. The VRF unit should be capable of connecting minimum ten different types of indoor units to one refrigerant circuit and controlled individually.

Each VRF unit shall have minimum two number scroll compressor/rotary compressor and out of two number Compressors one shall be inverter Compressor (With inverter controller) with and without vapour injection technology and capable of changing the rotating speed to follow variations in cooling loads. Each indoor unit having capability to cool or heat for the requirement of the rooms.

Compressor shall be inverter controlled. Compressor installed in each outdoor module unit shall be equipped with at least one inverter compressor in bigger (if modular) machines for higher reliability, improved life, better backup and duty cycling purpose. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling and heating load.

The Outdoor units shall be suitable for mix-match connection of following type:

- i. Ceiling mounted cassette type (Double flow)
- ii. Ceiling mounted cassette type (Multi flow)
- iii. Ceiling mounted duct type.
- iv. Ceiling suspended type.
- v. Wall mounted type
- vi. Floor standing type
- vii. Concealed floor standing type.

Please note that the refrigerant piping shall be capable of extending up to 150m with 50m level difference without any oil traps.



Both indoor and outdoor units shall be factory assembled, tested and filled with first charge of refrigerant. These being very hi-tech in construction with lots of factory checks being conducted, hence no sub assembly should be done at site preferably.

### **Outdoor Unit**

The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit should be completely factory wired tested with all necessary controls tested prior to dispatch conforming to the following specifications.

All outdoor units shall consist of minimum two scroll/rotary compressors, preferable one with inverter drive, capable to operate even when one compressor is unserviceable.

- i. Outdoor units having configuration will be as follows:

Hall                      -120 HP  
Green Room - 2 Nos. 1.65TR VRF Type Split Unit in each room

- ii. In such case, the units shall be provided with duty cycling arrangement for multiple inverter compressors.

- iii. The outdoor unit shall be modular in design to facilitate installation one after another close to each other. Preference would be given to compact units having smaller footprint.

- iv. Outdoor units should be rugged of anti-corrosion design and should have strong base plate for easy mounting of unit.

- v. The outdoor unit shall comprise of sub-cooling feature to effectively use the entire coil surface through proper circuit/bridge in order to prevent flushing of refrigerant owing to large length of piping.

- vi. The condensing unit shall be provided with state-of-the-art microprocessor-based control panel.

- vii. The outdoor unit shall be provided with provided with Aero spiral design fan exhibiting low noise level characteristics complete with aero fitting grille to facilitate spiral discharge of airflow to effect reduction in pressure losses. The fan should be capable to respond to external static pressure of 5mm.

- viii. Motor shall be speed controlled to ensure a stable operation for varying ambient; by a factory fitted direct acting head pressure activated variable speed drive for at least 15 steps to give precise discharge pressure and minimum power consumption of condenser fan motor.

- ix. The condenser shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessories necessary with the equipment supplied.

- x. The Outdoor unit shall have COP of 4.0 at AHRI Condition.

The condensing unit shall be designed to facilitate fail safe operation when connected to multiple indoor units. If possible, the system should work on standard operating parameters like discharge pressures of not more than 300 PSI as the ref. Piping will be moving around within a residential house, otherwise on any misfortune of any leakage it will act like a bullet on higher pressures. If working on higher operating pressures, vendor to comply with all safety codes of high-pressure safety & testing as recommended by manufacturers and give 2 sets of special tools to handle such equipment at site. All brazing should be done by only qualified trained person who had training on HIGH PRESSURE brazing, special tools & procedures.

### **Scroll Compressor**

The scroll compressor shall be an industrial quality rugged, cast iron, direct hermetic compressor with scroll plates, suction & discharge service valves. The compressor shall be completely enclosed in a chamber with no leakage path and providing the capability for scroll plates to separate. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM.

The compressor shall be highly efficient digital scroll type or inverter control. The inverter compressor shall change the speed in accordance to the variation in cooling or heating load requirement:

- i. All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.
- ii. Oil heater shall be provided in the compressor casing.
- iii. The inverter compressor shall preferably be efficient & reliable inverter compressor.

### **Heat Exchanger**

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil.

- i. The aluminum fins shall be covered by anti-corrosion resin film.
- iii. The unit should be with heat exchanger to optimize the path of heat exchanger and for better efficiency of condenser.
- iii. The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.

### **Refrigerant Circuit**

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end. The equipment must have inbuilt refrigerant stabilization control for proper refrigerant distribution.

All necessary safety devices shall be provided to ensure the safely operation of the system.

### **Refrigerant**

The VRF units shall be selected on R410/R407 refrigerant only. The units should be fully factory charged with refrigerant & oil & spare refrigerant & oil must be sent along with the machine for topping up of gas & oil as may be required.

### **Safety Devices**

All necessary safety devices shall be provided to ensure safe operation of the system.

*Following safety devices shall be integral part of the out-door unit:*

- i. High pressure switch
- ii. Fan drive overload protection switch
- iii. Fusible plug
- iv. Overload relay including overload protection for inverter driven compressor.

### **Oil Recovery System**

Entire system shall be designed and capable of oil recovery to ensure stable operation with long refrigeration piping lengths.

The system should have inbuilt (avoid external) oil balancing circuit to avoid poor lubrication.

### **Transit Damage**

The unit shall be restored to original conditions in case of any transit damages by the contractor at his own cost.

### **Piping**

All connections of Refrigerant piping shall be in high grade Copper of Refrigeration quality with Eddy Current Testing and material test Certificates.

All connections, tees, reducers etc. shall be standard make fittings.

Insulation of cold lines shall be carried out with Armaflex / K-Flex insulation sheets and tubes of appropriate thickness so that condensation does not occur.

For individual Piping 50 / 100 mm wide Aluminum Tape shall be used at joints of Piping with Bands for identification.

For outdoor piping, the finish shall be woven GRP Mat finished with coloured Epoxy paints to withstand outside ambient conditions and UV Radiation.

**Technical Requirement of VRF Unit:**

| S. No. | Description                                     | Unit         | Condition of Service |
|--------|-------------------------------------------------|--------------|----------------------|
| 1      | Type                                            | --           | Cool / Heat Type     |
| 2      | Capacity (cooling)                              | HP (Nominal) | As per BOQ           |
| 3      | Quantity                                        | Nos.         | As per BOQ           |
| 4      | Connectable No. of Possible indoor unit         | Nos.         | Refer Drawings       |
| 5      | Air entering condenser.                         | --           | 42.0 Deg C.          |
| 6      | Electric Supply                                 | --           | 415 V/3 Ph/50 Hz     |
| 7      | Maximum Refrigerant Piping Length for One Unit. | --           | 150 RMT              |
| 8      | COP @ ARI CONDITION                             | --           | 4.0                  |

## **VRF INDOOR UNIT**

### **Scope of Work**

This section deals with supply, erection, testing and commissioning of Various Type of Indoor Units confirming to general specification and suitable for the duty selected. The type, capacity and size of indoor units shall be as specified in Schedule of Quantities.

### **General**

Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

- i. The address of the indoor unit shall be set automatically in case of individual and group control
- ii. In case of centralized control, it shall be set by liquid crystal remote controller

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Each coil shall be factory tested at 21kg/sqm air pressure under water.

Unit shall have cleanable type filter fixed to an integrally moulded plastic frame. The filter shall be slide away type and neatly inserted.

Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling or cooling and heating.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

### **Ceiling Mounted Ductable Type Unit**

Unit shall be suitable for ceiling mounted type. The unit shall include pre-filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for Ductable arrangement.

### **HI Wall Mounted Unit**

The units shall be wall-mounted type. The unit includes pre-filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

Unit shall have an attractive external casing for supply and return air.

### **Floor Mounted Units**

The unit shall be suitable for floor mounting. The unit shall include, pre-filter fan section, DX. Coil section. The housing of unit shall be light weight powder coated galvanized / anodized aluminum panels. Unit shall have an attractive external casing with supply & return air grilles.

### **Color**

The colour of indoor units should be white or to suit interiors as designed by the architects / clients.

### **Electrical installation**

For Variable Refrigerant flow systems, power will be provided near outdoor unit location. HVAC Contractor to provide suitable distribution panel along with 3-phase power to outdoor units and single phase power to all indoor units fed by these outdoor units. Power / control cabling along with supports shall be included.

### **Central Remote Controller (Option if Specified in BOQ)**

A multi-functional microprocessor based centralized controller (central remote controller) shall be supplied as an optional accessory.

The controller shall be able to control upto min. 64 zones of 64 group (each group consisting of max. 16 units) or 128 nos. of indoor units with the following functions.

- Temperature setting for each zone, or group, or indoor unit.
- On/Off as a zone or individual unit.
- Indication of operating condition.
- Select ON of all operation modes for each zone..
- The controller shall have wide screen liquid crystal display and shall be wired by a non-polar 2 wire transmission cable to a distance of 1000m away from the indoor unit.

- The controller shall be integrated to BAS system thru software for monitoring & controlling of all above parameters including start/ stop of each indoor / outdoor unit. All necessary interface cards / units should be supplied as a part of the system to integrate to the BAS Software.

### **Unified On/Off Controller (Option if Specified in BOQ)**

Unified ON / OFF controller shall be supplied as an optional accessory.

The controller shall be able to control minimum 2 groups (each group containing maximum 16 indoor units) or 128 nos. of indoor units with the following functions.

- On / Off as a zone or individual unit.
- Indication of operation condition of each group.
- Select one of 4 operation modes.

The controller shall be wired by a non-polar 2 wire transmission cable to distance of 1 km away from indoor unit.

The controller shall be integrated to BAS system thru software for monitoring & controlling of all above parameters including start/ stop of each indoor / outdoor unit. All necessary interface cards / units should be supplied as a part of the system to integrate to the BAS Software.

## **FANS**

### **SCOPE**

The scope of this section comprises the supply, erection, testing and commissioning of centrifugal, in-line and propeller type fans and roof mounted units conforming to these Specifications and in accordance with the requirement of Drawings and Schedule of Quantities.

### **TYPE**

Centrifugal, in-line propeller fans and roof mounted units shall be of the type as indicated on Drawings and identified in Schedule of Quantities.

### **CAPACITY**

The air-moving capacity of fans shall be as shown on Drawings and in Schedule of Quantities.

### **CENTRIFUGAL FAN**

Centrifugal fan shall be DWDI / SWSI Class I construction arrangement 3 (i.e. bearings on both the sides) for DWDI fans complete with access door, squirrel-cage induction motor, V-belt drive, belt guard and vibration isolators, direction of discharge / rotation, and motor position shall be as per the Approved-for-Construction shop drawings.

- a. Housing shall be constructed of 14 gage sheet steel welded construction. It shall be rigidly reinforced and supported by structural angles. Split casing shall be provided on larger sizes of fans, however neoprene / asbestos packing should be provided throughout split joints to make it air-tight.

18 gauge galvanized wire mesh inlet guards of 5 cm sieves shall be provided on both inlets. Housing shall be provided with standard cleanout door with handles and neoprene gasket. Rotation arrow shall be clearly marked on the housing.

- b. Fan Wheel shall be backward-curved non-over loading type. Fan wheel and housing shall be statically and dynamically balanced. For fans upto 450 mm dia, fan outlet velocity shall not exceed 550 meter/minute and maximum fan speed shall not exceed 1450 rpm. For fans above 450 mm dia, the outlet velocity shall be within 700 meter/minute and maximum fan speed shall not exceed 1000 RPM. High static pressure fan speed shall be as per manufacturer.

- c. Shaft shall be constructed of steel, turned, ground and polished.

- d. Bearings : shall be of the sleeve / ball-bearing type mounted directly on the fan housing. Bearings shall be designed especially for quiet operation and shall be of the self-aligning, oil / grease pack pillow block type.

- e. Motor : Fan motor shall be energy efficient and suitable for  $415 \pm 10\%$  volts, 50 cycles, 3 phase AC power supply, squirrel-cage, totally enclosed, fan-cooled motor, provided with class F insulation, and of approved make. Motor name plate horsepower shall exceed brake horsepower by a minimum of 10%. Motor shall be designed especially for quiet operation and motor speed shall not exceed 1440 rpm. The fan and motor combination selected for the particular required performance shall be of the most efficient (smallest horse power), so that sound level is lowest.

|       | POWER FACTOR |      |      | EFFICIENCY |       |       |
|-------|--------------|------|------|------------|-------|-------|
|       | FL           | 3/4L | 1/2L | FL         | 3/4L  | 1/2L  |
| 0.50  | 0.71         | 0.62 | 0.50 | 73.00      | 73.00 | 68.00 |
| 0.75  | 0.74         | 0.64 | 0.50 | 78.00      | 78.00 | 70.00 |
| 1.00  | 0.76         | 0.67 | 0.55 | 82.50      | 82.50 | 77.00 |
| 1.50  | 0.77         | 0.70 | 0.57 | 83.80      | 83.80 | 80.00 |
| 2.00  | 0.77         | 0.70 | 0.57 | 85.00      | 85.00 | 81.00 |
| 3.00  | 0.82         | 0.74 | 0.60 | 86.40      | 86.40 | 84.00 |
| 5.00  | 0.82         | 0.78 | 0.63 | 88.30      | 88.30 | 86.00 |
| 7.50  | 0.85         | 0.80 | 0.71 | 89.50      | 88.50 | 88.00 |
| 10.00 | 0.86         | 0.83 | 0.76 | 90.30      | 90.30 | 89.00 |
| 12.50 | 0.84         | 0.82 | 0.73 | 90.50      | 90.50 | 88.00 |
| 15.00 | 0.85         | 0.83 | 0.76 | 91.50      | 91.50 | 89.50 |
| 20.00 | 0.85         | 0.83 | 0.76 | 92.20      | 92.20 | 91.00 |
| 25.00 | 0.85         | 0.82 | 0.76 | 92.40      | 92.40 | 91.00 |
| 30.00 | 0.85         | 0.80 | 0.72 | 92.80      | 92.80 | 92.00 |
| 40.00 | 0.86         | 0.85 | 0.80 | 93.20      | 93.20 | 91.00 |
| 50.00 | 0.87         | 0.85 | 0.77 | 93.60      | 93.60 | 91.60 |
| 60.00 | 0.88         | 0.86 | 0.78 | 93.90      | 93.90 | 91.90 |
| 75.00 | 0.87         | 0.85 | 0.78 | 94.20      | 94.20 | 92.80 |

- f. Drive to fan shall be provided through belt with adjustable motor sheave and a standard belt guard. Belts shall be of the oil-resistant type.

- g. Vibration Isolation : MS base shall be provided for both fan and motor, built as an integral part, and shall be mounted on a concrete foundation through resistoflex vibration isolators. The concrete foundation shall be atleast 15 cm above the finished floor level, or as shown in approved-for-construction shop drawings.



## **AXIAL FLOW FAN**

Fan shall be complete with motor, motor mount, belt driven (or direct driven) and vibration isolation type, suspension arrangement as per approved for construction shop drawings.

- a. Casing : shall be constructed of heavy gage sheet steel. Fan casing, motor mount and straightening vane shall be of welded steel construction. Motor mounting plate shall be minimum 15 mm thick and machined to receive motor flange.

An inspection door with handle and neoprene gasket shall be provided. Casing shall have flanged connection on both ends for ducted applications. Support brackets for ceiling suspension shall be welded to the casing for connection to hanger bolts. Straightening vanes shall be aerodynamically designed for maximum efficiency by converting velocity pressure to static pressure potential and minimizing turbulence. Casing shall be bonderized, primed and finish coated with enamel paint.

- b. Rotor : hub and blades shall be cast aluminium or cast steel construction. Blades shall be die-formed aerofoil shaped for maximum efficiency and shall vary in twist and width from hub to tip to effect equal air distribution along the blade length. Fan blades mounting on the hub shall be statically and dynamically balanced. Extended grease leads for external lubrication shall be provided. The fan pitch control may be manually readjusted at site upon installation, for obtaining actual air flow values, as specified and quoted.
- b. Motor: shall be energy efficient squirrel-cage, totally-enclosed, fan cooled, standard frame, constant speed, continuous duty, single winding, suitable for  $415 \pm 10\%$  volts, 50 cycles, 3 phase AC power supply, provided with class 'F' insulation. Motor shall be specially designed for quiet operation. The speed of the fans shall not exceed 1000 RPM for fans with impeller diameter above 450 mm, and 1440 RPM for fans with impeller diameter 450 mm and less. For lowest sound level, fan shall be selected for maximum efficiency or minimum horsepower. Motor conduit box shall be mounted on exterior of fan casing, and lead wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible metal conduit.

|       | POWER FACTOR |      |      | EFFICIENCY |       |       |
|-------|--------------|------|------|------------|-------|-------|
|       | FL           | 3/4L | 1/2L | FL         | 3/4L  | 1/2L  |
| 0.50  | 0.71         | 0.62 | 0.50 | 73.00      | 73.00 | 68.00 |
| 0.75  | 0.74         | 0.64 | 0.50 | 78.00      | 78.00 | 70.00 |
| 1.00  | 0.76         | 0.67 | 0.55 | 82.50      | 82.50 | 77.00 |
| 1.50  | 0.77         | 0.70 | 0.57 | 83.80      | 83.80 | 80.00 |
| 2.00  | 0.77         | 0.70 | 0.57 | 85.00      | 85.00 | 81.00 |
| 3.00  | 0.82         | 0.74 | 0.60 | 86.40      | 86.40 | 84.00 |
| 5.00  | 0.82         | 0.78 | 0.63 | 88.30      | 88.30 | 86.00 |
| 7.50  | 0.85         | 0.80 | 0.71 | 89.50      | 88.50 | 88.00 |
| 10.00 | 0.86         | 0.83 | 0.76 | 90.30      | 90.30 | 89.00 |
| 12.50 | 0.84         | 0.82 | 0.73 | 90.50      | 90.50 | 88.00 |
| 15.00 | 0.85         | 0.83 | 0.76 | 91.50      | 91.50 | 89.50 |
| 20.00 | 0.85         | 0.83 | 0.76 | 92.20      | 92.20 | 91.00 |
| 25.00 | 0.85         | 0.82 | 0.76 | 92.40      | 92.40 | 91.00 |
| 30.00 | 0.85         | 0.80 | 0.72 | 92.80      | 92.80 | 92.00 |
| 40.00 | 0.86         | 0.85 | 0.80 | 93.20      | 93.20 | 91.00 |

|       |      |      |      |       |       |       |
|-------|------|------|------|-------|-------|-------|
| 50.00 | 0.87 | 0.85 | 0.77 | 93.60 | 93.60 | 91.60 |
| 60.00 | 0.88 | 0.86 | 0.78 | 93.90 | 93.90 | 91.90 |
| 75.00 | 0.87 | 0.85 | 0.78 | 94.20 | 94.20 | 92.80 |

- d. Drive : to fan shall be provided through belt drive with adjustable motor sheave and standard sheet steel belt guard with vented front for heat dissipation. Belts shall be of oil-resistant type.
- e. Vibration Isolation : The assembly of fan and motor shall be suspended from the slab by vibration isolation suspension of heavy duty spring isolators type.
- f. Accessories : The following accessories shall be provided with all fans :
  - i. Outlet cone for static pressure regain.
  - ii. Inlet cone.

Fan silencers may be provided where specifically called for in Schedule of Quantities. Fans shall be factory assembled and shipped with all accessories factory-mounted.

Axial Flow Fan shall be AMCA certified for Air and Sound performance in accordance to AMCA 210 and AMCA 300

Axial Flow Fan (for Fire, Smoke)

The fans shall be of the direct drive axial type with cast aluminum aerofoil propellers and shall be suitable for mounting in duct or floor/slab as required/indicated on the tender drawings. The casing shall be constructed of continuously welded steel and include integral punched inlet and outlet flanges to prevent air leakage and shall withstand 250 degree 2 hours. The casing and motor base shall be constructed and formed members of heavy gauge steel to prevent vibration and rigidly support the motor. Motor support brackets shall be welded to fan casing for increased strength. Motors for emergency fire, smoke and heat ventilation shall certified according to stand BS EN 12101-3:2002 for 250°C for 2 hours.

Blades shall be aerofoil design. Hub and blades shall be a high strength cast aluminum alloy and shall withstand 250°C for 2 hours. Blade pitch shall be manually adjustable without removing from the fan casing. Rotors shall be statically and dynamically balanced.

All Fan casing are with integral punched flanges for sizes up through size 1600mm dia and shall be constructed of rolled steel with a continuous seam weld. Casing to be coated with a minimum of 2 coats of high temperature paint or Powder coated after phosphating process. Motor support framework to be constructed of structural steel that is suitable to handle the weights of the motor and propeller. Motor supports within the fan housing to be welded to the fan casing. Bolted construction is not acceptable. The impeller and fan casing shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

Complete Fan assembly (Fan Impeller, Fan Casing, Motor base frame along with Motor) shall be tested and approved by Exova Warringtonfire in accordance with BS EN 12101-3:2002 standard for "Powered Smoke and Heat Exhaust Ventilators for Smoke Control Systems" for (250° C) temperature for 2 hours of operation.

### **PROPELLER FAN**

Propeller fan shall be direct-driven, three or four blade type, mounted on a steel mounting plate with orifice ring.

- a. Mounting Plate shall be of steel construction, square with streamlined venturi inlet (reversed for supply applications) coated with baked enamel paint. Mounting plate shall be of standard size, constructed of 12 to 16 gauge sheet steel depending upon the fan size. Orifice ring shall be correctly formed by spinning or stamping to provide easy passage of air without turbulence and to direct the air stream.
- b. Fan Blades shall be constructed of aluminum or steel. Fan hub shall be of heavy welded steel construction with blades bolted to the hub. Fan blades and hub assembly shall be statically and dynamically balanced at the manufacturer's works.
- c. Shaft shall be of steel, accurately ground and shall be of ample size for the load transmitted and shall not pass through first critical speed thru the full range of specified fan speeds.
- d. Motor shall be standard (easily replaceable) permanent split capacitor or shaded pole for small sizes, totally enclosed with pre-lubricated sleeve or ball bearings, designed for quiet operation with a maximum speed of 1000 rpm for fans 60 cm dia or larger and 1440 rpm for fans 45 cm dia and smaller. Motors for larger fans shall be suitable for  $415 \pm 6\%$  volts, 50 cycles 3 phase power supply, and for smaller fans shall be suitable for  $220 \pm 6\%$  volts, 50 cycles single phase power supply. Motors shall be suitable for either horizontal or vertical service as indicated on Drawings and in Schedule of Quantities.
- e. Accessories : The following accessories shall be provided with propeller fans :
  - i. Wire guard on inlet side and bird screen at the outlet.
  - ii. Fixed or gravity louvers built into a steel frame at the outlet.
  - iii. Regulator for controlling fan speed for single phase fan motor.
  - iv. Single phase preventers for 3 phase fans.

### **PERFORMANCE DATA**

All fans shall be selected for the lowest operating noise level. Capacity ratings, power consumption, with operating points clearly indicated, shall be submitted and verified at the time of testing and commissioning of the installation.

### **TESTING**

Capacity of all fans shall be measured by an anemometer. Measured air flow capacities shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

## **INLINE FANS**

### **Scope**

The scope of work comprises of supply, erection, testing and commissioning of inline fans conforming to these specifications and in accordance with the Schedule of Quantities and drawings, as per relevant IS Codes, as per approval of Client/Consultant.

**Type** : Fans shall be Double Inlet Double Width (DIDW). Fan shall have directly driven forward curved centrifugal impeller, running in a metal scroll balanced to give quite and vibration free operation. Fan motor assembly shall be statically and dynamically balanced.

The fan shall be assembled in such a manner that the motor and impeller can be easily removed and reinstalled after servicing.

The air handling capacities, maximum motor H.P., Static pressure shall be as shown on Drawing and in Schedule of Quantities.

**Material** : Fans casing shall be manufactured from galvanized steel sheets 2.0 mm thick and painted with two coats of rust proof primer and two coats of synthetic enamel paint.

All parts shall be hot dip galvanized.

**Motor** : The fan motor shall be equipped with motor with speed regulator giving volume control from 0 to 100% of output including remote and cabling for remote control.

Motors shall be with class 'F' insulation wired to an externally mounted weather proofed terminal box.

Motor name plate horsepower shall exceed brake horsepower by minimum of 10%. Motor shall be designed especially for quiet operation and motor speed shall not exceed 1450 RPM.

Motor should be painted with two coats of rust proof primer and two coats of synthetic enamel paint.

**Installation** : Fan shall have rigid supports and fitted to both ends of the casing.

Wherever the fans are to be suspended from ceiling or mounted on the wall, the contractor shall include supply and fixing of all the material that may be required to complete the installation in all respect.

Fan inlet and outlet connections shall be by means of flexible canvas connections having flexibility and slackness as per relevant IS Codes.

**Testing** : Fan after installation shall be tested for capacities, power consumption, noise level and vibration and results shall confirm to the approved data furnished by the contractor.

## PIPING WORKS

### Refrigerant Piping

- i. Refrigerant piping for the air-conditioning system shall be upto 19 mm dia of soft seamless copper tubes & for above 19.1 mm dia the pipe material shall be of hard seamless copper tubes with pipes material being hard drawn copper pipe. Forged copper fittings shall be used for the refrigerant piping. The refrigerant piping arrangements shall be in accordance with good engineering practices as applicable to the air-conditioning industry, and shall include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits except Y joint/separation tubes.
- ii. Before joining any copper pipe or fittings, its internals shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently it shall be thoroughly blown out using nitrogen gas.
- iii. After completion of installation of the refrigerant piping, the refrigerant piping system shall be pressure tested using nitrogen gas at a suitable pressure as specified by OEM (Original Equipment Manufacturer).
- iv. The supplier of air-conditioning system shall choose sizes as designed and erect proper interconnections of the complete refrigerant circuit. The thickness of copper piping shall not be less than 22 SWG for pipes upto 19 mm and 16 SWG for larger dia.
- v. The suction line pipe size and the liquid line pipe sizes shall be selected according to the manufacturer's specified diameter. All refrigerant pipes shall be properly supported and anchored to the building/structure using steel hangers, fasteners, brackets and supports which shall be fixed to the building/structure by means of inserts or expansion shields or anchor fasteners of adequate size and number to support the load imposed thereon.
- vi. The refrigerant piping should be laid in such a way that it should not distort the interior of the room, wherever the refrigerant pipe has to be laid across the room, it should be laid in a concealed manner. All associated minor Civil Engineering works (like chasing on wall, ceiling & re-plastering & repainting etc.) related with the above items are included in the scope of work. The above scope does not include false ceiling wherever required.
- vii. To protect Nitrile rubber insulation of outdoor installed copper piping from degradation due to ultra violet rays and atmospheric condition, it shall be covered with polysield coating of at least two coats of resin and hardener (poly bond make or equivalent). Fibre glass tape shall be helically wound with adequate overlap & coated with two coats of resin with hardener to give smooth & plain finish.
- viii. Entire liquid and suction refrigerant pipe lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm/ 13mm thick electrometric nitrile rubber as specified in BOQ.

ix. Piping work shall be recessed in wall/floor wherever required as per direction of Engineer-in-charge without any extra cost.

### **Drain piping: duly insulated**

The drain pipe connection of each indoor unit to the main header should be 20 to 40 mm dia as required. The header pipe should be of 40 mm dia as required. The drain-pipe should be heavy duty PVC pipe ISI marked and conforming to relevant IS complete with fitting as required. The drain piping should be insulated with 9 mm thick tubular nitrile rubber Elastomeric insulation.

For proper drainage of condensate U trap shall be provided in the drain piping wherever required. All pipe supports shall be prefabricated and pre-painted slotted angle supports, properly installed with clamps. The condensate drain pipe arrangement for disposal of condensate water be made in such a way that there should not be any leakages of condensate water inside rooms as well in the route of drain water pipe line & water should be discharged at the location jointly decided with Engineer-in-Charge of work. All associated Civil Engineering works as per requirement at site in above connection like making chase in the wall & restoring it original shape by re-plastering & repainting, etc. are included in the scope of work. The arrangement of drain-pipe shall be made in such a way that it should not affect the aesthetic of the building as well as is maintenance friendly & easily accessible.

The pipes shall be laid in proper slope for efficient drainage of condensate water. A downward gradient of at least 1/100 will be provided for the drain piping.

All the drain piping shall be insulated with 6mm thick tubular nitrile elastomeric rubber insulation.

### **BMS (Building Management System) interface**

The power supply (pack) shall have a 2 wire dry contacts (NO/NC) for remote link to Building Management System. This is for performance indication of the air cleaning system. Should there be a fault or if service is required, the dry contacts close and a signal is sent to the building BMS System. Should there be multiple units, all the dry contacts can be looped into a set of signal. This ensures proper monitoring of the status of each unit.

### **Static Pressure Drops**

The pressure drop shall not exceed the following (inches H<sub>2</sub>O):

|                                               |            |
|-----------------------------------------------|------------|
| ESP Section (Including Metal Mesh pre filter) | 0.2 - 0.32 |
|-----------------------------------------------|------------|

The ESP section must have an internal pre filter.

External losses for ductwork, exhaust hoods, manufacturing equipment with associated entry losses, kitchen hoods, etc.. must be added with the above internal equipment losses to calculate total fan static pressure required.

## SHEET METAL & AIR DISTRIBUTION WORK

### Scope

The scope of this section comprises supply, fabrication, installation & testing of all sheet metal GI ducts as well as supply, installation, testing & balancing of all grilles, diffusers & other accessories in accordance with these specification & Schedule of Quantities. All the ducting used in the work will be factory fabricated.

### RAW MATERIALS

Galvanizing shall be Class VII – light coating of zinc, nominal 180gm/sq.m surface area and Lock Forming Quality prime material along with mill test certificates. In addition, if deemed necessary, samples of raw material, selected at random by owner's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense.

### Rectangular ducting

The duct shall be fabricated out of galvanized sheet, class VIII (Zinc coating 120 gm/m<sup>2</sup>□as per the parameters given below which are conforming to IS 655-2006.)

The thickness of sheets shall be as given below:

| MAXIMUM SIDE             | THICKNESS OF GI SHEET | TYPE OF TRANSVERSE JOINT CONNECTIONS                                                                           | BRACING                                                               |
|--------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| (1) mm                   | (2) mm                | (3)                                                                                                            | (4)                                                                   |
| Up to 450                | 0.63                  | S-drive, pocket or bar Slips, on 2.5m centers                                                                  | None                                                                  |
| 451 to 600<br>601 to 750 | 0.63                  | S-drive, pocket or bar slips, on 2.5m centers<br>S-drive, 25mm pocket or 25 mm bar slips on 2.5 m centers.     | None<br>25x25x3 mm angles, 1.2m from joint                            |
| 601 to 750               | 0.80                  | Drive, 25-mm pocket or 25mm bar slips, on 2.5 m centers 40 x 40mm angle connections,                           | 25x25x3 mm angles, 1.2 m from joint                                   |
| 751 to 1000              | 0.80                  | 40-mm bar slips, with 35 x 3 mm bar reinforcing on 2.5 m centers                                               | 40x40x3 mm angles, 1.2m from joints                                   |
| 1501 to 2200             | 1.00                  | 40 x 40 mm angle cross-sections, or 40-mm bar centers with 35 x 3 mm bar reinforcing                           | 40x 40 x 3 mm diagonal angles or 40x40x3 mm angle 60 cm from joint.   |
| 2200 to above*           | 1.25                  | 50 x 50 mm angle connections, or mm pocket or 40 mm bar slips, 1 m max. centers with 35 x 3 mm bar reinforcing | 40x40x4 mm diagonal angles or 40x 40 x 3 mm angles, 60 cm From joint. |

\* Ducts 2250 mm and larger require special field study for hanging and supporting methods.

In addition to above the following points should be also taken into account while fabrication of ducts.

- a. All ducts of size larger than 450mm shall be cross broken.
- b. Changes in section of duct work shall be effected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45° angle from the axis of the main duct unless otherwise approved by the Engineer-in-Charge.
- c. All ducts shall be supported from the ceiling / slab by means of MS rods of dia 9mm with MS angle of size 40 x 40 x 5 mm at the bottom with neoprene pad in between the duct and MS angle. The ducts shall be suspended from the ceiling with the help of dash fasteners. Provision for necessary ancillary materials required for hanging the ducts shall be arranged by the contractor.
- d. The vanes shall be provided wherever required and shall be securely fastened to prevent noise and vibration.
- e. The rubber gasket shall be installed between duct flanges in all connections and joints.
- f. All flanges and supports should be primer coated.
- g. The flexible joints shall be fitted to the delivery side of AHU fans with Fire Retardant Double canvass. The length of flexible joints should not be less than 150 mm and not more than 300 mm between faces.
- h. The ducting work can be modified if deemed necessary in consultation with the Engineer in Charge to suit actual site conditions in the building.

### **Site Fabricated Ducting**

Ducting work shall mean all ducts, casing, dampers, access doors, joints, stiffeners and hangers. The ducting shall be fabricated as per IS: 655.

The duct shall be fabricated from Lock Forming Quality (LFQ) grade galvanized steel sheets with 120 gms / sq.m galvanizing (total coating on both sides) on the sheets.

All ducts wherever specified, shall be factory fabricated in box sections from G.I. continuous coils with all suitable joints, supports, sealing arrangements etc.

Changes in section of duct work shall be affected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45 DEG. angles from the axis of the main duct unless otherwise approved by the Engineer-in-Charge.

All ducts shall be supported from the ceiling / slab by means of fully threaded GI rods of 9 mm – 12 mm dia, with M.S. slotted double-C channel of 3.0 mm thickness at the bottom. The rods shall be anchored to R.C. slab using metallic expansion fasteners.



## **Dampers**

All dampers shall be louver dampers of robust constructions and tightly fitted. The design, method of handling and control, shall be suitable for the location and service required.

Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation, control or setting in any desired position. Dampers and their operation devices shall be made robust, easily operable, and accessible through suitable access doors in the ducts. Every damper shall have an indicating device clearly showing the damper position at all times.

Damper shall be placed in ducts and at every branch, supply or return air duct connection whether or not indicated on the drawings for the proper volume control and balancing the system.

Fire Dampers shall be multi blade louvers type. The blade should remain in the air stream in open position and shall allow maximum free area to reduce pressure drop and noise in the air passage. The blades and frame shall be constructed with minimum 1.6 mm galvanized sheet of minimum 400 mm long. It shall be complete with locking device, motorized actuator and control panel.

Fire Dampers shall be motorized smoke and fire dampers type. It shall be provided with spring loaded UL stamped fusible link to close fire damper in the event of rise in duct temperature. Fire damper shall also close on receipt of fire alarm signal to cut off air supply instantaneously. An electric limit switch shall also be operated by the closing of fire damper, which in turn shall switch off power supply to ductable unit.

Fire dampers shall be CBRI tested and certified for 120 minutes against collapse and flame penetration as per UL 555-1993.

Fire dampers shall be compatible with the fire detection system of buildings and shall be capable of operating automatically on receiving signal from fire alarm panel.

## **Grilles and Diffusers** (As per Approved Sample)

Supply air grilles shall be provided with vertical and horizontal adjustable bars and volume control multi-louver damper which shall be key operated from the front of the grille.

All return air grilles and exhaust grilles shall be similar but without volume control damper.

Sheet metal fresh air louvers with frame, dampers, filters, etc. shall be provided in the clear opening in masonry made by the owner or in a window or as shown in the drawings. Wherever fresh air ducting is involved, it shall be carried out as shown and insulated with 25mm thick insulation wherever the duct crosses a conditioned area.

All G.I frames, rectangular or circular, for fixing thereon of supply and return air grilles and diffusers shall be deemed to be included in the quoted rates.

Linear grilles shall be provided with G.S.S. opposed blade volume control dampers in supply collars.

### **Installation**

The duct fabrication and installation shall generally conform to B.S.S. / IS Standards. Duct dimensions shown on drawings are clear inside dimensions. Wherever insulation is applied from inside, ducts shall be appropriately enlarged. All openings in walls required for running ducts or for return air shall have to be cut by the contractors without any extra cost. All such cuttings shall be made good by the contractors.

The contractors shall provide and neatly erect all sheet metal work as shown on drawings or as may be required to carry out the intent of these specifications and drawings and this work shall meet with the approval of the Engineer – In-charge in all its parts and details.

All necessary allowances and provisions shall be made by this contractor for beam, pipes, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work or plumbing or other pipes or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained, all as approved or directed by the Engineer – In-charge.

All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other contractors on the building.

Ducting over false ceiling shall be supported from the slab above, or from beams. In no case shall a duct be supported from the ceiling hangers or be permitted to rest on a hung ceiling.

If a duct cannot be run as shown on the drawing, the contractor shall install the duct between the required points by any suitable path available, subject to the approval of the Engineer – In-charge.

All duct shall be rigid and shall be adequately supported and braced where required with standing seams, tees or angles of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

All joints shall be tight and all interior surfaces shall be smooth. Bends shall be made with radius not less than one-half the width of the duct or with scientifically designed interior curved vanes, as approved. The each of the individual elbows formed by the vanes will be about five.

All sheet metal connections, partitions and plenums required to confine the flow of air to and through the filters and fans shall be constructed of 18 G Galvanized iron braces and fitted with all necessary doors as required by the architect, to give access to all parts of the apparatus. Doors shall not be less than 450 mm x 650 mm in size.

Where metal ducts or sleeves terminate in wood work brick or masonry openings, tight joints shall be made by means of closely fitting heavy flanged collars.

Doors shall be set in ducts and plenums for access to pipes, dampers, coils, valves etc.

## **BRAIDED ( WIRE) ROPE SUPPORT**

Braided (Wire) Hangers shall be used to suspend all static mechanical, electrical and HVAC services.

Braided (Wire) Rope Hangers shall consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded M8 stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet or any other end fixture type or size as per manufacturers recommendation. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a wire rope Hanger self-locking grip at the other end.

Only wire and/or supports supplied and/or approved, shall be used with the system.

- a. Braided (Wire) Rope Hangers have been independently tested by Lloyds Register, APAVE, TUV, UL, CSA and SMACNA, approved by ULC and CSA and comply with the requirements of DW/144 and BSRIA – wire Rope Suspension systems. Wire rope is manufactured to BSEN 12385: 2002.
- b. The contractor shall select the correct specification of wire Hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum safe working load limit.

The correct specification of Braided (Wire) Rope Hanger required is determined using the following formula.

Weight per meter of object suspended (kg) X distance between suspension points (m) = weight loading per Braided (Wire) Rope Hanger suspension point (kg).

The contractor shall select the correct length of Braided (Wire) Rope required to support the service. Lengths from 1-10m lengths. No in-line joints should be made in the rope.

Table. 1

| size  | minimum breaking load<br>of Braided (Wire) Rope | Braided (Wire)<br>Rope<br>construction | tensile<br>strength(Nmm2) | working load limit<br>(kg/lbs) |
|-------|-------------------------------------------------|----------------------------------------|---------------------------|--------------------------------|
| No. 1 | 80kg/176 lbs                                    | 7 x 7 (6/1)                            | 1770                      | 0-10 kg / 0-22 lbs             |
| No. 2 | 260kg/572 lbs                                   | 7 x 7 (6/1)                            | 1770                      | 10-45 kg / 23-100 lbs          |
| No. 3 | 580kg/1276 lbs                                  | 7 x 7 (6/1)                            | 1770                      | 45-90 kg / 101-200 lbs         |
| No. 4 | 1500kg/3300 lbs                                 | 7 x 19 (12/6/1)                        | 1770                      | 90-225 kg / 210-495 lbs        |
| No. 5 | 2160kg/4752 lbs                                 | 7 x 19 (12/6/1)                        | 1770                      | 225-325 kg / 496-715 lbs       |

The standard range of Braided (Wire) Rope Hanger Kits shall be used which contains galvanized high tensile steel wire rope, the minimum specification is as above and shall be manufactured to BS 302 (1987), BSEN12385.

**Ducting Supports:** All duct work shall be independently supported from building construction. All horizontal ducts shall be adequately secured and supported. In an approved manner, with trapeze Hangers formed of galvanized steel wire rope in a cradle support method under ducts at no greater than 2 meter centre. All vertical duct work shall be supported by structural members on each floor slab. Duct support shall be through dash / anchor fastener driven into the concrete slab by electrically

operated gun. Hanger wire shall then hang around the ducting. Rigid supports shall be used in conjunction with wire rope hangers to assist with alignment of services. Rigid support must also be used in conjunction with wire rope hangers with duct work at each change of direction or connection. Support ducting in accordance with Schedule I.

Ducting over furred ceiling shall be supported from the slab above or from beams after obtaining approval of Construction manager/consultant. In no case shall any duct be supported from false ceiling Hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other Contractor's work in the building.

**Piping Supports:** Rigid supports shall be used in conjunction with wire rope hangers to assist with alignment of services. Rigid support must also be used in conjunction with wire rope hangers with pipe work at each change of direction or connection. For insulated pipe, provide protective sleeve to protect the entire circumference of the pipe insulation. All supports of pipe shall be taken from structural slab/wall by means of fastener. Support piping in accordance with Schedule II at the end of this Section.

**Electrical Cable Tray/Raceway Supports:** Y-Fit solution shall be used to a maximum width of 500mm tray. For Tray over 500mm cradle support method or independent Gripple supports must be taken as appropriate based on load. Rigid supports shall be used in conjunction with wire rope hangers to assist with alignment of services. Any other Gripple solution can be used based on manufacturer's recommendation on site conditions after prior approval.

Refer to manufacturers catalogue and installation guide for further technical information. Comply with manufacturer's load ratings and recommended installation procedures.

#### **Schedule I: Duct Hanger Schedule**

| For ducts with external SP upto 250 Pa |       |                    | For ducts with external SP upto 500 Pa |       |                    |
|----------------------------------------|-------|--------------------|----------------------------------------|-------|--------------------|
| Maximum Duct Size (mm)                 | Gauge | Gripple Hanger No. | Maximum Duct Size (mm)                 | Gauge | Gripple Hanger No. |
| 1 - 751                                | 26    | 2                  | 1-600 mm                               | 26    | 2                  |
| 751-1000                               | 26    | 2                  | 601-750 mm                             | 26    | 2                  |
| 1001-1200                              | 24    | 3                  | 751-1000 mm                            | 24    | 3                  |
| 1201 - 1500                            | 24    | 3                  | 1001-1200 mm                           | 22    | 4                  |
| 1501 - 1800                            | 22    | 4                  | 1201-1300 mm                           | 20    | 4                  |
| 1801-2100                              | 20    | 4                  | 1301-1500 mm                           | 18    | 4                  |
| 2101-2700                              | 18    | 4                  | 1501-1800 mm                           | 18    | 4                  |
|                                        |       |                    | 1801-2100 mm                           | 18    | 4                  |
|                                        |       |                    | 2101-2250 mm                           | 18    | 4                  |

**All supports shall be at 2400 mm interval.**

### **Schedule II: Pipe Hanger Schedule**

| Pipe Size | Weight of pipe + fluid     | Weight of pipe + fluid per Rmt      | Spacings (pipe + fluid+insulation) | Spacings (pipe + fluid+plaster) | Total Weight of pipe + fluid | Total Weight of pipe + fluid        | Gripple Hanger No.         | Gripple Hanger No.                  |
|-----------|----------------------------|-------------------------------------|------------------------------------|---------------------------------|------------------------------|-------------------------------------|----------------------------|-------------------------------------|
| (mm)      | with insulation (kgs/rmts) | with sand cement plaster (kgs/rmts) | between supports (mts)             | between supports (mts)          | with insulation (kgs/rmts)   | with sand cement plaster (kgs/rmts) | with insulation (kgs/rmts) | with sand cement plaster (kgs/rmts) |
| 12-35     | 11.73                      | 14                                  | 1.5                                | 1.5                             | 18                           | 21                                  | 2                          | 2                                   |
| 40-65     | 11.73                      | 14                                  | 2                                  | 2                               | 23                           | 28                                  | 2                          | 2                                   |
| 80-125    | 34.73                      | 41.67                               | 2                                  | 2                               | 69                           | 83.34                               | 3                          | 3                                   |
| 150-250   | 112                        | 134                                 | 2                                  | 1.5                             | 224                          | 201                                 | 4                          | 4                                   |
| 300 - 350 | 180                        | 215                                 | 1.5                                | 1.5                             | 270                          | 322.5                               | 5                          | 5                                   |
| 400-500   | 320                        | 383                                 | 1.5                                | -                               | 480                          | -                                   | 6                          | -                                   |
|           |                            |                                     |                                    |                                 |                              |                                     |                            |                                     |

### **DOCUMENTATION & MEASUREMENTS FOR DUCTING**

All ducts fabricated and installed should be accompanied and supported by proper documentation viz:

a) Bill of material/Packing list for every duct section supplied.

Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.

Each and every duct piece to have a tag number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement and verification.

Unless otherwise specified, measurements for ducting for the project shall be on the basis of centerline measurements described herewith

Ductwork shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the center of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections. Plenums shall also be measured in a similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the centerline distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centerline.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 5mm thick between duct and support, vibration isolator suspension

where specified or required, inspection chamber/access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the specifications. These accessories shall NOT be separately measured nor paid for.

- b. Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith :
  - i. Grilles and registers - width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.
  - ii. Diffusers - cross section area for air flow at discharge area, excluding flanges. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.
  - iii. Linear diffusers - shall be measured by cross-sectional areas and shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.
  - iv. Fire dampers - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross section outside the air stream.
  - v. Flexible connection - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.
  - vi. Kitchen Hoods - shall be measured by their cross sectional area at the capture point of fumes, parallel to the surface of kitchen equipment. Quoted rates shall include the grease filters, provision for hood light, suspension arrangement for the hood, profile to direct the air to ventilation ducts and provision for removable drip tray.

#### **FLEXIBLE DUCT:**

Insulated flexible duct should be UL 181 CLASS I AIR DUCT LISTED AND LABELLED WITH NFPA 90A & 90B AND SEAL OF AIR DIFFUSION COUNCIL with double lamination of tough polyester which encapsulates steel helix wire forms the air tight inner core, double layer core wrapped in a multiple thickness of fiberglass wool with R Value 4.2 , Green guard certification of fiberglass wool must. , Reinforced and sheathed in a rugged and durable tri directionally reinforced metalized polyester jacket.

Flexible duct connections should be made as per UL181 listing procedure with proper flexible right forming brace connection allowing right connections for flexible duct into energy efficient . and Strapping the flexible duct connections with flexible duct strap ties.

### **TESTING AND BALANCING**

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leaks by visual inspection.

The entire air distribution system shall be balanced using an anemometer. Measured air quantities at fan discharge and at various outlets shall be identical to or less/excess than 5 percent in excess of those specified and quoted. Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted for scrutiny and approval, and four copies of the approved balance report shall be provided with completion documents.

### **Air Transfer Door Register**

Extruded aluminum construction air transfer door register will be provided as per approved shop drawings. The register will be complete with single /double register frame to be mounted on door panel from both sides. The central core shall be NO-SEE-THRU type. The register shall be anodized or powder coated as per Architect's requirement. The register shall be provided with insect screen to prevent movement of insects from inside to outside or vice versa.

### **Insulation**

All the ducts wherever specified shall be insulated in the manner specified hereinafter.

### **Testing**

After completion, all duct systems shall be tested for air leakage.

The entire air distribution system shall be balanced to supply the air quantities as required in the various regions and rooms to maintain the specified room condition. The final balance of air quantities through each grille, register or diffuser shall be recorded and submitted to the Architect for approval.

## **INSULATION**

### **General**

All tests like pressure testing should be complete and recorded and all systems approved before insulation is applied to the equipment and piping. Insulation material shall be manufactured by approved manufacturers and shall be of approved manufacture of the type specifically intended for the services specified.

Insulation materials and finishes shall be inherently proof against rotting, mould and fungal growth and attack by vermin, be non-hygroscopic and in all respects be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.

Unless otherwise indicated, all thermal insulating materials used within any building shall, when tested in accordance with Indian standards be classified non-combustible with a facing of combustible material provided the facing is not more than 0.8 mm thick. Thermal insulating materials used within any building shall be free from substances which in the event of a fire would generate appreciable quantities of smoke, noxious or toxic fumes.

The insulation material for thermal insulation of refrigerant pipes and drain pipes shall conform to following specifications in general:

- o Insulation material shall be Closed Cell nitrile rubber.
- o Density of Material shall be between 30 to 50 Kg / m<sup>3</sup> for thermal insulation.
- o Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.035 W/m<sup>2</sup>K at an average temperature of 20° C.

The insulation shall have fire performance such that it passes Class I as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O'; Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990.

Water Vapor permeability shall not exceed 0.017 per inch (2.48 x 10<sup>-14</sup> Kg / m.s.Pa), i.e. Moisture Diffusion Resistance Factory or 'μ' value should be minimum 7000.

Thickness of the insulation shall be as specified for the individual application.

At all points of support, both insulation and out covering shall be continuous and shall not be punctured or floured by the supports. The insulation at supports shall be material of sufficient compressive strength to take the loads transmitted to the supports. The load bearing insulation shall be extended on each side of the supports.

At entries into building the weather-proofed insulation shall extend not less than 100 mm beyond the inner face of the wall and be sealed to the satisfaction of the owner.

The Insulation of refrigerant piping, units, ducting, etc., shall be carried out as per specifications given below



### **Piping Insulation**

All refrigerant pipes and drain piping shall be insulated with closed cell Nitrile Rubber of thickness as per BOQ. The Insulation material shall confirm to these specifications:

The thickness of insulation material shall be selected with diameter of pipe as per BOQ.

The material should be rigid pre formed molded sections of closed cell nitrile rubber insulation class 'O' fire rating having a uniform density of 32 Kg/m<sup>3</sup> and with a "K" value not exceeding 0.035 W/mk at 20° C mean temperature.

All Refrigerant and Condensate Drain Pipe shall be insulated in the manner specified herein. An air gap of 100mm shall be present between adjacent insulated surfaces carrying chilled refrigerant and also between the insulated surface and the wall to allow natural ventilation without affecting it's external surface coefficient of heat transfer before applying insulation, all pipes shall be brushed and cleaned. All pipe surfaces shall be free from dirt, dust, mortar, grease, oil, etc. Nitrile rubber insulation shall be applied as follows:-

- a. Insulating material in tube form shall be sleeved on the pipes.
- b. On existing piping, slit opened tube of the insulating material (slit with a very sharp knife in a straight line) shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer.
- c. Adhesive must be allowed to tack dry and then press surface firmly together starting from but ends and working towards centre.
- d. Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations.
- e. The insulation shall be continuous over the entire run of piping, fittings and valves.

The detailed application specifications are as mentioned separately. The manufacturer's trained installer should only be used for installation.

The materials to be used for insulation shall be as follows, unless some other material is specifically mentioned elsewhere. The detailed specifications of the materials are listed under respective sub heads.

### **MATERIAL**

Thermal insulation material for Duct insulation shall be closed cell Elastomeric Nitrile Rubber or cross linked polyethylene of Thermal conductivity of the insulation material shall not exceed 0.038 W/moK or 0.212 BTU / (Hr-ft<sup>2</sup>-oF/inch) at an average temperature of 30oC. Density of the nitrile rubber shall be 30-60 Kg/m<sup>3</sup>. The product shall have temperature range of -40oC to 105oC. The insulation material shall be fire rated for Class 0 as per BS 476 Part 6 : 1989 for fire propagation test and for Class 1 as per BS 476 Part 7, 1987 for surface spread of flame test. Water vapour permeability shall be not less than

0.024 per inch ( $2.48 \times 10^{-14}$  Kg/m.s.Pa i.e.  $\mu > 7000$ : Water vapour diffusion resistance).

Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer's test certificate for thermal conductivity values, density, water vapour permeability, and fire properties. Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost. Adhesive used for sealing the insulation shall be non-flammable, vapor proof adhesive strictly as per manufacturer's recommendations.

Ducting insulation thickness shall be as per table below.

| Ducting position | Thk.  |
|------------------|-------|
| SA & return duct | 19 mm |
| Exposed Duct     | 25mm  |

### **Duct Thermal Insulation**

The materials for duct insulation shall be close linked closed cell nitrile rubber insulation with fire resistant (UL-723) having a low stable K-value of 0.027- 0.029 K.cal/hr. The density of insulation shall be 0.32 Kg/cum. The insulation shall adhere with CR adhesive grade R-242.

### **DUCT ACOUSTIC LINING**

Duct acoustic lining material shall be Acoustic lining inside ducts using Non Fibrous fire retardant cross-linked polyethylene foam of  $30 \pm 3$  Kg/m<sup>3</sup> density & thickness of 12mm having porous surface on one side & a flat surface on other side using Synthetic rubber based Adhesive preferably Low VOC & high strength characteristic (Initial portion of ducting and main plenum) as per specifications.

Thickness of the material shall be 12 mm thick specified for the individual application. The insulation should be installed as per manufacturer's recommendation.

- The Random Incidence Sound Absorption Coefficient (RISAC); tested as per ISO 354, should be minimum as per following chart

| Freq (Hz) | 125  | 250  | 500  | 1000 | 2000 | 4000 | NRC  |
|-----------|------|------|------|------|------|------|------|
| 10 mm     | 0.03 | 0.04 | 0.14 | 0.04 | 0.88 | 1.00 | 0.35 |
| 15 mm     | 0.01 | 0.09 | 0.29 | 0.74 | 1.08 | 0.83 | 0.55 |
| 20 mm     | 0.04 | 0.13 | 0.40 | 0.90 | 1.04 | 0.90 | 0.60 |
| 25 mm     | 0.02 | 0.25 | 0.86 | 1.14 | 0.88 | 0.99 | 0.80 |
| 30 mm     | 0.07 | 0.32 | 0.99 | 1.16 | 0.93 | 1.08 | 0.85 |
| 50 mm     | 0.23 | 0.73 | 1.29 | 0.99 | 1.09 | 1.11 | 1.05 |

### **DUCT ACOUSTIC LINING**

Ducts so identified and marked on Drawings and included in Schedule of Quantities shall be provided with 15 mm thick acoustic lining of thermal insulation material for a distance of minimum 5 meters (or 30% of the duct length whichever is more).

### **DUCT INSULATION**

External thermal insulation shall be provided as follows :

The thickness of nitrile rubber shall be as shown on drawing or identified in the schedule of quantity. Following procedure shall be adhered to:

Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubber sheets to size with sufficient allowance in dimension. Cutting of nitrile rubber sheets shall be done with adjustable blade to make 90° cut in thickness of nitrile rubber sheet. Hackshaw or blades are not acceptable tools for cutting the insulation.

Material shall be fitted under compression and no stretching of material shall be permitted. A film of adhesive shall be applied on the back of the insulating material sheet and then on to the metal surface. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. All longitudinal and transverse joints shall be sealed by providing 6 mm thick 50 mm wide nitrile rubber tape. The adhesive shall be strictly as recommended by the manufacturer.

### **PROTECTIVE COATING OVER INSULATION**

To provide mechanical strength and protection from damage all pipe / duct insulated with nitrile rubber shall be covered with thermal insulation protecting coating with alkali resistance glass fibre fabric of weight 200 GSM and 7 mil minimum thickness reinforcement. The coating non-volatile content shall be as per guideline of ASTM 1644-01 and Water permanence (perms) as per guideline ASTM E-96. The coating flammability, surface burning characteristics shall be as per ASTM E-84 and UL 723.

Insulated pipes & ducts exposed to UV rays shall be covered with fibreglass fabric. Over fabric one coat of fire proof epoxy or acrylic compound shall be applied. The coat shall be allowed to cure to non-stick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface.

### **UNDERDECK INSULATION**

Under deck insulation shall be 50mm thick TF Quality expanded polystyrene (32 Kg/m<sup>3</sup>) or 30mm thick phenotherm. Under deck surface of ceiling shall be cleaned and made dirt free. Insulation panels shall be pasted on this surface with black CPRX compound. 28g wire net shall be tightened around insulation so as to avoid any kind of sagging. Ends of net shall be overlapping by at least 25mm. Overlaps shall be screwed with galvanized screws to avoid rusting.

### **MEASUREMENT OF INSULATION**

Unless otherwise specified measurement for duct and pipe insulation for the project shall be on the basis of center line measurements described herewith

a. Pipe Insulation shall be measured in units of length along the center line of the installed pipe, strictly on the same basis as the piping measurements described earlier. The

linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers are not separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including cladding, valves, orifice plates and strainers shall be considered strictly by linear measurements along the center line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

b. Duct Insulation and Acoustic Lining shall be measured on the basis of surface area along the center line of insulation thickness. Thus the surface area of externally thermally insulated or acoustically lined be based on the perimeter comprising center line (of thickness of insulation) width and depth of the cross section of insulated or lined duct, multiplied by the center-line length including tapered pieces, bends, tees, branches, etc. as measured for bare ducting.

### **Installation Procedure**

The inside surface for the ducts shall be covered with adhesive recommended by the manufacturer. Cut Foamed sheets into required sizes apply adhesive on the foam and stick it to the duct surface.

### **Painting**

Painting of all supports and fittings shall be included with the cost of these items. Nothing extra shall be paid for this work.

## **ELECTRICAL INSTALLATION**

### **SCOPE**

The scope of this section comprises of fabrication, supply, erection, testing and commissioning of Motor Control Centre (MCC), wiring and earthing of all air-conditioning equipment, components and accessories.

### **GENERAL**

All motor control centres shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, 4 wire system with neutral grounded at transformer. All MCCs shall be CPRI tested design and manufactured by a approved manufacturer. CPRI certificate shall be made available.

MCCs shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993. MCCs / starter panels for outdoor equipment shall be suitable for outdoor duty application.

### **CONSTRUCTIONAL FEATURES**

The Motor Control Centre (MCC) shall be of 2 mm thick sheet steel cabinet and suitable for indoor installation, dead front, floor mounting/wall mounting type and shall be form 3b construction. The Distribution panels shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors and folded covers, Neoprene gasket, padlocking arrangement and bolted back. All removable/ hinged doors and covers shall be grounded by flexible standard connectors. MCC shall be suitable for the climatic conditions as specified in Special Conditions. Steel sheets used in the construction of panels shall be 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.

All MCCs/panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of Distribution panels. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels. Minimum operating clearance of 275 mm shall be provided between the floor of panels and the lowest operating height.

The MCC shall be of adequate size with a provision of spare feeders as per single line diagram. Feeders shall be arranged in multi-tier. Knockout holes of appropriate size and number shall be provided in the Motor Control Centre in conformity with the location of cable/conduit connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliate or engraved metal name plates. All panels shall be provided with circuit diagram mounted on inside of door shutter protected with Hylam sheet. All live accessible connections shall be shrouded and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

## **WIRING SYSTEM**

All L T power cabling between MCC and motors shall be carried out with 1100 volts grade PVC insulated, overall PVC sheathed aluminium conductor armoured cables above 25 sq.mm size, where as all cables below 25 sq.mm. size shall be of copper conductor. Cables shall be sized by applying proper derating factor. All control wiring shall be carried out by using PVC insulated copper conductor wires in conduits. Minimum size of control wiring shall be 1.5 sq mm. Minimum size of conductor for power wiring shall be 4 sq.mm 1100 volts grade PVC insulated copper conductor wires in conduit.

## **CIRCUIT COMPARTMENT**

All components for each feeder shall be housed in a separate compartment and shall have steel sheets on top and bottom of compartment. Sheet steel hinged lockable door shall be duly interlocked with the breaker in the "ON" position. Safety interlocks shall be provided to prevent the breaker from being drawn-out when the breaker is in 'ON' position. The door shall not form an integral part of the draw-out portion of the panel. Sheet steel barriers shall be provided between the tiers in a vertical section.

All MCCs shall be provided with feeders of appropriate capacity as per Single Line Diagram. All MCCs shall be completely factory wired, ready for connection. All the terminals shall be of proper current rating and sized to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Continuous earth bus sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames shall be connected to earth through adequately sized flexible braids.

## **INSTRUMENT ACCOMMODATION**

Adequate space shall be provided for accommodating instruments, indicating lamps, control contactors and control MCBs. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker and bus bar 'ON' lamps shall be provided on all outgoing feeders.

