**Civil, Interior, Furnishing, Plumbing, Electrical, HVAC works of NAFED Building at D-392, New Subzi Mandi, Azadpur Mandi, New Delhi- 110033**

**NATIONAL AGRICULTURAL COOPERATIVE MARKETING FEDERATION OF INDIA LTD.**

NAFED

National Agriculture Cooperative Marketing Federation of India ltd

**(TECHNICAL BID)**

**Architects**

**M/s SPACE ACE**

**ARCHITECTS & INTERIOR DESIGNERS**
**V-20A/05 DLF CITY-III, GURGAON,**
**HARYANA - 122002**
**TEL. PH. No. :- 8527253808**
**Email: spaceace.india@gmail.com**

Dated: 01.11.2023

**SECTION- I: DETAILS OF TENDER**

| | | |
|---|---|---|
| 1 | Details of work to be done | Civil, Interior, Furnishing, Plumbing, Electrical, HVAC works of NAFED Building at D-392, New Subzi Mandi, Azadpur Mandi, New Delhi- 110033 |
| 2 | Form of contract | Item rate tender |
| 3 | Earnest money (Refundable) | Rs.1,68,000 in form of demand draft in favor of the NAFED payable at New Delhi. |
| 4 | Cost of tender documents (Non refundable): | Rs.2,360/- (inclusive of 18 % GST) in form of demand draft in favor of the NAFED payable at New Delhi. |
| 5 | Period of contract / time of completion | 180 Days (to be completed in phased manner) |
| 6 | Last date and time for Receiving of sealed tender | 22.11.2023 upto 3.00 PM in office of NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi |
| 7 | Place and date of opening | Place: A 349, IInd Floor,<br>Azadpur Mandi, Delhi - 110033<br>Date : 23.11.2023 at 12.30 PM |

**SECTION- II : SUMMARY OF SALIENT FEATURES**

| | | |
|---|---|---|
| 1 | Type of Contract | Item rate basis |
| 2 | Validity of offer | 90 days from the last date of submission of bid. The same may be extended for a further period of 60 days with concurrence of the Tenderers. |
| 3 | Earnest Money Deposit (Refundable) | Rs. 1,68,000/- by demand draft only drawn in favor of NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi |
| 4 | Cost of tender documents (Nonrefundable) | Rs. 2,360/- (inclusive of 18 % GST) by demand draft only drawn in favour of NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi |
| 5 | Date of commencement of work at site | Within 7 days from the date of issue of letter of NAFED |
| 6 | Mobilization advance | 10% of the Contract price ( exclusive of GST) against equivalent amount of Bank Guarantee from any Nationalized / Scheduled Bank in favour of NAFED |
| 7 | Period of completion | 180 days from the 7$^{th}$ day of issue of letter of Intent (Site will |
| 8 | Interim Payments | Once in Every Month |
| 9 | Minimum value of work for running bills | Rs. 14 lakhs (except final bill) |
| 10 | Period of honoring of certificates | 21 days from the date of issue of certificate of payments by the Architect |
| 11 | Retention Money | 10% to be retained from each bills. |
| 12 | Defect Liability period | 12 months from the date of issue of virtual Completion certificate by the Architect. |
| 13 | Liquidated Damages | 0.5% per week or part there of subject to the max of 10% of accepted contract price. |
| 14 | Language for communication | English |
| 15 | Insurance, Custom Duties & taxes, work contract tax, sales tax, service tax | To be provided and paid by contractor (price quoted to include all taxes) |
| 16 | Assignment &Subletting | Not allowed |
| 17 | Rates of B.O.Q's items | To be quoted all inclusive and including all taxes, charges, surcharges, cess etc. i.e., net to the NAFED , but excluding GST. |
| 18 | Period of submitting final bill by contractor | One month from the date of virtual completion |
| 19 | Labor Cess | 1% of contract value will be deducted by NAFED as labour Cess payable to Delhi Government. |

| | | |
|---|---|---|
| 20 | Water and electricity charges | **Water Supply**:<br>Water Supply will be provided at single point by Owner, Contractor shall at his own expense make all necessary arrangements for distribution of water for construction purpose. The water consumption bill charges will be borne by the contractor for the entire duration of work.<br><br>**Electricity:**<br>Power required for the Installation will be provided at single point by Owner. The Contractor shall make his own arrangements for internal distribution of power meeting the safety regulation for electrical works as per statutory requirement. The electricity consumption bill charges will be borne by the contractor for the entire duration of work. |
| 21 | Signing of Agreement | Within seven days of the issue of letter of intent/work order. |
| 22 | Income tax deduction | At prevailing rate from each running bill |

**Signed this _____dated _____2023**

Signature of contractor
with date and seal

**SECTION – III : NOTICE TO CONTRACTORS**

M/s ----------

**PROJECT: Civil, Interior, Furnishing, Plumbing, Electrical, HVAC works of NAFED Building at D-392, New Subzi Mandi, Azadpur Mandi, New Delhi- 110033**

Dear Sir,

1. The NAFED, New Delhi takes the pleasure in inviting you to tender for the aforesaid work.

2. Sealed tender should be addressed to NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi.
3. The tenders are required to submit their offer in sealed packet.

4. The clarification on technical issue, if any, may be obtained from the Architect, M/s SPACE ACE,V-20A/05 , DLF- City- III, Gurgaon, Haryana- 122002 Phone no 8527253808 on any working day during normal working hours.

5. The tender must obtain for himself on his own responsibility and at his own expenses all the information which may be necessary for the purpose of filling this tender and for entering into contract for the execution of the same and must examine the drawings and inspect the site of the work acquaint himself with all local conditions and matters pertaining thereto.

6. Each of the tender documents is required to be signed by the person or persons submitting the tender in token of his/their having acquainted himself/themselves with all the conditions/specifications, as laid down. Any tender with any of the document not so signed may be rejected.

7. Any additions and alternations made in filling the tender must be attested by initial of the tenderer/s. Over-writing of figures is not permitted. Failure to comply with either of these conditions will render the tender void. No request, advice or any change in rates or conditions after submission of the tender will be entertained.

   The tenderers shall deposit with NAFED payable at Delhi Rs. 1,68,000/- by Demand Draft only from any of the scheduled bank in favor of the NAFED as the Earnest Money. The EMD of the unsuccessful tenderers will be returned without any interest within 30 days, after a decision is taken regarding the award of the Contract. Any tender not accompanied by the requisite Earnest Money in Demand Draft will not be considered and shall stand rejected. It may' be noted that conditional Tender may be liable to be rejected. The EMD of the Tenderer shall be forfeited in the following circumstances:-

   (i) the Tenderer withdraws his bid;
   (ii) the tenderer either fails to start the work within a period of 7 calendar days or fails to execute the agreement within 15 days after the receipt of letter of acceptance of tender or the Letter of intent;
   (iii) the Tenderer fails to supply goods / services as per the terms of the Tender and Purchase / Work Order.

(iv) any other justified reasons e.g. misleading or wrong information in the Bid, violation of the terms and conditions of the Tender, involvement in forming ring / cartel, submission of multiple bids in different names etc.

EMD of successful tenderer(s) shall be refunded to the successful Tenderer on receipt of Performance Security. If desired by the successful Tenderer in writing, the EMD may be converted into the Performance security and balance amount shall be deposited by him to complete the Performance Security. Performance Security should remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the Tenderer including warranty obligations.

8. Within 7 (working) days of the receipt of intimation from the NAFED of the acceptance of his/their tender, the successful tenderers shall be bound to implement the Contract by signing agreement in accordance with the terms and conditions of the contract attaching herewith, but the work order or the written acceptance by the NAFED of tender will constitute a binding agreement between the NAFED and the Contractors so tendering whether such formal contract is or not subsequently entered into.

9. All compensations or other monies payable by the Contractor to **NAFED** under the terms of this contract may be deducted from the retention money or from any sum that may be or may become due to the Contractor on any account whatsoever and in the event of the retention money being reduced by reason of- any such deductions the Contractor shall within 7 days of being asked to do so make good in cash or cheque any sum or sums which have been deducted from his retention money.

10. In case, where the same item of work is mentioned at more than one place in the Schedule of quantities the lowest of the rates quoted by the Contractor for the item shall be taken for the payment of that item.

**11.** Time is the essence of the Contract. The work should be completed in 180 days (Works to be completed in phased manner) to the Contractor from 7$^{th}$ day of issue of letter of Intent to commence the work. Tenders shall not claim any extension of time. However, the NAFED to its sole discretion may extend the time for completion of work.

**12.** The contractor fails to complete the work by the schedule date of completion or within any sanctioned extended time, he will have to pay liquidated damages for the period that work remains incomplete as per clause no. 1.10.15 of the attached 'General Conditions of Contract.

**13.** The quantities contained in the Schedule are only approximate. The work as actually carried out and done will be measure up from time to time, for which payment will be made subject to the terms and conditions of the Contract.

**14.** Tender shall be valid for period of ninety days **(90 days)** from the date of opening of Technical bid to the NAFED. However, **NAFED** is not bound to accept the lowest or any tender and reserves the right to accept or reject any or all tenders either in whole or in part, without assigning any reason for doing so. The along with their tender.

**NAFED Head (F&V)**
**New Subzi Mandi , Azadpur,**
**New Delhi- 110033**

Signature & Seal of the contractors

*SECTION – IV: LETTER INVITING TENDER*

To, _____
_____
_____
_____

**SUBJECT: Civil, Interior, Furnishing, Plumbing, Electrical, HVAC works of NAFED Building at D-392, New Subzi Mandi, Azadpur Mandi, New Delhi- 110033**

Dear Sir,

**A.** Sealed item rate tenders are invited for the subject work as detailed below:

A copy of tender document with one set of drawings is enclosed for submitting your offer.

Name of work : Civil, Interior, Furnishing , Plumbing , Electrical & HVAC works of NAFED building at Azadpur Mandi ,New Delhi-110033

1. Time for completion of the work **: 180 Days**

2. Earnest Money Deposit (Refundable) : Rs 1,68,000/- by demand draft favor of NAFED ,NEW DELHI only

Important: In case the contractor withdraws his offer within the validity period of the tender, the earnest money deposited along with tender shall stand forfeited.

3. Cost of tender documents (Non Refundable): Rs. 2360- (inclusive of 18 % GST) in form of demand draft in favour of the National Agricultural Cooperative Marketing Federation of India Ltd. Payable at New Delhi in a Separate Sealed Envelope.

4. Tenders to be submitted : **NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi- 110033**

5. **Last date for submission: of tender** **22.11.2023**

6. Date & time for opening: 23.11.2023 at 12.30 PM

**B. CONDITIONAL OFFER**

1. Any tenderer who proposes alterations to any of the conditions, specifications laid down in the tender documents or proposes any new conditions, whatsoever will be liable to be rejected

2. In case any tenderers, in spite of clause 1.0 above proposes any new conditions or proposes alteration to any condition / specifications, which will have financial effect if the condition/alteration are not accepted then at the financial effect plus or minus shall be indicated by the tenderer against each such condition/alteration proposed by the tendered for withdrawal of the condition/alteration, along with his tender offer. No financial effect shall be considered after opening of tender

3. NAFED reserves the absolute right to accept / reject any or all tenders without assigning any reason.

Kindly acknowledge the receipt of this letter with all enclosures and confirm that you will submit your order by due date

4. NAFED reserves the right to increase or decrease the quantity given in the tender. The quantities and drawing given are tentative and can vary and Change as per working drawings supplied for construction/furnishing.

**NAFED Head (F&V)**
**New Subzi Mandi, Azadpur,**
**New Delhi -110033**

**SECTION – V: STANDARD TENDER OFFER**

**NATIONAL AGRICULTURAL COOPERATIVE MARKETING FEDERATION OF INDIA LTD.**

**Item Rate Tender & Contract for Works**

Tender for Civil, Interior, Furnishing , Plumbing , Electrical & HVAC works of NAFED Building at D-392,New Subzi Mandi ,Azadpur Mandi ,New Delhi- 110033

.

To be submitted by _____between _____ hrs. to _____hrs.

Issued to: _____

Signature of the person issuing the documents: _____

Designation: _____

Date of Issue: _____

***TENDER***

1.0 I/We have read and examined the notice inviting tender, Schedule, specifications applicable, Drawings & Designs, General rules and Directions, Conditions of Contract, clauses of contract, Special conditions, Schedule of Quantities & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work. We have also visited the site and are familiar with the surroundings including applicable taxes/GST .

1.1 I/We hereby tender for the execution of the work specified for by **NAFED Head (F&V) New Subzi Mandi,Azadpur, New Delhi-110033** within the time specified in schedule, viz., schedule of quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in General Rules and Directions and the Conditions of contract and with such materials as are provided by and in respects in accordance with, such conditions so far as applicable.

1.2 1/We agree to keep the tender open for ninety days **(90 days)** from the last date of submission of bid and not to make any modifications in its terms and conditions.

1.3 A sum of Rs. 1,68,000/- (Rupees twelve lakhs only) is hereby forwarded in the form of Demand Draft of a Bank as earnest money. If I/we, fail to commence the work specified I/we agree that the said **NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi-110033** or the authorized officer in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely otherwise the said earnest money shall be retained by him towards performance security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered .

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

1.5 I/We agree that should I/we fail to commence the work specified in the above memorandum, an amount equal to the amount of the earnest money mentioned in the form of invitation of tender shall be absolutely forfeited **NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi-110033** and the same may at the option of the competent authority on behalf of The Officiating Secretary, **NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi-110033** be recovered without prejudice to any other right or remedy available in law out of the deposit in so far as the same may extend in terms of the said bond and in the event of deficiency out of any other money due to me/us under this contract or otherwise.

**1.7 Declaration –**

i. I/We have read and understood the terms and conditions given in the Tender Document;

ii. I/We are eligible for award of the contract as per the qualification criteria mentioned in the Tender Document;

iii. I/We have accept and agrees to all the terms and conditions of the Tender;

iv. I/We shall comply with all the terms and conditions of the Tender;

v. All the information / documents provided in his bid are true to the best of my/our knowledge and belief. If at any stage, the information / documents are found to be false, misleading or incorrect then his Bid / Purchase Order shall be cancelled at his cost and risk and I/We shall indemnify the NAFED for the loss caused due to the cancellation and I/We shall be liable for penal / legal action including black listing.

vi. I/We understand that the Institute reserves the right to cancel the Tender at any stage or to cancel / reject any one or more bid without incurring any liability.

Dated…….

**Sign. & Stamp of Contractor**

Postal Address

**Witness:**
Address:

Occupation:

## ACCEPTANCE

The above tender (as mentioned by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of **NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi-110033** for a sum of Rs. …… (Rupees..... )

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

a)
b)
c)

**For & on behalf of NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi-110033**

Dated ……..
Signature/Designation……

**Financial & Technical Parameters:**

| S. No. | Parameters | Remarks |
|---|---|---|
| **1.** | Average Sales Volume of the firm in the last 3 years | **Average financial turnover during the last 3 years, ending 31.03.2023, should be at least 80% of the estimated cost.** |
| 2. | Profit in the previous financial years | **The firm should have earned profit during the last 3 financial years ending 31.03.2023.** |
| 3. | Works executed in the last 5 years | **Experience of having successfully completed similar works during last 5 years ending last day of month previous to the one in which applications are invited should be either of the following: -**<br>**a) One similar work of minimum 80% of estimated cost OR**<br>**b) Two similar works of minimum 50% of estimated cost OR**<br>**c) Three similar works of minimum 40% of estimated cost**<br>**The Contractor should submit work order & completion/Performance Certificate from the previous employer in support of executing similar works failing which the tender shall not be considered.** |
| 4. | Similar Works | **Similar work means civil, electrical, plumbing, mechanical, interior and allied works of same nature / magnitude involving interior furnishing, electrification (low side & high side works) Non-Modular furniture, Air-Conditioning, etc. carried out for Public Sectors Banks/Private Sector Banks/Public Sector Undertakings/Central Govt/ State Govt** |
| 5. | Company Registration | **Contractor should submit their company registration certificate including the details of type of firm i.e Pvt. Ltd. / Proprietorship / Partnership etc.** |
| 6. | PAN No. / GST Registration Certificate | **Copy of PAN & GST Registration Certificate to be submitted.** |
| 7. | Company Details | **Email**<br>**Mobile No.**<br>**Registered office address** |
| 8. | Authority letter | **Name & contact details of the person authorized by the company to deal with NAFED during the execution of job.** |
| 9. | Copies of Registration with SSI/NSIC or ISO 9000 certification | **Enclosed copies (if any)** |
| 10 | Copy of PF/ESI certification | **Enclosed copies (if any)** |

Signature & Seal of the contractors

## MANDATORY INFORMATION

| | |
|---|---|
| Name of Firm | |
| Address of Firm with contact Phone and Mobile No: | |
| Local Address of Firm with contact Phone and Mobile no | |
| Email Id: | |
| PAN No: | |
| Service tax Number | |
| TAN No: | |
| TIN / VAT No: | |
| GST No: | |
| ESI / PF Registration No : | |
| Any other Registration details relevant to the contract | |
| Name of Bank with address: | |
| Branch Code: | |
| Type of Account: | |
| Account No: | |
| 9 Digit MICR Code no: | |

Signature & Seal of the contractors

## SECTION-VI: INSTRUCTION TO TENDERERS

1.0 The tenderer shall examine carefully all the tender documents consisting of:

**TECHNICAL BID**

- Invitation to Tenderers
- Instructions to Tenderers
- General Conditions of Contract
- Special Conditions of Contract
- List of Makes
- Drawings

**FINANCIAL BID**

- Schedule of Quantities

1.1 These shall form part of the agreement.

The tenderer is advised to visit and inspect the site at his own cost and responsibility and to secure all necessary information which may be required for completing the tender. Ignorance of site conditions or local information shall not be considered as an excuse for non-performance of the contract. All costs, charges and expenses that may be incurred by the tenderer in connection with the preparation of his tender shall be borne by him and the NAFED/Architect does not accept any liability whatsoever in this regard.

1.2 Time is the essence of the contract and the tenderers are required to complete the work in all respects within the stipulated time of completion and hand over the same, complete in all respects to the satisfaction of the Architects//NAFAD. Tenders shall not claim any extension of time. However, the NAFAD to its sole discretion may extend the time for completion of work.

1.3 The tender should contain not only the rates but also the value of each item of work entered in the prescribed column of the BOQ and all the items should be totaled up in order to show the aggregate value of the entire tender. The rates quoted by the tenderer should be expressed accurately both in words and figures so that there is no discrepancy. All corrections in the tender shall be duly attested by initials of the tenderers. Corrections if not attested, may entail rejection of tender. The rates quoted by the tenderers in item rate tender will be the basis (and not the amounts in case of discrepancies) in finalizing the tender.

1.4 It shall be clearly understood that the rates quoted in the tender are to be for complete work at site as per instructions to tenderers, conditions of contract, special conditions of contract specifications and drawings, addenda referred to therein and also for all such works as are necessary for the proper completion of the contract although specific mention thereof may not have been made in the specifications or in drawings or in tender documents. The rates shall be firm and shall not be subject to cost

escalation on account of labor and material and labor conditions or any other reason whatsoever.

1.5 The tenderers shall use only the form issued with this tender to fill up the rates.

1.6 Every page of the tender shall be signed on the **bottom of right hand side** and any tender not so completed is liable to be treated as defective and liable to be rejected.

1.7 The successful tenderer will be notified about the acceptance of his tender by the NAFED and he will execute agreement within 7 (seven) days thereof, failing which his tender would be liable to rejection with forfeiture of the Earnest Money and the Owner would be at Liberty to award it to another tenderer.

1.8 The contract will be governed by the Indian Contract Act, Indian Sale of goods Act and all other relevant laws. All payments due to the contractor under the contract will be made in Indian Rupees Currency.

1.9 The rates quoted shall be for complete work at site and should be inclusive of incidentals expenses necessary for carrying out the work. The rates shall be inclusive of Sales Tax if applicable at Delhi for or any other tax or duty levied by any Government or Public bodies. The rates shall be firm and shall not be subject to cost escalation of labor and material and exchange variations, labor conditions or any other conditions whatsoever.

1.10 A schedule of approximate quantities for various items accompanies this tender. It shall be clearly understood that neither the architect nor the NAFED accept any responsibility for the correctness or completeness of this schedule in respect of items and quantities and this schedule is liable to alterations by omission, deduction or additions at the discretion of the Owner in consultation with the architect without violating the terms of the contract.

1.11 The NAFED does not bind itself to accept the lowest or any tender or to assign any reason thereof and also reserves the right of accepting the whole or part of the tender. The part acceptance will not violate the terms and conditions of the contract and will execute the work at the specified rates without any extra charges or compensation.

1.12 Tax deductions will be made as per the prevailing rates from t he contractors on account bills as notified by the var ious govt. authorities.

## 2.0 LOCATION

The site is located in NAFED building D-392,New Subzi Mandi, New Delhi-110033. It is necessary for the tenderer to inspect the site to ascertain the nature of site, access thereto, location, facilities for procurement of material and working: labor rates prevalent in the area, all matters affecting the rates and execution of the work. The tenderer shall be deemed to have full knowledge of the site and drawings whether or not he actually

inspects them. Tenderers must get acquainted with proposed work and study drawings, designs, specifications, conditions of contract and other conditions carefully before tendering. No request of any change in rates or conditions for want of information on any particular point shall be entertained after receipt of the tenders.

3.0 SUBMISSION OF TENDER

3.1 You are request to quote strictly as per the terms and conditions, specifications, standards given in the tender document and not to stipulate any deviations.

3.2 Addenda to this document if issued prior to submission of the tender must be signed and submitted along with the tender document. The tenderer should write clearly revised quantities in "Schedule of Rates" of Tender Document and should price the work based on the revised quantities when amendment for quantities are issued in addenda.

3.3 Tenderers must return all the documents and drawings issued to them, while submission of their tender duly stamped and signed.

4.0 RATES TO BE IN FIGURES AND WORD

The tender shall quote in English both in figures as well as in words the rates and amounts tendered by him in the schedule of rates of each item in such a way that interpolation is not possible. The amount for each item should be worked out and entered and requisite totals given of all items both in figures and in words. The tendered amount for the work shall be entered in the tender and duly signed by the tenderer. The owner shall have the right to carry out arithmetical corrections and the unit rate quoted in words shall be considered for calculations and arriving at the contract sum.

5.0 CORRECTIONS OF ERASURES

All corrections and alterations in the entries of tender papers should be signed in full by the tenderers. Corrections with white fluid and overwriting are not permitted.

6.0 Any printing or typographical errors / omission in tender document shall be referred to the architect and their interpretations regarding correction shall be final and binding on contractor.

7.0 TRANSFER OF TENDER DOCUMENTS
A transfer of tender document purchased by one intending tenderer to another is not Permitted.

8.0 EARNEST MONEY

The tenderer must pay the amount of Earnest Money as mentioned in the Letter Inviting Tender.

8.1 The EMD of the unsuccessful tenderers will be returned without any interest within 30 days, after a decision is taken regarding the award of the Contract..

8.2 EMD of successful tenderer(s) shall be refunded to the successful Tenderer on receipt of Performance Security. If desired by the successful Tenderer in writing, the EMD

may be converted into the Performance security and balance amount shall be deposited by him to complete the Performance Security. Performance Security should remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the Tenderer including warranty obligations..

8.3 The EMD of the Tenderer shall be forfeited in the following circumstances:-

(i) the Tenderer withdraws his bid;
(ii) the tenderer either fails to start the work within a period of 7 calendar days or fails to execute the agreement within 15 days after the receipt of letter of acceptance of tender or the Letter of intent;
(iii) the Tenderer fails to supply goods / services as per the terms of the Tender and Purchase / Work Order.
(iv) any other justified reasons e.g. misleading or wrong information in the Bid, violation of the terms and conditions of the Tender, involvement in forming ring / cartel, submission of multiple bids in different names etc..

9.0 VALIDITY

Tenders submitted by tenderers shall be remain valid for period of ninety days **(90 days)** from the last date of submission of bid to NAFED

10.0 ADDENDA

Addenda to the tender documents may be issued prior to the date of opening of the tenders to clarify documents or to reflect modifications to the design or contract terms or specifications or quantities.

10.1 All addenda issued by the architect shall become part of the tender documents. Tenders shall be opened at the fixed date & timings indicated in the tender forwarding letter, in presence of those tenderers who have submitted tenders & may be present.

11.0 RIGHT TO ACCEPT OR REJECT TENDER

The acceptance of a tender will rest with NAFAD who does not bind itself to accept the lowest tender and reserve to the absolute authority to reject any or all the tender received without assigning any reason reasons.

12.0 TIME SCHEDULE

The time allowed for carrying out the job is 180 days to be reckoned from the date of issue of letter of intent. The site will be handed to the Contractor in phased manner as the building will remain operational during the execution of work. The Contractor needs to complete the works in phased manner. Only after completion one phase subsequent area/phase will be handed over to the Contractor.

The drawings issued along with tender documents are to give fair idea of type of works and for the purpose of bidding only. Working drawings for the purpose of execution of work at site shall be issued to the successful tender only after issue of the work order.

13.0 PRESENTATION

Contractors invited for discussion and shall be required to make a presentation regarding achieving quality, timely completion & safety regulations.

14.0 Contractor shall quote rates in full rupees, not in fractions.

15.0 SIGNING OF THE CONTRACT

The successful tender shall be required to execute agreement on stamp paper of appropriate value in the Performa attached with this tender document within 7 (seven) days from the date of receipt of the notice of acceptance of tender or letter of intent. All cost involved therein shall be borne by the contractor. In the event of failure on the part of the successful tenderer to sign the agreement within the above-stipulated period, the earnest money will be forfeited and acceptance of the tender shall be considered as cancelled

16.0 On acceptance of the tender, the tenderer shall furnish the names, addresses and work experience of his accredited representatives who would be responsible for taking instructions from the architect.

## SECTION VII - GENERAL CONDITIONS OF THE CONTRACT

## DIRECTIONS REGARDING PROCEDURES

In construing these conditions, specifications and Contract Agreement, the following words shall have the meaning here in assigned to them except where the subject or context otherwise requires:

(a) **"Owner"** Shall me **NAFED Head (F&V) New Subzi Mandi, Azadpur ,New Delhi-110033** having its office **at** and shall include his (their) legal representative/s assign/s or authorized officer.

(b) **"Contractor"** Shall mean the individual or firm or company, whether incorporated or not, undertaking the work and shall include legal personal representatives of such individual or the persons comprising such firm or company or the successors of such individual or firm or company and the permitted assignee of such individual or such individual or firm or company.

(c) **"Architect"** Shall mean **SPACE ACE** whose registered office is situated at V-20 A/05, DLF Phase-III, Gurgaon, Haryana-122002. (and shall include his authorized representative) or in the event of his death or termination of his services by the Owner in his sole and unqualified discretion, such other person/persons as shall be provided always that no person subsequently appointed to be Architect under this contract shall be entitled to disregard or over rule any previous decision or direction given or expressed by the Architect specified here in unless otherwise approved by the Owner.

(d) **"Contract"** Means the documents forming the tender and acceptance thereof and the formal agreement executed between the competent authority on behalf of **, NAFED Head (F&V) New Subzi Mandi, Azadpur ,New Delhi-110033** and the Contractor, together with the documents referred to there in including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-in-Charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.

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

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

(ii) The **site** shall mean the Institute's Premises (i.e. Land with Building) at D-392, New Subzi Mandi, Azadpur Mandi, New Delhi-110033 or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.

(iii) **Schedule(s)** referred to in these conditions shall mean the relevant schedule(s).

(iv) **Tendered Value** means the value of the entire work as stipulated in the letter of award of work.

**1.1 General**

The work shall be carried out strictly in accordance with the drawings amplified by the specifications of materials and workmanship given hereunder. The drawings and specifications shall be taken together and shall complement each other. In case of any discrepancy, the following order of preference shall be followed:

(a) Particular Specifications.
(b) Drawings.
(c) CPWD Specifications & DSR 2018.
(d) National Building Code and Relevant IS Provisions.

In case there are no specifications for items shown on the drawings or where items are not exhaustively described, the general specifications of CPWD shall be followed for which nothing extra shall be paid. However the specification should be got approved from the Architect before commencement of work.

**1.2 Drawings and Specifications**

(a) After signing the Contract, the contractor will be given free of charge three prints of all working drawings. The contractor shall make at his own expense any additional copies he requires. One copy of the drawing furnished to the contractor as aforesaid shall be kept by the contractor at site and the same shall, at all reasonable times be available for inspection and use by the Architect and his representatives any by any other person authorized by him in writing.

(b) Such further drawings and instructions including revisions, as the Architect may furnish to the Contractor shall form part of this contract.

(c) Only figured dimensions and detailed drawings shall be followed. The Contractor shall verify all dimensions in the field before any work is started and obtain instructions of the Architect in case of any discrepancy.

(d) The Architect with approval of the NAFED New Delhi Official shall have power and authority to supply to the Contractor from time to time during the progress of the work, such further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of work and the Contractor shall carry out and be bound by the same.

**1.3 Architects Status and Decisions**

(a) Status:

The Architects shall have general supervision and direction of the work. He has authority on behalf of the Owner to stop the work whenever such stoppage may be necessary to ensure the proper execution of the work. The architect shall be the interpreter of the conditions of contract and the judge of its performance.

(b) Decisions:

The Architect shall, within a reasonable time, make decisions on all claims of the contractor and on all other matter relating to the execution & progress of the work or the interpretation of the contract documents. The decisions, opinion or direction of the Architects with respect to all or any of the following matters shall be referred to the NAFED and decision so taken shall be final & binding to the contractor.

i) Variation or modifications of the design.

ii) The quality or quantity of works or the additions/alterations or omissions or substitutions of any work.

iii) Any discrepancy in the drawings or between the drawings and or specifications.

iv) The removal and / or re-execution of any work by the contractor.

v) The dismissal from the work of any persons employed therein.

vi) The opening up for inspection of any work covered up.

vii) The amending the making good of any defects under defects liability period.

viii) Approval of materials and workmanship.

ix) The contractor to provide everything necessary for the proper execution of the work.

(c) Dismissal:

The contractor shall on the report of the architects immediately dismiss from the works within 24 hours any person employed by him for the above work, who may, in the opinion of Architects be incompetent or misconducts himself and such person shall not be re-employed on the works without the permission of the Architects.

**1.4 Extent of Contract**

The contractor shall supply at his own cost all material implements, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work whether original, altered or substituted and whether included in the specifications or other documents forming part of the contractor of the contract or referred to in these conditions or not and which may be necessary for the purpose of satisfying of conditions he is entitled to be satisfied which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply survey instruments and other materials necessary for the purpose of setting out works, and counting weighing and assisting to the measurement or examinations at the any time and from time to time of the work material, failing his so doing the same may be provided by the engineer-in-charge at the expense of the contractor and the expenses may be deducted from any money due to the contractor under the contract from his security deposit or the proceeds of sale thereof. The contractor shall also provide a sufficient portion of fencing and lights required to protect the public from accident, and shall be bound to bear the expenses of defense brought by any person for injury sustained owing to neglect of the above precautions and to pay any damage and costs which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person. In no case, the Owner shall be a party to any such claim/claims and the contractor shall indemnify the Owner against any claim for any person on this account.

**1.5 Assignment or Sub Letting of Contract**

The contractor shall not assign the contract or any part thereof or any benefit or interest therein or there under or any claim arising out of the contract to any other party without the prior written consent of the Owner.

**1.6 Power to make Alterations**

Architect shall have power to make any alterations or additions to the stipulated specifications, drawings, designs, and in instructions that may appeal to him to be necessary or, advisable during the progress of the work and the contractor shall have no claim for compensation on account of such alterations or additions. The contractor shall

be bound to carry out the work in accordance with any instructions which may be given to him in writing signed by the Architect and such alterations shall not invalidate the contract and any 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 same conditions in all respects on which he agreed to do the main work and at the same rates as are specified in the tender for the main work. The time for the completion of the work shall be extended in the proportion that the additional work bears to the original contract work and the certificate of the Architect/ NAFED, shall be conclusive as to such proportions.

## 1.7 WORKS SUBJECT TO APPROVAL OF ARCHITECT

All works to be executed under the contract shall be subject to approval of the architect who shall be entitled to direct at what point or points and in what manner they are to be commenced and from time to time carried on.

## 1.8 Contractors office and Stores

All offices, sheds and stores required by the contractor shall be enacted at his own cost with the prior approval of NAFED or his representative and shall be dismantled and removed upon the completion of the work if so directed within 7 (seven) days of the issue of such intimation.

## 1.9 Urgent Repairs and Urgent works

If by reason of any accident or failure or other event occurring to or in connection with the work or any part thereof either during the execution of the work or during the period of Guarantee, any remedial or other work or repair shall in the opinion of the NAFED HEAD be urgently necessary for security and the contractor is unable or unwillingly at once to do such work or repair, the Owner may on its own get the work done/remedied/repaired as the resident engineer may consider necessary. If the work or repair so done by the Owner is such, which, in the opinion of the Architect the contractor was liable to do at his own expense under the contract, all costs and changes incurred by the Owner in doing so shall on demand be paid by the contractor to the Owner or may be deducted by the Owner from any money due or which may become due to the contract. Provided always that the resident engineer shall soon after the occurrence of any such emergency as may be reasonable notify the contractor thereof in writing.

## 1.10 DIRECTION FOR EXECUTION OF WORK

### 1.10.1 Setting outs

The contractor shall be responsible for the true and proper setting out of the works in relation to the original points, lines and levels of reference given by the architect in

writing and for correctness subject as above mentioned of all the positions, levels dimensions and alignments of all parts of the work and for the provision of all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of the work any error shall appear or arises in any part of the work, the contractor on being required to do so by NAFED HEAD shall at once inform the architect or their representatives. The checking of the work by the architect/representative shall not in any way relieve the contractor from his responsibilities of carrying out the work as per the best practices of construction.

### 1.10.2 Work to be to the satisfaction of the Architect

The contractor shall execute, complete and guarantee the work in accordance with the contract to the satisfaction of the architect and shall comply with their instructions & directions concerning the work.

### 1.10.3 Engagement of Labour

The contractor shall be solely responsible for the labour/ personnel employed and that the personnel provided by the contractor shall and will not make any claim to become employees of the Owner and that there will be no Employee and Owner relationship between the personnel engaged by the Contractor and the Owner.

The contractor shall employ labor in sufficient numbers either directly or through subcontractors, where such subletting is permitted to maintain the required rate of specified in the contract and to the satisfaction of the architect. The contractor shall not employ in connection with the works any person who has not completed his fifteen years of age.

The contractor shall comply with the provisions of the payment of Wages Act, 1936; Minimum Wages Act, 1948; Act, 1947; Maternity Benefit Act, 1961 and Mines Act, 1938, Labor Contract (Regulations & Abolishing) Act or Rules, or any modifications thereof and any other law relating thereto and rules made there under time to time.

The Contractor shall be fully responsible for timely monthly payment of wages and any other dues to the personnel deployed by the Contractor by 7th of every month in presence of official of the Owner, deputed for this specific purpose. Further the Contractor while submitting their bill for payment shall solely and also be responsible

to submit documentary evidence of having submitted ESI and EPF amount (both Owner's and employee's contribution) in the respective account of the worker for the period for which bill is raised, copies of challans and worker's permanent ESI account card/certificate.

The contractor shall indemnify the Owner against any payment to be made under and for observance of the Regulation aforesaid without prejudice to his right to claim indemnity from his sub-contractors.

The contractor shall provide and maintain at his own expenses all rights, guards, fencing and watching when and where necessary or required by the Resident Engineer for the protection of the works or for the safety and convenience of those employed on works or the public.

### 1.10.4 Disruption of Progress

The contractor shall give written notice to the Architect whenever planning or progress of the works is likely to be delayed or disrupted unless any further drawings or order, including a direction, instruction or approval is issued by the Architect within a reasonable time. The notice shall include details of the drawing or order required and by when if is required and of any delay or disruption likely to be suffered if it is late.

If, by reason of any failure or inability of the Architect to issue within a time reasonable in all the circumstances any drawings or order requested by the contractor and the work suffers delay then the architects shall take such delay into account in determining any extension of time to which the contractor is entitled under provisions of contract hereof, however no other compensation will be admissible on this account.

### 1.10.5 Rectification of Defects

If, it shall appear to the Architect or his representative in-charge of the works that any work any has been executed with unsound, imperfect or un-skillful workmanship or material or any inferior description, the contractor shall, on demand, in writing from the Architect specifying the work material or articles complained of shall rectify or remove and reconstruction work so specified in part, as the case may require.

### 1.10.6 Variation in quantity

In case the quantity of any item of the work executed increases or decreases by any amount the quoted item rates would be firm.

**1.10.7 Sampling**

The contractor shall submit the samples of various materials for the approval of the Architect & Owner. The contractor shall use the material only after the approval of the Architect/ Owner. The verification of the material shall be done on random base during the progress of the work in either the following manner:

(a) Random samples would be picked up during execution of work from site & if decided by the Architect/ Owner, it would be sent to one of the approved laboratories for test & quality check. The cost of such tests would be borne by the client.

(b) The Architect/ Owner may direct the contractor to submit the challan of delivery of the material brought at site. It would be on Random based. The Architect may also direct the contractor to submit the copy of the test/verification certificate provided by the manufacturer of that particular material.

**1.10.8 Free Access to work site**

The contractor shall provide all necessary and reasonable facilities and free access to the works and his records at site of work to the Architects, Resident Engineer and their representatives and also to the personnel of the Owner. The Contractor shall also provide facilities and space to the satisfaction of the Architect or his representative and also of the Owner for inspection of any part of work.

**1.10.9 Inspection of work**

All work under or in course of execution or executed in pursuance of the contract shall at all times be open to inspection and supervision of the Architect or his representative and to the personnel and the representatives of the Owner and the contractor shall at all times with reasonable notice or the intention of the Architect or his representatives to visit work shall have been given to the contractor, either himself be present to receive orders and instructions, or have responsible agent duly accredited in writing present for that purpose. Orders to the contractor's agent shall be deemed to have been given to the contractor himself.

**1.10.10 Preparation of Construction Programme Schedule**

As and when sufficient planning information is available, the contractor in consultation with the Architect shall prepare a programme schedule of the activities. Contractor

should prepare bar-charts & articles path method analysis of the light of the tendered quantities and their rates respectively. Under no circumstances shall this schedule be prepared later than one week of finalization of contract. Throughout the work, all programmes, schedules and charts shall be revised wherever any significant change occurs. The contractor shall also submit weekly progress chart to the Architect.

### 1.10.11 Site Order Book

The contractor shall maintain a Site Order Book at the site of the works wherein the instructions of the architect/ Owner or their representatives shall be reasoned. The site order book shall be the property of the Owner and the instructions recorded therein shall be deemed to have the same force and effect as if they had been given to the contractor himself. The contractor or his representative on the site must sign the book in token of his having persuade the orders given therein.

### 1.10.12 Hindrance Register

A Hindrance Register shall be maintained at the site of work wherein the contractor shall notify the items affected and the execution of work, the date on which the delay was cleared. These entries shall be initialed by the Owner /Architect as well.

### 1.10.13 Suspension of Work

The contractor shall on the written order of the Architect/The NAFED HEAD suspend the progress of the work or any part thereof for such time or time and in such a manner as the Architect/ NAFED HEAD may consider necessary and shall during such suspension properly protect and secure the work as considered necessary in the opinion of the Architect/ NAFED HEAD or their representative-in-charge of the work. No compensation shall be payable to the contractor on what so ever account for the suspension of work.

### 1.10.14 Extension of time for completion

Time is the essence of the contract. The owner and the contractor in consultation with the Architects shall agree upon the work progress chart. The chart shall be prepared in direct relation to the time stated in the contract or the works order for completion of the individual items thereof and/or the contract or works order as a whole. It shall indicate the forecast of the dates of commencement and completion of the various trade processes or sections of the work and shall be amended as may be required by agreement between the architects and the Contractor within the limitations of time imposed in the contract.

If the works be delayed:

i.) By force majeure, or
ii.) By reasons of abnormally and bad weather
iii.) By reason of serious loss or damage by fire or
iv.) By reason of civil accommodation local combination of workmen or strike or lockout effecting any of the trades employed on the work or
v.) By reason of delay on the part of contractor or tradesmen engaged by the owner in executing works not forming part of the contract or
vi.) By reason of proceeding taken threatened by or dispute with adjoining or neighboring owners or public authorities arising otherwise, than through the Contractor's own default, or
vii.) By reason of any other cause which in the absolute discretion of Owner is beyond contractor's control

then in any such case the owner may make fair and reasonable extension after obtaining Architect's advice in the completion dates of individual items or groups of items of work for which separate periods of completion are mentioned in the contractor or works order as applicable.

Upon the happening of any such event causing delay, the contractor shall immediately give the notice thereof in writing to the architects with a copy to Owner but shall nevertheless use constantly his best endeavor to prevent or make good the delay and shall do all that may reasonably be required to the satisfaction of the Architect/ Owner to proceed with the works Extension of time shall be granted.

### 1.10.15 Liquidated Damages for Delay

The times and date stipulated in the contract for the completion of the work or any part or stage thereof shall be deemed to be the essence of the contract.

The work shall, throughout the stipulated period of the contract, be carried out with all diligence. If the contractor fails to complete the work within the time prescribed or within the extended time under the contract, he shall pay to the Owner on demand amount without prejudice to other rights and remedies the Owner may have against the contractor, 0.5% (plus GST) of contract price per week or part there of as liquidated damages for such fault, if the work remain unfinished after the stipulated date of completion provided that the total liquidated damages payable shall not exceed 10% of the accepted contract price. The Owner may, without prejudice to any other method of recovery, deduct the amount of such damages from any money due or which become due to the contractor. The recovery or deduction of such damages shall not relieve the contractor from any obligations and liabilities under the contract.

### 1.10.16 Defects Liability Period

The contractor shall be responsible to make good and remedy at his own expense within such period as may be stipulated by the Owner any defect which may develop or may be noticed before the expiry of 12 (twelve) calendar months from the date of completion and intimation of which has been sent to the contractor within seven days of the expiry of the said period.

### 1.10.17 Defacement

If the contractor or his work people, or servants shall break, deface, injure, or destroy any part of a building, or interiors, then the contractor has to rectify the same part at his own expenses to the satisfaction of the Architect.

### 1.10.18 Approval of Materials

The contractor would bring samples of necessary materials as per the directions & would get them approved prior to execution of work from Architect.

## 1.11 SECURITY DEPOSIT

### 1.11.1 Rate of Security Deposit (Retention Money)

The Owner will, at the time of making any payment to the contractor for work done or supply made under the contract deducts 10% of Gross value of each interim bill. The maximum amount of Retention money + Earnest Money shall amount to total Security Deposit.

All compensations or other sums of money payable by the contractor to the Owner in terms of this contract may be deducted from, or paid by, the sale of a sufficient part of his security deposit, or from any sums which may become due to the contractor by the Owner on any account whatsoever, and in the event of his security deposit being reduced by reason of any such deduction or sale as aforesaid, the contractor shall within ten days. Thereafter make good in demand draft, endorsed in favor of the Owner as aforesaid any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof.

The Total Security Deposit on the contract is calculated as under

a) 10.00% to be retained as retention money from each running bill plus EMD amount.

Total Security Deposit shall comprise of --

a) Earnest Money Deposit
b) Retention money deposit @10% of each bill.

50% of the total security deposit to be released after completion of 6 months from issue of virtual completion certificate and balance 50% after completion of balance 6 months of defect liability period

**1.11.2 Forfeiture of Security Deposit**

The above said security deposit shall be liable to forfeiture wholly or in part at the sole discretion of the Architect if the contractor fails to carry out the work or perform or observe any of the conditions of the contract.

**1.11.3 Interest on the Security Deposit**

No interest would be payable by the Owner to the contractor on the security held in deposit.

**1.11.4 Responsibilities for the Structural Adequacy**

The contractor shall comply with the provisions of the contract and with due cares and diligence, execute and maintain the work and provide all labor, including supervision of all works, structural plans and other things whether of temporary or permanent nature required for such execution and maintenance in so far as the necessary for providing these, is specified or is reasonably inferred from the contract. The contractor shall take full responsibilities for the adequacy, suitability and safety at site of all the works and methods of the construction provided.

**1.12 MEASUREMENT**

**1.12.1** All bill supported with measurement details shall be submitted by the contractor to the Architect for all works executed in the previous period and the Architect/Owner or his representative shall verify the requisite measurement for the purpose of having the same verified for the claim as far as admissible.

All measurements to be taken in duplicate and all bills shall be submitted in triplicate along with a contractor's copy of each.

**1.12.2 Final Bill**

Final bill supported with consolidated measurement of the full work executed shall be submitted by the contractor within 30 days of completion of work.

When the final bill has been verified and corrected, the architect will give seven days' notice to the contractor to countersign the bill in token of

acceptance, the contractor shall countersign the bill within the above seven days or intimate in writing his intention to dispute. If the contractor fails to take appropriate action as above within the period prescribed, the bill finalized by the architect or his representative shall be final and binding on the contractor and the contractor shall have no right to dispute the same.

### 1.12.3 Claim for Interest

No claim for interest will be entertained by the Owner with respect to any moneys or balances which may be in its hands owing to a dispute between itself and the contractor or with respect of any delay on the part of the Owner in making interim or final payments or otherwise.

### 1.12.4 Rates for extra Additional, Altered or Substituted work

The rates for additional, altered or substituted work shall be worked out in accordance with the following provisions in their respective order.

i) If the rates for similar additional, altered or substituted work and directly available in the contract for the work, the contractor is bound to carry out the work at the same rates as are available in the contract for the work.

ii) If the rates for additional, altered or substituted work are not directly available in the contract for the work the rates will be derived from the rates for a similar class of work as are specified in the contract for the work.

iii) If the rates for the altered, additional or substituted work cannot be determined in the manner specified in sub-clause (i) to (ii) above, then the contractor shall within three days of the date of receipt of order to carry out the work, inform the Architect of the rate which it is intend ing to charge for such works supported by analysis of the rate or rates claimed (CPWD analysis). Rates finalized and approved by the Architect on the basis of these details will be final and binding. However, the architect by notice in writing will be at liberty to cancel his order to execute such work and arrange to carry it out in such a manner as he may deem advisable, but under no circumstances shall the contractor suspend the work once ordered in writing on the plea of non-settlement of rate.

iv) In case of furniture items, the minor changes I modifications in the design shall not be considered as deviation, and no price adjustment shall be made against the rates agreed to as per the Schedule of Quantities of the contract. For major change in the design of any item of the furniture, the deviation shall be priced by the Architects as Extra, as per above however the decision of the Architects whether the charge /

modification in the design of furniture items is minor or major, shall be final and binding on the contractor.

### 1.12.5 Reimbursement of Variation in Price

Prices and rates quoted by the Tenderers shall be considered as firm for the complete work and entire duration of the contract. No claim for extra payment due to any rise in rates of raw material and labour or due to whatsoever reasons shall be considered, not even for extended period of completion.

## 1.13 GUARANTEES

### 1.13.1 Quality of Work

The contractor shall guarantee that the materials and workmanship are the best of their respective kinds for the service intended and that all items of work will be free from all inherent defects in workmanship and materials. He shall also guarantee that the works will not fail in any respect due to quality of materials, workmanship and methods of construction.

The specifications assume a proper degree of skill on the part of contractor and workmen employed. The contractor shall consult the Architect or his representative, whenever in his judgment variation in the methods of construction or in the quality of material would be beneficial or necessary to fulfill the guarantee is called for. Such variations may be made by the contractor only when authorized by the architect.

### 1.13.2 Rejection

If during the “Period of Guarantee”, any work or material shall fail in any respect to meet the above guarantee, the contractor shall replace such work or material in a condition which will meet the above guarantee, immediately.

### 1.13.3 Cost of Execution of work or repair etc.

All work of repair shall be carried out by the contractor at his own expense if the necessity thereof shall in the opinion of the Architect be due to the use of materials or workmanship not in accordance with the contract or on account of neglect or failure on the part of the contractor to comply with any obligation expressed or complied on the contractor ’s part under the contract.

### 1.13.4 Remedy on Contractor's failure to carry out the work required

If the contractor shall fail to do any such work as aforesaid required by the architect the Owner shall be entitled to carry out such work from/through other person, at the contractor's own cost. The Owner shall be entitled to recover from the contractor the cost thereof or may deduct the same from any money due or that may be come due to the contractor.

### 1.13.5 Certificate of completion of works

On completion of the work, the Contractor shall be furnished with a certificate, but no such certificate be given nor shall the work be considered to have been completed until the contractor shall have removed from the area of the premises (to be distinctly marked by the Architect) in the site plan which, the work shall be executed) all scaffolding, surplus materials and rubbish and clean the dirt from all wood work, doors, windows, walls, floors or other parts of any building, in or upon which the work is to be exe cuted, or of which he may have had in possession for the purpose of the execution hereof. If the contractor shall fail to comply with the requirements of the clause as to the removal of scaffolding, surplus materials and rubbish and cleaning off dirt on or before the date fixed for the completion of the work, the architect may at the expense of the contractor remove such scaffolding, surplus materials, and the contractor shall forthwith pay the amount of all expense so incurred, and shall have no claim in r espect of any such scaffolding or surplus materials aforesaid, except for any sum actually realized by the sale thereof.

## 1.14 RESCINDING/TERMINATE CONTRACT

### 1.14.1 Rescinding Contract

In any case in which under any clause or clauses of this contract the contractor has rendered himself liable to pay compensation amounting to the whole of his security deposit in hand of Owner (whether paid in one sum or deduced by installments) the architect on behalf of the Owner shall have power to adopt any of the following course, as deemed best suited to the interests of Owner.

(a) To rescind the contract (of which rescission notice in writing to the contractor under hand of the architect shall be conclusive evidence), and in which case the security deposit of the contractor shall stand forfeited and be absolutely at the disposal of the Owner.

(b) To employ a new contractor paid by the Owner and to supply materials to carry out the work, or any party of the work, debiting the contractor with the cost of the labour and the price of the materials on site (of the

amount of which cost and price certificate of architect shall be final and conclusive against the contractor) and crediting him with the value of the work done, in all respects in the same manner and at the same rates as if it has been carried cut by the contractor under the terms of the contract. The certificate of the architect 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 of the work of the contractor as shall be unexecuted out of his hands, and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor if the whole work has been executed by him (of the amount of which excess certificate in writing of the architect shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by Owner under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or a sufficient part thereof.

(d) In the event of any of the above courses being adopted by the architect, the contractor will have no claim for compensation of any loss sustained by him by reason of his having purchased any materials, or entered into any engagements made any advances on account of execution of the work or performance of the contract. And in case of the provisions aforesaid, the contractor shall not be entitled to be paid for any work actually performed under this contract unless and until the architect shall have certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

### 1.14.2 Termination of the Contract

If at any time after the commencement of the work the Owner for any reason whatsoever does not require the whole or part thereof as specified in the tender to be carried out, the Owner shall have the right to terminate this Agreement and the NAFED HEAD shall communicate the termination by giving a notice in writing to the contractor.

The contractor shall have no claim to any payment or compensation whatsoever on account of any profit or advantage, which wou ld have derived from the execution of the work in full, but which he did not derive in consequences the full amount of the work not having been carried out.

The Contractor shall not have any claim or compensation by reason of any alterations having been made in the original specification, or the designs and instruction on which shall involve any containment of the work originally contemplated. However, in case of part cancellation, the

Contractor shall be paid such amount as is commensurate to the actual work done by him till such termination notice is received.

### 1.14.3 Jurisdiction

The contractor and its operation shall be governed by the law of India for the time being in force, irrespective of the place of delivery of materials the place of execution of work or place of payment under this contract shall be deemed to have been entered into at New Delhi.

### 1.14.4 Bye Laws of Local Authorities

The contractor shall conform to the provisions of all applicable Government Acts which relate to works and to the regulations and bye laws of any local authorities. The Contractor shall give all such notices required by the said Act or Laws, etc., and pay all fees payable to such authorities and allow for these contingencies in his tendered rates including fees for encroachment, stacking charges, costs of restorations, etc., and all other fees payable to the local authorities. The Contractor shall keep the Owner indemnified against all penalties and liabilities for every breach of any such Act, Rules, Regulations or Bye-laws.

Further the Contractor shall specifically ensure compliance of various Labour Laws/Acts including but not limited to with the following and their re-enactments/amendments/modifications while dealing with the employment of labour such as:

a. The Payment of Wages Act, 1936
b. The Minimum Wages Act, 1938
c. The Workmen Compensation Act, 1923
d. The Contract Labour (Regulations & Abolishing) Act.
e. The Owner's Liabilities Act, 1938
f. Industrial Dispute Act, 1938
g. Maternity Benefit Act, 1961
h. The Employees State Insurance Act, 1948

Safety code, labour welfare Act or rules or any modification thereof any other laws and regulations framed by the Competent Legislative Authorities from time to time.

### 1.14.5 Liasoning & Co- ordination with Local Municipal Authorities

The contractor has to liaison and take any clearance from local authorities like MCD / FIRE / WATER / ELECTRICITY BOARD etc. other authorities for approval to start renovation and during renovation of work including Defect Liability Period if needed. He has to take also any clearance from Delhi Fire Service if needed and NOC and completion certificate from fire service if needed. Including during renovation of work including Defect Liability Period. Only statuary fees will be reimbursed by NAFED for the above mentioned works.

### 1.14.6 Execution of Agreement

Separate agreements for award of work shall be executed between NAFED and the Applicant on Non-Judicial Stamp Paper of Rs. 100/-, to be provided by the Applicant on award of work. The terms and conditions enumerated in the tender shall form the part of the agreement. NAFED reserves the right to change the terms and conditions of the Service Level Agreement post award of the work and terms and conditions of the Service Level Agreement shall prevail over the EOI.

### 1.14.7 **Holiday Listing**

Notwithstanding anything contained in this bid documents, NAFED's policy for Holiday Listing of an Agency mutatis mutandis applies to this agreement and in the event, the agency(s) while discharging its obligations under the Agreement or otherwise, come(s) within the ambit of the said policy, NAFED's at its sole discretion reserves the right to suspend/discontinue dealings or take any curative measures with agency (s) in accordance with the policy in force.

### 21. **Integrity Pact (IP)**

Integrity Pact as decided by NAFED has to be signed by the Applicant as per "Annexure – A".