## **BUS BAR CONNECTIONS**

Bus bar and interconnections shall be of high conductivity electrolytic grade aluminium / copper as indicated in the bill of quantities complying with requirement of IS : 5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded. Bus bars shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bars shall be provided in a separate chamber and all connections shall be done by bolting. Additional cross sectional area to be added to the bus bar to compensate for the holes. All connections between bus bars and breakers shall be through solid copper / aluminium strips of proper size to carry full rated current and insulated with insulating sleeves. Maximum current density for the busbars shall be 0.8 A/sq.mm for aluminium and 1.4 A/sq.mm for copper busbars. Maximum allowable temperature for the Bus bar to be restricted to 85 deg C

### **TEMPERATURE - RISE LIMIT**

Unless otherwise specified, in the case of external surface of enclosures of bus bar compartment which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per IS 8623(Part-2) 1993.

### **CABLE COMPARTMENTS**

Cable compartment of adequate size shall be provided in the panel for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables as per approved for construction shop drawing.

### **AIR CIRCUIT BREAKERS (ACB)**

The ACB shall conform to the requirements of IEC 60947-2 / IS 13947-2 and shall be type tested & certified for compliance to standards from-CPRI, ERDA/ any accredited international lab. The circuit breaker shall be suitable for 415 V + 10%, 50 Hz supply system.

Air Circuit Breakers shall be with moulded housing flush front, draw out type and shall be provided with a trip free manual operating mechanism or as indicated in drawings and bill of quantities with mechanical "ON" "OFF" "TRIP" indications.

The ACB shall be 3/ 4 pole with modular construction, draw out, manually or electrically operated version as specified. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity (Ics) shall be as specified on the single line diagram and should be equal to the Ultimate breaking capacity(Icu) and short circuit withstand values(Icw) for 1 sec.

Circuit breakers shall be designed to 'close' and 'trip' without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breakers panel. Inspection of main contacts should be possible without using any tools. The ACB shall be provided with a door interlock. i.e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and in accessibility to live parts. All electrical closing breaker shall be with electrical motor wound stored energy spring closing mechanism with mechanical indicator to provide ON/OFF status of the ACB.

The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall close before the main contacts have closed. All other contacts shall close simultaneously with the main contacts. The auxiliary contacts in the trip circuits shall open after the main contacts open. Minimum 4 NO and 4 NC auxiliary contacts shall be provided on each breaker.

Rated insulation voltage shall be 1000 volts AC.

## **CRADLE**

The cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. The movements shall be free from jerks, easy to operate and shall be on steel balls/rollers and not on flat surfaces.

There shall be 4 distinct and separate position of the circuit breaker on the cradle. Racking Interlock in Connected/Test/Disconnected Position.

Service Position : Main Isolating contacts and control contacts of the breaker are engaged.

Test Position : Main Isolating contacts are isolated but control contacts are still engaged.

Isolated Position : Both main isolating and control contacts are isolated.

There shall be provision for locking the breaker in any or all of the first three positions.

The following safety features shall be incorporated :

- a. Withdrawal or engagement of Circuit breaker shall not be possible unless it is in open condition.
- b. Operation of Circuit breaker shall not be possible unless it is fully in service, test or drawn out position.
- c. All modules shall be provided with safety shutters operated automatically by movement of the carriage to cover exposed live parts when the module is withdrawn.
- d. All Switchgear module front covers shall have provision for locking.
- e. Switchgear operating handles shall be provided with arrangement for locking in 'OFF' position.

## **PROTECTIONS**

The breaker should be equipped with micro-controller based , communicable type release with RS 485 port for communication to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following four zones :

- Long time protection.
- Short time protection with intentional delay.
- Instantaneous protection.
- Ground fault protection.

The protection release shall generally have following features and settings however for exact requirement of protection releases, reference shall be made to SOQ:

- a. True RMS Sensing

The release shall sample the current at the rate of 16 times per cycle to monitor the actual load current waveform flowing in the system and shall monitor the true RMS value of the load current. It shall take into account the effect of harmonics also.



b. Thermal Memory When the breaker shall reclose after tripping on overload, then the thermal stresses caused by the overload if not dissipated completely, shall get stored in the memory of the release and this thermal memory shall ensure reduced tripping time in case of subsequent overloads. Realistic Hot/Cold curves shall take into account the integrated heating effects to offer closer protection to the system.

c. Defined time-current characteristics :

A variety of pick-up and time delay settings shall be available to define the current thresholds and the delays to be set independently for different protection zones thereby achieving a close-to-ideal protection curve.

- d. Trip Indication : Individual fault indication for each type of fault should be provided by LEDs for faster fault diagnosis.
- e. Self-powered : The release shall draw its power from the main breaker CTs and shall require no external power supply for its operation.
- f. Zone Selective Interlocking : The release shall be suitable for communication between breakers to enable zone selective interlocking. This feature shall be provided for both short circuit and ground fault protection zones to offer intelligent discrimination between breakers. This feature enables faster clearance of fault conditions, thereby reducing the thermal and dynamic stresses produced during fault conditions and thus minimizes the damage to the system. To implement ZSI manufacturer should supply all related equipment like power supply, wiring etc.

On-Line change of settings should be possible. It should be possible to carry out testing of release without tripping the breaker.

- g. The release shall meet the EMI / EMC requirements.
- h. The setting range of release shall be generally as follows :

| SETTING RANGE OF RELEASE |                                                                                                                                                               |                                                                                                                                     |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Type of Protection       | PICK-UP CURRENT                                                                                                                                               | TIME DELAY                                                                                                                          |
| Long Time                | 0.4 to 1.0 times $I_n$ ( $I_r$ )<br>Steps : 0.4, 0.5, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95, 1.00.<br>Operating Limit: 1.05 to 1.2 times $I_r$ | 0.5 to 30 sec at 6 $I_r$<br>Steps 0.5, 1, 2, 4, 6, 8, 12, 18, 24 and 30 secs<br>Tolerance : Corresponding $\pm 10\%$ of current.    |
| Short Time               | 2 to 10 times $I_r$<br>Steps : 2, 3, 4, 5, 6, 7, 8, 9 & 10<br>Tolerance : $\pm 10\%$                                                                          | 20 ms to 600 ms<br>Steps: 20, 60, 100, 160, 200, 260, 300, 400, 500 and 600 ms<br>Tolerance: $\pm 10\%$ or 20ms whichever is higher |
| Instantaneous            | 2 to 12 times $I_n$<br>Steps : 2, 3, 4, 6, 8, 10, 12<br>Tolerance : $\pm 10\%$                                                                                |                                                                                                                                     |
| Ground Fault             | 0.2 to 0.6 time $I_n$<br>Steps : 0.2, 0.3, 0.4, 0.5, 0.6<br>Tolerance : $\pm 10\%$                                                                            | 100 ms to 400 ms<br>Steps : 100, 200, 300, 400ms<br>Tolerance : $\pm 10\%$ or 20 ms whichever is higher.                            |

All **incomer** ACBs shall have following additional protections other than mentioned above.

- Under and over voltage
- Under and over frequency
- Restricted Earth Fault protection
- Trip Circuit supervision with PS class CT's.
- Undercurrent, ( for DG set only)
- Reverse power ( for DG set only)
- Phase sequence reversal ( for DG set only)
- Load shedding and reconnection thru programmable contacts.
- Release should display the Contact wear indication.

The release should provide local indication of actual %age loading at any instant. The release should be able to communicate on MODBUS RTU protocol using inbuilt RS485 port and shall be integral part of supply with trip unit. Parameters of the Protection Release should be changeable from Release as well as thru communication network. Release should have graphical LCD for display of power parameters. The release of incoming breakers should provide comprehensive metering with the following parameters

- Phase currents (running, avg& max) – All parameters in single window.
- Release should be able to capture short circuit current on which ACB has tripped. The last ten trips and alarms shall be stored in memory with the date & time stamping along with type of fault and alarm. The sensing CT Should be Rogowsky type with measurement precision of 1%.
- Release should be self-powered .
- Release should have facility to select different type of IDMTL protection(DT,SIT,VIT,EIT,HVF) for better co-ordination with HT Breaker/Fuse.
- Phase voltages (running, avg& max)
- Energy & power parameters (active, reactive and apparent)
- PF
- Frequency
- Maximum Demand ( KVA & KW)
- Total Harmonics distortion

All **O/G** ACBs shall have following functions.

#### **Protection**

- The ACB control unit shall offer the following protection functions as standard:
- Long-time (LT) protection with an adjustable current setting and time delay;
- Short-time (ST) protection with an adjustable pick-up and time delay;
- instantaneous (INST) protection with an adjustable pick-up and an OFF Position.
- Current and time delay setting shall be indicated in amperes and seconds respectively
- On a digital display.
- Earth-fault protection with an adjustable pick-up and time delay shall be provided if indicated on the appended single-line diagram.

#### **Measurements**

- An ammeter with a digital display shall indicate the true rms values of the currents for each phase. Release shall acknowledge the current & time delay settings done by user on the LCD display.
- A LED bar graph shall simultaneously display the load level on the three phases.
- A maxi meter shall store in memory and display the maximum current value observed since the last reset. The data shall continue to be stored and displayed even after opening of the circuit breaker.

#### **SAFETY FEATURES**

- i. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.
- ii. It shall not be possible to interchange two circuit breakers of two different thermal ratings. For Draw-out breakers, an arrangement shall be provided to prevent rating mismatch between breaker and cradle.
- iii. There shall be provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism. Earthing bolts shall be provided on the cradle or body of fixed ACB.
- iv. The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, digital voltmeter, and ammeter of size not less than 96 mm x 96 mm, selector switches, MCB for protection circuit and measuring instrument circuits.
- v. It shall be possible to bolt the draw out frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.
- vi. Draw out breakers should not close unless in distinct Service/Test/Isolated positions.
- vii. The insulation material used shall conform to Glow wire test as per IEC60695.
- viii. The ACB shall provide in built electrical and mechanical anti-pumping.

- ix. All EDO ACB's Shall have Ready to Close Contact to ensure that the ACB gets a command only when it is ready to close for applications of Remote Control, AMF, Synchronization and Auto Source Change Over Systems.

### **MOULDED CASE CIRCUIT BREAKER (MCCB)**

The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab.

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses

The breaking capacity of MCCB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-2. The breaker as supplied with ROM should meet IP54 degree of protection.

### **Current Limiting & Coordination**

- The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables and let-through energy curves for all.

### **Protection Functions**

- MCCBs with ratings up to 200 A shall be equipped with Thermal-magnetic (adjustable thermal for overload and fixed magnetic for short-circuit protection) trip units
- Microprocessor MCCBs with ratings 250A and above shall be equipped with microprocessor based trip units.
- Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorized access to the settings
- Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of RMS current values, electromagnetic compatibility, etc.)
- Protection settings shall apply to all poles of circuit breaker.
- All Microprocessor components shall withstand temperatures up to 125 °C

### **Testing**

- a) Original test certificate of the MCCB as per IEC 60947-1 & 2 or IS13947 shall be furnished.
- b) Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

### Interlocking

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

- a) Handle interlock to prevent unnecessary manipulations of the breaker.
- b) Door interlock to prevent the door being opened when the breaker is in ON position.
- c) Defeat-interlocking device to open the door even if the breaker is in ON position.
  - The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable over load & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.
  - All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit, and earth fault protection with time delay.

The trip command shall override all other commands.

### **MOTOR PROTECTION CIRCUIT BREAKER (MPCB)**

Motor circuit breakers shall conform to the general recommendations of standard IEC 947 - 1,2 and 4 (VDE 660, 0113 NF EN 60 947-1-2-4, BS 4752) and to standards UL 508 and CSA C22-2 N°14.

The devices shall be in utilization category A, conforming to IEC 947-2 and AC3 conforming to IEC 947-4. MPCB shall have a rated operational and insulation voltage of 690V AC (50 Hz) and MPCB shall be suitable for isolation conforming to standard IEC 60947-2 and shall have a rated impulse withstand voltage (Uimp) of 6 kV. The motor circuit breakers shall be designed to be mounted vertically or horizontally without derating. Power supply shall be from the top or from the bottom. In order to ensure maximum safety, the contacts shall be isolated from other functions such as the operating mechanism, casing, releases, auxiliaries, etc, by high performance thermoplastic chambers. The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles shall close, open, and trip simultaneously. The motor circuit breakers shall accept a padlocking device in the "isolated" position.

The motor circuit breakers shall be equipped with a "PUSH TO TRIP" device on the front enabling the correct operation of the mechanism and poles opening to be checked. The auxiliary contacts shall be front or side mounting, and both arrangements shall be possible. The front-mounting attachments shall not change the breaker surface area. Depending on its mounting direction the single pole contact block could be NO or Call the electrical auxiliaries and accessories shall be equipped with terminal blocks and shall be plug-in type. The motor circuit breakers shall have a combination with the downstream contactor enabling the provision of a perfectly co-ordinated motor-starter. This combination shall enable type 1 or type 2 co-ordination of the protective devices conforming to IEC 60947-4-1. Type 2 co-ordination shall be guaranteed by tables tested and certified by an official laboratory: LOVAG (or other official laboratory). The motor circuit breakers, depending on the type, could be equipped with a door-mounted operator which shall allow the device setting. The motor circuit breakers shall be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection. In order to

ensure safety and avoid unwanted tripping, the magnetic trip threshold (fixed) shall be factory set to an average value of 12 Ir.

All the elements of the motor circuit breakers shall be designated to enable operation at an ambient temperature of 60°C without derating. The thermal trips shall be adjustable on the front by a rotary selector. The adjustment of the protection shall be simultaneous for all poles. Phase unbalance and phase loss detection shall be available. Temperature compensation (-20°C to +60°C)

### **MINIATURE CIRCUIT BREAKER (MCB)**

Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

### **PAINTING**

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be as per relevant BIS code.

### **LABELS**

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel door and covered with transparent plastic sheet.

### **METERS**

- i. All voltmeters and indicating lamps shall be through MCB's.
- ii. Meters and indicating instruments shall be plug type.
- iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
- iv. CT ratio and burdens shall be as specified on the Single line diagram.

### **CURRENT TRANSFORMERS**

Current transformers shall be provided for Control panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondary's for operation of associated metering.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

### **SELECTOR SWITCH**

where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

### **STARTERS**

Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant IS Codes. All Star Delta Starters shall be fully automatic. Motors up to 10HP shall be provided by Direct on Line (DOL) starter, motors above 10 HP and up to 45 HP shall be provided by star/delta starter and motors above 45 HP shall be provided by soft starter.

### **CONTACTOR**

Contactors shall be built into a high strength thermoplastic body and shall be provided with an arc shield for quick arc extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter.

Starter's contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta and Reduced Voltage Starters. The insulation for contactor coils shall be of Class "E."

Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 220/415±10% volts AC, 50 cycles AC supply.

### **THERMAL OVERLOAD RELAY**

Thermal over load relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing as well as on overloading. The relay shall operate on the differential system of protection to safeguard against three phase overload, single phasing, and unbalanced voltage conditions.

Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual-reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from -5° C to +55°C.

All overload relays shall be of three elements, positive acting ambient temperature compensated time lagged thermal over load relays with adjustable setting. Relays shall be

directly connected for motors upto 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacities. Heater circuit contactors may not be provided with overload relays.

### **TIME DELAY RELAYS**

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connection.

### **INDICATING LAMP AND METERING**

All meters and indicating lamps shall be in accordance with relevant IS standard specification. The meters shall be flush mounted type. The indicating lamp shall be of LED type. Each MCC and control panel shall be provided with voltmeter 0-500 volts with three ways and off selector switch, CT operated ammeter of suitable range with three nos. CTS of suitable ratio with three ways and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 amps fuse. Other indicating lamps shall be backed up with fuses as called for in Schedule of Quantities.

### **TOGGLE SWITCH**

Toggle switches, where called for in Schedule of Quantities, shall be in conformity with relevant IS Codes and shall be of 5 amps rating.

### **PUSH BUTTON STATIONS**

Push button stations shall be provided for manual starting and stopping of motors / equipment Green and Red color push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating flaps shall be provided for push buttons. Push Buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

### **CONDUITS**

Conduits and Accessories shall conform to latest edition of Indian Standards IS-9537 part 1 & 2. 16/14 (16 gauge upto 32mm diameter & 14 gauge above 32 mm diameter) gauge screwed GI or MS conduits as specified on schedule of quantities shall be used. Joints between conduits and accessories shall be securely made by standard accessories, as per IS-2667, IS-3837, and IS-5133 to ensure earth continuity. All conduit accessories shall be threaded type only.

Only approved make of conduits and accessories shall be used.

Conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

**Note. :** Whatever materials required to be billed by the Contractor should come on site with proper Chelan Numbers and quantity mentioned in each such Chelan...



Maximum permissible numbers of 1100 volt grade PVC insulated wires that may be drawn into metallic Conduits are given below:

| Size of wires<br>Nominal Cross<br>Section Area<br>(Sq. mm.) | Maximum number of wires within<br>conduit size(mm) |    |    |    |    |
|-------------------------------------------------------------|----------------------------------------------------|----|----|----|----|
|                                                             | 20                                                 | 25 | 32 | 40 | 50 |
| 1.5                                                         | 5                                                  | 10 | 14 | -- | -- |
| 2.5                                                         | 5                                                  | 8  | 12 | -- | -- |
| 4                                                           | 3                                                  | 7  | 10 | -- | -- |
| 6                                                           | 2                                                  | 5  | 8  | -- | -- |
| 10                                                          | --                                                 | 3  | 5  | 6  | -- |
| 16                                                          | --                                                 | 2  | 3  | 6  | 6  |
| 25                                                          | --                                                 | -- | 2  | 4  | 6  |
| 35                                                          | --                                                 | -- | -- | 3  | 5  |

Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into rigid non metallic or PVC Conduits are given below:

| Size of wires<br>Nominal Cross<br>Section Area<br>(Sq. mm.) | Maximum number of wires within<br>conduit size(mm) |    |    |    |    |
|-------------------------------------------------------------|----------------------------------------------------|----|----|----|----|
|                                                             | 20                                                 | 25 | 32 | 40 | 50 |
| 1.5                                                         | 7                                                  | 12 | 16 | -- | -- |
| 2.5                                                         | 5                                                  | 10 | 14 | -- | -- |
| 4                                                           | 4                                                  | 8  | 12 | -- | -- |
| 6                                                           | 3                                                  | 6  | 8  | -- | -- |
| 10                                                          | --                                                 | 4  | 5  | 6  | -- |
| 16                                                          | --                                                 | 3  | 3  | 6  | 6  |
| 25                                                          | --                                                 | -- | 2  | 4  | 6  |
| 35                                                          | --                                                 | -- | -- | 3  | 5  |

## **CABLES**

The MV cables shall be cross linked polyethylene (XLPE) insulated PVC inner sheathed and HR PVC / FRLS PVC outer sheath of 1100 volts grade as asked for in the schedule of quantities. Cables upto 16 sq.mm shall be with copper conductor and 25 sq.mm and above shall be with aluminium conductor and suitable for lying in trenches, ducts, and on cable trays as required. M.V. Cables shall be termite resistant. Cable glands shall be double compression glands. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armoured cables.

## **CABLE LAYING**

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable. The cable drums shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks.

## **Laying of Cables on Cable Trays**

The relative position of the cables, laid on the cable tray shall be preserved and the cables shall not cross each other. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius as recommended by the manufacturers. All cables shall be laid with minimum one diameter gap and shall be clamped at every meter to the

cable tray. Cables shall be tagged for identification with aluminum tag and clamped properly at every 20M. Tags shall be provided at both ends and all changes in directions both sides of wall and floor crossings. All cable shall be identified by embossing on the tag the size of the cable, place of origin and termination.

All cables passing through holes in floor or walls shall be sealed with fire retardant Sealant and shall be painted with fire retardant paint upto one meter on all joints, terminations and both sides of the wall crossings by "VIPER CABLE RETARD."

### **Laying of Cables in Ground**

The width of trench for laying single cable shall be minimum 350 mm. Where more than one cable is to be laid in horizontal formation, the width of the trench shall be workout by providing 200 mm gap between the cables, except where otherwise specified. There shall be clearance of 150 mm between the end cable and the side wall of the trench. The minimum depth of the cable trench shall not be less than 750 mm for single layer of cables. When the cables are laid in more than one tier the depth of the trench shall be increased by 300 mm for each additional tier.

Excavation of trenches: The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided. Where gradients and changes in depth are unavoidable, these shall be gradual. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. The bottom of the trench shall be leveled and shall be made free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 100 mm in depth. Prior to lying of cables, the cores shall be tested for continuity and insulation resistance. The cable drum shall be properly mounted on jacks, at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum and the spindle is horizontal. Cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains. The entire drum length shall be laid in one stretch. However, where this is not possible the remainder of the cable shall be removed by 'Flaking' i.e. By making one long loop in the reverse direction. After the cable has been uncoiled and laid into the trench over the rollers, the cable shall be lifted off the rollers beginning from one end by helpers standing about 10 meters apart and laid in a reasonably straight line. Cable laid in trenches in a single tier formation shall have a cover of clean, dry sand of not less than 150 mm. above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid, a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid. Finally the cables shall be protected by second class bricks before back filling the trench. The buried depth of uppermost layer of cable shall not be less than 750mm.

Back Filling : The trenches shall be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 300 mm. Unless otherwise specified, a crown of earth not less than 50 mm in the centre and tapering towards the sides of the trench shall be left to allow for subsidence.

### **WIRE AND WIRE SIZES**

1100 volts grade PVC insulated copper conductor wires in conduit shall be used.

For all single phase/ 3 phase wiring, 1100 volts grade PVC insulated copper conductor FRLS/ZHFR wires shall be used. The equipment inside plant room and AHU room shall be connected to the control panel by means of insulated copper conductor wires of adequate size in exposed conduits. Final connections to the equipment shall be through wiring enclosed in galvanized flexible conduits rigidly clamped at both ends and at regular intervals.

An isolator shall be provided neareach motor/equipment wherever the motor/equipment is separated from the supply panel through a partition barrier or through ceiling construction.

PVC insulated copper conductor wires shall be used inside the control panel for connecting different components and all the wires inside the control panel shall be neatly dressed and plastic beads shall be provided at both the ends for easy identification of control wiring.

The minimum size of control wiring shall be 1.5 sq. mm PVC insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting equipment and control panels.

Power wiring, cabling shall be of the following sizes:

|       |                                                     |                                                            |
|-------|-----------------------------------------------------|------------------------------------------------------------|
| i.    | Upto 5 HP motors/ 5 KW heaters                      | 3x4 sq.mm copper conductor wires.                          |
| ii.   | From 6 HP to 10 HP motors<br>6 KW to 7.5 KW heaters | 3x 6 sq.mm copper conductor wires.                         |
| iii.  | From 12.5 HP to 15 HP motors                        | 2 Nos. 3 x 6 sq. mm copper conductor wires                 |
| iv.   | From 20 HP to 25 HP motors                          | 2 Nos. 3 x 10 sq. mm copper conductor wires                |
| v.    | From 30 HP to 35 HP motors                          | 2 nos. 3 x 16 sq. mm aluminium conductor armoured cable.   |
| vi.   | From 40 HP to 50 HP motors                          | 2 Nos. 3 x 25 sq. mm. aluminium conductor armoured cable.  |
| vii.  | From 60 HP to 75 HP motors                          | 1 No. 3 x 70 sq. mm aluminium conductor armoured cable.    |
| viii. | 100 HP motors                                       | 1 No. 3 x 150 sq. mm. aluminium conductor armoured cable   |
| ix.   | 150 HP motor                                        | 1 No. 3 x 240 sq. mm. aluminium conductor armoured cable.  |
| x.    | 250 HP motor                                        | 2 Nos. 3 x 240 sq. mm. aluminium conductor armoured cable. |
| xi.   | 400 HP motor                                        | 3 Nos. 3 x 240 sq. mm. aluminium conductor armoured cable. |
| xii.  | 600 HP motor                                        | 3 Nos. 3 x 400 sq. mm. aluminium conductor armoured cable. |

All the switches, contactors, push button stations, indicating lamps shall be distinctly marked with a small description of the service installed. The following capacity contactors and overload relays shall be provided for different capacity motors or as per manufacturer's recommendation.

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TYPE OF CONTACTOR OVERLOAD STARTER CURRENT RELAY CAPACITY RANGE

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|      |           |                      |          |                   |
|------|-----------|----------------------|----------|-------------------|
| 5    | HP Motors | D O L                | 16 amps  | 6-10 amps         |
| 7.5  | HP motors | D O L                | 16 amps  | 9-15 amps         |
| 10   | HP Motors | D O L                | 25 amps  | 9-15 amps         |
| 12.5 | HP Motors | Automatic Star Delta | 16 amps  | 9-15 amps         |
| 15   | HP Motors | Automatic Star Delta | 25 amps  | 9-15 amps         |
| 20   | HP Motors | Automatic Star Delta | 32 amps  | 14-23 amps        |
| 25   | HP Motors | Automatic Star Delta | 32 amps  | 14-23 amps        |
| 30   | HP Motors | Automatic Star Delta | 40 amps  | 20-33 amps        |
| 35   | HP Motors | Automatic Star Delta | 40 amps  | 20-33 amps        |
| 40   | HP Motors | Automatic Star Delta | 40 amps  | 30-50 amps        |
| 50   | HP Motors | VFD / soft           | 70 amps  | 30-50 amps        |
| 60   | HP Motors | VFD/ soft            | 110 amps | 30-50 amps        |
| 75   | HP Motors | VFD / soft           | 110 amps | 90-150 amps       |
| 100  | HP Motors | VFD / soft           | 200 amps | CT operated relay |
| 125  | HP Motors | VFD / soft           | 200 amps | CT operated relay |
| 150  | HP Motors | VFD / soft           | 200 amps | CT operated relay |
| 150  | HP Motors | VFD / soft           | 300 amps | CT operated relay |
| 200  | HP Motors | VFD / soft           | 300 amps | CT operated relay |
| 250  | HP Motors | VFD / soft           | 400 amps | CT operated relay |
| 300  | HP Motors | VFD / soft           | 400 amps | CT operated relay |
| 400  | HP Motors | VFD / soft           | 600 amps | CT operated relay |
| 600  | HP Motors | VFD / soft           | 900 amps | CT operated relay |

Two speed motors when specified, shall be provided with DOL starter irrespective of it rating.

### **CABLE TRAYS**

Ladder and perforated type Cable Trays shall be of Hot dip Galvanized type and factory fabricated out of CRCA sheet with standard accessories like tee, bends, couplers etc. for different loads and number and size of cables as given below :

Cable trays shall be galvanized as per Specifications..

- a. 1500 mm wide  
Runners 25 x 100 x 25 x 3 mm  
Rungs 2# 20 x 40 x 20 x 3 mm 250 mm C/C  
Suspenders 2 Nos. 40 x 40 x 5 mm GI angle 1500 mm C/C with base support of 40x 40 x 5mm GI angle.
- b. 1200 mm wide  
Runners 25 x 100 x 25 x 3 mm  
Rungs 2# 20 x 40 x 20 x 3 mm 250 mm C/C  
Suspenders 2 Nos. 40 x 40 x 5 mm GI angle 1500 mm C/C with base support of 40x 40 x 5mm GI angle.
- c. 1000 mm wide  
Runners 25 x 100 x 25 x 3 mm  
Rungs 2# 20 x 40 x 20 x 3 mm 250 mm C/C

Suspenders 2 Nos. 40 x 40 x 5 mm GI angle 1500 mm C/C with base support of 40x 40 x 5mm GI angle.

- d. 750 mm wide  
Runners 20 x 75 x 20 x 2.5 mm  
Rungs 20 x 30 x 20 x 2.5 mm 250 mm C/C  
Suspenders 2 Nos. 32 x 32 x 5 mm GI angle 1800 mm C/C with base support of 40x 40 x 5mm GI angle.
- e. 600 mm wide  
Runners 20 x 75 x 20 x 2.5 mm  
Rungs 20 x 30 x 20 x 2.5 mm 250 mm C/C  
Suspenders 2 Nos. 32 x 32 x 5 mm GI angle 1800 mm C/C with base support of 40x 40 x 5mm GI angle.
- f. 450 mm wide  
Runners 20 x 75 x 20 x 2.5 mm  
Rungs 20 x 30 x 20 x 2.5 mm 250 mm C/C  
Suspenders 2 Nos. 25 x 25 x 4 mm GI angle 1800 mm C/C with base support of 40x 40 x 5mm GI angle.
- g. Supply and fixing of perforated type cable trays of the following sizes of pre-galvanized iron.
  - i. 600 x 40 x 40 x 2 mm thick
  - i. 450 x 40 x 40 x 2 mm thick
  - i. 300 x 40 x 40 x 2 mm thick
  - ii. 150 x 40 x 40 x 2 mm thick

**Note:** Suitable length of 10 mm dia GI rod suspenders at 1800 mm interval shall be included in the item for perforated type cable tray.

### **SPECIFICATION FOR HOT DIP GALVANIZING PROCESS**

(for Mild Steel Used For Earthing, Cable Trays Or Junction Boxes For Electrical Installation.)

#### General Requirements

##### I. Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS:209-1992.

##### II. Coating Requirement

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square metre shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth, and free from imperfections as flux, ash, and dross inclusions, bare patches black spots, pimples, lumpiness, runs, rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing.

### **FIRE RETARDANT CABLE PAINT & FIRE BARRIER**

The fire retardant paint / barrier shall be listed by independent test agencies such as UL, FM or OPL and be tested to, and pass the criteria of ASTM E 814 ( UL1479) standard test method for fire test through- penetration fire stops and ASTM E 1996 ( UL 2079) standard test method for fire resistive joint system/

#### **Fire retardant cable Paint**

The Fire resistant cable coating / painting shall be intumescent / ablative, water based compound, and the coating shall expand up to 10 times, supplied in a manufacturer seal container indicating manufacturing and expiry dates. The coating material shall be non-toxic, asbestos free, & halogen free and shall have good mechanical strength. The color of paint shall be white and density of coating shall be 1.3kg/ltr , coating shall have a snap time of 30 minutes, the expansion shall begin at 230 deg.C and it shall have a oxygen index of 41%.

Coating shall be applied by ordinary paint brush after cleaning the cables of dust and oil deposition. A minimum textured finish of 3 mm wet film thickness shall be achieved by applying the material in 2-3 layers leaving intervals of 2 to 8 hours depending upon the moisture and thickness, moisture and temperature hours between each coat.

#### **Fire Barrier sheet for floor and wall sealing**

The framing & fixing part of fire barrier sheet shall be very simple & directly fixed around walls & floors by help of anchored bolts & washer. For 2 hour fire rating the fire barrier sheet shall be minimum 7.62 mm thick and shall be cut as per the profile of penetration and opening. The small gap left around the penetration shall be closed with fire rated soft & mouldable putty. Fire barrier must be design on the intumescent technology to seal larger penetration through the fire rated walls & floors. Fire barrier must be a composite construction with the quality incorporated with organic/ inorganic fire resistive elastomeric sheet with specific gravity of 1.6 gm/ cubic centimeter.

**TESTING OF CABLES** : Cables shall be tested at works for all routine tests as per IS including the following tests before being dispatched to site by the project team.

- a) Insulation Resistance Test.
- b) Continuity resistance test.
- c) Sheathing continuity test.
- d) Earth test.(in armoured cables)
- e) Hi Pot Test.

Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing. On completion of cable laying work, the following tests shall be conducted in the presence of the Owner's site representative.

- a) Insulation Resistance Test( Sectional and overall)
- b) Continuity resistance test.
- c) Sheathing continuity test.
- d) Earth test.

All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules. The Contractor shall provide necessary instruments, equipment and labor for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Owner's site representative, results will be noted and signed by all present and record be maintained.

## **EARTHING**

Earthing shall be provided in accordance with IS : 3043 – 1987 and shall be copper strips /wires .The main panel shall be connected to main earthing system of the power supply. All single phase metal clad switches and control panels be earthed with minimum 3 mm diameter copper conductor wire. All 3 phase motors and equipment shall be earthed with 2 numbers distinct and independent copper wires / tapes as follows:

- |      |                                        |                                   |
|------|----------------------------------------|-----------------------------------|
| i.   | Motor upto and including 10 HP rating. | 2 Nos. 3 mm dia copper wires.     |
| ii.  | Motor 12.5 HP to 40 HP capacity.       | 2 Nos. 4 mm dia copper wires.     |
| iii. | Motor 50 to 75 HP capacity.            | 2 Nos. 6 mm dia copper            |
| iv.  | Motor above 75 HP.                     | 2 Nos. 25 mm x 3 mm copper tapes. |

All switches shall be earthed with two numbers distinct and independent copper wires' tapes as follows:

- |      |                                                                     |                                   |
|------|---------------------------------------------------------------------|-----------------------------------|
| i.   | 3 phase switches and control panels upto 60 amps rating.            | 2 nos. 3 mm dia copper wires.     |
| ii.  | 3 phase switches, and control panels 63 amps to 100 amps rating.    | 2 Nos. 4 mm dia copper wires.     |
| iii. | 3 phase switches and control panels 125 amps to 200 amps rating.    | 2 Nos. 6 mm dia copper wires.     |
| iv.  | 3 phase switches, control panels, bus ducts, above 200 amps rating. | 2 Nos. 3 mm x 25 mm copper tapes. |

The earthing connections shall be tapped off from the main earthing of electrical installation. The overlapping in earthing strips at joints where required shall be minimum 75 mm. These straight joints shall be riveted with brass rivets & brazed in approved manner. Sweated lugs of adequate capacity and size shall be used for all termination of wires. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance, and properly tinned.

## **DRAWINGS**

Shop drawings for control panels and for wiring of equipment showing the route of conduit & cable shall be submitted by the contractor for approval of Architect/Consultant before starting the fabrication of panel and starting the work. On completion, four sets of complete "As-installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. Shall be furnished by the Contractor.

### **TESTING**

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS codes and test report furnished by a qualified and authorized person. The entire electrical installation shall be gotten approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Owner's site representative. Testing of the panels shall be as per relevant BIS Codes :

### **PAINTING**

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be baked in an oven. The finishing treatment shall be by application of powder coating of approved shade.

### **MEASUREMENT OF ELECTRICAL CONTROL PANELS**

Panels shall be counted as number of units. Quoted rates shall include as lump sum (NOT measurable lengths) for all internal wiring, power wiring and earthing connections from the control panel to the starter and to the motor, control wiring for interlocking, power and control wiring for automatic and safety controls, and control wiring for remote start/stop as well as indication as per the specifications. The quoted rate of panel shall also include all accessories, switchgear, contactors, indicating meters and lights as per the Specifications and Schedule of Quantities.

### **RUBBER MAT**

Rubber mat shall be provided in front to cover the full length of all panels. Where back space is provided for working from the rear of the panel, rubber mat shall also be provided at the back of the panel also to cover the full length of panel. Rubber mats provided shall be as per IS 15652-2006



**ELECTRICAL TECHNICAL DATA SHEETS****For MCC +PDBs+MLDBs/SLDBs/DBs ( To be filled by the bidders)**

| S. No. | Description                                       | Recommended Specification                                                                                         | Confirmation by the Bidders |
|--------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1      | Type of Panel                                     | a. MCC non drawout type compartmentalized.<br><br>b. AHU Panels non drawout type, non compartmentalized           |                             |
| 2      | Type of Mounting                                  | Free standing Floor Mounted                                                                                       |                             |
| 3      | Fault kA                                          | 50kA -1 Sec for MCC<br>25kA – 1 Sec for AHU Panels                                                                |                             |
| 4      | Thickness of CRCA sheets                          |                                                                                                                   |                             |
| a      | Structural members                                | 3mm                                                                                                               |                             |
| b      | Covers and doors                                  | 2mm                                                                                                               |                             |
| c      | Base channel                                      | MCC - ISMC 100                                                                                                    |                             |
| d      | Gland plate                                       | 3mm                                                                                                               |                             |
| 5      | Painting/ Process                                 | Synthetic Enamel Paint<br>As per seven tank process<br>Oven baked.                                                |                             |
| b      | Paint shade;                                      |                                                                                                                   |                             |
| a.     | Inside                                            | RAL – 7032                                                                                                        |                             |
| b.     | Outside                                           | RAL - 7032                                                                                                        |                             |
| 6      | Details of busbars                                | Electrolytic grade Copper of specified rating for details see constructional features mentioned in specifications |                             |
| 7      | Cable Entry                                       | For MCC & AHU Panels<br>Top or Bottom depending upon location of Panel.                                           |                             |
| 8      | Enclosure Protection/ Ventilation                 | For MCC – IP -52 with louvers Ventilation.                                                                        |                             |
| 9      | Control Wiring/Power Wiring                       | Insulated 660Volts Cu wire.                                                                                       |                             |
| a.     | Voltage Circuit                                   | 1.5 sq mm                                                                                                         |                             |
| b.     | Current Circuit                                   | 2.5 sq mm                                                                                                         |                             |
| c.     | Minimum size of Power wiring CKt                  | 16 sq mm                                                                                                          |                             |
| 10     | Maximum Operating Height                          | 2100                                                                                                              |                             |
| 11     | Mounting height of Relays/Meters Control Switches | Range 350mm to 1900mm                                                                                             |                             |

**Constructional Features for MCC**

| S. No. | Description                    | Recommended Specification                                                                                                                                                                      | Confirmation By the Bidders |
|--------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1      | MCC                            |                                                                                                                                                                                                |                             |
| a.     | Busbar Chamber                 | 400mm ht                                                                                                                                                                                       |                             |
| b.     | Metering Chamber               | 400mm ht                                                                                                                                                                                       |                             |
| c.     | Incoming Compartment           | 1000mm wide Module<br>Single Tier                                                                                                                                                              |                             |
| d.     | Overall Height                 | 2100 mm                                                                                                                                                                                        |                             |
| e.     | Overall Depth                  | 1300 & 900 mm                                                                                                                                                                                  |                             |
| f.     | Overall Length                 | ( To be indicated by the bidder)                                                                                                                                                               |                             |
| g.     | Construction                   | IP-52 with louvers for ventilation                                                                                                                                                             |                             |
| h.     | Current Density                | 1.25 Amp / Sq.mm                                                                                                                                                                               |                             |
|        | Main Bus                       | 1.75 Amp / Sq.mm                                                                                                                                                                               |                             |
|        | Branch Bus Rating              | 75% of aggregate<br>Switches connected.<br>1.25 Amp / Sq.mm Density                                                                                                                            |                             |
|        | Neutral Bus                    | Half of the size of phase bus                                                                                                                                                                  |                             |
|        | Earth Bus                      | Half of the size of phase bus                                                                                                                                                                  |                             |
| i.     | Incoming and outgoing feeders. | As per SLD                                                                                                                                                                                     |                             |
| 2      | AHU Panels                     |                                                                                                                                                                                                |                             |
| a.     | Accessibility                  | front accessible only                                                                                                                                                                          |                             |
| b.     | Overall Depth                  | 300 mm                                                                                                                                                                                         |                             |
| c.     | Overall Height                 | 700 mm                                                                                                                                                                                         |                             |
| d.     | Incoming compartment           | Individually one module of 600mm wide with direct entry of incoming cables with cable busbars for terminating multiple incoming cable. incoming metering units and outgoing cables as per SLD. |                             |

## **VARIABLE FREQUENCY DRIVES FOR HVAC SYSTEMS**

### **GENERAL REQUIREMENTS**

- 1.1 This specification covers complete variable frequency drives (Vedas) designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD.
- 1.2 The frequency converter shall not be a general purpose product, but a dedicated HVAC engineered product.
- 1.3 The VFD and its options shall be factory mounted and tested as a single unit under full load before dispatch.
- 1.4 The VFD shall be tested to UL 508C. The appropriate UL label shall be applied.
- 1.5 The VFD shall be CE marked and conform to the European Union Electro Magnetic Compatibility directive.
- 1.6 The VFD shall be UL listed for a short circuit current rating of 100 kA and labeled with this rating.

### **TECHNICAL REQUIREMENTS**

The VFD shall convert incoming fixed frequency three-phase AC power into an adjustable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for the driven load and to eliminate the need for motor derating.

When properly sized, the VFD shall allow the motor to produce full rated power at rated motor voltage, current, and speed without using the motor's service factor. Vedas utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

VFD shall be installed within panel, suitable for operating conditions.

The VFD shall include an input full-wave bridge rectifier and maintain a fundamental (displacement) power factor near unity regardless of speed or load.

The VFD shall have a dual 5% impedance DC link reactor (harmonic filters) on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable.

Vedas with saturating (non-linear) DC link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.

IEEE519, 1992 recommendations shall be used for the basis of calculation of total harmonic distortion (THD) at the point of common coupling (PCC). On request VFD manufacturer shall provide THD figures for the total connected load. The contractor shall provide details of supply transformer rating, impedance, short circuit current, short circuit impedance etc to allow this calculation to be made.

All Vedas shall contain integral EMC Filters to attenuate Radio Frequency Interference conducted to the AC power line. The Vedas shall comply with the emission and immunity requirements of IEC 61800-3: 2004, Category C1 with 50m motor cable (unrestricted distribution). The suppliers of Vedas shall include additional EMC filters if required to meet compliance to this requirement.

The Veda's full load output current rating shall meet or exceed the normal rated currents of standard IEC induction motors. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.

The VFD shall provide full motor torque at any selected frequency from 20 Hz to base speed while providing a variable torque V/Hz output at reduced speed. This is to allow driving direct drive fans without high speed derating or low speed excessive magnetization, as would occur if a constant torque V/Hz curve was used at reduced speeds. Breakaway current of 160% shall be available.

A programmable automatic energy optimization selection feature shall be provided as standard in the VFD. This feature shall automatically and continuously monitor the motor's speed and load to adjust the applied voltage to maximize energy savings.

The VFD must be able to produce full torque at low speed to operate direct driven fans.

Output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD.

An Automatic Motor Adaptation algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to perform the test.

galvanic isolation shall be provided between the Veda's power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. Vedas not including either galvanic or optical isolation on both analog I/O and discrete digital I/O shall include additional isolation modules.

VFD shall minimize the audible motor noise through the used of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD operation while reducing motor noise. Vedas with fixed carrier frequency are not acceptable.

The VFD shall allow up to at least 100 meters of SWA (Single Wire Armour) cable to be used between the FC and the motor and allow the use of MICS (Mineral Insulated Copper Sheath) cable in the motor circuit for fire locations.

## **PROTECTIVE FEATURES**

A minimum of Class 20 I<sup>2</sup>t electronic motor overload protection for single motor applications shall be provided. Overload protection shall automatically compensate for changes in motor speed.

Protection against input transients, loss of AC line phase, output short circuit, output ground fault, over voltage, under voltage, VFD over temperature and motor over temperature. The VFD shall display all faults in plain language. Codes are not acceptable.

Protect VFD from input phase loss. The VFD should be able to protect itself from damage and indicate the phase loss condition. During an input phase loss condition, the VFD shall be able to be programmed to either trip off while displaying an alarm, issue a warning while running at reduced output capacity, or issue a warning while running at full commanded speed. This function is independent of which input power phase is lost.

Protect from under voltage. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD will continue to operate with reduced output, without faulting, with an input voltage as low as 70% of the nominal voltage.

VFD shall include current sensors on all three output phases to accurately measure motor current, protect the VFD from output short circuits, output ground faults, and act as a motor overload. If an output phase loss is detected, the VFD will trip off and identify which of the output phases is low or lost.

If the temperature of the Veda's heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. It shall also be possible to program the VFD so that it reduces its output current limit value if the VFD's temperature becomes too high.

In order to ensure operation during periods of overload, it must be possible to program the VFD to automatically reduce its output current to a programmed value during periods of excessive load. This allows the VFD to continue to run the load without tripping.

The VFD shall have temperature controlled cooling fan(s) for quiet operation, minimized losses, and increased fan life. At low loads or low ambient temperatures, the fan(s) may be off even when the VFD is running.

Protect from output switching : The VFD shall be fully protected from switching a contactor / isolator at the output with out causing tripping e.g.: for switching on/off the isolators of the AHU / ventilation fans.

The VFD shall store in memory the last 10 alarms. A description of the alarm, and the date and time of the alarm shall be recorded.

When used with a pumping system, the VFD shall be able to detect no-flow situations, dry pump conditions, and operation off the end of the pump curve. It shall be programmable to take appropriate protective action when one of the above situations is detected.

## **INTERFACE FEATURES**

Hand, Off and Auto keys shall be provided on the control panel to start and stop the VFD and determine the source of the speed reference. It shall be possible to either disable these keys or password protect them from undesired operation.

There shall be an "Info" key on the keypad. The Info key shall include "on-line" context sensitive assistance for programming and troubleshooting.

The VFD shall be programmable to provide a digital output signal to indicate whether the VFD is in Hand or Auto mode. This is to alert the Building Automation System whether the VFD is being controlled locally or by the Building Automation System.

Password protected keypad with alphanumeric, graphical, backlit display can be remotely mounted. Two levels of password protection shall be provided to guard against unauthorized parameter changes.

All VFDs shall have the same customer interface. The keypad and display shall be identical and interchangeable for all sizes of VFDs.

To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFD's keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters. Keypad shall provide visual indication of copy status.

Display shall be programmable to communicate in multiple languages including English, Chinese, Korean, Japanese, Thai and Indonesian.

A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.

A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD. The VFD shall also have individual Fan, Pump, and Compressor menus specifically designed to facilitate start-up of these applications.

A three-feedback PID controller to control the speed of the VFD shall be standard.

This controller shall accept up to three feedback signals. It shall be programmable to compare the feedback signals to a common setpoint or to individual setpoints and to automatically select either the maximum or minimum deviating signal as the controlling signal. It shall also be possible to calculate the controlling feedback signal as the average of all feedback signals or the difference between a pair of feedback signals.

The VFD shall be able to apply individual scaling to each feedback signal.

For fan flow tracking applications, the VFD shall be able to calculate the square root of any or all individual feedback signals so that a pressure sensor can be used to measure air flow.

The VFD's PID controller shall be able to actively adjust its setpoint based on flow. This allows the VFD to compensate for a pressure feedback sensor which is located near the output of the pump rather than out in the controlled system.

The VFD shall have three additional PID controllers which can be used to control damper and valve positioners in the system and to provide setpoint reset.

Floating point control interface shall be provided to increase/decrease speed in response to contact closures.

Five simultaneous meter displays shall be available. They shall be selectable from (at a minimum), frequency, motor current, motor voltage, VFD output power, VFD output energy, VFD temperature in degrees, feedback signals in their own units, among others.

Programmable Sleep Mode shall be able to stop the VFD. When its output frequency drops below set "sleep" level for a specified time, when an external contact commands that the VFD go into Sleep Mode, or when the VFD detects a no-flow

situation, the VFD may be programmed to stop. When the VFD's speed is being controlled by its PID controller, it shall be possible to program a "wake-up" feedback value that will cause the VFD to start. To avoid excessive starting and stopping of the driven equipment, it shall be possible to program a minimum run time before sleep mode can be initiated and a minimum sleep time for the VFD.

A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of initiating an output "run request" signal to indicate to the external equipment that the VFD has received a request to run.

VFD shall be programmable to display feedback signals in appropriate units, such as inches of water column (in-wg), pressure per square inch (psi) or temperature (°F). Examples can be room temperature in °C, return air temperature in °C, supply air temperature in °C, CO<sub>2</sub> concentration in ppm, pressure in bar, differential pressure in PSI etc.

VFD shall be programmable to sense the loss of load. The VFD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. To ensure against nuisance indications, this feature must be based on motor torque, not current, and must include a proof timer to keep brief periods of no load from falsely triggering this indication.

#### Standard Control and Monitoring Inputs and Outputs

Four dedicated, programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.

Two terminals shall be programmable to act as either as digital outputs or additional digital inputs.

Two programmable relay outputs, Form C 240 V AC, 2 A, shall be provided for remote indication of VFD status.

Each relay shall have an adjustable on delay / off delay time.

Two programmable analog inputs shall be provided that can be either direct-or-reverse acting.

Each shall be independently selectable to be used with either an analog voltage or current signal.

The maximum and minimum range of each shall be able to be independently scalable from 0 to 10 V dc and 0 to 20 mA.

A programmable low-pass filter for either or both of the analog inputs must be included to compensate for noise.

The VFD shall provide front panel meter displays programmable to show the value of each analog input signal for system set-up and troubleshooting,

One programmable analog current output (0/4 to 20 mA) shall be provided for indication of VFD status. This output shall be programmable to show the reference or feedback signal supplied to the VFD and for VFD output frequency, current and power. It shall be possible to scale the minimum and maximum values of this output.

It shall be possible to read the status of all analog and digital inputs of the VFD through serial bus communications.

It shall be possible to command all digital and analog output through the serial communication bus.

#### Optional Control and Monitoring Inputs and Outputs

It shall be possible to add optional modules to the VFD in the field to expand its analog and digital inputs and outputs.

These modules shall use rigid connectors to plug into the VFD's control card.

The VFD shall automatically recognize the option module after it is powered up. There shall be no need to manually configure the module.

Modules may include such items as:

Additional digital outputs, including relay outputs

Additional digital inputs

Additional analog outputs

Additional analog inputs, including Ni or Pt temperature sensor inputs

It shall be possible through serial bus communications to control the status of all optional analog and digital outputs of the VFD.

Standard programmable firefighter's override mode allows a digital input to control the VFD and override all other local or remote commands. It shall be possible to program the VFD so that it will ignore most normal VFD safety circuits including motor overload. The VFD shall display FIREMODE whenever in firefighter's override mode. Firemode shall allow selection of forward or reverse operation and the selection of a speed source or preset speed, as required to accommodate local fire codes, standards and conditions.

A real-time clock shall be an integral part of the VFD.

It shall be possible to use this to display the current date and time on the VFD's display.

Ten programmable time periods, with individually selectable ON and OFF functions shall be available. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter setpoints and output relays. It shall be possible to program unique events that occur only during normal work days, others that occur only on non-work days, and others that occur on specific days or dates. The manufacturer shall provide free PC-based software to set up the calendar for this schedule.

All VFD faults shall be time stamped to aid troubleshooting.

It shall be possible to program maintenance reminders based on date and time, VFD running hours, or VFD operating hours.

The real-time clock shall be able to time and date stamp all faults recorded in the VFD fault log.



The VFD shall be able to store load profile data to assist in analyzing the system demand and energy consumption over time.

The VFD shall include a sequential logic controller to provide advanced control interface capabilities. This shall include:

Comparators for comparing VFD analog values to programmed trigger values

Logic operators to combine up to three logic expressions using Boolean algebra

Delay timers

The VFD shall include a Cascade Controller which allows the VFD to operate in closed loop set point (PID) control mode one motor at a controlled speed and control the operation of 3 additional constant speed motor starters.

### **SERIAL COMMUNICATIONS**

The VFD shall include a standard EIA-485 communications port and capabilities to be connected to the following serial communication protocols at no additional cost and without a need to install any additional hardware or software in the VFD:

Metasys N2  
Modbus RTU

VFD shall have standard USB port for direct connection of Personal Computer (PC) to the VFD. The manufacturer shall provide no-charge PC software to allow complete setup and access of the VFD and logs of VFD operation through the USB port. It shall be possible to communicate to the VFD through this USB port without interrupting VFD communications to the building management system.

The VFD shall have provisions for an optional 24 V DC back-up power interface to power the VFD's control card. This is to allow the VFD to continue to communicate to the building automation system even if power to the VFD is lost.

### **ADJUSTMENTS**

The VFD shall have a manually adjustable carrier frequency that can be adjusted in 0.5 kHz increments to allow the user to select the desired operating characteristics. The VFD shall also be programmable to automatically reduce its carrier frequency to avoid tripping due to thermal loading.

Four independent setups shall be provided.

Four preset speeds per setup shall be provided for a total of 16.

Each setup shall have two programmable ramp up and ramp down times. Acceleration and deceleration ramp times shall be adjustable over the range from 1 to 3,600 seconds.

Each setup shall be programmable for a unique current limit value. If the output current from the VFD reaches this value, any further attempt to increase the current produced by the VFD will cause the VFD to reduce its output frequency to reduce the load on the VFD. If desired, it shall be possible to program a timer which will cause the VFD to trip off after a programmed time period.

If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: external interlock, under-voltage, over-voltage, current limit, over temperature, and VFD overload.

The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.

An automatic "start delay" may be selected from 0 to 120 seconds. During this delay time, the VFD shall be programmable to either apply no voltage to the motor or apply a DC braking current if desired.

Four programmable critical frequency lockout ranges to prevent the VFD from operating the load at a speed that causes vibration in the driven equipment shall be provided. Semi-automatic setting of lockout ranges shall simplify the set-up.

### **OPTIONAL FEATURES**

All optional features shall be built and mounted by VFD manufacturer as an inbuilt factory solution. All optional features shall be UL listed by the VFD manufacturer as a complete assembly and carry a UL label.

### **SERVICE CONDITIONS**

Ambient temperature at full speed, full load operation with continuous drive rated output current:

10 to 45°C for ratings upto 90 kW without derating

10 to 40°C for ratings 110 kW and higher without derating

Relative Humidity : 0 to 95%, non-condensing.

Elevation : Up to 3,300 feet without derating.

AC line voltage variation :  $\pm$  10% of nominal with full output.

VFD Enclosure protection : IP 55, integral, with no additional cabinets.

Side Clearances : No side clearance shall be required for cooling.

All power and control wiring shall be done from the bottom.

All VFDs shall be plenum rated.

### **QUALITY ASSURANCE**

To ensure quality, the complete VFD shall be tested by the manufacturer. The VFD shall drive a motor connected to a dynamometer at full load and speed and shall be cycled during the automated test procedure.

All optional features shall be functionally tested at the factory for proper operation.

## **TESTING, COMMISSIONING AND FORMAL ACCEPTANCE**

### **Connecting, Commissioning and Adjustments**

The tests, commissioning and adjustment of each item of equipment shall be recorded in a report, which shall be included with the as-built documentation.

The adjustment and testing operations shall comprise at least the following operations:

- Balancing of the air systems
- Checking for air flow rates at all air supply grilles.
- Checking for absence of leaks or of unplugged connections on the ducts
- Checking of noise levels
- Adjustment of air handling units, or extract casings
- Complete adjustment of the regulation
- Checking the operation of all the limit switch contacts, levels, etc.
- Operating tests with the installation running permanently for two days under nominal monsoon, summer and winter conditions:

Compliance with specified temperatures during occupied periods (temperatures measured at the centre of the rooms using a sling psychrometer).

The contractor shall provide as-built drawings indicating the locations of the measuring points, the method of measurement used for the tests and the technical environment of the equipment tested (technical equipment located nearby that could affect the results).

### **Formal acceptance**

After the technical acceptance tests, the Engineer-in-charge will inspect the installation and may grant formal acceptance, provided that:

- The works are completed
- The technical acceptance inspection has given satisfactory results
- The premises have been cleaned.

If differences between the expected technical results and those obtained are not numerous, they may be listed as reserves at handover. If they are general, handover shall be delayed while awaiting corrective measures to be implemented by the constructors.

Handover shall be confirmed if the inspection report by the official organisations responsible for checking that the installation complies with safety requirements does not include major reserves.

## **Documentation**

### **As-built documentation**

- The contractor shall submit the following document at the completion stage of work.
- The as-built drawings
- The technical instructions for the items of equipment installed
- A set of maintenance documentation (regular systematic work to be carried out on the equipment and its frequency).

### **Training of operating staff**

The staff responsible for the operation and maintenance of the installation must be advised how it works. They must be given suitable training, which may require the participation of specialist staff and of the suppliers of the equipment.

### **Mode of Measurement:**

#### **1.1 Measurements of Sheet Metal Ducts, Grilles / Diffusers etc.**

Unless otherwise specified, measurements for ducting for the project shall be on the basis of centre-line measurements described herewith:

**1.2 Duct Work** shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the centre of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections. Plenums shall also be measured in similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the centre line distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centre line.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 3 mm thick between duct and support, vibration isolator suspension where required, inspection chamber / access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other

accessories required to complete the duct installation as per the Specifications. These accessories shall NOT be separately measured nor paid for.

1.3 Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith:

a) Grilles, registers & diffusers - cross section area for air flow at discharge area, excluding flanges. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted. The supply air plenum for linear diffusers shall be measured with ducting as described earlier. Linear slot diffusers shall be measured as per actual length in meters.

a) Fire / Smoke dampers - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators, fusible link / solenoid and panel. No special allowance shall be payable for extension of cross section outside the air stream.

#### **1.4 Insulation:**

##### **1.4.1 Ducts & Acoustic Duct Lining**

Duct Insulation & Acoustic Lining shall be measured on the basis of surface area along the centre line of insulation thickness through all dampers, flanges and fittings. Thus the surface area of externally thermally insulated or acoustically lined duct shall be based on the perimeter at the centre of thickness of insulation, multiplied by the centre line length of ducting including tapered pieces, bends, tees, brand etc. as measured for bare ducting. Measurements for the dampers, flanges, fittings shall be for the surface dimension for the connecting duct, nothing extra over the above shall be payable for insulation over dampers, flanges and fittings in duct routing.

##### **1.4.2 Insulated Piping:**

Payments shall be on the same basis as for uninsulated pipe, and the linear rate per meter shall include all the items as in uninsulated piping plus the cost of pipe insulation (with plaster where provided). The linear measurement shall be taken before the application of insulation.

##### **1.4.3 Duct Insulation:**

The item is provided separately for various thickness and shall be paid for on area basis of uninsulated shall be measured before application of insulation.

##### **1.4.4 Painting:**

Painting of all supports and fittings shall be included with the cost of these items. Nothing extra shall be paid for this work.

## TEST READINGS & TESTS AT SITES

### Test readings shall be submitted as follows:

| -----   |                              | -----                            |                     |
|---------|------------------------------|----------------------------------|---------------------|
| Sl. No. | Item                         | Test Results                     |                     |
| -----   |                              | -----                            |                     |
| 1.      | Evaporators and Indoor units | Air quantity                     | (C.F.M.)            |
| B)      |                              | Air temperature - entering       | (°C. D. B), (°C. W. |
| B)      |                              | Air temperature - leaving        | (°C. D. B), (°C. W. |
|         |                              | Motor power consumption          | (Amps)              |
| 2.      | Outdoor Units                | Refrigerant gas suction pressure | (Kg/ Sq. cm)        |
|         |                              | "temp                            | (°C)                |
|         |                              | "discharge pressure              | (Kg/ Sq. cm)        |
|         |                              | "temp.                           | (°C)                |
|         |                              | Motor power consumption          | (Amps)              |
| 3.      | Indoor Units                 |                                  |                     |
|         |                              | Air quantity supply              | (C.F.M.)            |
|         |                              | Air quantity exhausts            | (C.F.M.)            |
| B)      |                              | Air temperature - entering       | (°C. D. B), (°C. W. |
| B)      |                              | Air temperature - fresh          | (°C. D.B) , (°C. W. |
| B)      |                              | Air temperature - supply         | (°C. D. B), (°C. W. |
|         |                              | Motor power consumption          | (Amps)              |

### LIST OF APPROVED MAKES OF MATERIAL FOR HVAC WORK

| Details of Materials / Equipment                                                      | Manufacturer's Name                                                                          |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Motor Control Centre & Bus Ducts                                                      | Adlec System Pvt Ltd Advance Panels & Switchgear<br>Tricolite/Milestone/SPC                  |
| Motor                                                                                 | ABB/Siemens/Bharat Bijlee/Kirloskar                                                          |
| Starter                                                                               | ABB/Allen Bradley/Schneider/Siemens/Kirloskar/L&T                                            |
| Variable Frequency Drive (VFD)                                                        | ABB/Danfoss/Siemens/VACON                                                                    |
| Air Circuit Breaker ( 3/4 Pole )<br>(Select any one range only)                       | ABB(E-Max)/L&T(U-Power)/Schneider Electric<br>(Master Pact NW)/Siemens (3 WL)                |
| Moulded Case Circuit Breaker (MCCB)                                                   | ABB (T-Max)/MDS Legrand/L&T (D-Shine)/<br>Schneider Electric (Compact NS)/Siemens (3 VL)     |
| Motor Protection Circuit Breaker(MPCB)                                                | Siemens/Hager(Marketed by L&T)/Schneider Electric/ABB                                        |
| Miniature Circuit Breakers (MCB)                                                      | Siemens/Hager (L&T)/Havells (Export Range)/<br>Schneider Electric –(Multi 9)/ABB/MDS Legrand |
| Residual Current Circuit Breaker (RCCB)                                               | ABB/ Hager (L&T)/ MDS Legrand/<br>Schneider Electric (Multi 9)Siemens                        |
| Power/Aux. Contactor                                                                  | ABB/Larsen & Toubro/Schneider Electric /Siemens                                              |
| Change Over Switch                                                                    | H H Elcon/HPL – Socomec/Larsen & Toubro                                                      |
| Control Transformer/Potential Transformers                                            | Automatic Electric/ Gilbert & Maxwell                                                        |
| Current Transformer (Epoxy Cast Resin)                                                | Automatic Electric/ Gilbert & Maxwell                                                        |
| PROTECTION RELAY<br>a. Numeric Type<br>b. Electromagnetic Type                        | ABB/Areva                                                                                    |
| Indicating Lamps LED type and Push Button                                             | Altos/GE Power Controls/Larsen & Toubro (ESBEE)/<br>Schneider Electric (MG)                  |
| Overload relays with built in Single Phase<br>preverter                               | ABB /L&T/Schneider Electric (Telemechanique)/ Siemens                                        |
| Electronic Digital Meters<br>(A/V/PF/Hz/KW/KWH) with LED Display                      | ABB/Automatic Electric/Conzerv/L & T/Schneider Electric<br>Secure                            |
| Dual Energy Meter with centralized<br>metering & billing system                       | Actaris /Conserve/Secure                                                                     |
| Prepaid Meters & accessories                                                          | Actaris/Conserve/Secure                                                                      |
| Electromagnetic Meters                                                                | Automatic Electric/Rishabh (L&T)/Conserve                                                    |
| Static Power Meter & Logger (SPML) with RS<br>485 port                                | Conserv/EI measure/Larsen &Toubro/Schneider Electric                                         |
| Autoamtic Power Factor Correction Relay<br>(Numeric Type)                             | Areva/ BELUK (Germany)/ Conzerv/ Ducati/ Siemens                                             |
| Thyristerised APFC Control Panel                                                      | ABB/Ducati /Meher(Larsen & Toubro)/ Power Matrix Solutions<br>/Siemens                       |
| PVC insulated XLPE aluminum/copper<br>conductor armored MV Cables upto 1100V<br>grade | Finolex/ Polycab/ KEI/ Skytone                                                               |
| LT Jointing Kit / Termination                                                         | Raychem/ REPL/ Safe Kit                                                                      |
| Cable Glands Double Compression with<br>earthing links                                | Dowell's/ Comet/ Cosmos                                                                      |
| Bimettalic Cable Lug                                                                  | Comet/ Cosmos/ Dowell's (Biller India)/ Hax Brass<br>(Copper Alloy India)                    |
| PVC insulated copper conductor stranded<br>flexible wires (FRLS) -                    | Finolex/Polycab/Lapp kabel/KEI/Skytone                                                       |

| <b>Details of Materials / Equipment</b>     | <b>Manufacturer's Name</b>                                            |
|---------------------------------------------|-----------------------------------------------------------------------|
| Mettalic Conduit (ISI approved)             | AKG/BEC                                                               |
| PVC Conduit (ISI approved)                  | AKG/BEC/Polypack                                                      |
| INDUSTRIAL SOCKET                           |                                                                       |
| Splash Proof                                | Clipsal /MDS Legrand/ Schneider Electric                              |
| Industrial Socket Metal Clad                | BCH / MDS                                                             |
| Selector Switch, Toggle switch              | Kaycee/ Salzer (Larsen & Toubro)                                      |
| Timer                                       | ABB/BCH/ Larsen & Toubro/ MDS Legrand/<br>Schneider Electric /Siemens |
| Cable Trays (Factory Fabricated) / Raceways | Slotco / Indiana/ Pilco/ Rico Steel                                   |
| Fire Sealant & Fire Retardant Paint         | Birla 3 M/ HILTI/ Promat                                              |
|                                             |                                                                       |

- All ISI marked items shall be supplied with type test certificates suitable to the ratings marked for the application.
- All approved makes shall be supplied with serial nos. cross referred with OEM Approved test certificates.
- All equivalent makes shall be prior approved before dispatch to site by Engineer in charge/ Architect in charge.
- All makes mentioned above and in item description shall further confirm to standard specifications of each items as mentioned in technical specifications of tender documents.



**C.    ADDITIONAL CONDITIONS**

### C. ADDITIONAL CONDITIONS:

1. The contractor shall have to provide his own level instrument for this work.
2. The safety of the traffic and surrounding properties is the prime important factor. As it is the renovation work in existing residential and commercial area the fencing, lighting, covering etc., requires to be provided as per clause 1.1.15. and as per the site requirement. Sign Board shall have to be provided at required locations, so that there will not be any fatal accident.
3. In case of any ambiguity found in inspections / drawings, specifications, etc, the decision of engineer-in-charge shall be final and binding to the contractor.
4. Rates quoted in Bill of Quantities to cover everything necessary for complete Execution of work:

The rates quoted will be held to cover everything necessary of the due and complete execution of the work according to the drawings and the several conditions and the stipulations of the contract, including specification, or the evident intent and meaning of all or either of them or according to customary usage and for the periodical and final inspection and test and proof of the work in every respect and for measuring, numbering or weighing the same including setting out and laying or fixing in position and the provision of all materials,

Power, tool rammers, beaters, labour, tackle platforms with impervious lapped joints for scaffolding ranging rods, straight edges, centering and boxes, wedges, moulds, templates, post straight rails, boning-staves, measuring rods, page boards, shores, barriers, fencing, lighting, pumping apparatus, temporary arrangements of passage of traffic, access to premises and continuance of drainage, water supply and lighting (if interrupted by the work) lard temporary sheds and buildings nahanis roofed in or otherwise haulage, painting, varnishing, polishing, establishments for efficient supervision and watching arrangements for the efficient protection of life and property and all requisite plant, implements and appliances every kind, except only such matter and things as it may be distinctly stated here in are to be supplied by the contractors. A rate for anyone description of work is to be held to include such items of other classes of and for these on separate specific charge will be admitted. The contractors shall keep every portion of the work clear of accumulation from time to time and shall leave every portion of the work clean, clear, perfect and at the

conclusion of whole, providing at their own cost all such material implement appliances and labour as the Engineer may require to prove if it is to be so.

5. The contractors are particularly directed to observe from the Articles of Agreement and the specifications, what is to be included in their rates for the several portions of the work and also under what conditions payments are to be made.
6. The contractor shall have to avail P F Code as per the prevailing Circular of Government for the employees on work. The process for preparation of bill will be taken up only after submission of the Challan for the amount of P.F. deposited every month for the employees on work, which will be binding to the contractor. The required documents shall have to be submitted every month by the contractor to the competent authority.
7. The contractor shall have to get registered under ESI (Employer's State Insurance) Act and obtain ESI Registration number if the number of workers are 10 Nos. or more. Also, the agency shall have to give all the benefits to the workers as available under the ESI Act. The agency should follow all the rules and regulations of ESI Act as per prevailing norms.
8. This office Circular bearing No.RMC/C/329 dated 22-12-2012 and Order No.RMC/C/132 dated 10-06-2013 are uploaded separately as a part of tender document. The Contractors/Consultants quoting their rates shall have to read, implement, and submit the same duly signed along with the documents to be submitted during physical submission.
9. In reference to the above Circular and Order cited para above, the Contractors/Consultant who have quoted their rates for this work will be called in person for verification of original documents. The date and time for verification of original documents will be as prescribed in the tender document.
10. After issuance of work order for this tender, if the work falls under any kind of dispute then Rajkot Municipal Corporation reserves the right to terminate the contract for this work awarded to the contractor or execute part work. The decision of Rajkot Municipal Corporation in this regard will be final and binding to the contractor.
11. Till the Completion Certificate is issued by Rajkot Municipal Corporation, the agency will be the sole responsible for security of material and structure at site.

12. The quantities given in the Schedules are provisional. The Rajkot Municipal Corporation reserves the right to increase or decrease the quantity of work or totally omit any item work and the contractor shall not be entitled to claim any extras or damages on these grounds & he is bound to execute the work as per the instruction of the Engineer-in-charge. Rajkot Municipal Corporation will not entertain any dispute in this regard.
13. It is further clarified that Performance Guarantee (SD) for extra work will also be recovered @ 10% from the bill of extra work i.e. works beyond tender amount.
14. The bidder must understand clearly that the prices quoted are for the totally works or the part of the total works quoted for and include all costs due to materials, labour, equipments, supervision, other services, royalties, taxes, duties, etc., and to include all extra to cover the cost. No claim for additional payment beyond the prices quoted will be entertained and the bidder will not be entitled subsequently to make any claim on any ground.
15. Qualified engineer must be deployed on site and at Plant. The details of qualified engineers are to be given to RMC at the time of bidding of this tender.
16. If any irregularities found during the work then penalty will be imposed by Engineer-in-charge or any higher officer. If any disputes arises regarding penalty imposed by Engineer-in-charge then decision of Municipal Commissioner will be final and binding to agency.
17. The time limit will remain same as mentioned in the tender document and the work is to be completed accordingly.
18. Tender of such Contractor not having registration in appropriate Class and Category, will be treated as non-responsive. In case of any conflicting provisions between registration of appropriate category and Pre-qualification criteria, the later shall govern the process of bid evaluation.
19. The agency shall have to quote their rates only after visiting the site and looking to the site conditions.
20. DEFECTS: Date of completion for start of defect liability period for the entire work will be considered as the last date mentioned in the completion of work recorded in Measurement Book. The contractor shall be required to make good all the damages/ defects identified and conveyed to him, during the entire defect liability period. The

Method and time limit of rectification will be decided by the Engineer in charge. If the contractor fails to carry out rectification as per the instructions, the same will be carried out at his cost and the cost will be recovered from the amount retained.

21. Joint venture shall not be allowed under this tender.
22. After the completion of work, at the interval of every three months, joint inspection must be done by the agency and RMC staff and then agency has to submit the report stating the condition of work to Rajkot Municipal Corporation. The final checking report stating the condition of work is also to be submitted by the agency before one month of the expiry of defect liability period to the competent authority.
23. The Royalty of each and every material, required to be paid is to be borne by the contractor.
24. Testing of each material as and when required by Rajkot Municipal Corporation, is to be carried out in Government approved laboratory by the contractor at his own cost. Schedule of testing of material will be as per R&B, State Government Manual and I S Code provision.
25. Necessary tests for material quality, soil tests etc. shall be carried out as per the instructions of engineer-in-charge by contractor at his own cost and reports to be submitted to the engineer-in-charge.
26. As this work is to be done in existing structure and also keeping in mind surrounding properties, all due precautions should be taken so that no damage occurs to any of the services like; water connection, drainage connection, water pipeline, drainage line or any other services. However, if any damage occurs to any of such service(s) then the contractor shall have to carry out necessary repairs immediately and satisfactorily, at his own cost.
27. Wherever the rolling with the road roller is not possible on metalling work and murrum work, the compaction with hand roller or by any other means at such places shall have to be carried out by the contractor satisfactorily as per instructions of engineer-in-charge.
28. The Contractor shall carry out modifications in the procedure of work, if found necessary, as directed by the Engineer during inspection. Works falling short of quality shall be rectified / redone by the Contractor at his own cost, and defective work shall also be removed from the site of works by the Contractor at his own cost.

29. Defective Materials: All materials which the Engineer / his representative has determined as not confirming to the requirements of the Contract shall be rejected whether in place or not; they shall be removed immediately from the site as directed. Materials, which have been subsequently corrected, shall not be used in the work unless approval is accorded in writing by the Engineer. Upon failure of the Contractor to comply with any order of the Engineer / his representative given under this clause, the Engineer-in-charge shall have authority to cause the removal of rejected material and to deduct the removal cost thereof from any payments due to the contractor.
30. The Defect Liability period for this work is 24 months. After completion of work, a report at the interval of every six months by way of joint inspection shall have to be submitted to the competent authority. The portion which is observed defective / damaged by normal cause during the joint inspection shall have to be repaired/rectified and necessary evidence along with photographs shall also have to be submitted to the competent authority.
31. The agency shall have to get interior done from the approved Architect / Engineer and also to get approved from engineer-in-charge. The agency shall have to get the approval within a period of 7 (Seven) days.
32. The Plans got prepared by the agency shall have to be get the design done from the Structural Engineer, the cost of which also is to be borne by the agency.
33. The work order will be given only after getting the preliminary approval from Town Planning Department.
34. Providing and fixing of precast RCC slab and column shall have to be carried out in line and level.
35. For excavation of trench, use of JCB machine will not be permitted directly on the top surface of the road. After excavation up to minimum 1.00 mt. depth from road surface or existing ground level, same shall have to be carried out manually or by using Breaker and after locating underground services like; water supply pipeline, water connection lines, pipe gutters, telephone cables, electric cables etc., and thereafter upon taking the prior approval of the Engineer-In-Charge, the excavation can be carried out by using JCB machine.
36. Rajkot Municipal Corporation shall recommend to the competent authority to give Controlled Blasting License to the contractor for

carrying out excavation in hard rock. In case of blasting license not permissible from the competent authority in some places then excavation is to be done by using wedges and hammers, chiseling, breakers, pneumatic tools, etc. Also in case where blasting license is permitted but even then if there is no possibility of carrying out the blasting for whatsoever reason, the excavation is to be done by using Wedges and hammers, chiseling, breakers, pneumatic tools etc. No extra payment shall be made for excavation to be carried out in any of the above mentioned both the situations.

37. Excavation in soft rock and hard rock shall have to be carried out only by Chiseling, Breaker (pneumatic tools) etc., as far as possible. If excavation is not possible in terms of above and if excavation is required to be carried out with the help of blasting then the same shall have to be carried out only after taking prior approval and necessary license for blasting from the competent authority.
38. In case of excavation not possible manually or by chiseling in certain place(s) as well as if blasting is also not possible due to various reasons i.e. to avoid damage to nearby water pipeline, pipe gutter, telephone cables / Duct, Raw houses / week buildings / narrow street etc., then the excavation by blasting will not be permitted. Under these circumstances, excavation shall have to be carried out only by Breaker (pneumatic tools) as per the instructions of the Engineer-In-Charge. No extra payment will be made for such type of excavation done by using Breaker. The rate for excavation shall be paid as per the rate of related item mentioned in Schedule-B.
39. Regarding the width of excavation, as (a) it is difficult to carry out the vertical trench excavation, (b) possibility of sliding the soil, and (c) Uneven excavation trench width in case of blasting. In this connection, for every 1.5 mt lift if there is less width up to 5 cm at the bottom then the top width of excavated trench, it shall be considered as per the specified trench width or actual trench width carried out at the ground level by the contractor whichever is less. If excavation is carried out more than the specified width then the payment will be made only for the specified width of excavation.
40. After entering into an agreement, the agency shall have to finalize the agency for supply of the material like Precast RCC slab and column and the name of manufacturer / supplier should immediately be informed to Rajkot Municipal Corporation so that Rajkot Municipal Corporation can also expedite the manufacturer / supplier for the material. If necessary, Rajkot Municipal Corporation will visit and inspect the factory. During the inspection, if Rajkot Municipal Corporation is not satisfied then the contractor shall have

- to procure the material from other manufacturer(s).
41. During construction activity, proper care must be taken for labor safety and all the provisions of the labor laws must be followed by the contractor.
  42. The G.A. Drawings and other Drawings as provided at present with the tender document are indicative, however, there is possibility of any change or modification in the said drawing and as such the contractor shall have to carry out the work accordingly at the approved rates without any extra cost.
  43. The contracting Agency then has to prepare bar bending schedule as per Structural Drawings and submit it to RMC after then RMC shall permit to work to start. Structure design is in the scope of work of contractor and its cost is to be borne by the contractor. The structure designer should be RMC license holder. The proof check of the structure design should be done by one of the structure designers, as suggested by RMC. (If the structure designer is suggested by RMC, then the proof check is not needed.) Bar Bending Schedule, register shall be maintained on site with the details of cut length of bar. The certificate for same shall be denoted in Pour Card.
  44. Contract Agency has to provide a Site Office Room, a separate Laboratory included with necessary lab instruments for slump test, sieve analysis, etc. whatever suggested by Site Engineer in charge on site premises. There shall be provision of minimum 24 cube mould of 15 x 15 x 15 cm size and 12 mould of 7.5 x 7.5 x 7.5 cm. There shall be a provision of necessary stationary & Furniture. The periodical calibration of instruments like weigh batch Plant, Electronic Balance etc. shall be carried out as per instruction of Engineer in Charge. Without satisfactory report for the same the work may not be continued.
  45. The Mix Design of Cement Concrete shall be revised submitted with respect to changes in Materials like Cement, Sand, Aggregate
  46. The Final Completion Drawings shall be submitted in hard copy and as Auto Cad format by Agency. If the same is not submitted, the permanent deposit 0.25 % of Final Bill amount will be deducted from Final bill.
  47. After the drawings for the proposed work are finalized by RMC, the agency has to submit the same to qualified & experienced structure engineer.
  48. The agency has to submit the approved & signed copier of structure



design 3 sets to Rajkot Municipal Corporation

49. Agency has to get the structure designs proof checked by the structure engineer suggested by Rajkot Municipal Corporation and the fees for the same shall be borne by the agency.
50. Additional alternation changes during the work shall has to be incorporated in the structure drawing & shall be re submitted to Rajkot Municipal Corporation accordingly.
51. The contracting Agency then has to prepare bar bending schedule, submit it to Rajkot Municipal Corporation. &After checking the bar bending schedule, then Rajkot Municipal Corporation shall permit to work to start.
52. Approval to the samples of various materials given by the Engineer-in-charge shall not absolve the contractor from the responsibility of replacing defective material brought on site of materials used in the work found defective at a later date. The contractor shall have no claim to any payment of compensation whatsoever on account of any such materials being rejected by the Engineer-in-charge.
53. The agency has to facilitate the Town Planning department in all respective terms and has to provide all the required items as instructed by a surveyor of Town planning Dept. The items which are required for demarcation are colors, Tags, Nails, labors and agency will also be responsible for cleaning of the plot without any extra cost.
54. The agency has to create the passage/access to the plot where the work is supposed to start. If in case the access to plot is restricted by any farming land, then the agency has to take a proper arrangement for passage and whatever the cost occurred in the construction of the passage, the agency has to pay the cost of its own.
55. The compound wall has to be constructed with the proper guidance by the Engineer- in- charge, such as if the land has difference in the level (irregular topography), then the agency has to construct the compound wall in the step pattern form.
56. The top of the precast wall will be either in Semi-circular or triangular whichever instructed by the Engineer-in-charge. The Measurement of the Semi-circular or triangular item of the precast wall will be taken from the middle of the section of the item.
57. If in case the Semi-circular or triangular item of the precast wall will

not be fixed, then the agency has to keep the top section of precast pole empty, without any curtailment in the height of the pole. But the measurement will be counted only for the constructed slabs.

58. In the precast wall, either the cement mortar in the ratio of 1:1 or Standard chemical mortar to be filled in Groove i.e. the area between two precast slabs and the area between the slabs and pole, whichever instructed by the Engineer- in- charge.
59. The restoration work for the excavation done is to be carried out immediately as per the instructions of engineer in charge. The excess material shall have to be disposed with no extra cost at the site specified by engineer-in-charge.

The word "Arbitration" or "Arbitration Clause" wherever mentioned in this tender document, is now to be treated as "Deleted". In this context, an Order bearing No.RMC/Legal/1858 dated 18-02-2017 of Legal Department of Rajkot Municipal Corporation is uploaded separately along with this tender, which Order, will hereafter be referred and taken into consideration for Arbitration related purpose for the tenders of Rajkot Municipal Corporation.

**ADDL. CITY ENGINEER**  
**Rajkot Municipal Corporation**

**Signature of Contractor with Seal**

**Rajkot Municipal Corporation**

**:: SPECIAL CONDITIONS ::**

1. The Royalty of each and every material, required to be paid is to be borne by the contractor.
2. Testing of each material as and when required by Rajkot Municipal Corporation, is to be carried out by the contractor at his own cost. Schedule of testing of material will be as per R&B, State Government Manual and I S Code provision.
3. The whole work shall be executed by qualified Site Engineer. The required L- Section and Cross section is to be prepared by contractor at his own cost. The work should be done by levelling instrument. The Drawings shall be submitted accordingly in advance before starting the work. No extra payment will be made for the above work. Contractor has to submit Bill form with hard copy and soft copy of cross section and L-section of work completed. No bill will be accepted without above drawings.
4. Necessary tests for material quality, Paving Blocks, soil tests etc. shall be carried out as per the instructions of engineer-in- charge by contractor at his own cost and reports to be submitted to the engineer-in-charge.
5. The contractor shall have to get registered under ESI (Employer's State Insurance) Act and obtain ESI Registration number if the number of workers are 10 Nos. or more. Also, the agency shall have to give all the benefits to the workers as available under the ESI Act. The agency should follow all the rules and regulations of ESI Act as per prevailing norms.
6. The testing of metal and the design as per IRC shall have to be carried out by the contractor at his own cost.
7. Structure design is to be prepared by contractor and after approval of engineer-in-charge the work can be started.

**ADDL. CITY ENGINEER  
Rajkot Municipal Corporation**

**Signature of Contractor with Seal**

## PART-III

**PART-III**  
**BILL OF QUANTITIES**  
**(Attached in Separate Folder)**

**BID FORM(WITH PRICE)**

**CONTRACT No:** RMC/ENGG/CZ/23-24/07

Bidders are required to fill up all blank spaces in this Bid Form

The Commissioner  
Rajkot Municipal Corporation  
Dr. Ambedkar Bhavan  
Dhebar Road  
Rajkot

Dear Sir,

**SUB : RENOVATION OF EXISTING ARVINDBHAI MANIYAR  
HALL, RAJKOT**

1. Having visited the site and examined the Bid Documents, Drawings, Conditions of Contract, Specifications, Schedules, Annexures, Preamble to Price Schedules, Price Schedules etc. including Addenda/Amendments to the above, for the execution of the above Contract, we the undersigned offer to carry out as given in Conditions of Contract and in conformity with the Drawings, Conditions of Contract, Specifications, Preamble to Price Schedules, Price Schedules, Annexures, Bidding Documents, including Addenda Nos. \_\_\_\_\_(insert numbers) for \_\_\_\_\_%age  
(in \_\_\_\_\_ figure)  
\_\_\_\_\_  
(in words) below / above than the rates given in Price Schedule.
2. I / We agree that
  - (a) if we fail to provide required facilities to the Employer's representative or any other person/agency by the employer to perform on his behalf for carrying out the inspection and testing of materials and workmanship  
or
  - (b) if we incorporate into the Works, materials before they are tested and approved by the Engineer's representative  
or
  - (c) if we fail to deliver raw water of required quantity according to the conditions/stipulations of the Contract, the Engineer will be at liberty to take any action including termination of Contract and impose at his absolute discretion any penalties, and/or reject the work.

3. We undertake, if our Bid is accepted, to complete and deliver the Works in accordance with the Contract within **11 Months** of construction period from the date of Work Order issued to us by you.
4. We agree to abide by this Bid for a period of **180 Days** from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiry of that period.
5. In the event of our Bid being accepted, we agree to enter into a formal Contract Agreement with you incorporating the conditions of Contract thereto annexed but until such agreement is prepared this Bid together with your written acceptance thereof shall constitute a binding Contract between us.
6. We agree, if our Bid is accepted, to furnish Performance Bond/Security in the forms and of value specified in the Conditions of Contract of a sum equivalent to 5% of the Contract price for due performance of the Contract.
7. We have independently considered the amounts of liquidated damages shown in Appendix to Bid and agree that they represent a fair estimate of the damages likely to be suffered by you in the event of the Work not being completed by us in time.
8. We understand that you are not bound to accept the lowest or any Bid you may receive.

Dated \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

\_\_\_\_\_  
(Signature)

Company Seal

\_\_\_\_\_  
(Name of the person)

\_\_\_\_\_  
(Name of firm)

\_\_\_\_\_  
(In the capacity of)

Duly authorised to sign Bid for and on behalf of  
(Fill in block capitals)

\_\_\_\_\_  
Witness

Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_



# PREAMBLE TO PRICE SCHEDULES

### **Note on Schedule:**

The bid is percentage rate bid for **RENOVATION OF EXISTING ARVINDBHAI MANIYAR HALL, RAJKOT**

1. The bid is percentage rate bid.
2. The rates and prices shall be submitted in the formats given in the online Price Schedules. Rates and prices received in any other formats will be rejected and the Bids will be disqualified.
3. It will be entirely at the discretion of the Employer to accept or reject the bidder's proposal, without giving any reasons whatsoever.
4. In Price Schedule, bidder shall quote his percentage Equal/Above/Below for items listed in the schedule. Prices quoted in Schedule only will be considered for price evaluation & shall form a part of the Contract Agreement.
5. The Only Price Schedule will be considered for financial evaluation of the bid with the successful bidder.
6. The bidder shall be deemed to have allowed in his price for provision, maintenance and final removal of all temporary works of whatsoever nature required for construction including temporary bunds, diverting water, pumping, dewatering etc. for the proper execution of works. The rates shall also be deemed to include any works and setting out that may be required to be carried out for laying out of all the works involved.
7. Where there is a discrepancy between the unit rates and the amount entered, the latter shall govern.
8. The Price Schedules are to be read in conjunction with the Conditions of Contract, the Specifications and other sections of these bid documents and these documents are to be taken as mutually explanatory of one another.
9. Prices quoted by the bidder shall be firm for the entire period of Contract without any escalation.
10. The bidder shall interpret the data furnished and carry out any additional survey work, or investigative work required at his own cost.
11. The prices quoted shall also include the cost of materials utilized for testing.

12. The bidder should acquaint himself with the site conditions including the access to Worksite. The successful bidder shall have to make suitable access to worksites at his own cost. These accesses will be used by the other contractors working for RMC.
13. The material shall be inspected departmentally, the cost of which, if any, is to be borne by contractor.
14. The contractor shall have to quote their rates including GST and other taxes and the Invoice with break-up of GST is to be submitted accordingly, failing which, such amount will be deducted from the bill of the agency and deposited accordingly.

The contractor shall have to purchase the material required for this tender work, only from the supplier having registered GST Number. RMC will not be responsible to pay any amount towards GST if the material is purchased from the unregistered supplier not having GST Number.

15. In case of extra item work if quoted and approved tender price is above Percentage Rate then no above percentage rate will be given, only the rates as per S.O.R. will be paid for such extra item. But, if the quoted and approved tender price is below percentage rate then that below percentage rate will be considered for paying of any extra item.
16. The whole work is to be done under the supervision of RMC.
17. The rates and prices shall be submitted in the formats given in the enclosed Price Schedules. Rates and prices received in any other formats will be rejected and the Bids will be disqualified.
18. It will be entirely at the discretion of the Employer to accept or reject the bidder's proposal, without giving any reasons whatsoever.
19. In Price Schedule, bidder shall quote his percentage Equal/Above/Below for items listed in the schedule. Prices quoted in Schedule only will be considered for price evaluation & shall form a part of the Contract Agreement.
20. Only Price Schedule will be considered for financial evaluation of the bid with the successful bidder.
21. The Price Schedules are to be read in conjunction with the Conditions of Contract, the Specifications and other sections of

These bid documents and these documents are to be taken as mutually explanatory of one another.

22. Prices quoted by the bidder shall be firm for the entire period of Contract without any escalation.
23. The bidder shall interpret the data furnished and carry out any additional survey work, or investigation work required at his own cost.
24. The prices quoted shall also include the cost of materials utilized for testing.
25. The bidder should acquaint himself with the site conditions including the access to Worksite. The successful bidder shall have to make suitable access to worksites at his own cost. These accesses will be used by the other contractors working for RMC.
26. From each Running Account Bill, labour cess will be deducted as per norms.
27. In Every running bill 0.25% amount shall be retained as extra security deposit if Drawings of work done are not submitted by agency.
28. The quoted rates should be inclusive of all taxes and duties.
29. The prices shall have to be quoted firm & fix including all the taxes & duties without any statutory variation. RMC will not consider any statutory variation as well as the price rise in the market and if any, those shall be on account of contractor.
30. The work contract tax will be borne by the agency.
31. While considering experience of ongoing sewer/storm water pipeline works, part work completed in all respect will be considered for evaluation of bid. In this regard contractor shall be required to submit part completion certificate along with bid document from competent authority.
32. Use of ready mix concrete may be permitted if it fulfils tender specifications.
33. No extra item or extra width will be paid due to excavating method or type of machinery.

34. For any type of license regarding labour, etc. has to be achieved by agency.
35. This office Circular bearing No. RMC/C/329 dated 22-12-2012 and Order No. RMC/C/132 dated 10-06-2013 are uploaded in tender document.
36. In reference to the above Circular and Order cited at above, the Contractor firm who have quoted their rates for this work will be called in person for verification of original documents. The date and time for verification of original documents will be intimated to the Contractors.
37. If the progress of work is found slow then Extra security Deposit may be recovered from any running bill as decided by Engineer in charge up to maximum 5% amount of concerned R.A. Bill amount.
38. In case of Extra Item, No “On” %age i.e. +ve % age Rate will be given but if there is Down %age i.e. -ve % age Rate that will be applied to that rate of that Extra Item.
- 39. For this project work SJMMSVY Grant, Third Party Inspection (TPI) is mandatory. The TPI agency will be appointed by Rajkot Municipal Corporation and remittance of charges @ 0.70 % of contract value for the same is to be borne by the agency, which will be deducted from the contractor's bill.**

**Signature of Contractor with Seal**

**SSSADDL. CITY ENGINEER**  
**Rajkot Municipal Corporation**

| <b>Check List for submission of Documents</b>                                                                    |          |
|------------------------------------------------------------------------------------------------------------------|----------|
| Tender Fee submitted as per Tender                                                                               | Yes / No |
| Tender Earnest Money Deposit submitted as per Tender                                                             | Yes / No |
| Registration documents submitted as per tender requirement                                                       | Yes / No |
| <b>Financial Details:</b>                                                                                        |          |
| Turnover details submitted as per requirement                                                                    | Yes / No |
| Working Capital as per requirement of tender is submitted                                                        | Yes / No |
| Valid Bank Solvency submitted                                                                                    | Yes / No |
| Validity of Bank Solvency                                                                                        | Date:    |
| <b>Experience Details:</b>                                                                                       |          |
| Details of Technical Staff and details of machineries submitted                                                  | Yes / No |
| Address proof submitted                                                                                          | Yes / No |
| Identity proof submitted                                                                                         | Yes / No |
| Fresh Declaration on Non-Judicial Stamp Paper regarding not black listed or Terminated or Debarred, is submitted | Yes / No |
| Professional Tax Receipt of current year                                                                         | Yes / No |

**Note:**

Over and above, the agency shall also have to submit all other necessary documents as may be required for pre-qualification, failing which, the agency will be treated as Non-responsive and will be DISQUALIFIED and also the online price bid of such agency will not be opened.

Signature of Contractor with seal

# PRICE SCHEDULE

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |      | 472          |
|----------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | IN FIGURE |      |              |
| 1                                                                    | 8.00                                         | Excavation of Foundation in Soft Murrum, Soil or Sand from 0.0 mtr. to 1.50 mtr depth including lifting and laying in 90 mtr. lead area as instructed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 96.60     | Cum  | 772.80       |
| 2                                                                    | 8.00                                         | PCC : Foundation filling with CC work in proportion of 1:3:6 using 1.5 cm to 2.0 cm aggregate including Raming, Curing etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3360.00   | Cum  | 26,880.00    |
| 3                                                                    | 5.00                                         | CC work M25 for RCC slab using aggregate of size 10-20 mm, centring,curing, finishing etc. complete (without reinforcement)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5875.00   | Cum  | 29,375.00    |
| 4                                                                    | 100.00                                       | Supplying, Cutting, Beding, Binding and Hooking and binding with wire for RCC work Tor steel TMT round bar including all cost                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 57.00     | Kg   | 5,700.00     |
| 5                                                                    | 2.00                                         | Brick Masonry work in Cement:Mortar 1:6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4196.00   | Cum  | 8,392.00     |
| 6                                                                    | 13.00                                        | Brick Masonry Partition Wall in Cement:Mortar 1:4 (3.5 to 4.5 inch thick)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 411.00    | Sqm  | 5,343.00     |
| 7                                                                    | 187.00                                       | Cement Plaster 12 mm thick using Cement:Mortar in proportion 1:3 with Niru Finishing curing, etc. Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 182.00    | Sqm  | 34,034.00    |
| 8                                                                    | 170.00                                       | Supplying the material Dr Fixit/Forsroc new coat and Dr Fixit / Forsroc primeseal as per the required quantity with applying and primer coat with Dr Fixit / Forsroc primeseal and applying three coats of Dr Fixit / Forsroc new coat with fiber mesh.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 563.00    | Sqm  | 95,710.00    |
| 9                                                                    | 250.00                                       | Water proof plaster : Water Proof Cement Plaster 20 mm thick using Water Proofing Compound and in the ratio of 1:3 with necessary finishing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 203.00    | Sqm  | 50,750.00    |
| 10                                                                   | 100.00                                       | Cutting and repairing Wall: Making zari by Chasing upto 75mm wide x 50mm deep with mechanical cutter in plastered brick wall and making good after work is completed in white cement and POP for electrical works for changes. The item shall be measured in Rmt. Rate shall be inclusive of providing & fixing chicken mesh on conduits before repairing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 144.48    | Rmt  | 14,448.00    |
| 11                                                                   | 76.00                                        | P & L 24" x 24" vitrified 8 mm thick tile flooring over 20 mm (average) base of cement mortar 1:6 ( 1 cement: 6 coarse sand) on new surface or fixing on existing flooring by adhesive material including dismantling of existing flooring and jointed with color cement slurry including finised with flush pointing & cleaning the surface etc. complete for antiskit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1052.34   | Sqm  | 79,977.84    |
| 12                                                                   | 162.00                                       | Providing and laying Vitrified tiles 8 to 10 mm thick , 24" x 24" in skirting risers of steps and dedo on 10mm thick cement plaster 1:3 (1-cement : 3-coarse sand) and jointed with white cement slurry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 819.00    | Sqm  | 1,32,678.00  |
| 13                                                                   | 607.00                                       | Supply, Fixing & Polishing for Granite Flooring work 18mm thick & 200 mm Base of Lime:Mortar in proportion of 1:2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2578.00   | Sqm  | 15,64,846.00 |
| 14                                                                   | 42.00                                        | Supply & Fixing of Granite Stone (Telephone Black Color) on wall after rough cast Cement Plaster in proportion of 1:3 and fixing grainage in Cement Paste                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2502.00   | Sqm  | 1,05,084.00  |
| 15                                                                   | 7.00                                         | Providing & laying approved quality prepolished machine cut average 18mm thick first quality Granite of approved shade, (selected and sorted for its uniform colour and thickness), for stair tread, sill, jambs, coping etc. in required sizes and shapes, including average 40 mm thick cement mortar bedding in 1:5 laid and jointed with white cement and matching pigment including rubbing, re-polishing (if required) with different grades of Emery, refilling of open joints, curing, daily cleaning and mopping etc. all complete. The rate includes machine cut edges of uniform thickness and beveling and mirror polishing of edges, groove for anti skid surface. Sample shall be approved by Architect before execution.                                                                                                                                                                                                                                                                                                                                                                                                                        | 3688.37   | Sqm  | 25,818.59    |
| 16                                                                   | 7.00                                         | Granite - wash basin counter, urinal partition : Providing & laying 18mm thick both side mirror polished granite of approved shade and quality, seleted and sorted for uniform color for urinal partition/ wash basin counter/ platform as per design and in required sizes and shapes after chasing /cutting of dado/ paster with cutter machine fixing shall be carried out in white cement sand mortar (1:1) with matching pigment and/ or necessary adhesive. (Only finished granite work shall be measured). All expose edges shall be chamfered and polished. The rate includes making hole, cutting/ chasing, rounding champhering, edge polishing of edges. Sample shall be approved by Architect before execution.                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3551.78   | Sqm  | 24,862.46    |
| 17                                                                   | 8.00                                         | Sandwich Platform : Providing & laying sandwich platform comprising of<br>1. Sandwich of 18 mm the Granite of approved shade and sample on top and 30 mm the polished kota in bottom with 20mm thick cement mortar 1:4 bedding in between & neat cement float.<br>2. At centre vertical sandwich supports of 30 mm the two kadappa/ kota stone on sides, cement mortar 1:4 bedding in between and at both end walls vertical supports of 18 mm the granite.<br>3. 75 mm raised platform at bottom with kota on top and screed (1:2:4) at bottom with necessary cement mortar, Granite stone skirting as per design and approved sample. All expose side stone shall be of granite and same in shade and as per approved sample. The rate includes rounding, champhering and mirror polishing of edges, fascias of granite, including necessary bonding adhesive (if required) of approved make. Rate shall be also inclusive of stone arrangement for fixing of sink or wash basin, Pillar tap/ Bib tap etc. as directed by engineer in charge. Only plan area of platform shall be measured & paid for. Sink, basin, taps etc shall be paid in relevant items | 6952.00   | Sqm  | 55,616.00    |
| 18                                                                   | 130.00                                       | Supply & Fixing of Broken Glazed (China Mosaic) tiles size 5-6 mm thick of different size and shade (approved crazy patern) in Cement:Mortar 1:2 and joint filling with White Cement / Coloured Cement including Ramping, Watering, Curing etc. complete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 259.00    | Sqm  | 33,670.00    |



| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |      | 473          |
|----------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | IN FIGURE |      |              |
| 19                                                                   | 53.00                                        | Supply & Fixing of 60mm M-30 Grade cement concrete rubber mold paving inter locking paving block (Grey colour) after bedding of Bhogavo sand in line and CC on the edge in proportion of 1:2:4 with curing etc. Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 514.00    | Sqm  | 27,242.00    |
| 20                                                                   | 22.00                                        | Providing and fixing pre-cast concrete kerb stone of gray cement based concrete block 30cm length,30cm height and 15cm thick of M250 grade concret as per approved design and including excavation for fixing in proper line and level, filling the joint with C:M 1:3 (1cement:3fine sand) etc complete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 326.55    | Rmt  | 7,184.10     |
| 21                                                                   | 43.00                                        | Flush door shutter + both side laminates + WPC frame + Hardware Provoding and fixing 35mm thick flush door shutters, solid core construction with frame of first class hardwood with cross board and face veneer or plywood face panels, including butt hinges with necessary screws fixed on with WPC door frame of 70 to 100mm in size with single rebate for door/ window shutter with required number of Dash fastener of approved make and size. 6mm thick teak wood lipping shall be fixed on periphery of shutter. External side of lipping shall be finished with lacqured polish/ paint in required coat and of approved make and shade. Shutter shall be finished (both side) with 1mm thick laminates of approved make and shade.<br>- Non-decorative type and block board core with SS 304 grade butt hinges, tower bolt, both side aldrop, pair of handle of required size (200mm to 300mm long) in flush door shutters All sample shall be approved before execution.  | 6936.00   | Sqm  | 2,98,248.00  |
| 22                                                                   | 13.00                                        | Flush door shutter + both side veneer + WPC frame + Hardware Provoding and fixing 35mm thick flush door shutters, solid core construction with frame of first class hardwood with cross board and face veneer or plywood face panels, including butt hinges with necessary screws fixed on with WPC door frame of 70 to 100mm in size with single rebate for door/ window shutter with required number of Dash fastener of approved make and size. 6mm thick teak wood lipping shall be fixed on periphery of shutter. External side of lipping shall be finished with lacqured polish in required coat and of approved make and shade. Shutter shall be finished (both side) with 4mm thick venner of approved make and shade, type, finish.<br>- Non-decorative type and block board core with SS 304 grade butt hinges, tower bolt, both side aldrop, pair of handle of required size (450mm to 600mm long) in flush door shutters All sample shall be approved before execution. | 9714.00   | Sqm  | 1,26,282.00  |
| 23                                                                   | 5.00                                         | SS plate signage : Providing and fixing SS 304 grade Internal signage of size 100mm x 100mm x 1.2mm thick with laser print/ etching and filled with duco paint of approved make and as specified type including fixing etc complete as directed by engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 535.00    | No   | 2,675.00     |
| 24                                                                   | 3.00                                         | Providing and fixing signage made of 4mm ACP sheet of approved make and shade (high intensity grade sheeting) and acrylic letter of required size as per drawing, fixed with SS 304 screws, fastner on any surface including lettering (vinyl printing, stickering and lamination) and signs etc complete for all level all height and as directed by Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6000.00   | Sqm  | 18,000.00    |
| 25                                                                   | 1828.00                                      | Iron round gate as per drawing with colour incuding all                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 116.00    | Kg   | 2,12,048.00  |
| 26                                                                   | 190.00                                       | providing,fabricating,erecting and placing in position stainless steelpipe(304 grade) including cutting welding and bolting wherever necessary including accessories fixing hardware.All welded joints tobe griended and cleaned and finished as satin finish including buffing. All ss to 304 grade                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 460.00    | Kg   | 87,400.00    |
| 27                                                                   | 50.00                                        | Dash fastener 12.5 mm dia 50 mm long                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 55.20     |      | 2,760.00     |
| 28                                                                   | 675.00                                       | Fixing 24 guage galvanized iron sheets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 684.00    | Sqm  | 4,61,700.00  |
| 29                                                                   | 71.00                                        | Providing and fixing of Ridge flashing for roof panel shall be made out of 0.5 mm thick pre coated GI sheet . The Precoated sheet shall be of minimum 240 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS:277:1992 , 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron. The PPGI Sheet shall have plastic protective guard film of minimum 25 microns to avoid scratches during transportation. The ridge shall be fixed to the steel members by pop rivet or self drilling/self stitching fastners @ maximum 450 mm c/c along length of capping/flashing etc complete .                                                                                                                                                                                                                                                                                                                   | 514.50    | Rmt  | 36,529.50    |
| 30                                                                   | 177.00                                       | Providing & fixing 0.60xx 0.60 size tiles & galvenized frame on gypsam board, false ceiling with moulding & designed patta.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1176.00   | Sqm  | 2,08,152.00  |

## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ESTIMATED | Unit | Total Amount |
|---------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | IN FIGURE |      |              |
| 31      | 462.00                                       | Gypsum perforated ceiling : Providing and fixing perforated gypsum ceiling system of approved make includes perimeter channel to be fixed along the perimeter of existing wall with the help of (6x40) impact anchor at 600mm centres. Ceiling angle shall be suspended by fixing it to the soffit cleat. Soffit cleat and Rawlplug (Ø8 x 45mm, as per IS 513 CR1 grade, Zinc coating (7 to 8 microns), pull out load- 6.8kN for M30 concrete grade) creating 1200mm x 1200mm grid. Intermediate channel shall be fixed to the ceiling angle with M6 x 12mm Hex Bolt & nut arrangement, as per EN 10083, Zinc Plating or with 2 Nos of Ø4.2 x 13 metal to metal screw made of carbon steel as per EN-ISO 7049/50, Zinc Coating. The ceiling section shall be fixed to the intermediate channel with the help of connecting clip and in direction perpendicular to the Intermediate channel at 600mm c/c. Framing member shall be GI as per IS 513, serrated/ knurled/ ribbed in pattern, YS-260Mpa, finish-Galvanised 150GSM as per IS277. Single layer 12.5mm board of size 1200 x 2400mm having all four tapered edges, 16% perforation area of board & hole size of 12mm of any shape, having 8 perforation sets per board and each set of size 487mm x 487 mm, 56.5mm border and 113mm center band, backed with acoustic tissue, having NRC values 0.65, shall be screw fixed to ceiling section with 25mm drywall screws made of carbon steel (as per EN-ISO 7049/50 and finish - Grey Phosphating), at 230mm centres. Resin bonded glass wool of 24kg/M3 and 50mm thick shall be placed on top of the board. Finally all tapered edges of the boards are to be jointed and finished so as to have a flush look which includes filling and finishing with Pro-Fill Jointing compound (Conforms to ASTM C475), Joint Paper tape. Contractor shall co-ordinate with all services for making cutout for light fixtures, grill, diffuser, fire equipment, AV system, etc including additional framing member if required. Contractor shall prepare shop drawing and get approval from Architect. Rate shall be for all level, all height including scaffolding etc complete and as directed by Engineer in charge. | 2035.50   | Sqm  | 9,40,401.00  |
| 32      | 562.00                                       | Acoustic Panelling : Providing and fixing panelling as per drawing with acoustic panel boards of approved make and fire retardant fabric over frame work as per detailed drawing. Providing & fixing acoustical infill material of 25 mm th Synth directly between wooden frame Synth shall be held in position by using adhesive tape Providing and Fixing vinyl grippers directly on plywood base approx at 1200mm centers by using pneumatic stapler or suitable metal fasteners as per manufacturers specifications. Vinyl grippers must have base tapes for better grip. Providing and fixing wood wool board Sound Smooth of size 1200 x 600 x 15mm thick having density 400Kg/ m3 fixed in between Vinyl grippers and again pasting Synth of 10mm thick on the acoustical panel by using adhesive as per specifications of manufacturer. Supplying and laying FR grade fabric then cut into required size and shape and stretched, inserted inside the gripper by using tools recommended by manufacturer. Rate shall include cost of making of all cut-outs for light fixtures, switch boards gadgets, gizmo, pelmets, grooves, beads cut out as per EIC instruction at site. The rate shall be in sq.mt for all floors and at all heights including all costs. The shop drawing shall be prepared by Contractor and approved from EIC and Architect. Basic rate of fabric 1400/-Rmt for 54" wide. Panelling item including openable shutter wherever required area and finish with the same material. Only the clear elevation area of the acoustic panel shall be measured and paid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6106.50   | Sqm  | 34,31,853.00 |
| 33      | 61.00                                        | Ply + veneer : Providing and fixing 19mm thick plywood (IS 303) and 4mm thick veneer for window/ door jamb/ panelling/ palmet etc including provision of teak wooden beading/ frame as per design, lacquer polish on veneer and wooden surface, scaffolding etc for all level all height and as directed by Engineer in charge. Sample shall be approved by Architect before execution.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4394.55   | Sqm  | 2,68,067.55  |
| 34      | 55.00                                        | Laminated Wooden flooring : Supplying and fixing 12mm thick Laminated wooden Flooring Work conforming to EN13329:2006 with plank size not less than 1200 mm X 190 mm (with unilin/tongue-groove locking arrangement) having 0.2mm thk top abrasive layer over a decorative layer followed by a High-density fibreboard (HDF) having density > 850 kg/m3 substrate core over a resin saturated backing layer and installing through unilin or tongue- groove system (having locking strength not less than 1000 kg/m) over a 2 mm thk underlayer polyurethane foam on polythene sheet 250 micron, over a smooth, flat, hard subfloor free from moisture (< 8%), grease etc. complete in all respect with requisite accessories like end profile, transition profile, reducer 'T' profile, skirting (wherever required) etc. wherever required and preparation of base including all other incidental works as per direction & satisfaction of Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2239.05   | Sqm  | 1,23,147.75  |
| 35      | 600.00                                       | Auditorium chair : Providing and fixing in position Chair's for auditorium made in mild steel powder coated frame for gang arrangement. Seat to be of foldable mechanism. Seat shall be fixed on floor with required size of anchors. The rates to be inclusive of transportation, loading, unloading, installation at site with necessary hardware at all floors and levels etc. complete as approved by Architect / EIC. Contractor to get loose and installed sample approved by Architect / EIC before mass procurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5000.00   | No   | 30,00,000.00 |
| 36      | 10.00                                        | Green room chair : Providing and fixign Low back leatherette chair with cushioned back and seat, multilock mechanism/multiple recline lock and knee tilt mechanism, chrome plated fixed arms, gas lift, chrome plated metal base and relevant specifications of approved make and as approved by Architect. Contractor to get loose and installed sample approved by Architect before mass procurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2000.00   | No   | 20,000.00    |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |      | 475          |
|----------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | IN FIGURE |      |              |
| 37                                                                   | 163.96                                       | Auditorium Stage Curtain of central opening - Providing and fixing Auditorium Curtain (double layered curtain) with Manual Cord Operated Split Channel with central opening. The rates shall be inclusive of installation, material cost, labor, wastage, operating system all tools tackles, scaffoldings, hardware at all floors, all levels and heights, necessary edge binding with approved fabric and thread of colour similar to the colour of the blinds controller system having chain pulley arrangement with chain of required length and compatible locking arrangement. Minimum 2 ties and 2 clamps shall be provided per 1 m length of the curtain and maximum length of curtain shall not exceed 1.50m. Same rate shall be applicable for all heights and for all floors. Both layered curtain shall be measured fro payment                                                                                                                                                                                                   | 1859.00   | Sqm  | 3,04,809.01  |
| 38                                                                   | 20.00                                        | Polish on old wooden : Providing and applying lacquer polish on existing wooden surfcae after preper cleaning including sand papering, protection, scaffolding etc compete for all level, all height and as directed by Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1017.75   | Sqm  | 20,355.00    |
| 39                                                                   | 118.00                                       | Double coat oil paint on wall surface with remove all dirt & dust without first hand primer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 75.00     | Sqm  | 8,850.00     |
| 40                                                                   | 105.00                                       | Applying two coats of putty & two coats of primer of approved brand and manufacture on new wall surface to give an even shade including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 47.41     | Sqm  | 4,978.05     |
| 41                                                                   | 1314.17                                      | Plastic Imulsion Paint (Two coats) (Asian Paint, ICI, Dulux, Nerolac, Berger etc. of approved type) (without Prime Coat)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 91.00     | Sqm  | 1,19,589.17  |
| 42                                                                   | 420.00                                       | Designer paint on ceiling : Providing and applying designer paint nwith pattern as per concepth design with plastic emulsion paint/ special paint of approved make. Item shall be executed by special agency. Sample shall be approved by Architect. Work shall be carried out by any means for all level, all height and as directed by Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 678.50    | Sqm  | 2,84,970.00  |
| 43                                                                   | 118.00                                       | Apex Color work on Outer side of Wall (Two coats) (with Base Coat)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 99.00     | Sqm  | 11,682.00    |
| 44                                                                   | 1310.83                                      | Providing and applying water based, low VOC, breathable and biodegradable, water, oil and stain repellent coating with of approved make on natural stone surface (suitable product according to sand stone/ lime stone) of approved make having acrylic fluoropolymer technology at all heights & leads and wherever instructed by Engineer-In-Charge. The treatment shall be in two coats wet-on-wet or as recommended by approved manufacturer including cleaning the dirt, dust, bird dropping, grease, oil, algae, fungus, vegetable growth, preparation of surfaces by cleaning with Ammonia water with the help of required scrubbers and also cleaning with machine operated water jet without causing any scratching/ damage to the stone surface, finally washing the surface with clean water, curing, protecting, scaffolding including taking all precautions to safeguard ventilators, windows, doors etc. by suitable covering so as to avoid any damage to the building/structure, all as per direction of Engineer in-charge. | 305.30    | Sqm  | 4,00,197.42  |
| 45                                                                   | 1021.00                                      | Removal of Flooring of type Shabadi Ladi / Cement / Tiles flooring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 31.00     | Sqm  | 31,651.00    |
| 46                                                                   | 53.00                                        | Removal work of Interlocking block                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 22.00     | Sqm  | 1,166.00     |
| 47                                                                   | 53.00                                        | Removal of Sheet / Wooden foyer with removal of flooring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 27.60     | Sqm  | 1,462.80     |
| 48                                                                   | 134.00                                       | Removal of Cement / Lime Plaster (with excavation of vatta)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 17.30     | Sqm  | 2,318.20     |
| 49                                                                   | 1577.00                                      | Removing dry or oil bound distemper by a washing and scraping and sand papering the wall surface smooth including necessary repairs to scratches complete.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 7.25      | Sqm  | 11,433.25    |
| 50                                                                   | 118.00                                       | Removing old colour as a oil paint, distemper etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 31.00     | Sqm  | 3,658.00     |
| 51                                                                   | 675.00                                       | Removal / Fixing of Cement Sheet Or Iron Sheet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 35.00     | Sqm  | 23,625.00    |
| 52                                                                   | 17.00                                        | Removal of Door / Window / Cup Board                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 114.00    | No   | 1,938.00     |
| 53                                                                   | 50.00                                        | Cleaning and high gloss mirror polishing of existing marble flooring as per satisfaction of Architect and Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 257.60    | Sqm  | 12,880.00    |
| 54                                                                   | 116.00                                       | Cleaning of glass window from both side and repaint/ repolish of existing wooden/metal member of window as per satisfaction of Architect and Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 407.10    | Sqm  | 47,223.60    |
| 55                                                                   | 983.00                                       | Dismantling steel work including dismembering and stacking the materials with all lead and lift.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.42      | Kg   | 2,378.86     |
| 56                                                                   | 1024.00                                      | Dismantling false ceiling/ wall panelling/ partition made of any material including framing, sub structure, anchor, etc. complete and stacking them within all lead and lift                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 47.25     | Sqm  | 48,384.00    |
| 57                                                                   | 637.00                                       | Removing auditorium chair including foundation bolt/ fixing arrangement etc complete and stacking them within all lead and lift as directed by Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 56.70     | No   | 36,117.90    |
| 58                                                                   | 1.00                                         | Removing of auditorium curtain, pelmat, sign box, arrangement for equipments etc complete and stacking them within all lead and lift as directed by Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 708.75    | Lot  | 708.75       |
| 59                                                                   | 21.00                                        | Dismantling sanitary fittings like wash basin . W.C. pan Indian and European type, flushing tank etc. including stacking the materials with all lead and lift.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 260.40    | No   | 5,468.40     |
| 60                                                                   | 80.00                                        | Dismantling C.I. pipes G.S.W.pipes abd A.C. rain water pipes with fittings and clamps including stacking the materials with all lead and lift ( for any dia, of pipe)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 48.20     | Rmt  | 3,856.00     |
| 61                                                                   | 1.00                                         | Dismantling of all MEP services item including wire, cable, conduit, duct, cable tray, light fixture, grills, AC unit, fan, fire pipes, equipments, accessories etc, for all level, all height as directed by Engineer in charge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 10000.00  | Job  | 10,000.00    |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |      | 476          |
|----------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | IN FIGURE |      |              |
| 62                                                                   | 10.00                                        | Core cutting : Providing and wet drilling accurate and clean holes of required diameter in RCC walls, slabs, beam or any other RCC member without vibration by core cutting (diamond drilling) machine of approved make for laying service lines including scaffolding, disposing the debris, cleaning, making good, providing epoxy mortar/ micro concrete/ patch repair mortar/ Non shrink grout for concrete for grouting the gaps around the pipes for all levels/ all height, after approval of engineer in charge etc compete. Measurement shall be taken for the depth of holes in running meter for specified diameter. Holes shall made by authorized approved agency.                             | 474.95    | Rmt  | 4,749.50     |
| 63                                                                   | 4.00                                         | <b>INTERNAL PLUMBING WORK</b> : Providing, fixing, jointing and testing in position of various Bathroom C.P. Fixtures with hydraulic testing complete as per design, drawing and instruction of site incharge. 25mm Dia Control Valve (Make: Zoloto, VB,SANT)                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1696.00   | Nos  | 6,784.00     |
| 64                                                                   | 12.00                                        | Providing and fixing screw down bib taps of following size. (B) Brass chromium plated screws down Bib Tap. (i) 15mm dia. Jaquare - CON-049NKN (Make :- Jaquar, Hindware , Parryware or Equivalent).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1229.00   | Nos  | 14,748.00    |
| 65                                                                   | 9.00                                         | Providing and fixing health faucet with 1 m PVC tube and swivel hook including all fittings complete. (Jaquare Code : ALD-573)(Make :- Jaquar, Hindware , Parryware or Equivalent).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1698.00   | Nos  | 15,282.00    |
| 66                                                                   | 15.00                                        | Nahni trape 7.6cm of PVC fitting and fixing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 224.00    | Nos  | 3,360.00     |
| 67                                                                   | 9.00                                         | Providing and fixing white glazed vitreous china wall mounting type (European type) water closet with C.P. bolts, nuts, C.I. Chair or other hanging arrangement, white solid plastic seat with lid, C.P. brass hinges and rubber buffers, Metropole flush valve regular 40mm size (concealed body) with exposed shut off provision , C.P. brass screws and washers complete, including cutting and making good the walls floors where required. Wall hung EWC (Jaquare - VGS-WHT-81953UF), (FLV-1093N - Metropole Flush Valve) & (FLV-1071 - Concealed Flush Valve Complete) matching white plastic seat with lid & CP brass hinges & CP push plate . (Make :- Jaquar, Hindware , Parryware or Equivalent). | 11042.00  | Nos  | 99,378.00    |
| 68                                                                   | 6.00                                         | White porselin wash bassin 560/410mm indian make c.i. bracket with fitting cromium platted topes 25cm plastic waste pipe and 12mm pillar cock with comp.i)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1397.00   | Nos  | 8,382.00     |
| 69                                                                   | 6.00                                         | White Porselin Urinal with require plastic waste pipe fitting and fixing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1162.00   | Nos  | 6,972.00     |
| 70                                                                   | 6.00                                         | Providing, fixing, jointing and testing in position Urinal stop cock including all fittings complete with hydraulic testing complete. (Code : Jaquare CON-1081KN) (Make: Jaquare, Cera, Hindware, Somani)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1730.00   | Nos  | 10,380.00    |
| 71                                                                   | 15.00                                        | Providing & fixing in position 15 mm C.P. brass angle cock of best quality with 1.2 Rmt Long pvc Tube and accessories with necessary fittings etc. complete. (Make : Jaquar, Hindware, Cera, Somani)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2273.00   | Nos  | 34,095.00    |
| 72                                                                   | 6.00                                         | Providing & fixing in position 15 mm C.P. brass pillar cock of best quality with necessary fittings etc. complete.[Jaquar FLR - CHR-5011N)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2037.00   | Nos  | 12,222.00    |
| 73                                                                   | 4.00                                         | Providing and fixing soap dispenser as approved by the architect.Work complete including all type of fittings , etc complete as per suggestion of Architect/EIC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1320.00   | Nos  | 5,280.00     |
| 74                                                                   | 20.00                                        | Providing, laying and jointing in true line and level 110 diametre U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 110 mm diametre x 149 mm length x 145 mm heigh at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials.              | 551.25    | Rmt  | 11,025.00    |
| 75                                                                   | 20.00                                        | Providing laying and jointing in true line and level 65 mm dia. U.P.V.C. Pipe ( SCH- 80) for cold water including fittings of make PRINCE / SUPREME / ASTRAL / FINOLEX as approved by Engineer In Charge. Pipe shall be fixed on the wall with the help of clamp at every two metre C/C or shall be cancelled as directed including necessary fittings etc. including testing of pipe and joints and fixing the same with adhesive solvent, including cost of all materials                                                                                                                                                                                                                                 | 887.00    | Rmt  | 17,740.00    |
| 76                                                                   | 50.00                                        | Providing and fixing to wall ceiling and floor 6.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low densidy, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(B) 25mm                                                                                                                                                                                                                                                                                                                                                                                                                                   | 66.99     | Rmt  | 3,349.50     |
| 77                                                                   | 20.00                                        | Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low densidy, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(C) 32mm                                                                                                                                                                                                                                                                                                                                                                                                                                  | 77.60     | Rmt  | 1,552.00     |
| 78                                                                   | 20.00                                        | Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low density, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(D) 40mm                                                                                                                                                                                                                                                                                                                                                                                                                                  | 82.95     | Rmt  | 1,659.00     |
| 79                                                                   | 20.00                                        | Providing and fixing to wall ceiling and floor 10.0 Kg. F/Cm2 working pressure poluthene pipes of the following outside Dia. Low densidy, complete with special falnge compression type fittings, wall clipsetc. including making good the wall ceiling and floor.(E) 50mm                                                                                                                                                                                                                                                                                                                                                                                                                                  | 109.20    | Rmt  | 2,184.00     |
| 80                                                                   | 4.00                                         | Providing and fixing S.W. gully trap with C.I. grating brick masonry chamber and water tight C.I. cover with frame of 300mm x 300mm size (inside) with standard weight.(i) Square mouth traps.(B) 150mm x 100mm size P or R type                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1231.65   | No   | 4,926.60     |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |      | 477          |
|----------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | IN FIGURE |      |              |
| 81                                                                   | 116.67                                       | Providing and fixing 6mm thick frame less mirror of approve make in any shape and sizes as per drawing. Mirror shall be fixed on 12mm thick cement fiber board backing. Cement fiber board shall be fixed to wall with approved SS 304 fastener. All edges of glass shall be sharp grinded, cute corner and polished. Glass shall be fixed with silicon sealant/ 3M tape etc complete at all floors/ all levels/ all heights as directed by EIC. Installed area of mirror shall be considered for payment without wastage.                                                                                                                                                                                                                                                                                                                                                                                                                 | 2083.00   | Sqm  | 2,43,016.67  |
| 82                                                                   | 1.00                                         | FIRE FIGHTING SYSTEM : FIRE PUMPS, EQUIPMENT, PIPING, VALVES & ACCESSORIES - Providing and fixing, testing and commissioning of electric driven main fire hydrant pump suitable for automatic operation and consisting of following: complete in all respect as required. 30.0 HP, 1200 LPM, 70-80 Meter head.<br>a) Horizontal type centrifugal back pull out pump of cast iron body and bronze impeller with cs shaft, mechanical seal to ensure a minimum pressure of 3.5 kg/sq.cm. at highest and farthest outlet at specified 30.0 HP flow of 1200 LPM at 70-80 Meter head conforming to IS 1520.<br>b) Suitable HP, SQ cage induction motor, TEFC, synchronous speed 2900 RPM, suitable for operation on 415 ± 6% volts, 3 phase 50 Hz. AC with IP 55 protection for enclosure with Class-'F' insulation, conforming to IS-325.<br>c) M.S.fabricated common base plate, coupling, coupling guard, foundation bolts etc. as required. | 169212.00 | Set  | 1,69,212.00  |
| 83                                                                   | 1.00                                         | Providing and fixing, testing and commissioning of electric driven main fire jockey pump suitable for automatic operation and consisting of following: complete in all respect as required. 7.5 HP, 180 LPM, 60-65 Meter head.<br>a) Horizontal type centrifugal back pull out pump of cast iron body and bronze impeller with cs shaft, mechanical seal to ensure a minimum pressure of 3.5 kg/sq.cm. at highest and farthest outlet at specified 7.5 HP flow of 180 LPM at 60-65 Meter head conforming to IS 1520.<br>b) Suitable HP, SQ cage induction motor, TEFC, synchronous speed 2900 RPM, suitable for operation on 415 ± 6% volts, 3 phase 50 Hz. AC with IP 55 protection for enclosure with Class-'F' insulation, conforming to IS-325.<br>c) M.S.fabricated common base plate, coupling, coupling guard, foundation bolts etc. as required.                                                                                   | 85845.00  | Set  | 85,845.00    |
| 84                                                                   | 1.00                                         | Providing and fixing, testing and commissioning of Diesel engine main fire diesel pump suitable for automatic operation and consisting of following: complete in all respect as required. 30.0 HP, 1200 LPM, 70-80 Meter head.<br>a) Horizontal type centrifugal back pull out pump of cast iron body and bronze impeller with cs shaft, mechanical seal to ensure a minimum pressure of 3.5 kg/sq.cm. at highest and farthest outlet at specified 30.0 HP flow of 1200 LPM at 70-80 Meter head conforming to IS 1520.<br>b) Suitable HP, SQ cage induction motor, TEFC, synchronous speed 2900 RPM, suitable for operation on 415 ± 6% volts, 3 phase 50 Hz. AC with IP 55 protection for enclosure with Class-'F' insulation, conforming to IS-325.<br>c) M.S.fabricated common base plate, coupling, coupling guard, foundation bolts etc. as required.                                                                                 | 185260.00 | Set  | 1,85,260.00  |
| 85                                                                   | 1.00                                         | Providing and fixing, testing and commissioning of Combine Control Panel suitable for auto start and stop of fire pump with the provision of push buttons for manual operation with supply & control cabling & earthing and all instrumetation etc as required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 136691.20 | Nos  | 1,36,691.20  |
| 86                                                                   | 3.00                                         | Providing and fixing of dial type Pressure Guage having 100 mm dial & range of 0-10 Kg/cm2 with syphon and cock.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1534.00   | Nos  | 4,602.00     |
| 87                                                                   | 3.00                                         | Providing and fixing, testing and commissioning of pressure switches as specified.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1534.00   | Nos  | 4,602.00     |
| 88                                                                   | 4.00                                         | Providing and fixing, testing and commissioning of CI Buterfly valve (PN 1.0) with integrally moulded linear of nitrile or EPDM. Stainless steel Disc & Steam Lever operated with ISI Marked as required. 100 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4236.20   | Each | 16,944.80    |
| 89                                                                   | 2.00                                         | Providing and fixing, testing and commissioning of CI Buterfly valve (PN 1.0) with integrally moulded linear of nitrile or EPDM. Stainless steel Disc & Steam Lever operated with ISI Marked as required. 80 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3374.80   | Each | 6,749.60     |
| 90                                                                   | 2.00                                         | Providing and fixing, testing and commissioning of CI Buterfly valve (PN 1.0) with integrally moulded linear of nitrile or EPDM. Stainless steel Disc & Steam Lever operated with ISI Marked as required. 50 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2737.60   | Each | 5,475.20     |
| 91                                                                   | 1.00                                         | Providing, fixing, testing and commissioning of dual plate weffer type non-return valve of following sizes conforming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc. as required. 100 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3953.00   | Each | 3,953.00     |
| 92                                                                   | 2.00                                         | Providing, fixing, testing and commissioning of dual plate heavy dual plate type non-return valve of following sizes conforming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc. as required. 100 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 9145.00   | Each | 18,290.00    |
| 93                                                                   | 1.00                                         | Providing, fixing, testing and commissioning of dual plate heavy dual plate type non-return valve of following sizes conforming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc. as required. 80 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5605.00   | Each | 5,605.00     |
| 94                                                                   | 2.00                                         | Providing, fixing, testing and comissioning of S.S Ball valve of sizes: 25 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1298.00   | Each | 2,596.00     |
| 95                                                                   | 1.00                                         | Providing, fixing, testing and commissioning of Ball type Foot Valve of following sizes conforming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc. as required. 80mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 8791.00   | Each | 8,791.00     |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |      | 478          |
|----------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                    | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                 | IN FIGURE |      |              |
| 96                                                                   | 2.00                                         | Providing, fixing, testing and commissioning of Ball type Foot Valve of following sizes conforming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc. as required. 100mm dia.                                                                                                                                                                                                                                | 12803.00  | Each | 25,606.00    |
| 97                                                                   | 132.00                                       | FIRE HYDRANT & SPRINKLER SYSTEM : Providing, laying, testing & commissioning of 'C' class heavy duty MS pipe conforming to IS 3589/IS 1239 including Welding, fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. and fixing the pipe on the wall/ceiling with suitable clamp/support frame and painting with two or more coats of synthetic enamel paint of required shade complete as required : 100 mm dia | 2555.00   | Rmt  | 3,37,260.00  |
| 98                                                                   | 25.00                                        | Providing, laying, testing & commissioning of 'C' class heavy duty MS pipe conforming to IS 3589/IS 1239 including Welding, fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. and fixing the pipe on the wall/ceiling with suitable clamp/support frame and painting with two or more coats of synthetic enamel paint of required shade complete as required : 80 mm dia                                    | 1885.00   | Rmt  | 47,125.00    |
| 99                                                                   | 90.00                                        | Providing, laying, testing & commissioning of 'C' class heavy duty MS pipe conforming to IS 3589/IS 1239 including Welding, fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. and fixing the pipe on the wall/ceiling with suitable clamp/support frame and painting with two or more coats of synthetic enamel paint of required shade complete as required : 50 mm dia.                                   | 1281.00   | Rmt  | 1,15,290.00  |
| 100                                                                  | 55.00                                        | Providing, laying, testing & commissioning of 'C' class heavy duty MS pipe conforming to IS 3589/IS 1239 including Welding, fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. and fixing the pipe on the wall/ceiling with suitable clamp/support frame and painting with two or more coats of synthetic enamel paint of required shade complete as required : 32 mm dia.                                   | 851.00    | Rmt  | 46,805.00    |
| 101                                                                  | 30.00                                        | Providing, laying, testing & commissioning of 'C' class heavy duty MS pipe conforming to IS 3589/IS 1239 including Welding, fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. and fixing the pipe on the wall/ceiling with suitable clamp/support frame and painting with two or more coats of synthetic enamel paint of required shade complete as required : 25 mm dia.                                   | 744.00    | Rmt  | 22,320.00    |
| 102                                                                  | 2.00                                         | Providing, fixing, testing and commissioning of SS single headed ISI marked oblique pattern hydrant landing valves as per IS: 5290 with 80 mm dia flanged inlet & 63 mm dia female outlet complete with gun metal cap.                                                                                                                                                                                                          | 5015.00   | Each | 10,030.00    |
| 103                                                                  | 2.00                                         | Providing, fixing, testing and commissioning of 63 mm dia 15m long RRL hose pipe with 63 mm dia. Male and female SS couplings duly binded with GI wire, rivets etc. conforming to IS 636 (type-A) as required.                                                                                                                                                                                                                  | 3953.00   | Each | 7,906.00     |
| 104                                                                  | 2.00                                         | Providing, fixing, testing and commissioning of Standard SS branch pipe with nozzle of 20 mm nominal bore outlet as per IS:903 suitable to fit with standard instantaneous type 63 mm dia coupling.                                                                                                                                                                                                                             | 1711.00   | Each | 3,422.00     |
| 105                                                                  | 2.00                                         | Supplying and fixing First Aid hose reel with MS construction spray painted in post office red, conforming to IS 884 with upto date amendments, complete with the following as required.                                                                                                                                                                                                                                        | 7139.00   | Each | 14,278.00    |
| 106                                                                  | 2.00                                         | Providing, fixing, testing and commissioning of Weather proof standard fire hose cabinet wall mounting type (450 mm x 600 mm x 250 mm deep) having single or double opening with necessary locking arrangement by allan key suitable for housing 1 nos. hose pipe, 1no. Branch pipe & nozzle spaner. (16 Gauge)                                                                                                                 | 1888.00   | Each | 3,776.00     |
| 107                                                                  | 2.00                                         | Providing, fixing, testing and commissioning of Gun metal four way fire brigade inlet as per IS:904 having 63 mm dia inlet with blank cap and chain with necessary fittings, flanges, nutbolts etc.                                                                                                                                                                                                                             | 8083.00   | Each | 16,166.00    |
| 108                                                                  | 45.00                                        | Providing and fixing of 15 mm dia quartzoid bulb type Crome plated sprinkler head. Pandent sprinkler 57oC                                                                                                                                                                                                                                                                                                                       | 395.30    | Each | 17,788.50    |
| 109                                                                  | 6.00                                         | Mono Amonium Phosphate (ABC) Powder type Fire Extinguisher of capacity 6 kg. as per IS 15683 with hanging bracket & accessories.                                                                                                                                                                                                                                                                                                | 2784.80   | Each | 16,708.80    |
| 110                                                                  | 6.00                                         | Carbon Dioxide (CO2) Gas type Fire Extinguisher of capacity 4.5 kg. as per IS 15683 with squeeze grip type operation with swivel horn, hanging bracket & accessories.                                                                                                                                                                                                                                                           | 5970.80   | Each | 35,824.80    |
| 111                                                                  | 2.00                                         | Providing and fixing of fire alarm and pump trigger system as per requirement and specification consisting of following items. Manual call point:                                                                                                                                                                                                                                                                               | 2478.00   | Each | 4,956.00     |
| 112                                                                  | 2.00                                         | Providing and fixing of fire alarm and pump trigger system as per requirement and specification consisting of following items. Hooter:                                                                                                                                                                                                                                                                                          | 2478.00   | Each | 4,956.00     |
| 113                                                                  | 2.00                                         | Providing and fixing of fire alarm and pump trigger system as per requirement and specification consisting of following items. Pump On / Off switch:                                                                                                                                                                                                                                                                            | 2478.00   | Each | 4,956.00     |
| 114                                                                  | 25.00                                        | Providing and fixing of fire alarm and pump trigger system as per requirement and specification consisting of following items. Convettional Smoke Detector:                                                                                                                                                                                                                                                                     | 2950.00   | Each | 73,750.00    |
| 115                                                                  | 2.00                                         | Providing and fixing of fire alarm and pump trigger system as per requirement and specification consisting of following items. 12 V 7 AH Battery - Chloride by Exide:                                                                                                                                                                                                                                                           | 1593.00   | Each | 3,186.00     |
| 116                                                                  | 320.00                                       | Providing and fixing of fire alarm and pump trigger system as per requirement and specification consisting of following items. 1.5 Sq.mm copper cable:                                                                                                                                                                                                                                                                          | 41.30     | Rmt  | 13,216.00    |
| 117                                                                  | 45.00                                        | Providing and fixing of fire alarm and pump trigger system as per requirement and specification consisting of following items. 6 sq.mm x 3 c Patti cable for pump suction:                                                                                                                                                                                                                                                      | 311.52    | Rmt  | 14,018.40    |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |       | 479          |
|----------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |       |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ESTIMATED | Unit  | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | IN FIGURE |       |              |
| 118                                                                  | 1.00                                         | Providing and fixing of 4 Zone Alarm Control Panel for fire alarm system complete with cabling and as per the requirement of the system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 26845.00  | Set   | 26,845.00    |
| 119                                                                  | 176.00                                       | ELECTRICAL WORK : Point wiring for Light / Bell with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires up to 10 mtr length , in below type of pipe erected with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic/Wooden box, single mounting base frame covered with textured/metallic/white front plate modules erected on / in wall / ceiling as per pipe erected, with necessary Lamp holder/ceiling rose / H.D.Connector as directed. (f) with medium class Rigid PVC pipe and accessories erected concealed in wall/ceiling complete Cat-III   | 495.00    | Point | 87,120.00    |
| 120                                                                  | 25.00                                        | Point wiring for secondary light point with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires, in below type of pipe to be erected complete with earth continuity and necessary connection with primary light with accessories erected on Metal / PVC / wooden box covered with 3 mm thick PC(Polycarbonate) / Acrylic sheet for open / concealed wiring. with necessary Lamp holder / ceiling rose / H.D.Connector as directed. (f) with medium class Rigid PVC pipe and accessories erected concealed in wall/ceiling complete                                                                                      | 164.00    | Point | 4,100.00     |
| 121                                                                  | 4.00                                         | Point wiring for FAN with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (Green) both are of .ISI marked 1.1 KV Grade FRLS PVC insulated multi strand copper wires up to 10 mtr length, in below type of pipe erected with 6A Modular type switch and hum free EME step type electronic fan regulator mounted and accessories with earth continuity of following type erected on PVC / Metallic/Wooden box, single mounting base frame covered with textured/metallic/white front plate modules erected on / in wall / ceiling as per pipe erected. with necessary ceiling rose / H.D.Connector as directed.(f) with medium class Rigid PVC pipe and accessories erected concealed in wall/ceiling complete | 695.00    | Point | 2,780.00     |
| 122                                                                  | 4.00                                         | Point wiring for Individual Plug with & earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires up to 10 mtr length, in below type of pipe erected complete with Modular type switch & 5 pin Plug erected on PVC / Metallic/Wooden box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories.[I] For 6A Plug and 6 a switch with 2-1.5 sq.mm Cu. Wire from nearby switchboard/mcb db board (f) with medium class Rigid PVC pipe and accessories erected concealed in wall/ceiling complete Cat-III                                                           | 523.00    | Point | 2,092.00     |
| 123                                                                  | 53.00                                        | Point wiring for Individual Plug with & earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires up to 10 mtr length, in below type of pipe erected complete with Modular type switch & 5 pin Plug erected on PVC / Metallic/Wooden box covered with appropriate front plate modules erected on / in wall / ceiling as per pipe erected with following type of accessories.[II] For 16A Plug and 16 amp switch with 2-2.5 sq.mm Cu. Wire from mcb db board. (f) with medium class Rigid PVC pipe and accessories erected concealed in wall/ceiling complete Cat-III                                                                        | 773.00    | Point | 40,969.00    |
| 124                                                                  | 4.00                                         | Point wiring for on board Looped Plug with 6A Modular type switch & 5 pin socket erected on PVC / Metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate modules erected on / in wall / ceiling with following type accessories. Cat-III                                                                                                                                                                                                                                                                                                                                                                                                               | 266.00    | Point | 1,064.00     |
| 125                                                                  | 4.00                                         | Point wiring for Two Way Controlled Light Point with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (green) both are of .ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires erected in below type of pipe with 6A Modular type switches and following type of accessories erected on PVC / Metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate modules erected on / in wall / ceiling as per pipe erected. with necessary batten/angle holder or ceiling rose or H.D.Connector as directed.(f) with medium class Rigid PVC pipe and accessories erected concealed in wall/ceiling complete. Cat-III                                        | 616.00    | Point | 2,464.00     |
| 126                                                                  | 8.00                                         | Providing following type of Modular Type Accessories mounted with PVC / metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate , modules erected with necessary connections as per site situation directed by Engineer In charge.(3) Two Pin/RJ-11 Telephone Socket [A] For One Gang cat III                                                                                                                                                                                                                                                                                                                                                           | 178.00    | Each  | 1,424.00     |
| 127                                                                  | 20.00                                        | Providing following type of Modular Type Accessories mounted with PVC / metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate , modules erected with necessary connections as per site situation directed by Engineer In charge. Blank Plate Single cat III                                                                                                                                                                                                                                                                                                                                                                                           | 28.00     | Each  | 560.00       |
| 128                                                                  | 8.00                                         | Providing following type of Modular Type Accessories mounted with PVC / metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate , modules erected with necessary connections as per site situation directed by Engineer In charge. Computer RJ-45 socket                                                                                                                                                                                                                                                                                                                                                                                                | 178.00    | Each  | 1,424.00     |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |      | 480          |
|----------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                       | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                    | IN FIGURE |      |              |
| 129                                                                  | 5.00                                         | Providing following type of Modular Type Accessories mounted with PVC / metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate , modules erected with necessary connections as per site situation directed by Engineer In charge. 6/16Amp. Universal socket cat III                                                                                                                                    | 222.00    | Each | 1,110.00     |
| 130                                                                  | 2.00                                         | Providing following type of Modular Type Accessories mounted with PVC / metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate , modules erected with necessary connections as per site situation directed by Engineer In charge. Modular Indicating Call Bell cat III                                                                                                                                 | 366.00    | Each | 732.00       |
| 131                                                                  | 2.00                                         | Providing following type of Modular Type Accessories mounted with PVC / metallic/Wooden box, single mounting base frame covered with textured / metallic/white front plate , modules erected with necessary connections as per site situation directed by Engineer In charge. 16/20/25 Amp. Modular Starter for Motor / A.C. Unit Complete. cat III                                                                                                | 554.00    | Each | 1,108.00     |
| 132                                                                  | 329.00                                       | Providing and erecting ISI mark Medium class RIGID PVC PIPES of following size complete to be erected on/in wall or ceiling erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following dia of pipes, in approved manner as directed.(A)20 mm                                                                                                                                                        | 26.00     | Mtr  | 8,554.00     |
| 133                                                                  | 50.00                                        | Providing and erecting ISI mark Medium class RIGID PVC PIPES of following size complete to be erected on/in wall or ceiling erected with necessary PVC fittings & Junction boxes fixed with adhesive solution & Clamps with following dia of pipes, in approved manner as directed.(B)25 MM                                                                                                                                                        | 36.00     | Mtr  | 1,800.00     |
| 134                                                                  | 70.00                                        | Supplying & erecting UPVC Mini trunking (PVC Casing-n-Capping) having double-locking arrangement with grooves, trunking of size not below 12.5 mm in height as per IS with accessories of PVC/Resin polypropylene not below 1.8 mm thick duly sealed in joint & erected on wall / ceiling of following size .(1) 20 MM                                                                                                                             | 23.00     | Mtr  | 1,610.00     |
| 135                                                                  | 50.00                                        | Supplying & erecting UPVC Mini trunking (PVC Casing-n-Capping) having double-locking arrangement with grooves, trunking of size not below 12.5 mm in height as per IS with accessories of PVC/Resin polypropylene not below 1.8 mm thick duly sealed in joint & erected on wall / ceiling of following size .(2) 25 mm                                                                                                                             | 34.00     | Mtr  | 1,700.00     |
| 136                                                                  | 50.00                                        | Supplying & erecting UPVC Mini trunking (PVC Casing-n-Capping) having double-locking arrangement with grooves, trunking of size not below 12.5 mm in height as per IS with accessories of PVC/Resin polypropylene not below 1.8 mm thick duly sealed in joint & erected on wall / ceiling of following size .(3) 32 mm                                                                                                                             | 40.00     | Mtr  | 2,000.00     |
| 137                                                                  | 50.00                                        | Supplying & erecting UPVC Mini trunking (PVC Casing-n-Capping) having double-locking arrangement with grooves, trunking of size not below 12.5 mm in height as per IS with accessories of PVC/Resin polypropylene not below 1.8 mm thick duly sealed in joint & erected on wall / ceiling of following size .(4) 40 mm                                                                                                                             | 45.00     | Mtr  | 2,250.00     |
| 138                                                                  | 361.00                                       | Providing and erecting Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected concealed in /flushed on wall/ceiling, with 1.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size (A) with medium class Rigid PVC pipe and accessories (a) 2 wire 1.5 sq. mm                                                     | 68.00     | Mtr. | 24,548.00    |
| 139                                                                  | 71.00                                        | Providing and erecting Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected concealed in /flushed on wall/ceiling, with 1.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size (A) with medium class Rigid PVC pipe and accessories(B) with medium class Rigid PVC pipe and accessories (a) 2 wire 2.5 sq. mm | 90.00     | Mtr. | 6,390.00     |
| 140                                                                  | 28.00                                        | providing and erecting Mains with 1.1 KV grade FRLS PVC insulated ISI marked stranded Copper conductor wire in following type of pipe to be erected in / on wall / ceiling with 2.5 sq. mm copper conductor FRLS PVC insulated stranded wire of green colour for earth continuity of following size.(A) with medium class Rigid PVC pipe and accessories.(a) 2 wire 4 sq. mm                                                                       | 123.00    | Mtr. | 3,444.00     |
| 141                                                                  | 500.00                                       | Supplying and erecting Flexible PVC insulated multi strand multi core 1.1 kv grade ISI marked copper wires of following size to be erected as directed.(e) 1.50 Sq.mm 3 core round PVC sheathed                                                                                                                                                                                                                                                    | 51.00     | Mtr. | 25,500.00    |
| 142                                                                  | 50.00                                        | Providing & Erecting approved make following size of TV Co-axial flexible cable comprising inner conductor of solid bare copper insulated with Foam PE & Secondary conductor made of poly - Aluminium film bonded Al. Braids @ suitable coverage overall sheathed with black PVC insulation.(e) RG-11                                                                                                                                              | 68.00     | Mtr  | 3,400.00     |
| 143                                                                  | 8.00                                         | Providing & erecting Switch board for Computer or electric apparatus consisting of following modular type accessories mounted with PVC / Metallic concealed/open box with single mounting base frame covered with textured/metallic /white front plate,modules erected with necessary connections as directed<br>1 no. 6A/16A universal plug-switch combined.<br>3 nos. 6A Switch<br>3 nos. 6A 5 pin Plug Cat III                                  | 1262.00   | Each | 10,096.00    |



## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ESTIMATED | Unit | Total Amount |
|---------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | IN FIGURE |      |              |
| 144     | 4.00                                         | EARTHING : Supplying & erecting earth pit of minimum bore dia.150mm size approved make Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free hot dipped G.I.Pipes having Outer pipe dia of 50mm having 80-200 Micron galvanising, Inner pipe dia of 25 mm having 200-250 Micron galvanising, connection terminal dia of 12mm with constant ohmic value surrounded by highly conductive compound with high charge dissipation suitable for following type of applications with chamber and heavy duty cover.(approved make OEM has to submit test certificate) & having back filling compound of (B) Inner chemical (CCM Compound)- Resistivity:- 0.2 $\Omega$ / meter testing as per IEC 62561-2017, Voltage drop:- < 1 volt at no load & dry form, Sulphar content:- <2%(C) Back fill Compound :- Earthing compound should be capable to retain moisture for long time Necessary test report must be submitted. (a) For Electrical Installation up to 440V in normal soil<br>Length of pipe - 1 Mtr<br>Back filling compound - 1 Nos Bag of 15 Kg. | 5363.00   | Each | 21,452.00    |
| 145     | 12.00                                        | Supplying & erecting in earthpit of minimum bore dia. 225mm size approved make Safe Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free hot dipped G.I.Pipes having Outer pipe dia of 80 mm having 80-200 Micron galvanising, Inner pipe dia of 40 mm having 200-250 Micron galvanising, connection terminal dia of 14 mm with constant ohmic value surrounded by highly conductive compound with high charge dissipation suitable for following type of applications with chamber and heavy duty cover.(approved make OEM has to submit test certificate including value of earth resistance of installation.[C] For Electrical Installation covering Transformer Neutrals, Lightning arrester Earthing, A.C.Plant & Sensitive Computer System(like Automation, SCADA)i.e. independent Earthing located in other than normal soil i.e. Soft Rock, Marshy Soil etc.<br>-Length of Pipe : 3 Mtrs.<br>-Back filling Compound :2 nos Bags of 25 Kg.                                                                                                  | 12375.00  | Each | 1,48,500.00  |
| 146     | 50.00                                        | Providing and erecting required size HOT deep Galvanised iron strip for earthing of H.T. , OCB/ ACB/ Transformer LT panel board, Motors etc. using proper clamp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 90.00     | Kg   | 4,500.00     |
| 147     | 25.00                                        | Providing and erecting required size Copper strip for earthing of H.T. OCB / ACB/ Transformer, LT panel board, Motors etc. using copper clamp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 928.00    | Kg   | 23,200.00    |
| 148     | 12.00                                        | Providing and erecting HOT deep Galvanised iron strip wire 8 to 16 SWG.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 90.00     | Kg   | 1,080.00     |
| 149     | 10.00                                        | Lighting Fixtures ,Fan & other items : Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA/aluminium pressure die cast powder coated and high U.V. & corrosion resistance with diffuser housed in aluminium casted body with company mark/name 160V to 270V,Power Factor more than 0.9, THD < 15 %, CCT 3000 K to 6500K, Luminaire efficacy> 85 lumens/watt ,LED driver efficiency > 85 % ( fitting required LM-79 & LM-80 Certificates)(NOTE: Below description have shown ranges of Wattage capacity of LED fittings.The Engineer incharge may select any wattage capacity between the ranges shown.)(A) Square/ Circular shaped Surface/Recessed Mount Downlight with provision for spring loaded mounting clips complete. IP20 (b) 11-15 watts, Surge-2 KV                                                                                                                                                                      | 550.00    | Each | 5,500.00     |
| 150     | 50.00                                        | Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA/aluminium pressure die cast powder coated and high U.V. & corrosion resistance with diffuser housed in aluminium casted body with company mark/name 160V to 270V,Power Factor more than 0.9, THD < 15 %, CCT 3000 K to 6500K, Luminaire efficacy> 85 lumens/watt ,LED driver efficiency > 85 % ( fitting required LM-79 & LM-80 Certificates)(NOTE: Below description have shown ranges of Wattage capacity of LED fittings.The Engineer incharge may select any wattage capacity between the ranges shown.)(A) Square/ Circular shaped Surface/Recessed Mount Downlight with provision for spring loaded mounting clips complete. IP20 (G) Step Light having Aluminium die cast and ABS Plastic material.(i) 5 watts, Direct/Indirect luminaire Cat-III                                                                                                                        | 740.00    | Each | 37,000.00    |
| 151     | 10.00                                        | Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA/aluminium pressure die cast powder coated and high U.V. & corrosion resistance with diffuser housed in aluminium casted body with company mark/name 160V to 270V,Power Factor more than 0.9, THD < 15 %, CCT 3000 K to 6500K, Luminaire efficacy> 85 lumens/watt ,LED driver efficiency > 85 % ( fitting required LM-79 & LM-80 Certificates)(NOTE: Below description have shown ranges of Wattage capacity of LED fittings.The Engineer incharge may select any wattage capacity between the ranges shown.)(A) Square/ Circular shaped Surface/Recessed Mount Downlight with provision for spring loaded mounting clips complete.IP20 (F) Spot Light 425 Lumens, Surge-2KV, (ii) 8 to 11 Watts, Cat-III                                                                                                                                                                        | 1770.00   | Each | 17,700.00    |

## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ESTIMATED | Unit | Total Amount |
|---------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | IN FIGURE |      |              |
| 152     | 13.00                                        | Supply, Installation Testing and Commissioning of 8W recessed mounted High quality polycarbonate diffuser and PDC AI housing recessed design 150 mm Cutout for visual comfort Downlighter delivering >1000 Lumen, 4000 TO 6000K CRI>80, THD <10%, Input voltage Range 140-270 VAC , EMI EMC Compliant (as per CISPR 15)Replacable driver Luminaire driver both BIS Compliant and having CRS ( R No ) L70B50 @ 50K Hrs, Power factor>0.95, IP20 protection, operating temperature range from 0 to 45 deg C, internal surge protection of 2.5kV. LM79 and LM80 reports must be submitted from a NABL accredited laboratory. BIS certificate for driver as well as the luminaire must be submitted for records. Driver and luminaire shall be of same make.                                                                                                                                                                                              | 1926.10   | Each | 25,039.30    |
| 153     | 31.00                                        | Supply, Installation Testing and Commissioning of 18W deep recessed mounted High quality glossy reflector & PDC AI Deep recessed design ensures Low Glare (UGR <= 19, shielding 38°) 125 mm Cutout for visual comfort Downlighter delivering >2000 Lumen, 4000 TO 6000K CRI>80 with Ra>0, THD <10%, SDCM<5, Beam angle 60-65 Deg Input voltage Range 140-270 VAC , EMI EMC Compliant (as per CISPR 15)Replacable driver Luminaire driver both BIS Compliant and having CRS ( R No ) L70B50 @ 50K Hrs, Power factor>0.9, IP20 protection, operating temperature range from 0 to 45 deg C, internal surge protection of 2.5kV. LM79 and LM80 reports must be submitted from a NABL accredited laboratory. BIS certificate for driver as well as the luminaire must be submitted for records. Driver and luminaire shall be of same make.                                                                                                                | 2964.50   | Each | 91,899.50    |
| 154     | 12.00                                        | Supply, Installation Testing and Commissioning of 18W deep recessed mounted High quality glossy reflector & PDC AI Deep recessed design ensures Low Glare (UGR <= 19, shielding 38°) 125 mm Cutout for visual comfort Downlighter delivering >2000 Lumen, 4000 TO 6000K CRI>80 with Ra>0, THD <10%, SDCM<5, Beam angle 60-65 Deg Input voltage Range 140-270 VAC , EMI EMC Compliant (as per CISPR 15)Replacable driver Luminaire driver both BIS Compliant and having CRS ( R No ) L70B50 @ 50K Hrs, Power factor>0.9, IP20 protection, operating temperature range from 0 to 45 deg C, internal surge protection of 2.5kV. LM79 and LM80 reports must be submitted from a NABL accredited laboratory. BIS certificate for driver as well as the luminaire must be submitted for records. Driver and luminaire shall be of same make.                                                                                                                | 2964.50   | Each | 35,574.00    |
| 155     | 114.00                                       | Supply, Installation Testing and Commissioning of 20W recessed mounted High quality polycarbonate diffuser and PDC AI housing recessed design 150 mm Cutout for visual comfort Downlighter delivering >2000 Lumen, 4000 TO 6000K CRI>80, THD <10%, Input voltage Range 140-270 VAC , EMI EMC Compliant (as per CISPR 15)Replacable driver Luminaire driver both BIS Compliant and having CRS ( R No ) L70B50 @ 50K Hrs, Power factor>0.95, IP20 protection, operating temperature range from 0 to 45 deg C, internal surge protection of 2.5kV. LM79 and LM80 reports must be submitted from a NABL accredited laboratory. BIS certificate for driver as well as the luminaire must be submitted for records. Driver and luminaire shall be of same make.                                                                                                                                                                                             | 2964.50   | Each | 3,37,953.00  |
| 156     | 50.00                                        | Supply, Installation Testing and Commissioning of 20W DALI DRIVER... Driver and luminaire shall be of same make.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2964.50   | Each | 1,48,225.00  |
| 157     | 1.00                                         | Supply,Installation,Testing and Commissioning of 2-Channel DIN Rail DALI Module Should be DIN rail mountable 9M wide or less; Should have minimum 2xIndependent DALI loops or more; Should support minimum 128 DALI Ballasts or more; Should have Integrated DALI power supply; Should be IEEE 802.3af PoE Powered Device; Should support minimum 4 wires bus connectivity or PoE communication or better; Should includes an override input connectivity option; Should have sets up option via the front panel or through software; Should be capable of communicating with central control system; Should be UL Listed, CE, CEC Title 24 2013 device compliant; Should have addressing option so that multiple units of same kind can be controlled via single communication port in a control system (Including Five year free maintenance with guarantee) OR Equivalent to phillips, hawells,Bajaj Dali System or Approved by engineer/Architect | 96800.00  | Each | 96,800.00    |
| 158     | 1.00                                         | Supply,Installation,Testing and Commissioning of Universal Keypad Interface Should Transforms a third-party keypad to controller compitable Should supports 8 or more buttons. Should be capable to drive 8 LEDs or more for feedback Each input should support a range of 0-24 Volts DC Should support Open drain outputs rated for 100mA @ 24VDC (Including Five year free maintenance with guarantee) OR Equivalent to phillips, hawells,Bajaj Dali System or Approved by engineer/Architect                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 23200.00  | Each | 23,200.00    |
| 159     | 1.00                                         | Supply,Installation,Testing and Commissioning of Control Power Redundancy Module Should enables redundancy in control network by providing a provision of two power supplies connections. Should function as If one of the power supplies fails, the second power supply takes over to power the system to prevent downtime. Should have an 2-line LCD display. Should be capable to show the Voltage indication and current consumption on the LCD display (Including Five year free maintenance with guarantee) OR Equivalent to phillips, hawells,Bajaj Dali System or Approved by engineer/Architect                                                                                                                                                                                                                                                                                                                                              | 48400.00  | Each | 48,400.00    |

## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ESTIMATED | Unit | Total Amount |
|---------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | IN FIGURE |      |              |
| 160     | 1.00                                         | Supply,Installation,Testing and Commissioning of BACne Network/IP License for Controller Should enables interfacing with BACne network/IP based equipment directly through controller BACnet network/IP support enables seamless integration with existing building management systems. Should enables a control system to support minimum 500 BACnet objects or better Should be managed such that All systems run independently and communicate with each other on the same platform (Including Five year free maintenance with guarantee) OR Equivalent to phillips, hawells,Bajaj Dali System or Approved by engineer/Architect                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 121000.00 | Each | 1,21,000.00  |
| 161     | 4.00                                         | Providing & erecting Approved make Power Saving 50 Watt Ceiling Fan with double ball bearing ISI mark with Condenser 230 volt A.C. 50 Hz 1200 mm sweep complete having 3blades with aluminium blades with , canopy & 30 cm. down rod erected with earthing.(Make shall be approved by Engineer in charge)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2070.00   | Each | 8,280.00     |
| 162     | 4.00                                         | Supplying & erecting fan hook box of 10 mm M.S. round bar bounded to the RCC bars up to 50mm length each side and pierced through a 16 Gauge M.S. box / Heavy Duty PVC box complete erected concealed in Ceiling with necessary finishing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 125.00    | Each | 500.00       |
| 163     | 4.00                                         | Providing 2.5mm.thick laminated acrylic sheet to cover the fan hook or Fan box.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20.00     | Each | 80.00        |
| 164     | 10.00                                        | Supplying & erecting approved make low noise decorative exhaust fan having square frame ABS body with inbuilt lowers & square frame.For 200mm with 1350 RPM cat-ii                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1990.00   | Each | 19,900.00    |
| 165     | 8.00                                         | <b>Panel &amp; Switchgear</b> : Providing and erecting metallic danger notice board for MEDIUM VOLTAGE installation to be erected as per I.S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 80.00     | Each | 640.00       |
| 166     | 4.00                                         | Providing & erecting weather proof, dust & vermin proof, floor mounted front operated indoor type cubical panel board necessary IP-42 and above protection as per approval from engineer incharge made from 14 SWG thick CRC M.S. sheet for outer body & doors, 16 SWG thick CRC M.S.sheet for internal partitions with necessary accessories , supporting angles/ flats channel including cutting, bending, drilling, welding, riveting with internal partitions & cable alley as per requirements & instruction of engineer-in-charge with erection of supplied switch gears, BUSBARS, suitable size of inter connecting PVC copper wire / copper-aluminium strips, rubber grommets, rib, bakelite control fuses/MCB for measuring instruments, earth bus & earth bolts, foundation flange - bolts-base Plates, sufficient nos. of hinged doors, handles with locking arrangement and rubber gasket,heavy duty end terminal connection,danger notice board,necessary ventilation,earthing strip complete. The Panel shall be painted with epoxy powder coating. (The rates excludes the cost of switchgears, bus bars, inter connecting mains & Copper Aluminium strips, meters, Fuses etc. The dimension shall be measured excluding base beams) The panel shall be supplied with following approved manufacturers with following size. (B) The standard companies switch gear shall be used and only manufacturers at CPRI approved factory (ii) with 550mm depth | 22650.00  | Sqmt | 90,600.00    |
| 167     | 1.00                                         | Supplying & erecting approved make Four Pole 415V change over switch interior for panel mounting with operating mechanism A.C.23 duty confirming to IS for (G) 630 A. Cat.III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 30550.00  | Each | 30,550.00    |
| 168     | 2.00                                         | Supplying and erecting triple pole & neutral 440V / 500V panel mounting Copper Busbars with four equal Nos. of electrolyte bus having current density not more than 1.6 Amp. / sq.mm (Rated current / cross section area) duly wrapped with colour insulating tape for phase sequence of following current carrying capacity, erected with necessary bus bar supports /insulators, main cable socket to each bar, erected in existing cubical panel with necessary connections.(E) Suitable for 630 Amp. capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 12335.00  | Rmt  | 24,670.00    |
| 169     | 2.00                                         | Supplying and erecting triple pole & neutral 440V / 500V panel mounting Copper Busbars with four equal Nos. of electrolyte bus having current density not more than 1.6 Amp. / sq.mm (Rated current / cross section area) duly wrapped with colour insulating tape for phase sequence of following current carrying capacity, erected with necessary bus bar supports /insulators, main cable socket to each bar, erected in existing cubical panel with necessary connections(d) Suitable for 400 Amp. Capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8550.00   | Rmt  | 17,100.00    |
| 170     | 2.00                                         | Supplying and erecting triple pole & neutral 440V / 500V panel mounting Copper Busbars with four equal Nos. of electrolyte bus having current density not more than 1.6 Amp. / sq.mm (Rated current / cross section area) duly wrapped with colour insulating tape for phase sequence of following current carrying capacity, erected with necessary bus bar supports /insulators, main cable socket to each bar, erected in existing cubical panel with necessary connections(b ) Suitable for 200 Amp. Capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3740.00   | Rmt  | 7,480.00     |
| 171     | 2.00                                         | Supplying and erecting triple pole & neutral 440V / 500V panel mounting Copper Busbars with four equal Nos. of electrolyte bus having current density not more than 1.6 Amp. / sq.mm (Rated current / cross section area) duly wrapped with colour insulating tape for phase sequence of following current carrying capacity, erected with necessary bus bar supports /insulators, main cable socket to each bar, erected in existing cubical panel with necessary connections(a) Suitable for 100 Amp. Capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2290.00   | Rmt  | 4,580.00     |

## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                               | ESTIMATED | Unit | Total Amount |
|---------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                            | IN FIGURE |      |              |
| 172     | 1.00                                         | Providing and erecting Approved make Four pole moulded case circuit breaker having breaking capacity ICU of 50 K.A. and above at 415 V having normal current rating up to 630A. with variable thermal & magnetic release suitable to work on A.C.supply 50 c/s. with all internal connections, spreader tinned copper & complete erected in existing 16 G.M.S. housing ICS=100% of ICU only. Cat III                                       | 32915.00  | Each | 32,915.00    |
| 173     | 2.00                                         | Providing and erecting Approved make Four pole moulded case circuit breaker having breaking capacity ICU of 50 KA and above at 415 V having Normal current rating 400A. with variable Thermal & magnetic release suitable to work on A.C.supply 50 c/s. With all internal connections, spreader tinned copper & complete erected in existing 16 G.M.S. housing. ICS=100% of ICU only. Cat.-III (APFC+HVAC)                                 | 29475.00  | Each | 58,950.00    |
| 174     | 1.00                                         | Providing and erecting Approved make Four pole moulded case circuit breaker having breaking capacity ICU of 35 KA. at 415 V. having Normal current rating 200A.with variable Thermal & magnetic release suitable to work on A.C.supply 50 c/s. with all internal connections, spreader tinned copper & complete erected in existing 16 G.M.S.housing ICS=100% of ICU only. Cat.-III                                                        | 18950.00  | Each | 18,950.00    |
| 175     | 6.00                                         | Providing and erecting Approved make Four pole moulded case circuit breaker having breaking capacity ICU of 25 KA. at 415 V, having normal current rating up to 25 A to 100A. with Fixed thermal & magnetic release suitable to work on A.C. supply 50 c/s. with all internal connections, spreader tinned copper & complete erected in existing 16 G.M.S. housing. ICS=100% of ICU only Cat III                                           | 7210.00   | Nos. | 43,260.00    |
| 176     | 1.00                                         | Supplying, erecting, testing and commissioning of approved make panel mounting type Digital Voltmeter having 3 digits LED display 0 to 750 AC Volts range erected on existing panel board with all connection, wiring etc., with manufacturers calibration certificate.                                                                                                                                                                    | 1490.00   | Nos. | 1,490.00     |
| 177     | 1.00                                         | Supplying, erecting, testing and commissioning of approved make panel mounting type Digital Ammeter having 3 digits LED display, external CT operated, calibrated for 0 to 400 Amps. suitable to operate on 500 volt AC erected on existing panel board with all connection wiring etc., with manufacturers calibration certificate.                                                                                                       | 1820.00   | Nos. | 1,820.00     |
| 178     | 2.00                                         | Supplying, erecting, testing and commissioning of Ammeter / Voltmeter selector switch for 3 phase AC supply 500 V on existing panel board with necessary connections.                                                                                                                                                                                                                                                                      | 370.00    | Nos. | 740.00       |
| 179     | 3.00                                         | Providing, erecting, testing and commissioning of L.T. Current Transformer with bus bar primary 50/5 to 1000/5 ratio 15 VA burden. Duly secured with insulating materials connected to the meter.                                                                                                                                                                                                                                          | 320.00    | Nos. | 960.00       |
| 180     | 5.00                                         | Supplying and erecting approved make suitable panel indicator LED type lamp, lens cover, complete erected with necessary connections.                                                                                                                                                                                                                                                                                                      | 50.00     | Nos. | 250.00       |
| 181     | 3.00                                         | Providing & erecting 415 V MCB Four pole switch for motor & Inductive Load (C curve) having 10 KA breaking capacity & confirms to IS : 8828 in existing M.S box having following capacity:<br>© 63 Amp. Cat- III                                                                                                                                                                                                                           | 860.00    | Nos. | 2,580.00     |
| 182     | 12.00                                        | Providing and erecting 415 Volt MCB four pole motor & inductive load(c Curve) having 10 KA Breaking capacity and confirms to IS : 8828 in existing metal box having following capacity.<br>(a) 40 Amp Capacity. Cat III                                                                                                                                                                                                                    | 780.00    | Each | 9,360.00     |
| 183     | 2.00                                         | Providing & erecting 240 V MCB double pole switch for motor & inductive load (C Curve) having 10 KA breaking capacity & confirms to IS : 8828 in existing box having following capacity<br>(B) 40 Amp. CAT-iii                                                                                                                                                                                                                             | 386.00    | Each | 772.00       |
| 184     | 4.00                                         | providing and erecting Approved make RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 10 KA and suitable for operation on single phase 240 V,50Hz. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. for following Max. rating erected as directed. (i) 25Amps. DP                                             | 2300.00   | Each | 9,200.00     |
| 185     | 12.00                                        | providing and erecting Approved make RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 10 KA and suitable for operation on single phase 240 V,50Hz. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. for following Max. rating erected as directed(ii) 40Amps. DP                                              | 2610.00   | Each | 31,320.00    |
| 186     | 64.00                                        | providing and erecting Miniature circuit breaker single pole 6A to 25A suitable to operate on 240 V A.C. system and having breaking capacity 10 KA to be erected in existing box. conforming to IS 8828/1996 with ISI Mark .Cat.III (3 ph DB + LDB)                                                                                                                                                                                        | 130.00    | Each | 8,320.00     |
| 187     | 2.00                                         | Providing and erecting Sheet Steel powder coated MCB distribution board - flush / surface mounted fitted with busbar, neutral link, earth bar and DIN rail, Conforms to IS 8623-1 & 3, IEC 61439-1 & 3 without MCB to house appropriate nos. of MCBs.(The DBs should be used of same company of MCB to be used) suitable for (A) single phase incoming and horizontal single phase outgoing.(b) sheet steel double door (IP-43) (iv)8- way | 1346.00   | Each | 2,692.00     |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |      | 485          |
|----------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | IN FIGURE |      |              |
| 188                                                                  | 4.00                                         | Providing and erecting Sheet Steel powder coated MCB distribution board - flush / surface mounted fitted with busbar, neutral link, earth bar and DIN rail, Conforms to IS 8623-1 & 3, IEC 61439-1 & 3 without MCB to house appropriate nos. of MCBs.(The DBs should be used of same company of MCB to be used) suitable for(B) three phase incoming and single phase horizontal type outgoing Per phase isolation type (PPI) (b) sheet steel double door (i)4-way  | 2732.00   | Each | 10,928.00    |
| 189                                                                  | 1.00                                         | Providing and erecting Sheet Steel powder coated MCB distribution board - flush / surface mounted fitted with busbar, neutral link, earth bar and DIN rail, Conforms to IS 8623-1 & 3, IEC 61439-1 & 3 without MCB to house appropriate nos. of MCBs.(The DBs should be used of same company of MCB to be used) suitable for(B) three phase incoming and single phase horizontal type outgoing Per phase isolation type (PPI) (b) sheet steel double door(iii)8 way | 3986.00   | Each | 3,986.00     |
| 190                                                                  | 90.00                                        | providing and erecting Mains with ISI marked, 1.5 KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required.(a) One wire 1.50 sq. mm                                                     | 18.00     | Mtr. | 1,620.00     |
| 191                                                                  | 50.00                                        | providing and erecting Mains with ISI marked, 1.5 KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required.(b) One wire 6.00 sq. mm                                                     | 62.00     | Mtr. | 3,100.00     |
| 192                                                                  | 60.00                                        | providing and erecting Mains with ISI marked, 1.5 KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required.(c) One wire 10.00 sq. mm                                                    | 101.00    | Mtr. | 6,060.00     |
| 193                                                                  | 36.00                                        | providing and erecting Mains with ISI marked, 1.5 KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required.(d) One wire 16.00 sq. mm                                                    | 157.00    | Mtr. | 5,652.00     |
| 194                                                                  | 18.00                                        | providing and erecting Mains with ISI marked, 1.5 KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required.(d) One wire 35.00 sq. mm                                                    | 334.00    | Mtr. | 6,012.00     |
| 195                                                                  | 50.00                                        | <b>CABLES</b> : Providing and erecting ISI Marked 3core 185 Sq.mm XLPE insulated 11 KV armoured cable Aluminium conductor IS-7098 to be laid on wall with clamps or in provided cable trench / pipe approved manner as directed.                                                                                                                                                                                                                                    | 2290.00   | Mtr  | 1,14,500.00  |
| 196                                                                  | 1.00                                         | Providing and erecting cable end termination kit, heat shrinkable Push on type Densons/ Raychem/ Elastimold make suitable for 11 KV XLPE cable 3core 95 & 120 Sq.mm(A) Outdoor type                                                                                                                                                                                                                                                                                 | 17070.00  | Each | 17,070.00    |
| 197                                                                  | 1.00                                         | Providing and erecting cable end termination kit, heat shrinkable Push on type Densons/ Raychem/ Elastimold make suitable for 11 KV XLPE cable 3core 95 & 120 Sq.mm(B) Indoor type                                                                                                                                                                                                                                                                                  | 9350.00   | Each | 9,350.00     |
| 198                                                                  | 1000.00                                      | Supplying & erecting XLPE(IS:7098) (I)-88 ISI unarmoured Aluminium cable 1.1 KV.grade to be erected as directed of following size. (A)4 core 2.5 Sq. mm                                                                                                                                                                                                                                                                                                             | 56.00     | Mtr  | 56,000.00    |
| 199                                                                  | 100.00                                       | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables. (I) 3 1/2 core 240 Sq. mm( 120 Sq. mm 1/2 core) source to LT panel                                                                                                                                                                                     | 1356.00   | Mtr  | 1,35,600.00  |
| 200                                                                  | 100.00                                       | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables.(H) 3 1/2 core 185 Sq. mm ( 95 Sq. mm 1/2 core)                                                                                                                                                                                                         | 1050.00   | Mtr  | 1,05,000.00  |
| 201                                                                  | 125.00                                       | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand / Solid Copper conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe at road crossing or floor of following size of cables.(C) 4 core 6 Sq. mm                                                                                                                                                                                                      | 592.00    | Mtr  | 74,000.00    |
| 202                                                                  | 110.00                                       | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Copper conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe at road crossing or floor of following size of cables.(a) 4 core 10 Sq. mm                                                                                                                                                                                                             | 786.00    | Mtr  | 86,460.00    |
| 203                                                                  | 60.00                                        | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Copper conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe at road crossing or floor of following size of cables.(B) 4 core 16 Sq. mm                                                                                                                                                                                                             | 1149.00   | Mtr  | 68,940.00    |
| 204                                                                  | 50.00                                        | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Copper conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe at road crossing or floor of following size of cables.(C) 4 core 25 Sq. mm                                                                                                                                                                                                             | 1752.00   | Mtr  | 87,600.00    |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |      | 486          |
|----------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | IN FIGURE |      |              |
| 205                                                                  | 10.00                                        | Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.(C) 2 to 4 core 10 Sq. Mm                                                                                                                                                                                                                                                                               | 43.00     | Each | 430.00       |
| 206                                                                  | 6.00                                         | Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.(D) 2 to 4 core 16 Sq. Mm                                                                                                                                                                                                                                                                               | 54.00     | Each | 324.00       |
| 207                                                                  | 2.00                                         | Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.(E) 2 to 4 core 25 Sq. Mm                                                                                                                                                                                                                                                                               | 59.00     | Each | 118.00       |
| 208                                                                  | 2.00                                         | Providing and, fixing heavy duty flange type brass double compression type cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables..(A) 3 & 1/2 / 4 core 25 Sq. Mm                                                                                                                                                                                                                                                 | 76.00     | Each | 152.00       |
| 209                                                                  | 4.00                                         | Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.(G) 3 & 1/2 core 185 Sq. mm                                                                                                                                                                                                                                                                             | 277.00    | Each | 1,108.00     |
| 210                                                                  | 8.00                                         | Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.(H) 3 & 1/2 core 240 Sq. mm                                                                                                                                                                                                                                                                             | 288.00    | Each | 2,304.00     |
| 211                                                                  | 30.00                                        | Solder less crimping type <b>Copper lugs</b> conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. (A) 1.5/2.5 to 6 Sq.mm                                                                                                                                                                                                                                          | 9.00      | Each | 270.00       |
| 212                                                                  | 12.00                                        | Solder less crimping type Copper lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(B) 10 Sq.mm                                                                                                                                                                                                                                                            | 11.00     | Each | 132.00       |
| 213                                                                  | 30.00                                        | Solder less crimping type <b>Aluminium lugs conforming to IS</b> suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. (A) 1.5/ 2.5/4/6 Sq.mm                                                                                                                                                                                                                                       | 6.00      | Each | 180.00       |
| 214                                                                  | 40.00                                        | Solder less crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(B) 10 Sq.mm                                                                                                                                                                                                                                                         | 14.00     | Each | 560.00       |
| 215                                                                  | 16.00                                        | Solder less crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(C) 16/25 Sq.mm.                                                                                                                                                                                                                                                     | 17.00     | Each | 272.00       |
| 216                                                                  | 2.00                                         | Solder less crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(F) 95 Sq.mm.                                                                                                                                                                                                                                                        | 46.00     | Each | 92.00        |
| 217                                                                  | 8.00                                         | Solder less crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(G) 120 Sq.mm.                                                                                                                                                                                                                                                       | 52.00     | Each | 416.00       |
| 218                                                                  | 6.00                                         | Solder less crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(I ) 185 Sq.mm.                                                                                                                                                                                                                                                      | 93.00     | Each | 558.00       |
| 219                                                                  | 24.00                                        | Solder less crimping type Aluminium lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.(J) 225 Sq.mm.                                                                                                                                                                                                                                                       | 99.00     | Each | 2,376.00     |
| 220                                                                  | 175.00                                       | Providing and fixing approved make Perforated C type cable tray. Made from sheet steel. The cable tray should be single or double bended as per required and as per IS 2062/1079 and shall be coated with hot dip galvanizing as per IS 2629/4759. with max 17.5% perforation with coupler plate / Fish plate and GI hardware like nut - bolt and washers etc. erection with necessary support( included) as per Specification and as per instruction of engineer in charge..(3) 150 X 50 X 1.6 mm Thick | 495.00    | Mtr  | 86,625.00    |
| 221                                                                  | 25.00                                        | Providing and fixing approved make Perforated C type cable tray. Made from sheet steel. The cable tray should be single or double bended as per required and as per IS 2062/1079 and shall be coated with hot dip galvanizing as per IS 2629/4759. with max 17.5% perforation with coupler plate / Fish plate and GI hardware like nut - bolt and washers etc. erection with necessary support( included) as per Specification and as per instruction of engineer in charge.(5) 300 X 50 X 2.0 mm Thick  | 725.00    | Mtr  | 18,125.00    |
| 222                                                                  | 25.00                                        | Providing and fixing approved make Perforated C type cable tray. Made from sheet steel. The cable tray should be single or double bended as per required and as per IS 2062/1079 and shall be coated with hot dip galvanizing as per IS 2629/4759. with max 17.5% perforation with coupler plate / Fish plate and GI hardware like nut - bolt and washers etc. erection with necessary support( included) as per Specification and as per instruction of engineer in charge.(6) 450 X 50 X 2.0 mm Thick  | 935.00    | Mtr  | 23,375.00    |

## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ESTIMATED  | Unit | Total Amount |
|---------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | IN FIGURE  |      |              |
| 223     | 2.00                                         | Providing, and erecting 11 KV D.P. 9 mtr. high Structure made of 6" x 3" 'I'-Section Girder, 4" x 2"channels, clamps, nuts, bolts etc. Suitable for erection of the followings duly connected with necessary ACSR conductors. as per drawing approved by the Engineer- in charge complete with following. Height as per IS 7 Mtr above ground )<br>(A) 11 KV 200 Amps Drop out fuses with S.R.B.P. tubes carries.-Three nos .<br>(B) 11 KV G.O.D. switch complete with insulators, operating handle with galvanised pipe, Sq.bar etc. 400 Amp.- Set.<br>(C) 11 KV lightening arrestor with clamp- Three Nos.<br>(D) 11 KV shackle insulators- Six Nos.<br>(E) The above D.P. structure should be earthed with 25 mm.X 3 mm thick double copper earth strips run separately and connected with separate copper plate earth electrode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 115000.00  | Each | 2,30,000.00  |
| 224     | 1.00                                         | SITC of SF6 gas insulated Single VCB: Sheet steel enclosed, free standing, Outdoor mounted, 11 kV, 630A, 21kA/3s, 1 WAY Non - extensible SF6 gas insulated VCB, consisting of One no. direct connection of Incoming supply cable upto 300sq mm and one no. VCB( Manually charging & closing) in series with LBS between VCB and Transformer, Self Powered Relay 3 O/C +1 E/F Relay type CSPR-V5 , mechanical ON/OFF indicator, trip coil , Manual Close & Trip PB, live cable indicator, mechanical interlocks, pad locking facility, SF6 gas manometer, cable boots, 3 nos. CTs with Ratio -/1A, Cl: 5P10, 2.5 VA for protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 200000.00  | Each | 2,00,000.00  |
| 225     | 1.00                                         | Providing, erecting, testing & commissioning approved make oil immersed ONAN cooled, double wound, core type indoor / outdoor copper wound 11KV/ 433V step down transformer of following capacities operating on 3 phase, 50 Hz 4 wire & neutral earthed system continuously rated for a full temperature rise in oil not exceeding 45 Deg.C.at maximum ambient temp. of 50 Deg. C. complete with necessary radiator first filling of new transformer oil & standard fitting as below complying with IS 1180( Part 1 ):2014 standards with energy efficiency level 2.<br>Off load tap changing range steps +2.5% to -5% on H.V for variation should be provided. The H.V. shall be connected Delta & Secondary with star connection. The transformer should have cable-end boxes on H.T. side suitable for up to 3 core 150 sq.mm. XLPE cable & on L.T. side suitable for bus duct or cables as per requirement complete with test certificates from manufacturers<br>1. Oil conservator with filling Hole & Cap - One No.<br>2. Thermometer pocket with 6" dial type thermometer switch alarm & trip contacts- Two nos.<br>3. Silica-gel breather with charge- One No.<br>4. Plain oil level gauge - One No.<br>5. Drain / Sampling / Filter valve- One No.<br>6. Top Filter Valve - One No.<br>7. Explosion vent with Diaphragm - One No.<br>8. Rating & Diagram plate - One No.<br>9. Additional neutral bushing for earthing - One No.<br>10. Bi directional Roller - Four Nos.<br>11. Earthing terminals - Two Nos.<br>12. Lifting lugs - Two Nos.<br>13. Air release plug. - One No.<br>14. Double float buchholz relay with Alarm and trip contacts.<br>15. Control cable as required from Transformer to VCB Panel is to be provided with necessary connection to VCB relays for protection. as per IS 1180 level-2 (c) 500 KVA<br>Max. allowable losses at 50 % of rated load is 1.510 KW and at full load is 4.3 KW | 1117562.50 | Each | 11,17,562.50 |
| 226     | 1.00                                         | Design, Supplying, installing, testing of factory fabricated ready made Three phase APFC Panel Cubical Panel fabrication should be type tested as per IEC 61921, 61439:1&2 Capacitor Duty Contactor for switching as per following Steps Incomer Switch of MCCB type Icu=Ics=50KA at 400/440 Volts, with OC, SC, internal earth fault protection Incomer Switch of MCCB type Icu=Ics=50KA at 400/440 Volts, with OC, SC, internal earth fault protection,Copper tinned insulated Busbar,Cubical panel should be indoor type with IP 43 and IK 10,Metalized polypropylene film type3-phase 550Volt Capacitor,De tuning Reactor for each capacitor,Panel having Short Circuit and Overload protection,Each step Capacitor having suitable MCB with Sc, OL, internal earth fault relay,Each stage having Stage Contactor (Capacitor load rating),PF regulator master controller having suitable steps with LCD display, Rs 485 Communication port, Indication LED Lamps for main incomer and ON-OFF for each capacitor bank,MS Chanel for Floor mounting, Cable entry as per site situation,Cooling fans for panel for 150 KVAR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 506000.00  | Each | 5,06,000.00  |

## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ESTIMATED  | Unit    | Total Amount |
|---------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | IN FIGURE  |         |              |
| 227     | 1.00                                         | Supplying and erecting, commissioning and testing of Diesel Generating set confirming to IS: 4722:1968 & BS:5514 having continuous rating, 3 phase, 415 volts, 50 cycles A.C. supply comprising of a totally enclosed air/water cooled diesel engine with multi-cylinders developing suitable BHP not less than following capacity at 1500 RPM with 10% overload for one hour in 24 hours with standard accessories like fly wheel, lubricating oil cooler, "A" class governor, heavy duty fuel wheel and lubricating oil filter, oil bath air filler, lubricating oil pressure gauge, end exhaust manifold, standard set of tools with adjustable spanners, screw drivers, cylinder head to cover, joint cylinder head to exhaust, element lube oil filter, 12 / 24 volts electric starting equipment complete with standard heavy duty battery, dynamo, cut-outs, ammeter, necessary wiring, pressure gauge, starter etc and heavy duty Residential type exhaust silencer and vertical hot air duct both logged with asbestos rope, save oil trays, exhaust piping of required length, standard wall/floor mounted fuel with level indicator and piping and drip proof alternator, self excited, self regulated, screen protected, with excitation system, capable of delivering the rated system output at 415 volts, 3 phase, 0.8 PF, 50 Hz, 4 wire, running at 1500 RPM, conforming to IS-4722- 1968 with voltage regulation +/- 5% of rated voltage from no load to full load. Both the engine and alternator fitted on a common fabricated steel base plate with antivibration mounting engine and alternator both connected to each other by flexible flange coupling and with floor/wall mounted control panel box comprising of voltmeter ammeter, selector switches, ACB / MCCB / MCB of adequate capacity, indicator lamps duly wired with HRC fuses. The alternator & control panel shall be connected with provided suitable capacity armoured cable and complete with Acoustic enclosure (canopy) made out of 16 SWG CRCA Sheet, sound absorbing material Rockwool of 64 density & 100 mm thick conforming to IS:8183 / PU Foam of 40 Density - at least 40 mm. The resin bonded rockwool covered from inside the canopy by perforated sheet with 3/4 mm holes, sound level not more than 75 dB at a distance of 1 mtr, as per PVCT norms. Erection, commissioning and satisfactory testing as per requirement with first filling of fuel, oil, etc. with guarantee / Warrantee of complete system for Two years. & with obtaining all necessary certificate from Electrical Inspector. The Capacity and Ratings of DG sets are as below.(U) Continuous rating of 400 KVA ,BHP not less than 480 BHP | 2792980.00 | Each    | 27,92,980.00 |
| 228     | 1.00                                         | Providing & erecting approved make AMF control panel suitable for following size of 3 phase, 415 V., 50 cycles, A.C. diesel generating set complete of scope as detailed below:<br>1) Power module: A pair of electromechanically interlocked contactors (for mains & generator) Overload relay for generator contactor Neutral contactor for mains and generator Power socket for connections.<br>2) Control and metering module: Line voltage monitor. Generator voltage monitor Ammeter 3 items attempt start facility. Air circuit breakers/MCB/MCCB of suitable rating for auto/manual operation. Auto/manual switch. Emergency stop push buttons. Manual start push button. frequency meter. Engine hour meter. Two earthing studs.3) Protection module: The engine shutdown in the unlikely event of Low lube oil pressure High cylinder head temperature. V belt failure.<br>4) Indicators with alarm Load on generator.<br>5) Indicators Load on mains Engine fails to start . Emergency stop battery charger. The AMF Panel of following capacity<br>(F) AMF Control Panel for 400 KVA3 phase DG Set                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 414750.00  | Each    | 4,14,750.00  |
| 229     | 2.00                                         | LPS : SITC of Vertical Air Termination Solid aluminium with Base- 10 mm dia and 1000 mm long. Air Termination Base tested for conditioning, Ageing Test & Lightning impulse current withstand test: 100 kA of 10/350µs waveform in an accredited Third party laboratory as per 6.3 & 6.4 of IEC 62561-1 2017 protocol with MAST 34mm dia 3000 mm long- Cold Galvanized                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11000.00   | Each    | 22,000.00    |
| 230     | 250.00                                       | SITC of 8 mm dia solid Aluminium Conductor for roof top mesh grid and tested as per IEC 62561- 2 conducted in the Govt. accredited thirty party laboratory to meet the requirement of IS/IEC 62305 with Required Accessories - Aluminium Holding clamp at every 1 mtr distance, Aluminium/SS cross splicer at every crossing of Alu. conductor, Expansion piece with connectors at every 20 mtr distance, Aluminium straight Splicer to connect conductors. All Accessories should be tested as per IEC 62561-1 2018 Cl. 6.3 for conditioning & Ageing Test & 6.4 for Lightning impulse current withstand test: 100 kA of 10/350µs waveform(Ageing & Electrical test ) conducted in a sequence manner & tested in the Govt. accredited Third party laboratory to meet the requirements of IS/IEC 6230                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 350.00     | Mtr     | 87,500.00    |
| 231     | 75.00                                        | SITC of Galvanized Steel Flat 25x6 mm thickness from earth electrode directly in ground as required. Zinc coating: 500 g/m square (Approx:70 micron coating) tested and used exclusively for lightning protection earthing system and ring equipotential bonding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 180.00     | Mtr     | 13,500.00    |
| 232     | 4.00                                         | SITC of 14.2 mm dia 3 mtr long Earth electrode of High tensile steel electrode with 250 micron copper bonding & 1 bag of Carbon fill Based environment friendly backfill tested as per IEC 62561-7 in NABL accredited Laboratory and suitable stainless Steel double sided clamp. Eco Friendly rust proof heavy duty weather proof Polyethylene Earth Pit Chamber with following dimensions :254 mm dia (top), 330 mm dia (bottom) & 260 mm (height).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7000.00    | Per Set | 28,000.00    |



## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ESTIMATED | Unit | Total Amount |
|---------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | IN FIGURE |      |              |
| 233     | 200.00                                       | FAS : Supplying & laying of 2x1.5 sqmm fire alarm armoured cable, 600/1000V rated with annealed copper conductor having XLPE insulation, steel wire armouring & FRLS outer sheath complete as required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 145.00    | Rmt  | 29,000.00    |
| 234     | 1.00                                         | FIRE ALARM SYSTEM : SITC of Microprocessor based Net-workable Analogue Addressable Fire Alarm Control Panel. The Panel shall be compliant with EN54-2, EN54-4 and approved by LPCB. The Fire Alarm Control Panel shall have expandable capacity upto 4 loops. The Panel must have large graphic display. The Panel must also have the capability to take Addressable Intelligent Wired and Wireless Devices on same loop. Each loop shall have a capacity of 127 analogue Addressable devices and 127 Base sounders/Base Sounder Beacons. The Panel shall have 240 V AC power supply along with automatic Battery Charger. Approved by LPCB (Including Five year free maintenance with guarantee) Approved makes-Esser , autronica,Notifier                                                                                                                                                                                                                   | 396834.00 | No   | 3,96,834.00  |
| 235     | 10.00                                        | SITC of Analogue Addressable Multi- Sensor which is fully compatible with Analogue Addressable Protocol,having removable high performance chamber with Twin fire LED's allow 360 degree viewing, User selectable sensitivity modes 1% to 4.5% obs/m, Incorporate Optical and dual Heat elements, lock mechanism (sensor to base), Electronically addressed, Pulsing/non-pulsing controlled from panel. Approved by LPCB & VdS. (Including Five year free maintenance with guarantee) Approved makes-Esser , autronica,Notifier                                                                                                                                                                                                                                                                                                                                                                                                                                | 6265.80   | No   | 62,658.00    |
| 236     | 3.00                                         | SITC of Optical Beam Detector with transmitter and receiver set. The detector shall have 5 - 100 m range, Automatic compensation, Maximum coverage 1500m2, Automatic Signal strength adjustment, Emitter unit can be powered directly from zone (or loop), Features a Latching or Non- Latching fault relay, Full line continuity options, Approved by LPCB & VdS (Including Five year free maintenance with guarantee) Approved makes-Esser , autronica,Notifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 104430.00 | No   | 3,13,290.00  |
| 237     | 7.00                                         | SITC of Analogue Addressable Manual Call Point with Integral Short Circuit Isolator, Analogue Addressable Protocol having, Bi-coloured status LED (red for alarm, amber for (short-circuit), Non-frangible element fitted as standard (conforms to EN54), pulsing/non-pulsing can selectable via panel, Electronically addressed, Approved by LPCB. (Including Five year free maintenance with guarantee) Approved makes-Esser, autronica,Notifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 8354.40   | No   | 58,480.80    |
| 238     | 7.00                                         | SITC of Analogue addressable loop powered Base Sounder, variable sound output 50 ~ 98 dB(A) (±2 dB(A)) output at 1 metre, 51 user-selectable tones (all tones EN54-3 compatible), Auto shutdown feature prevents noise-pollution, Approved by LPCB & VdS (Including Five year free maintenance with guarantee) Approved makes-Esser , autronica,Notifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6683.52   | No   | 46,784.64    |
| 239     | 400.00                                       | Supplying and drawing of cable FRLS PVC insulated copper conductor cable in the existing surface / recessed conduit of following pairs, cores and size including connections and interconnections etc. as required. Single pair, 2-core, 1.5 sqmm, For Fire Alarm & Detection System. as per site requirement. as per technical specification etc. as required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 194.70    | Mtr  | 77,880.00    |
| 240     | 120.00                                       | HVAC SYSTEM : Supply Installation, Testing & Commissioning of modular type Variable Refrigerant Volume air cooled Outdoor units suitable for cooling and heating, having all hermetically sealed inverter type Scroll Compressor(s), microprocessor based Controller, top discharge type condensing unit(s), with R410 A Refrigerant (Or Eco Friendly Green Gas if any), vibration isolators, with suitable foundation, MS Stand for Unit with necessary paint etc. complete as required. The unit shall deliver the rated capacity at AHRI Conditions and work even at 50°C ambient temperature without tripping. The unit shall be suitable to work on 400V +/- 10%, 3 Phase, 50Hz AC power supply. The unit shall be filled with first charge of the refrigerant and ready for use as required. The COP at AHRI conditions shall not be less than 3.1 and IEER not less than 6.5. (Design should be got approval before execution from engineer in charge) | 23600.00  | HP   | 28,32,000.00 |
| 241     | 4.00                                         | Supply, installation, testing and commissioning of following minimum capacity VRV High wall type Indoor unit equipped with washable synthetic media pre-filter, fan section with noise level maximum 60 dB @min 400 cfm /dynamically balanced blower, multispeed motor, coil section with DX copper coil, electronic expansion valve, outer cabinet, cord less remote control, drain pan, necessary accessories etc., suitable for operation on 230 V ± 10%, 50 Hz, single phase AC supply, complete as required. The unit shall have automatic force shut down provision in case of fire on receiving signal from BMS System. The cooling capacity of indoor unit will be at air inlet conditions of 27 Degree C DB and 19 Degree C WB temperature. (D) 1.65 TR                                                                                                                                                                                              | 20600.00  | Each | 82,400.00    |
| 242     | 50.00                                        | Supply, Installation, testing and commissioning including vaccumiazation and Nitrogen testing of following nominal sizes of soft/hard drawn copper refrigerant piping for VRV system, complete with fittings, with suitable adjustable ring type hanger supports, jointing/brazing including accessories, insulated with XPLE Class-0 tubular insulation/with Class-0 closed cell elastometric nitrile rubber tubular sleeves sections of specified thickness as given below for Suction and Liquid lines, all accessories as per specifications etc with necessary refrigerant joint as required : (B) 9.5 mm dia (OD) (Soft drawn) with tube thickness 1.2 mm with 19 mm thick insulation                                                                                                                                                                                                                                                                   | 370.00    | Mtr  | 18,500.00    |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |      | 490          |
|----------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | IN FIGURE |      |              |
| 243                                                                  | 50.00                                        | Supply, Installation, testing and commissioning including vaccumiazation and Nitrogen testing of following nominal sizes of soft/hard drawn copper refrigerant piping for VRV system, complete with fittings, with suitable adjustable ring type hanger supports, jointing/brazing including accessories, insulated with XPLE Class-0 tubular insulation/with Class-0 closed cell elastometric nitrile rubber tubular sleeves sections of specified thickness as given below for Suction and Liquid lines, all accessories as per specifications etc with necessary refrigerant joint as required : (C.) 12.7 mm dia (OD) (Soft drawn) with tube thickness 1.2 mm with 19 mm thick insulation | 510.00    | Mtr  | 25,500.00    |
| 244                                                                  | 50.00                                        | Supply, Installation, testing and commissioning including vaccumiazation and Nitrogen testing of following nominal sizes of soft/hard drawn copper refrigerant piping for VRV system, complete with fittings, with suitable adjustable ring type hanger supports, jointing/brazing including accessories, insulated with XPLE Class-0 tubular insulation/with Class-0 closed cell elastometric nitrile rubber tubular sleeves sections of specified thickness as given below for Suction and Liquid lines, all accessories as per specifications etc with necessary refrigerant joint as required : (D) 15.86 mm dia (OD) (Soft drawn) with tube thickness 1.2 mm with 19 mm thick insulation | 660.00    | Mtr  | 33,000.00    |
| 245                                                                  | 50.00                                        | Supply, Installation, testing and commissioning including vaccumiazation and Nitrogen testing of following nominal sizes of soft/hard drawn copper refrigerant piping for VRV system, complete with fittings, with suitable adjustable ring type hanger supports, jointing/brazing including accessories, insulated with XPLE Class-0 tubular insulation/with Class-0 closed cell elastometric nitrile rubber tubular sleeves sections of specified thickness as given below for Suction and Liquid lines, all accessories as per specifications etc with necessary refrigerant joint as required : (E) 19 mm dia (OD) (Hard drawn) with tube thickness 1.2 mm with 19 mm thick insulation    | 780.00    | Mtr  | 39,000.00    |
| 246                                                                  | 120.00                                       | Central Control System : (B) Central wired Remote Control System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1650.00   | HP   | 1,98,000.00  |
| 247                                                                  | 115.00                                       | Rigid UPVC drain pipe of 10 Kg/cm2. rating with 9 mm thick.nitrile rubber insulation. (D) 25 mm dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 90.00     | Rmt  | 10,350.00    |
| 248                                                                  | 75.00                                        | Supply installation testing commissioning Shielded Shielded Control Cables for VRV System with necessary ISI mark Medium class rigid PVC pipes with necessary accessories with termination in machine and control equipments. (B) 3C X 1.5 Sq mm Shielded Armoured                                                                                                                                                                                                                                                                                                                                                                                                                            | 150.00    | Mtr  | 11,250.00    |
| 249                                                                  | 75.00                                        | Supply installation testing commissioning Shielded Shielded Control Cables for VRV System with necessary ISI mark Medium class rigid PVC pipes with necessary accessories with termination in machine and control equipments. (C) 4C X 1.5 Sq mm Shielded Armoured                                                                                                                                                                                                                                                                                                                                                                                                                            | 200.00    | Mtr  | 15,000.00    |
| 250                                                                  | 1500.00                                      | Providing , erecting , fabricating the M.S. structure as per requirement on site incorporating proper size of M.S. angles,square,round, flats, bars, channels, sections complete with cutting, welding, grinding & finishing duly painted with one coat of red oxide with erection on site as per direction of engineer in charge with necessary grouting, cementing, plastering & finishing complete.                                                                                                                                                                                                                                                                                        | 90.00     | Kg   | 1,35,000.00  |
| 251                                                                  | 90.00                                        | Providing and fixing approved make Perforated C type cable tray. Made from sheet steel. The cable tray should be single or double bended as per required and as per IS 2062/1079 and shall be coated with hot dip galvanizing as per IS 2629/4759. with max 17.5% perforation with coupler plate / Fish plate and GI hardware like nut - bolt and washers etc. erection with necessary support( included) as per Specification and as per instruction of engineer in charge..(3) 150 X 50 X 1.6 mm Thick                                                                                                                                                                                      | 495.00    | Mtr  | 44,550.00    |
| 252                                                                  | 100.00                                       | Providing and fixing approved make Perforated C type cable tray. Made from sheet steel. The cable tray should be single or double bended as per required and as per IS 2062/1079 and shall be coated with hot dip galvanizing as per IS 2629/4759. with max 17.5% perforation with coupler plate / Fish plate and GI hardware like nut - bolt and washers etc. erection with necessary support( included) as per Specification and as per instruction of engineer in charge. (5) 300 X 50 X 2.0 mm Thick                                                                                                                                                                                      | 725.00    | Mtr  | 72,500.00    |
| 253                                                                  | 50.00                                        | Providing and fixing approved make Perforated C type cable tray. Made from sheet steel. The cable tray should be single or double bended as per required and as per IS 2062/1079 and shall be coated with hot dip galvanizing as per IS 2629/4759. with max 17.5% perforation with coupler plate / Fish plate and GI hardware like nut - bolt and washers etc. erection with necessary support( included) as per Specification and as per instruction of engineer in charge. (6) 450 X 50 X 2.0 mm Thick                                                                                                                                                                                      | 935.00    | Mtr  | 46,750.00    |
| 254                                                                  | 270.00                                       | Supply, installation, balancing and commissioning of fabricated at site GSS sheet metal rectangular/round ducting complete with neoprene rubber gaskets, elbows, splitter dampers, vanes, hangers, supports etc. as per approved drawings and specifications of following sheet thickness complete as required. (A) Thickness 0.63 mm sheet (22 Gauge)                                                                                                                                                                                                                                                                                                                                        | 1260.00   | Smt  | 3,40,200.00  |
| 255                                                                  | 384.00                                       | Supply, installation, balancing and commissioning of fabricated at site GSS sheet metal rectangular/round ducting complete with neoprene rubber gaskets, elbows, splitter dampers, vanes, hangers, supports etc. as per approved drawings and specifications of following sheet thickness complete as required. (B) Thickness 0.80 mm sheet (20 Gauge)                                                                                                                                                                                                                                                                                                                                        | 1470.00   | Smt  | 5,64,480.00  |
| 256                                                                  | 96.00                                        | Supply, installation, balancing and commissioning of fabricated at site GSS sheet metal rectangular/round ducting complete with neoprene rubber gaskets, elbows, splitter dampers, vanes, hangers, supports etc. as per approved drawings and specifications of following sheet thickness complete as required. (C.) Thickness 1.00 mm sheet (18 Gauge)                                                                                                                                                                                                                                                                                                                                       | 1880.00   | Smt  | 1,80,480.00  |

## SCHEDULE-B

| Sr. No. | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ESTIMATED | Unit   | Total Amount |
|---------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|--------------|
|         |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | IN FIGURE |        |              |
| 257     | 180.00                                       | Supply, installation, balancing and commissioning of fabricated at site GSS sheet metal rectangular/round ducting complete with neoprene rubber gaskets, elbows, splitter dampers, vanes, hangers, supports etc. as per approved drawings and specifications of following sheet thickness complete as required. (D) Thickness 1.25 mm sheet ( 16 Gauge)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2110.00   | Smt    | 3,79,800.00  |
| 258     | 25.00                                        | Supply, installation, testing and commissioning of GI volume control duct damper complete with neoprene rubber gaskets, nuts, bolts, screws linkages, flanges etc, as per specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8360.00   | Smt    | 2,09,000.00  |
| 259     | 20.00                                        | Supply, installation, testing and commissioning of Motorized (ON-OFF Type) duct mounted GI volume control damper with enthalpy sensor and necessary control wire (minimum 1.5 sq-mm) for integration within AHU room. (B) Actuator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9750.00   | Each   | 1,95,000.00  |
| 260     | 18.00                                        | Supplying & fixing of powder coated extruded aluminium Supply Air Grills with aluminium volume control dampers complete as per specifications and size & shape as per site requirement and approved design.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 10320.00  | Smt    | 1,85,760.00  |
| 261     | 18.00                                        | Supplying & fixing of powder coated extruded aluminium Return Air Grills with louvers but without volume control dampers complete as per specifications and size & shape as per site requirement and approved design.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7050.00   | Smt    | 1,26,900.00  |
| 262     | 20.00                                        | Supplying, Fixing, testing and commissioning of fire dampers in supply air duct/main branch and return air path as and where required of required sizes i/c control wiring,the damper shall be motorized and spring return so as to close the damper in the event of power failure automatically and open the same in case of power being restored. The spring return action shall be inbuilt mechanism and not externally mounted. The damper shall also be closed in the event of fire signal complete as required and as per specifications. (A) Fire damper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 11870.00  | Smt    | 2,37,400.00  |
| 263     | 24.00                                        | Supply and fixing of acoustic lining of supply air duct and plenum with 25 mm thick resin bonded glass wool having density of 32 kg/m <sup>3</sup> , with 25 mm X 25 mm GI section of 1.25 mm thick, at 600 mm centre to centre covered with Reinforced Plastic tissue paper and 0.5 mm thick perforated aluminum sheet fixed to inside surface of ducts with cadmium plated nuts, bolts, stick pins, CPRX compound etc. complete as required and as per specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 820.00    | Smt    | 19,680.00    |
| 264     | 930.00                                       | Supplying and fixing of following thickness duly laminated aluminum foil of mat finish closed cell Nitrile rubber (Class "O") insulation on existing duct after applying suitable adhesive for Nitrile rubber. The joints shall be sealed with 50 mm wide and 3 mm thick self adhesive nitrile rubber tape insulation complete as per specifications and as required. (A) 19mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 870.00    | Smt    | 8,09,100.00  |
| 265     | 100.00                                       | Supplying and fixing of following thickness duly laminated aluminum foil of mat finish closed cell Nitrile rubber (Class "O") insulation on existing duct after applying suitable adhesive for Nitrile rubber. The joints shall be sealed with 50 mm wide and 3 mm thick self adhesive nitrile rubber tape insulation complete as per specifications and as required. (B) 25mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1090.00   | Smt    | 1,09,000.00  |
| 266     | 6.00                                         | Providing & erecting weather proof, dust & vermin proof, floor mounted front operated indoor type cubical panel board necessary IP-42 and above protection as per approval from engineer incharge made from 14 SWG thick CRC M.S. sheet for outer body & doors, 16 SWG thick CRC M.S.sheet for internal partitions with necessary accessories , supporting angles/ flats channel including cutting, bending, drilling, welding, riveting with internal partitions & cable alley as per requirements & instruction of engineer-in-charge with erection of supplied switch gears, BUSBARS, suitable size of inter connecting PVC copper wire / copper-aluminium strips, rubber grommets, rib, bakelite control fuses/MCB for measuring instruments, earth bus & earth bolts, foundation flange - bolts-base Plates, sufficient nos. of hinged doors, handles with locking arrangement and rubber gasket,heavy duty end terminal connection,danger notice board,necessary ventilation, earthing strip complete. The Panel shall be painted with epoxy powder coating. (The rates excludes the cost of switchgears, bus bars, inter connecting mains & Copper Aluminium strips, meters, Fuses etc. The dimension shall be measured excluding base beams) The panel shall be supplied with following approved manufacturers with following size. (B) The standard companies switch gear shall be used and only manufacturers at CPRI approved factory, (i) with 350 mm depth | 17410.00  | Smt    | 1,04,460.00  |
| 267     | 1.00                                         | Supplying and erecting triple pole & neutral 440V / 500V panel mounting Copper Busbars with four equal Nos. of electrolyte bus having current density not more than 1.6 Amp. / sq.mm (Rated current / cross section area) duly wrapped with colour insulating tape for phase sequence of following current carrying capacity, erected with necessary bus bar supports /insulators, main cable socket to each bar, erected in existing cubical panel with necessary connections.. Suitable for 350 Amp. Capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3000.00   | Rn.Mtr | 3,000.00     |
| 268     | 8.00                                         | Providing and erecting Approved make Four pole moulded case circuit breaker having breaking capacity ICU of 35 KA. at 415 V. having normal current rating 125A. with Fixed thermal & magnetic release suitable to work on A.C.supply 50 c/s. with all internal connections, spreader tinned copper & complete erected in existing 16 G.M.S. housing. ICS=100% of ICu only. Cat.-III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9410.00   | Each   | 75,280.00    |
| 269     | 1.00                                         | Supplying, erecting, testing and commissioning of approved make panel mounting type Digital Voltmeter having 3 digits LED display 0 to 750 AC Volts range erected on existing panel board with all connection, wiring etc., with manufacturers calibration certificate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1490.00   | Nos.   | 1,490.00     |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                   |           |      | 492          |
|----------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|--------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                   |           |      |              |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                      | ESTIMATED | Unit | Total Amount |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                   | IN FIGURE |      |              |
| 270                                                                  | 1.00                                         | Supplying, erecting, testing and commissioning of approved make panel mounting type Digital Ammeter having 3 digits LED display, external CT operated, calibrated for 0 to 400 Amps. suitable to operate on 500 volt AC erected on existing panel board with all connection wiring etc., with manufacturers calibration certificate.                                                                              | 1820.00   | Nos. | 1,820.00     |
| 271                                                                  | 2.00                                         | Supplying, erecting, testing and commissioning of Ammeter / Voltmeter selector switch for 3 phase AC supply 500 V on existing panel board with necessary connections.                                                                                                                                                                                                                                             | 370.00    | Nos. | 740.00       |
| 272                                                                  | 3.00                                         | Providing, erecting, testing and commissioning of L.T. Current Transformer with bus bar primary 50/5 to 1000/5 ratio 15 VA burden. Duly secured with insulating materials connected to the meter.                                                                                                                                                                                                                 | 320.00    | Nos. | 960.00       |
| 273                                                                  | 3.00                                         | Supplying and erecting approved make suitable panel indicator LED type lamp, lens cover, complete erected with necessary connections.                                                                                                                                                                                                                                                                             | 50.00     | Nos. | 150.00       |
| 274                                                                  | 4.00                                         | Providing & erecting 415 V MCB Four pole switch for motor & Inductive Load (C curve) having 10 KA breaking capacity & confirms to IS : 8828 in existing M.S box having following capacity:<br>© 63 Amp. Cat- III                                                                                                                                                                                                  | 860.00    | Nos. | 3,440.00     |
| 275                                                                  | 4.00                                         | Providing and erecting 415 Volt MCB four pole motor & inductive load(c Curve) having 10 KA Breaking capacity and confirms to IS : 8828 in existing metal box having following capacity.<br>(a) 40 Amp Capacity. Cat III                                                                                                                                                                                           | 780.00    | Each | 3,120.00     |
| 276                                                                  | 6.00                                         | Providing & erecting 415V MCB Four Pole Switch for Lighting Load (B curve) having 10KA breaking capacity & confirms to IS :8828 in existing box having following capacity For 40 amp cat-III (For 3-ph DB)                                                                                                                                                                                                        | 745.00    | Each | 4,470.00     |
| 277                                                                  | 1.00                                         | Approved make Earth fault Relay suitable to mount with inter connection to moulded case circuit breaker having CT ratio & MCCB rating as following along with shunt trip 220V AC. with all internal connections & complete erected in existing M.S.housing.. (2) 125 A -200 A , CT Ratio 1/200                                                                                                                    | 5820.00   | Each | 5,820.00     |
| 278                                                                  | 50.00                                        | providing and erecting Mains with ISI marked, 1.5 KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required. (f) One wire 10.00 sq. mm | 101.00    | Mtr. | 5,050.00     |
| 279                                                                  | 50.00                                        | providing and erecting Mains with ISI marked, 1.5 KV grade electrolyte multi stranded, annealed copper conductor with heat resistant PVC insulated conforms to IS 694, IEC - 227 erected in existing pipe of following size (Specifically for control panel, relays, power switchgears, motor starters & control wiring) with required size of copper lugs, nuts and bolts if required. (g) One wire 16.00 sq. mm | 157.00    | Mtr. | 7,850.00     |
| 280                                                                  | 50.00                                        | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables (B) 3 1/2 core 50 Sq. mm (25 Sq.1/2 mm core)                                                                                                                                                          | 327.00    | Mtr  | 16,350.00    |
| 281                                                                  | 200.00                                       | Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables (C) 3 1/2 core 70 Sq. mm ( 35 Sq. mm 1/2 core)                                                                                                                                                        | 434.00    | Mtr  | 86,800.00    |
| 282                                                                  | 75.00                                        | Providing and erecting XLPE (IS:7098)(I)-88 ISI <b>armoured cable</b> multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables (a) 4 core 16 Sq. Mm                                                                                                                                                                          | 175.00    | Mtr  | 13,125.00    |
| 283                                                                  | 75.00                                        | Providing and erecting XLPE (IS:7098)(I)-88 ISI <b>armoured cable</b> multistrand Aluminium conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe of following size of cables (B) 4 core 25 Sq. mm                                                                                                                                                                          | 219.00    | Mtr  | 16,425.00    |
| 284                                                                  | 12.00                                        | Providing and, fixing heavy duty flange type brass <b>cable gland</b> with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables.(A) 2 to 4 core 16 Sq. Mm                                                                                                                                                                                 | 54.00     | Each | 648.00       |
| 285                                                                  | 4.00                                         | Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables. (B) 2 to 4 core 25 Sq. Mm                                                                                                                                                                                       | 59.00     | Each | 236.00       |
| 286                                                                  | 4.00                                         | Providing and, fixing heavy duty flange type brass double compression type <b>cable gland</b> with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables. (a) 3 core 35/50 Sq. Mm                                                                                                                                                          | 76.00     | Each | 304.00       |
| 287                                                                  | 4.00                                         | Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables. (b) 3 core 70 Sq. Mm                                                                                                                                                                                            | 104.00    | Each | 416.00       |
| 288                                                                  | 16.00                                        | Solder less crimping type <b>Aluminium lugs</b> conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. (c) 16/25 Sq.mm.                                                                                                                                                      | 17.00     | Each | 272.00       |
| 289                                                                  | 16.00                                        | Solder less crimping type <b>Aluminium lugs</b> conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. (d) 35/50 Sq.mm.                                                                                                                                                      | 23.00     | Each | 368.00       |

| Name of Work: Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |      | 493                   |
|----------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------|-----------------------|
| SCHEDULE-B                                                           |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |      |                       |
| Sr. No.                                                              | QUANTITIES ESTIMATED BUT MAY BE MORE OR LESS | Item of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ESTIMATED           | Unit | Total Amount          |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | IN FIGURE           |      |                       |
| 290                                                                  | 16.00                                        | Solder less crimping type <b>Aluminium lugs</b> conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. (e) 70 Sq.mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 28.00               | Each | 448.00                |
| 291                                                                  | 2.00                                         | Supplying, installing, testing and commissioning of VRF Type AIR HANDLING UNITS with double skin construction as per specificatopns, each complete with squirrel cage induction motor (mounted internally), airfoil centrifugal fan belt drive and vibrations isolators.Motors shall be suitable for 415 +- 10% volts, 50 cycles , 3 phase AC supply an static pressure shall be as indicated . Fan-motor assembly (as whole) shall be statically & dynamically balanced to grade G6.3 as per ISO-1940/AMCA 204-3. All AHUS (Fan sections) shall be suitable for outdoor duty and complete with duct flexible connections and volume control damper . In additional all supply fans (SF) shall be provided with prefilter AHU shall be with cooling coil, electrical heating coil, steam humidifier, necessary measuring and control devices, evaporator fan with motor, pre and micro-vee filters and inbuilt starter. & the Power and control cabling from indoor to outdoor unit along with supports / cable trays shall be included. Cost should be inclusive of Control Panel & all required fitting to connect the AHU with VRF ODU (a_Capacity-20HP,ESP-300 Pascal,Air Fow-6000 CFM  | 575000.00           | Each | 11,50,000.00          |
| 292                                                                  | 2.00                                         | Supplying, installing, testing and commissioning of VRF Type AIR HANDLING UNITS with double skin construction as per specificatopns, each complete with squirrel cage induction motor (mounted internally), airfoil centrifugal fan belt drive and vibrations isolators.Motors shall be suitable for 415 +- 10% volts, 50 cycles , 3 phase AC supply an static pressure shall be as indicated . Fan-motor assembly (as whole) shall be statically & dynamically balanced to grade G6.3 as per ISO-1940/AMCA 204-3. All AHUS (Fan sections) shall be suitable for outdoor duty and complete with duct flexible connections and volume control damper . In additional all supply fans (SF) shall be provided with prefilter AHU shall be with cooling coil, electrical heating coil, steam humidifier, necessary measuring and control devices, evaporator fan with motor, pre and micro-vee filters and inbuilt starter. & the Power and control cabling from indoor to outdoor unit along with supports / cable trays shall be included. Cost should be inclusive of Control Panel & all required fitting to connect the AHU with VRF ODU (b_Capacity-40HP,ESP-400 Pascal,Air Fow-12000 CFM | 850000.00           | Each | 17,00,000.00          |
| 293                                                                  | 24.00                                        | Supply Installation Testing & Comissioning of the Jet Nozzle Diffuser Aluminum construction,White powercoated RAL9010/9016 of 400 mm dia etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 25000.00            | Each | 6,00,000.00           |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>TOTAL AMOUNT</b> |      | <b>3,48,96,617.00</b> |
|                                                                      |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>SAY.</b>         |      | <b>3,49,00,000.00</b> |

I am/ We are willing to carry out the work @ ..... % (should be written in figures and words) Below/ Above the Tendered / Estimated Rates Mentioned above. Amount of my/ our tender works out as under:-

Estimated Rs. 34900000

Estimated

Deduct.... Rs. ....

Deduct....

Net Rs. ....

Net

In words:.....

**Please strike out whichever is not Applicable**

**Note:-**

- 1 . All work shall be carried out as per public work department hand book and other specifications of Division or as directed.
- 2 . All the columns in schedule should be filled in Ink and the total of the entries in the last columns should be struck by the contractor under his signature.
- 3 . Rates quoted include clearance of site ( Prior commencement of work and its close) in all respects and hold good for work under all condition,site,moisture/
- 4 . The Contractor shall be exhibit board as per government circular No.BDG/3277/1657 N dated 26/01/1997 S (M.GUJ) with detailed specification and details of work and amount Involved at site without any payment as directed by Engineer-In-Charge.
- 5 . I/We hereby declare that, I/We have visited the site and fully acquainted my self / ourselves with the local situation regarding materials & other factors pertaining to the works before submitting this tender.
- 6 . I/We hereby declare that, I/We have carefully studied conditions of contract, Specifications & other than tender documents of this work and agree to execute that same accordingly.
- 7 . The price bid shall include all taxes, GST, duties, levies, fees and other charges as per applicable taxes including service tax & labour cess.

## PART-IV

## **NOMINATED ELECTRICAL SUB –CONTRACTORS**

**Name of Work: - Renovation of Existing Arvindbhai Maniyar Hall, Rajkot**

- (1) The main contractor shall identify in his bid offer and name Electrical Contractor Who will execute electrical items of the contract. Such Electrical contractor will be referred to as “Nominated Electrical sub-Contractor “The Electrical Sub contractor shall fulfill the following condition
  - 1.1 He should be Registered in “D and Above” as Electrical Contractor by any Electrical Division of Road and Building Department or Narmada and Water Resource Department of Government of Gujarat
  - 1.2 He should be holding currently valid registration certificate issued by the above specified Electrical Division.
  - 1.3 He should have spare capacity to execute the electrical component of the contract work taking into consideration his contract works on hand. For this purpose, he should furnish the statement showing the details of contract works on hand, total value of such works executed up to the month including the month of submission of this offer and the balance value of contract works in progress yet to be executed.
- (2) The main contractor should produce with his offer “Memorandum of understanding “with the Electrical sub-contractor disclosing the terms and conditions specifying the obligation regarding performance of the contract work pertaining to Electrical portion of this tender such Memorandum of under standing must contain, besides other terms the following provision. (As per attached blank memorandum of understanding)
 

"That in respect of work, goods, materials or services the subject of the sub contract, the obtained electrical sub contractor will undertake to wards the contractor the like obligations and liabilities as are imposed on the contractor to wards the employer by the terms of the contract"
- (3) The nominated electrical sub contractor shall be approved subject to the following conditions.
  - 3.1 The works, goods, materials, services and electrical items to be executed by the nominated electrical sub contractor will be subject to approval and supervision of Executive Engineer (Electrical).

3.2 The rates, quantities as measured and amount payable for electrical items of work will be certified by the Executive Engineer (Electrical) and the same will be paid in the running bills and final bill of the main contractor.

3.3 The main contractor and nominated electrical sub contractor will be jointly responsible for quality of electrical portion of contract work and for rectification of defective work up to defect liability period as per condition of contract i.e., on in the tender document.

3.4 Prior approval of the Engineer in charge will be necessary for relieving nominated electrical sub contractor before contract work is accepted as completed and for appointment of new electrical sub contract. The approval will be given subject to such conditions as the engineer in charge may consider necessary for satisfactory and finely completion of electrical portion of contract. The Engineer in charge will have powers to reject the premature relief of nominated electrical sub contractor if he is not satisfied with reasons for relieving the nominated electrical sub contractor and after such refusal, the main contractor shall be deemed to have committed default in performance of the contract if he does not restore the originally approved nominated electrical sub contractor. The approval of new electrical sub contractor will be subject to fulfillment of all requirements prescribed for approval of electrical sub contractor.

4.0 The Bidder shall have to confirm that the Electrical Sub – Contractor shall execute the Electrical item to the contract fulfilling following requirement.

4.1 All equipments, materials and other accessories to be provided by the contractor under the terms of this contract shall confirm to the relevant I.S.S. Samples of materials and accessories to be supplied shall be furnished for approval to the Engineer in charge well before they are used on the work. The make of these shall be preferred from the approved list of material for use on works for relevant S.O.R. or at appendix of the tender document as may apply.

4.2 The installation shall also be carried out strictly in conformity with the requirement of Indian Electricity Act. - 1910 as amended and the Indian electricity rules 1956 as well other statutory regulations that may be relevant to such electrical installations.

4.3 In this electrical work, erection, testing and commissioning shall comply with relevant Indian standards and codal practice in force.



4.4 Good workmanship is the essence of this contract and shall be observed during execution of work at all times. A qualified and an experienced supervisor shall be charged by the contractor as well any defect noticed by the engineer in charge shall be rectified by the contractor immediately free of cost.

4.5 After completion of works/ installations necessary tests will be carried out as may require under relevant rules including.

A] Insulation resistance test with 500V/ 1000V meger for 250V/415V, system respectively and the test result should not be less than 1 meger ohm value

B] Resistance to earth of any point in grounding system the test result should not exceed one (1) Ohm.

4.6 On completion of the electrical installation work the contractor shall submit six copies of "RECORD PLAN" indicating very clearly the runs of various size of mains, sub mains position and circuit of all points with their subjective controls etc. Duly signed by the licensed electrical supervisor & contractor under whose supervision this work has been carried out.

4.7 The electrical contractor shall furnish the test certificate/ test reports in prescribed Performa duly signed as may require and arrange to obtain electrical power connection from the licensee of the region on completion of this work without any delay.

4.8 Any other clause that may be thought proper and applicable by the Govt. shall be binding on the bidder.

- (5) The Employer will not be responsible for financial settlement and disputes settlements between the main contractor and electrical sub contractor.
- (6) Before issuing the completion certificate or preparation of the final bill the Engineer-in-charge shall be entitled to demand from the main contractor reasonable proof that all payments. Less retentions, security for performance, tax Deductions in respect of work or goods, materials or services rendered by or supplied by nominated Electrical sub-contractor have been paid or discharge by the contractor to the nominated Electrical sub contractor. If the main contractor can not satisfy the employer by furnishing reason for nonpayment of dues to the nominated Electrical sub contractor, the Engineer -in -charge shall be entitled to retain the disputed amount as security deposit which will be released only after production mutually

agreed settlement of account or the award of the Arbitrator to be nominated by electrical sub contractor.

Also, the security deposit along with performance bond of electrical sub contractor shall become refundable only after getting no objection certificate from concerned authority.

Signature of Contractor

Deputy Executive Engineer

RMC

Executive Engineer

RMC

Superintending Engineer

RMC

## MEMORANDUM OF UNDERSTANDING

1. ....Registered firm having their office at.....

....." The Main Contractor and party hereto the First Part" (Which express shall mean and include its heirs, executors, administrators, assignees)

AND

2. ....registered Firm having their office at.....

.....herein after called "The Nominated Electrical sub-Contractor" the party hereto of the second part (which express shall mean and include its heirs, executors, administrators, assignees) WHEREAS the party hereto of the first part & Second part agree to perform. At the terms & conditions specifying the obligation regarding performance of the contract works pertaining to Electrical portion that in respect of work, goods materials or service of the work to the following conditions.

1. The work, goods, materials, services and electrical items to be executed by the nominated electrical sub-contractor will be subject to approval and supervision of Executive Engineer (Electrical)
2. The rates, quantities as measured and amount payable for electrical items of work will be certified by the Executive Engineer (Electrical) and the same will be paid in the running bills and final bill of the main contractor.
3. The main contractor (i.e., the first part) and nominated electrical sub-contractor (i.e., the second part) will be jointly responsible for quality of electrical portion of contract work and for rectification of defective work up to defect liability periods as per condition of contract i.e., as in the tender document.
4. All equipment's, materials and other accessories to be provided by the contractor under the terms of this contract shall confirm to the relevant ISS samples of materials and accessories to be supplied shall be furnished for approval to the engineer in charge well before they are used on the work. The make of these shall be preferred from the approved list of material for use on works for relevant SOR or at appendix of the tender document as may apply.
5. Prior approval of the engineer in charge will be necessary for relieving nominated electrical sub-contractor before contract work is accepted as completed and for appointment of new electrical sub contract.
6. Also, the security deposits along with performance bond of electrical sub-contractor shall become refundable only after getting no objection certificate from concern authority.
7. The electrical contractor shall furnish the test certificate/test reports duly signed.
8. Any other clause that may be thought proper and applicable by the Govt. shall be binding on the bidder.

9. IN WITNESS WHERE OF THE party hereto have under set and subscribed their respective hands on the day month and the year first hereinabove written.

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(Prime Contractor)

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Witness

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(Sub-Contractor)

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Witness

**AMC FOR All Electrical item , LV item & HVAC item (Mention in Schedule -B) work  
including for 5 YEARS (To be filled by CONTRACTOR)**

| Sr. No. | Item                                                                            | Quantity                                                       | AMC rate for per year based on capital cost (*) | Final Rate.                                     |
|---------|---------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| 1       | All-In-Service charges After completion of free maintenance period of one year. | All Electrical item, All Low voltage (LV) item & All HAVC item |                                                 |                                                 |
| 1       | For 1st year                                                                    | Mention in Schedule-B (Item No. 119 to 293)                    | 199033.78                                       | Consider as per contractor rate, above or below |
| 2       | For 2nd year                                                                    |                                                                | 218937.16                                       |                                                 |
| 3       | For 3rd year                                                                    |                                                                | 240830.88                                       |                                                 |
| 4       | For 4th year                                                                    |                                                                | 264913.97                                       |                                                 |
| 5       | For 5th year                                                                    |                                                                | 291405.37                                       |                                                 |

Note : (\*) Capital cost: Capital cost for % of AMC rate is considered on the basis of estimated rate or the quoted rate whichever is less.

The Offer received for yearly maintenance will be dealt independently and shall have no relevance with main work and Schedule-B.

The All Electrical, LV and HVAC System manufacturing company, which is selected by the Civil Contractor (Agency) From All Electrical, LV and HVAC System companies as mentioned in Tender for All Electrical, LV and HVAC System installation shall have to enter in to an agreement as per scope of work attached as follows for the work of AMC for All Electrical, LV and HVAC System for 5 years with the Executive Engineer, RMC or with his representative or any authority suggested by him as instructed by him prior to completion of the work.

the L<sub>1</sub> (Lowest bidder) of Electrical, LV and HVAC installation work will have to agree, according to negotiated rate on the basis of Govt. resolution No. – BDG/3180/3875/(2507)/Part-3/N Dtd. 28-03-2003.

Deputy Executive Engineer  
RMC

Executive Engineer  
RMC

Superintending Engineer  
RMC

**Name of work: Operation and All in Comprehensive maintenance of Internal Electrical System at Renovation of Existing Arvindbhai Maniyar Hall, Rajkot**

**Defect Liability Period (DLP):-**

Defect liability Period will be considered from to the final handling over of entire site and closing of contract, part handling over will not be considered even if the some part/ floor/ department/ almost full site is underutilization/ shifting in part or fully. During above DLP contractor have to maintain and operate the entire system which may be utilized/ used/ shifted by the user.

**PART – I: OPERATION OF Internal Electrical System.**

**SPECIFICATIONS, TERMS/ CONDITIONS.**

01. Timing of Operation is in normal condition is from 8:00am to 12:00pm (Late night) in working. But it will be intimated to contractor, for operation of System in any other timing, holydays etc.
02. Contract of Operation and Maintenance of Internal Electrical System for Arvindbhai Maniyar Hall, Rajkot. Equipment's, installed at Renovation of Existing Arvindbhai Maniyar Hall, Rajkot
03. Abstract of Internal Electrical System and its related accessories/controls, etc. under the scope of contractor for the purpose of operation etc. are included under "Scope of Equipment's/Items Cover" The contractor will be responsible at all times for satisfactory operation of their Internal & External Electrical System along with all the related equipments/accessories with NIL down time from their side.
04. The contractor will engage the following minimum manpower for day to day operation and maintenance.

One Electrician, 8:00am to 12:00pm (Late night)  
Semi Skilled helper (every day - for any event)

If additional manpower required for smooth operation of system contractor will provide without any extra cost.

05. The operator of respective Internal Electrical System will take hourly readings of Internal Electrical System / Equipment's Temperature & Energy readings. All these readings will be recorded in logbook register. Any abnormality in the system including time of starting / stopping of equipments should be clearly recorded in the logbook register.
06. Operator will be responsible for proper sequential operation of Systems and stopping the same as per the procedural practice. In case of any abnormality (like non-availability of power supply, etc.) he will immediately report the matter to his supervisor for further action. Similarly any malfunction in the system will be immediately reported by him to his supervisor for suitable corrective actions.

07. Operator will physically check the performance of Internal & External Electrical System once in a day and record the same in logbook register.
08. Whenever required, operator will manually adjust the ampere rating under the guidance of his supervisor & record the same in logbook register. Separate logbook register will be provided and maintained by the Contractor for every equipment.
09. The helper of respective System will assist the operator in day to day operation of Internal Electrical System like checking of energy reading, power consumption, temperature settings etc. as and when required, checking of terminal as and when required, cable/wire temperature etc. Helper will be responsible for keeping Electrical rooms including all the equipments in clean and tidy condition including transformer, LT Panels, DG Rooms, HT Panel location area. He will also carry out general cleaning of all equipment's including Electrical Panels on regular basis.
10. The supervisor will be responsible for the following:
  - 10.1 To continuously supervise the satisfactory operation of all Equipments like Transformers, load Sharing, Load Management, DG synchronization, PLC control, Capacitor operations, HT Panels, LT Panels, lighting Automation system etc.
  - 10.2 To take daily instructions from Engineer-in-charge/Site Engineer.
  - 10.3 To check the readings of Entire System taken by operators and sign the same in respective logbook register on daily basis.
  - 10.4 To ensure that all the equipments & rooms/areas occupied by Systems are always in neat and tidy condition and also to ensure that regular sweeping/mopping is done by housekeeping Agency.
  - 10.5 To monitor all the parameters/readings on DDC system (where-ever available) and maintain the record of same on daily basis from server.
  - 10.6 To ensure satisfactory performance of DDC system and to take Suitable corrective measures to the possible extent in case of Malfunctioning.
  - 10.7 He will feed all the readings of all Systems in the computer available with DDC control system on daily basis. Coordination with BMS system will be available in Control room & subsequently on any particular day readings should be available
  - 10.8 To report the performance of all Electrical operated equipments to Engineer-in-charge on fortnightly basis. During this review, he will produce all the Details/log register, etc. along with any abnormality/malfunctioning Problems and note down the instructions of Engineer-in-charge for further action.
  - 10.9 To maintain daily attendance of his personnel in a separate register.
  - 10.10 He will contact identified end users of buildings for obtaining their views/comments/complaints regarding overall performance of Electrical system, at least alternate day and will record the same in his site register and will produce the same to Engineer-in-charge during fortnightly review. He will also take immediate suitable corrective measure as per the necessity.

- 10.11 He will inform immediately to Engineer-in-charge/Site Engineer of Arvindbhai Maniyar Hall, Rajkot for any malfunctioning in Electrical System, causing the stoppage of Power Supply.
11. In case of any operator/helper being on leave, the contractor will immediately take advance action and provide substitute so that minimum manpower as indicated above is not reduced on any day. Same is applicable in case of supervisor also.
  12. All the tools/logbook register/attendance Register/Supervisor Register, etc. will be provided and maintained by the contractor. One set of tools should be always available with the operator of respective System for carrying out the essential work as may become necessary for operation of equipments.
  13. The contractor will be totally responsible at all times for the safety Of his personnel; who will follow all safety rules and regulations during the entire period of the contract. Contractor will be responsible for the risk and compensation to his personnel in case of any eventuality. Department will not be responsible for any mishap, injury, accident, etc. of the personnel of the Contractor.
  14. Damage of any Electrical Equipment or any of the components of Systems due to wrong operation or due to negligence by the contractor's personnel will be made good immediately by the vendor.
  15. the contractor will furnish the list of his personnel along with police verification for providing entry pass. In case of any change in personnel, same should be informed to Engineer-in-charge immediately.
  16. They should confine their activities in the concerned building only for the required purpose. They should not tamper on mingle with any of the users equipments / components at any time. If such an incident is noticed, the matter will be viewed very seriously and the contractor will be held responsible for consequences.
  17. Operators / Helpers engaged by the contractor will always wear uniform while in Arvindbhai Maniyar Hall, Rajkot premises with their name & name of contractor for easy identification.
  18. The contractor will ensure that the Electrical System and other rooms housing Electrical operated equipments are kept in clean and tidy condition. All the equipments & accessories should be kept in clean condition by the helpers / operators.
  19. The work will be reviewed by the Engineer-in-charge with the supervisor of the contractor on fortnightly basis. During this review supervisor of the contractor will produce all the details to the Engineer-in-charge. Any corrective measures / instructions issued by the Engineer-in-charge, during the review, should be followed by the contractor immediately.
  20. The contract can be extended by the Department for next year after expiry date, if required on mutual agreed as per accepted price.
  21. After completion of the contract period it will be the contractor's responsibility to hand over to Dept. Entire System / Accessories in good working.



**TECHNICAL SPECIFICATION, TERMS AND CONDITIONS**

**The Entire Internal Electrical Systems and equipment's must be handed over to the Engineer-in-charge after Expiry of Contract. If fails to that, SD will be for fitted and recommended for black listing of Agency.**

1. Abstract details of Internal Electrical System and equipment and their related accessories / controls etc. under the scope of Contract for the purpose of Maintenance and servicing are indicated under "Scope of Equipments/Items Cover". The contractor will be responsible at all times during the period of Contract for satisfactory working of these Internal Electrical Systems and equipments / accessories with Zero down time.
2. The Contractor will engage the following minimum manpower.
  - 1 No. Supervisor Minimum Diploma Holder, with at least Seven-Ten YEARS experience in similar field to continuously supervise the subject Electrical and equipments for their satisfactory operation / working.
  - To ensure that all the subject Electrical Systems, equipment and accessories are in good working condition, including DDC system, and to take suitable corrective measures in case of their malfunctioning.
  - To report the performance of all Electrical Systems and the Equipment to Engineer-in-charge on fortnightly basis. During the review he will produce all the details / Log book registers, indicating actions taken, while doing preventive maintenance and routine servicing including any abnormality / malfunctioning problems etc. and note down the instructions of Engineer-in-charge for further compliance.
  - He will also contact identified end user of subject buildings for obtaining their comments / views / complaints, if any, regarding overall performance of Electrical Systems and will record in his site register, the same and will produce the same to Engineer-in-charge during fortnightly review. He will also take immediate suitable corrective measure as per necessity.
  - He will inform immediately to Engineer-in-charge / site Engineer for any malfunctioning / breakdown causing stoppage of Electrical System.

**Note: - These Persons is other than Operation team.**

3. In case of Supervisor / Technicians / Helper being on leave the contractor will immediately take advance action and provide substitute so that minimum manpower as indicated above is not reduced on any day.
4. All the tools, logbook register, attendance register, etc. will be provided and maintained by the contractor. One set of tools and measuring instruments should always be available in each System room for carrying out the essential works, as to

set right the defective Electrical equipment and also for setting / resetting of the Controls.

5. Supervisor, Technician / helper engaged by the contractor will always wear uniform, while in Arvindbhai maniyar Hall premises, with their name and that of the contractor for clear identification.
6. The contractor will be totally responsible at all times for the safety of their personnel, who will follow all the safety rules and regulations during the entire period of contract. The contractor will be responsible for the risk & compensation to his personnel in case of any eventuality, Department will not be responsible for any mishap, injury, accident etc. occurred to personnel.
7. Damage of any System or any of the Electrical Components, under the scope of contract, due to negligence of personnel will be made good immediately by the contractor.
8. The contractor will furnish the list of the personnel along with police verification for arranging Entry passes. In case of any change in personnel, same should be intimated to the Engineer-in-charge immediately.
9. The contractor personnel should confine their activities in the concerned buildings only for the above given purpose. They should not tamper / mingle with any of the users Lab. Equipment, at any time. It will be viewed very seriously.
10. Combine (O & M) Bill Payments will be made on Quarterly basis, on production of the invoice/bill by the contractor along with attendance sheet of the personnel deployed to The Engineer-in-charge. The bill will be certified by the Engineer-in-charge. Payment will be made on availability of Funds/L.C.
11. As far as possible all emergency repairs should be carried out on 'holidays. Maintenance and repairs to nay equipment should be carried out using the Standby equipment wherever available Major repairs should be carried out during off-season.
12. The standby equipment should always be maintained in good working condition.
13. Replacement of spares / components of any equipment should be done as per Recommendation of the manufacturer and also as and when becomes necessary.
14. Notwithstanding as to what is specifically stated above, it shall be the responsibility of the contractor to attend to all the preventive maintenance routine servicing, repairs and breakdown maintenance etc. including replacement of defective parts / components, without any extra cost.
15. Normally repairing works should be done at site, however if it is to be taken outside campus to the service station, to and fro transportation charges shall be borne by the contractor and necessary permits / material gate passes will be arranged by Department.
16. In case of any unsatisfactory performance on the part of the contractor, department reserves the right to terminate the contract with prior notice.

17. You will provide skilled manpower, spares, consumables etc. for preventive maintenance and to attend complaint call as and when required. The complaint call can be beyond normal working hours and on holidays and the same should be attended immediately.
18. It is the responsibility of the contractor to follow all the rules and Regulations of Labour department, for the personnel employed by him. For maintenance work the agency should obtain Labour License from the office of the Labour Commissioner, if required as per the statutes.
19. The contract can be extended by the Department for next year after expiry date, if required on mutual agreed as per accepted price.
20. All the Safety Controls of Electrical Systems such as H.P., L.P., O.P., Pressure Switch, Interlocking of all the Electrical Equipments to be checked once in a month and same to be recorded in the register.
21. After completion of the contract period it will be the contractor's responsibility to hand over to Dept. all the Electrical Systems/ Accessories in good working as per manufacturer specification.

#### **SCOPE OF WORK**

01. This is all in all comprehensive maintenance contract. The scope of work includes maintaining the Entire Electrical Systems and equipment in Proper/safe operating condition by regular and systematic examining, Adjusting, lubricating, repairing/replacing of all the defective equipment parts/components pertaining to the equipment as specified using only original and genuine parts.
02. Lubricating, servicing and checking of all the equipment shall be done once in a month or as and when required. During emergency services of repairing crew shall be available at any time, during the regular working hours as well as overtime hours including on holidays. It will be obligatory on the part of the contractor to respond immediately after receiving the complaint.
03. Overhauling of all the Electrical Systems and equipment shall be done at least once in a year and also as per Manufacturer/OEM/System Integrator Guidelines.
04. Cleaning of Terminals, changing of oil/ filters/ checking and operation of all breakers, shall be done once in year and also as and when necessary.
05. Consumables, should be done as and when required, as a result of breakdown in the system and also arising out of wear & tear. (No Extra payment will be made in any case of use of any consumable/ Equipments/ Spare part etc)
06. Adjustment of terminals, inspection of the all electrical contacts, breakers etc for abnormal Abrasion Etc. including replacement of these items is to be done as and when necessary. Sufficient Stock of required MCB, MCCB, Cables, Earthing systems etc may please be maintained at site.

07. Cleaning and operation of all equipments at regular interval, and replacement of the same should be done if found unclean able and unserviceable.
08. Servicing repairing and replacement of defective spares and Components, whenever required should be carried out with Knowledge of Engineer-in-charge and signature of Site Engineer should be obtained in token of work done. And enter in Log Book of Equipments.
09. Preventive maintenance should be carried out in a phased manner, in consultation with the site Engineer and the Engineer-in-charge by engaging necessary additional manpower. Preventive maintenance to be done as per manufacturer guidelines.
10. Painting of all the equipment, electrical panel boards etc. and transformers DG sets shall be done as per required at site. Make it clean and smooth surface.
12. To supply spares, components of Distribution Boxes, Panels, Cubicles and electrical accessories in the electrical panels etc. is under the Scope of Work. And all the parts of Electrical systems & Electrical panels are same as original make and models. If changes get approval first.
13. Monthly preventive maintenance will comprise the following and also as Per-enclosed Annexure – IV & V of preventive maintenance schedule chart.
  - a) To check the general functioning of all the equipment accessories & to take corrective measures, as and when required.
  - b) Checking the system for Earth leakages and to take the resistive measures, including measure Testing etc. as and when required.
  - c) Inspection / Adjustment and resetting of Controls, for maintaining the Electrical Systems in perfect working condition.
  - d) To replace / repair immediately components is found defective during the above checking.
14. "Maintenance & Servicing History Card" for individual equipment shall be provided and up-dated regularly.
15. The preventive maintenance Schedule chart will be prepared by agency and submit to engineer-in-charge for approval. As per approved schedule chart work will taking on hand.
16. The UPS is under this Scope for UPS AMC.
  - (a). UPS is running round the clock, and to maintain desire quality of power in server room is responsibility of Contractor.
  - (b). During the availability of normal supply UPS is running on that, other time (Night Hours, Holydays) UPS will working on Battery mode. Agency should ensure 24 x7 working of UPS and maintaining quality of power in server room.

## 17. PUMPS:-

1. All Pumps should be Services every half of months during normal working days or holidays.
2. The Contractor should carry out following work during service.
3. Pump motor, starter, relays, pump sensor, greasing, oiling of bearing & miscellaneous item like indicating lamps, MCB etc.
4. Call back service will also be provided bet's regular examinations as and when informed engineer-in-charge.
5. This contract is All in All Comprehensive maintenance type so all parts required to be replace is under the scope of contract.
6. Any tools & tackles required to carrying out maintenance of pumps or its relevant parts must be supplied by contractor at no extra cost.
7. If at any stage contractor fails to complete the job (i.e. maintenance work etc.) the same will be got done at his risk and cost and additional expenditure incurred by the owner, will recovered from contractor's bill.
8. If the work is not found satisfactory owner reserved rights to terminate the contract without any reason.
9. Replacement any parts if required, contractor will have to replace the same make & model without any extra cost.
10. Contractor should be maintain Log Register for each equipment and entry into register whatever work done.
11. If any fetal accident contractor will be responsible that.
12. The water level sensor, electric panel, starter, vaLV & FAS e, gauge, suction pipe, motor, diesel engine, lubricant oil of diesel engine, coolant for diesel engine, wires, cable for control signal is under the scope of work other details are as for the BOQ.
13. Filling of Diesel from filling station to site is under this scope payment of diesel will separate as actual.
14. Firefighting equipment test every fourth monthly and maintain register, All the time of expiry of contract handing over all the equipment in good working condition.
16. At the time of renewal of license of firefighting system contractor should manage all the lizaning with Chief Fire Officer.
17. After completion of contract handed over the entire system to the department/ new agency.

## **SECTION C**

### **LV & FAS & FAS OPERATION AND MAINTANANCE LOW VOLTAGE SYSTEMS**

#### **PART I: GENERAL CONDITIONS OF O&M**

The Authorized System Integrator will carry out testing, Commissioning of all systems before starting AMC and also do Maintenance for the period as specified.