## SECTION VIII – SPECIAL CONDITIONS OF THE CONTRACT

### 1.1.0 Insurance for Works

The contractor at the time of signing the contract or before commencing the execution of work, without limiting his obligations and responsibilities shall insure the works at his own cost and keep them insured until the virtual completion of the contract against all acts of God including Fire, Theft, Riots, War, Floods etc. with a Nationalized Insurance company in the joint names of the Owner and the contractor (the name of the former being placed first in the policy) for the full amount of the contract. Such policy shall cover the property of the Owner and fees for assessing the claim and in connection with is services generally therein and shall not cover any property of the Contractor or of any sub-contractor or employee.

The contractor shall deposit the policy and receipt for the premiums with the Owner within seven (7) days, from the date of signing of the contract/commencement of the execution of the work or unless otherwise instructed by the Owner. In default of the contractor insuring as provided above, the Owner on his behalf may so insure and may deduct the premiu ms paid from any moneys due on which may become due to the contractor. The contractor shall as soon any claim under the policy is settled on the work reinstated by the Insurance office should elect to do so, proceed with all due diligence with, the completion of the works in the same manner as through the misfortune/accident had not occurred and in all respects under the same conditions of the contract. The contractor in case of rebuilding or reimbursement after accident shall be entitled to such extension of time for completion, as the Owner deems fit.

### 1.1.1 Insurance in respect of damage to persons and property

a. The contractor shall be responsible for all injury to persons, animals or things and for all structural and decorative damage to property which may arise from the operation or neglect of himself or of any approved sub-contractor’s or employees, whether such injury or damage arise from carelessness, accident or any other cause whatsoever in any way connected with the carrying out of this contract. The clause shall be held to include any damage to buildings, whether immediately adjacent or otherwise, and any damage to roads, streets, foot paths, bridges and works forming the subject of this contract by frost or other inclemency of the weather. The contractor shall indemnify the Owner and hold him harmless damage to persons or property as aforesaid and also respect of any claims made in respect of injury or damage under any Acts of Government or otherwise and also in respect of any award of compensation of damages consequent upon such claims.

b. The contractor shall reinstate all damages of every sort mentioned in this clause, so as to deliver up the whole of the contract works complete and perfect in every respect and so as to make good or otherwise sat isfy all claims for damage to the property of third parties.

c. The contractor shall indemnify the Owner against all claims which may be made against the Owner by any member of the public or other third party in respect of works in consequence thereof and shall at his own expense arrange to effect and maintain, until the virtual completion of the contract, with any Nationalized Insurance company in the joint name of the Owner and the contractor against such risks and deposit such policy or policies with the Owner from time to time during the currency of this contract. The contractor shall similarly indemnify the Owner against all claims which may be made upon the Owner whether under the Workman's Compensation Act or any other statute in force during the currency of this contract or at common law in respect of any employee of the contractor or any sub-contractor and shall at his own expenses effect and maintain with an approved office a policy of Insurance in the joint names of the Owner and the contractor against such risks and deposit such policy of policies with the Owner and the contractor against such risks and deposit such policy or policies with the Owner from time to time during the currency of the contract. The contractor shall be responsible for anything which may be excluded from the insurance policies above referred to and also for all other damages to any property arising out of and incidental to the negligent or defective carrying out of this contract. He shall also indemnify the Owner in respect of any costs, charges or expenses arising out of any claim or proceedings and also in respect of any award of or compensation of damages arising therefrom.

d. The Owner shall be at liberty and is empowered to deduct the amount of any damages, compensation costs, charges and expenses arising or occurring from or in respect of any such claim or damage from any sum or sums due to or become due to the contractor including the security deposit.

e. If the contractor fails to comply with the terms of these conditions, the Owner may insure the works and may deduct the amount of the premiums paid from any moneys that may be or become payable to the contractor or may at the option, not release running payment to the contractor until the contractor shall have complied with the terms of this condition.

f. Such insurance whether affected by the Owner or the contractor will not limit or bar the liability and obligation of the contractor to deliver the works to the Owner completed in all respects according to the contract. In case of loss or damage due to any of the aforesaid clause, the moneys payable under any such insurance shall be received and retained by the

Owner until the works are finally completed and such moneys shall then be credited to the contractor in final settlement of accounts.

g. The works shall be executed in close co-ordination with the progress of other work. This being absence of the contract, no claim for idles labor will be entertained.

## 1.2.0. TYPOGRAPHIC OR CLERICAL ERRORS:

The Architect's/Engineer-in-Charge's clarifications regarding partially omitted particulars or typographical or clerical errors shall be final and binding on the Contractor.

## 2.0 SCOPE OF CONTRACT:

Repairing & Renovation work - Structure rehabilitation of the outside members of building, front Facade glazing & ACP cladding, Texture paint (external face), waterproofing of basement with allied civil works, firefighting / alarm system, Toilet renovation of the entire building, Removal of Porta cabins from terrace, CCTV works, Access control works for all floors, fixing of MS grill at windows, Furnishing work includes fixed furniture like workstations, storages, tables & interior works includes flooring, false ceiling, internal and external electrical works including facade lighting , sanitary work , tiling, paneling, Partitions, Electrical wiring and switches, electrical fittings, , DB's, electrical panels , data and voice cabling including hubs etc , outside civil works in facade, driveways, canopies etc , signage etc to make the interiors complete.

The Contractor shall carry out above mentioned works including miscellaneous, electrical works and modification / addition to existing provision with the directions of and to the satisfaction of the Architects and the Owner. The Architects may in their absolute discretion and from time to time, issue further drawings and/or written instructions, details, directions and explanations which are hereafter collectively referred to as "Architect's Instructions" in regard to:

a) The variations or modifications of the design quality or quantity of works or the addition or omission or substitute of any work.
b) Any discrepancy in the drawings or between the Schedule of Quantities and/or drawings and/or Specifications.

(c) The removal and / or re-execution or any works executed by the Contractor.

(d) The removal from the site of any material brought there on by the contractor and the Substitution of any other material there from.

(e) The dismissal from the works of any person / persons employed thereupon.

(f) The opening up for inspection of any work covered up.

(g) The amending and making good of any defects under clause "Removal of Improper Work and Material".

The Contractor shall forthwith comply and fully execute any work comprised in such Architect's Instructions. Directions and explanations given to the Contractor or his representative upon the works by the Architects shall, if involving a variation, be confirmed in writing by the Contractor within 3 days and if not dissented from in writing within further 3 days by the Architect. Such shall be deemed to be the Architect's instructions within the scope of the contract.

If compliance with the Architect's instructions as aforesaid involved work and/or Expenses and/or loss beyond that contemplated by the Contract. Then unless the same were issued owing to some breach of this contract by the Contractors. The Owner shall pay to the Contractor on the Architect's Certificate, the price of the said work (as an extra to be valued as herein after provided) and/or expense and/or loss.

## 3. SCHEDULE OF QUANTITIES:

The Schedule of Quantities unless otherwise stated shall be deemed to have been prepared in accordance with the method of measurements specified in the particular specifications and shall be considered to be approximate. The Owner does not undertake to carry out the whole of work as shown in the drawings and taken in the schedule of quantities and reserves the right to modify the same or any part thereof. The Contractor shall not be allowed any compensations or damages for the work so omitted or cancelled by the Owner. Each tender item should be filled in with the rates and amounts in separate columns and all the sections should be totaled up in order to show the aggregate value of the entire tender. The rates should be filled both in figures and words for each item and in case of discrepancy the rates filled in words shall be considered as correct for the evaluation of tender amount. The initials of the tenderers shall duly attest all corrections in the tender Schedule. Corrections, which are not attested, may entail the rejection of tender.

## 4. SUFFICIENCY OF SCHEDULE OF QUANTITIES:

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the prices stated in the Schedule of Quantities and/or the Schedule of Rate and Prices, which rates and prices shall cover all their obligations under the contract, and all matters and things necessary for the proper completion of the works.

## 5. ERRORS IN SCHEDULE OF QUANTITIES:

Should any error appear in the Schedule of Quantities, other than in the Contractor's prices and calculations, it shall be rectified and such rectification shall not vitiate the contract but shall constitute a variation of the Contract and be dealt with as an authorized extra or deduction.

## 6. CONTRACTOR TO PROVIDE EVERYTHING NECESSARY

The contractor shall provide everything necessary for the proper execution of works according to the true intent and meaning of the drawings, General conditions; specifications

and Schedule of Quantities taken together whether the same mayor may not be particularly shown or described therein, provided that the same can reasonably be inferred therefrom and if the Contractor finds any discrepancy in the drawings or between the drawings, general conditions, specifications and Schedule of Quantities. He shall immediately refer the same in writing to the Architect, who shall decide in consultation with the Owner which shall be followed and their decisions shall be final and binding in the matter.

The Contractor shall supply, fix and maintain at his own cost, during the execution of any works, all necessary centering; scaffolding, staging, planking, strutting, hoarding, watching and lighting by nights as well as by day required not only for the proper execution and protection of the said works, but also for the protection of the public and the safety of any adjacent roads, streets, collars, vaults, pavements, walls, houses, building all other erections, matters or things. The Contractors shall take down and remove any or all such centering, scaffolding, staging, planking, strutting, etc. as occasion shall require or when ordered so to do and shall fully reinstate at his own cost and make good all the matters and things disturbed during the execution of the works to the satisfaction of the Architects.

## 7. AUTHORITIES. NOTICES, PATENT, RIGHTS AND ROYALTIES:

The contractor shall conform to the provisions of the statutes relating to the works, and to the Regulation and bye-laws of any local authority, and or any water, lighting and other Companies and / or Authorities with whose systems and the executed works building proposed to be connected, and shall before making any variation from the drawings or specifications. That may be necessitated, by so conforming give to the Architects written notice with a copy to the Owner specifying the variations proposed to be made and the reason for the making it and apply for instruction thereon. In case, the contractor shall not within ten days receive such instructions, he shall proceed with the work conforming with the provisions regulations or bye-laws in Question.

The Contractor shall bring to the attention of the architect all notices required by the said acts, regulations or bye-laws to be given to any Authority, and pay to such Authority or to any Public Officer all fees that may be properly chargeable in respect of the works and lodge the receipts with the Architect/Owner. .

The Contractor shall indemnify the Owner against all claims in respect of patent rights designs, trademarks or name of other projected rights in respect of any work or material used for or in connection with the works or temporary works and from and against all claims, demands, proceedings damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. The Contractor shall defend all actions arising from such claims, and shall himself pay all royalties, license fees, damages, cost and charges of all and every sort that may be legally incurred in respect thereof

## 8. MATERIAL AND WORKMANSHIP TO CONFORM TO DESCRIPTION:

All materials and workmanship shall, as far as procurable be of the respective kinds specified in the Schedule of Quantities and/or specifications and in accordance with the Architects instructions and the Contractor shall upon the request of the Architect's furnish to them all invoices, accounts, receipts and the other vouchers to prove that the materials comply therewith. The contractor shall at his own cost arrange for and / or carry any test of any materials which the Architect and l o*r* Owner may require.

It will always be the responsibility of the Contractor to select and obtain all materials of good quality from the manufacturers without having any manufacturing defect there

**9. THE SETTING OUT**

The Contractor shall at his own expense set out the works accurately in accordance with plans and to the complete satisfaction of the Architect/Owner. The Contractor shall be solely responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof. If at any time any error in the respect shall appear during the progress or on completion of any part of the work. The Contractor shall at his cost rectify such error if called upon to do so to the satisfaction of the Architect and the Owner. The Architect and/or his representatives shall from time to time inspect the work. But such inspections shall not exonerate the Contractor in any way from his obligations to remedy any defects at his own cost which may be found exist at any stage of the work or after the same is completed.

**10.** The Contractor shall be solely responsible at all times for the use of good quality materials and for doing good workmanship even though the, Owner/Architects have failed to bring to his notice during their inspection of works about use of the some defective materials, and bad workmanship during the execution of the works and after completion of the works. In all cases of faulty execution and finish of the works due to use of faulty, defective and interior materials, used in the works. And due to their bad workmanship Contractor shall be liable for the payment towards damages to the Owner as ascertained by the Architect/Owner and/or he shall have to rectify the same works at his cost.

10. **OPENING UP WORKS:**

The Contractor shall notify the Architect in writing for their inspections of such works/, items to ensure that the same is executed as per specifications or which required to be' measured before covering/concealing the same. After notifying the Architect, he shall await instructions, which shall be given within three days of receipt of such notice. If the Contractor covers up the work, before he has up notified to reinstate all work that may subsequently be, at any time, damaged, on account of any defect or insufficiency of the specifications. The Contractor shall at the request of the architect, within such time as the Architect so desires, open up for inspection any such work, and should the contractor refuse or neglect, to comply with such request, the Owner, through the Architect may employ other workmen. to open up the same. If the said work has been covered up in contravention up of the Architect's instructions, or if, on being opened up. it be found in accordance with the drawings and specifications, or the instructions of the Architect, the expenses of such other workmen shall be borne by and recoverable from the contractor, or may be deducted from any amount due or which may become due to the contractor. IF the work has been covered up after being approved by the Architects/ Owner’s representatives and is uncovered subsequently and be found in accordance with the said drawings and specifications and instructions, then the expenses aforesaid shall be borne by the Owner and be added to the contract sum provided always that in the case of any urgent work so opened up and requiring immediate attention, the Architect shall within three days after receipt of the written notice from the Contractor that the work has been opened, make or cause the inspection thereof to be made, and at the expiration of such time if such inspection shall not have been made, the contractor may cover the same and shall not be required to open it up again, except at the expense of Owner.

## 12. CONTRACTOR'S SUPERINTENDENCE & REPRESENTATIVE ONWORKS:

**12.1** The contractor shall give all necessary personal superintendence during the execution of the works and so long thereafter as the Architect may consider it necessary until the expiration of the "Defects Liability period" as stated in the contract. The Contractor shall meet the Architect or their/his representatives whenever required and so informed by the Architect.

The contractor shall maintain and the represented on site, at his own cost at all times while the work is in progress, by an experienced and qualified Civil Engineer, approved by the Architect and who must thoroughly understand all the trades entailed and be constantly in attendance while the men are at work. The contract's Engineer appointed at the site shall not be removed from the work without the written consent of the Architects / Owner. Any directions explanations, instruction or notices given by the Architect / Owner to such representative shall be deemed to the given to the contractor and shall be binding as such on the contractor.

**12.2** The contractor shall give all necessary personal superintend ence during the execution of the works and so long thereafter as the Architect may consider it necessary until the expiration of the "Defects Liability period" as stated in the contract. The Contractor shall meet the Architect or their/his representatives whenever required and so informed by the Architect.

The contractor shall maintain and the represented on site, at his own cost at all times while the work is in progress, by an experienced and qualified Electrical Engineer, approved by the Architect and who must thoroughly understand all the trades entailed and be constantly in attendance while the men are at work. The contract's Engineer appointed at the site shall not be removed from the work without the written consent of the Architects / Owner. Any directions explanations, instruction or notices given by the Architect / Owner to such representative shall be deemed to the given to the contractor and shall be binding as such on the contractor.

## 13. DISMISSAL OF WORKMEN

The contractor shall on the request of the Architect/ Owner immediately dismiss from the works any person employed thereon who may, in the opinion of the Architect or of the Owner, be unsuitable or incompetent or who may misconduct himself, and such person shall not again be Owner or allowed on the works without the permission of the Architect/Owner as the case may be. The Architects or the Owner shall not enter into correspondence for stating the reason for dismissal of such workman.

## 14. SUB-CONTRACTORS

All Specialists, Merchants, Tradesmen and others executing any work of supplying and or fixing any goods for which prime cost prices or provisional sums are included in the Schedule of Quantities and /or Specifications, who may be nominated or selected by the architect are

hereby declared to be subcontractors employed by the contractor, are herein referred to as nominated subcontractors.

No nominated subcontractors shall be employed on in connection with the works against whom the contractor shall make reasonable objection or (save Where the Architects and Contractors otherwise agree) who will not enter into a contractor providing:

a) The nominated sub-Contractors shall indemnify the contractor/ Owner against the same obligations in respect of the sub -contract as the contractor is bound under this contract for performance of his obligations with the Owner.

b) The nominated sub -contractors shall indemnify the contractor against claims in respect of any negligence by the sub-contractor, his servants or agents or any misuse by him or them of any scaffolding or other plant, the property of the contractor or under any workman's compensation Act in force.

c) Payment shall be made to the nominated sub-contractor within 14 days of receipt of the Architect's Certificate: provided that before any Certificate is issued, the Contractor shall upon request furnish to the Architect proof that a nominated sub- Contractor's account included in the previous certificates have been duly discharged. If however the Owner is called upon to make such payments, the same may be done upon a Certificate of the Architect and deduct the amount thereof from sums due or which may become due to the Contractor.

## 15. UNFIXED MATERIAL

When any materials intended for the works shall have been placed at site by the contractor, such materials shall not be removed there from (except for the purpose of being used on the works) without the written authority of the architect and when the contractor shall have received payment in respect of any Certificate in which the Architect shall have stated that he has taken into account the value of such unfixed materials on the works such materials shall become the property of the Owner and the contractor shall be liable for any loss or damage to any such materials. The payment certified against value of any unfixed materials shall not in any way exonerate the contractor from his obligation the supply of good, quality materials, which may be found to exist at any stage of work even after the same is completed.

## 16. REMOVAL OF IMPROPER WORK AND MATERIAL

The Architects shall during the progress of the works, have power to order in writing from time to time the removal from the works, within such reasonable time/ times, as may be specified in the order, of any materials which in the opinion of the Architect are not accordance with the specifications or the instructions of the Architect, and the substitution of proper materials and the removal and proper re-execution of any work, which has been executed with materials or workman ship, not in accordance with the drawings and specification or instructions, and the contractor shall forthwith carry out such orders at his own cost, In case of default on the part of the contractor to carry out such orders, the Owner shall have to employ and pay other persons to carry out the same and all expense consequent thereon or incidental thereto shall be borne by the Contractor, and shall be recovered or may

be deducted by the Architects/Owner from any money due or nay become due to the contractor

In lieu of correcting work not done in accordance with the contract, the Architect may allow such work to remain and in that case may make allowance for the difference in value together with such further allowance for damage to the Owner, as his option may be reasonable.

## 17. CERTIFICATE OF VIRTUAL COMPLETION:

The Contractor shall intimate in writing to the Architects as and when the works are complete in all respects in order to enable the Architect to intimate the Owner to take possession of the same. The works shall not be considered as virtually completed, until the Architects have carried in writing that the same have been 'Virtually complied'.

The defects liability period shall commence from the date of such Virtual Completion Certificate.

## 18. OTHER PERSONS ENGAGED BY THE OWNER:

The Owner reserves the right to use the premises and any portions of the site for the execution of any work not included in this contract which he may desire to have carried out by other persons, and the Contractor is to allow all reasonable facilities for the execution of such work, but is not required to provide any plant or materials for the execution of such work, except by special arrangement with the Owner. Such work shall be carried out in such a manner as not to impede the progress of the works included in the Contract, and the Contractor shall not be responsible for any damage or delay which may happen to or be occasioned by such work. .

## 19. INSURANCE IN RESPECT OF DAMAGE TO PERSONS AND PROPERTY:

The contractor shall be responsible for all injury to persons. Property or things and for all structural and decorative damage to property which may arise from operation or neglect or default of himself or any Sub-Contractor or of any of his or a Sub- Contractor's employees, whether such injury or damage may arise from carelessness, accident or any other cause whatever in any way connected with the carrying out of this Contract. The Contractor shall report serious accidents to any person working at site including visitors whenever occurring at site of the work, to the Architects *I* Owner. This clause be held to include, interlace any damage to buildings, whether immediately adjacent any otherwise, any damage to roads, streets, footpaths, bridges, or ways otherwise any damages caused to the buildings and works forming the subject of this contract by frost or other inclement weather. The Contractor indemnify the Owner and hold him harmless in respect of all and any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of any claim made in respect in injury or damage under any Acts of Governments or otherwise, and also in respect of any award of compensation or damages consequent upon such claim.

The Contractor shall make good all damages of every sort mentioned in this clause, so as to deliver up the whole of the Contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of third parties.

The contractor shall indemnify the Owner against all claims which may be made against the Owner by his employees or by any member of the public or other third party in respect of anything which may arise in respect of the works or in consequence thereof and shall at his

own cost, effect and maintain until the Virtual Completion of the contract with an approved office, a policy of Insurance in the joint names of the Owner and the contractor against such risks and deposit such Policy or Policies with the architect on the signing of the contract.. The contract shall also indemnify the Owner against all claims which may be made to the Owner whether under the workmen's compensation Act or any other Statute in force during the currency of this contract or at Common Law in respect of any employee of the Contractor or of any Sub- Contractor and shall at his own expense effect and maintain until the Virtual completion of the Contract, with an approved office a Policy of Insurance in the joint names of the Owner and the Contractor against such risks and deposit such policy or policies with the Architects from time to time, during the currency of contract. In default of the contractor insuring the premiums paid from any money due or which may become due to the contractor.

The contractor shall be responsible for anything which may be excluded from the Insurance Policies above referred to and also for all other damages to any property arising out of and incidental to the negligent or defective carrying out of this contract however such damage may be caused.

The contractor shall also indemnify the Owner in respect of any costs, charges or expenses arising out of any claim or proceeding and also in respect of any award or compensation of damages arising therefrom.

The Owner shall be at liberty and is hereby empowered to deduct the amount of any damages. Compensations, costs, charges and expenses arising or occurring from or in respect of any such claims or damages from any sums due or to become due to the Contractor against his pending or future bills.

**20. FIRE INSURANCE**

a) The Contractor shall at the time of signing the contract insure the works and keep them insured until the virtual completion of the contract, against loss or damage by fire and all natural calamities and against all other risks in an office to be approved by the Owner in the joint names of the Owner and Contractor (the name of the former being placed first in the policy) for the full amount of the contract and for further sum if called upon 'to do so by the Architect, the premium of such further sum being allowed to the Contractor as an authorized extra.

Such policy shall cover the property of the Owner only, and shall not cover any property of the Contractor or of any sub-contractor or employees. The contractor shall deposit the policy and receipts for the premiums with the Owner within 10 days from the date of signing the Contract. In default of the Contractor insuring as provided above. The Owner on his behalf may so insure and may deduct the premiums paid from any money due or which may become due to the contractor. The Contractor shall as soon as the claim under the policy is settled, or the work reinstated by the Insurance Office should they elect to do so proceed with all due diligence with the completion of the works in the same manner as though the fire had not occurred and in ask respects under the same conditions of contract. The Contractor in case, of rebuilding or reinstatement after fire, shall be entitled to such extension of time for completion as the architect deems fit in consultation with the owner.

b) The amount so due as aforesaid shall be the total value of the works duly executed and of the contract materials and goods delivered upon the site for use in the works upto and including a date not more than seven days prior to the date of the said Certificate less the amount to be detained by the Owner (as hereinafter provided) and less any installments previously paid under this clause. Provided that such Certificates shall only include the value of the said materials and goods as and from time as they are reasonably properly and not prematurely brought upon the site and then only if property stored and /or protected against weather.

## 21. PAYMENT OF WAGES OF LABOUR BY THE CONTRACTOR

The contractor shall pay to the labor engaged by him in connection with work directly or indirectly through sub-contractors, wages not less than the minimum fixed by the appropriate. Governments Authorities under minimum wages Act, 1946, as amended and shall duly and properly comply with or ensure compliance with, a legislation laws, rules or regulations relating to the Employment of labor. The Contractor shall be liable for any damages or loss caused to the Owner by violation of the provisions of this clause. A violation of this clause shall also be deemed to be a breach of Contract. If the Owner is called upon to make any payment towards wages etc. of the labor employed by the Contractor, the same will be done from the outstanding payments against pending or future bills of the Contractor.

The contractor shall be solely responsible for the labour/ personnel employed and that the personnel provided by the contractor shall and will not make any claim to become employees of the Owner and that there will be no Employee and Owner relationship between the personnel engaged by the Contractor and the Owner.

The Contractor shall be fully responsible for timely monthly payment of wages and any other dues to the personnel deployed by the Contractor by 7th of every month in presence of official of the Owner, deputed for this specific purpose.

Further the Contractor while submitting their bill for payment shall solely and also be responsible to submit documentary evidence of having submitted ESI and EPF amount (both Owner’s and employee’s contribution) in the respective account of the worker for the period for which bill is raised, copies of challans and worker’s permanent ESI account card/certificate.

**22. FAILURE BY CONTRACTOR TO COMPLY WITH ARCHITECTS INSTRUCTION:**

If the Contractor after receipt of writing notice from the Architect requiring compliance with such further drawing and/or Architect's instructions, fails within seven days to comply with the same, the Architect may employ and pay other persons to execute any such work whatsoever as may be necessary to give effect thereto and all costs incurred in connection therewith shall be recoverable from the Contractors by the Owner on a Certificate by the Architect as a debit or may be deducted by him from any moneys due or which may become due to the Contractor.

**23.** If there are any discrepancies omission and errors in meaning or the actual contents of each item of Schedule of Quantities and other conditions of all the tender documents. the reasoning, the opinion and decision given by the Architect shall be taken as final and binding on both parties without any further appeal.

**24. SUSPENSION OF WORKS:**

If the Contractor, except on account of any legal restraint upon the Owner preventing the continuance of the works or on account of any of the causes mentioned in the Clause "Extension of Time", shall suspend works or in the opinion of the Architects, shall neglect fail to proceed with due diligence in the performance of his part of the Contract or if he shall more than once make default in the respects mentioned in clause 23 (removal of improper work and materials), the Owner through the Architect shall have the power to give notice in writing to the Contractor requiring that the works be proceeded within a reasonable manner, and with reasonable dispatch, such notice shall not be unreasonably given and must signify that it purports to be a notice under the provisions of this clause and must specify the acts or defaults on the part of the Contractor upon which it is based. After such notice shall have been given, the Contractor shall not remove the site of works or from any ground contiguous there to any plant or materials belonging to him which shall have been placed thereon for the purpose of the work and the Owner shall have lien upon such plants and materials to subsist from date of such notice being given until the notice shall have been complied with. Provided always that such Hen shall not under any circumstance subsist after the expiration of 30 (thirty) days from the date of such notice given, unless the Owner shall have entered upon and taken possession of the works and site as hereinafter provided.

If the Contractor shall fail seven days after such notice has been given, to proceed with the works as therein prescribed, the Owner may enter upon and take possession of works and site, and of all such plants and materials thereon intended to be used for the works, and the Owner shall retain and hold a been upon all such plants and materials until the work shall have been completed under powers hereinafter conferred upon him.

If the Owner shall exercise the above power, he may engage any other person to complete the works and exclude the Contractor his agents and servants from entry upon or access to the same, except that the Contractor or any person appointed in writing may have access at all times during the progress of the works to inspect, survey and measure the works. Such written appointments or a copy thereof shall be delivered to the Architects before the person appointed comes on to the works and the Owner shall take such steps as in the opinion of the Architect may be reasonably necessary for completing the works, without undue delay of expense using for that purpose the plant and materials above mentioned in so far so they are suitable and adapted to such use.

Upon the completion of the works, the Architect shall certify the amount of the expenses properly incurred consequent and incidental to the default of the Contractor as aforesaid and in completing the works by other persons.

Should the amount so certified as the expenses properly incurred be less than the amount which should have been due to the Contractor upon the Completion of the works by the him. the difference shall be paid to the Contractor by the Owner should the amount of the former exceed the latter, the difference shall be paid by the Contractor to the Owner. The Owner shall not be liable to make any further payments or compensations to the Contractor for or on account of the proper use of the plant for the completion of the works under the provision herein before mentioned other than such payments as is included in the Contract.