The Authorized System Integrator shall provide maintenance from the date of work order and also support for Maintenance of entire system for 5 years after completion of maintenance period of 5 (Five) year.

Further, The Authorized System Integrator shall make minimum four maintenance schedules per annum to maintain the system and subsystems during AMC

#### **RESPONSIBILITY OF THE LV & FAS CONTRACTOR**

The LV & FAS contractor shall utilize optimally the land available for AMC of various facilities/components of the work and cost all components and allied works. The details of the costing shall form part of the proposal. The LV & FAS contractor shall provide a detailed scheme of AMC Work.

The LV & FAS contractor has to bear in mind that if selected for the award of contract he shall have to ensure that in any case no damage is caused to the environment while executing the work.

Necessary barricading and other necessary safety measures shall be the responsibility of the AMC Contractor. Any loss of human or damages or so, shall be the responsibility of the Work Contractor.

No Damage in case shall be caused to the structure. The selected contractor shall be Held responsible in occurrence of any such incident and will be responsible for the cost of required rectifications.

Site shall be returned to the Employer as it was in the original condition and completely free of any garbage and temporary structures.

The LV & FAS contractor shall bear all costs associated with the preparation and submission of its bid, and the Employer in no case is responsible or liable for these costs, regardless of the outcome of the bidding.

The LV & FAS contractor shall ensure proper housekeeping of the area after completion of maintenance job.

## **PART II: SPECIAL CONDITIONS OF O&M**

### INSURANCE UNDER WORKMEN COMPENSATION ACT.

Agency is required to take insurance cover under the workmen compensation Act, 1923 amended from time to time from an approved insurance company and pay premium charge thereof. Wherever required by NBCC the Agency shall produce the policy or the policies of Insurance and the receipt of payment of the current premiums.

### LABOUR LAWS TO BE COMPLIED BY THE AGENCY

The Agency shall obtain a valid license under the contract labour (R&A) Act Central Rules 1971 and amended from time to time, and continue to have a valid license until the completion of the work. The Agency shall also abide by the provision of the child labour (Prohibition and Regulation) Act, 1986 and amended from time to time. Any failure to fulfil this requirement shall attract the penal provisions of this contract arising out the resultant for non execution of the work before the commencement of work. No labour below the age of 18 years shall be employed on the work.

### LABOUR SAFETY PROVISION

The Agency shall be fully responsible to observe the labour safety provisions as per Labour Laws and Law of the Land. Ignorance of any labour law related to labour safety will not be an excuse if at any stage the same are found violated by authority or and by labour inspector.

### EMPLOYMENT OF PERSONNEL

- i) The Agency shall employ only Indian Nationals as his representatives, servants and workmen after verifying their antecedents and loyalty. He shall ensure that no personnel of doubtful antecedents and any other nationality in any way is associated with the works.
- ii) Tendering Authority shall have full power and without assigning any reason to the Agency, immediately remove any representative, agent, servant and workmen or employees on account of misconduct negligence or incompetence or whose continued employment may in his opinion be undesirable. The Agency shall not be allowed any compensation on this account.

### WORKMEN'S COMPENSATION ACT.

The Agency shall at all times indemnify Tendering authority and owner against all claims for compensation under the provision of workmen's employed by the Agency or his sub-Agency in carrying out the contract and against all cost and expenses incurred by the authority herewith.

### MINIMUM WAGES ACT.

The Agency shall comply with all the provisions of the minimum wages Act, 1948, contract labour Act (R&A) 1970, and rules framed there under and other labour laws/laws affecting contract labour that may be brought into force from time to time.

### **PART III: TERMS & CONDITIONS & SCOPE OF WORK FOR O&M**

#### **A. MAINTANANCE**

During the term of this Agreement THE LV & FAS CONTRACTOR agrees to maintain the EQUIPMENT in good working order and for this purpose will provide the following repair and maintenance service and will bind to conditions as stated below:

- 1) THE LV & FAS CONTRACTOR shall correct any faults and failures in the EQUIPMENT and shall repair and replace worn or defective parts of the EQUIPMENT during THE Office's normal working hours on all working days. In cases where unserviceable parts of the EQUIPMENT need replacement THE LV & FAS CONTRACTOR shall replace such parts, at no extra cost to THE OFFICE, with brand new parts or those equivalent to new parts in performance. THE LV & FAS CONTRACTOR shall further ensure that the EQUIPMENT is not down at any time for want of spare parts.

Each and every component including plastic parts, breakdown due to power conditions, rodents etc. are covers under the contract excluding such Component which is Stolen, Broken, Burnt and Damaged due to fire/water/Pilferage/Mishandling or any other such act not attributed to normal working condition of such systems.

The LV & FAS CONTRACTOR must take all the necessary precautions/measures so that there is no breakdown during any of the meeting. The LV & FAS CONTRACTOR has to attend to any fault immediately or has to provide suitable alternative immediately so that the proceeding of the meeting are not disturbed/hampered.

- 2) THE LV & FAS CONTRACTOR shall correct any faults and failures in the Cable and shall repair and replace worn or defective parts of the Cable during THE Office's normal working hours on all working days. In cases where unserviceable parts of the Cable need replacement THE LV & FAS CONTRACTOR shall replace such parts, at no extra cost to THE OFFICE, with brand new parts or those equivalent to new parts in performance.
- 3) THE LV & FAS CONTRACTOR agrees that special arrangements may be made by THE OFFICE to have such maintenance service provided outside the hours specified in (a) above.
- 4) THE LV & FAS CONTRACTOR shall provide repair and maintenance service, in response to oral including telephone notice by THE OFFICE and such services should be available for a period of 10 hours from 10 a.m. to 8 p.m. on all working days.

However, due to any reason if THE OFFICE will remain open on any public holiday then THE LV & FAS CONTRACTOR has to provide service on the request of THE OFFICE.

- 5) THE LV & FAS CONTRACTOR shall ensure 24 hours response time (i.e. total time taken by THE LV & FAS CONTRACTOR between registering the complaint and attending the complaint).
- 6) THE LV & FAS CONTRACTOR shall ensure break down call time of 48 hours (i.e. total time taken by THE LV & FAS CONTRACTOR between registering the complaint and rectifying the fault). This time includes time taken to reach the site, diagnose and repair/replace the faulty component/module/device & equipment that are covered under the contract.
- 7) THE LV & FAS CONTRACTOR shall ensure Spares availability. Stocking of sufficient spares & equipments as considered necessary at the site for immediate attending the fault/breakdown & for replacement as the case may be. In case, it is not possible to repair some equipment or not possible to repair at site and has to be taken out for repairs, THE LV



& FAS CONTRACTOR shall provide a suitable replacement as Standby arrangement within 24 hours so that the work is not hampered. The packing /unpacking, transportation, loading / unloading, connection / disconnection, configuration / re-configuration and any associated activity with the repair and maintenance shall be the sole responsibility of THE LV & FAS CONTRACTOR. However, if Standby arrangement has been made then it shall be replaced with original or functionally equivalent equipment within next 15 working business days.

- 8) Preventive Maintenance: THE LV & FAS CONTRACTOR shall conduct Preventive Maintenance (including but not limited to inspection, testing, satisfactory execution of all diagnostics, cleaning and removal of dust and dirt from the interior and exterior of the EQUIPMENT, necessary repairing of the EQUIPMENT) once within the first fifteen days of the commencement of the maintenance period and once within the first fifteen days of every subsequent month, during the currency of this Agreement, on a day and at a time to be mutually agreed upon and inform the representative of THE OFFICE about any necessary steps to be taken like configuration, up gradation of software's or purchase of consumables etc.  
Notwithstanding the foregoing, THE LV & FAS CONTRACTOR recognizes THE OFFICE's operational needs and agrees that THE OFFICE shall have the right to require THE LV & FAS CONTRACTOR to adjourn Preventive Maintenance from any scheduled time to a date and time, not later than fifteen working days thereafter.
- 9) Qualified maintenance engineers totally familiar with the EQUIPMENT shall perform all repair and maintenance service described herein. As the system is a sophisticated one the LV & FAS CONTRACTOR must be having trained personnel with the required testing/repairing facilities for the system.
- 10) All the T&P and testing facilities required for the job shall have to be arranged by the LV & FAS CONTRACTOR within the scope of work. The following consumable materials & tools items for maintaining the installations shall be arranged by the LV & FAS CONTRACTOR at their own cost and shall keep ready at site in sufficient quantity under the scope of work for which nothing extra shall be paid. Tool & Plant required to operate, repair servicing and maintain the installation like spanners, goti sets, screwdriver, crow bars, magger, multimeter, blower, crimping tool, torch hand lamp bucket, container, table, chair, almirah & other unforeseen T & P.
- 11) THE LV & FAS CONTRACTOR shall maintain at THE Office's site, a written maintenance and repair log; and shall record therein each incident of EQUIPMENT malfunction, date and time of commencement and successful completion of repair work and nature of repair work performed on the EQUIPMENT together with a description of the cause for work, either by description of the malfunction or as regularly scheduled Preventive Maintenance. THE OFFICE shall use the same log for recording the nature of faults and failures observed in the EQUIPMENT, the date and time of their occurrence and provide to the respective offices when ever required.
- 12) THE LV & FAS CONTRACTOR shall maintain the operating system software on the workstation/server, as per the terms of the purchase order/agreement related to this EQUIPMENT.
- 13) THE LV & FAS CONTRACTOR shall also maintain the system health against virus attack which includes cleaning of viruses from workstation/server.
- 14) In case if THE LV & FAS CONTRACTOR is not able to repair the original equipment, THE LV & FAS CONTRACTOR shall supply the new substitute of same specifications or of higher specifications of reputable brand, with prior approval of THE OFFICE.

The spare & equipments to be used for repairs/replacement shall preferably be of the same make & specification as provided originally in the system as far as possible. Other make shall be permitted only if the existing make is not being manufactured or is not readily available with the prior approval of Engineer-in- Charge.

- 15) The LV & FAS contractor shall keep at least one technically skilled person at site to take care maintenance activities during visit of VVIPs, LV & FAS contractor will be informed by the authority in advance for the same.
- 16) Failure in adhering to any of the terms and conditions mentioned in the scope of work will attract penalty clause.
- 17) THE EQUIPMENT shall not be shifted to an alternate site and installed during the currency of this Agreement without prior written notice to THE LV & FAS CONTRACTOR. However, if THE OFFICE desires to shift the EQUIPMENT to a new site and install it, THE LV & FAS CONTRACTOR shall be informed of the same. THE OFFICE shall bear the charges for such shifting and reinstallation and THE LV & FAS CONTRACTOR shall provide necessary assistance to THE OFFICE in doing so. This Agreement, after such shifting and reinstallation, would continue to be binding on THE LV & FAS CONTRACTOR and THE OFFICE
- 18) The LV & FAS CONTRACTOR shall be responsible for ESIC & EPF.
- 19) The LV & FAS CONTRACTOR has to maintain all the equipment in working condition. Rs. 2000/- will be deducted for each day of delay for rectifying the fault & Rs. 1000/- each day for not providing sufficient technical staff.
- 20) THE OFFICE shall arrange to maintain appropriate environmental conditions, such as those relating to space, temperature, power supply, and dust to within the acceptable limits required for equipment similar to that covered by this Agreement.
- 21) No terms or provision hereof shall be deemed waived and no breach excused, unless such waiver or consent shall be in writing and signed by the party claimed to have waived or consented. Any consent by any party to or waiver of a breach by the other, whether express or implied, shall not constitute a consent to, or waiver of, or excuse for any other, different or subsequent breach.
- 22) THE LV & FAS CONTRACTOR shall provide all working mobile nos. and email address of the contact person(s) to THE OFFICE for the satisfactory performance of the contract.
- 23) THE LV & FAS CONTRACTOR will not subcontract or permit anyone other than THE LV & FAS CONTRACTOR personnel to perform any of the work, services or other performance required of THE LV & FAS CONTRACTOR under this Agreement without the prior written consent of THE OFFICE.
- 24) THE OFFICE shall have the right to make changes and attachments to the equipment, provided such changes or attachments do not prevent proper maintenance from being performed, or unreasonably increase THE LV & FAS CONTRACTOR cost of performing repair and maintenance service.
- 25) The contractor shall take over the installation for its maintenance and upkeep before start of work will hand over the installation in normal working order to the department after completion of work /on expiry of the contract. If any defect/damage (except normal wear & tear) is noticed, the same shall have to be rectified/replaced by the contractor at his own cost failing which the same shall be got rectified at their cost.

- 26) THE LV & FAS CONTRACTOR agrees that it and its personnel will at all times comply with all security regulations in effect from time to time at THE Office's premises and externally for materials belonging to THE OFFICE.
- 27) During the performance of the contract, if the person(s) of THE LV & FAS CONTRACTOR meet with any accident which results into the death or injuries to the person(s) of THE LV & FAS CONTRACTOR or any damage made to the Third party and any claim or legal penalties arise out of it will be responsibility of THE LV & FAS CONTRACTOR only. THE OFFICE will not be responsible in any way.
- 28) THE LV & FAS CONTRACTOR shall follow all the regulations of Government of Gujarat and Government of India. THE LV & FAS CONTRACTOR shall have any and all responsibilities of all the person(s) employed for the performance of the contract.
- 29) THE LV & FAS CONTRACTOR acknowledges that all material and information which has or will come into its possession or knowledge in connection with this Agreement or the performance hereof, consists of confidential and proprietary data, whose disclosure to or use by third parties will be damaging or cause loss to THE OFFICE. THE LV & FAS CONTRACTOR agrees to hold such material and information in strictest confidence, not to make use thereof other than for the performance of this Agreement, to release it only to employees requiring such information, and not to release or disclose it to any other party. THE LV & FAS CONTRACTOR agrees to take appropriate action with respect to its employees to ensure that the obligations of non-use and nondisclosure of confidential information under this Agreement can be fully satisfied.
- 30) THE LV & FAS CONTRACTOR represents and warrants that the repair and maintenance service/products hereby sold do not violate or infringe upon any patent, copyright, trade secret, or other property right of any other person or other entity. THE LV & FAS CONTRACTOR agrees that it will, and hereby does, indemnify THE OFFICE from any claim, directly or indirectly resulting from or arising out of any breach or claimed breach of this warranty.
- 31) THE LV & FAS CONTRACTOR shall submit to THE OFFICE their invoice(s) for payments due in accordance with this AGREEMENT. The terms of such invoice(s) is that they shall be payable as per the rates submitted, negotiated and agreed by both
- 32) All of the prices, terms, warranties and benefits granted by THE LV & FAS CONTRACTOR herein are comparable to or better than the equivalent terms being offered by THE LV & FAS CONTRACTOR to any of its present customers. If THE LV & FAS CONTRACTOR shall, during the term of this Agreement, enter into arrangements with any of its customers providing greater benefits or more favorable terms, this Agreement shall thereupon be deemed to provide the same to THE OFFICE.
- 33) Payment: The LV & FAS contractor shall be paid quarterly payment after satisfactory services.
- 34) THE OFFICE reserves the right to change any bid condition of any item even after inviting the bids, with/without prior notification.
- 35) During the period of contract, in any dispute arising between THE OFFICE and THE LV & FAS CONTRACTOR, the decision of THE OFFICE will be considered final. However, in any case if the requirement of Arbitration is felt then the appointment of Arbitrator will be made by THE OFFICE only and the decision of THE LV & FAS CONTRACTOR shall be bound by the decision taken by such appointed Arbitrator.
- 36) The jurisdiction of any dispute will be Rajkot.

- 37) Force Majeure shall mean and be limited to the following:
- a) War / hostilities
  - b) Riot or Civil commotion
  - c) Earthquake, flood, tempest, lightening or other natural physical disaster.
  - d) Restrictions imposed by the Government or other statutory bodies which prevents or delays the execution of the order by the LV & FAS CONTRACTOR.
- 38) Consumables like Projector Lamps, Remote cell, battery etc shall be bought by Department and supplied to THE LV & FAS CONTRACTOR whenever required for replacement of Used Lamps.

The LV & FAS CONTRACTOR shall advise THE OFFICE by a registered letter duly certified by the local statutory authorities, the beginning and end of the above causes of delay within seven (7) days of the occurrence and cessation of such Force Majeure Conditions. In the event of delay lasting over two months, if arising out of causes of Force Majeure, THE OFFICE reserves the right to cancel the order.

Completion period may be extended to circumstances relating to Force Majeure by the THE OFFICE. LV & FAS contractor shall not claim any further extension for completion of work. THE OFFICE / GoG shall not be liable to pay extra costs under any conditions.

It will be prerogative of OFFICE/GoG to take the decision on force major Conditions and OFFICE/GoG decision will be binding to the LV & FAS contractor.

## B. OPERATION

### Terms & Conditions of the Operation Contract.

1. The Work shall be carried out as per instructions of Engineer- in - charge of work.
2. The work shall be carried out in VVIP buildings so all the security restrictions and rules shall be followed by firm.
3. The scope of work includes testing of the system in the morning period before start of the Session/Event/Programmed and operation of the system during the session period of the day. .
4. The firm has to issue identity card for the staff deployed by them.
5. The department shall be at liberty to discontinue /cancel the contract / agreement by giving one week's notice in accordance with the above terms and conditions or otherwise without assigning any reason therefore. Decision of Engineer-in –charge shall be final binding on the contractor for which no claim on any account shall be entertained by the department.
6. Nothing extra shall be paid on account of wastage of labour due to security reasons.
7. Attendance of Sound operators from 10.30 hours till the end of the day during Session and checking the system daily in normal working hours when the session is not in ON .
8. The total requirement operators and maintenance engineers/technicians has to be decided by LV & FAS contractor, but at least four technician for AV & PA System and one technician for FAS should be available full time to take care of O & M
9. Name and addresses of labours/staff etc working at site shall be furnished for security verification.
10. The labourr/staff should not be changed frequently once the verification of the character and antecedents is done. After verification of antecedents of workers, identification passes will be issued to them. The cost of photos would be borne by the contractor.
11. The staff deployed by the firm shall not have any claim for regularization/appointment in the department at a later date.
12. Department shall not be responsible for any injury partial or permanent or death of any worker at site due to accident or of malfunctioning of the equipment or by negligence of the staff and any kind of compensation will not paid by the department.
13. As and when there will be security requirements, certain additional restrictions can be Proposed as per the requirement of the situation. No. claim what so ever will be entertained by the department on account of any restrictions imposed by the security agencies during execution of work.
14. The contractor and his staff employed on this work will follow the instruction given time to time by J.E. / A.E./ E.E. (E) in order to clear the emergency situation.

**Name of work: Operation and All in Comprehensive maintenance of Variable Refrigerant Based Centralized Air Conditioning System  
Renovation of Existing Arvindbhai Maniyar Hall, Rajkot**

**Defect Liability Period (DLP):-**

Defect liability Period will be considered from to the final handling over of entire site and closing of contract, part handling over will not be considered even if the some part/ floor/ department/ almost full site is underutilization/ shifting in part or fully. During above DLP contractor have to maintain and operate the entire system which may be utilized/ used/ shifted by the user.

**PART – I: OPERATION OF VARIABLE REFRIGERANT BASED CENTRALIZED AIR  
CONDITIONING SYSTEM.**

**SPECIFICATIONS, TERMS/ CONDITIONS.**

01. Timing of Operation is in normal condition is from 8:30 to 21:30 in working day. But it will be intimated to contractor, for operation of System in any other timing, holydays etc.
02. Contract of Operation and Maintenance of Variable Refrigerant Based Centralized A.C. System & IBMS for Arvindbhai Maniyar Hall, Rajkot. Equipments, installed at Renovation of Existing Arvindbhai Maniyar Hall, Rajkot at Renovation of Existing Arvindbhai Maniyar Hall, Rajkot.
03. Abstract of Variable Refrigerant Based Centralized A.C. System its related accessories/controls, etc. under the scope of contractor for the purpose of operation etc. are included under “Scope of Equipment’s/Items Cover” The contractor will be responsible at all times for satisfactory operation of their Variable Refrigerant Based Centralized A.C. System& IBMS along with all the related equipment’s/accessories with NIL down time from their side.
04. The contractor will engage the following minimum manpower. One Senior Experienced Supervisor Four Persons Operators, Two Persons helper, One Persons Electrician cum BAS operator.

If additional manpower required for smooth operation of system contractor will provide without any extra cost.

05. The operator of respective A.C. System will take hourly readings of Variable Refrigerant Based Centralized A.C. System / Equipment's Temperature & R.H. readings. All these readings will be recorded in logbook register. Any abnormality in the system including time of starting / stopping of Variable Refrigerant Based Centralized A.C. System should be clearly recorded in the logbook register.
06. Operator will be responsible for proper sequential operation of Systems and stopping the same as per the procedural practice. In case of any abnormality (like non-availability of power supply, etc.) he will immediately report the matter to his supervisor for further action. Similarly any malfunction in the system will be immediately reported by him to his supervisor for suitable corrective actions.
07. Operator will physically check the performance of Variable Refrigerant Based Centralized A.C. System once in a day and record the same in logbook register.
08. Whenever required, operator will manually adjust the fresh Air quantity under the guidance of his supervisor & record the same in logbook register. Separate logbook register will be provided and maintained by the Contractor for every equipment.
09. The helper of respective A.C. System will assist the operator in day to day operation of A.C. System like checking of temperature settings etc. As and when required, cleaning of filters as and when required, cleaning of pre Air-filters of TFA, etc. Helper will be responsible for keeping AHU rooms/ Blowers rooms including all the A.C. equipment's in clean and tidy condition including outdoor location area. He will also carry out general cleaning of all A.C. equipment's including Electrical Panels on regular basis.
10. The supervisor will be responsible for the following:
  - 10.1 To continuously supervise the satisfactory operation of all AC Systems.
  - 10.2 To take daily instructions from Engineer-in-charge/Site Engineer.
  - 10.3 To check the readings of A.C. System taken by operators and sign the same in respective logbook register on daily basis.
  - 10.4 To ensure that all the A.C. System equipment's & rooms/areas occupied by Systems are always in neat and tidy condition and also to ensure that regular sweeping/mopping is done by housekeeping Agency.

- 10.5 To monitor all the parameters/readings on DDC system (where-ever available) and maintain the record of same on daily basis from server.
- 10.6 To ensure satisfactory performance of DDC system and to take Suitable corrective measures to the possible extent in case of Malfunctioning.
- 10.7 He will feed all the readings of all A.C. Systems in the computer available with DDC control system on daily basis. This computer will be interfaced by BAS facility available in A/C System room & subsequently on any particular day readings should be available
- 10.8 To report the performance of all A.C. Systems to Engineer-in-charge on fortnightly basis. During this review, he will produce all the Details/log register, etc. along with any abnormality/malfunctioning Problems and note down the instructions of Engineer-in-charge for further action.
- 10.9 To maintain daily attendance of his personnel in a separate register.
- 10.10 He will contact identified end users of buildings for obtaining their views/comments/complaints regarding overall performance of AC system, at least alternate day and will record the same in his site register and will produce the same to Engineer-in-charge during fortnightly review. He will also take immediate suitable corrective measure as per the necessity.
- 10.11 He will inform immediately to Engineer-in-charge/Site Engineer of Arvindbhai Maniyar Hall, Rajkot for any malfunctioning in A.C. System, causing the stoppage of A.C. System.
11. In case of any operator/helper being on leave, the contractor will immediately take advance action and provide substitute so that minimum manpower as indicated above is not reduced on any day. Same is applicable in case of supervisor also.
12. All the tools/logbook register/attendance Register/Supervisor Register, etc. will be provided and maintained by the contractor. One set of tools should be always available with the operator of respective A.C. System for carrying out the essential work as may become necessary for operation of A.C. Systems & equipment's.
13. The contractor will be totally responsible at all times for the safety
14. Of his personnel; who will follow all safety rules and regulations during the entire period of the contract. Contractor will be responsible for the risk and compensation to his personnel in case of any eventuality. Department will not be responsible for any mishap, injury, accident, etc. of the personnel of the Contractor.



15. Damage of any A.C. System or any of the components of A.C. Systems due to wrong operation or due to negligence by the contractor's personnel will be made good immediately by the vendor.
16. Arvindhbai Maniyar Hall, Rajkot Campus is Security area; the contractor will furnish the list of his personnel along with police verification for providing entry pass. In case of any change in personnel, same should be informed to Engineer-in-charge immediately.
17. The contractors or his personnel will follow security regulations of Arvindhbai Maniyar Hall, Rajkot at all times. They should confine their activities in the concerned building only for the required purpose. They should not tamper or mingle with any of the users equipment's / components at any time. If such an incident is noticed, the matter will be viewed very seriously and the contractor will be held responsible for consequences.
18. Operators / Helpers engaged by the contractor will always wear uniform while in Arvindhbai Maniyar Hall, Rajkot premises with their name & name of contractor for easy identification.
19. The contractor will ensure that the AC System and other rooms housing AC equipment's are kept in clean and tidy condition. All the AC equipment's & accessories should be kept in clean condition by the helpers / operators.
20. The work will be reviewed by the Engineer-in-charge with the supervisor of the contractor on fortnightly basis. During this review supervisor of the contractor will produce all the details to the Engineer-in-charge. Any corrective measures / instructions issued by the Engineer-in-charge, during the review, should be followed by the contractor immediately.
21. The contract can be extended by the Department for next year after expiry date, if required on mutual agreed as per accepted price.
22. After completion of the contract period it will be the contractor's responsibility to hand over to Dept. Entire System AC Systems/ Accessories in good working.

## PART – II: MAINTENANCE OF CENTRAL A.C. SYSTEMS

### TECHNICAL SPECIFICATION, TERMS AND CONDITIONS

The Entire A.C. Systems and equipment's must be handed over to the Engineer-in-charge after Expiry of Contract. If fails to that, SD will be for fitted and recommended for black listing of Agency.

1. Abstract details of A.C. Systems and equipment and their related accessories / controls etc. under the scope of Contract for the purpose of Maintenance and servicing are indicated under "Scope of Equipment's/Items Cover". The contractor will be responsible at all times during the period of Contract for satisfactory working of these A.C. Systems and equipment's / accessories with Zero down time.
2. The Contractor will engage the following minimum manpower.
  - 1 No. Supervisor Minimum Diploma Holder, with at least Seven-Ten YEARS experience in similar field to continuously supervise the subject A.C. Systems and equipment's for their satisfactory operation / working.
  - To ensure that all the subject AC Systems, equipment and accessories are in good working condition, including DDC system, BAS System, CPM and to take suitable corrective measures in case of their malfunctioning.
  - To report the performance of all AC Systems and the Equipment to Engineer-in-charge on fortnightly basis. During the review he will produce all the details / Log book registers, indicating actions taken, while doing preventive maintenance and routine servicing including any abnormality / malfunctioning problems etc. and note down the instructions of Engineer-in-charge for further compliance.
  - He will also contact identified end user of subject buildings for obtaining their comments / views / complaints, if any, regarding overall performance of AC Systems and will record in his site register, the same and will produce the same to Engineer-in-charge during fortnightly review. He will also take immediate suitable corrective measure as per necessity.
  - He will inform immediately to Engineer-in-charge / site Engineer for any malfunctioning / breakdown causing stoppage of AC System.
- b) 2.No. Minimum ITI qualified and experienced / skilled Technician per shift, round clock basis, throughout the year for all the days of the year, including Saturdays, Sundays & Public Holidays.
- c) 2 Helper on 6 days per week, from 08:00 hrs to 19:00 hrs.
- d) 1.No. Minimum ITI qualified and experienced / skilled A.C. Systems Operator per shift, round clock basis, throughout the year for all the days of the year, including Saturdays, Sundays & Public Holidays

**Note: - These Persons is other than Operation team.**

3. In case of Supervisor / Technicians / Helper being on leave the contractor will immediately take advance action and provide substitute so that minimum manpower as indicated above is not reduced on any day.
4. All the tools, logbook register, attendance register, etc. will be provided and maintained by the contractor. One set of tools and measuring instruments should always be available in each System room for carrying out the essential works, as to set right the defective A.C. equipment and also for setting / resetting of the Controls.
5. Supervisor, Technician / helper engaged by the contractor will always wear uniform, while in Arvindbhai Maniyar Hall, Rajkot premises, with their name and that of the contractor for clear identification.
6. The contractor will be totally responsible at all times for the safety of their personnel, who will follow all the safety rules and regulations during the entire period of contract. The contractor will be responsible for the risk & compensation to his personnel in case of any eventuality, Department will not be responsible for any mishap, injury, accident etc. occurred to personnel.
7. Damage of any System or any of the AC Components, under the scope of contract, due to negligence of personnel will be made good immediately by the contractor.
8. Arvindbhai Maniyar Hall, Rajkot is Highly Security area the contractor will furnish the list of the personnel along with police verification for arranging Entry passes. In case of any change in personnel, same should be intimated to the Engineer-in-charge immediately.
9. The contractor personnel should confine their activities in the concerned buildings only for the above given purpose. They should not tamper / mingle with any of the users Lab. Equipment, at any time. It will be viewed very seriously.
10. Combine (O &M) Bill Payments will be made on Quarterly basis, on production of the invoice/bill by the contractor along with attendance sheet of the personnel deployed to The Engineer-in-charge. The bill will be certified by the Engineer-in-charge. Payment will be made on availability of Funds/L.C.
11. As far as possible all emergency repairs should be carried out on 'holidays. Maintenance and repairs to nay equipment should be carried out using the Standby equipment wherever available Major repairs should be carried out during off-season.
12. The standby equipment should always be maintained in good working condition.
13. Replacement of spares / components of any equipment should be done as per Recommendation of the manufacturer and also as and when becomes necessary.

14. Notwithstanding as to what is specifically stated above, it shall be the responsibility of the contractor to attend to all the preventive maintenance routine servicing, repairs and breakdown maintenance etc. including replacement of defective parts / components, without any extra cost.
15. Normally repairing works should be done at site, however if it is to be taken outside campus to the service station, to and fro transportation charges shall be borne by the contractor and necessary permits / material gate passes will be arranged by Department.
16. In case of any unsatisfactory performance on the part of the contractor, department reserves the right to terminate the contract with prior notice.
17. You will provide skilled manpower, spares, consumables etc. for preventive maintenance and to attend complaint call as and when required. The complaint call can be beyond normal working hours and on holidays and the same should be attended immediately.
18. It is the responsibility of the contractor to follow all the rules and Regulations of Labour department, for the personnel employed by him. For maintenance work the agency should obtain Labour License from the office of the Labour Commissioner, if required as per the statutes.
19. The contract can be extended by the Department for next year after expiry date, if required on mutual agreed as per accepted price.
20. All the Safety Controls of A.C. Systems such as H.P., L.P., O.P., Pressure Switch, Interlocking of all the A.C. Equipment's to be checked once in a month and same to be recorded in the register.
21. After completion of the contract period it will be the contractor's responsibility to hand over to Dept .all he AC Systems/ Accessories in good working as per manufacturer specification.

**SCOPE OF WORK**

01. The scope of work includes maintaining the AC Systems and equipment in Proper/safe operating condition by regular and systematic examining, Adjusting, lubricating, repairing/replacing of all the defective equipment parts/components pertaining to the equipment as specified using only original and genuine parts.
02. Lubricating, servicing and checking of all the equipment shall be done once in a month or as and when required. During emergency services of repairing crew shall be available at any time, during the regular working hours as well as overtime hours including on holidays. It will be obligatory on the part of the contractor to respond immediately after receiving the complaint.
03. Overhauling of all the AC Systems and equipment shall be done at least once in a year and also as per Manufacturer/OEM/System Integrator Guidelines.
04. Cleaning of Condenser Coils, A.H.U. Cooling Coils / Evaporator coils, shall be done once in year and also as and when necessary.
05. Refrigerant gas, Compressor oil etc. and the Consumables, should be done as and when required, as a result of leak in the system and also arising out of wear & tear. (Gas and Oil are in the scope of AMC)
06. Adjustment of belt tension, inspection of the belts for abnormal Abrasion Etc. including replacement of these worn out belts is to be done as and when necessary. Sufficient Stock of required size of Belts may please be maintained at site.
07. Cleaning of R.A. filters of indoor units, T.F.A./A.H.U.s, filters should be done at regular interval, and replacement of the same should be done if found unclean able and unserviceable.
08. Servicing repairing and replacement of defective spares and Components, whenever required should be carried out with Knowledge of Engineer-in-charge and signature of Site Engineer should be obtained in token of work done. And enter in Log Book of Equipment's.

09. Preventive maintenance should be carried out in a phased manner, in consultation with the site Engineer and the Engineer-in-charge by engaging necessary additional manpower. Preventive maintenance to be done as per manufacturer guidelines.
10. Painting of all the equipment, piping, valves, electrical panel boards etc. and outdoor VRF unit shall be done as per required at site. Make it clean and smooth surface.
12. To supply spares, components of compressor and electrical accessories in the electrical panels etc. is under the Scope of Work. And all the parts of Variable Refrigerant AC Electrical panels are same as original make and models. If changes get approval first.
13. Monthly preventive maintenance will comprise the following and preventive maintenance schedule chart as per Manufacturers recommendations.
  - a) To check the general functioning of all the equipment accessories & to take corrective measures, as and when required.
  - b) Checking the system for refrigerant leakages and to take the Corrective measures, including Pressure Testing, Vacuuming and Gas charging etc. as and when required.
  - c) Inspection / Adjustment and resetting of Refrigerant Controls, for maintaining the AC Systems in perfect working condition.
  - d) To replace / repair immediately components is found defective during the above checking.
14. "Maintenance & Servicing History Card" for individual equipment shall be provided and up-dated regularly.
15. The preventive maintenance Schedule chart will be prepared by agency and submit to engineer-in-charge for approval. As per approved schedule chart work will taking on hand.

**Name of work : Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot**

**Rs. 3,49,00,000.00**

I/We am/are willing to carry out the work at \_\_\_\_\_ below \_\_\_\_\_ % (should be written in figures and words) of Estimate rates mentioned above. Amount of my/our tender work out as under:

(A) Total Tendered amount.

(B) (B) Rebate on above tender amount (if any) = ----- % ( In Figure)

Rs. -----

(C) Net Tendered amount (A-B) -----Rs. -----

In Words (Rupees -----)

(a) I /We hereby declare that I/We have visited the site and fully exquisite myself/ourselves with the local situation regarding materials, labour another factors pertaining to work before submitting tender.

(b) I/We here declare that I/We have carefully studied the conditions of contracts, detailed specification and other documents of this work and agree to execute the same accordingly.

- Note: 1) The rates are inclusive of all taxes, transport Charges, octroi duty and storage charges up to date.  
 2) The materials covered under contract should be got approved from the Dy. Executive Engineer in Charge of the work.  
 3) The materials and work shall have to be sued and carried out as specification in technical note.  
 4) All works shall be carried out as per public works Department hand book and other specifications of the Dn. or as directed.  
 5) Rates are inclusive of 1% labour cess in tender amount so 1% of total amount of bill will be deducted from the bill.  
 6) The material to be used in this work should be approved strictly from Engineer-in Charge/Deputy Ex. Engineer as applicable.  
 7) The agency will have to agree to carried out the work as per brand demand of concern Depts.

Signature of the Contractor

**Name of work : Renovation Of Existing Arvindbhai Maniyar Hall, Rajkot**

**Rs. 3,49,00,000.00**

I/We am/are willing to carry out the work at \_\_\_\_\_ below \_\_\_\_\_ % (should be written in figures and words) of Estimate rates mentioned above. Amount of my/our tender work out as under:

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 6) The material to be used in this work should be approved strictly from Engineer-in Charge/Deputy Ex.Engineer as applicable.  
 7) The agency will have to agree to carried out the work as per brand demand of concern Depts.

Signature of the Contractor



**AMOUNT PUT TO TENDER****Name of Work:- : RENOVATION OF EXISITNG ARVINDBHAI MANIYAR HALL, RAJKOT**

| Sr.no. | Particular | Amount                      |
|--------|------------|-----------------------------|
| 1      |            | <b>Rs. 3,49,00,000.00/-</b> |

Roads & Buildings Department  
Government of Gujarat

Division \_\_\_\_\_

**TENDER  
FOR  
ELECTRIAL WORK**

Name of work \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Estimated Cost Rs. \_\_\_\_\_

Date of Issue of Tender \_\_\_\_\_

Last Date of Receiving Tender \_\_\_\_\_

Name of Work \_\_\_\_\_

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**Last Date of Receipt of Tenders by R.P.A.D. Dt.**

Issued to M/s. \_\_\_\_\_

**Divisional Accountant / D.A.O.**

**Executive Engineer..**

**Instructions to Tenderers**

1. Tenders, sealed and marked on the outside for  
"will be received by undersigned  
Upto the \_\_\_\_\_ day of 200  
in the form of "Tender for Electrical Works" hereto annexed
2. The tenderers shall state precisely in his tender the type and description of the materials, plant and stores he proposes to use for the work. If he proposes to use materials, plant or stores of other than Indian manufacture he must clearly state this in his tender, together with the name, manufacturer and of the country of origin of the same.
3. The officer with whom cash deposits are to be made, or to whom securities are to be endorsed in accordance with clause 3 of General Conditions of Contract for Electrical Works, is the Ex. Engr. \_\_\_\_\_
4. The work must be carried out in accordance with the General Conditions of Contract for Electrical Works, and the general specification for electrical works in Government building.
5. Plans may be seen, in the office of the Ex. Engr. \_\_\_\_\_  
Division.  
Department \_\_\_\_\_
6. The Governor of Gujarat does not undertake to accept the lowest or any tender.

Date : \_\_\_\_\_ - 200

Executive Engineer.

**Original**

**Form of Tender for Electrical Works****Department**

1. I/We do hereby tender to execute the whole of the work

Described in the accompanying tender for the several sums, and in the case of measured works, at the several rates, set forth in the tender hereto attached and signed by me/us and should this tender be accepted, I/We further undertake to complete the work within the time stated below reckoned for the date of acceptance of tender, namely.

2. I/We do agree and bind myself/ourselves to abide by and fulfil the general conditions of contract and the Special Conditions of Contract annexed to the Specification or in default thereof to pay to the purchaser, as reasonable compensation for such breach of such conditions, the sums of money mentioned in the said condition.

3. I/We further agree to make good at my/our own expense all defect in the installation which appear within twelve months from the date bringing the installation into beneficial use when such defects are due to defective workmanship or material executed or supplied by me/us.

4. I/We hereby declare that my/our near relative are not working in this Division or in its sub-division as an Ex. Engineer, Deputy Executive Engineer, Assistant Engineer, Additional Assistant Engineer, Overseer, Divisional Accountant, Store Keeper, Manager of Atithi/Vishram Gruha and in the circle as Superintending Engineer in addition for Panchayat Works not working nor having posting as Chairman of P.W. Committee or as incumbant in Jilla Panchayat at today.

Signature(s)

Dated at

The Date of 200

The above tender is hereby accepted by me for and on behalf of the Governor of Gujarat.

Dated at

The day of 200

**Executive Engineer.**

**Form of Tender for Electrical Works****Department**

1. I/We do hereby tender to execute the whole of the work

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Signature(s)

Dated at

The Date of 200

The above tender is hereby accepted by me for and on behalf of the Governor of Gujarat.

Dated at

The day of 200

**Executive Engineer.**

## GENERAL CONDITIONS

1. The work of the Electrical Installation shall be carried out as per I.S. Specifications I.S. 732-Code Part I, II & III – 1982-82 of practice of Electrical wiring and fitting in building.  
 For Hospital I.S. 7732 of 1985  
 For Educational Installation I.S. 108941 – 1984  
 For Aluminium Conductor I.S. 398 – 1984 Part III
2. The fitting should be fixed with mild steel hooks to be supplied and erected and duly grouted in the cement concrete by the contractor wherever possible the decision of the Ex. Engr. in respect of the feasibility of providing such hooks in the cement concrete, shall be final and binding on the contractors.
3. The work shall have to be completed within the prescribed time limit unless the extension in the time limit at the instance and the request of the contractor is granted by the authorities in which case, the application for the extension in time limit have to be made by the contractors by registered post before the date of expiry of the schedule time limit under the agreement.
4. The amount of Rs. 1-00 for each empty wooden box of ceiling fan and 0-50 paise for each empty wooden box of Table fan issued to the contractors for the work as per Schedule B of the work shall be recovered from the Contractors.
5. Materials required for the work shall be supplied to the contractor as per rates mentioned in the Schedule 'A' attached herewith and the cost of materials will be recovered from their bills.
6. The tender documents required shall have to be filled in either in ink or by ballpen.  
 (G.R.B. & C. Dept. No. TNC-1175 1113-853/198 V, Dtd. 8-6-79).
7. In addition to the above the tender will also be liable to be rejected outright if -
  - (i) Any of the pages of the tender is/are removed or replaced.
  - (ii) In the case of "Item rate" tender, the rates not entered in ink in figures and words and the total of each item and grand total are not struck by the tenderer or in ink in the last column of schedule 'B' under his signature.
  - (iii) All Corrections additions or pasted slips are not initialled by the tenderer.
  - (iv) Any erasure is made by him in the tender AND
  - (v) The tenderer in the case of a firm, each partner or the person holding the power of attorney thereof does not sign or the signature is/are not attested by witness on page 8 of the tender in the space provided for purpose.
8. A certificate of registration as approved contractor should be attached with the tender
9. In respect of tenders from the Co-operative society a solvency certificate of an amount equal to 20% of the amount of the work put to tender plus costs of work in hand will have to be produced along with the tender or a certificate, regarding the borrowing capacity of the society issued by the legal Assistant, Directorate of Cottage Industries will have to be produced along with the tender.
10. The several documents forming the contract are the essential parts of the contract and requirement occurring in one is as binding as though occurring in all, they are intended to be mutually explanatory and complementary and to describe and provide for a complete work.
11. In the event of any discrepancy the several documents forming the contract or in any one document the following order of precedence should apply
  - (a) Dimension and quantities :
    - (i) Drawing
    - (ii) Schedule 'B' of the tender form
    - (iii) Specification
 On drawing figures, dimensions unless obvious in contract will be followed in preference to sealed dimension.
  - (b) Description :
    - (i) Schedule 'B' of the tender form
    - (ii) Drawings
    - (iii) Specifications
 In case of defective description or an ambiguity, the Ex. Engineer in charge should issue further instructions directing in what manner the work is to be carried out is being understood that the last modern practice is to be followed. The contractor should forthwith comply with such instruction.
12. The contractor should take no advantage of any apparent error, omission in drawings or a specifications and the Ex Engineer in charge should be permitted to make fulfil the intent of the plans and specifications.
13. Controlled materials (Essentially certificate)
  - (i) As regards "Controlled materials, the R. & B. Dept. will help to arrange for the permits as far as possible and hold the contractor in securing the same. All incidental charges in procuring these materials shall be borne by the permit as far as possible by the contractor himself. Though the R. & B. Dept. will help to arrange for the permit as far as possible and help the contractor in obtaining the materials, it shall not accept any responsibility for any delay or loss on account of delay caused to the contractor while obtaining the same.
  - (ii) The contractor shall submit the monthly returns in the prescribed forms as to the receipts and actual use of the controlled materials during the month to the Ex. Engr. of Every calendar month.
  - (iii) The contractor shall submit the Ex. Engineer or his representatives to inspect the stock of the controlled

materials by him at any time whenever the Ex. Engineer or his representatives so desire.

14. The tender for the work shall remain open for a period (90/120\*) days from the stipulated date of receiving of the tenders for this work and that the tenderer shall not be allowed to withdraw or modify the offer on his own after handing over the tender to postal authorities for despatch. If any tenderer withdraws or makes any modifications or additions in the terms and conditions of his tender not acceptable to the Government ( Public Works Department ) then the Government shall without prejudice to any right remedy, be at liberty to forfeit in full the said earnest money absolutely.
15. The contractor shall employ only such labourers who shall produce a valid certificate of having been vaccinated against small pox within a period of last three years.
16. The contractor shall provide drinking water facilities to the workers, labourers to comply with the provisions, the engineer in charge shall give notice for such facility to the workers, Labourers within a period of ten days from the date of the notice in writing the Engineer in charge shall there upon make the arrangement for the drinking water at the cost of the contractor.
17. The contractor shall provide the amenity of shade and shelter to the workers, labourers and their children on Govt. work as soon as the work starts. If the contractor fails to provide shade and shelter than the Govt. Shall provide the same at the cost of the contractor.  
Govt Resolution PWD No. TNC-2172 (i) 76-C Dt. 4-7-1973.
18. Challan for earnest money @ 1% of the estimated cost must accompany the tender. Tenderer may pay earnest money upto Rs. 50,000 in cash or in the form of Crossed Demand Draft or in case of tenderer is member of only IEEMA DEPOSIT AT CALL receipts of Nationalised or scheduled Bank drawn in favour of Executive Engineer, Divisional Officer concerned. However in respect of the works estimated to cost above Rs. 50 lacs, the amount of earnest money in excess of Rs. 50,000 can be offered by the contractor, at his choice, in the form of Bank Guarantee of the Scheduled Bank only. The Bank Guarantee in such cases will be furnished in the following form. In such cases also, the amount of first Rs. 50,000 will be paid only in the form of cash or crossed demand drafts or fixed deposit receipts or deposit at call receipts worth the validity period of not less than 6 months of the nationalised or Scheduled Banks.

The Contractors who have secured exemption certificate for payment of earnest money by depositing Lump Sum earnest money Deposit need not pay earnest money, but produce the certified copy of the exemption certificate alongwith the tender.

#### **BANK GUARANTEE**

Where as M/s. \_\_\_\_\_ (hereinafter called the Tenderer) is desirous and preferred to tender for works in accordance with the terms and conditions of tender for the work of \_\_\_\_\_ and where as We, Bank, agree to give the tenderer a guarantee for the Earnest Money.

1. Therefore, we hereby affirm that we are guarantors on behalf of the Tenderer upto total rupees \_\_\_\_\_ in words) Rs. \_\_\_\_\_ ( in figures ) and we undertake to pay to Executive Engineer \_\_\_\_\_ Division \_\_\_\_\_ Department of Government of Gujarat the \_\_\_\_\_ (name of Govt. previous notice of judicial or to be specified). upto his first written demand, without demur, without delay and without the necessity of a previous notice of judicial or administrative procedures and without the necessity to prove to the Bank the defects or shortcomings or debits of the contractor any sum within the limit of Rs. \_\_\_\_\_

2. We further agree that the Guarantee herein contained, shall remain in full force and effect during the period that would be taken for the acceptance of tender.

However, unless a demand of claim under this guarantee is made on us in writing on or before the \_\_\_\_\_ ( Date to be specified - will not be less than 180 days from the date of opening the tender ) we shall be discharged from all liabilities under the guarantee thereafter.

3. We undertake not to revoke the guarantee during its currency except with the previous consent of the Executive Engineer \_\_\_\_\_ Division \_\_\_\_\_ in writing.

4. We lastly undertake not to revoke the guarantee for any change in constitution of the Tenderer or of the Bank.

**Date**

**Signature & Seal of Guarantor** \_\_\_\_\_

**Bank Address** \_\_\_\_\_

19. Wires of I.S.I. mark will be allowed to be used on the work.
20. The rates should be written both in words and figures inclusive of all taxes and duties.
21. The percentage additions in total amount tendered of any items is not allowed however if over all reduction in

\* Strike out whichever is not applicable.



and figures. If no reduction is to be made the gap should be filled in by the word 'NIL'.

Note : As per Govt. Resol. No. CDN/1269/PAC/51-C. dt. 15/4/1978

22. Safeguards :

- (a) That the percentages and the tender amount by each contractor shall actually be shown to the other contractors who may be present at the time of opening the tenders.
  - (b) That a tender with any erasures and/or over writing in percentage (both in word and in figures) shall be rejected outright.
  - (c) That insertions and or correction in the percentage quoted (both in words and in figures) resulting into increase in the value of the work shall be liable to be rejected outright unless it is authenticated by the officer opening the tender at the time of opening tender as well as the contractors they may be present at the time of opening tender and
  - (d) That any other correction or insertions shall be authenticated by the officer opening the tender and the intending bidders who may be present.
23. Wherever secured advance has been granted the contractor should provide necessary sign board indicating the fact of hypothecation of the materials to the Govt. and exhibited the same publically prominently. (Govt. in P.W.D. Resol. No. PWD-2675-IB-905-66-C. dtd. 30-11-77).
24. The contractor should give a written undertaking while applying for the grant of secured advance in case of the agreement indenture bond already prescribed to the effect that he has not taken or caused to be taken nor shall be taken or caused to be taken any advance on the same materials on which secured advance is applied for from any other person/firm, corporation, limited company or any financing institution like Bank etc. by hypothecating or pledging the materials (Govt. in P.W.D. Resolution No. PWD-2675 B/905/66-C, dtd. 30-11-77).
25. Secured advance will be paid after producing equivalent amount of Bank Guarantee of Schedule Bank (R&BD G.R.No. P.W.M.-1090/U-0-13(5)-C, dated 4-10-1997)
26. Any error in quantity or amount in Schedule 'B' showing items of works to be carried out shall be adjusted in accordance with the following rules :
- (a) In the event of a discrepancy between description in words and figures quoted by a tenderer in the rates column, the description in words shall prevail.
  - (b) In the event of an error occurring in the amount column of the Schedule 'B' showing item of works, as a result of wrong multiplication of the unit rate and quantity the unit rate shall be regarded as firm and multiplication shall be amended on the basis of the rate.
  - (c) All errors in totalling in the amount column, and in carrying forward totals shall be corrected.
  - (d) Any rounding off of amounts against items of in totals shall be ignored. The tendered sum so altered shall for the purpose of tender be substituted for the sum original tendered and considered for acceptance.
27. Battens shall be teakwood for acceptable quality and shall be varnished before fixing in position.
28. Wooden-cup board should be polished on both the sides.
29. Whenever Government materials are issued, the contractor shall be responsible for the safe custody and proper use of the materials.
30. Loose electric fitting connections should be done at the time of handing over possession of building to the concerned civil or administrative department and accordingly after taking over possession of these connection concerned Civil/ Administrative department is responsible for fittings.
31. (i) Late tenders (i.e. tender received after the specified time of opening) Delayed tender (i.e. tenders received before the time of opening but after the due date & time of receipt of tenders) and post tender offers shall not be opened and considered at all.
31. (ii) The tenders received (by registered post after the time of date specified in the tender notice) shall not be received by the concerned office from the postman, for which date and time may be recorded on the cover of the tender as to when tender was refused by the Divisional Accountant or the Divisional Head or any other person in charge.
૩૧. ૧ કરોડથી વધુ રકમનાં વર્કસ કોન્ટ્રાક્ટ સંબંધે રકમની ચૂકવણી વખતે ચૂકવવાપાત્ર થતી રકમમાંથી નીચે મુજબ ૧ થી ૩ ની રકમ બાદ કર્યા પછી રહેતી સિલક ઉપર ૨ ટકાની રકમની કપાત કરવામાં આવશે. (૧) આંતર રાજ્ય વાણિજ્ય અને વેપાર દરમ્યાનનાં વેચાણ થયેલ માલની કિંમત (૨) વર્કસ કોન્ટ્રાક્ટની રકમમાં સંડોવાયેલ મજૂરી ની રકમ (૩) આંતર-રાજ્ય વાણિજ્ય અને વેપાર દરમ્યાનની ખરીદી અથવા રાજ્ય બહારથી આયાત કરેલ માલની ખરીદીની કિંમત. પરંતુ (૬) મુજબ રાજ્ય સરકારે રાખેલ વર્કસ કોન્ટ્રાક્ટ પરત્વે રાજ્ય સરકારે ચૂકવવાની થતી રકમના પ્રસંગે તા. ૧-૪-૨૦૦૨ પછી ચૂકવણી કરવાની થતી રકમ પરત્વે કલમ ૫૭-બની ટી.ડી.એસ.ની જોગવાઈ લાગુ પડશે નહીં.
- ઉપરોક્ત બાદ કરવાની રકમ નક્કી કરવાનાં હેતુથી સેલ્સ ટેક્સના નમુના પૃષ્ઠનાં નિયત કરેલ કોર્મમાં લેખિત નિવેદન કોન્ટ્રાક્ટરે રજૂ કરવાનું રહેશે. (વેચાણવેરા કમિશ્નરશ્રી ગુજરાત રાજ્યનો તારીખ ૨૨-૪-૦૨ તથા ૨૦-૮-૦૨નો જાહેર પરિપત્ર ક્રમાંક ગુજકા/૧૦-ક/૫૪૮/ક-૫૭-બ/વેલીડેશન એક્ટ/૨૦૦૨-૦૩ જા.૧૧૭૭/૭૦૨)

Signature of contractor/s

Executive Engineer.

Division

# GENERAL CONDITION OF CONTRACT FOR ELECTRICAL WORKS IN THE BUILDING AND COMMUNICATION DEPARTMENT

## GENERAL CONDITIONS OF CONTRACT

### 1. Definition of terms :

In construing these general conditions and the annexed specification the following words shall have the meaning here assigned to them unless there is something in the subject or context inconsistent with such constructions :

The "GOVERNOR OF GUJARAT" shall include his successors and assigns.

The "Engineer" shall mean the Ex. Engineer, Electrical Division, for the time being attached to the Public Works Department of the Gujarat State or such other officer as may be appointed by the Ex. Engineer, Electrical Division to supervise the work on behalf of the Governor of Gujarat.

The "CONTRACTOR" shall mean the Tenderer whose tender, shall be accepted by the Governor of Gujarat, and shall include the tenderer's legal personal representatives or successors and assigns.

"PLANT" shall mean and include any machine, fixed or movable, used for the generation or transmission of power or actuated by power.

"WORK" or "WORKS" shall mean the whole of the plant and material to be provided and work to be done, executed or carried out by the contractor under the contract.

The "CONTRACT" shall mean all the documents by which the agreement by the contractor to be provided to execute or carry out the plant work or works shall be constituted or in or by which the terms of such agreement or any of them are contained or set forth specially as per these General conditions, any special conditions attached to or issued, with these conditions, the specification, the Drawing, the invitation for Tenders (if any) or any other letter, notice or document upon or with reference to which the Tender is made and the schedule of prices (if any) furnished by the contractor with his Tender.

The "SPECIFICATION" shall mean the specification annexed to these General conditions and the Schedule thereto (if any).

The "SITE" shall mean the whole of the premises, buildings and grounds in or upon which the Plant work or works is or are to be provided, executed, erected, done or carried out.

The "DRAWINGS" shall mean the drawings issued with the specification which will ordinarily be identified by being signed by the Engineer and any further drawings submitted by the contractor with his tender and duly signed by him and accepted or approved by the Engineer and all other drawings supplied or furnished by the contractor or by the Engineer in accordance with these General conditions.

The 'SPECIAL CONDITIONS' shall mean the special conditions of contractor (if any) attached to general condition.

The "SCHEDULE" shall mean the schedule or schedules attached to the specification.

### 2. Contractor to inform himself fully :

The contractor shall be deemed to have carefully examined the invitation for Tender (if any) the general and any special conditions, the specification and Drawings and the Schedule of price (if any). In case of discordance or want of agreement between or amongst the several things herein described as the grounds or data of the contract, then these conditions shall have precedence of and be held to be more correct and binding and in like manner detailed drawings shall be held to be more correct, and binding than general drawings and in like manner drawing made to a large scale, or for special instruction, shall be held to be more correct and binding than drawing made to a smaller scale, or for general instruction and figured dimensions shall be held to be more correct than dimensions by scale but subject nevertheless in case of doubt or dispute as to any of the matters aforesaid to the determination and decision of Engineer as hereafter is more particularly mentioned and provided always that nothing herein contained shall limit the powers of the Engineer hereinafter mentioned.

### 3. Security Deposit :

The person/persons whose tender is accepted (hereinafter called the "Contractor" which expression shall, unless excluded by, or repugnant to the context include his Legal heirs, executors, administrators and assigns) shall (a) Deposit with the Executive Engineer a sum sufficient to make up the full security deposit specified in the tender in cash or Government securities (as mentioned in para 208 of Gujarat Public Works Department Manual Vol. 1) duly transferred in the name of the Executive Engineer or fixed deposit receipts or Term Deposits of Narmada Project in the name of the Executive Engineer within a period of 10 days from the date of receipt of the Notification of acceptance of his tender, or (b) (i) deposit fifty percentage of the total security deposits as specified in the tender form with the Executive Engineer in form of small saving schemes or securities of Sardar Sarovar Narmada Nigam or F.D. Rs. of scheduled bank. However, the Contractor can deposit twenty five percentage of total security deposit in the form of Govt. security (as mentioned in para 208 of Gujarat Public Works Department Manual Vol. 1) or Term Deposits of Narmada Project duly transferred in the name of the

Executive Engineer, or fixed deposit receipts in the name of the Executive Engineer within a period of ten days from the date of receipt of notification of acceptance of his tender. If the security deposit is not paid within the above specified time, no work order will be issued till the issue about delay is finally decided by the competent authority. (b) (ii) The Government shall be deemed to have been authorised to deduct the balance of fifty percentage of the security deposit as specified in the tender form from the amounts that become payable to the contractor for the work done under the contract from time to time, such deduction shall not exceed ten percentage of the amount so payable and the whole amount paid in cash or by way of deduction shall be held by Government by way of security deposit. For the works whose estimated amount is more than rupees fifteen lacs, the Contractor shall have to give the performance bond supported by F. D. R. or Unconditional. So that same can be encashed without giving any reason by the Executive Engineer Non Transferable and Irrecoverable Bank Guarantee of any schedule bank equivalent to five percentage of the estimated amount put to tender alongwith the initial security deposits. All compensation, Liquidated damages or other sums or money payable by the contractor to Government under the terms of this contract shall be deducted from or recouped by the realisation of a sufficient part of his security deposit, or from the interest arising therefrom or performance bond or from any sums which may due or may become due by Government to the Contractor on any account whatsoever and whether in respect of this contract, any other contract, or otherwise. In the event of his security deposit being reduced by reason of any such deduction or recoupment as aforesaid, the contractor shall within ten days thereafter, make good in cash or in Government securities transferred as aforesaid any sum or sums required to make good the shortfall in the amount of the security deposit. The security deposit, when paid as above shall at the cost of the depositor, be converted into interest bearing Government securities in the name of Executive Engineer provided that the depositor has expressly desired this in writing. This is subject to the condition that twenty five percentage of the total security deposit must be held in the form of small saving Schemes or Term Deposits of Narmada Project. If the full amount of the security deposit to be paid as above within the period specified above, is not paid the tender/contract already accepted shall be considered as cancelled and legal steps shall be taken against the contractor for recovery of the amounts.

Fifty percentage of the Security Deposit alongwith performance bond shall become refundable within fifteen days after the final completion certificate is issued as per Clause-25. All dues under this contract or other contract, or otherwise, including the royalty charge if "No Due-Certificate" is not produced by the contractor shall be recovered from the aforesaid amount of fifty percentage of the said security deposit and the balance shall be refunded within fifteen days after the final certificate is issued as per clause-25. The remaining fifty percentage of the security deposit shall be refunded after the expiry of the Defect Liability period as per clause-33 after deducting therefrom the amount of expenses, if any, due to Government under this contract.

#### Annexure

#### PERFORMANCE BOND

( The date of this bond must not be prior to the date of the instrument in connection with which it is given).

.....  
Principal (Contractor)

.....  
Surety (Bank)

.....  
Sum of bond (express in words and figures)

.....  
Contract No. and date of contract

.....  
**KNOW ALL MEN BY THESE PRESENTS, THAT WE, THE PRINCIPALS AND SURETY** above named are held and firmly bound unto the ..... hereinafter called the Employer in the amount stated for payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by these presents subject to the provisions of which the aforesaid Contractor on demand and without demand on a claim being made by the Employer.

**THE CONDITION OF THIS OBLIGATION IS SUCH**, that whereas the principals have entered in to a contract with the Employer numbered and dates as shown above and hereto attached for the execution of work .....