After the works shall have been so completed by persons other than the contractor, under the provisions herein before contained, the Architect shall give notice to the contractor to remove his plant and all surplus materials as may not have been used in the completion of the works from the site. If such plant and materials are not removed within a period of 14 days after the notice shall have been given, the Owner may remove and sell the same, holding the proceeding loss the cost of the removal and sale to the credit of the Contractor. The Owner shall not be responsible for any loss sustained by the Contractor from he sale of the plant and materials etc. in the event of the Contractor not removing it after notice.

## 25. PRIME COST AND PROVISIONAL SUMS:

a) Where 'Prime Cost (P.C.) prices or provisions sums of money are provided for any goods or works in the specifications or Schedule of Quantities, the same are exclusive of any trade discounts, or allowances, discount for cash or profit which the Contractor may require and for carriage and fixing.

b) All goods or work for which prime cost prices or provisional sums of money are provided may be selected or ordered from any manufacturers or firms, at the discretion of the Architect or the Owner. The Owner reserves to himself the right of paying directly for any such goods or work and the Architect may deduct the said prices or sums from the amount of the Contract. Should any good or works for which prune cost prices or provisional sums are provided or portions of same shall not be required, such prices or sums, together with the profits allowed for the same and such additional amount as the contractor may have allowed for carnage and fixing will be deducted in full from the amount of the Contract. Whether the goods be ordered by the Contractor or otherwise the Contractor shall, at his own cost fix the same, if called upon to do so, and the Contractor shall also receive and sign for such goods and be responsible for their safe custody as and from the date of their delivery upon the works.

c) In case in which provisional quantities of materials are contained in the Contract, the Contractor shall provide such materials to such amounts or to greater or lesser amounts as the Architect shall direct in writing at the net rates at which he shall have priced such items in his Schedule of Quantities. Should, however, any such items be entirely omitted, which omissions shall be at the Architect's discretion, no profit on such items shall be allowed to the Contractor.

d) No Prime cost sum or sums (or any portion thereof) shall be included in any certificate for payment to the Contractor until the receipted accounts relating to them have been produced by the Contractor to the Architect. Such accounts shall show all discounts and any sum or sums in respect of such discounts shall be treated as a trade discount. Provided always, that should the Contractor in lieu of producing such receipted accounts, request the Architect in writing to issue a certificate on the Owner for such sum or sums due either on account or in settlement to a sub-contractor direct, the Architect shall, upon satisfying himself that the sub-contractor is entitled to the same, to issue the certificate and sum or sums be deducted from the amount of the

Contractor, at the settlement of accounts and any profit or sum to which the Contractor is properly entitled, in respect of such sub-contract, and which is in conformity with the terms of contract as though the amount of such certificates, to the sub-contractor had been included in a certificate drawn in favour of the Contractor.

e) If the Contractor neither produces the receipt nor give authority to the Architect to issue a certificate in favor of such sub-contractor direct, the Architect may upon giving the Contractor seven days' notice in writing of his intention to do so, issue to the sub-contractor such certificate direct to the Owner and obtain a receipt from the sub-contractor which receipt shall he deemed a discharged for the amount, of such certificate as thought, given by the contractor In such event, the Contractor shall not be allowed any profit he may have added in the Schedule of Quantities upon such sub-contract,

f) The exercise of the option referred to herein-before by the Contractor and the issue of Certificate, as before described to sub-contractor upon the Contractor's request or the issue to the sub-contractor direct of certificates by the Architect, shall not, however, relieve the Contractor from any of the liabilities in respect of insufficient, faulty or incomplete work of the sub-contractor for which he may be liable under the terms of the contract.

g) If any provisional items are provided for work of a nature usually carried out by the Contractor in the ordinary course of their business, the Owner shall give the Contractor an opportunity of tendering for the same without prejudice to the Owner's right to reject the lowest or any tender.

## 26. CERTIFICATES AND PAYMENTS:

The Contractor shall be paid by the Owner from time to time, by installments under Interim Certificates to be issued by the Architect on the bills submitted by the Contractor in the Performa prescribed by the Architect/Owner on account of the work executed when in the opinion of the Architect, work to the approximate value, named in the Appendix as 'Value of Work for Interim Certificates (or less at the reasonable discretion of the Architects) has been executed in accordance with this Contract.

The Payment shall, however, to a retention of the percentage of such value named in the Appendix hereto mentioned as 'Retention Percentage until the total amount, retained shall reach the sum named in the appendix as 'Total Retention Money' after which time the installments shall be upto the full value of the work subsequently so executed. The Architects may in their discretion include such amount, as they may consider proper on account of materials delivered upon the site by the Contractor for use in the work.

And when the works have been virtually completed and the Architect shall have certified in writing that they have been completed. The Contractor shall be paid by the Owner in accordance with the Certificate to be issued by the Architect the sum of money named in the Appendix as 'Installment after Virtual Completion', being a part of the said Total Retention Money.

The Contractor shall be entitled to the payment of the final balance in accordance with the final certificate to be issued in writing by the Architect/ Owner at the expiration of the period referred to as 'The Defects Liability Period' in the Appendix hereto from the date of Virtual Completion or as soon after the expiration of such period as the works shall have been finally completed and all defects made good according to the true intent and meaning hereof, whichever shall happen, provided always that the issue by the Architect of any certificate during the progress of the works or at or after the completion shall not relieve the Contractor from his liabilities in cases of fraud, dishonesty or fraudulent concealment relating to the works or materials or any matter dealt with in the certificate, and in case of all defects and

insufficiency in the works or materials which reasonable examination would not have disclosed. No certificate of the Architect shall of itself be conclusive evidence that any works or materials to which it relates are in accordance with the contract.

The Architect shall have power to withhold any Certificate if any works or any parts thereof are not being carried out to his satisfaction. The Architect may be any certificate makes any correction in any previous certificate, which shall have been issued by him.
All efforts shall be made so that invariably the payment upon the Architect's Certificates are made within the period named in the Appendix as Period of Honoring of Certificates after such certificates have been delivered to the Owner. Notwithstanding the aforesaid, the Owner shall have a right to withhold payment of pending of future bills of the Contractor if there is any demand from his workers for payment of wages etc. which he is legally bound to pay, and adjust, the same against such bills and release the balance amount, if any, to him.

**27. NOTICE IN WRITING:**

Written Notices for the Owner, the Architect, or the Contractor may be served personally or otherwise proved to have been received or sent by registered post to the-last known place of abode or business of the party to whom the same is to be given or in the case of a Company or Corporation, Notices may be served at or sent by registered post to the Registered Offices of the Company or Corporation.
Any notice sent by registered post shall be deemed to be served at the time, when in the ordinary course of post it would be delivered.

For any dispute as regards valuing, the final amount to be paid to the contractor in connection with the Contractor's final bill, amount and value of the all authorized extra items, the decisions of the Architects shall be considered as absolute, final and binding to both the parties without any further appeal.

That the responsibility of procuring various items of materials which will require to be incorporated in the works will be that of the Contractor. No material for incorporation of the work including Cement shall be issued to the Contractor by the Owner.

The Contractor shall indemnify the Owner against any loss caused (at any time during the execution of the said works, or during the Defects liability Period after completion of the said works), on account of defective workmanship in works and on account of use of the materials which are not as per Specification in the said works referred to in this Contract, even though they received the payments from the Owner against the same works.

**28. MATTERS TO BE FINALLY DETERMINED BY THE ARCHITECT**:

The Architect's decision opinion, direction certificate (except for payment) with respect to all or any of the matters mentioned under clause 2 (scope of contract), 6 (contractor to provide everything necessary)**,** 14 (sub-contractors), 15 (unfixed material), 24(suspension of works), 38 (measurements of works).

**29. SETTLEMENT OF DISPUTES AND DIFFERENCES:**

Any dispute, difference, controversy or claim ("Dispute") arising between the Parties out of or in relation to or in connection with this Tender / Contract, or the breach, termination, effect, validity, interpretation or application of this Tender / Contract or as to their rights, duties or liabilities hereunder, shall be addressed for mutual resolution by the authorized official of the parties. If, for any reason, such Dispute cannot be resolved amicably by the Parties, the same shall be referred to the sole arbitration of NATIONAL AGRICULTURAL COOPERATIVE MARKETING, FEDERATION OF INDIA LTD.or any other person appoint the ted by him as Sole Arbitrator. The provisions of the Arbitration and Conciliation Act, 1996 or any statutory modifications on re-enactment thereof as in force will be applicable to the arbitration proceedings. The venue of the arbitration shall be at New Delhi. The cost of the Arbitration proceedings shall be shared equally by both the parties. The language of the arbitration and the award shall be English. The decision / award of the arbitrator shall be final and binding.

**30. SERVICE OF NOTICE TO CONTRACTOR:**

Any notice to be given to the Contractor under the terms of the contract shall be served by sending the same by post to or leaving the same at the address of the Contractor as shown on the tender form.

**31. SERVICE OF NOTICE ON OWNER:**

Any notice to be given to the Owner under the terms of the contract shall be served by sending the same by post to or leaving the same at the Owner's registered office.

**32. PRICES ARE FIRM AND NOT SUBJECT TO ANY VARIATION:**

All rates and prices in this contract are firm for the entire period of contract. No price escalation or de-escalation or adjustment to the contract price or rates of item shall be made in respect of any increase or decrease after the submission and/or acceptance of tender, in the prevailing market rates of labor or materials etc on account of any reason, statutory or otherwise, which may result in an increase or decrease of the cost in carrying out the work. The accepted agreement rates for various items are taken as including all the above and firm for the entire period of contract.
All liabilities that may arise due to any statutory increase in the cost of labour and/or material shall be borne by the Contractor till the entire completion of work and nothing extra shall be paid.

**33. WATER:**

Water shall be made available to the Contractor free of cost at one point in the premises and the Contractor shall have to make his own arrangements for carriage / storage of water.

**34. ELECTRICITY:**

The Owner will provide D.G Set to contractor for usage, but diesel to be procured by the contractor at his own arrangement and cost for which no extra payment shall be paid by the Owner and contractor may also arrange for his own electrical backup at the time of failure of D.G set. Temporary light points required in working area will be provided by the Contractor at his own cost in consultation with the Architect at site. The tender rates shall be quoted accordingly by the contractor.

**35. ELECTRICIAN:**

The contractor shall maintain at site-licensed electrician to ensure that the electrical work is earned out properly and no accident takes place. The electrician will work in close coordination with the Architect.

**36. PROVIDENT FUND AND E.S.I.S.**

The contractor shall bear full liability for payments under provident fund and employees State Insurance Scheme and other labor laws for his workers and staff.

**37. SHOP DRAWINGS:**

All furniture shop drawings, electrical drawings, route drawings and furniture samples to be got approved from the architect before execution after completion of work the contractor has to submit three sets of hard copy and one set of soft copy in AutoCAD of electrical route drawings , position for maintenance purpose. The cost of above to be included in the tender of respective items.

**38. MEASUREMENTS OF WORKS:**

The Architects/Owner may from time to time intimate the Contractor that they require the works to be measured jointly and the contractor shall forthwith attend or send a qualified agent to assist the Architects/Owner or their representatives in taking such measurements and calculations and to furnish all particulars or give all assistance required by either of them.

Should the contractor not attend or neglect or omit to send such an agent then the measurements taken by the Architects/Owner shall be taken to be correct measurements of the works- The measurements. Unless otherwise stated, shall be taken in accordance with the 'method of measurements' mentioned in the particular specifications. In case of any dispute arises in the 'Method of measurements' then the final decision given by the Architects regarding the method of measurement shall be

Taken to be correct and final by the Contractor and the Owner. The contractor or his agent may at the time of measurement take such notes and measurements as he may require.

All authorized extra works, omissions and all variations made without the Architect's knowledge, if substantially sanctioned by him in writing shall be included in such measurements.

39. In case of failure to supply the goods / services of the ordered quantity / specifications / quality in the time schedule and at the agreed rates, the Owner shall have right to purchase the same from the market at the prevalent rate and the difference between the agreed price and purchase price would be adjusted with the Retention Money / Security deposit of the Contractor or recovered from the Contractor. Further, if the supplied items are not in accordance with the ordered items then the Owner reserves the right to reject the whole lot or accept, whole or part supply, at less than the agreed / market price. Any loss to the Employee on this account shall be adjusted with the Retention Money / Security deposit of the Contractor.

40. Black-Listing – Tenderer would be also being liable to be black-listed under following circumstances: -

- Giving false, misleading or fake information / document in the tender / bid;
- Withdrawing the bid after opening of the Financial bids;
- Refusal to accept Work / Purchase Order at the quoted prices;
- Failure to supply goods of the ordered quantity / quality / specifications at the agreed rates within the time schedule;
- Adoption of any unethical or illegal practices;
- Any other justified reason.

AGREMENT (on Rs 100 non Judicial stamp paper):

**NAFED Head (F&V) New Subzi Mandi, Azadpur , New Delhi-110033**
AND

M/s_____

THIS AGREEMENT is entered into on_____, 2023.

**BETWEEN**

A. **NATIONAL AGRICULTURAL COOPERTIVE MARKETING FEDERATION OF INDIA LTD.** , having its principal office at NAFED Ashram Chowk, New Delhi {Hereinafter referred to as the **"Owner"** which expression shall, unless repugnant to the context or meaning thereof, include its administrators, successors and assigns} of First Part;

**AND**

B. **M/s_____**, having its principal office at _____ (hereinafter referred to as **"Contractor"** which expression shall, unless repugnant to the context or meaning thereof, include its successors and permitted assigns and substitutes) of the Second Part.

**AND**

C. **M/s. Space Ace,** V-20A/05, DLF PHASE-III, Gurgaon, Haryana -122002 through its partner/Director Shri _____Architect (hereinafter, called and referred to as the '**Architects'** shall deemed to include its successors and permitted assigns) of the Third Part.

The Owner and the Contractor and the Architects are hereinafter, collectively referred to as the "**Parties**" and individually as a "**Party**".

FOR : INTERIOR-FURNISHING, ELECTRICAL & OTHER ALLIED WORKS AT D-392, NAFED OFFICE BUILDING AT AZADPUR MANDI, NEW DELHI-110033

at the accepted tendered cost for Rs _____

(Rupees_____) subject to the executed and verified quantities

***WHEREAS**:*

WHEREAS the Owners desirous of furnishing including structural glazing of the building **NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi-110033** and for that purpose have selected the Architects for furnishing including structural glazing of the building **NAFED Head (F&V) New Subzi Mandi, Azadpur, New Delhi-110033** and for that purpose the Architects and the Owner have entered into a Service Agreement dated [●].

WHEREAS, the Owner is desirous of employing a Contractor for civil/interior –furnishing /electrical and other allied works, more specifically stated in the Technical Bid Documents which has been annexed and is a part of the Service Agreement dated [●].

WHEREAS, the Owner after going through the various tenders submitted by various contractors and after having being satisfied by the various representations made by the **[PLEASE INSERT THE NAME OF THE CONTRACTOR WHOM YOU WOULD SELECT],** have decided to select **[NAME OF THE CONTRACTOR]** as Contractors for Contractor for civil/interior –furnishing /electrical and other allied works to be done at the Building of Institute of Company Secretaries of India located at **NAFED Head (F&V) New Sabzi Mandi,Azadpur ,New Delhi-110033**

AND WHEREAS, the Contractor having represented that it has the capability and the diligence and the infrastructure to meet the obligations and the responsibilities and carry out works specified in Tender document (Annexure of this Contract) which they submitted on [●] and was accepted on [●], the Contractor has decided and is willing to undertake all the obligations and the responsibilities have been appointed as Contractor for civil/interior –furnishing /electrical and other allied works to be done at the Building of Institute of Company Secretaries of India located at **NAFED Head (F&V) New Sabzi Mandi, Azadpur, New Delhi-110033**

Now therefore this Agreement witnessed that Contractors, in consideration of the payment to be made by the Owner of the fees as per the terms and conditions of this Agreement and the Tender Document dated **[●]**and under the general supervision of the Architect, will perform and render all services in connection with the furnishing including structural glazing of the

aforesaid Building, subject to the terms and conditions in this Agreement and such specialized professional services as are described in this Agreement.

## 1. TIME SCHEDULE

The time allowed for carrying out the job is 180 days to be reckoned from the date of issue of letter of intent. The site will be handed to the Contractor in phased manner as the building will remain operational during the execution of work. The Contractor needs to complete the works in phased manner. Only after completion one phase subsequent area/phase will be handed over to the Contractor.

The drawings issued along with tender documents are to give fair idea of type of works and for the purpose of bidding only. Working drawings for the purpose of execution of work at site shall be issued to the successful tender only after issue of the work order.

## 2. SCOPE OF WORK:

Repairing & Renovation work - Structure rehabilitation of the outside members of building, front Facade glazing & ACP cladding, Texture paint (external face), waterproofing of basement with allied civil works, firefighting / alarm system, Toilet renovation of the entire building, Removal of Porta cabins from terrace, CCTV works, Access control works for all floors, fixing of MS grill at windows, Furnishing work includes fixed furniture like workstations, storages, tables & interior works includes flooring, false ceiling, internal and external electrical works including facade lighting, sanitary work, tiling, paneling, Partitions, Electrical wiring and switches, electrical fittings, DB's, electrical panels, data and voice cabling including hubs etc., outside civil works in facade, driveways, canopies, signages etc. to make the work complete.

The Contractor shall carry out above mentioned works including miscellaneous, electrical works and modification / addition to existing provision with the directions of and to the satisfaction of the Architects and the Owner. The Architects may in their absolute discretion and from time to time, issue further drawings and/or written instructions, details, directions and explanations which are hereafter collectively referred to as "Architect's Instructions" in regard to:

d) The variations or modifications of the design quality or quantity of works or the addition or omission or substitute of any work.
e) Any discrepancy in the drawings or between the Schedule of Quantities and/or drawings and/or Specifications.
f) The removal and / or re-execution or any works executed by the Contractor.
g) The removal from the site of any material brought there on by the contractor and the Substitution of any other material there from.
h) The dismissal from the works of any person / persons employed thereupon.
i) The opening up for inspection of any work covered up. The amending and making good of any defects under clause "Removal of Improper Work and Material".

The Contractor shall forthwith comply and fully execute any work comprised in such Architect's Instructions. Directions and explanations given to the Contractor or his representative upon the works by the Architects shall, if involving a variation, be confirmed in writing by the Contractor within 3 days and if not dissented from in writing within further 3 days by the Architect. Such shall be deemed to be the Architect's instructions within the scope of the contract.

If compliance with the Architect's instructions as aforesaid involved work and/or Expenses and/or loss beyond that contemplated by the Contract. Then unless the same were issued owing to some breach of this contract by the Contractors. The Owner shall pay to the Contractor on the Architect's Certificate, the price of the said work (as an extra to be valued as herein after provided) and/or expense and/or loss.

**3. GOVERNING LAW AND JURISDICTION:**

This agreement shall be constructed and interpreted in accordance with the laws of India. All disputes and difference of any kind whatsoever arising out of or in connection with this contract shall be deemed to have arisen in New Delhi and only courts having jurisdiction over Delhi shall determine the same.

**4. MEASUREMENT AND PAYMENTS**

All bills ( maximum of 6 bills including final bill @ minimum Rs 14.0 lacs each leaving final bill) supported with measurement details shall be submitted by the contractor fortnightly to the Architect for all works executed in the previous period and the Architect / Director, Institute of Company Secretaries of India, New Delhi or his representative shall verify the requisite measurement for the purpose of having the same verified for the claim as far as admissible, if possible before the expiry of 15 days from the presentation of the bill.

All measurements to be taken in duplicate and all bills shall be submitted in duplicate along with a contractor's copy of each.

Part or complete Payment will be made by the National Agricultural Cooperative Marketing Federation of India Ltd. only on satisfactory completion of work in full / part thereof and value of work executed shall be determined, based on the measurements and check measurements checked by Architect / Institute of Company Secretaries of India, New Delhi and certificate given by the Architect.

**5. Engagement of Labor**

The contractor shall be solely responsible for the labour/ personnel employed and that the personnel provided by the contractor shall and will not make any claim to become employees of the Owner and that there will be no Employee and Owner relationship between the personnel engaged by the Contractor and the Owner.

The contractor shall employ labor in sufficient numbers either directly or through subcontractors, where such sub letting is permitted to maintain the required rate of specified in the contract and to the satisfaction of the architect. The contractor shall not employ in connection with the works any person who has not completed his eighteen years of age.

The contractor shall comply with the provisions of the payment of Wages Act, 1936; Minimum Wages Act, 1948; Act, 1947; Maternity Benefit Act, 1961 and Mines Act, 1938, Labor Contract (Regulations & Abolishing) Act or Rules, or any modifications thereof or any other law relating thereto and rules made there under time to time.

The Contractor shall be fully responsible for timely monthly payment of wages and any other dues to the personnel deployed by the Contractor by 7th of every month in presence of official of the Owner, deputed for this specific purpose. Further the Contractor while submitting their bill for payment shall solely and also be responsible to submit documentary evidence of having submitted ESI and EPF amount (both Owner's and employee's contribution) in the respective account of the worker for the period for which bill is raised, copies of challans and worker's permanent ESI account card/certificate.

The contractor shall indemnify the Owner against any payment to be made under and for observance of the Regulation aforesaid without prejudice to his right to claim indemnify from his sub-contractors.

The contractor shall provide and maintain at his own expenses all rights, guards, fencing and watching when and where necessary or required by the Resident Engineer for the protection of the works or for the safety and convenience of those employed on works or the public.

## 6. FINAL BILL:

Final bill supported with consolidated measurement of the full work executed shall be submitted by the contractor within 1 month of completion of work.

When the final bill has been verified and corrected, the Architect will give seven days notice to the contractor to countersign the bill in token of acceptance, the contractor shall countersign the bill within the above seven days or intimate in writing his intention to dispute. If the contractor fails to take appropriate action as above within the period prescribed, the bill finalized by the architect or his representative shall be final and binding on the contractor and the contractor shall have no right to dispute the same.

**7. CLAIM FOR INTEREST:**

No claim for interest will be entertained by the Owner with respect to any moneys or balances which may be in its hands owing to a dispute between itself and the contractor or with respect of any delay on the part of the Owner in making interim or final payments or otherwise.

**8. RATES FOR EXTRA ADDITIONAL, ALTERED OR SUBSTITUTED WORK:**

The rates for additional, altered or substituted work shall be worked out in accordance with the following provisions in their respective order.

I.) If the rates for similar additional, altered or substituted work and directly available in the contract for the work, the contractor is bound to carry out the work at the same rates as are available in the contract for the work.

II.) If the rates for additional, altered or substituted work are not directly available in the contract for the work the rates will be derived from the rates for a similar class of work as are specified in the contract for the work.

III.) If the rates for the altered, additional or substituted work cannot be determined in the manner specified in sub-clause (i) to (ii) above, then the contractor shall within three days of the date of receipt o f order to carry out the work, inform the Architect of the rate which it is intending to charge for such works supported by analysis of the rate or rates claimed (CPWD analysis). Rates finalized and approved by the Architect on the basis of these details will be final and binding. However, the architect by notice in writing will be at liberty to cancel his order to execute such work and arrange to carry it out in such a manner as he may deem advisable, but under no circumstances shall the contractor suspend the work once ordered in writing on the plea of non-settlement of rate.

IV.) In case of furniture items, the minor changes I modifications in the design shall not be considered as deviation, and no price adjustment shall be made against the rates agreed to as per the Schedule of Quantities of the contract. For major change in the design of any item of the furniture, the deviation shall be priced by the Architects as Extra, as per above however the decision of the Architects whether the charge / modification in the design of furniture items is minor or major, shall be final and binding on the contractor.

## 9. REIMBURSEMENT OF VARIATION IN PRICE:

Prices and rates quoted by the Tenderers shall be considered as firm for the complete work and entire duration of the contract. No claim for extra payment due to any rise in rates of raw material and labour or due to whatsoever reasons shall be considered, not even for extended period of completion.

## 10. PREPARATION OF CONSTRUCTION PROGRAMME SCHEDULE:

As and when sufficient planning information is available, the contractor in consultation with the architect shall prepare a programme schedule of the activities. Contractor should prepare bar-charts & articles path method analysis of the light of the tendered quantities and their rates respectively. Under no circumstances shall this schedule be prepared later than one week of finalization of contract. Throughout the work, all programmes, schedules and charts shall be revised wherever any significant change occurs. The contractor shall also submit weekly progress chart to the architect.

## 11. BYE LAWS OF LOCAL AUTHORITIES:

The contractor shall conform to the provisions of all applicable Government Acts which relate to works and to the regulations and bye laws of any local authorities. The contractor shall give all such notices required by the said Act or Laws, etc., and pay all fees payable to such authorities and allow for these contingencies in his tendered rates including fees for encroachment, stacking charges, costs of restorations, etc., and all other fees payable to the local authorities. The contractor shall keep the Owner indemnified against all penalties and liabilities for every breach of any such Act, Rules, Regulations or Bye-laws.

Further the Contractor shall specifically ensure compliance of various Labour Laws/Acts including but not limited to with the following and their re-enactments/amendments/modifications while dealing with the employment of labor such as:

I. The Payment of Wages Act, 1936
II. The Minimum Wages Act, 1938
III. The Workmen Compensation Act, 1923
IV. The Contract Labor (Regulations & Abolishing) Act.
V. The Owner's Liabilities Act, 1938
VI. Industrial Dispute Act, 1938

VII. Maternity Benefit Act, 1961
VIII. The Employees State Insurance Act, 1948

Safety code, labor welfare Act or rules or any modification thereof or any other laws and regulations framed by the Competent Legislative Authorities from time to time.

**12. LIAISONING & CO- ORDINATION WITH LOCAL MUNICIPAL AUTHORITIES:**

The contractor has to liaison and takes any clearance from local authorities like MCD / APMC, Azadpur other authorities for approval to start renovation and during renovation of work including Defect Liability Period if needed. He has to take also any clearance from Delhi Fire Service if needed and NOC and completion certificate from Delhi fire service if needed. Including during renovation of work including Defect Liability Period. Only statuary fees will be reimbursed by NAFED

**13 TERMINATION OF THE CONTRACT**

If at any time after the commencement of the work the Owner for any reason whatsoever does not require the whole or part thereof as specified in the tender to be carried out, the Owner shall have the right to terminate this Agreement and Owner's hall communicate the termination by giving a notice in writing to the contractor.

The Owner without prejudice to any other remedy, reserves the right to terminate the agreement in whole or in part by giving 30 days' notice in writing in case Contractor fails to discharge its obligation under this agreement without sufficient grounds or found guilty for breach of condition(s) of the agreement, negligence, carelessness, inefficiency, fraud, mischief and misappropriation or any other type of misconduct by Contractor or by its staff or agent.

Any pending or unresolved operational issues, performance, unpaid fees and any other remedies shall continue by the Contractor during the period of termination notice and the same must be satisfied before this agreement is terminated. The Owner may also put in place any other agency/contractor for carrying out the remaining work and expenditure incurred on same shall be recovered from the Contractor.

The contractor shall have no claim to any payment or compensation whatsoever on account of any profit or advantage, which would have derived from the execution of the work in full, but which he did not derive in consequences the full amount of the work not having been carried out.