.....  
**NOW THEREFORE**, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original terms of the said Contract and any extensions thereof that may be granted by the Employer with or without notice to the surety and during the life or any guarantee required under the contract and shall also well and truly perform and fulfill all the Undertakings, covenants, terms, conditions and agreements of any all duty and unduly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the surety being hereby waived or shall pay over, make good and reimburse to the Employer all loss and damages which the employer may sustain by reason of failure or default on the part of said Principal so to do.

We ..... further agree that the guarantee herein Contained shall remain in full force and effect during the period that would be taken for the validity of the said Contract, and that it shall continue to be enforceable till all the dues of the employer under or by virtue of the Contract have been fully paid and its claims satisfied or discharged or till the Employer certifies that the terms and conditions of the Contract have been fully and properly carried out by the said Contractor and accordingly discharges the guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the ..... we shall be discharged from all liability under this guarantee thereafter.

**IN WITNESS WHERE OF**, the above bounded parties have executed this instrument under their several seals on the date indicated above the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

In the presence of witness

individual

Principal

1. .... as to ..... (seal)
2. .... as to ..... (seal)
3. .... as to ..... (seal)
4. .... as to ..... (seal)

Attested by ..... affix Corporate Seal  
Corporate surety  
Business address

Affix by ..... corporate Seal

Title

For and on behalf of the Employer

#### 4. Mistake in contractor's Drawings :

The contractor shall submit such drawings as may be required and shall be responsible for any discrepancies, errors or omissions in any drawings or other particulars supplied by him notwithstanding that such drawings or particulars may have been approved by Engineer.

#### 5. Patent Rights etc.

The contractor shall fully indemnify the Governor of Gujarat against all actions suits claims demands, costs, charges and expenses arising from or incurred by reason of any infringement or alleged infringement, of any, letters patent, design, trademark or name copyright or other protected rights in respect of any machine, plant, work materials thing or system or method of using, fixing, working or arrangement used or fixed or supplied by the contractor but this indemnity shall not extend or apply to any action, suit, claim, demand, cost charges or expenses arising from or incurred by reason of the use of the work or any part thereof otherwise than in the manner of for a purpose contemplated by the contract. All royalties and other similar payments which may have to be paid for the use of any machine, plant, work, material, thing, system or method as aforesaid (whether payable in one sum or by installments or otherwise) shall be covered by the contract price and payable by the contractor.

In the event of any claim or demand being made or action or suit brought against the Governor of Gujarat in respect of any such matter or matters as all negotiations for the settlement of such claim or demand and such action aforesaid the contractor shall be duly notified, thereof, and he shall conduct or suit also be conducted by him subject if and so far as the Governor of Gujarat shall think proper under the Supervision & Control of Governor of Gujarat through the officer duly authorised on his behalf.

#### 6. Excess over Tender quantities, Extra items & Variations in Specifications, Drawings etc. :

6.1 The Engineer-in-charge shall have power to make any alterations additions in or to the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Engineer-in-charge and such alternation shall not invalidate the contract and additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the manner above specified as part of the work shall be carried out by the contractor in the same conditions in all respects on which he agreed to do the work and at the same rate as are specified in the tender for the main work.

6.2 Except that when the quantity of any item exceeds the quantity as in the tender by more than 30% the contractor will be paid for the quantity in excess of 30% at the rate entered in the S.O.R. of the year during which the excess in quantity is first executed and for the materials consumed in excess quantity the rate for the materials to be charged would be the basic rate taken into account for fixing the rate for the S.O.R. above instead of the rate stipulated in schedule-A.

6.3 If the additional or altered work includes any class of work for which no rate is specified in this contract, then

such class of work shall be carried out.

(i) At the rate derived from the item within the contract which is comparable to the one involving additional or altered class of work; where there are more than one comparable items, the item of the contract which is nearest in comparison with regard to class or classes of the work involved shall be selected and the decision of the Superintending Engineer as to the nearest comparable item shall be final and binding on the contractor.

(ii) If the rate cannot be derived in accordance with (i) above, such class of works shall be carried out at the rate entered in the Schedule of Rates of the Division for the year in which, the tender was received, increased or decreased by the percentage by which the tender received, increased or decreased by the percentage by which the tender amount is more or less as compared or decreased by the percentage by which the tender amount is more or less as compared to the amount arrived at the rates in the "Schedule of Rates" of the Division in the year in which the tender was received. If the Schedule of rates calculated considering such items which were included in the "Schedule of Rates" of the Division for the year and for materials consumed on such item the rate to be charged would be the basic rate taken into account for fixing the rate in S.O.R. referred to above, instead of the rate.

(iii) If it is not possible to arrive at the rate from (1) and (ii) above, such class of work shall be carried out at the rate decided by: the competent authorities on the basis of detailed rate analysis after hearing the contractor before a committee of two superintending Engineers stationed at the same place or the nearest place.

**6.4** If the additional or altered work, for which no rate is entered in the "Schedule of Rates" of the Division is ordered to be carried out before the rate is agreed upon, then the contractor shall within seven days of the date of receipt by him of the order to carry out the work, inform the Engineer-in-charge of the rate, which it is his intention to charge for such class of work and if the Engineer-in-charge does not agree to this rates, he shall by notice in writing be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider it advisable, provided always that if the contractor shall commence work or incur any expenditure in regard thereof before the rates shall have been determined as lastly herein before mentioned, then in such cases he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of the dispute, the decision of the Superintending Engineer of the Circle shall be final.

Where, however, the work is to be executed according to the designs, drawings and specifications recommended by the contractor and accepted by the competent authority, the alternation above referred to shall be within the scope of such designs, drawings and specifications appended to the tenders.

The time limit for the completion of the work shall be extended in the proportion that the increase in the cost occasioned by alternations bears to the cost of the original contract work and the certificate of the Engineer-in-charge as to such proportion shall final and conclusive.

#### **7. Workmanship and Materials :**

The work shall be carried out in all respects with workmanship and materials of the best and most substantial and approved qualities to the entire satisfaction of the Engineer who may reject any plant, apparatus of material or workmanship which shall in his opinion be of defective quality any such rejection to be final and conclusive. The contractor shall at his own expenses provide all material labour, haulage, power, tools, tackles and apparatus necessary to execute and complete the works and plant in the manner aforesaid.

#### **8. Use of work pending completion :**

The Governor of Gujarat shall be at liberty at any time to put into beneficial use the whole or any part of the work he may desire to use pending the formal completion and taking over of the same.

#### **9. Subletting of contract :**

The contractor shall not without the consent in writing of the Governor of Gujarat under the hand of the Engineer assign or sublet the contract nor make any sub contract with any person or persons for the execution of any portion of the work other than for raw materials, or for any part of the work of which the manufacturers are named on his contract.

#### **10. Protection and liability for accidents, Theft and Damage .**

The Contractor shall at all times until the commencement of the period maintenance as provided in clause 16 property and sufficiently cover up and protect all materials delivered on site from damage or injury by exposure to the weather and shall take every proper precaution against accident, damage or injury on the same from any cause. The contractor shall be and remain answerable and liable for all accident and damage thereto which until the commencement of the period of maintenance as provided for under clause 16 may arise or be occasioned by the acts or omissions of the contractor or his workmen, agents, servants or sub-contractors and all losses and damages arising from such accidents, damage or injuries as aforesaid shall be made good in the most complete and substantial manner by and at sole cost of the contractor and to the satisfaction of the Engineer.

Provided that should the Engineer certify, that the work has been completed but that owing to circumstances over which the contractor has no control the work cannot be taken over the contractor shall not be held liable for any loss of or damage to the work occasioned by such delay in taking over and occurring more than one month after date of completion of the work as certified by the Engineer.

Until the work shall be or deemed to be taken over as hereafter provided the Contractor shall also indemnify to Governor of Gujarat from and against all claims and demands, suits, proceedings, cost and expenses in respect in respect of or in connection with any injury to person or damage to property by whomsoever sustained or by defective design work or materials made, done, furnished or supplied by the contractor. The Contractor shall also be responsible for thefts of any property of the Governor of Gujarat or of others committed by any employees of his own or his subcontractors and shall be liable for the costs of replacing any property stolen.

#### **11. Insurance :**

Subject as hereinafter provided the contractor shall at his own expense insure and at all times prior to the commencement of the period of maintenance keep insured against destruction or damage by fire or earthquake storm and tempest such plant and materials ordered for the work as may for the time being be upon the site for the full value of such plant and materials.

#### **12. Materials brought on the site :**

All materials, tools and tackle brought to and delivered upon the site for the purpose of the work shall from the time of their being so brought vest in and be the property of the Governor of Gujarat but may be used for the purpose of the work but for that purpose only and not on any account be removed or taken away by the contractor or any other person without the express permission in writing of the Engineer, but the Contractor shall nevertheless (Subject as hereinafter provided) be solely liable and responsible for any loss or destruction thereof or damage unless resulting from causes beyond the Contractor's control not being causes insurance against destruction or damage from which is provided for in clause 11. The Governor of Gujarat shall have a lien on such materials, tools and tackle for any sum which may to any time prior to the completion of the works be due or owing to him by the Contractor under in respect of or by reason of the Contract and shall be at liberty to sell and dispose of any of such materials, tools and tackle remaining after the completion of the works in such manner as he shall think fit, and to apply the proceeds in or towards the satisfaction of such sum or sums so due or owing as aforesaid but subject to such lien and power of sale and disposal such surplus materials, tools and tackle shall belong to the contractor and may be removed and disposed of by him as he shall think fit after the lien is withdrawn by the Engineer in charge.

#### **13. Default :**

If the Contractor shall at any time fail in the opinion of the Engineer to proceed with the work with due diligence and expedition, or shall refuse, neglect or omit to comply with any orders given to him in writing by the Engineer in accordance with the provisions of these conditions or shall commit any other breach of the provision of the contract, the Engineer shall be at liberty to give notice in writing to the Contractor to make good the failure neglect, omission or breach complained of and should the Contractor shall fail to comply with any such notice within such period as may be prescribed in such notice then and in such case the Governor of Gujarat shall be at liberty to employ workmen other than those of the contractor to perform and execute the work in respect of which the failure neglect or omission referred to in such notice shall have been committed or occurred. If the Governor of Gujarat shall think fit, it shall be lawful for him to enter into a new contract with any other persons, or person, for the execution of such part of the work as may not have been executed and in that event the Governor of Gujarat shall without incurring any liability to the Contractor be entitled to use all or any of the materials, tools, tackle or other things which may then be on site for the purpose of completing the work or any part thereof and to provide any additional materials, tools, or tackle required for the purpose and the cost of executing any such work and providing any such materials shall be paid by the contractor to the Governor of Gujarat on demand.

Subject to and after satisfaction of the lien of the Governor of Gujarat for any sum due to him by the Contractor for any expenses, cost or charges incurred in the completion of the work, all materials, tools, tackle or other thing remaining on the site and unsold after such completion shall forthwith hereafter be removed by the contractor.

#### **14. Replacement of Defective work or material :**

If during the progress of the work the Engineer shall notify in writing to the contractor that in his opinion the Contractor has executed any unsound or imperfect work, or has supplied any materials inferior in quality to those stipulated for by the Contractor, the contractor shall at his own expense, within ten days of his receiving the notice, proceed with due expedition to remove or alter and reconstruct or replace the work, or as the case may be supplied fresh materials up to the standard of the specification. In place of the work or materials complained of by the notice (as the case may be) and in case the contractor shall fail to do so the Governor of Gujarat may after expiration of ten days from giving of such notice give a further notice in writing stating that the Governor of Gujarat intention so to do forthwith at the cost of the Contractor remove the work or materials complained of and perform all such work or (as the case may be) supply all such materials in place of those complained of as may be necessary or proper in order to comply with the Contractor and the cost as certified by the Engineer of any such removed and performance of work or supply of materials shall be paid by the contractor to the Governor of Gujarat on demand, provided always that nothing

in this clause shall be deemed to deprive the Governor of Gujarat or effect any other rights or remedies under the Contract or otherwise which he may have in respect of such defects or deficiencies. No payment which have been made on account of materials delivered or work executed shall be looked on as acceptance of such or any work or materials.

#### **15. Cutting away & making good :**

The tender is to include all necessary cutting and making good for the purpose of the contract of the wood work, walls, floors etc. of the site. The contractor will be held responsible for, and will have to make good at his own expense, to the satisfaction of the Engineer, any damages to or disfigurement of the site which may have been caused by the acts or omissions of himself or his servants or agents in connection with the carrying out of the contract.

#### **16. Maintenance :**

The Contractor shall make good at his own expense all defects due to faulty design material, or workmanship on the part of the contractor which may during a period of 6 calendar months from the date on which the work is certified by the Engineer to have been brought into beneficial use or if no such certificate is given from the date of the final payment for the work under clause 20 (which period is hereinafter called the "the period of maintenance" ) develop under proper use in the work or any part thereof by replacing plant materials or work or otherwise as may be necessary. Any such making good by the contractor shall in no case relieve him from his liability to make good any further defect in the work made good of replace which may develop during the remainder of such period of twelve months. If any such defects are clearly caused by the fault of the Contractor and are liable to recurrence the contractor shall make such alterations as are required to prevent any recurrence of such defects. If any defects or alterations which Contractor shall become liable to make good or make under this clause be not made good or made (as the case may be) within such time as the Engineer may prescribe for the purpose, the Engineer may proceed to make good or make the same (as the case may be) at the risk and expense of the Contractor, but without prejudice to any other right or remedies which the Governor of Gujarat may have against the Contractor in respect of his default in making good or making the same as aforesaid and the cost of any such making good or making shall be paid by the Contractor to the Government of Gujarat on demand.

#### **17. Contractor's Representative & workmen :**

The contractor Shall employ at least one competent representative, whose name or names shall have previously been communicated in writing to the Engineer by the Contractor to Superintend the carrying out the works. The said representative, of if more then one shall be employed then, one of such representative, shall always be present on the site during working hours and any written orders or instruction which the Engineer or his duly authorized representative, whose name shall have been previously communicated in writing to the contractor, may give to the said representative of contractor, shall be deemed to have been given to the contractor.

The Engineer shall be at liberty to object to any representative or person employed by the Contractor in the execution of or otherwise about the work who in the Engineers opinion shall misconduct himself or be incompetent or negligent and the contractor shall remove every person so objected to forthwith upon receipt from the Engineer of notice in writing requiring him to do so.

#### **17.A Minimum age of persons employed and employment of donkeys or other animals :**

- (i) The Contractor shall not employ any person who is under the age 12 years.
- (ii) The contractor shall not employ donkeys or other animals with breaching of string or thin rope. The breaching must be attest three inches side and should be tape (Nawar).
- (iii) No animal suffering from sores, lameness or emaciation or which is immature shall be employed on the work.
- (iv) If contractor does not accept the proceeding conditions No. (i), (ii), & (iii) his tender shall not be accepted and his name shall be removed from the list of contractors.
- (v) The Engineer shall remove from the work any person or animal found working which does not satisfy these conditions and to responsibility shall be accepted by the Governor of Gujarat for any delay caused in the completion of the work by such removal.

#### **18. Submission of Samples :**

The contractor shall not without written sanction of the Engineer use for the execution of the work any materials plant or stores of any type of description other than those specified in his tender. He shall, if required to do so, or at his options, deposit samples, at the office of the Engineer for approval and the Engineer shall within 14 days of the receipt of the samples, express in writing to the contractor his approval or otherwise of the samples deposited, and all materials, plant and stores used in the execution of the works must be in every way equal to the deposited samples. All the deposited samples will be returned to the contractor within one month of the work being taken over :

## **19. Deduction from contract Price :**

The amount or all costs of works, expenses or other sums which under the contract shall be payable by the contractor to the Governor of Gujarat from any moneys due or becoming due by him to the Contractor under contract, without prejudice to the Governor of Gujarat, right to recover the same by the ordinary process of law.

## **20. Terms of Payment :**

Subject to any deduction which the Governor of Gujarat may be authorised to make under the contract, the Contractor shall be entitled upon the certificate of the Engineer to the effect hereinafter stated **payments of R.A.Bills shall be made to the contractor as per items, in measurable units executed according to the specifications.**

If at any time the contractor shall be prevented for any period of not less than 30 days from causes within the control of the Governor of Gujarat either first, from delivering on the site any plant or material ready in India for delivery or secondly from proceeding with the erection at any plant or materials which he had already delivered on the site, the Governor of Gujarat shall bear the cost of storage and protection, including insurance in accordance with clause II, of the plant and material during such period in the first of such of contractor shall be entitled to payment of 80% percent of the value certified as aforesaid of the plant or materials delivery of which shall have been so prevented within one month from the date on which as certified by the Engineer such plant or material are so ready as aforesaid provided that all portions thereof have been suitably and sufficiently marked as being property of the Governor of Gujarat and are delivered into the custody of some person approved by the Engineer who has granted a receipt thereof.

Installments shall be due and payable by the Governor of Gujarat within one month from the date of each certificate of the Engineer.

## **21. Certificates of Engineer :**

Every applications to the Engineer for a certificate must be accompanied by a detailed claim in duplicate) setting forth (in the order of the Schedule for price if any) particulars of the Plant or materials delivered and work executed to the date of the claim, and the certificate as to such of the plant and work mentioned in the claim as is in the opinion the Engineer in accordance with the contract shall be issued within 14 days of the application. No application for a certificate shall be made within 14 days previous applications.

## **22. Certificate not to affect rights of the Governor of Gujarat of contractor :**

The Engineer may by any certificate make any correction or modification in any certificate previously issued, by him, any payment shall be regulated and adjusted accordingly. No certificate of the Engineer shall nor shall any payments on account by the Governor of Gujarat to the Contractor, nor extension of time for the execution of the works by the contractor which may be granted by or behalf of the Governor of Gujarat affect or prejudice any of the rights of the Governor of Gujarat against the contractor under or relieve him any of his obligations for or in respect of the due performance of the contract, or be interpreted as approval of work done or of material supplied.

## **23. Suspension of Work :**

The Governor of Gujarat shall any to the contractor all proper expenses arising from suspensions of the works by order in writing of the Engineer or any other officer on behalf of the Governor of Gujarat unless such suspension is due of some default on the part of the Contractor or any sub-contractor under him.

## **24. Damages for delay in completion :**

(i) If the Contractor fails to complete the work under contract by the stipulated date, he shall pay liquidated damages of Rs. 0.1 percentage of the contract value per day from the date of delaying the said work upto the date of completion and handing over to the Government.

(ii) However also if the contractor fails to complete any part of the work Proportionate to by the time in relation to the value of such part, he shall pay Liquidated damages per day from the date of delaying the said part of the work up to the date of completion of the said designated part at the rates shown in the said schedule of the contract Value of such part for such failure till the said designated part is completed.

(iii) The aggregate maximum of liquidated damages payable under this clause shall not exceed Rs. 0.1 percentage of contract value per day and shall be subject to the maximum amount of ten percent of the estimated amount put to tender.

(iv) Delays requiring payment of ten percent liquidated damages of the amount put to tender for performance shall be sufficient cause for termination of contract and for forfeiture of security deposit. (including amount of performance bond in respect of works estimated to cost more than Rs. 15 lacs, for performance) and registration of the contractor shall also be kept in abeyance for three years from the date as fixed in all such cases.

**24-A** If the Contractor shall desire an extension of the time for completion of work on the ground of his having been unavoidably hindered in it execution or on any other ground he shall apply in writing to the Ex. Engr. before the



expiration of the period stipulated in the tender or before expiration of 30 days from the date on which he was hindered as aforesaid on with the cause for making for extension occurred whichever is earlier and the Ex. Engr. may if in his opinion. There are reasonable and bonafide grounds for granting, and extension grant such extension as he thinks necessary or proper. The decision of the Ex. Engr. in this matter shall be final.

No applications for extension of time for completion of work shall be considered unless it is received by registered post in the office of the Executive Engr. or left at his office and obtained receipt there of duly signed by the Ex. Engr. or his nominee authorised in this respect.

The date of receipt of application by the Ex. Engr. shall be considered as the date of application for the purpose of counting the period as mentioned above.

**24-B.** "If the contractor or his workmen, or servants shall break, deface, injure or destroy and part of the building, or the work in question in/or which they may be working or any building, road fence, enclosure or glass-land or cultivated ground contingence to the premises on which the work or any part thereof is being executed or if any damage shall be done to the work from any cause whatever before completion of the work or before the completion of the maintenance period whichever is later or any damages occurred/caused due to normal flood or rain or if any imperfection become apparent in it within three-months from the grant of a certificate of completion, final or otherwise by the Engineer-in-charge, the contractor shall make good the same at his own expenses or in default, the Engineer-in-charge may cause the same to be good by other contractor, and deduct expenses (of which the certificate of the Engineer-in-charge shall be final) from any sums that may then be due or may thereafter become due to the contractor or from his security deposit or the proceeds of sale thereof a sufficient portion thereof".

**24-C Force Major Clause :**

Neither party shall be liable to the other for any loss or damage occasioned by or arising out of acts of God, such as Unprecedented flood, Volcanic eruption, earthquake or other convulsion of nature and other acts such as but not restricted to general strike, invasion, the acts of foreign countries, hostilities, or war like operations before or after declaration of war, rebellion, military or Usurped power which prevent performance of the contract and which could not have been foreseen or avoided by a prudent person.

**Note :** "Unprecedented flood" means the flood crossing the High Flood Level of the past \_\_\_\_\_ year(s) which is on the available record.

(Modified Vide R & B D. G. R. No. TNC - 1096 - IB - 143 - (16) - C dated 11-1-99)

**25. Time of taking over :**

The work shall for the purpose of all the provisions of these conditions be deemed to have been completed and taken over by the Governor of Gujarat when the Engineer, shall have certified in writing that it has been completed in accordance with the Contract conditions and such Certificate shall not be unreasonable withheld nor shall the Engineer delay its issue on account of commissions or defects which in his opinion do not effect the efficient use of the work, but such issue shall be without prejudice to the Contractor's liability to make good any such omissions and defects with the greatest possible expedition.

**26. Death & Bankruptcy :**

If the Contractor shall die, or become insolvent or bankrupt or have a receiving order made against him or compound with or make no proposal carrying on his business under inspection or for the benefit of his creditors, or commit an act of insolvency or bankruptcy, or being a corporation be ordered to be wound up or have a received of its business appointed the Governor of Gujarat shall be entitled forthwith by notice in writing to the Contractor his legal representatives to determine the contract and the Governor of Gujarat may in that event complete the contract in such time and manner and by such person as he shall think fit.

**27. Disputes to be referred to Gujarat Public Works Disputes Arbitration Tribunal :**

The disputes relating to this Contract in so far as they fall within the jurisdiction of Gujarat Public Works Disputes arbitration tribunal shall be referred to the said Tribunal of Gujarat State.

However the reference to Arbitration Tribunal under this clause will not stay fulfillment of obligations of the contractor or rights of the Engineer-in-charge under this contract, unless otherwise ordered to the contrary by the said Tribunal as Interim Relief measure.

**(The following clause is to be deemed included in this conditions only when Plant or Machinery is included in the Contract).**

**28. Contract Drawings :**

The contractor shall submit to the Engineer for his approval on or before the dates stipulated for this purpose in the specification copies of all the drawings of the general arrangements of the plant as set out therein and of such detail

drawings as may be reasonably necessary.

Within Fourteen days from the receipt, by him of such copies the Engineer shall signify his approval or otherwise of the same and if he does not do so he shall be deemed to have approved thereof.

Within Fourteen days from the notification by the Engineer to the Contractor of his approval such copies, or in the absence of such notification within thirty days from the receipt of such copies, the copies in ink on tracing cloth or ferrographic prints mounted on cloth, of all drawings as approved shall be supplied to the engineer by the contractor respectively and shall thereupon be signed by the contractor and become the property of the Governor of Gujarat.

Such signed copies of the drawing shall not be departed from in any way whatsoever except with the written permission of the Engineer. During the execution of the works of the signed copies shall be always kept available for reference on the site.

In the event of the Contractor desiring to keep in his own possession a signed copy of the drawings as approved he shall supply three copies instead of two and in this case the Engineer shall sign the third copy and return the same to the Contractor.

### **29. Manner of Execution, Quality of materials etc. :**

The plant shall be manufactured, constructed, provided, put in position and maintained in the best and most substantial and workmen like manner and materials of the best and approved qualities having regard to their respective uses.

### **30. Tests on site :**

In all cases where the special conditions are provided for tests on the site whether of plant, materials or workmanship the Governor of Gujarat except where otherwise specifically stipulated shall provide free of charge such labour, materials fuel stores, apparatus and instruments as may be requisitioned from time to time efficiently to carry out such tests in accordance with the condition.

Where electrical energy is required for tests on site and a supply is available on the site from an existing installation such electrical energy shall be supplied to the contractor by the Govt. free of charge at the pressure and frequency of the ordinary supply is available the electrical energy necessary for such tests shall be provided by the contractor.

### **31. Delivery of plants & materials :**

No Plant materials shall be tendered for delivery until an intimation in writing shall have been given to the contractor by the Engineer that Governor of Gujarat is ready to take delivery.

### **32. Tests on completion :**

On the completion of the works on the site in accordance with the contract the contractor shall give the Engineer notice in writing of such completion. The Engineer shall after receipt of such notice by notice in writing under his hand for date and an hour on that date for the making of the test on site if any such are provided for the contract.

The contractor shall carry out such tests upon the date and at the hour so fixed and if the Engineer or his authorised representative shall attend on that date at that hours such test shall be carried out in the presence of the Engineer or such representative.

If any portion of the plant fails under the tests to satisfy the contract conditions similar tests according to the contract of the portion so failing shall if required by the Engineer or by the Contractor be repeated within a time to be fixed by the Engineer and the provisions of this clause shall apply to such repeat test as if they were the original tests and the contractor shall pay to the Governor of Gujarat all reasonable expenses to which he may be put by such tests.

If the tests or any repeated tests so required as aforesaid be not made by the Contractor on the date fixed as aforesaid for the same by the Engineer may proceed to make such test himself at the contractor's risk and expense.

If in any test under this clause the plant tested shall fail to satisfy the contract conditions the Governor of Gujarat shall as from the date stipulated by the contract for completion nevertheless have the right of using such plant until the same shall satisfy such conditions and such use shall be at the contractor's risk. In the event of the question whether the works have been completed in accordance with the contract or any question regarding such completion being submitted to Arbitration as any portion of the plant the Engineer may certify to be capable of being used on condition of paying to the contractor a sum calculated (according to the period or the use) at the rate of 5 percent per annum upon the amount withheld or deducted in respect of such plant.

### **33. Rejection of Defective work :**

If the works, or any portion thereof shall not in the opinion of the Engineer on the stipulated tests (if any) being made in accordance with the contract satisfy the contract condition within three months after the date stipulated for completion the engineer may give notice in writing to the contractor setting for the particular of the defects of particulars in respect of which the works in his opinion fail to comply with the contract conditions and requiring the contractor to make good, after or replace the same within such time to be specified in the notice as the engineer may consider reasonable and the contractor shall make good, after or replace the same as required by such notice and so as to make it comply with the requirements

of the contract condition within the time so specified. Should he fail to do so within that time the Governor of Gujarat may make good after or replace the same as so required and the cost of such making alteration good or replacement (less in the case of any replacement any sum which would have become due to the contractor under the contract in respect of the works replaced and which shall not have been paid to him) shall be paid by the contractor to the Governor of Gujarat on demand or should the Governor of Gujarat not make good, after or replace any defective works in respect of which such notice as aforesaid shall be given within six weeks from the date of the giving of such notice the contractor shall repay to the Governor of Gujarat all sums (if any) paid by him to the Contractor in respect of such works. Nothing contained in this clause shall prejudice or affect the rights of the Governor of Gujarat under the contract whether in the way of enforcement of penalties or otherwise in respect of any delay in the completion of this work.

**34. Use of plant of works pending making good :**

If at expiration of the time specified for making good, altering or replacing the plant of works in any notice given by the engineer to the contractor under the last preceding clause the contractor shall not have duly made good, altered or replaced the same in accordance with the contract the Governor of Gujarat shall be at liberty if he thinks fit to make use of the same for such time as shall be reasonably sufficient according to the circumstances to enable him, to make good after or replace the same (whichever he may see fit to do) provided that in respect of the period of such user, the Govt. of Gujarat shall not be entitled to any damages under clause 24 of these conditions and in the case of complete replacement the contractor shall be entitled to be paid in reasonable sum for the same.

**35. Workman's compensation in case of injury :**

The contractor shall be responsible for any compensation and shall pay to his workmen Compensation payable for injuries under, the workmen's Compensation Act, 1923 (VIII of 1923) hereinafter called the said Act. If such compensation is paid by Govt. as principal under sub-section (1) of section 12 of the said Act, on behalf of the Contractor, it shall be recoverable by Government from the contractor under sub section (2) of the said section such compensation shall be recovered in the manner laid down in clause 3 and 19 of the condition of contract.

**36. The Apprentices :**

The contractors shall afford or procure as the case may be every facility to Indian apprentices for practical training in the factory.

Owned managed controlled or patronized by them, so as to enable the Indian Apprentices to acquire full knowledge of the technique and work of their trade industry, calling or profession.

**37. Set-off Clause :**

Any sums of money due to the Contractor (including the security deposit returnable to the contractor under this contract shall be appropriated by the Government and shall be set off against any claim of the Government for the payment of sum of a money arising out of or under any other contract made by the contractor with the Government. When no such amount for purpose of the recovery from the contractor against any claim of the Government is available such a recovery shall be made from the contractor as arrears of land revenue.

**38. Appointment of Local Labourers :**

The Contractor should as far as possible obtain the requirement of labourers skilled and unskilled from the nearest employment exchange, so as to utilize the local employment potential. If there are no local employment exchange or such exchanges are not able to provide the required labourers locally, suitable local labours should be utilized to the maximum extent possible.

**39. Fairwages :**

If a contractor fails to pay within '7' (seven) days to the labourer (s) worker(s) the minimum wages prescribed by the Government under the Minimum Wages Act, 1949 as in force from time to time the Executive Engineer or the officer of a equal rank shall be at liberty to deduct the amount payable to the labourer (s) workers from his (contractor's) bill or deposit(s) payable by the contractor after making due inquiries and shall not be entitled to any payment or compensation on account of any loss that he (contractor) may have to incur of the action as aforesaid. Before the action as aforesaid is enforced notice in writing to the contractor shall be issued by the Executive Engineer or the officer of the equal rank to pay the wages as per minimum Wages Act in force at the relevant time. If the contractor does not act as aforesaid within seven days then the action contemplated as above shall be taken against him.

Signature of contractor/s

Executive Engineer.  
Division

**SPECIFICATIONS FOR ELECTRICAL WORKS IN GOVERNMENT BUILDING  
SUBJECT TO THE GENERAL CONDITION OF CONTRACT IN FORCE**

**(1986)**

**GENERAL**

**1. Wiring Rules :**

The installation generally shall be carried out in conformity with relevant Indian Standard Specifications and code of practices prevalent, Indian Electricity Rules, 1956 and Indian Electricity Act, 1910 as amended from time to time.

**2. Definition :**

The definition of terms shall be in accordance with Indian Standard code of Practice for Electrical wiring Installation IS- 732-1982 except for the definition of point in case of Internal Electrical Installation. For definition of point wiring and measurement of Electrical works IS-5908-1970 shall be referred to.

**3. Voltage and Frequency of Supply :**

All current consuming devices shall be suitable for frequency of 50 C/s and system of voltage meant for unless otherwise specified.

**4. Layout of wiring and its discription :**

(i) The wiring shall be carried out as per Schedule "power" wiring must be in screwed conduit and shall be kept separate and distinct from lighting wiring. All wiring must be done on the distribution system with main and branch distribution boards at convenient centres and without isolated fuses. All conductors shall be run as far as possible along the walls and ceiling as to be easily accessible and capable of being thoroughly inspected. The balancing of circuits will be arranged before hand by the Ex. Engineer Electrical Division.

(ii) Within one month of the taking over the installation, the contractor shall supply to the Ex. Engineer, Elect. Division a complete set of wiring diagrams of the same on drawings to be supplied when available by the Executive Engineer, Electrical Division, and to the satisfaction of the Ex. Engineer, Elct. Dn. and these wiring plans shall be "Drawings" within the meaning of the term as used in the General Conditions of contract.

**5. Conductors :**

All conductors unless otherwise specified shall not be less than 1.5 Sq. mm for point wiring and 2.5 Sq. mm for mains Conductors for power and lighting circuits shall be of adequate size to carry the designed circuit load without exceeding the permissible thermal limits for the installation, and such sizes will be stipulated in specifications and or drawings.

**6. Cables :**

- 6.1 All cables shall conform to releveant Indian Standards.
- 6.2 Conductors of all cable except the flexible cable shall be of ialuminium. The smallest aluminium conductors for the final circuit shall have nominal cross sectional area of not less than 1.5 Sq. mm. The minimum size of the aluminium conductors for power wiring shall be 4 sq. mm
- 6.3.1 Conductors of flexible cables shall be of copper. The minimumcross sectional area of such a cables shall be 14.0193 mm. The flexible cable shall have uniform and adequate insulation.
- 6.3.2 Unless the flexible cables and conductors are protected by armour or though rubber or PVC Sheath, these shall not be used in workshops and other places where they are liable to mechanical damage.
- 6.3.3 Core flexible cables shall be used for connecting signle phase Appliances for phase, neutral & earth connections.

**7. Fall of Potential :**

The cross sectional area of all conductors inside buildings shall be so proportioned to their lengths that the drop in voltage between main fuses and the farthest point or any lamp shall not exceed three percent of the voltage of the consumer's with all the consuming devices in use.

- 7.1 If the CABLE SIZE is increased to avoid the voltage drop in circuit current rating of the cable shall be more than that for which the circuit is designed. In each circuit or sub circuit every cable shall have a current rating not less

than that of the fuse which protects the circuit or sub circuit respectively for current higher than the full load current.

## **8. Ratings of lamps and fans socket outlets : Points and exhaust fans**

- 8.1 Incandescent lamps installed in residential and non-residential buildings shall be rated at 60 watts & 100 watts respectively.
- 8.2 Table fans and ceiling fans shall be rated at 60 watts, exhaust fan shall be rated according to their capacity.
- 8.3 5 Amp. socket outlet points and 15 Amp. sockets outlet points shall be rated at 100 watts and 1000 watts respectively for the purpose of load assessment unless actual values of the load are known or specified.

## **9. Tests :**

- 9.1 Before the installation is commissioned following tests shall be carried out.

- (1) Insulation Resistance test
- (2) Polarity Tests of Switches
- (3) Earth continuity tests
- (4) Earth electrode Resistance test

9.2.1.1 The insulation resistance shall be measured between earth and the whole system of conductors or any section thereof with all fuses in place and all switches closed, and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together a direct current pressure of not less than twice the working pressure provided that it need not exceed 500 volts for medium voltage circuits where the supply is derived from the three wire D.C. or a poly phase A.C. System, the neutral pole of which is connected to earth either direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.

9.2.1.2 The insulation resistance shall also be measured between all conductors to one pole or phase conductor of the supply and all the conductors connected to the neutral or to the other pole or phase conductors of the supply with all lamps in position and switches in 'OFF' position and its value shall be not less than in that specified in Sub-Clause 9.2.1.3.

9.2.1.3 The insulation resistance in Megohms measured as above shall not be less than 50 Megohms divided by the number of outlet or when PVC insulated cables are used for wiring 12.5 megohms divided by number of outlets.

9.2.1.4 Where a whole installation is being tested, a lower value than that given by the formula, subject to a minimum of 1 megohm is acceptable.

9.2.1.5 A preliminary and similar test may be made before lamps, etc. are installed and in this event the insulation resistance to earth should be not less than 100 megohms divided by the number of outlet or when PVC insulated cables are used for wiring 25 megohms divided by number of outlets.

9.2.1.6 The term "Outlet" includes every switch except that a switch combined with a socket outlet, appliance or lighting fitting is regarded as one outlet.

9.2.1.7 Control rheostat heating and power appliance and electric sign may, if required, be disconnected from the circuit during the test, but in that event the insulation resistance between the case or frame work, and all live parts of each rheostat, appliance and sign, shall be not less than that specified in the relevant Indian Standard Specification or where there is no such specification shall be not less than half a megohm.

### **9.2.2 Polarity Test :**

9.2.2.1 In a two wire installation a test shall be made to verify that all switches in every circuit have been fitted in the same conductor through out & such conductor shall be labelled or marked for connection to the phase conductor or to the non-earthed conductor of the supply.

9.2.2.2 In a three wire or a four wire installation a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labelled or marked for connection to one of the phase conductor of the supply.

- 9.2.2.3 The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp one lead of which is connected to the earth. Glowing of test lamp to its full brilliance, when the switch is in 'on' position irrespective of appliance in position or not shall indicate that the switch is connected to the right polarity.

### 9.2.3. Earth Continuity Test :

The earth continuity conductor including metal conduits and metallic envelops of cables in all cases shall be tested for electric continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

#### 9.2.3.1 Earth Electrode Resistance Test :

Earth electrode Resistance test may be carried out by Megger Earth Testers containing a direct reading ohm-meter, a hand driven generator and auxiliary electrodes.

- 9.3 On completion of an electric installation (addition and alteration) a certificate shall be furnished by the contractor countersigned by the certified Supervisor under whose direction supervision the installation was carried out. This certificate shall be in the prescribed form as given in Appendix-'B' in addition to the test certificate required by Local Electrical Supply Authorities.

### 10. Joint and looping back :

Unless with the sanction of Ex. Engineer Electrical Divisions all joints in conductor shall be means of approved mechanical connectors in suitable and approved junction boxes but looping back system shall be preferable. In wiring unless otherwise specified Phase and live conduct shall be looped at the switch box where a neutral conductor can be looped from light, fan or socket. In non-residential buildings, neutral and earth continuity wire shall be brought to each of the switch boards should be of adequate size to accommodate at least one number of 5 Amps. socket outlet and control switch in future.

### 11. Switches :

#### Main Switchgears, Switch Board and their location :

- 11.1 All main switches (other than those of iron clad pattern) carrying current of 10 Amp. and above shall be fitted for back connections and shall be suitably protected.
- 11.2 All switches and circuit breakers shall be constructed in accordance with the I.S. 4237-1967. General requirement for switchgear and control gear for voltage not exceeding 1000 Volts and other relevant I.S. provided also that spring shall be either of phosphor bronze or if steel shall be copper or Nickel plated and that handle shall be so fastened that they do not tend to unscrew or become loose.
- 11.3 All main switches shall be either of metal clad enclosed pattern or of any insulated enclosed pattern which shall be fixed at close proximity to the point of entry of supply.
- 11.4 Switch boards shall not be erected above gas, stoves, or sinks or within 2.5 m of any washing unit in the washing rooms of laundries or in the bath rooms, lavatories, toilets or kitchens.
- 11.5 Switch boards, if unavoidably fixed in places likely to be exposed to weather, to drip or to abnormal moist temperature the outlet casing shall be weather proof and shall be provided with glands or bushing of adopted to receive screwed conduit according to the manner in which cables are run. PVC and double flanged bushes shall be fitted in the holes of the switches for entry and exit of wires.
- 11.6 A switch board not be installed so that its bottom is within 1.25 m above the floor unless the front of the switch board is completely enclosed by a door or the switch board is located in a position to which only authorised persons have access.
- 11.7 Switch boards shall be recessed in the wall if so specified in the schedule of work or in the special specification. The front shall be fitted with hinged panel of other suitable material such as bakelite in wood frame with locking arrangement, the outer surface of door being flush with the walls. Ample room shall be provided at the back for connections and at the front between the switchgear mountings and the door.

- 11.8 Equipments which are on the front of a switch board shall be so arranged that inadvertently personal contact with live parts is unlikely during the manipulation of switchgears, changing of fuses or like operations.
- 11.9 No holes other than the holes by means of which the panel is fixed shall be drilled closer than 1.3 cms. from any edge of the panel.
- 11.10 The various live parts, unless they are effectively screened by substantial barriers of non-hygroscopic, non-inflammable insulating material, shall be so spaced that space shall not be maintained between such parts and earth.
- 11.11 The arrangement of gear shall be such that they shall be readily accessible and their connections to all instruments and apparatus shall also be traceable.
- 11.12 In every case in which switches and fuses are fitted on the same pole, these fuses shall be so arranged that the fuses are not alive when their respective switches are in the off position.
- 11.13 No fuses other than fuses in instrument circuit shall be fixed on the back of or behind a switch board panel or frame.
- 11.14 All the metal switchgears and switch boards shall be painted, prior to erection with one coat of antirust primer. After erection they shall be painted with two coats of approved enamel or aluminium paint as required on all sides wherever accessible.
- 11.15 All switch boards connected to medium voltage and above shall be provided with 'Danger Notice Plate' conforming to relevant Indian Standards.

## **12. Control at Point of Commencement of Supply :**

- 12.1 There shall be a linked main switchgear with fuse on each live conductor of the supply mains at the point of entry. The wiring through out the installation shall be such that there is no break in the neutral wire except in the form of a linked switchgear. The neutral shall also be distinctly marked. In this connection Rule 32(2) of the Indian Electricity Rules, 1966 (See Appendix- 'A') shall also be referred.
- 12.2 The main switchgear shall be situated as near as practicable to the termination of service line and shall be easily accessible without the use of any external aid.
- 12.3 On the main switchgear, where the conductor of a two wire system or an earthed neutral conductor of a multi-wire system or a conductor which is to be connected thereto, an indication of a permanent nature shall be provided to identify the earthed neutral conductor. In this connection Rule 32(1) of Indian Electricity Rules, 1956 (see appendix 'A') shall be referred.

## **13.0 Switch Board & Distribution Boards :**

Metal clad switch gear shall preferably be mounted on any of the following types of Board.

### **13.1 Hinged type Metal Boards :**

These shall consist of a box made of sheet metal not less than 2 mm thick and shall be provided with a hinged cover to enable the board to swing open for examination of the wiring at the back. The joints shall be welded. A teak wood board, thoroughly protected both inside and outside with good insulating varnish conforming to IS : 1347-1952 specification for varnish shellac, for General purpose, and of not less than 6.5 mm thickness, shall be provided at the back for attachment of incoming and outgoing cables. There shall be a clear distance of not less than 2.9 cm between the teak wood board and the cover, the distance being increased for larger boards in order that on closing of the cover, the insulation of the cables is not subjected to damage and no short length of cables is subjected to excessive twisting or bending in any case. The board shall be securely fixed to the wall by means of lag bolts, plugs or wooden Gutties and shall be provided with a locking arrangement and an earthing stud. All wires passing through the metal board shall be bunched. Alternatively, hinged type metal boards shall be made of sheet covering mounted on channel or angle iron frame.

**Note :** Such type of boards are particularly suitable for small switch-boards for mounting metal-clad switchgear connected to supply at low voltages.

**13.2 Fixed type Metal Boards :**

These shall consist of an angle or channel of iron frame fixed on the wall or on floor and supported on the wall at the top if necessary. There shall be a clear distance of one metre in front of the switch board. If there are attachments of base connections at the back of the switch board Rules 51(1) (c) of Indian Electricity Rules, 1956 shall apply.

**Noten :** Such type of boards are particularly suitable for large switchboard for mounting large number of switchgears or higher capacity metal clad switchgears or both.

**13.3 Teakwood Boards :**

For small installations connected to a single phase 200 volts supply teak wood boards may be used as main boards or sub-board. These shall be of seasoned teak or other durable wood with solid back impregnated with varnish of approved quality with all joints dovetailed.

**13.4** In large size medium voltage installations, before proceeding with the actual construction of the boards, a proper drawing showing the detailed dimensions and design including the disposition of the mountings, which shall be symmetrically and neatly arranged for arriving at the overall dimensions, shall be prepared and approved by the Engineer-in-charge.

**13.5 Recessing of Boards :**

Where so specified the switch boards shall be recessed in the wall. The front shall be fitted with a hinged panel of teak wood or other suitable materials, such as bakelite, or with unbreakable glass doors in teak wood frame with locking arrangement, the other surface of the doors being flush with the walls. Ample room shall be provided at the back for connection and at the front between the switchgear mountings.

**13.6 Arrangement of Apparatus :**

- a) Equipment which is on the front of a switch board shall be so arranged that inadvertent personal contact with live parts is unlikely during the manipulation of switches, changing of fuses or like operation.
- b) No apparatus shall project beyond any edge of panel. No fuse body shall be mounted within 2.5 cm. of any edge of the panel and no hole other than holes by means of which the panel is fixed shall be drilled closer than 1.3 cms from any edge of the panel.
- c) The various live parts, unless they are effectively screened by substantial barriers of non-hygroscopic, non-inflammable insulating material, shall be so spaced that an arc cannot maintain between such parts and earth.
- d) The arrangement of the gear shall be such that they shall be readily accessible and their connections to all instruments and apparatus shall also be easily traceable.
- e) In every case in which switches and fuses are fitted on the same pole, these fuses shall be so arranged that the fuses are not alive when their respective switches are in the 'OFF' position.
- f) No fuses other than fuses instrument circuit shall be fixed on the back of or behind a switchboard panel or frame.

**13.7 Marking of Apparatus :**

- a) Where a board is connected to voltage higher than 250 volts, all the apparatus mounted on it shall be marked in the following colours to indicate the different poles or phases to which the apparatus or its different terminals may have been connected.

**Alternating Current**

Three-phase-red,

Yellow, &amp; blue,

Natural-black

**Direct Current**

Three wire system-2 outer wires

Positive red &amp; negative blue

Natural-black



Where fuse-wire three phase wiring is done, the neutral shall be in one colour and the other three wires in another colour.

- b) Where a board has more than one switch each such switch shall be marked to indicate which section of the installation it controls.
- c) All markings required under the rule shall be clear permanent.

### **13.8 Main & Branch Distribution Board :**

13.8.1 Main and branch distribution boards shall be of any type mentioned in 13.1

13.8.2 Main distribution boards shall be provided with a switch or air circuit breaker on each pole of each circuit, a fuse on the phase or live conductor and a link on the neutral or earthed conductor of each circuit. The switches shall always be linked.

13.8.3 Branch Distribution Board :

13.8.3.1 Branch distribution boards shall be provided with a fuse or a miniature circuit breaker or both the adequate rating-setting chosen on the live conductor of each circuit and the earthed neutral conductor shall be connected to a common link and be capable of being disconnected individually for testing purposes. At least one spare circuit of the same capacity shall be provided on each branch distribution board.

13.8.3.2 In residential installations, lights and fans may be wired on a common circuit such sub circuit shall not have more than total of ten points of lights, fans and socket outlets. The load of such circuit shall be restricted to 800 watts. If a separate fan circuit is provided, the number of fans in the circuit shall not exceed ten. Power sub-circuits shall be designed according to the load but in no case shall there be more than two outlets on each sub-circuits.

13.8.3.3 In industrial and other similar installations requiring the use of group control of switching operation, circuits, for socket outlets may be kept separate from fans and lights. Normally fans and lights may be wired on a common circuit, however, if need is felt separate circuits may be provided for the two. The load on any low voltage sub-circuit shall not exceed 3000 Watts. In case of new installation, all circuits and sub-circuits shall be designed by making provision of 20 per cent increase in load due to any future modification. Power sub-circuits shall be designed according to the load but in no case shall there be more than four outlets in each sub-circuits.

### **13.9 Installation of Distribution Boards :**

13.9.1 The distribution fuse-boards shall be located as near as possible to the centre of the load they are intended to control.

13.9.2 These shall be fixed on suitable stanchion or wall and shall be accessible for replacement of fuses.

13.9.3 These shall be of either metal-clad type, or all insulated type. But, if exposed to weather or damp situations, they shall be of the weather proof type and, if installed where exposed to explosive dust, vapour or gas, they shall be of flame proof type.

13.9.4 Where two or more distribution fuse boards feed low voltage these distribution boards shall be :

- (1) Fixed not less than 2 m apart or,
- (2) Arranged so that it is not possible to open two at a time, namely they are interlocked and the metal case is marked 'Danger 415 Volts', or
- (3) Installed in a room or enclosure accessible to only authorised persons.

13.9.5 All distribution boards shall be marked 'Lighting', 'Power', as the case may be and also marked with the voltage and number of phases of the supply. Each shall be provided with a circuit list giving details of each circuit which it controls and the current rating of the circuit and size of fuse-element.

13.9.6 Triple pole distribution boards shall not be generally used for final circuit distribution unless specific approval of Engineer-in-charge is obtained. In special cases where use of Triple pole distribution boards are inevitable they shall be of H.R.C. fuse type only.

### 13.10 Wiring and Distribution Board :

- 13.10.1 In wiring a branch board, total load of the consuming devices shall be divided, as far as possible, evenly between the number of ways of the boards leaving the spare circuit for future extension.
- 13.10.2 All connections between pieces of apparatus or between apparatus and terminals on a board shall be neatly arranged in a definite sequence following the arrangement of the apparatus mounted thereon, avoiding unnecessary crossing.
- 13.10.3 Cables shall be connected to a terminal only by soldered or welded or crimped lugs using suitable sleeve, lugs or ferrules unless the terminal is of such a form that it is possible to securely clamp them without the cutting away of cable strands.
- 13.10.4 All bare conductor shall be rigidly fixed in such a manner that a clearance of at least 2.5 cms. is maintained between conductor of opposite polarity or phase and between the conductors and any material other than insulating material.
- 13.10.5 If required, a pilot lamp shall be fixed and connected through an independent single-pole switch and fuse to the bus-bars of the board.
- 13.10.6 In a hinged type board, the incoming and outgoing cables shall be fixed at one or more points according to the number of cables on the back of the board leaving suitable space in between cables and shall also, if possible be fixed at the corresponding points on the switch board panel. The cables between these points shall be arranged to form a "U" or "S" shaped loop which shall be of such length as to allow the switchboard panel to swing through an angle of not less than 90°.

### 14.0 Capacity of Circuits :

- 14.1 Lights and fans may be issued on a common circuits and such a circuit shall not have more than a total of ten points of lights, fan and socket outlets, or a load of 800 watts whichever is less. The power circuits shall be designed with a maximum of two outlets per circuits generally when load is not known or specified. In non-residential buildings at important District centres however one outlet per circuit may be preferred. The circuit shall be designed based on the loading of the circuit where not specified the load shall be taken as 1 KW per outlet. Where the load is more than 1 KW it should be controlled by a isolater switch or miniature circuit breaker.

### 15.0 Passing Through Walls and Floors :

- 15.1 Where conductors pass through walls one of the following methods shall be employed. Care shall be taken to see that wires pass very freely through protective pipe or box and that the wires pass through in a straight line without any twist or cross in wires, on other ends of such holes.
- (a) A teak wood box extending through the whole thickness of the wall shall be buried in the wall and casings or conductors shall be carried so as to allow 1.3 cms air space on three sides, of the casing conductor.
  - (b) The conductor shall be carried either in a rigid steel conduit conforming to 'IS : 1653-1964 specification for Rigid Steel conduits of Electrical wiring (Revised) or a rigid non-metallic conduit conforming to 'IS : 2509-1963 specification for Rigid Non-Metalic conduits for Electrical Installations, or in a porcelain tube of such size which permits easy drawing in. The end of conduit shall be neatly bushed with porcelain, wood or other approved material.
  - (c) Insulated conductors while passing through floors shall be protected from mechanical injury by means of rigid steel conduit (see 'IS 1653-1964) to a height not less than 1.5 m above the floors and flush with the ceiling below. This steel conduit shall be earthed and securely bushed.
- 15.2 Where a wall tube passes outside a building so as to be exposed to weather, the outer end shall be belt mounted and turned down wards, and properly bushed on the open end.

**16.0 Fixing to Walls and Ceilings :**

Plugs for ordinary walls or ceilings shall be of well seasoned teak or other aproved hardwood not less than 5 cm long 2.5 cm. square on the inner end and 2 cm. square on the outer end. They shall be cemented into walls to witin 7.5 mm of the surface, thr remaining being finished according to the nature of the surface with plaster or lime punning.

16.1 Where owing to irregular crossing or other reasons the plugging of the walls or ceiling with wood plugs presents difficulties, the wood casing, wood batten, metal conduit, or cleat (as the case may be) shall be attached to the wall or ceiling in an approved manner. In the case of new building, wherever possible teak wood plugs shall be fixed in the walls before they are plastered.

16.2 To achieve neatness, plugging of walls or ceiling may be done by an approved type of asbestos, metalic or a fibre fixing plug.

**17.0 Branch Switches :**

Where the supply is derived from a three-wire or four-wire source, and distribution is done on the two wire system, all branch switches shall be placed in the outer or live conductor of the circuit and no single-phase switch or fuse shall be inserted in the middle wire, earth or earthed neutral conductor of the circuit. Single-pole switches (Other than for multiple control) Carring not more than 15 amperes may be of tumbler type which shall be 'ON' when the handle known is down.

**18.0 Fittings :**

Where conductors are required to be threaded through tubes or channels formed in the metal work of fittings these must be free from sharp angles or projecting edges and such size that will enable them to be wired with the conductors used for the final sub Circuits without removing the boarding, taping or outer covering. As far as possible, all tubes and channels should be of sufficient size to permit 'Looping back' of wires cables and flexible cords other than those designed for high temperature shall not be used for wiring fittings except for portable fittings. All fittings must have not less than a half inch male nipple. Fiffings and lamp holders for gas filled lamps shall be adequately ventilated.

18.1 Where light fitting is supported by one or more flexible cords, the maximum weight to which the twin flexible cords may be subjected shall be as follows :

| Nominal cross<br>sectional<br>Area cord.<br>mm <sup>2</sup> | No. & Dia in<br>mm of wires. | Max. Permissible<br>weight<br>Kg. |
|-------------------------------------------------------------|------------------------------|-----------------------------------|
| 0.5                                                         | 16/0.2                       | 1.7                               |
| 0.75                                                        | 24/0.2                       | 2.6                               |
| 1.0                                                         | 32/0.2                       | 3.5                               |
| 2.5                                                         | 48/0.2                       | 5.3                               |
| 3.5                                                         | 80/0.2                       | 8.8                               |
| 4                                                           | 128/0.2                      | 14.0                              |

18.2 No inflammable shade shall form a part of light fitting unless such shade is well protected against all risks of fire. Celluloid shade or light fitting shall not be used under any circumstances.

**18.3 Fitting of Wire :**

The use of fitting wire shall be restricted to the internal wiring and the lighting fittings. Where fitting wire is used for wiring, for the sub-circuit loads shall be terminated in a ceiling zone or connector from which they shall be carried into the fittings.

**19.0 Lamp Holders :**

Lamp holders for use on brackets and the like shall be in accordance with \*IS : 1258-1967, specification for Boyonet lampholders and all those for use flexible pendants shall be provided with cord grips. All lampholders shall be provided with shade carriers. Where centre contact edison screw lampholders are used, the outer or screw contacts shall be connected to the middle wire, the netural, and the earthed conductor of the circuit.

**20.0 Outdoor Lamps :**

External and road lamps shall have weather proof fittings of approved design so as to effectively prevent the admission of moisture. An insulating distance piece of moisture proof materials shall be inserted in the fittings. Flexible cord and cord grip lampholders shall not be used where exposed to whether. In verandahs and similar exposed situations where pendants are used, they shall be of fixed rod type.

**21.0 Lamps :**

All incandescent lamps, unless otherwise required and suitably protected, shall be hung at a height of not less than 2.5 m above the floor level. They shall be in accordance with IS : 418 : 1957 specification for Tungsten Filament General Service electric lamps.

**22.0 Fans, Regulators and Clamps :****22.1.0 Ceiling fans :**

Ceiling fans including their suspension shall conform to IS 374-1960 specification for electric ceiling fans and regulators (Revised) & to the following requirements :

- (a) All ceiling fans shall be wired to ceiling roses or to special connector boxes, to which fans rod wires shall be connected and suspended from hooks or shackles with insulators between hooks and suspension rods. There shall be no joint in the suspension rod, but if joints be avoidable then such joints shall be screwed to special couplers of 5 cm minimum length and both ends of pipes shall touch together within couplers, and shall in addition be secured by means of split pins; alternatively, the two pipes may be welded.
- (b) Fans clamps shall be of suitable design according to the nature of construction of ceiling on which these clamps are fitted. In all cases fan clamps shall be fabricated from tested new metal of suitable sizes and they shall be as close fitting as possible. Fan clamps for reinforced concrete roofs shall be buried with the casting and due care shall be taken that they shall serve the purpose. Fan clamps for wood beams shall be of suitable flat iron fixed on two sides of the beam and according to the size and section of the beam one or two mild steel bolts passing through the beam shall hold both flat irons together. Fan clamps for steel joint shall be fabricated from tested flat iron to fit in rigidly to the bottom flange of the beam. Care shall be taken during fabrication that the metal does not crack while hammering to shape. Other fan clamps shall be made to suit the position, but in all cases care shall be taken to see that they are rigid and safe.

**Note :** All fan clamps shall be so fabricated that fans revolve steadily.

- (c) Canopies on top and bottom of suspension rod shall effectively hide suspensions and connections to fan motors, respectively.
- (d) The lead-in-wire shall be of nominal cross-sectional area not less than 1.0 mm<sup>2</sup> with copper and 1.5 mm<sup>2</sup> with aluminium and shall be protected from abrasion.
- (e) Unless otherwise specified, the clear distance between the ceiling fan and the floor shall be less than 2.75 m.

**22.2.0 Exhaust Fans :**

For fixing of an exhaust fan, a circular hole shall be provided in the wall to suit the size of the frame which shall be fixed by means of rag-bolts embedded in the wall. The hole shall be neatly plastered with cement and brought to the original finish of the wall. The exhaust fan shall be connected to exhaust fan point which shall be wired as near to the hole as possible by means of a flexible cord, care being taken that the blades rotate in the proper direction.

**23.0 Attachment of fittings and accessories :**

- 23.1 In other than conduit wiring, all ceiling crosses, brackets, pendants and accessories attached to walls or ceilings shall be mounted on substantial teak wood block twice Varnished after all fixing holes are made in them. Blocks shall be not less than 4 cms. deep. Brass screws only shall be used for attaching fittings and accessories to their base blocks.

**24.0 Interchangeability :**

Similar part of all switches, lampholders, distribution fuse- boards ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in each installation.

## 25.0 Conduit Wiring System :

25.1.1 **Type and size of conduit** - All conduit pipes shall be conforming to \*IS : 1653-1964, furnished with galvanised or stove enamelled surface. All conduit accessories shall be of threaded type and under no circumstances pin grip type or clamp type accessories be used. No steel conduit less than 16 mm in diameter shall be used. The number of insulated conductors that can be drawn into rigid steel conduit are given in Table II.

25.1.2 **Bunching of cables** - Unless otherwise specified, insulated conductors of AC supply and DC supply shall be bunched in separate conduits.

25.1.3 **Conduit-joints**-Conduit pipes shall be joined by means of screwed couplers and screwed accessories only (\*IS : 2667-1964).