The Contractor shall not have any claim or compensation by reason of any alterations having been made in the original specification, or the designs and instruction on which shall involve any containment of the work originally contemplated. However, in case of part cancellation, the Contractor shall be paid such amount as is commensurate to the actual work done by him till such termination notice is received.

## 14. CONTRACTOR'S SUPERINTENDENCE & REPRESENTATIVE ON WORKS:

The contractor shall give all necessary personal superintendence during the execution of the works and so long thereafter as the Architect may consider it necessary until the expiration of the "Defects Liability period" as stated in the contract. The Contractor shall meet the Architect or their/his representatives whenever required and so informed by the Architect.
The contractor shall maintain and the represented on site, at his own cost at all times while the work is in progress, by an experienced and qualified Civil Engineer , approved by the Architect and who must thoroughly understand all the trades entailed and be constantly in attendance while the men are at work. The contract's Engineer appointed at the site shall not be removed from the work without the written consent of the Architects / Owner. Any directions explanations, instruction or notices given by the Architect / Owner to such representative shall be deemed to the given to the contractor and shall be binding as such on the contractor.

The contractor shall give all necessary personal superintendence during the execution of the works and so long thereafter as the Architect may consider it necessary until the expiration of the "Defects Liability period" as stated in the contract. The Contractor shall meet the Architect or their/his representatives whenever required and so informed by the Architect.
The contractor shall maintain and the represented on site, at his own cost at all times while the work is in progress, by an experienced and qualified Electrical Engineer, approved by the Architect and who must thoroughly understand all the trades entailed and be constantly in attendance while the men are at work. The contract's Engineer appointed at the site shall not be removed from the work without the written consent of the Architects / Owner. Any directions explanations, instruction or notices given by the Architect / Owner to such representative shall be deemed to the given to the contractor and shall be binding as such on the contractor.

## 15. OWNER

Owner shall mean **NAFED Head (f&v) New Sabzi Mandi,Azadpur ,new delhi-110033** and shall include his (their) legal representative / s assign/s or authorized officer.

**16. Consultant/Architect appointed to monitor the work along with giving clarifications and decisions**

Consultant/Architect shall mean M/s Space Ace whose registered office is situated at V-20 A/05, DLF Phase-III, Gurgaon, Haryana-122002. (and shall include his authorized representative) or in the event of his death or termination of his services by the Owner any consultant or person whose authorization to act as consultant for the project would be given by the Owner .

**17. Quality of Work**

The contractor shall guarantee that the materials and workmanship are the best of their respective kinds for the service intended and that all items of work will be free from all inherent defects in workmanship and materials. He shall also guarantee that the works will not fail in any respect due to quality of materials, workmanship and methods of construction.

The specifications assume a proper degree of skill on the part of contractor and workmen employed. The contractor shall consult the Architect or his representative, whenever in his judgment variation in the methods of construction or in the quality of material would be beneficial methods of construction or in the quality of material would be beneficial or necessary to fulfill the guarantee called for. Such variations may be made by the contractor only when authorized by the architect.

**19. SECURITY DEPOSIT**

A. Rate of Security Deposit (Retention Money)

The Owner will, at the time of making any payment to the contractor for work done or supply made under the contract deducts 10% of Gross value of each interim bill. The maximum amount of Retention money + Earnest Money shall amount to total Security Deposit.

All compensations or other sums of money payable by the contractor to the Owner in terms of this contract may be deducted from, or paid by, the sale of a sufficient part of his security deposit, or from any sums which may become due to the contractor by the Owner on any account whatsoever, and in the event of his security deposit being reduced by reason of any such deduction or sale as aforesaid, the contractor shall within ten days. Thereafter make good in demand draft, endorsed in favor of the Owner as aforesaid any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof.

**Total Security Deposit: -**

The Total Security Deposit on the contract is calculated as under

b) 10.00% to be retained as retention money from each running bill plus EMD amount.

Total Security Deposit shall comprise of --

c) Earnest Money Deposit
d) Retention money deposit @10% of each bill.
50% of the total security deposit to be released after completion of 6 months from issue of virtual completion certificate and balance 50% after completion of balance 6 months of defect liability period.

B. Forfeiture of Security Deposit

The above said security deposit shall be liable to forfeiture wholly or in part at the sole discretion of the Architect if the contractor fails to carry out the work or perform or observe any of the conditions of the contract.

C. Interest on the Security Deposit

No interest would be payable by the Owner to the contractor on the security held in deposit.

**20. Compliances of Law:-**

A. Contractor shall carry out the Work and Services in strict compliance with all relevant laws and regulations of the State or Territory within India where the Work and Services are being rendered and in accordance with the conditions of any permit, license or concession relating to any part of the Work and Services, whether held by Contractor, Employee or Architect.

B. Contractor shall indemnify and hold Owner harmless from and against any liability, penalty, cost or expense suffered or incurred as a result of Contractor failing to comply with any law, or regulation, or such permit or license relating to any part of the Work and Services."

**21. Intellectual Property Rights**

Contractor shall ensure that it holds all necessary patents, license rights and other proprietary rights required in respect of any device or method used by it while conducting the Work and Services under this agreement. Contractor shall indemnify and hold the Owner harmless from and against any liability, penalty, cost or expense suffered or incurred as a result of Contractor failing to comply with this obligation.

## 22. Indemnity

a. The contractor shall at all times during the agreement and thereafter, indemnify and keep indemnified the Institute, its officers, employees and representatives, from all or any claims, losses, demands, damages, etc., which the Institute, its officers, employees and representatives may or are likely to suffer by reason of acts, defaults, deeds, things, omissions and commissions committed by the contractor, while performing the conditions of this agreement.

b. The indemnifying party shall be granted immediate and complete control of any claim of indemnity and the indemnified party shall not prejudice the indemnifying party's defence of the claim.

c. The indemnified party shall give the indemnifying party all reasonable assistance at the expense of the indemnifying party on such claim of indemnity.

## 23. FORCE MAJEURE

The Parties shall not be liable for any failure to perform, any of its obligations under this Agreement if the performance is prevented, hindered or delayed by a Force Majeure event (defined below) and in such case its obligations shall be suspended for so long as the Force Majeure Event continues. Each party shall promptly inform the other of the existence of a Force Majeure Event and shall consult together to find a mutually acceptable solution.

"Force Majeure Event" means any event due to any cause beyond the reasonable control of the Party, including, without limitation, unavailability of any communication system, sabotage, fire, flood, explosion, acts of God, civil commotion, strikes or industrial action of any kind, riots, insurrection, war or acts of government.

## 24. Confidentiality of Information

a. During the term of this Agreement and thereafter, any disclosing party's Confidential Information received by the receiving party, under and by virtue of this Agreement, shall be maintained in the strictest confidence and trust and shall not be disclosed to a third party without the prior written consent of the disclosing party, unless such information is required to be disclosed in pursuance of the order of a competent court, tribunal or other regulatory authority exercising valid jurisdiction, in which case the party required to make the disclosure shall promptly notify the other Party in writing of such disclosure. For purposes of this agreement "Confidential Information" means information that: (i) is sufficiently secret to derive economic value, actual or potential, from not being generally known to other persons who can obtain economic value from its disclosure or use; and / or (ii) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy or confidentiality.

b. Any software / hardware material, product specifications, financial information, documents covered under this agreement shall be confidential information and deemed to be in private domain and it shall not be made public or shared with any other party without the prior written consent of the Owner. All such information/material shall be treated as confidential for a minimum period of two years after this agreement comes to an end or as agreed from time to time.

c. Provided that upon the expiration, cancellation, or termination of this Agreement, each party shall, upon the written request of the other party, return or destroy, to the satisfaction of the other Party, all Confidential Information, documents, manuals and other materials specified by the other Party.

d. Service provider shall sign Non-Disclosure Agreement with the NAFAD for confidentiality of the data and information/records of the NAFAD.

**25. Blacklisting**

The Owner may by notice in writing blacklist the Contractor for suitable period in case Contractor fails to discharge its obligation under this agreement without sufficient grounds or found guilty for breach of condition(s) of the agreement, negligence, carelessness, inefficiency, fraud, mischief and misappropriation or any other type of misconduct.

**26. Dispute Resolution:-**

Any dispute, difference, controversy or claim ("Dispute") arising between the Parties out of or in relation to or in connection with this Contract / Agreement, or the breach, termination, effect, validity, interpretation or application of this Contract / Agreement or as to their rights, duties or liabilities hereunder, shall be addressed for mutual resolution by the authorized official of the parties. If, for any reason, such Dispute cannot be resolved amicably by the Parties, the same shall be referred to the sole arbitration of the Officiating Secretary of the Institute of Company Secretaries of India or any other person appointed by him as Sole Arbitrator. The provisions of the Arbitration and Conciliation Act, 1996 or any statutory modifications on re-enactment thereof as in force will be applicable to the arbitration proceedings. The venue of the arbitration shall be at New Delhi. The cost of the Arbitration proceedings shall be shared equally by both the parties. The language of the arbitration and the award shall be English. The decision / award of the arbitrator shall be final and binding.

**27. Independent Contract & Relationship between the Parties**

The relationship of Contractor to NAFAD under this Agreement shall be that of an independent contractor. The acts/performance and actions taken by either party in furtherance of their respective activities of operation shall not bind the other except to the extent provided under this Agreement. The acts performed and action taken by either party that do not fall under the Agreement shall have binding effect on the other to the extent they are reduced to writing and the prior consent of the other party is obtained.

**28. Non-Exclusive Agreement**

The agreement between the parties is a non-exclusive agreement and parties are free to enter into any such agreement with any other person or agency during currency or the extended currency of this Agreement.

**29. Complete / Entire Agreement:**

This Agreement, its Attachments, if any, and the documents specifically referred herein constitute the complete Agreement between the Parties and replace any written or oral Agreement or understanding with respect to the subject matter. Changes, amendments or interpretations of this Agreement shall be valid only if they are in writing and signed by both parties, except that each Party may make a change of domicile or change of the name of the person to whom notifications shall be sent. This notification shall be made through a written document to the other Party to this Agreement.

**30. Representations and Warranties**

The Parties represent and warrant that they have relevant authority and permission under the applicable laws/ rules/ notifications or by virtue of the order/ instruction/ directive from the relevant authority to enter into this Agreement.

**31. Non Waiver:**

Failure to exercise by either party of any right under this Agreement in one or more instances shall not constitute a waiver of those rights in another instance. Such waiver by one Party of any of the rights established herein shall not be considered as a waiver of another right established herein. A provision or right under this agreement shall not be waived except in writing signed by the party granting the waiver, or varied except in writing signed by all the parties.

**32 Severability**

If any provision of this agreement is held invalid, unenforceable or illegal for any reason, this agreement will remain otherwise in full force apart from that provision(s) which shall be deemed deleted.

**33. Assignment & Sub-Letting**

The contractor shall not assign, delegate, transfer, etc., any of their right/s and / or obligation/s under this agreement to any third person/s, concern/s, firm/s, company/ies or entity/ies.

**34. Alteration and Modification**

Any alteration or modification or waiver in connection with this agreement will not be effective unless made in writing and signed by the parties.

**35. Headings:**

The headings used in this Agreement are for purposes of convenience only and shall not control the language or meaning of the provision following.

**36. Precedence:**

In the event of any ambiguity or doubt or dispute on the terms and conditions applicable, the order of precedence for the purposes of resolving such ambiguity, doubt or dispute shall be:

(1) This Agreement
(2) The Attachments (if any)
(3) The Purchase / Work Order
(4) The Offer / RFP / Tender

**The filled BOQ (financial Bid) and signed original tender documents (technical bid) would be part of this Agreement.**

SIGNED, SEALED AND
DELIVERED
For and on behalf of
NAFAD HEAD
by:

(Signature of the Director)

In the presence of:
1.
2

SIGNED, SEALED AND
DELIVERED
For and on behalf of
M/s Space Ace

In the presence of:
1.
2

SIGNED, SEALED AND
DELIVERED
For and on behalf of
Contractor
by:

**TECHNICAL SPECIFICATIONS FOR INTERIORS**

I. GENERAL

The measurement of the works executed shall be as per IS-1200 (latest) or as given along with the item.

This specification is for work to be done, items to be supplied and materials to be used in the works as shown and defined in the drawings and described herein, all as specified and to the entire satisfaction of the Owner/Architect.

The workmanship is be of highest standards. Use of specialized tradesmen in all respects of the work, and allowance must be made in the rates for so doing.

The materials and items to be provided by the Contractor shall be the best of their respective kinds as approved by the Owner/Architect and in accordance with any samples which may be submitted for approval and in accordance with the specifications. Where materials or products are specified in this specification and/or bill of quantities by the name of the manufacturer or the brand, trade name of catalogue reference, the contractor will be required to obtain the approval of the Owner/ Architect before using the materials and also produce all invoices, vouchers or receipted accounts for any materials if called upon to do so by the Owner/Architect. Samples of all materials are to be submitted to the Owner/Architect for their approval before the contractor orders or delivers in bulk to the site, samples, together with their pickings, are to be provided free of charge by the contractor and should any materials be rejected they will be removed from the site of work at the contractor's own expense. All samples will be retained by the Owner/Architect for comparison with materials which will be delivered at site subsequently. Also, the contractor will be required to submit specimen finished of colors, fabrics, etc., for the approval of the Owner/Architect before proceeding with the works.

1.0 **TEAK WOOD / EUROPEAN STEEM BEECH**

The teak wood should be of the best quality available in India such as ivory coast teak wood It should be free from saps, knots, warps, cracks and other defects. All woodwork shall be planned neatly and truly finished to the exact dimensions. All joints shall be neat and strong, truly and accurately fitted and glued before being fitted together. All exposed wood shall be melamine polished and should be of 1st quality.

1.1 Timber is to be of the best of its kind, properly seasoned, of mature growth free from wormholes, saps, wraps, cracks and other defects.

2.0 PLYWOOD

Plywood should be equal or superior quality as laid down in is 303-1989 premium quality, resin bonded, weather proof, close grained suitable for veneering, painting, polishing or bonding plastic laminate.

A "strip of solid ivory coast teak wood wood glued or detailed as shown in Architect's drawings shall lip exposed edges of plywood. The thickness shall be as mentioned in the drawings. The contractor shall obtain the approval for the preference of the brand name from the Owner/Architect as per the approved list.

The samples collected randomly cut from each of the boards selected shall be subjected to the tests specified as under:

a) Glue Adhesion: Plywood when tested in accordance with is 1734 (Part 4): 1983 shall have an average and a minimum individual shear strength not less than as specified in the respective IS code.

b) Water Resistant test: The plywood when tested in accordance with Is 1734 (Part 6}: 1983 shall have an average and min. individual shear strength not less than as specified in the respective IS code.

c) Moisture Content test: The plywood when tested in accordance with IS 1734 (Part 1) L 1983 shall have a moisture content not less than 5% and not more than 15%.

d) Procedure of Edge Straightness: The straightness of the edges and ends of plywood shall be verified against a straightedge not less than the full length of the plywood. If the edges on the end of the plywood is convex, it shall be held against the straightedge in such a way as to give approx. equal gap at each end. The largest gap between the straight edge and the edge shall be measured to the nearest millimeter and record.

e) Procedure for square ness: The square ness of plywood shall be checked with a 1200mm x 1200mm square, by applying one arm of the square to the plywood. The maximum width of the gap shall be recorded.

Each plywood shall be legibly and indelibly marked or stamped with the following:

Indication of the source of manufacture Year of manufacture
Batch No. and type of grade.

## 3.0 **LAMINATE**

Laminate shall be of the brand, catalogue surface finish, colour as specified and approved by the Owner/Owner. Plastic laminates must not be applied to timber with moisture content of more than 12% and a temperature of less than 6 degree C.The bonding agent shall be an approved adhesive, used in strict accordance with the manufacturer's instructions. Rubber based adhesives shall in no case be used.

## 4.0 **NAILS, SPIKES & BOLTS**

Nails, spikes and bolts shall be of the best quality galvanized mild steel or wrought iron and of lengths and weights approved by the Owner/Architect. Nails shall comply with IS 1959-1960 or equivalent approved quality sample. Bolts heads nails are comply with B.S.

1494. Brass screws where specified shall comply with B.S. 1210. Wire staples shall comply with B.S. 1494 or equivalent. The contact surfaces of dowels.tenons, wedges etc., shall be glued with an adhesive complying with the requirements of one of the following I.S. Specifications or such approved adhesive, C.P. brass/steel screws of Nettle fold make.

## 5.0 **GLUE**

Where glued joinery and carpentry work is likely to come into contact with moisture, the glue shall be waterproof. The use of animal glues will not be permitted.

## 6.0 **TIMBER**

Timber is to be cut to the required sizes and lengths as soon as practicable after the works are begun and stored under cover, so that the air circulates freely around it. Any portions that warps or develops shakes or other defects thereafter, are to be framed and finished in a proper and workman like manner. In accordance with the detailed drawings, weight where required and fitted with all necessary metal ties, bolts, screws, etc.

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

Timber shall be wrought on all sides, free from large knots, splayed as required. plugged and fixed to walls, etc. at l'-6" centers with G.I. screws and fastners.

Wood plugs are to be cut on the twist. Patent wall plugs or plastic filling may be used in lieu of wood plugs with the approval of the Owner/Architect.
The counters, shelving etc. shall be constructed of plywood as described and specified, properly housed, grooved, tongued, glued, blocked and screwed together, and entirely to the satisfaction of the Owner/Architect.

## 7.0 **JOINERY**

Joinery is to prepared immediately after the placing of the-contract, framed up.bonded and wedged up. Any portions that warp or develop shakes or other defects are to be replaced before wedging up.

The entire work is to be framed and finished in a proper and workman like manner, in accordance with the detailed drawings, and fitted with all necessary metal ties, straps, bells, screws, glue etc. as required. Running bonded joints are to be cross tongued with teak/cedar tongues and where over 1" thick, double cross tongued with teak/cedar tongues. Jointer's work generally is to be finished with fine glass prepared surfaces unless otherwise specified. Should joints in jointer's work open, or other defects arise within the period stated for defects liability period in the contract, and the cause thereof be deemed by the Owner/Architect to be due to unseasoned timber or faulty or bad workmanship, such defective joinery shall be taken down, refitted, redecorated and/or replaced if necessary and any work disturbed shall be made good at the Contractor's expense. The Contractor shall be responsible for providing and maintaining any boxing or other temporary coverings required for the protection of dressed or finished work if

left unprotected till the final handover. Contractor is to clean out all shaving, cut ends and other waste from all parts of the works before coverings or in fillings are constructed.

The hardware throughout shall be of approved manufacturer and brand name, well made and equal in every respect to the samples to be deposited with the Owner/Architect. The contractor may he required to produce and provide samples from many different sources before the Owner/Architect are able to make a decision and the contractor should allow in his rates for doing so.

Aluminum fittings shall have powder coated satin chrome or anodised finish, of 20-22 micron (min.) thickness unless otherwise specified and shall be suitable for their intended purposes.

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

Cover up and protect the brass and bronze surface with a thick grease or other suitable protective material, renew as necessary and subsequently clean off and clear away on completion.

## 8.0 **GLAZIER**

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

Polished plate glass shall be 'glazing glass' (G.G.) quality. That for mirrors shall be 'Silvering quality' (S.Q.) conforming to IS 3438-1965 or as per approved samples and quality.

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

In Cutting glass, proper allowance be made for expansion. Each square of glazing to be in one whole shoot.

On completion, clean all glass inside and out, replace all cracked, scratched or broken panes and leave in good condition to the satisfaction of the Owner/Architect.

For any location the largest possible size of glass is to be used i.e. with minimum joints, unless otherwise mentioned in the drawings. Location of joints is glass are to be to the entire satisfaction of Architect/Owner.

## 9.0 PAINT AND POLISHING

All material required for the works shall be of specified and approved manufacture, delivered to the site in the manufacturer's containers with the seals, etc., unbroken and are to be clearly marked with the manufacturers name or trademark with a

description of the contents and colour. All materials are to be stored on the site to the works.

Spray painting with approved machines will be permitted only if written approval has been obtained from the Owner/Architect prior to painting. No spraying will be permitted in the case of priming coats nor where the soiling of adjacent surface is Likely to occur.

The nozzle and pressure *to* be so operated as to give an even coating throughout to the satisfaction of the Owner/Architect. The paint used for spraying is to comply with the specifications concerned and is to be specifically prepared by the manufacturer for spraying. Thinning of paint made for brushing will not be allowed.

10.0 Wood preservative: All unexposed surface of timber framing; backs of door frames, cup board framing, grounds etc. are to be treated with salignum or other equal approved impregnating wood preservative. All woodwork is also to be treated with fire retardant paint and antitermite treatment.

All brushes, tools, pots, kettles etc. used in carrying out the work shall be clean and free from foreign matter and are to be thoroughly cleaned out before being used with a different type or shade of material.

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

Surfaces of new woodwork, which shall be painted, are to be cleaned down, knotted and stopped for the approval of the Owner/Architect.

Surfaces of new woodwork which shall be painted are to be cleaned down to remove dirt, grease etc. Minor areas of defective paint shall be removed by scraping back to a firm edge and the exposed surface toughed in with primer as described and stopped with putty.

Where woodwork has been previously painted or polished and is to be newly polished, the existing finish shall *be* completely removed by scraping, burning off or rubbing down as required.

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

GENERAL SPECIFICATION FOR INTERIORS

## GENERAL

The Contractor is advised to study all the drawings in details including the intent of the design. All clarifications necessary should be sought by the Contractors, prior to filling in the tender.

All the work shall be carried out in best workmanship like manner and wherever, specifications for any item are not given, the relevant Indian Standard Institution specifications shall be applicable.

Generally, the make as approved in the list of approved makes and materials shall be insisted upon, except for any reason valid and appropriate in the opinion of both Architect and Owner. No. Extra cost is liable to be entertained for any variations in the basic cost of material.

## MATERIALS

All commercial ply or block board shall be as per preferred make. All exposed ply block board edges shall have lipping of as directed.

When ply/teak board is used for panelling, partitions, furniture etc. the same shall be of straight matching grains only. (Group Match to 6 ply)

## SCREWS

All screws shall be of best quality chromium plated brass or steel screws of nettle fold make.

## PROCEDURE OF WORK

The contractor shall arrange the operations that are convened and agreed to ply the Architect/Owner. He shall adhere to the time schedule presented by him and agreed to by the Architect/Owner and shall complete ail works allotted to him in time, giving best workmanship to construction/manufacturing jobs to the entire satisfaction of the Architect/Owner.

## BUILT *IN* JOINERY

Where joinery work is specified to be built-in, it shall be the responsibility of the contractor to ensure that the joinery works are set in plumb and true in Sine and shall not be damaged or displaced by subsequent operations.

## PROTECTION OF WORK

The contractor shall he responsible for the temporary erection of doors a nd closing of openings necessary for the protection of the work during progress. He shall also provide a nd maintain any ot her temporary covering required for the protection of finished / unfinished wood work that may be damaged during the progress of the work if left unprotected and at his own expenses.

**MAKE GOOD DEFECTIVE WORK**

The contractor shall be responsible for the shrinkage or warping or any other defects, which may appear in any joinery work. All deductive damaged work shall be taken down and renewed or repaired to the satisfaction of the Architect/Owner without any extra charges.

**FURNITURE**

All furniture shall he in accordance with the drawings and the sample piece as approved by the Architect/Owner. The Contractors shall first prepare a sample piece and the same shall be got approved from the Owners to their entire satisfaction. The contractor will be expected to do all the modifications to the sample for which no claim will be entertained. Glue used shall be superior synthetic quality such as Fevicol *etc.* Wherever mitred joint are used, dovetailing shall be introduced.

**BRICK WORK**

Bricks shall be of class designation - 75 of standard specifications as per approved sample and shall be laid in 1:3 cement sand mortar (1 cement 3 coarse sand.) Cement to be used shall be of approved make and sand shall be sharp, clean, free from organic and foreign matters. Bricks shall be fully soaked in clear water for a period of 12 hrs. Prior to use. Bricks shall be well-bonded and laid in true level and plumb. Mortar joints shall not exceed 6mm in thickness and joints shall be fully filled with mortar. All joints should be raked and faces of wall cleaned at the end of each day's work. The brickwork shall be kept wet for atleast 10 days after laying.

**PLASTERING**

Joints of brickwork shall be raked out to a depth of 18mm and the surface of the wall shall be washed and kept wet for two days before plastering. The cement, plaster shall be of 1:4 (1 cement: 4 coarse sand) proportion of 12mm thickness to be applied in three coats finished to t rue smooth and uniform surface by float and trowel. The work shall be tested frequently with a straight edge and plumb U C O BANK Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered. The plaster shall be kept wet for atleast 10 days. Any defective plaster shall be cut out in rectangular shape and replaced.

**FALSE CEILING**

Neat, cutting in false ceiling for provision of light fittings, AC supply and return grills shall be left and all the such openings shall he provided with additional frame work. The false ceiling shall be in complete level and edges in perfect alignment. . As per manufacturer's specifications. IS: 2095 - 1982 and 2542 - 1981

**FLOORING**

It shall be laid with minimum possible joints with recommended adhesive in required quantity.

**REJECTION / WASTAGE**

All rejections and wastage in process and in final stages, will be to the contractor's account.

**PAINTING, OIL/ENAMEL /PLASTIC EMULSION ETC**.

Ready mixed oil paints. flat oil paint, plastic emulsion paint, ready mixed synthetic enamel paint, aluminium paint etc. shall be brought in original containers and in sealed tines. If for any reasons a thinner necessary, the brand and quality of the thinner recommended by the manufacturer or as instructed by the architect shall be used. The surface shall be prepared as specified and a coat of approved primer shall be applied. After 24 hours drying , approved or specified quality paint shall be applied evenly and smoothly. A filler putty coating may be given to give a smooth finish. Each coat shall be allowed to *dry* out thoroughly and then lightly rubbed down with sand paper and cleaned of dust before the next coat is applied. The number of coats shall be as specified in the item and if the finish of the surface is not uniform additional coat as required shall be applied to get good uniform finish at no extra cost. After completion no hair mark from the brush or clothing of paint, puddles in the corners of panels, endless of the moulding etc. shall be cleaned off from stains. When the final coat is applied the surface shall be roiled with a roller or textured to a special texture finish as approved by the architect as per sample to be prepared before start, of work.

Spectrum spray coat plaster/paint to be applied over the prepared surface i.e. finished in POP. The coat to be applied as per the specification of the manufacturers.

. Primer of following materials to be applied:

a) Wood work: White or pink wood primer

b) Steel work: Red oxide zinc chromates

Mode of measurement of painting on following material shall be as follows:

a) *Wood Work:*

For melamine polish on woodwork no separate measurement shall be made. All items of woodwork include the cost of polishing.

b) *Walls:*

For 2 or more coats of wall emulsion paint (applied with roller) the surface area shall be measured.

c) *Steel work:*

For 2 or more coats of enamel paint applied with brush. All items inclusive of paint work except existing windows.

tl) *Dry Distemper :* IS 427 : 1965

**PARTICULAR SPECIFICATIONS FOR INTERIORS**

1. For all cupboards, wall cabinets, tables credenzas, drawers etc all vertical surfaces exposed to view to have 1.0mm thick laminate, all horizontal top usable surfaces shall have 1mm thick laminate unless otherwise mentioned in the BOQ.
2. All non laminated non veneered surfaces shall be enamel painted with synthetic enamel paint (two or more coats) in stain of approved shade matching to the exterior finish or of shade and make approved by the Owner / Architect after a priming coat and anti termite paint coating. The cost of such painting is deemed to be included in the rate of the item.
3. Al1 unexposed surface of all partition / panelling / wood work / framework to be treated with one coat of approved fire retardant and anti termite paint FR-881 (viper) as per manufacturer's specifications.
4. All loose ends of the commercial/decorative boards etc. shall be sealed with cedar wood lipping of width equivalent to that of the board /ply
5. In case of laminated front shutters surface the lipping shall be left exposed and at right angle junctions and the joints shall be mitered.
6. The cost of all exposed woodwork is deemed to include painting and polishing with melamine to a smooth finish as per specifications.
7. No extra payment for making neat cut outs of any sort for electrical fittings.
8. For all doors anodised adjustable doorstoppers, door closers locks shall be provided with necessary screws and bolts *etc.* of make mentioned in the tender. The cost for the same shall be as specified in bill of Quantities and shall be paid as per relevant item.
9.All cupboards/ storage shutters shall be provided with box hinge / flap hinge / auto closing hinge / glass unless otherwise specified, as per the requirements and instructions of the Owner / Architect along with with rubber stoppers, brass ball catchers and brass latches. The cost towards all above is deemed to be included in the item.
10. All drawers shall slide on a pair of side mounted Drawer slides of hettich/haffle make.
11. All drawer units, credenzas shall be provided with Multipurpose, as shown in the drawing.
12. For all storages / drawers etc. handles for opening shall be in built using moulded cedar wood section approx. 32x32mm running along the width of the shutter with edges round unless mentioned specifically in the detailed specification/item.
13. For all cupboards all inside vertical dividers and horizontal shelving shall be made out of 19mrn thick commercial block board unless otherwise specified in the bill of quantities.
14. All exposed wood cedar, teak or any other decorative veneer ply, lipping etc. lipping etc. to be finished with melamine polish with stain of approved shade.
15. All iron mongery to be of ISI marked unless specified other wise.

16. All items shall be including sales tax/royalty / transportation / centering / shuttering etc. No facility for issue of any form whatsoever of any kind will be given.
17. All eiectrical switches and sockets to be located as per drawing or as instructed by the Owner / Architect. The cost of fittings shall be paid in relevant item.
18. The contractor shall be responsible for removing malba from the site to a place permitted by the Municipal authorities every fifteen days and cleaning the site

regularly. Cost of removal of malba transportation, loading, unloading etc. (upto any lead) is deemed to be included in the relevant item of demolition / construction.
19. Contractors shall prepare the sample of each item as per nomenclature. He should get it approved from the Owner /Architect before execution of work Furniture supplied must be strictly in conformity with the samples approved by the Owner / Architect.
20. MM Foam used in furniture shall be ISI marked.
21. The working general shall be carried out as per C.P. W. D. specifications (latest) unless otherwise specified in the nomenclature of the individual item or in particular specifications.
22. Before start of work the contractor shall submit the programme of execution of work and get it approved by the Owner / Architect and shall strictly adhere to the same for timely completion of work.

24. The entire work shall be carried out in close co-ordination/ co-operation with all other agencies working in the building and its surroundings. The contractor shall not be entitled to any compensation on account of temporary stoppage of work, if any, due to other construction activities. The contractor is required to stack his material in such a way that all works at site can progress without any difficulty. Nothing extra will be paid on this account.
25. The contractor shall make necessary arrangement for watch and ward and protection against any theft or damage to all the items during their execution and after completion till these are taken over by the Owner / Architect. He shall also provide and maintain temporary covering required for the protection of finished items at his own cost and no claim shall be entertained on this account.
26. Any damage to the building, furniture, fittings articles or any existing work caused by the contractor or his workmen during execution of work shall be made good by the contractor at his own cost failing which the same shall be got made good at the cost and, risk of the contractor. The decision of the Owner / Architect shall be final in this regard.
27. The contractor shall maintain in good condition all works during execution till completion of entire work.
28. Rejected items / material shall be removed by the contractor within 3 days of rejection at his own cost and nothing extra shall be paid on this account, failing which the same shall be got removed at his cost and risk by the Architect / Owner.
29. All wood work shall be 1st class steam beech wood, unless otherwise specified in particular item, shall be of good quality, kiln seasoned, free from knots, decay, sap, warping etc. It shall have uniform colour, shade and straight grains.
30. Wherever adhesive is to be used, it shall be phenol formaldehyde synthetic resin confirming to B.W.R. (Boiling water Resistant) type as per Is - 848 - 1974.
31. All the joining work will be glued before the members are joined together with fully threaded screws.
32. The decorative laminated mica sheets/block boards / ply boards shall have joints at the junctions of the two units only or as mentioned in the drg. and no intermediate or other joints shall be permitted.
33. The woodwork shall not be painted or covered with any treatment unit the same is approved by the Owner / Architect.

34. The samples of all materials and fittings required for execution of the work shall be got approved from the Owner / Architect before execution of the work.
35. At the discretion of Owner / Architect samples of all materials so supplied will be got tested from the laboratory approved by Owner / Architect. The cost of its packing, handling transportation and cost of testing will be borne by the Contractor. No claims of whatsoever kind on this account shall be entertained.
36. All usable materials from dismantling to be stacked at safe place, jointly measured and to be kept in safe custody / security by the contractor.
37. In case of any dispute regarding specifications of materials, dimensions, sizeand shape and brand names of the materials, the decision of the Owner / Architect shall be final and binding.
38. Rates quoted are for finished item of size / shape as specified in relevant item anddrgs. All incidental charges of any kind including cartage, storage,cutting and wastage etc. shall be borne exclusively by the contractor and nothing extra shall bepaid to him on this account.
39. No payment will be made to the contractor for damage caused by rain or other natural calamities during the execution of the work and no claim whatsoever will be entertained on this account. The contractor shall he required to safe guard all the materials against any such calamity.
40. Nothing extra shall be paid for making holes walls / RCC members etc. for fixing work and making good the same to restore the original surface of the building.

41. Unless otherwise specified in the Schedule / Bill of quantities the rates tendered by the contractor shall include the cost of all labour, material and other inputs, cartage and lift upto any floor level of the buildings, royalty or any other tax incidental charges involved in complete execution of work and nothing extra shall be payable on this account.

42. The drawings will be read in correlation / conjunction with specification of item and variance if any, shall be brought to the notice of Owner / Architect prior to submission of tender by the tenderer(s) or else the decision of the Owner / Architect shall be final and binding.

**GENERAL SPECIFICATIONS IN CASE OF FURNITURE**

The chairs, tables, etc. shall be constructed of foam rubber, fabric, teak wood/cedar wood as described and specified, properly housed, grooved, tennoned, glued entirely to the satisfaction of the Owner / Architect,. A prototype sample of all custom-made pieces must be prepared and submitted to the Owner / Architect for their approval before proceeding with the work en mass.

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

**JOINTS:** All joints will be standard mortise and tennon dowel, dovetail, cross halved, and rebated unless otherwise instructed at site by the Owner / Architect Nailed or glued butt joints will not be permitted.

**FASTNERS:** They will match the finish of the hardware item. Nails in a finished surface shall be neatly punched and the hole filled with wood filler matching the finish. Screws in a finished surface will be round head, raised head or sunk (beneath the surface and the hole plugged with matching colour and grain of the wood surface, unless specially detailed).

**PLYWOOD:** Plywood used mainly for the body work in this furniture, shall be closed grained plywood suitable for veneering, painting, or bonding plastic laminate. It will be a resin bonded, waterproof brand and for 'outdoor' furniture standard specification, as described by the Owner / Architect. Exposed edges will be finished with ivory coast teak wood lipping tongued and grooved and glued or as detailed.

**HARDWARE:** Hinges, locks, latches etc. on door, shutters shall be as specified, and as far as possible, by the manufacturer specifications. In any variation of this, the quality of the substitute shall be equal to or better than the original specified, and sample should be submitted *to* the Owner / Architect for prior approval.
METAL: Where metal legs, frames etc., are used these shall be welded, brazed, bolted or rivetted as required and on finished surfaces welding, brazing and rivetting shall be neatly smoothed so that no evidence of this is apparent on the final finish of the metal, which will be as specified in the drawing.

On all legs, nylon glides or adjustable plastic screws are to be installed as per instruction of the Architect / Owner.

**FINISH:**
This will be as indicated on the drawing and colour scheme to be finalised by the Architects in consultation with Owner and materials (timber, plastic laminates, lacquer, paints etc.) must be as specified and no variation will be accepted unless with the prior approval of the Owner / Architect.
'Bricks' of cabinets in contact with wall/floor *etc.* where wall hung shall he treated with an approved brand of wood preservative (FR - 881 / Viper).

NOTE: This specifications is of a general type only, and must he read in conjunction with the drawing of the particular item. Any thing shown on the drawing, but not in the specification must be complied with, and vice versa, and read with the item of work in Schedule of Quantity including notes given therein. Where discrepancy in description / drawing occurs; the decision of the Owner / Architect shall be final and binding on both parties.

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# TECHNICAL SPECIFICATION
# (ELECTRICAL WORKS)

## CONDITIONS AND SPECIFICATIONS FOR ELECTRICAL WORKS/ FIRE ALARM/ VOICE & DATA

1. The electrical works shall be executed by the contractor himself if he registered in appropriate class for electrical works with CPWD / P & T / MES / Railways / State PWD / Public undertaking Banks etc. through subcontractor registered in appropriate class for electrical works with CPWD / P & T / MES / Railways / State PWD.

2. The work shall be carried out as per CPWD Specification 2007 Part-I (internal) & Part - II 2008 (external) both amended up to date. All the installation shall comply with the requirement of Indian electricity Rule 1956 amended up to date. If the specifications for any item is not available in the CPWD specifications cited above, relevant IS specifications shall be followed. In case ISI specifications are also not available, the decision of the Engineer-In-charge given in writing based on acceptable sound Engineering Practice and local usage shall be final and binding on the contractor.

3. All the material to be used on the work shall be of superior quality and shall have to be got approved from the Engineer-In-Charge before use at site.

4. The layout for running of the conduits, positions of switches fitting etc. shall have to be got approved from the Engineer-In-Charge before execution of the same.

5. Suitable size of TW block duly varnished shall be provided for Fl. fittings for which nothing extra shall be paid.

6. All the conduit to be laid shall be provided with fix wire or not less than 16 SWG for which nothing extra shall be paid.

7. All the switches to be provided for lighting/ fans/ light plug/ power plug/ call bell etc. shall be of modular type of superior quality.

8. The switchboards shall be provided with decorative sheet of approved colour and quality, which shall be got approved from the Engineer-In-charge before use at site.

9. The contractor shall make his own arrangement for the safe custody/ storage of his material. Breakage, damage if any done during the storage/ execution, the same shall be replaced/ rectified by the contractor at his own cost.

10. The contractor is bound to sign the entry/ entries made by the Engineer-In-Charge or his representative in the site order book time to time.

11. Good workmanship is an essential requirement for compliance with the rules & specifications.

12. The entire installation shall be at the risk and responsibility of the contractor until these are tested and handed over to the department.

13. Earthing loop earthing shall invariably be along as per CPWD specifications.

14. Not withstanding the schedule of quantity. All items of inter-related work considered necessary to make installation complete and seperative deemed to be included shall be provided by the contractor at no extra cost.

15. Contractor has to supply the layout / circuit drawings of installation after the completion of work.

16. The cover of all junction boxes shall be of bakelite sheet.

17. The tenderer shall submit a sample board, in-corporating in it the samples of all electrical wires, conduits etc. proposed to be used for approval of Engineer-in-charge before commencement of work. No extra payment shall be given for the same.

18. Any damage caused to Building as a result of execution of electrical work shall be responsibility of the electrical contractor. The damage if so caused shall be made good by the contractor promptly at his own cost to the entire satisfaction of the Engineer-In-charge.

19. Embedding of earth electrode shall be done in the presence of Engineer-in-charge for his authorized representative.

20. The contractor shall submit the completion plan separately for each floor for one particular building only in triplicate on Blue print showing the route of sub-mains etc.

21. The Engineer-in-charge will be at liberty to get the work inspected through the C.T.E. or any other agency appointed by the Govt. or Municipal Corporation and the result of their finding will be binding on the contractor.

22. Contractor shall not assign or sub-let the work without prior approval of Engineer-in-charge.

23. Contractor would get load enhancement done from the electrical authority/delhi/concerned agency, NAFAD would only pay the requisite fees needed by authority against indent supplied by the concerned agency.

a. **The Contractor shall appoint an authorized agency of relevant manufacturer for carrying out the works for the Data and VOICE Networking and get a Certification of the executed work and installation and get it tested to the satisfaction of Architect/ Owner .The authorization certificate from the relevant manufacturer whether the agency doing the work is their authorized agent/system integrator has to be submitted before starting of the work shall be produced. Without the performance certificate from the company, the executed work shall be deemed as incomplete and shall not be accepted by the client and all payments made in this head be recovered by 25% for that particular Head. The performance certificate should be for 8/10 years from the relevant manufacturer as applicable, The Data Cabling Scope of Work will also to have provision for the GFC Drawings including route, Labeling and Penta Testing Report and as Built drawings .**

24. For Addressable Fire Alarm System, the Contractor shall appoint an authorized agency of the relevant principal manufacturer for carrying out the work and get a Certification of the executed work and installation and get it tested to the satisfaction of Engineer-in-Charge/client .

25. The civil contractor / Electrical Contractor combined shall appoint an Electrical Engineer / Diploma Holder / Foreman of sufficient experience not less than 3 years for the works to be executed at site as per the IE rules.

26. The contractor shall submit a sample board, incorporating in it all the samples of the Electrical Works, ie., Wires, Conduits etc. proposed to be used for approval of Engineer- in –charge before commencement of work. No extra payment shall be given for the same.

**ADDITIONAL SPECIAL CONDITIONS OF CONTRACT FOR FOR ELECTRICAL WORKS/ FIRE ALARM/ VOICE & DATA:**

1. The contractor shall take the responsibility of dismantling and disposal of existing civil, electrical and furniture work to the destination specified by the owner.

2. All electrical fixtures, equipment should be removed so as to be serviceable and handed over to the owners and these fittings and fixtures shall be the property of NAFAD

3. The contractor shall take responsibility of getting approval of Building Authorities / Estate Officer and other Authority as required for executing the work during and off the office timings.

4. On partial completion of work the contractor shall be furnished with a certificate, but not such certificate be given nor shall the work be considered to complete until the contractor shall have removed from the area of the premises ( to be distinctly marked by the Architect/ Owner in the site plan which, the work shall be executed) all scaffoldings, surplus materials and rubbish and clean the dirt from all wood work, doors, windows, walls, floors or other parts of any building, in or upon which the work is to executed, or of which he may have had in possession for the purpose of the execution hereof. If the contractor shall fail to comply with the requirements of the clause as to the removal of scaffoldings, surplus materials and rubbish and cleaning off dirt on or before the date fixed for the completion of the work, the architect may at the expense of the contractor remove such scaffolding, surplus materials, and the contractor shall forthwith pay the amount of all expense so incurred, and shall have no claim in respect of any such scaffolding or surplus materials aforesaid, except for any actually realized by the sale thereof.

5. **SELECTION OF MATERIALS**

On unavailability of any material in the list of approved materials for interior works, for any reason whatsoever may be, the Architects in consultation with NAFAD may permit the contractor to use the equivalent material.

In an event, the contractor fails to procure approval from statutory Authorities if needed by municipal authorities, as mentioned above/ otherwise required, the work shall not be deemed to be completed and 25% of the EMD payment due to the contractor shall stand forfeited.

**1. <u>SCOPE OF WORK :-</u>**

The scope of internal and external electrification under this contract shall include the design, engineering, manufacture, assembly, testing, delivery, erection and commissioning of electrical system including supply of all material, labour, T&P etc for followings. The scope also covers the detailed engineering and calculations of the various equipments/system mentioned hereunder and the same shall be approved by the Owner prior to execution of the job

- Main Switches, Main L T Panels, meter board and external cable connection.
- 11 KV HT Panel.
- 11 KV / 0.433 KV Transformers.
- 11KV / 0.433 KV Compact Substation.
- L T Bus duct
- LT / control cables and terminations.
- Capacitor and capacitor control panels
- Battery and battery charger.
- Sub and branch distribution boards, circuit breakers etc.

- Mains and Sub mains between various panels, meter boards and distribution boards.

- Point wiring with Conduits for all type of wiring including circuits, sub mains, light, fans, power and AC etc.

- Switches and socket outlets for light, fans, plug, power, Tel, TV, computer network etc with suitable MS/GI boxes with accessories complete.

- Conduits and wiring for Telephone, EPABX, TV system, PA system, Music system and Computer networking, fire alarm, broad band etc.

- Under ground and above ground LT/ HT Cables and other allied works.

- Provision of emergency electrical supply and distribution for complete light, fans and other specified points is also included in the scope of work. For the purpose of emergency distribution separate DB's shall be installed for Light/fans and Power/AC at every place, so that these can be separated. Similarly arrangement for change over etc is also to be made in the panels.

- Lighting Fixtures fans and exhaust fans. (If these are supplied by the client, then the contractor will erect the fixture as required without any extra payment beyond the contract)

- External lighting including underground cables and connection with the external cables and earthing.

- Feeder pillars with circuit breakers.

- Underground cables.

- Safety to personnel and equipment during both operation and maintenance.
- Reliability of Service.

- Minimum fire risk.
- Ease of maintenance and convenience of operation.
- Automatic protection of all electrical equipment through selective relaying system.
- Electrical supply to equipment and machinery within the design operating limits.
- Adequate provision for future expansion and modification.
- Maximum interchangeability of equipment.
- Fail safe feature.
- Suitability for applicable environmental factors.

All the above work shall be complete in all respects up to the satisfaction of architect, consultant, Client and Engineer in charge as per the details mentioned in Bill Of Quantities and drawings supplied time to time.

Unless and otherwise mentioned in the tender documents the following works shall have to be done by the contractor, and therefore their cost shall be deemed to be included in their tendered cost:

a) Furnishing of all labour, skilled and unskilled, supervisory and administrative personnel, erection tools and tackles, testing equipment, implements, supplies, consumables like welding rods and gas, oil and grease, cleaning fluids, insulating tape, anti corrosive paints, jute cotton waste etc. ,and hardware for timely and efficient execution of the erection work.
b) Transport vehicles necessary for efficient transportation of equipment from Owner's stores to site of erection and excess materials back to owner's stores.
c) Complete assembly, erection and connection, testing and commissioning, putting into successful and satisfactory commercial operations of above equipment.
d) The items of work to be performed on all equipment and materials shall include but not limited to the following:
    (i) Receiving, unloading and transportation at site. (To Owner's or Contractor's stores and from there upto actual place of erection).
    (ii) Opening, inspecting and reporting all damages and short supply items.
    (iii) Arranging to repair and/or re-order all damaged and short supply items.
    (iv) Storing at site with suitable all weather protection.
    (v) Assemblies, erection and complete Installation.
    (vi) Necessary coordination between work done by other Contractors.
    (vii) Final check-up, testing and commissioning in presence of Owner's representative.

(viii) Obtaining Owner's written acceptance of satisfactory performance.

Compliance with these specifications and/or approval of any of the Contractor's documents shall in no case relieve the Contractor of his contractual obligations.

All work to be performed and supplied shall be as a part of contract require specific approval/review of Owner or his authorized representative. Major activities requiring approval/review shall include but not to be limited to the following:

The engineering activities shall comprise the submission for approval of the following from Architect/Owner.

- Basic engineering documents e.g. overall single line diagram, overall cable layout, testing, type test at factory and report, guaranteed particulars of all equipments and maintenance manuals.
- Quality assurance procedures.
- Factory manufacturing & testing / testing procedures.
- Field testing and commissioning procedures.
- Basic engineering calculations viz. fault level calculations, voltage drop calculations. (For bus duct, cables & switch boards etc.)
- Control and protection schemes with relay setting chart with back-up calculations etc.
- Load sharing and annunciation scheme.
- Sizing calculation for cable and cable trays.

**2. <u>BIDDERS SHALL BE RESPONSIBLE FOR :</u>**

Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, lighting layouts, cabling layouts including equipment installation and cable termination details etc. prior to start of work.

Preparation of bill of materials for cabling and miscellaneous items etc.

Cable schedule.

Lighting/power panel schedule.

Interconnection drawing.

Protection co-ordination drawings/tables for complete power system.

Shop inspection and testing procedures.

Field testing and commissioning procedures.

Preparation of as built drawings.

## 3. RATES :-

a) The rates tendered shall be for complete items of work inclusive of Cost of material, erection, connection, testing, labor, supervision, tool & plants, storage, contingencies, breakage, wastage, execution at any level & height , all taxes (including works contract tax, if any), sales tax, excise duty, service tax, duties, and levies etc. and all charges for items contingent to the work, such as, packing, forwarding, insurance, freight and delivery at site for the materials to be supplied by the contractor.
b) The price quoted for erection & commissioning shall include cost of all consumables, taxes & duties. (if any). No additional taxes/duties shall be payable by Owner.
c) Contractor shall furnish prices separately for spare parts for two (2) year's trouble free operation of the equipment and shall furnish the list of the same.
d) The work contract tax will be deducted from the bills of contractor as applicable in the state in which the work is carried out, at the time of payment, at prevalent rate.

## 4. ELECTRIC POWER SUPPLY AND WATER SUPPLY :-

Power supply and water supply as may be required shall be arranged by the contractor for installation and testing of the entire work at the site of work.

## 5. PROVISIONS AGAINST ACCIDENTS AND SAFETY MEASURES

a) All safety rules and codes as applicable to work including rules applicable as per factory inspector shall be followed during execution of above work.
b) All safety appliances and protective devices including hand gloves, aprons, helmets, shields, goggles, belts etc. shall be provided by Contractor for his personnel.
c) The Contractor shall arrange to provide guards and prominent display caution notices if access to any equipment / area is considered unsafe and hazardous.

## 6. TOOLS FOR HANDLING AND ERECTION :-

All tools and tackles required for handling of equipment and materials at site of work as well as for their assembly and erection and also necessary test instruments shall be the responsibility of the contractor.

## 7. CO-ORDINATION WITH OTHER AGENCY :-

The contractor shall co-ordinate with all other agencies involved in the building work so that the building work is not hampered due to delay in his work. Recessed conduit and other works which directly affect the progress of building work should be given priority.

## 8. STATUTORY REGULATION AND APPROVALS :-

All electrical works shall be carried out only by those Contractors who are licensed by the concerned local authorities to execute this type of work. Only "A" Class government approved electrical contractor shall execute the job.

The contractor shall obtain all sanctions, electrical loads, approval of drawing / Electrical Sub station from the concerned authorities / electrical safety and permits required for the electrical installation work. All actual fee payable in this regard will be reimbursed against receipt/documentary evidence. On completion of work, the contractor shall obtain NOC from SEB & Chief Electrical Inspector, a copy of the same shall be delivered to the Owner through consultant. The Owner shall have full power regarding the materials or work got tested by independent agency at the electrical contractor's expenses in order to prove their soundness and adequacy. The contractor will rectify the defects/suggestions pointed out by independent agency through Owner at his own expenses.

The installation shall comply in all respects with the requirements of Indian Electricity Act 1910, Indian Electricity Rules (IER) 1956 and other related Laws and Regulations as amended up to date, there under and special requirements, if any, of the State Electricity Boards etc. The bidder is liable to furnish the list of authorized licensed persons/ employed/deputed to carry out the works/perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 as amended up to date.

## 9. STANDARDS AND CODE OF PRACTICE :-

The work shall be carried out as per the enclosed Specifications of work and the construction drawings to be issued from time to time. These specifications shall be read in conjunction with National Building Code, National Electrical Code, Relevant Codes of Practices and Standards as issued by ISI and Indian Electricity Rules, Indian electricity act, factory act, CPWD specifications for electrical works (all with the latest amendments). The installation shall confirm in all respects to Indian Standard code of Practices. Following BIS codes shall be referred -

a) National Electrical Code
b) IS : 694 – 1977 : PVC insulated cables for working voltage up to and including 1100 volts
c) IS : 732 -1989 : Electrical wiring installation

d) IS : 1225 -1938 : Installation and Maintenance of power Cables up to and including 33 KV Rating
e) IS : 1554 (Part-1) : PVC insulated heavy duty electrical cables.
f) IS : 1860 : Installation operation and maintenance of passenger and goods elevator.
g) IS : 2026 & 335 : Distribution Transformers
h) IS : 2309 -1989 : Protection of building and allied structures against lightning.
i) IS : 2705 : CT for metering and protection
j) IS : 2834 : Capacitors
k) IS : 2959 : Contactors
l) IS: 3043 -1987: Earthing
m) IS: 3231 : Electrical relays for power system protection
n) IS: 3646 (Part-1) -1992: Interior Illumination
o) IS: 3961 (Part-2) -1967: Current rating for cable
p) IS: 3961 (Part-5) -1968: Current rating for cable
q) IS: 4201 : Application guide for current transformer
r) IS: 4146 : Application guide for Voltage transformer
s) IS: 5082 / IEC-255 : Electrolytic copper and aluminium bus bars
t) IS: 5216 (Part-1) -1982: Recommendations on safety procedures and practices in electrical work.
u) IS: 6121 : Cable glands
v) IS: 7098 (1 & 2) : XLPE insulated cables
w) IS: 7752 : Improvement of power factor
x) IS: 9537 : Conduits for electrical wiring
y) IS: 10028 (Part-1) -1985: selection, Installation and Maintenance of Transformers
z) IS: 10118 (Part-1) -1982: Selection, Installation and Maintenance of switchgear and Control gear
aa) IS: 10561 : Application guide for power transformer
bb) IS: 10810 : Test procedures for cables
cc) IS: 13947 / IEC 947 : ACB / MCCB

## 10. ELECTRICAL DRAWINGS :-

i) The electrical drawings issued from time to time to the contractor are diagrammatic but shall be following as closely as actual construction and work will permit. Any deviation from the drawings required to conform to the building construction shall be made by the Contractor at his own expenses. The architectural drawings shall take precedence over the electrical drawings as for as the civil and other trades works are concerned.

ii) If there is any discrepancy due to in-complete description, ambiguity or omission in the drawings and other documents relating to this Contract found by the Contractor either before starting the work or during execution or after completion, the same shall be immediately brought to the attention of the Architect/Consultant and his decision would be final and binding on the Contractor.

iii) Shop Drawings

The contractor shall prepare detailed coordinated electrical shop drawing and cable Schedule with other relevant services and submit to the Consultant for approval or the Engineer-in-Charge before commencing the work. The shop drawings shall indicate all setting out details, physical dimensions, layouts and positions of various services, such as :

- Conduiting for entire electrical and low voltage works
- Switches / outlets
- Distribution Boards / panels
- Earthing details with location of pits and conductor run
- HT Panel
- Transformers
- D G Sets with exhaust pipe run, cooling system
- LT Panel Boards
- Control and relay panels
- Capacitor panels
- Schematic diagram for power distribution
- Bus Ducts
- Rising mains
- Metering Panels
- Cable layouts
- Control wiring
- Cable trays
- Lightning Protection

All work shall be carried out on the approval of these drawings. Contractor will submit 2 prints for preliminary approval and finally six prints for distribution.