Specification for Fittings for Rigid Steel Conduits for Electrical Wiring). In long distance strance straight runs of conduit, inspection type couplers at reasonable intervals shall be provided or running threads with couplers and jam-puts (in the latter case the bare threaded portion shall be treated with anti- corrosive preservative) shall be provided. Thread on conduit pipes in all cases shall be between 11 mm to 27 mm long sufficient to accommodate pipes to full threaded portion of couplers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any or buries left to avoid damage to the insulation of conductors while puling them through such pipes;

TABLE-II MAXIMUM PERMISSIBLE NUMBER OF 250-V  
GRADE SINGLE CORE CABLES THAT CAN BE DRAWN INTO  
RIGID STEEL CONDUIT

(CLAUSE 6.5.1.1)

| Size of cable  |                                 | Size of conduit (mm) |   |    |   |    |    |    |    |    |   |    |   |    |   |   |   |
|----------------|---------------------------------|----------------------|---|----|---|----|----|----|----|----|---|----|---|----|---|---|---|
| Nominal        | Number                          | 16                   | : | 20 | : | 25 | :  | 32 | :  | 40 | : | 50 | : | 63 | : |   |   |
| Crosssectional | and                             | (No. of cable Max)   |   |    |   |    |    |    |    |    |   |    |   |    |   |   |   |
| area.          | Diameter in                     |                      |   |    |   |    |    |    |    |    |   |    |   |    |   |   |   |
|                | mm of wires                     |                      |   |    |   |    |    |    |    |    |   |    |   |    |   |   |   |
|                |                                 | S                    | B | S  | B | S  | B  | S  | B  | S  | B | S  | B | S  | B | S | B |
| 1.0            | 1/1.12                          | 5                    | 4 | 7  | 5 | 13 | 10 | 20 | 14 | -  | - | -  | - | -  | - | - | - |
| 1.5            | 1/1.40                          | 4                    | 3 | 7  | 5 | 12 | 10 | 20 | 14 | -  | - | -  | - | -  | - | - | - |
| 2.5            | 1/1.80                          | 3                    | 2 | 6  | 5 | 10 | 8  | 18 | 12 | -  | - | -  | - | -  | - | - | - |
| 4              | 1/1.24<br>(3/1.06*)<br>(7/0.85) | 3                    | 2 | 4  | 3 | 7  | 6  | 12 | 10 | -  | - | -  | - | -  | - | - | - |
| 6              | 1/2.80<br>(7/1.06*)             | 2                    | - | 3  | 2 | 6  | 5  | 10 | 8  |    |   |    |   |    |   |   |   |
| 10             | 1/3.55+                         | -                    | - | 2  | - | 5  | 4  | 8  | 7  | -  | - | -  | - | -  | - | - | - |
|                | 7/1.40*                         | -                    | - | 2  | - | 4  | 3  | 6  | 5  | 8  | 6 | -  | - | -  | - | - | - |
| 16             | 7/1.70                          | -                    | - | -  | - | 2  | -  | 4  | 3  | 7  | 6 | -  | - | -  | - | - | - |
| 25             | 7/2.24                          | -                    | - | -  | - | -  | -  | 2  | -  | 4  | 3 | 7  | 6 | 9  | 7 |   |   |
| 35             | 7/2.50                          | -                    | - | -  | - | -  | -  | -  | -  | 2  | - | 5  | 4 | 6  | 5 |   |   |
| 50             | 7/3.00+                         | -                    | - | -  | - | -  | -  | -  | -  | 2  | - | 5  | 4 | 6  | 5 |   |   |

\* For Cu. Conductors only.

+For Al. Conductors only.

**NOTE :** 1. The cable shows the maximum capacity of conduits for the simultaneous drawing-in of cables. The table applies to 250 volts grade cable. The columns headed 'S' apply to runs of conduit which have distance not exceeding 4.25

M between draw in boxes, and which do not deflect from the straight by angle of more than  $15^{\circ}$ . The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than  $15^{\circ}$ .

**NOTE :** 2 In case of inspection type draw-in box has been provided and if the cables is first drawn through one straight conduit, then through the drawn box, and then through the second straight conduit, such systems may be considered as that of a straight conduit even if the conduit deflects through the straight by more than  $15^{\circ}$ .

- 25.1.4 **Protection against dampness**- In order to minimise condensation or seating inside the tube, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects as far as possible.
- 25.1.5 **Protection of conduit against rust** - The outer surface of the conduit pipes, including all bends, unions, tees junction boxes, etc., forming part of the conduit system shall be adequately protected against rust particularly when such system is exposed to weather. In all cases, no bare threaded portion of conduit pipe shall be allowed unless such bare threaded portion is treated with anti-corrosive preservative or covered with approved plastic compound.
- 25.1.6 **Fixing of conduit** - Conduit pipes shall be fixed by heavy gauge saddles, secured to suitable wood plugs or any other approved plug with screws in an approved manner at an interval of not more than one metre but on either side of couplers or bends or similar fittings, saddles shall be fixed at a distance of 30 cm. from the centre of such fittings.
- 25.1.7 **Bends in conduit** - All necessary bends in the system including diversion shall be done by bending pipes, or by inserting suitable solid or inspection type normal bends, elbows or similar fittings; or by fixing cast iron inspection boxes whichever is more suitable. Conduit fitting shall be avoided as far as possible. On conduit system exposed to weather, where necessary, solid type fitting shall be used. Radius of such bends in conduit pipes shall be not less than 7.5 cm. No length of conduit shall have more than the equivalent of four quarter bends from outlet, the bends at the outlets not being counted.
- 25.1.8 **Outlets** - All outlets for fitting switches etc., shall be boxes, of suitable metal or any other approved outlet boxes for other surface mounting or flush mounting system.
- 25.1.9 **Conductors** - All conductors used in conduits wirings shall preferably be stranded. No single -core cable or nominal Cross- sectional area greater than  $130 \text{ mm}^2$  shall be enclosed in a conduit and used for alternating current.
- 25.1.10 **Erection and earthing of conduit** - The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit and permanently connected to earth conforming to the requirements specified under pipe in a workman like manner for a perfect continuity between each wire and conduit. Gas or water pipes shall not be used as earth medium. If conduit pipes are liable to mechanical damage, they shall be adequately protected.
- 25.2 **Recessed Conduit wiring system with Rigid Steel conduits** - Recessed conduit wiring system shall comply with all the requirements for surface conduit wiring system specified in 6.5.1.1 to 6.5.1.10 and in addition, conform to the requirements specified in 6.5.2.1 to 6.5.2.4.
- 25.2.1 **Making of chase** - The chase in the wall shall be neatly made and be of ample dimensions to permit the conduit to be fixed in the manner desired. In the case of buildings under construction, chases shall be provided in the wall, ceiling etc., at the time of their construction and shall be filled up neatly after erection of conduit and brought to the original finish of the wall.
- 25.2.2 **Fixing of conduit in chase** - The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60 cm. apart. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a large radius which will permit easy drawing-in of conductors. All threaded joints of rigid steel conduit shall be treated with some approved preservative compound to secure protection against rust.
- 25.2.3 **Inspection boxes** - Suitable inspection boxes shall be provided to permit periodical inspection and to facilitate removal of wires, if necessary. These shall be mounted flush with the wall Suitable ventilating holes shall be provided in the inspection box covers.
- 25.2.4 **Type of accessories to be used** - All outlets such as switches and wall sockets, may be either or flush mounting type or surface mounting type.
- (a) **Flush mounting type** - All flush mounting outlets shall be of cast iron mild steel boxes with a cover of approved insulating material or shall be a box made of a suitable insulating material. The switches and

other outlets shall be mounted on such boxes as would be approved. The metal box shall be efficiently earthed with conduit by an approved means of earth attachment.

- (b) **Surface mounting type** - If surface mounting type outlet box is specified, it shall be of any approved insulating material and outlet mounted in an approved manner.

25.2.5 When crossing through expansion joints in buildings, the conduit sections across the joint may be through flexible conduits of the same size as the rigid conduit.

### 25.3 Conduit Wiring System with Rigid Non-Metallic Conduits :

Rigid Non-Metallic conduits are used for surface, recessed and concealed conduit wiring.

25.3.1 **Type and size** - All non-metallic conduits used shall conform to IS : 2509-1963 and shall be used with the corresponding accessories (See IS : 3419-1965) specification for Fittings for Rigid Non-Metallic Conduits).

25.3.2 **Bunching off cables** - Conductors of AC supply and DC supply shall be bunched in separate conduits. The number of insulated cables that may be drawn into the conduits are given in Table III. In this table space factor does not exceed 40 percent.

TABLE-III MAXIMUM PERMISSIBLE NUMBER OF 250 VOLTS GRADE SINGLE-CORE CABLE THAT MAY BE DRAWN INTO RIGID NON-METALLIC CONDUITS

| Size of cable        |                 | Size of conduit (mm) |    |    |    |    |    |
|----------------------|-----------------|----------------------|----|----|----|----|----|
| Nominal              | No. Diameter in | 16                   | 20 | 25 | 32 | 40 | 50 |
| Crosssectional area. | mm of wires     | (No. of cable Max)   |    |    |    |    |    |
| mm <sup>2</sup>      |                 |                      |    |    |    |    |    |
| 1.0                  | 1/1.12*         | 5                    | 7  | 13 | 20 | —  | —  |
| 1.5                  | 1/1.40          | 4                    | 6  | 10 | 14 | —  | —  |
| 2.5                  | 1/1.80          | 3                    | 5  | 10 | 14 | —  | —  |
|                      | 3/1.06*         |                      |    |    |    |    |    |
| 4                    | 1/1.24          | 2                    | 3  | 6  | 10 | 14 | —  |
|                      | 7/0.85*         |                      |    |    |    |    |    |
| 6                    | 1/2.80          | —                    | 2  | 5  | 8  | 11 | —  |
|                      | 7/1.06*         |                      |    |    |    |    |    |
| 10                   | 1/3.55+         | —                    | —  | 4  | 7  | 9  | —  |
|                      | 7/1.40*—        |                      |    |    |    |    |    |
| 16                   | 7/1.70          | —                    | —  | 2  | 4  | 5  | 15 |
| 25                   | 7/2.24          | —                    | —  | —  | 2  | 2  | 6  |
| 35                   | 7/2.50          | —                    | —  | —  | —  | 2  | 5  |
| 50                   | 7/3.00+         | —                    | —  | —  | —  | 2  | 3  |
|                      | 19/1.80         |                      |    |    |    |    |    |

\* For Cu. Conductors only.

+For Al. Conductors only.

25.3.3 **Conduit joints** - shall be joined by means of screwed or plain couplers depending on wheather the conduits are screwed or plain. Where there are long runs of straight conduit. Inspection type couplers shall be provided at intervals. For conduit fittings and accessories reference may be made to IS : 3419-1965.

25.3.4 **Fixing of conduits** - The provision of 25.1.6 shall apply except that the spacing between saddles or supports is recommended to be 60 cms for rigid non-metallic conduits.

25.3.5 **Bends in conduit** - Wherever necessary, bends or diversions may be achieved by bending the conduits (See 6.5.3.9) or by employing normal bends, inspection bends, inspection boxes, elbows or similar fittings.

- 25.3.6 Conduit fittings shall be avoided, as far as possible on outdoor system.
- 25.3.7 **Outlets** - All the outlets for fittings, switches, etc., shall be boxes of substantial construction. In order to minimise condensation or sweating inside the conduit, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects, etc. as far as possible.
- 25.3.8 For use with recessed conduit wiring system the provisions of 6.5.2.1 to 6.5.2.4 shall apply.
- 25.3.9 Heat may be used to soften conduit for bending and forming joints in case of plastic conduits. As the material softens when heated, fitting of conduit in close proximity to hot surfaces should be avoided. Caution should be exercised in the use of the conduit in locations where the ambient temperature is 50°C or above. Use of such conduits in place where ambient temperature is 60°C or above is prohibited.

## **PVC INSULATED AND P.V.C. SHEATHED OR T.R.S. WIRING SYSTEM**

### **26.0 GENERAL :**

This system of wiring, is suitable for low pressure installation, and shall not be used in places exposed to sun and rain nor in damp places, provided they are sheathed in the special approved protective covering and well protected to withstand dampness.

### **26.1 Attachment to walls and ceiling :**

- 26.1.1 All cables on brick walls, stone or plastered walls and ceiling shall be run on well seasoned, perfectly straight and well seasoned, perfectly straight and well varnished on four sides, teak wood or any approved hardwood battens not less than 10 mm finished thick, width of which shall be such as to suit total width of cables laid on the batten, prior to election, these shall be painted with one coat of varnish or approved paint of colour to match with surrounding. These battens shall be secured to wall and ceilings by flat head wood screws to raws plug or phill plug at an interval not exceeding 75 cm. Wood plug can be used only with special approval of the Engineer-in-charge. The flat head wood screws shall be counter within wood batten and smoothed down with file.
- 26.1.2 Where wiring is to be carried out along the face of the rolled steel joints a wooden batten of adequate width shall first be laid on the same and dipped to it as inconspicuously as possible. The wiring should then be fixed to this backing shall be suitably bushed to prevent the abrasion of the cables.
- 26.1.3 **Attachment to false ceiling :** In no case, the open wiring shall be run above the false ceiling without the approval of Engineer-in-charge.
- 26.20 **Link clips :** Only aluminium alloy clips/joint clips shall be used. The thickness shall be 0.32 mm (30 SWG) for lengths of 25 mm to 40 mm and 40 mm (28 SWG) for lengths of 50 mm to 80 mm. The width shall not be less than 8 mm in all these cases. Link clips/joint clips shall be so arranged that one single clip shall not hold more than two core or three single core TRS of PVC insulated and PVC sheathed upto 2.5 sq. mm above while a single clip shall hold a single twin core or two single core cables. The clips shall be fixed on varnished wood batten switch iron pins and space at interval of 15 cm both in the case of horizontal and vertical runs.
- 26.3.0 **Bends in wiring :** The wiring shall not in circumstances be bent so as to form an abrupt right angle but must be rounded off at the corners to a radius not less than six times the overall diameter of the cable.
- 26.4.0 Protection of wiring from Mechanical Damage :**
- 26.4.1 In cases where there are chances of any damage to wiring, such wiring shall be drawn complying with all the requirements of conduit wiring system.
- 26.4.2 Such protective covering shall in all cases be fitted on all down drops within 1.5 m from the floor, or from floor level upto the switch board whichever is less.
- 26.5.0 **Passing through floors :** All cables taken through floor shall be enclosed in heavy gauge steel conduit extending 1.5 m above the floor or upto the switch board whichever is less and flush with the ceiling below or by means of any approved type of metallic covering. The ends of all conduits or pipes shall be neatly bushed with porcelain wood or other approved material. The conduit pipes, shall be security earthed.
- 26.6.0 **Passing through walls :** When conductors pass through walls, any one of the following methods shall be employed. Care should be taken to see that wires pass very freely through protective pipe or box and that wires pass



through in a straight line without any twist or cross in wires on either ends of such holes.

- (a) A box of teak wood or approved hard wood extending through the hole thickness of the wall shall be buried in the wall and casings or conductors and casing or conductors shall be carried so as to allow 1.3 cm air space on the three sides of the casing or conductor.
- (b) The conductors shall be carried in an approved heavy gauge solid drawn or lap weld conduit or in a porcelain tube of such a size that it permits easy drawing in, the ends of conduit shall be neatly bushed with porcelain, wood or other approved material.

26.6.1 Where a wall tube passes outside a building so as to be exposed to weather, the outer end shall be mounted and turned downwards and properly bushed on the open end. The conduit shall be neatly arranged so that the cables enter them without bending.

26.7.0 **Buried cables** : The TRS or PVC sheathed cable shall not normally be buried directly in plaster. Where so specified in the special specification they may be taken in teak wood channeling of ample capacity or conduit pipe buried in the wall.

26.8.0 **Stripping of outer covering**. While cutting and stripping of the outer covering of the cable care shall be taken that the sharp edge of the cutting instrument does not touch the inner insulation of the conductors. The protective outer covering of the cables shall be stripped off near connecting terminal and this protective covering shall be maintained upto the close proximity of connecting terminals as far as practicable. Care shall be taken to avoid hammering on link clips with any metal instrument after the cables are laid. Where junction boxes are provided they shall be made moisture proof with a plastic compound.

## 27.0 PAINTING WORK IN GENERAL :

27.1 **Paints** : paints, oils varnishes, etc, of approved make in original to the satisfaction of the Engineer-in-charge shall only be used.

27.2 **Preparation of surface** : The surface shall be thoroughly cleaned and dusted before painting is started. The proposed surface shall be inspected by Engineer-in-charge or his authorised agent and shall have received the approval before painting is commenced.

27.3 **Application** : Paint shall be applied with brush. The paint shall be spread as smooth & even as possible. Particular care shall be paid to revets, nuts, bolts and cover lapping. Before drawing cut, it shall be continuously stirred in the smaller containers with a smooth stick while it is being applied.

Each coat shall be allowed to dry out sufficiently before a subsequent coat is applied.

27.4 **Scope** : Painting on old surface in indoor situations will not include primer coat except where specially mentioned in the schedule of work or special specification. However, where rust has formed on iron and steel surfaces the spots will be painted with one anti-rust primer coat.

27.5 **Precautions** : All furniture fixtures, glazing floors, etc, shall be protected by covering. All stains, smears, splashings, dropping of every kind shall be removed. While painting of wiring etc, it shall be ensured that painting of wall ceiling etc, is not spoiled in any way.

27.6 **Painting of conduit and accessories** : After installation surface of conduit pipes, fittings switch and regulator boxes, etc, shall be painted with two coats of approved enamel paint or aluminium paint as required to match the finish of surrounding wall, trusser, etc.

## 28. link clip :

The clip for batten wiring shall be of Aluminium conforming to I.S. specification No. 2415-1975.

## APPENDIX - 'A'

**Important Clauses of Indian Electricity Rules, 1956. Following clauses of Indian Electricity Rules, 1956 shall in particular be taken care of in the execution of electrical works**

| Clause No.                                        | Subject                                                                                                     |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 3.                                                | Authorisation :                                                                                             |
| 29.                                               | Construction, installation, protection, operation and maintenance of electric supply lines and apparatuses. |
| 31.                                               | Cut-out on consumer's premises.                                                                             |
| 32.                                               | Identification of earthed and earthed neutral conductors and position of switches and cutouts therein.      |
| 33.                                               | Earthed terminal on consumer's premises.                                                                    |
| 34.                                               | Handling of electric supply lines and apparatus.                                                            |
| 41.                                               | Distinction of circuits of different voltages.                                                              |
| 42.                                               | Accidental charge.                                                                                          |
| 43.                                               | Provisions applicable to protective equipment.                                                              |
| 44.                                               | Instructions for restoration of persons suffering from electric shock.                                      |
| 45.                                               | Precautions to be adopted by consumers, owners, electrical contractors, Electrical workmen and suppliers.   |
| 46.                                               | Periodical inspection and testing of consumer's installation.                                               |
| 48.                                               | Precautions against leakage before connection.                                                              |
| 50.                                               | Supply to consumers.                                                                                        |
| 51.                                               | Provisions applicable to medium, high voltage installations.                                                |
| 58.                                               | Point of commencement of supply.                                                                            |
| 59.                                               | Precautions against failure of supply: Notice of failures.                                                  |
| 61.                                               | Connection with earth, (low and Medium Voltage system).                                                     |
| 64.                                               | Use of energy at high and extra-high voltage system.                                                        |
| 67.                                               | Connection with earth. (High & Extra-high voltage system).                                                  |
| 68.                                               | General conditions as to transformation and control of energy.                                              |
| All clauses under Chapter VIII on Overhead Lines. |                                                                                                             |
| 137.                                              | Mode of entry.                                                                                              |
| 138.                                              | Penalty for breaking seal.                                                                                  |
| 139.                                              | Penalty for breach of rule 45.                                                                              |
| 140.                                              | Penalty for breach of rule 82.                                                                              |
| 141.                                              | Penalty for breach of rules.                                                                                |

# APPENDIX-'B'

## Form of Completion Certificate

I/We certify that the installation detailed below has been installed by me/us and tested and that to the best of my/our knowledge and belief, it complies with Indian Electricity Rules, 1956, as well as the C.P.W.D. General Specification for Electrical Works, 1972.

Electrical Installation at Voltage and system of supply

**(1) Particulars of works :**

| (a) Internal Electrical Installation | No. Total Load<br>of wiring. | Type or system |
|--------------------------------------|------------------------------|----------------|
| (i) Light point                      |                              |                |
| (ii) Fan point                       |                              |                |
| (iii) Plug point                     |                              |                |
| (a) 3 pin 5 Amp.                     |                              |                |
| (b) 3 pin 15 Amp.                    |                              |                |

**(b) Others :**

| Description      | HP/KW |
|------------------|-------|
| (a) Motors : (i) |       |
| (ii)             |       |
| @ X1 = (iii)     |       |

**(c) Other Plants :**

**(d) If the work involves installation of over head line/or under ground cable :**

- (a) (i) Type & Description of overhead line.
- (ii) Total length & No. of spans.
- (iii) No. of street light & its description
- (b) (i) Total length of under ground cable & its size.
- (ii) No. of joint.

End joint :

Tee join :

St. through joint :

**2) Earthing :**

- (i) Description of earthing electrode :
- (ii) No. of earth electrodes :
- (iii) Size of main earth lead :

**3) Test Results :**

- (a) Insulation Resistance :
  - (i) Insulation resistance of the whole system of conductors to earth. Megohms.
  - (ii) Insulation resistance between the phase conductors and neutral. Megohms.
  - Between phase R and neutral Megohms

Between phase Y and neutral

Megohms

Between phase B and neutral

Megohms

(iii) Insulation resistance between the phase conductors in case of polyphase supply.

Between phase R & phase Y

Megohms

Between phase Y & phase B

Megohms

Between phase B & phase R

Megohms

(b) Polarity Test :

Polarity of non linked single pole branch switches.

(c) Earth continuity Test :

Maximum resistance between any point in the earth continuity conductor including metal conduits & main earthing lead.

d) Earth Electrode Resistance :

Resistance of each electrode.

i) ohms

ii) ohms

iii) ohms

iv) ohms

e) Lighting Protective System :

Resistance of the whole of lighting-protective system to earth before any bonding is effected with electrode and metal in/on the structure.

ohms

Signature of Supervisor

Signature of Contractor

Name & Address

Name & Address

## SPECIFICATIONS

All Specification, standard, publication etc. specified mean the latest standards, publication etc. pertaining to Electrical Installation and should conform to the following wherever applicable.

- 1) Indian Electricity Act, 1910 with its amendments.
- 2) Indian Electricity Rules, 1956 and its amendments.
- 3) Indian Electricity supply Act, 1948.
- 4) Regulation for Electrical Equipment in building by I.E.F. Landon.
- 5) The Factory Act, 1948 and its amendments.
- 6) I.S.-732-1982 Part-I, II & III code of practice for Electrical wiring and fittings in buildings for low and medium voltages.
- 7) I.S. 4064-1967 H.D. Air break switches and fuses for Voltages not exceeding 1100 volts.
- 8) I.S. 3043 - Earthing code of practice for
- 9) I.S. - 1554 Part-I - 1970 PVC insulated (Heavy duty) Electrical Cables for working voltages upto and including 110 volts.
- 10) I.S. : 694 - 1964 Part- II - PVC insulated cable with Alluminium conduits (revised) for voltages upto 110 volts.
- 11) I.S. : 5908-1970 - Electrical installations in buildings. method of measurements of.
- 12) I.S. : 4237-1967 - General requirement for switchgear and control gear for voltage not exceeding 1000 volts.
- 13) IS : 1653-1964 - Rigid steel conduits for electrical wiring (revised)
- 14) IS : 2509-1973 - Rigid steel conduits for electrical installation. (First revision).
- 15) IS : 1258-1967 - Bayonet lampholders (First revision).
- 16) IS : 418-1957 - Tungston-Filament General service electric lamps (Third revision).
- 17) IS : 374-1966 - Fans and Regulators. ceiling type, electric (second revision).
- 18) IS : 2667-1964 - Fittings for rigid steel conduits for electrical wiring.
- 19) IS : 3419-1976 - Fitting for rigid non-metallic conduits (First revision).
- 20) National Electric Code, 1986.

# ANNEXURE I

## Abstract of the Wiring Rules of the Institution of Electrical Engineer (referred to in the specification)

### DEFINITIONS (See Clause 2 of the Specification)

#### Systems :

All electrical system in which all the conductor and apparatus are electrically connected to a common source of supply.

- 1) **Earthed** : Effectually connected to the general mass of the earth. Solidly earthed means earthed without the intervention of a fuse, switch, circuit-breaker, resistor reactor or solenoid.
- 2) **Uninsulated Conductor** : A conductor without provision, by the interposition of a dielectric or otherwise, for its insulation from earth.
- 3) **Bare** : Not covered with insulating material.
- 4) **Diaelectric** : anu material which offers high resistance to the passage of an electric current.
- 5) **Bunch Conductor** : When more than one conductor is contained within a single duct or groove or when they are run enclosed and not spaced apart from each other.
- 6) **Points** : In wiring as per IS : 5908-1970-Method of measurements of electrical installation in buildings.
- 7) **Switch board** : An assemblage pf switchgear with or without instruments, but the term does not apply to a group of local switches in a final sub-circuit where each switch has its own insulating base.

**Note** : In the electricity (Factories Act) special regulations, 1908 and 1944 the term "Switchborad" includes "Distribution board".

- 8) **Single pole switch** : A switch suitable for closing and or opening a circuit on one phase or pole only.
- 9) **Linked switches** : A switch the blades of which are so linked mechanically as to make or break all poles simultaneously or in a definite sequence.
- 10) **Fuse Switch** : A switch the moving part of which carreis one or more fuses.
- 11) **Three Wire System** :

**a) Outer Conductor** : Those between which there is the greatest difference of potenital. This use of the word outer must not be confused with the use of the work when applied to the external conductor of a concentric main.

**b) Neutral Conductors** : The term includes the neutral conductor of a 3 phase 4 wire system, the conductor of a single phase or d.c. installation which is earthed by the supply undertaking (or otherwise at the source of the supply) and the middle wire or common return conductor of a 3 wire d.c. or single phase a.c. system.

- 12) **Semi enclosed machine** : One in which the ventilating openings in the frame are covered with-
  - a) Grids expanded metal or wire gauge, with openings of less than 1/4 inch so as to obstruct free ventilation.
  - b) Wire gauge, in which the openings are less than 1/4 inch but not less than 3/32 inch (diameter or width) :
  - c) Screens with smaller openings than the above.

- 13) **Totally - enclosed Machine** :

One in which the enclosing case and bearings are dust proof and which does not allow circulation of air between the inside and outside of the case.

- 14) **Pipe Ventilated Machine** : An enclosed machine in which the frame is so arranged that the ventilating air may be conveyed to it through a pipe attached to the frame, the ventilation opening maintained by the fanning action produced by the machine - itself.
- 15) **Forced draught machine** : An enclosed machine in which the ventilating air supply is maintained by an independent fan external to the machine itself.
- 16) **Protected Machine** : One having end shield bearings and in which there is free access to the interior without opening doors or removing covers.

## SWITCHES AND CIRCUIT BREAKERS

(See clause II of Specifications)

### 17) Switches and Circuit Breakers :

Switches and circuit breakers (rules 2b. 36 and 37) whether fixed separately or combined with lamps, holders or fittings, must comply with the following requirements :

- (a) Overheating must not take place at the point of contact or elsewhere, when the full current flows continuously.
- (b) They must be so constructed or arranged that the contacts cannot accidentally close when left open.
- (c) The basis must be of incombustible, non-conducting and moisture proof material.
- (d) Circuit breaker as must be so arranged and placed that no combustible material is endangered by their action.
- (e) Unless placed in an engine room or in a compartment especially arranged for the purpose, they must their live parts covered. The covers must be of incombustible material and must be either non-conducting or of rigid metal and clear of all internal mechanism. For more than 6 amperes, at pressures exceeding 125 Volts metal covers must be lined with insulating material.
- (f) In positions where they are liable to injury or come into contact with goods, they must be further protected by an open fronted box or other suitable guard.
- (g) Handles must be insulated and so arranged that the hand cannot touch live metal, or be injured through and adjacent fuse blowing.
- (h) Switches having a handle projecting through an open slot in the cover, must not be used.

Signature of Contractor/s

Executive Engineer

## SECTION F-1A

### GENERAL REQUIREMENTS

#### 1.1 Scope of works :

The work covered by electrical specification consists supplying and installing, electrical wiring system complete in strict accordance with this specification and the applicable drawing and subject to the terms and conditions of the contract. It includes.

- (a) Conduit and wiring system for fans, lighting points bells, clocks sockets, etc. including fixing of lighting fixtures and fans etc. and miscellaneous points.
  - (b) Conduit and wiring system for exhaust fans, power sockets etc.
  - (c) Panel boards, distribution boards. switch fuse units.
  - (d) Complete power and lighting cable systems.
  - (e) Grounding system.
-

- (f) Conduits system.
- (g) Street lighting system.
- (h) Other miscellaneous electrical work.

**1.2 Completeness of Contract :**

Any work fittings accessories or apparatus which may not have been specifically mentioned in the specification but which are necessary in the equipment for efficient working of the plant should be deemed to be included in the contract and should be executed and provided by the contractors. All plant and apparatus should be complete in all the details, where such details are mentioned in the specifications or not.

Three prints and one permanent negative of each of the finally approved drawings incorporating all the modifications proposed by the Department should be submitted. No modifications should be made in a drawing already approved by the Engineer-in-charge without his prior consent.

Approval of the contractor's drawing will not relieve the contractor of any part of his obligation to meet all the requirements of the contract.

**1.3 Guarantee :**

The performance of all the equipments and the installations should be guaranteed at least for a minimum period of one year from the date of taking over the installation by the Department. All equipments must comply with the relevant IS-BS specifications.

**1.4 Interchangeability :**

All corresponding parts of similar plant and equipment should be interchangeable in every way.

**1.5 Tools :**

All special tools required for dismantling and assembly of the equipment covered by the contract shall be supplied as obligation under the contract.

A list of items to be supplied by the Contractor should be submitted alongwith the tender.



## SECTION F-2A

### Specifications for Electrical Installation in Buildings

#### 1. GENERAL :

1.1 These specifications relate to the electrical installations in the buildings of P.W.D. Electrical. The specifications cover general requirements to be fulfilled. These general specifications are supplemented by the specifications for the particular buildings separately attached.

1.2 These specifications are governed by the General conditions of the contract attached hereto.

#### 1.3 APPLICABLE RULES AND REGULATIONS :

1.3.1 Installation shall be carried out in conformity with the regulations for electrical equipments of buildings, published by the Institute of Electrical Engineers London (14th Edition 1966 and as amended upto date) herein after referred to as the I.E.E. wiring regulations. Where these specifications, or the special specifications for the particular building attached hereto are at variance with the I.E.E. regulations these specifications or special specifications as the case may be, shall be followed. The installation shall also comply with the requirements of the Indian Electricity Act, 1910 as amended upto date and rules issued thereunder and also the regulations for the Electrical Association of India. Where not specified otherwise, the installation should generally follow the Indian standard codes of practice and in their absence the relevant British Standard of practices. All the materials shall comply with the relevant Indian Standard of British Standard specifications.

#### 1.4 DEFINITIONS :

1.4.1. The definitions of terms in the I.E.E. Regulations shall apply in general.

#### 1.5 DRAWINGS :

1.5.1 The preliminary drawings only indicate the general scheme of requirement. The exact position of all points, control switch boxes, runs of wiring and/or conduits joint boxes, inspection boxes, mains, and sub-distribution boards, mains etc. shall be got approved by the Engineer-in-charge. All circuits shall be clearly numbered in wiring diagrams and building plans. The detailed design of a switch-board, special fixture or any other part of the electrical installation as may be called for by the engineer-in-charge shall also be supplied by the Contractor and should be got approved by the Engineer-in-charge. Three sets of completion drawings and wiring diagrams showing the installations as executed shall be supplied by the contractor alongwith the completion certificate.

#### 1.6 MATERIALS :

All materials shall be new and of the best quality conforming to the relevant I.S.B.S. specifications. They must be the products of reliable manufacturers of many years or standings. All like parts of materials shall be interchangeable. In case of equipments such as circuit breakers, switch fuses etc. a descriptive and illustrated literature shall accompany the tender. The names of manufacturers of various materials shall be furnished in proforma in Appendix-I. Samples of materials wherever required should be approved by the Engineer-in-charge before use in the installation. One set of such approved samples shall be deposited with the Engineer-in-charge. All materials shall be rust-proof or rendered rust proof by application of suitable paints. The supply of all equipments, switchgears etc. shall be complete with accessories, fittings and mountings as may be required for their proper performance, and as specified in the relevant IS-BS Code of Practice and standards.

#### 1.7 WORKMANSHIP :

1.7.1. Good workmanship and neat finished appearance are the prerequisites for complying with the clauses of these specifications. With a view to ensure fine workmanship the tenderers shall employ licenced wiremen, with an experience of not less than 5 years in the type of work they are engaged. The work should be done under supervisions of licenced Electrical Supervisors with good educational qualifications and considerable experience.

- 1.7.2 Tenderers shall furnish the names of Supervisor and their wiremen who will be engaged in this work with details of their experience.

**1.8 CO-OPERATIVE WITH CIVIL AND OTHER WORKS CONTRACTORS :**

- 1.8.1 The tenderer, after the award of the contract, shall co-operate with the civil and other contractors and shall co-ordinate his work with the work of other contractors with the least amount of dislocation and interference to the other works. Tenderers shall go through the drawings carefully and shall furnish the Engineer-in-charge with all the details of openings in the walls etc. they may be required for concealing any of the electrical equipments or accessories. Where the contractor fails to furnish such information as may be required for the purpose of concealing the equipments etc. they shall be made at his (Contractor) cost and expense. Any alteration to parts of the building shall be carried out with prior permission of the competent authority. All chasies of the structural work shall be made good at the contractor's expense and brought to the original shape finish and colour.

**1.9 TESTING :**

The electrical contractor shall be completely responsible for the testing and commissioning of those installations covered by these specifications in compliance with the standard procedure, in obtaining permission of the Government Electrical Inspector. Any modification which is demanded by Government Electrical Inspector shall have to be carried out within the scope of the contract. The contractor shall submit four copies of drawings of installations as per regulations for shall be provided by the contractor for carrying out the installation work. All tests shall be carried out in the presence of the Engineer-in-charge or his authorised representative and his approval obtained for the test results.

**1.10 COMPLETION CERTIFICATE AND MAINTENANCE GUARANTEE :**

- 1.10. 1 After the completion of the installation and testing, the contractor should furnish a certificate in the proforma in Appendix-III, at the time of taking over the installation by the Department. The installation shall be guaranteed for period of 12 months from the date of taking over by the Department. During the period of guarantee all defects in material or in workmanship shall be rectified or replaced free of cost to the Department.

**1.11 TENDERER'S ABILITY :**

- 1.11.1 In order to enable the Department to assess the ability of the tenderer to execute the work, the tenderer shall furnish evidence of his experience and capacity to carry out the work of the magnitude and nature.

**1.12 RATES :**

- 1.12.1 The rates of items shall include all taxes, transport, loading and unloading charge and all such charges that may be required to be incurred for the supply and installation of the materials at site. The rates shall be firm and variations in the market are not entertained. Break up figures as required in the schedule of work shall also be furnished. As far as possible indigenous materials only shall be included for supply. Where it is unavoidable, imported items may be included and tenderer should clearly indicate materials, quantity, rate and amount of these items.

**1.13 STORAGE SPACE :**

No covered storage space will be provided by the Department. The contractor has to make his own arrangement. However, the Department may give an open space near the place of execution where the contractor can build his own stores for executing the work.

**1.14 DEPARTURE FROM SPECIFICATIONS :**

The tenderer should clearly indicate departure, if any, from the specifications with reasons for the same.

**1.15 EXTRA ITEMS :**

Rates for extra items shall generally be derived from the rates already available in the schedule. Where it is not

possible, the rates shall be mutually agreed upon and the contractor shall furnish a detailed analysis of the rates claimed by him.

## **2. • TECHNICAL SPECIFICATION :**

### **2.1 Supply System :**

The wiring installation shall be suitable for 3 phase 4 wire, 400-440 V 50 cycles system of supply. Colour code of different phase shall be followed as per standard.

### **2.2 Wiring for Lights and Fans :**

2.2.1 Looping system of wiring shall be adopted. No joints shall be made at intermediate runs of cables and where they are unavoidable, such joints shall be through approved mechanical connections.

#### **2.2.2 Point wiring :**

Point wiring shall consist of the branch wiring from the switch board together with the controlling switch or push as far as and including the ceiling rose or any other approved connector or socket, outlets. In case of more than one light being controlled by one switch, the wiring upto the ceiling rose of the first light including the switch shall be considered as a 'Primary point'. Loop wiring from light shall be considered as a 'Secondary' point and rates shall be quoted separately, including final connections to fixtures and plugs.

#### **2.2.3 Conductors :**

No conductor for final sub circuit wiring for light and socket outlets shall have across-section less than that of 2.5 sq. m (aluminium).

#### **2.2.4 Loading :**

No final sub-circuit radiating from the fuse board of a sub- distribution board and wires with 25 sq. m. (Al.) cable shall carry more than 10 lights, fans or socket outlets or a connected load of 800 watts whichever is greater. The following wattages may be assumed for estimating the load on each sub-circuit unless otherwise known or specified.

|                               |           |
|-------------------------------|-----------|
| Incandescent Lampts           | 100 watts |
| Ceiling fans                  | 60 watts  |
| 5-A Socket Outlets (lighting) | 100 watts |
| 4. ft. fluorescent tube.      | 50 watts  |
| 5 ft. fluorescent tubes.      | 100 watts |

In each sub-distribution board at least one way preferably two ways shall be left spare for future requirement. A wiring diagram giving the details of the exact utilization of the ways shall be prepared and fixed in the sub-distribution board itself or any other easily accessible place. The ways of sub-distribution boards shall be accordingly numbered.

#### **2.2.5 Local Control Switches (General) :**

Local control switches for circuit carrying not less than 5-5 shall be piano type and shall conform to relevant I.S. Standards. The switch shall be 'ON' when the knob is in the down position. All local control switches shall be connected in the phase or live conductor only and not in the neutral conductor, switches shall be fixed in iron clad box and shall be so placed that the centre of the switch box is 1.3 mtr. from the finished floor level unless otherwise stated. All switch boxes shall be provided with 1/8" thick perspex cover fixed to the switch box with chromium plated counter sunk screws (brass).

#### **2.2.5A Switches (Two way) :**

- Two way switches shall be piano type single pole, double throw, 250V, suitable for flush mounting and of 5A capacity as per the drawings. All switches shall be recessed in an embedded metal box.
- Each box shall have suitable outlet for fixing conduits directly.
- Each box shall have perspex cover painted inside with the wall colour, if required.
- Each switch shall be suitable for the position in a corridor stairway wiring.

**2.2.5B Switch Boxes (General) :**

Electrical circuits shall be written suitably on the cover of all switch boxes, as approved by the Engineer-in-charge (Elect) whenever different phase are terminated in a switch box bakelite partition shall be provided. Each case shall be provided with a G.I. Earth stud nut and washers for earth connectors.

**2.2.6 Ceiling Rose :**

Ceiling rose shall be used on circuits having a voltage normally exceeding 200V. Only one flexible cord shall be attached to a ceiling rose. Only 3-pin 5A socket outlet shall be provided in lighting circuits. All socket outlets shall be provided with a control switch and they shall be mounted in switch boxes in an approved manner.

**2.2.7 Fittings :**

These shall be of approved type as specified in the tender schedule. The subcircuits leads should terminate in a ceiling rose or conductor in the fitting and internal connection made therefrom. Wherever these fitting are suspended they shall be done so through the conduits and ball and socket joints. All fittings shall be grounded by a G.I. conductor not less than 16 S.W.G.

**2.2.8 Flexible wiring :**

Flexible cords of not less than 23/0076 size shall be used. The weight of suspension shall be governed by I.E.E. Regulations.

**2.2.9 Ceiling Fans :**

All ceiling fans shall be wired to ceiling rose and suspended from a hook shackle or clamp and insulated from the same. All joints in the suspension rod shall be screwed and secured by means of split pins. The fan clamps supplied by the Contractor shall be suitable for the ceiling or roof member as the case may be. For concrete roofs, fan hooks shall be buried in concrete during construction in an approved manner and securely bound to the reinforcement.

**2.2.10 Conduits and Earthing :**

All conduits feeding lighting and fan circuits shall be provided with earth continuity G.I. conductor as specified for power wiring. All conduits shall be as specified for power wiring.

**2.3.1. Point wiring :**

Point wiring for power shall be as defined under section 2.2.2 and shall include the switches and sockets.

**2.3.2. Loading :**

All distribution board for power wiring shall be not less than 15A per way. Loading per way shall not exceed normally 100 watts. The following loads may be assumed if exact figures are not known.

|                   |             |
|-------------------|-------------|
| 3-Pin 15A Outlets | 1,000 Watts |
| 3-Pin 5A Outlets  | 100 Watts   |

**2.3.3 Wiring for Motors :**

2.3.3.1. Final sub-circuits loop in motors shall be connected to separate ways of the Distribution board even if the current in the sub-circuit is less than 15A. No looping is permissible.

2.3.3.2 All wiring shall be carried in H.G. conduit as specified in I.S. specification for gauge for different sizes of conduits. When the motor is resiliently mounted flexible conduit with approved adapters shall be used for the last few feet. Where cables are used sufficient loop shall be left.

2.3.3.3 All switch fuse units controlling circuits feeding motor shall be provided with H.R.C. fuses or as specified.

2.3.3.4 The frame of every motor and its association control gear shall be earthed by two separate and distinct connections to earth connector shall be capable of carrying 3 times the rating of fuse or 1.1/2 time the setting of the circuit breakers but in no case less than No. 8 S.W.G. or 7064" or equivalent cross section of copper. Where practicable, the earth connections shall be visible for periodical inspection. Gas or water pipes shall not be used for earth connections.

### 2.3.3.5 Socket Outlets and Control Switches 5A and 15A :

All socket outlets shall be of 3 pin type, the third pin being connected to the earth stud of nearest distribution board by separate earthing wire. The socket shall conform to I.S. : 1293/1938, single pole, piano type. Each socket outlets shall be provided with a control switch of appropriate rating and as specified. The switch and socket shall be mounted inside the iron clad box provided with 1/8" perspex cover as directed by the Engineer-in-charge or as specified in schedule of quantities. Inside switch box ample space shall be available around switches for connecting wires to switches. All socket outlets for power shall be mounted at the skirting level unless otherwise specified or as directed by the Engineer-in-charge.

The three phase plug receptacles shall have their earth terminals connected by independent earth wires to ring main earth strips on the building. In buildings where explosion proof fixtures are installed single phase plug receptacles as well as light points shall be connected to ring main ground bus installed in the building by separate earth wires of approved size.

Socket outlet shall have some provision not to receive the matching plug unless the grounding pin is in correct position. The grounding pin of the plug shall make the contact first and break the contact last at the time of inserting or removing the plug respectively.

The grounding terminal shall be connected to the enclosed metal body by providing G.I. stud, nut washers welded to the box.

Each unit shall be suitable for flush mounting as required and indicated in the applicable drawings.

Combination unit of socket outlet and switch shall be complete with necessary internal wiring. The switch/socket shall be mounted on M.S. bracket enclosed in a box.

### 2.4 Conduit Wiring :

2.4.1 Where conduit wiring is adopted the type and size of the conduit shall be as indicated in the drawing. The minimum of the conduit shall be 19 mm.

2.4.2 The contractor shall thoroughly study the structural arrangements of the buildings and wherever necessary shall in consultation with Department's representatives at site, make suitable adjustments in the cable routings, earthing arrangements, and location boxes, fitting etc. with a view to avoid interference with any part of the building, structure, equipment or any other work in the building or to effect any improvement in the arrangement.

#### 2.4.3 Protection of conduit against rust :

Conduit shall be given two coats of oxide paint before they are placed in position. All exposed conduit shall be painted after installation with the colour as approved by the Engineer-in-charge. This do not apply to galvanised conduit.

#### 2.4.3.A Protection against insects and damp :

In order to minimise condensation or sweating inside the conduit, system shall be properly drained and ventilated in such a manner as to prevent the entry of insects.

2.4.4 Conduit shall first be installed as a complete system without cables and shall be continuous from outlet to outlet from fitting to fitting and mechanically and electrically connected to all boxes and fittings.

### 2.5 SPECIFICATION FOR POWER CONTROL AND TELEPHONE CABLES :

#### 1. SCOPE :

- i. The specifications cover the supply and installation of medium voltage power and control cables either in ground or trench depending on the conditions at site including accessories for the same. The work in general, consists of supplying, laying, jointing terminating and connecting all, 1.1. KV APLSTS PVC power and control cables.
- ii. The contractor shall supply all accessories including jointing and terminating materials, compound, tapes supporting materials, cleats cable lugs, concrete stabs, bricks sand, cable markers etc. as required to make the installation work including digging and back filling of the trenches as required.

#### II. SPECIFICATION :

- i. All power cables to be supplied mentioned as 'APLSTS' in the Schedule should be mass impregnated, non-draining, paper insulated lead sheathed, double steel tape armoured and must comply with the latest ISI BS specifications.
- ii. All cabling materials such as cable compound, cable lugs, tapes shall be of approved quality acceptable to the type recommended by the manufacturer of the cable for which it is used and approved by the Department.

- iii. Installation of all equipment shall also conform to the applicable. Codes and practice as per the IS and shall be executed to comply with the latest Indian Electricity rules as regards the safety, earthing of equipments and other essential provisions specified therein.
- iv. Only approved make of cable shall be used. ICC and CCI will be preferred.
- v. The cables shall generally be laid as per is Code of practice.

### III. GENERAL RULES CABLE LAYING :

- i. Installation shall be carried out in a neat, workmen like manner by skilled experienced and competent workmen in accordance with the standard practices.
- ii. Cables shall be laid preferably in one piece length to avoid joints. If straight joints are found necessary, these can be introduced with prior approval of the Engineer-in-charge. The cost of the straight joint however, shall not be borne by the Department. But in no case joint shall be within the conduit G.I. pipe and duct.
- iii. Proper care should be exercised in handling the cable to avoid formation of kink etc. and should it become necessary a cable be bent to a radius not less than 20 times the overall diameter of the cable.
- iv. Method of installation, routing of cable etc. shall in every case be subject to the Department's approval and the contractor shall modify and or certify at no extra cost to the Department any portions of the installation which do not meet with the Department's approval. All damages to the civil and other works on this account shall be made good by the contractor at no extra cost to the Department.

The electrical contractor while notifying the building contractor for such work shall furnish the proper drawings, fully explaining the work involved or indicate at site actual work to be carried out as may be required by the building contractor. The electrical of any such work as soon as the electrical work with respect to the same has been completed.

- v. Where cables pass through hume pipes, contractor shall fix hard wood bushed round the cables at the ends of hume pipes. Where the cables pass through the floors or chambers and in such other situations as the Engineer shall require, the contractor shall seal cable holes in a manner approved by Engineer-in-charge. Where cable pass through roads nallahs, etc. cables must be protected by Class 'A' Hume pipe of diameter not less than 6" (15cms.)
- vi. The cable route shall be the shortest and these shall be minimum interference with built up areas, lawns etc.
- vii. Care shall be exercised for providing suitable props for supporting other service lines on earth at the time of excavation. Where cutting of a lawn become inevitable it should be with the approval of the Engineer-in-charge.
- viii. Excavation of the trenches shall be executed with verticle sides and the trenches shall be kept as straight as possible. The exact location of each trench shall be settled by the Engineer- in-charge. On the site when the contracot is in a position to commence each portion of the work.

The trench shall be not less than 1/2 meter wide and 90 cms deep. If more, cables are to be laid, the width should be suitably increased.
- ix. After the cables are laid, the trench shall be filled in layers, the earth in each layer being well rammed by spraying water and consolidated and sufficient allowance made for settlement. The extra earth over the trench should be removed from the place of trench to a place as decided by the Engineer- in-charge at site.
- x. Ends of cables shall be properly sealed to prevent entry of moisture prior to installation.
- xi. Where it is as specified as 1/2 core cables the 1/2 core shall be a neutral conductor having reduced section.
- xii. For all multicore cables each core and tails shall be brought out, marked and or coloured in on approved manner.
- xiii. Cables termination shall be done with suitable compression brass glands in the case of PVC cables and cast iron trifurating boxes in the case of APLSTS cables. The armour should be connected to the right main earth in building with duplicate earth wires as per the relevant IS/BS specification.

The core insulation over each conductor shall however be retained through out the run of the conductor upto the end where lugs shall be fitted thereon for connections. The lugs shall be fitted by means of approved solder and flux such as aleap, and Eyre No. 7 liberally used. The joint shall be mechanically strong and pressure tested.

## 2.6 DISTRIBUTION BOARDS AND PANELS :

### General Requirements :

- 2.6.2 All distribution panels shall comply with I.E.E. Rules 60- 61. A clear distance of 0.91b metre in front of the switch board shall be kept. Where bare connections or attachments are provided at the back of the switch board the space behind the panel shall be either less than 0.299 metre or more than 0.762 main width there shall be a passage way from the furthest outstanding part of any attachment or conductor. If the space behind the switch board exceeds 0.70 main width there shall be a passage way from either end of the switch board clear to height of 1.928 m width 0.299 m. All wiring connection shall be made neatly and securely.
- 2.6.2 For circuits carrying more than 10 Amps, tinned cable sockets shall be used. All connections shall be so made as to form their own diagram Circuit shall be clearly numbered to correspond to wiring diagram Names of the distribution boards shall be painted as directed by the Engineer-in-charge. All the switch fuse units and isolators D.Bs. shall be complete with earthing studs lugs neutral bar link, H.R.C. fuses and of aproved make.
- 2.6.3 Skeleton type panels shall have a rigid form work adequately braced and supported. The switch and distribution boards shall be neatly arranged in the frame. The details of the frame work and the arrangement of switches shall be got approved by the Engineer-in-charge before the panel is fabricated.
- 2.6.4 All cubical type panels shall have rigid supporting frames adequately braced over which sheet metal shall be nearly secured. All switches, distribution boards etc. shall be neatly arranged on the panels and all connections made from the back of switches. The panels shall be rendered dust and vermin-proof. The interior of the panels shall not be accessible to unauthorised persons.
- 2.6.5 The recess type boards shall be embedded in wall in a cupboard with a metal hinged door with locking arrangement. In all recessed conduit work all distribution boards shall be recessed. Where recessing is not possible, free standing panel may be provided as approved by the Engineer-in-charge.
- 2.6.6 All individual components i.e. switch fuse units D.Bs. etc. shall be connected by earth continuity wire of appropriate size with the main earth bus of the panel D.B. etc. The panel switches or D.Bs. shall be earthed by the less than 2 distinctive paths to earth. Earthing of metallic parts of exposed metal shall not be effected through any structural metal work which houses the installation. Where metallic parts are not required to be earthed and are liable to become alive should the installation of the contractor become defective such metallic parts shall be separated by durable non-conducting material from any structural work.
  - (a) Power panels shall be 3 phase, 4 wire, 400/230 volts for the distribution of 3 phase or single phase power loads. Lighting panels shall be 3 phase 4 wire 400/230 volts for single phase lighting load distribution on all 3 phase.
  - (b) All panels shall be done or protected front type with no mechanical or electrical defects.
  - (c) Bus bars shall be of electrolytic copper or aluminium as specified and the properly tinned sizes as indicated on applicable drawings as required.
  - (d) All knock outs for branch circuits, conduit entries shall be drilled in and filled as required. For lighting panels the top and bottom cover plates shall be removable type.
  - (e) Main disconnect device for all panel boards shall be of switches of disconnect type and of the size as indicated shall be mounted directly below the panel or through a short thread conduit of required size.
  - (f) The main disconnect for all panel boards shall have an entry suitable for PVC armoured cable from bottom.
  - (g) All panel boards shall be provided with an earthing terminal and lug for connection to the grounding system.
  - (h) Temperature rise of all electrical parts shall not be more than 300° with full load amseres at room temperature.

- (i) Buses shall be securely supported so that ordinary vibrations will not cause any of the parts to become loose.
- (j) All barriers and supports of current carrying parts shall be of moisture resistant insulating material and shall not be adversely affected by arcing.
- (k) The locations of panels shown in the drawings are only tentative. Panels may be located at a place approved by the Engineer-in-charge.
- (l) All civil works connected with fixing such as grouting chasing and making good shall be the tenderer's responsibility.
- (m) Wires adequate capacity with proper size of lugs shall be used for inter connections.
- (n) Panel should be self supported on angle channel iron frame work. It should be preferably of bolted construction in case of transportation and flexibility. The frames shall be of the required size for the mounting of the equipment on it. It shall be bolted or grouted rigidly after levelling and alignment.
- (o) The cupboard and D.B. should be of such size so to be accommodated in the existing room as per I.S. rules and I.S. codes of practice for installations of Medium voltage switch gear.
- (p) Fabrication drawing showing the detailed dimensions and panels and its components indicating the frame work, earthing positioning of switches, D.Bs, cable boxes, adopter chambers etc. shall be furnished to the Engineer-in-charge for his approval. All material to be got approved by the Engineer-in-charge. Panel should be guaranteed for satisfactory operations for a period of one year after handing over.
- (q) The panel should be painted with anticorrosive paint suitable for humid and salty atmosphere on two coats of primer.

### **Switch Gears, Powers Panels D. B. and S. F. Us.**

- 2.6.8 The main busbar shall have continuous current rating as specified with neutral bar having half of full load rating of the phase busbar. The sizes of the bus bars shall be so selected that the current density in bar does not exceed 150 amps. per sq.m. for copper. The length of bus-bar chamber should be as suitable length to fix all the switches etc. as per the prevailing standards. clear spacing of two adjacent buses shall be 1 1/2" minimum bar should be itaped all alongwith colour coated 11KV grade PVC tape. The maximum internal of support for each unsupported length shall exceed 600 mm.

The bus bar shall be of copper/alluminium and fabricated to the relevant standards specification. In case alluminium bus bar is used special with high conductivity alluminium bus bar alloy E 91 C frame conforming to E.S.S. 2898 shall be used. The current density shall not exceed 800A per sq. inch. Hylam barriers will be provided over the joints to prevent any short circuit.

The bus enclosings shall be made out not less than 16 gauge M.S. sheet construct on with angle iron support. All interconnections between bus bars S.F. Us. and D. Bs. shall be of adequate size and details of such inter connection shall be furnished to the Engineer-in-charge for his approval.

The bus bar shall be air insulated extensible type rectangular one. The bus bars chamber shall be dust tight by providing gaskets secured properly so as to tender it vermin proof.

The Combination Fuse-switch unit should comply with IS 4064 BS 861 and BBS 2510 wherever applicable. It should be suitable to accommdate High Repturing Capacity Catridge Fuselinks complying with IS 2208 or BS 88 and having a certified rupturing capacity of not less than 35 MVA at 440 volts (AC5 duly). The switch gear (panes. D. Bs. etc.) shall be installed generally as per IS-Part- I 3072 and ias specified and shown in drawings.

All fuse switch units shall be provided with non-deteriorating HRC fuse links complying with IS 2208-1962 and having rupturing capacity of 35 MVA at 415 volts or as specified.

All switches above 60 amps. rating shall be provided with suitable size adapted boxes. All switches mounted on the top of the busbars shall be provided with detachable type reverse entry adapter boxes. Suitably engraved labels shall be provided for each circuit as well as for the board.



A meters sector switches and LMH metre shall be provided where specifically mentioned. Small wiring for the inter-connecting shall be colour coded and provided with numbered fuses for easy identification of circuits.

- (a) The distribution boards should be totally enclosed metal clad complying with B. S. 214. The M. S. sheet steel enclosures for recessed D. Bs. shall be of not less than 14 guage.
- (b) The D. B. shall be with hinged door and the locking arrangements as approved by the Engineer-in-charge.
- (c) All the components shall be enclosed in the enclosure. The mounting of D. B. shall be got approved by the Engineer-in-charge before carrying out the installation.
- (d) The D. Bs. shall have proper size cut outs for conduits entry or cable entry as required and these shall be made on site.
- (e) Adequate spacing shall be provided inside the D. Bs. for easy removal of the fuses and carry out the inter connection.
- (f) A set of insulating barriers have to be provided between incoming breakers switches and fuses.

#### Switchfuse Units :

- (a) All the D.P.T.P. and T.P.N. switch fuse units shall be totally enclosed iron clad quick make, quick break type to best Indian make conforming to the I. S. or B.S. 3185 specifications. All the switch fuse units shall have mechanical interlock with a door, so that the door cannot be opened when the switches are in 'ON' position. The switches should be of double break solation type to ensure safely.
- (b) Each T.P. & T.P.N. switch fuse unit shall be earthen with two distinct earth connections.
- (c) Suitable insulator shall be provided between phase.
- (d) There shall be suitable natural link in the fuse box.
- (e) All T. P. & T.P.N. switch fuse units shall be rated for 500 volts and D. P. (required for single phase supply) and S.P.N. switches for 250 volts.
- (f) The H.R.C. cartridge fuse shall conform to H.S. 88 (1952).

The O.C.Bs. ACB shall be suitable for 400/440 volts 3 phase 50 cycle supply capable of interuping a fault MVA of not less than 31. The circuit breaker shall conform to the BSS-936-1940 BSS 3659 with such tripping arrangement as may as required under special specifications for the building. Efficient and fool-proof mechanical interlocking shall be provided for the safe operation and maintenance. The rate shall be inclusive of the first filling of oil.

#### 2.7 Instrumentation :

The instruments and meters wherever necessary shall be housed in special sheet steel box located between switch fuses units and bus bar chambers. The instruments etc. shall be mounted on the hinged cover with their dial flushed. All instruments shall have protective H. R. C. fuse links. All interconnections and small wiring shall be neatly dressed arranged and duly coloured for easy identification of circuits.

Meters shall be provided as required in the Schedule. Meters shall be dead head and be suitable for 400/440 volt 3 phase 4 wire 50 cycle (inbalanced load) supply.

Each selector switch shall be 3 point and of minimum 250 volts grade with silver tipped contacts suitable for metering circuits, current transformers shall be of 5VA burden and commercial metering accuracy. Indicating lamps shall be penal mounting type preferably of 250V grade. Every unit shall be prewired and interconnected to the system for its required indicating performance. Indicating lamps shall have independent circuit fuse.

#### 2.8 FIXING OF LIGHTING FIXTURES :

1. Location of fixtures their manner of fixing mounting height etc. are indicated in relevant drawing. Actual location and levels shall however be arrived at site in co-ordination with other service etc. and prior approval of the Engineer-in-charge regarding the actual location. Manner of fixing shall be obtained before the work is taken up in hand.

2. In all cases the contractor shall provide necessary interconnection wiring earthing painting etc. all necessary for complete installation. The contractor shall also test and commission the fixtures during completion of the work.
3. General arrangement of fixtures layout is indicated in drawings. Care shall be taken to see that all light fixtures are in a row in a room or particular area, are in absolute line and plumb and are symmetrically disposed with respect to finished surfaces of walls columns beams etc.
4. The inter-connections wiring from the light outlet point upto the fixture shall be carried out by means of flexible copper wire of section not less than 1.5 mm<sup>2</sup>.
5. All fixtures suspended by means of conduits shall be done with all and socket joints or as per approved design.

#### 2.9 Telephone System :

1. Empty conduiting shall be done, recessed or exposed to surface along with pull boxes, junction boxes and telephone outlet boxes, in areas and location as indicated in the relevant drawing as per materials and methods as described in regard to conduiting under section "Wiring in Conduits" except the G.I. pull wires of gauge not less than 20 SWG shall be kept pulled through conduits in all sections so that in future telephone wires can be pulled easily.
2. Location shown on the drawing are approximate and final location shall be decided in the field by the Engineer-in-charge.

## SECTION G

### SPECIFICATION FOR EARTHING.

#### 1. Installation of Earthing Plates :

All installation of earthing shall conform to Indian Electricity Rules, IS-3043 latest edition and I.E.E. The copper earth plates should be tinned before intallation. The earth plates of copper 60 cm x 60 cm x 3.515 mm thick size as mentioned in the schedule be in separate pits at least 150 cms to 300 cms. away from the building at a depth necessary to reach moist earth surface but with a minimum depth of 2.5 mtr from the finished ground level upto the top vertical dodge of earth electrode. The earth plate shall be thoroughly cleaned to remove all dirt from the surface and be tinned property for electrical contact with the main ground. Each earth pit should be provided with 38 mm. dia G.I. pipe 2.5 Mts. long or more depending upto the depth of pit, put over the vertical edge of earth plate (with top end of pipe provided with a closed to couyler). Alternative layers of salt and coke shall be provided surrounding the plate. The pits shall be filled when the plates are in position and with the approval of Engineer-in-charge.

To facilitate watering the pit, a concrete compartment should be made with funnel with mesh and cover plate as per rules provided in ISI regulation. The masonry endousures shall be 25 cm x 25 cm x 25 cm (deep) with C. I. lid of 23 cm x 30 cms size. After installation, the earthing resistance of each earth plate should be measured by resistance meggar in the presence of Engineer-in- charge, three days after the completion of earthing work, and the value should conform to regulations.

Signature of contractor/s

Executive Engineer.

Division.

#### -- List of Approved Products --

As Per Seperate Booklet Attached