## 11. INSPECTION, TESTING AND INSPECTION CERTIFICATE :-

- The Purchaser and the Consultant or duly authorised representative shall have at all reasonable times free access to the Contractor's premises or works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection, if part of the works is being manufactured or assembled at other premises or works, the Contractor shall obtain permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

- All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Bidder shall submit the type tests reports for approval. The Contractor shall intimate the Owner/Consultant the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies. If for any item type test is pending payment would be made on successful completion of type/routine test(s) actually carried out as per Consultant/Owner instructions.

- The Contractor shall give the Consultant/Owner thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account. The Consultant/Owner unless witnessing of the tests is virtually waived will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed with the test which shall be deemed to have been made in the presence of Owner/Consultant and he shall forthwith forward to the Consultant duly certified copies of tests in triplicate.

- The Consultant/Owner shall within fifteen (15) days from the date of inspection as defined shall inform in writing to the Contractor of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and make the necessary modifications accordingly.

- When the factory tests have been completed at the Contractor's or Sub-contractor's works, the Consultant/Owner shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Consultant/Owner, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Consultant/Owner. Failure of the issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to

accept the equipment should, it, on further tests after erection, be found not to comply with the Specification. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC (Material Inspection Clearance Certificate) by the Owner.

- For tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be required by Owner/Consultant or this authorised representative to carry out effectively such tests of the equipment in accordance with the Specification.

- The inspection by Owner/Consultant and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.

- The Consultant/Owner will have the right of having at his own expenses any other tests(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests to satisfy that the material comply with the specifications.

- The Owner/Consultant reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Contractor.

## 12. GUARANTEE / defect liability period

The installation will be handed over to the Client after necessary testing and commissioning. The installation will be guaranteed against any defective design/workmanship. Similarly, the materials supplied by the contractor will be guaranteed against any manufacturing defect, inferior quality. The guarantee period will be for a period of 12 months from the date of actual completion or complete and satisfactory handing over to the client whichever is later. Installation/ equipments or components thereof shall be rectified/ repaired to the satisfaction of the Engineer-in-charge free of charge.

## 13. HANDLING, STORING AND INSTALLATION

- In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment / material included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented.

- Contractor shall follow the unloading and transporting procedure at site, as well as storing, testing and commissioning of the various equipment being procured by him separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's Engineer(s) and shall extend full co-operation to them.

- In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained form the Owner/Consultant. Contractor shall be held responsible for any damage to the equipment consequent for not following manufacturer's drawings/instructions correctly.

- Where assemblies are supplied in more than the one section, Contractor shall make all necessary connections between sections. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.

- The Contractor shall submit to the Owner every week, a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

- The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Owner in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.

- The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which require indoor storage.

- The words 'erection' and 'installation' used in the specification are synonymous.

## 14. COMPLETION DRAWINGS / AS BUILT DRAWINGS

On completion of the work and before issue of certificate of virtual completion, the contractor shall submit to the consultant 6 sets along with soft copy of 'As Built' drawings of the work along with originals including write up (trouble shooting, installation, operation and maintenance manual with instructions) incorporating all such changes and modifications during engineering and execution.

These drawings must provide:

- Run and size of conduits, inspection, junction and pull boxes.
- Size of conductor in each circuit.
- Location and ratings of sockets and switches controlling the light/fan and power outlets.
- Location and details of distribution boards, mains, switches, switch gears and other particulars.
- A complete wiring diagram as installed and schematic drawings showing all connections in the complete electrical system.
- Location of telephone outlets, junction boxes and sizes of various conduits.
- Location of all earthing stations, route and size of all earthing conductors etc.
- Layout and particulars of all cables.
- Location and details of PCC's, MCC's, capacitor control panels, PLC, D.G. set panel and relay panels with description detailed control wiring diagram.
- Location of transformer and their details and control wiring diagram.
- Location of HT panel / accessories
- Layout of cable trays with support and their fixing details.
- Layout and particulars of bus duct with fixing details

## 15. QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

- All Non-Destructive Examination procedures, stress relief and weld repair procedure actually used during fabrication and reports including radiography interpretation reports.
- Welder and welding operator qualification certificates.

- Welder’s identification list, listing welder’s and welding operator’s qualification procedure and welding identification symbols.

- Raw material test reports on components as specified by the specification and/or agreed to in the quality plan.

- Stress relief time temperature charts/oil impregnation time temperature charts.

- Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.

- The quality plan with verification of various customer inspection points (CIP) as mutually and methods used to verify the inspection and testing points in the quality plan were performed satisfactorily.

## SYSTEM DESCRIPTION

### 1.0 GENERAL INFORMATION

1.1 Ambient air temperature shall be taken as 50 deg. C for the purpose of designing of electrical equipment.

1.2 This specification shall be read and constructed in conjunction with the drawings and annexure to determine the scope of work.

1.3 All equipment shall be capable of continuous operation satisfactorily under the following conditions:

a) voltage variation : ± 10%
b) frequency variation : ± 5%
c) combined voltage & frequency variation : ± 10%

1.4 Nominal system supply available shall be as follows:

a) Incoming : 11 kV, 3 Ph., 50 Hz, with fault level of 350 MVA.

b) Distribution : 415V, 3 Ph., 4 wire, 50 Hz with fault level of 35 kA.

### 2.0 CODES AND STANDARDS

2.1 All equipment and materials specified herein or not, shall be designed, manufactured and tested with the latest applicable standards & bureau of Indian standards.

2.2 All electrical equipment shall also conform to the latest electricity rules as regards safety and other essential provisions.

2.3 All electrical installation work shall comply with the requirements of the following Act / rules / codes as amended up to date:

a) Indian electricity act.
b) Indian electricity rules.
c) National electric code published by BIS.
d) All relevant Is codes of practice.
e) Regulations published by tariff advisory committee.

### 3.0 SYSTEM DESCRIPTION

#### 3.1 GENERAL

a) One independent radial feeder is envisaged from State Electricity Board for receiving incoming supply on 11 kV.
b) Two poles structure consisting of LAs, Isolator, drop out fuses etc. or 11 KV incoming supply shall be connected to Metering Panel through 11 kV XLPE cable. On two Pole structure 11 kV XLPE cable shall be terminated through outdoor termination.

c) 11 kV XLPE cable from two pole structure to metering Panel to shall be buried in ground
d) 11 KV Panel shall have one incomer and two outgoings, each outgoing shall feed power to the Transformer.
e) 415V L T panel shall receive power from Distribution Transformer *I* DG synchronization panel and shall feed power to various Blocks & Common Services as per enclosed single line diagram.
f) There shall be different metering for State Electricity supply and for DG power supply through the same energy meter. For this purpose, a control cable shall run from substation to different energy meters.
g) Further routing of cables and Power Distribution shall be as per Single Line Diagram.

## 4.0 DESIGN CRITERIA

### 4.1 GENERAL

a) The equipment shall be used in high voltage system having characteristics as listed in this specification.
b) The equipment shall be installed in a hot, dusty, humid and tropical atmosphere.
c) There shall be no radio interference when the equipment are operated at maximum service voltage.
d) The max. temp. in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards.
e) The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration.
f) All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.
g) The safety clearances of all live parts of the equipment shall be as per relevant standards.
h) All equipment/components of identical rating shall be physically and electrically interchangeable.
i) All outdoor equipment shall be suitable to mount on steel structure. Connectors shall be bimetallic conductor.
j) Wherever single core cables are terminated in any equipment, gland plate shall be of Aluminium (3-4 mm thick).
k) There shall be no straight through joints in power & control cables.
l) All cable terminations shall be with Double compression cable gland with armour holding system.
m) The lighting fixture shall have loop in & loop out facility.

## GENERAL & TECHNICAL

## 1 POINT WIRING :-

### 1.1. Definition :-

A point including socket outlet point shall include all work necessary in complete wiring to the various outlets from the controlling switch or MCB.

The scope of wiring for a point shall include the circuit wiring from distribution board to the switch board and from switch board to the individual point. The wiring includes the phase, neutral and earth wire as required.

### 1.2. Scope :-

Following shall be deemed to included in point wiring.

i. Conduit/casing and capping/channels as the case may be, accessories for the same and wiring cables between the switch box and the point outlet, loop protective earthing of each fan / light fixture.

ii. All fixing accessories such as clips, nails, screws, Phil plug, rawl plug etc as required.

iii. Metal / PVC switch boxes for control switches, regulators, sockets etc, recessed or surface type of modular type or piano type with sheet as required and as mentioned in BOQ.

iv. Outlet boxes, junction boxes, pull-through boxes etc, but excluding metal boxes if any, provided with switchboards for loose wires/conduit terminations.

v. Any special block required for neatly housing the connector.

vi. Control switch or MCB, as specified in BOQ / drawings.

vii. 3 / 5 pin or 6 pin socket, ceiling rose or connector as required.

viii. Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc.

xi. Bushes conduit or porcelain tubing where wiring cables pass through wall etc.

**1.3 Material :-**

i The system of wiring shall consist of ISI marked single core, PVC insulated, FRLS, 1100 volt grade, stranded, flexible copper conductor wires as per IS : 694 amended up to date.

ii The Conduit and accessories shall be of mild steel of ISI marked (IS:9537) ERW black, stove enameled, screwed type. The wall thickness of conduits shall be 16 SWG for 20, 25 and 32 mm dia conduits and 14 SWG for 40 and 50 mm dia conduits.

iii The Conduit and accessories shall be of ISI marked (IS:9537-III, 3419 & 2509) heavy duty Rigid PVC. The wall thickness shall be 2 mm (Heavy grade) for all conduits to be laid in RCC slab and the 1.5 mm (Medium grade) for all conduits to be laid in Brick walls.

**1.4. Conductor Size :-**

**Wiring shall be carried out with following sizes of wires –**

| | | | |
|---|---|---|---|
| a. | Light/fan/call bell/ exhaust fan point | - | 1.0 / 1.5 sq mm. |
| b. | 5 amp plug points | - | 1.0 / 1.5 sq mm.. |
| c. | Light circuit | - | 1.5 sq mm. |
| d. | 5 amp plug points for computers | - | 2.5 / 1.5 sq mm. |
| e. | General / Primary Power point | - | 4.0 sq mm. |
| f. | Secondary Power point | - | 2.5 sq mm. |
| g. | Power point for AC | - | 4.0 / 6.0 sq mm. |

**1.5 Size of Earth wires shall be as per following table -**

| Size of point/ circuit / submain wires | | Earth wire |
|---|---|---|
| 2x1.5 sqmm. | - | 1x1.0 / 1.5 sqmm. |
| 2x2.5 sqmm. | - | 1x1.5 sqmm. |

| | | |
|---|---|---|
| 2x4 sqmm. | - | 1x2.5 sqmm. |
| 2x6 sqmm. | - | 1x4 sqmm. |
| 2x10 sqmm. | - | 1x6 sqmm. |
| 2x16 sqmm. | - | 1x6 sqmm. |
| 4x6 sqmm. | - | 2x4 sqmm. |
| 4x10 sqmm. | - | 2x6 sqmm. |
| 4x16 sqmm. | - | 2x6 sqmm. |

## 2. MEASUREMENT :-

### 2.1. Point wiring :-

i. Unless and otherwise specified, there shall be no linear measurement for point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting.

ii. No separate measurement will be made for interconnections between points in the same distribution circuit and for the circuit protective (loop earthing) conductors between metallic switch boxes.

### 2.2 Point wiring for socket outlet points :-

i. The light plug (5A/6A) point and power (5A/15A) point shall be measured on unit basis by counting. The submain / circuit wiring to socket outlets is included in the item, from the respective tapping point of live cable, namely switch box, another socket outlet point, or the sub distribution board as the case may be, up to the socket outlet.

ii. The metal box with cover, switch/MCB socket outlet and other accessories shall also be included in the above item.

### 2.3 Group control Points wiring :-

i. In the case of points with more than one point controlled by the same switch, such point shall be measured in parts i.e.(a) from the switch to the first point outlet as one

point (Primary point), and (b) for the subsequent points each shall be treated as separate point (additional/secondary).

**2.4 Multiple controlled call bell Points wiring :-**

g. In the case of call bell points with a single call bell outlet, controlled from more than one place, the point shall be measured in parts i.e. (a) from the call bell outlet to one of the nearest ceiling roses meant for connection to bell push, treated as one point and (b) from that ceiling rose to the next one and so on, shall be treated as separate point(s).

**3. CIRCUIT AND SUBMAIN WIRING :-**

**3.1. Circuit wiring :-**

Circuit wiring shall mean the wiring from the distribution board up to the first tapping point inside the switch board. (This is included in the point wiring)

**3.2. Sub main wiring :-**

Sub main wiring shall mean the wiring from one main/distribution switchboard to another board / panel and from Distribution Board to Power Outlet / AC Outlet.

## 4. MEASUREMENT OF SUBMAIN / CIRCUIT WIRING :-

a. Sub main wiring shall be measured on linear basis along the run of the wiring. The measurement shall include all length from end to end of conduit or casing and capping as the case may be, exclusive of interconnections inside the switch board etc. The increase on account of diversion or slackness shall not be included in the measurement.

## 5. SYSTEM OF DISTRIBUTION AND WIRINGS :-

i. Main distribution board shall be controlled by the circuit breaker. Each outgoing circuit shall be controlled by a circuit breaker on the phase or live conductor.

ii. The branch distribution board shall be controlled by a circuit breaker. Each outgoing circuit shall be provided with a MCB of specified rating on the phase or live conductor.

iii. The load of the circuits shall be divided, as far as possible, evenly between the number of ways of the distribution boards, leaving at least one spare circuit for future extension.

iv. The neutral conductors (incoming and outgoing) shall be connected to a common link (multi way connector) in the distribution board and be capable of being disconnected individually for testing purposes.

i. Wiring shall be separate for essential loads (ie those fed through stand by supply) and non-essential loads throughout.

## 6. BALANCING OF CIRCUITS :-

The balancing of circuits in three wire or poly phase installations shall be arranged up to the satisfaction of the Engineer-in-charge.

## 7. WIRING SYSTEM :-

a) the wiring shall be done only by the “Looping system”. Phase or live conductors shall be looped at the switch boxes. For point wiring neutral / earth wire looping for the first point shall be done in the switch box, and neutral / earth looping of subsequent point will be made from point outlet.

b) Lights, fans and call bells shall be wired in the 'lighting' circuits. 15A/16A socket outlets and other power outlets shall be wired in the 'Power' circuits. 5A/6A socket outlets shall also be wired in the "Lighting" circuit unless mentioned otherwise.

c) The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of a linked switch gear.

d) Surface wiring shall run, as far as possible, along the walls and ceiling so as to be easily accessible for inspection.

e) In all types of wiring, due consideration shall be given for neatness, good appearance and safety.

f) Colour coding :

| | | |
|---|---|---|
| Phase | : | Red / Yellow / Blue (three phase wiring) |
| Live | : | Red (single phase wiring) |
| Neutral | : | Black |
| Earth | : | Green |

**8. <u>PASSING THROUGH WALLS OR FLOORS :-</u>**

i. When wiring cables are to pass through a wall, these shall be taken through a protection (steel/PVC) pipe or porcelain tube of suitable size such that they pass through in a straight line without twist or cross in them on either end of such holes. The ends of metallic pipe shall be neatly bushed with porcelain, PVC or other approved material.

ii. Where a wall pipe passes outside a building so as to be exposed to weather, the outer end shall be bell mouthed and turned downwards and properly bushed on the open end.

iii. All floor openings for carrying any wiring shall be suitably sealed after installation.

**9. <u>JOINTS IN WIRING :-</u>**

i. No bare conductor in phase and/or neutral or twisted joints in phase, neutral, and/or protective conductors in wiring shall be permitted.

ii. There shall be no joints in the through-runs of cables. If the length of final circuit or sub main is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.

iii. Termination of multi stranded conductors shall be done using suitable crimping type thimbles.

## 10. CONFORMITY TO I.E. ACT, I.E. RULES AND STANDARDS :-

i. All electrical works shall be carried out in accordance with the provisions of the Indian Electricity Act, 1910 and Indian Electricity Rules 1956 amended up to date.

ii. The work shall also conform to relevant Indian Standard codes of practice for the type of work involved.

iii. In all electrical installation works, relevant safety codes of practice shall be followed.

iv. The complete wiring installation shall confirm to IS : 732 amended up to date.

## 11. GENERAL REQUIREMENTS OF COMPONENTS :-

### 11.1 Quality of Materials :-

All materials and equipment supplied by the contractor shall be new. They shall be of such design, size and material as to satisfactorily function under the rated conditions of operation and to with stand the environmental conditions at site.

### 11.2 Rating of Components :-

i. All components in a wiring installation shall be of appropriate ratings of voltage, current and frequency, as required at the respective sections of the electrical installation in which they are used.

ii. All conductors, switches and accessories shall be of such size as to be capable of carrying the maximum current which will normally flow through them, without their respective ratings being exceeded.

### 11.3 Conformity of standards :-

All components shall conform to relevant Indian Standard specification, wherever existing. Materials with ISI certification mark shall be preferred. However for conduits, wiring cables, piano/tumbler switches and socket outlets, ISI marked materials shall only be permitted.

**11.4 Interchangeability :-**

Similar parts of all switches, lamp holders, distribution fuse boards, switch gears, ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in each installation.

**SWITCHES & RECEPTACLES (Piano Type)**

## 1. CONTROL SWITCHES FOR POINTS :-

i. The switch box or regulator box shall be hot dipped galvanized, factory fabricated. The wall thickness shall not be less than 1.2 mm (18 gauge) for boxes up to a size of 20 cm x 30 cm, and above this size 1.6 mm (16 gauge) thick boxes shall be used. The metallic boxes shall be duly painted with anticorrosive paint before erection.

ii. Where a large number of control switches and/or fan regulators are required to be installed at one place, these shall be installed in more than one outlet box adjacent to each other for ease of maintenance.

iii. An earth terminal with stud & 2 metal washers shall be provided in each box for termination of protective conductors and for connection to socket outlet/metallic body of fan regulator etc.

iv. Clear depth of the box shall not be less than 50 mm, and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern.

v. The fan regulators can also be mounted on the switch box covers, if so directed by the Engineer-in-charge.

vi. Control switches (single pole switches) carrying not more than 16 A shall be of piano type, as specified, and the switch shall be "ON" when the nob is down.

vii. Control switch shall be placed only in the live conductor of the circuit. No single pole switch or fuse shall be inserted in the protective (earth) conductor, or earthed neutral conductor of the circuit.

All switches, regulators, outlets & other accessories shall be selected in consultation with the client/architect/consultants approval.

viii. All switches shall be as per IS 3854 amended up to date.

## 2. SOCKET OUTLETS :-

i. Socket outlet shall be of the same type, white piano type as their control switches. These shall be rated either for 5A/6A or 15A/16A. Combined 5A/15A or 6A/16A six pin socket outlet shall be provided in `power' circuits.

ii. In an earthed system of supply, socket outlets and plugs shall only be of 3 pin type, the third pin shall be connected to earth through protective (loop earthing) conductor. 2 pin or 5 pin sockets shall not be permitted to be used.

iii. Every socket outlets shall be controlled by a switch or MCB, as specified. The control switch/MCB shall be connected on the `live' side of the line.

iv. Outlet boxes for socket outlets (both15A/16A and 5A/6A) points shall be of size 175 mm x 100mm.

v. Unless and other wise specified, the control switches for the 5A/6A and 15A/16A socket outlets shall be kept along with the socket outlets.

viii. All sockets shall be as per IS 1293 amended up to date.

## 3. SWITCH BOX COVERS :-

Phenolic laminated sheets of approved white shade (same as switches and sockets) shall be used for switch box covers. These shall be of white 3 mm thick synthetic phenolic resin bonded laminated sheet as base material and conforming to grade P-I of IS:2036-1974, Secured to the box with counter sunk C.P. Brass Screws. The corners of cover plates shall be at right angle.

## SWITCHES & BOXES (Modular Type)

i. The switch box or regulator box shall be made of metal on all sides, except on the front. The boxes shall be used of the same make and model as of modular switches. In no case the locally manufactured switch boxes will be accepted. The size of box shall be governed by the number of switches/outlets/regulators on the respective board. The boxes shall be either made out of G I Sheet or M S Sheet with zinc plating and yellow passivation to complies with the rust test as per IS 3854. The boxes should have slotted holes for level adjustments. The boxes shall be fitted with riveted brass earth terminals for earth connections. The thickness of boxes shall be minimum 1.0 mm for upto 8 modules and minimum 1.20 mm for above 8 modules.

ii. Clear depth of the box shall not in a range of 50 mm to 65 mm depending upon the size of board and manufacturer.

iii Control switch shall be placed only in the live conductor of the circuit. No single pole switch or fuse shall be inserted in the protective (earth) conductor, or earthed neutral conductor of the circuit. The switches shall be provided with silver contacts. The neutral should make first and breaks last.

iv. Socket outlet shall be rated either for 5A/6A or 15A/16A. 5/6 Amp sockets shall be of 5 pin type with shutters. Combined 5A/15A or 6A/16A six pin shuttered socket outlet shall be provided in `power' circuits. The earth pin shall be connected to earth through protective (loop earthing) conductor. All sockets shall be provided with safety shutters to allow easy entry of two pin plugs without the need to force the earth terminal by unsafe means. All sockets shall confirm to IS:1293.

v. Every socket outlet shall be controlled by a switch, as specified. The control switch shall be connected on the `live' side of the line.

vi The switches and sockets shall be manufactured using engineering plastic to make it fire retardant and highly resistant to impact.

vii. The fan speed regulators shall be of electronic and stepped type

viii. The RJ-45 data socket shall be suitable for cat5/cat 6 data cables.

ix. Gold plated contacts shall be provided in all communication jacks to enhance data and voice transmission.

**General Specifications/Guidelines for IT cabling distribution inside Lounges:**

a. Panduit passive cabling components for all Cat 6 related parts
b. ISI marked conduits

1. Horizontal Cabling

1. The horizontal cabling system shall provide physical connectivity between the end point and Consolidation point (CP) in the provided area. It shall consist of cabling, modular jacks, outlet faceplates, with labels for UTP cable on both end, faceplate & patch cord

1.1 The horizontal cable shall be UTP, four pair, RJ 45 copper solution meeting CAT 6 performance requirements defined in ANSI/TIA/EIA-568-C as under:
Not exceeding 90 m cable length
Not exceeding delay skews of 25 µs
3dB headroom on NEXT

1.2 At CP end, the cables shall be bunched together in groups and neatly routed throughout, terminated on 96 Pair Standard Density Punch down Termination Kit (CP box). The cabling shall be well supported inside the cable tray and secured by Velcro type cable ties.

1.3 The cable shall be terminated on modular jack on field end with each cable pair having a maximum amount of untwist of less than 13 mm.

2 The horizontal cabling shall be terminated on 96 Pair(24 port) Standard Density Punch down Termination Kit with each cable wire pair having a maximum amount of twisted of less than 13mm. The Kit includes required quantity of bases and 4-pair connecting blocks and highly visible color-coded wiring slots ease wiring with each block able to replace individually.

3. Communication Outlet

3.1 All modular jacks shall have a minimum of 50 microns of gold plating over a nickel base, certified to an equivalent Underwriters Laboratory Inc. L® listed, NEC/CSA approved and shall meet the US Federal Communications Commission (FCC) part 68 requirements.

3.2 Each modular jack to be equipped with integral/hinged dust cover. Alternatively the jack dust cover may be filtered on the outlet faceplate. All dust cover must be installed at both end of the terminated cable.

3.3 The modular RJ 45 jacks shall be color coded and have two permanent labeling.

3.4 Blank port inserts shall be provided for any unused ports on the data faceplates.

3.5 A matching faceplate with a complete set of mounting screw for the outlet. All visible screws shall match the finish of their faceplate. The color of the faceplates shall match the electrical power outlets. Painted surface shall be by electrostatic powder coating process.

3.6 Faceplate / Outlet shall have integral outlet labeling.

4. Wall Outlets

High quality ganged power/communications outlet boxes, recessed style communications faceplate with 1, 2 or 4 opening for RJ45 modular jack as required. The RJ45 jacks shall be 45 degree angled and their back boxes shall have a minimum depth as required to integrate with wall finishes.

5. Floor Outlets

Recessed style floor boxes consisting of 1, 2 or 4 opening for RJ45 modular jacks.

6. Furniture Outlets

Flush mount 2 and 4 port modular system furniture adapters to be utilized for system furniture workstations. The color of the system furniture adapters to be coordinated with the subcontractor. If the furniture adaptor cannot be accommodated, the subcontractor is to supply surface-mount housing with flush-mount faceplate for the RJ45 jacks at each location.

9. Cables within cable trays

a. The attaching of cables to support system and throughout the installation shall be by used of Velcro or hook-and-loop type fasteners. Plastic cable ties and like shall not be used.
b. Fix cables neatly to the tray, wherever possible, in a single layer and install parallel with the tray edge.
c. Install cables at fixed intervals not exceeding 1200mm by means of approved fastenings of non-corrosive materials.

10. Conduits:

a. Conduits concealed or exposed in wall chases or embedded in floor slabs or installed in inaccessible locations shall be of GI type, and are to be complete with a draw cords to enable the pulling in of cables.

b. Conduit shall be interfaced with underside of cable trays. Conduit shall be appropriately secured to the underside of the cable tray using the conduit manufactures proprietary components.

c. Junction boxes shall be provided at each conduit bend or change in direction and at every 10mtr interval along straight runs (or greater as per Bscsi standards).

d. Conduits and fittings are to comply with the following:

I. Use inspection-type fittings only in accessible locations and where exposed to view;
II. Provide straight long runs, smooth and free from rags, burrs and sharp edges;
III. If installed in damp locations, galvanize mild steel wiring enclosures and support systems;
IV. Install conduits in parallel runs with right angle changes of direction;
V. Bends shall be made where possible with easy sweeps. Bends of 90 degrees shall be made with a radius of not less than three (3) times the external diameter of the conduit. Conduit shall not be installed under mechanical stress sufficient to cause deformation. The number of 90 degree bends between boxes in any single conduit shall be limited to no more than two (2).
VI. Solid elbows shall not be used.
VII. Inspection fittings shall not be cast into concrete or installed in rendered walls or other inaccessible locations.
VIII. Conduits shall not be less than 25mm diameter.
IX. Draw cords installed with 1m of cord coiled at each end of the run;
X. Use polypropylene cord, or insulated stranded earth wire, 2.5mm2 minimum size;
XI. Provide draw-in boxes at intervals not exceeding 30 m in straight runs, and at changes of level or direction;
XII. For underground draw-in boxes, provide gasketted covers and seal against moisture.
XIII. For single conduits up to 25mm diameter metallic galvanized half saddles may be used;
XIV. Seal other ducts and conduits after cable installation.

10.1 Flexible conduit

a. Corrugated flexible conduit may be used where sweep bends are required and for final connections. Flexible conduits shall only be used following approval

b. Flexible conduit shall not be used for straight runs or chased into walls.

c. Fittings for use with flexible conduit shall be compatible with the conduit systems and shall be suitable for terminating onto rigid conduit where required.

d. Allowance shall be made for any differences between the cable carrying capacities of rigid and flexible conduits. Install the next larger size of flexible conduit if necessary, to maintain the equivalent required cable capacity.

11. Cabling Installation Methods

11.1 General

a. Install cables in a workman like manner parallel to walls, floors and ceilings, as applicable.

b. Neatly loom and continuously cable tie to the cable trays.

c. Install cables in a manner to eliminate any possibility of strain on the cable itself or on cable terminations.

d. Do not embed cables directly in plaster, concrete, mortar or other finishes.

e. Install cables a safe distance from items liable to become hot.

f. Bending radii are to be less than the maker's recommendation and in all cases not less than six times the overall cable diameter.

11.2 Cables on trays

a. Fix cables neatly to the tray, wherever possible, in a single layer and install parallel with the tray edge.

b. Install cables such that spare space capacity of not less than 20% of each tray is provided.

c. Install cables at fixed intervals not exceeding 1200mm by means of Velcro or hook-and-loop type fasteners.

11.3 Cables in Conduits

Cross Section area of cables installed in conduit shall not exceed 40% of cross sectional area of the inside dimensions of the conduit itself.

12. Labeling:

a. Every component of the telecommunications infrastructure is to be labeled in an independent manner, nominally in accordance with TIA 606A (based on a point of origin) directed by NAFAD/Consultant.

b. Each horizontal cable is labeled on both ends with an identifier that locates its termination point in the rack.
c. All patch cable labeling must be no more than 10cm from the edge of the cable jacket and installed so they are visible by a technician from a normal stance.

d. All identifiers are independent and scalable. All labels will be read from the general to the specific from left to right.

e. Labels must not be handwritten but must be made using a device which produces typewritten print secured around cable or on equipment in a permanent manner.

f. Labels must be laser printed labels made from a low-profile, heat resistant polyester. Labels on plenum rated cable must be made of low-smoke and flame material.

g. Cable marking shall be permanent and indelible and shall indicate a cable number, a prefix relevant to the type of device at the destination of the cable and the equipment connection location the cable is connected to in the system.
h. Each cable shall be identified at each point of termination with the identification numbers clearly visible within fifty (50) mm of the termination.

14. Termination

All Unshielded Twisted Pair backbone cables to be terminated on 96 Pair (24 port) Standard Density Punch down Termination Kit consisting of the following components. These must all source manufacturers.

a. Standard Density Kit that meet a minimum of ANSI/TIA-568-C.2 Category 6 standard.

b. Ideal for use in cross-connects and consolidation point applications.

c. Pre-packaged components necessary for termination.
d. Kit includes required quantity of bases and 4-pair connecting blocks, label holders and labels.

e. Highly visible color-coded wiring slots ease wiring

f. Cables shall be routed in maximum of eight (12) cables, cabled tied together with Velcro cable ties, as they enter and leave CP. (12 cables from left hand side and 12 cables from right hand side)

g. 4 Pair Punch down Tool, GP6 used to terminate wires on both cable and cross-connect sides of Blocks.

h. 4-pair punch down tool seats 4- or 5-pair connecting blocks.

i. Reversible blade provides option of terminating without cutting wire.

## 15 TESTING & COMMISIONING REQUIREMENTS

a. Tenant shall be responsible for obtaining all permits, approvals licenses and liaison required, for the completion of whole of the cabling works.

b. Tenant shall perform all tests required by all regulatory and statutory Authorities and ensure compliance to Codes through testing.

c. Tenant shall mobilize all required resources, such as manpower and machinery, for all testing and acceptance by ICSL IT

d. Tenant shall ensure that all tools used are properly calibrated in accordance with applicable standards and to the satisfaction of the Contractor.

### 15.1 Specific Cable Testing Requirements

The following cables tests shall be carried out on the installed CAT 6 cabling system.

a. Permanent Link
b. Wire Map
c. Length
d. Attenuation
e. Near End and Far End Crosstalk Loss
f. All other tests required to be carried out as stipulated by the ANSI/EIA/TIA-568-C on 100 % of the installation

All other tests required as stipulated by the cable manufacturer in order for provision of minimum 25 year “Permanent Link” warranty and certification.

## SWITCHGEAR AND CONTROLGEAR

### 1. GENERAL ASPECTS :-

i. All items of switchgear and distribution boards (DB' s) shall be metal clad type.

ii. The types, rating and/or categories of switch gear and protective gear shall be as specified in the tender schedule of work.

iii. RCCB's and RCBO's where specified, shall conform to the requirements of current rating, fault rating, single phase or three phase configuration and sensitivity laid down in the tender documents.

iv. While each outgoing way of distribution board (D.B.) shall be of miniature circuit breaker (MCB) as specified, and of suitable rating on the phase conductor, the corresponding earthed neutral conductor shall be connected to a common neutral terminal block and shall be capable of being disconnected individually for testing purpose.

v. **Independent earth terminal block.**

Every distribution board (single phase as well as three phase) shall have an earth terminal block identical to, but independent from neutral terminal block, to enable termination of protective (loop earthing) conductors (incoming as well as out goings) individually by screwed connection and without twisting.

vi. Earthing terminal (1 for single phase and 2 for three phase) shall be provided on the metal cladding of switches and D.B.' s for body earthing. These shall be suitably marked.

vii. Knock out holes, with or without end plates as per standard design of manufacturers, shall be provided in the metal cladding of switches and D.B.' s for termination of conduits/cables.

viii. Each distribution board shall be provided with a circuit list giving details of each circuit which it controls and the current rating of the circuit, and the size of the fuse element.

### 2. MCB TYPE DISTRIBUTION BOARDS (MCB DB) :-

i. MCB DB' s may be of single phase, three phase (horizontal type) suitable for feeding single phase loads or 3 phase (vertical type) suitable for feeding single phase as well

as three phase loads, each phase isolation type three phase DB in which each phase can be isolated by a separate circuit breaker or RCCB, as specified. These shall be complete with accessories, but without MCB' s, which shall be specified as a separate item in the tender documents.

ii. The current ratings and the number of ways shall be as specified. Blanking plates shall be provided to close unused ways. These shall be indicated as a separate item in the Schedule of work.

iii. MCB DB' s shall be of surface/flush mounting pattern according to the requirement of their location, and shall be suitable to accommodate MCB' s and MCB type isolators and RCCB (ELCB) at incoming in single pole or multi pole configuration, as required.

iv. MCB DB's shall be double door type, dust and vermin proof conforming to IP 43 or as per BOQ, and shall be fabricated out of CRCA sheet steel, minimum 1.2 mm thick, with stove enamelled paint finish.

v. In case of Concealed / Recessed D.B.'s, the DB should have metallic collar for zero error installation, however, cutting of brick work, providing suitable lintel, making good the wall including plastering etc. with necessary civil work including all Civil material shall be included in contractor's scope for proper completion of work.

vi. MCB DB' s shall have removal type end plates with knock-outs at the bottom and top, and shall have hinged covers with locking arrangement.

vii. Only the knobs of the MCB' s shall protrude out of the front covers through openings neatly machine made for the purpose.

viii. The bus bars used shall be solid electrolytic copper of appropriate sections.

ix. Din bar(s) shall be provided for mounting the MCB' s.

x. The complete board shall be factory fabricated and shall be duly pre-wired in the works, ready for installation at site.

xi. The board shall be fully pre wired with single core PVC insulated copper conductors/insulated solid copper links, and terminated on to extended type terminal connectors, suitable for connections to the sizes of the respective conductors.

xii. All incoming and outgoing wiring to the pre wired MCBDB' s shall be terminated only in the extended terminal connectors to be provided within the DB. The terminal connectors shall therefore be so provided as to facilitate easy cable connections and subsequent maintenance.

## 3. MCCB TYPE DISTRIBUTION BOARDS (MCCB DB) :-

i. All MCCB DB' s shall be of three phase suitable for feeding single phase loads or 3 phase loads through SP/TP MCB's, IP 43 enclosure, sheet steel, double door with tinned copper bus bar, neutral bar, earth bar, knock outs etc. The DB's shall be original factory fabricated of approved make.

ii. The current ratings of Incomer MCCB shall be upto 250 amp and the number of ways shall be as specified. Blanking plates shall be provided to close unused ways.

iii. MCCB DB shall be of surface/flush mounting pattern according to the requirement of their location, and shall be suitable to accommodate Four pole MCCB at incomer and SP/TP MCB's at outgoings, as required.

ii. MCCB DB's shall be dust and vermin proof conforming to IP 43, and shall be fabricated out of CRCA sheet steel, minimum 1.3 mm thick, with stove enameled paint finish.

v. In case of Concealed / Recessed D.B.'s, the DB should have metallic collar for zero error installation, however, cutting of brick work, providing suitable lintel, making good the wall including plastering etc. with necessary civil work including all Civil material shall be included in contractor's scope for proper completion of work.

vi. MCCB DB' s shall have removal type end plates with knock-outs at the bottom and top, and shall have hinged covers with locking arrangement.

viii. The bus bars used shall be solid electrolytic copper of appropriate sections.

ix. Din bar(s) shall be provided for mounting the MCB' s.

## 4. WORKMANSHIP :-

i. Good workmanship is an essential requirement to be complied with. The entire work of manufacture/fabrication, assembly and installation shall conform to sound engineering practice.

ii. The work shall be carried out under the direct supervision of a first class licensed foreman, or of a person holding a certificate of competency issued by the state Government for the type of work involved, employed by the contractor, who shall rectify then and there the defects pointed out by the Engineer-in-charge during the progress of work.

## 5. COMMISSIONING ON COMPLETION :-

Before the workman leaves the work finally, he must make sure that the installation is in commission, after due testing.

## 6. COMPLETION PLAN AND COMPLETION CERTIFICATE :-

i. For all works completion certificate after completion of work shall be submitted to the Engineer-in-charge.

ii. Completion plan drawn to a suitable scale in tracing cloth with ink indicating the following, along with three blue print copies of the same shall also be submitted.

a) General layout of the building.

b) Locations of main switch board and distribution boards, indicating the circuit numbers controlled by them.

c) Position of all points and their controls.

d) Types of fittings, viz. fluorescent, pendants, brackets, bulkhead, fans and exhaust fans etc.

e) Name of work, job number, accepted tender reference, actual date of completion, names of Division/Sub-Division and name of the firm who executed the work with their signature.

## METALLIC CONDUIT WIRING SYSTEM

### 1. SCOPE :-

This chapter covers the detailed requirements for wiring work in metallic conduits. This chapter covers both surface and recessed types of works.

### 2. APPLICATION :-

i. Recessed conduit is suitable generally for all applications. Surface conduit work may be adopted in places like workshops, plant rooms, pump rooms, wiring above false ceiling/below false flooring, and at locations where recessed work may not be possible to be done. The type of work, viz. surface or recessed, shall be as specified in the respective works.

ii. Flexible conduits may only be permitted for interconnections between switch gear, DB' s and conduit terminations in wall.

### 3. MATERIALS :-

### 3.1 Conduits :-

i. All rigid conduit pipes shall be of steel and be ISI marked. The wall thickness shall be not less than 1.6 mm (16 SWG) for conduit up to 32 mm dia. and not less than 2 mm (14 SWG) for conduits above 32 mm. These shall be solid drawn or reamed by welding, and finished with galvanized or stove enameled surface.

ii. The maximum number of PVC insulated cables conforming to IS : 694-1990 that can be drawn in one conduit is given size wise in **table 1**, and the number of cables per conduit shall not be exceeded. Conduit sizes shall be selected accordingly in each run.

iii. No steel conduit less than 20 mm in diameter shall be used.

### 3.2 Conduit accessories :-

i. The conduit wiring system shall be complete in all respects, including their accessories.

ii. All conduit accessories shall be of threaded type, and under no circumstances pin grip type or clamp grip type accessories shall be used.

iii. Bends, couplers etc. shall be solid type in recessed type of works and may be solid or inspection type as required, in surface type of works.

iv. a) Saddles for surface conduit work on wall shall not be less than 0.55 mm (24 gauge) for conduits up to 25 mm dia. and not less than 0.9 mm (20 gauge) for larger diameter. The corresponding widths shall be 19mm & 25mm.

b) The minimum width and the thickness of girder clips used for fixing conduits to steel joists, and clamps shall be as per **table 2.**

**TABLE - 1**

**Maximum number of PVC insulated 650/ 1100 Volt grade copper conductor cable that can be drawn into rigid steel conduit.**

| **Nominal cross sectional area of conductor in Sq. mm.** | **20 mm** | **25 mm** | **32 mm** | **40 mm** |
|---|---|---|---|---|
| 1.50 | 5 | 10 | 14 | - |
| 2.50 | 5 | 8 | 12 | - |
| 4.00 | 3 | 8 | 10 | - |
| 6.00 | 2 | 5 | 8 | - |
| 10.00 | - | 3 | 5 | 6 |
| 16.00 | - | - | 3 | 6 |
| 25.00 | - | - | 2 | 4 |

**Note :-**

The above table shows the maximum capacity of conduits for a simultaneous drawing of cables.

**TABLE – 2**

**Girder clips or clamps**

| S.No. | Size of conduit | Width | Thickness |
|---|---|---|---|
| i. | 20 mm | 19 mm | 0.9 mm ( 20 SWG ) |
| ii. | 25 mm | 19 mm | 0.9 mm ( 20 SWG ) |
| iii. | 32 mm & above | 25 mm | 1.2 mm ( 18 SWG ) |

## 4. INSTALLATION :-

### 4.1 Common aspects for recessed and surface conduit works :-

#### i. Conduit joints :-

a) The conduit works of each circuit or section shall be completed before the cables are drawn in.

b) Conduit pipes shall be jointed by means of screwed couplers and screwed accessories only. Threads on conduit pipes in all cases shall be between 13 mm to 19 mm long, sufficient to accommodate pipes to full threaded portion of couplers or accessories.

c) Cut ends of conduit pipes shall have no sharp edges, nor any burrs left to avoid damage to the insulation of the conductors while pulling them through such pipes.

d) The Engineer-in-charge, with a view to ensuring that the above provision has been carried out, may require that the separate lengths of conduit etc., after they have been prepared, shall be submitted for inspection before being fixed.

e) No bare threaded portion of conduit pipe shall be allowed, unless such bare threaded portion is treated with anticorrosive preservative or covered with approved plastic compound.

#### ii. Bends in conduits :-

a) All necessary bends in the system, shall be done either by neatly bending the pipes without cracking with a bending radius of not less than 7.5 cm, or alternatively, by inserting suitable solid or inspection type normal bends, elbows or similar fittings, or by fixing cast iron inspection boxes, whichever is most suitable.

b) Conduit fittings shall be avoided as far as possible on conduit system exposed to weather. Where necessary, solid type fittings shall be used.

**iii. Outlets :-**

a) All outlets such as switches, wall sockets etc. may be either flush mounting type, or of surface mounting type, as specified and as required on site.

b) All switches and accessories shall be fixed in flush pattern.

**iv. Painting after erection :-**

After installation, all accessible surface of conduit pipes, fittings, switch and regulator boxes etc shall be painted.

**5. ADDITIONAL REQUIREMENTS FOR SURFACE CONDUIT WORKS :-**

**i. Painting before erection :-**

The outer surface of conduit including all bends, unions, tees, junction boxes, etc. forming part of the conduit system , shall be adequately protected against rust when such system is exposed to weather by being painted with 2 coats of red oxide paint applied before they are fixed.

**ii. Fixing conduit on surface :-**

a) Conduit pipes shall be fixed by saddles, screwed to suitable approved plugs with screws in an approved manner at an interval of not more than one meter, on either side of the couplers or bends or similar fittings.

b) Where conduit pipes are to be laid along the trusses, steel joists etc. the same shall be secured by means of saddles or girder clips or clamps as required by the Engineer-in-charge.

c) In long distance straight run of conduit, inspection type couplers at reasonable intervals shall be provided, or running threads with couplers and jam nuts shall be provided.

**iii. Fixing outlet boxes :-**

Only a portion of the switch box may be sunk in the wall, the other portion being projected out for suitable entry of conduit pipes into the box.

## 6. ADDITIONAL REQUIREMENTS FOR RECESSED CONDUIT WORK :-

**i. Making chase :-**

a) chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.

b) In the case of buildings under construction, the conduits shall be buried in the wall before plastering, and shall be finished neatly after erection of conduit.

c) In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

**ii. Fixing conduit in chase :-**

a) The conduit pipe shall be fixed by means of staples, J-hooks, or by means of saddles, not more than 60 cm apart or by any other approved means of fixing.

b) All threaded joints of conduit pipes shall be treated with some approved preservative compound to secure protection against rust.

**iii. Fixing conduit in R.C.C. work :-**

a) The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

b) Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing of conductors.

c) Location of inspection/junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

**iv. Fixing inspection boxes :-**

a) Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

b) These shall be mounted flush with the wall or ceiling concrete. Minimum 65 mm depth junction boxes shall be used in roof slabs.

c) Suitable ventilating holes shall be provided in the inspection box covers.

**v. Fixing switch boxes and accessories :-**

Switch boxes shall be mounted flush with the wall. All outlets such as switches, socket outlets etc. shall be flush mounting type, unless otherwise specified in the Additional Specification.

**vi. Fish wire :-**

To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.2 mm (18 SWG) shall be provided along with the laying of the recessed conduit.

**7. BUNCHING OF CABLES :-**

a) Cable carrying alternating current, installed in metal conduit, shall always be bunched so that the outgoing and return cables are drawn into the same conduit.

b) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.

c) In case of three phase loads, separate conduits shall be run from the distribution boards to the load points, or outlets as the case may be.

## 8. EARTHING REQUIREMENTS :

i. The entire system of metallic conduit work, including the outlet boxes and other metallic accessories, shall be mechanically and electrically continuous by proper screwed joints, or by double chuck nuts at terminations. The conduit shall be continuous when passing through walls or floors.

ii. Protective (loop earthing) conductor(s) shall be laid along the runs of the conduit between the metallic switch boxes and the distribution boards/switch boards, terminated thereto. These conductors shall be of such size and material, the protective earth conductors shall be either drawn inside the conduits along with the cables, or shall be laid external to the conduits. When laid external to the conduits, this shall be properly clamped with the conduit at regular intervals.

iii. The protective conductors shall be terminated properly using earth studs, earth terminal block etc. as the case may be.

iv. Gas or water pipe shall not be used as protective conductor (earth medium).

## PVC CONDUIT WIRING SYSTEM (for private)

### MATERIAL :-

The Conduit and accessories shall be of ISI marked (IS: IS:9537-III & 3419) Rigid PVC. The wall thickness shall be 2 mm (Heavy grade) for all conduits to be laid in RCC slab and the 1.5 mm (Medium grade) for all conduits to be laid in Brick walls.

The conduit shall be circular in cross-section. The conduit shall be designated by their nominal outside diameter. The dimensional details of rigid non-metallic conduits are given in **Table-1a.**

No non-metallic conduit less than 20 mm in diameter shall be used. However, in RCC slab the minimum size of conduit will be 25 mm dia irrespective of the number of wires drawn into it.

### Wiring capacity :-

The maximum number of PVC insulated aluminium/copper conductor cables of 650/1100 V grade conforming to IS : 694-1990 that can be drawn in one conduit of various sizes is given in **table-2a**. Conduit sizes shall be selected accordingly.

### Conduit accessories :-

i. The conduit wiring system shall be complete in all respect including accessories.

ii. Rigid conduit accessories shall be normally of grip type.

iii. Flexible conduit accessories shall be of threaded type.

iv. Bends, couplers etc. shall be solid type in recessed type of works, and may be solid or inspection type as required, in surface type of works.

v. Saddles for fixing conduits shall be heavy gauge non-metallic type with base.

vi. The minimum width and the thickness of the ordinary clips or girder clips shall be as per **Table-3a.**

vii. For all sizes of conduit, the size of clamping rod shall be 4.5mm (7 SWG) diameter.

**INSTALLATION :-**

**1. Common aspects for both recessed and surface conduit works.**

i. The erection of conduits of each circuit shall be completed before the cables are drawn in.

ii. **Conduit joints :-**

a) All joints shall be sealed/cemented with an approved cement. Damaged conduit pipes / fittings shall not be used in the work. Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid damage to the insulation of conductors while pulling them through such pipes.

b) The Engineer-in-charge, with a view to ensuring that the above provision has been Carried out, may require that the separate lengths of conduit etc. after they have been prepared, shall be submitted for inspection before being fixed.

iii. **Bends in conduits :-**

a) All bends in the system may be formed either by bending the pipes by an approved method of heating, or by inserting suitable accessories such as bends, elbows or similar fittings, or by fixing non-metallic inspection boxes, whichever is most suitable. Where necessary, solid type fittings shall be used.

b) Radius of bends in conduit pipes shall not be less than 7.5 cm.

c) Care shall be taken while bending the pipes to ensure that the conduit pipe is not injured, and that the internal diameter is not effectively reduced.

## ADDITIONAL REQUIREMENTS FOR RECESSED CONDUIT WORK :-

i. **Making chase :-**

a) chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.

b) In the case of buildings under construction, the conduits shall be buried in the wall Before plastering, and shall be finished neatly after erection of conduit.

c) In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

ii. **Fixing conduits in chase :-**

a) The conduit pipe shall be fixed by means of staples, or by means of non-metallic saddles, placed at not more than 60 cm apart, or shall be fixed by any other approved means of fixing.

b) At either side of the bends, saddles/staples shall be fixed at a distance of 15 cm from the center of the bends.

iii. **Erection in RCC work :-**

a) The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

b) Fixing of standard bends or elbows shall be avoided as far as practicable, and all Curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing of conductors.

c) Location of inspection/junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

iv. **Fixing inspection boxes :-**

a) Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

b) These shall be mounted flush with the wall or ceiling concrete. Minimum 65 mm Depth junction boxes shall be used in roof slabs.

c) Suitable ventilating holes shall be provided in the inspection box covers.

v. **Fixing switch boxes and accessories :-**

Switch boxes shall be mounted flush with the wall. All 133outlets such as switches, socket outlets etc. shall be flush mounting type, unless otherwise specified in the additional specification.

vi. **Fish wire :-**

To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.2 mm (18 SWG) shall be provided along with the laying of the recessed conduit.

**BUNCHING OF CABLES :-**

a) Cable carrying alternating current, installed in metal conduit, shall always be bunched so that the outgoing and return cables are drawn into the same conduit.

b) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.

c) In case of three phase loads, separate conduits shall be run from the distribution boards to the load points, or outlets as the case may be.

**EARTHING REQUIREMENTS :-**

i. A protective (earth) conductor shall be drawn inside the conduit in all distribution circuits to provide for earthing of non-current carrying metallic parts of the installation. These shall be terminated on the earth terminal in the switch boxes, and/or earth terminal blocks at the DB's.

ii. Protective conductors of large size which may not be possible to be carried inside the conduits (as in the case of some sub mains etc.) may be laid external to the conduits and clamped thereto suitably.

iii. Gas or water pipes shall not be used as protective conductors (Earth medium).

**TABLE – 1a.**

**Dimensional details of rigid non-metallic (PVC) conduits.**

**(All dimensions in mm)**

| S.No. | Nominal outside diameter ( In mm ) | Maximum outside diameter ( In mm ) | Minimum inside diameter ( In mm ) | Maximum permissible eccentricity ( In mm ) | Maximum permissible ovality ( In mm ) |
|---|---|---|---|---|---|
| 1. | 20 | $20^{+0.3}$ | 17.2 | 0.2 | 0.5 |
| 2. | 25 | $25^{+0.3}$ | 21.6 | 0.2 | 0.5 |
| 3. | 32 | $32^{+0.3}$ | 28.2 | 0.2 | 0.5 |
| 4. | 40 | $40^{+0.3}$ | 35.8 | 0.2 | 0.5 |
| 5. | 50 | $50^{+0.3}$ | 45.0 | 0.4 | 0.6 |

**TABLE – 2a**

**Maximum number of PVC insulated 650/ 1100 Volt grade copper conductor cable that can be drawn into rigid pvc conduit.**

| Nominal cross sectional area of conductor in Sqmm. | 20 mm | 25 mm | 32 mm | 40 mm |
|---|---|---|---|---|
| 1.50 | 5 | 10 | 14 | - |
| 2.50 | 5 | 8 | 12 | - |
| 4.00 | 3 | 8 | 10 | - |
| 6.00 | 2 | 5 | 8 | - |
| 10.00 | - | 3 | 5 | 6 |
| 16.00 | - | - | 3 | 6 |
| 25.00 | - | - | 2 | 4 |

**Note :-**

The above table shows the maximum capacity of conduits for a simultaneous drawing of cables.

**TABLE – 3a.**

**Ordinary clips or girder clips.**

| S.No. | Size of conduit | Width | Thickness |
|---|---|---|---|
| 1. | 20 mm & 25 mm | 19 mm | 20 SWG ( 0.9144 mm ) |
| 2. | 32 mm & above | 25 mm | 18 SWG ( 1.219 mm ) |

## TRUNKING CABLE MANAGEMENT SYSTEM

### SCOPE

1. This chapter covers the requirements of mini trunking (casing wiring) and adaptable metallic or PVC trunking ("otherwise also called wire ways").

   Adaptable trunking shall be used for power cables and data cables to run parallel in two different compartments with partition.

2. Mini Trunking is suitable for surface wiring work indoors where necessitated, either due to aesthetics or technical requirements, such as case of extension of existing wiring, avoidance of recessed wiring in RCC columns etc. PVC insulated cables and / or other approved insulated cables to IS: 694-1990 shall be used in this type of work.

   Wherever data cables are used for information outlets. Adaptable trunking shall be used.

   3. (i) This system using PVC trunking shall be adopted in residential buildings, or office building where there is a need of tidy wiring system.

   (ii) PVC Trunking for distribution of Voice, Data and Power should be used for cable management and should accept RJ45 Data socket and Power socket or other wiring accessory like switches, indicators etc.

(iii) Trunking should be equipped with rail on its surface on which clip-on partition can be clipped which should accept frames/plates for wiring devices upto 6/8 modules.

   (i) Trunking should have insulation rating of 5 mega Ohm. Trunking should have the following fire resistance characteristics.

- Operating temperature between - 40 Deg to 60 Deg.

### MATERIAL

1. The mini trunking and adaptable trunking shall be of the same material, viz. either PVC or anodized aluminium in extruded sections.

2. The mini trunking shall have a square or rectangular body. The trunking cover shall be "CLIP-ON" type with double grooving in the case of PVC wire-ways, and CLIP-ON type for the metallic wire ways. All surfaces shall have smooth finish inside and outside. The top of the side walls of the body shall be suitable for the above types of

fixing arrangement of trunking. PVC trunking or Aluminium trunking should have uniform thickness throughout its length and shall be of factory finish.

3. PVC trunking shall be of good quality PVC, free from defects like deformation, unevenness, blisters, cavities etc.

**Dimensions**

(i) The sizes of mini trunking for the various sizes of cables and the maximum number of 650/1100 V grade PVC insulated aluminium / copper conductor cables that can be carried in one trunking are given size wise in Table given later.

(ii) The thickness of the mini trunking & adaptable trunking shall be 1 mm minimum.

(iii) When mini trunking cover is clipped onto the trunking body, cover should completely overlap on the base (casing),

**Outlet Boxes**

The outlet boxes such as switch boxes, regulator boxes and their phenolic laminated sheet covers shall be as per requirements.

## INSTALLATION

1. Attachment to wall and ceiling

(i) The mini trunking and adaptable tmnking shall be fixed by means of suitable screws to approved type of asbestos or fiber fixing plugs, at intervals not exceeding 60 cm for all sizes for mini trunking. In case of Adaptable tmnking, the screwing distance shall be such that the weight of the trunking & cable hold firmly on the wall or ceiling. On either side of the joints, the distance of the fixing arrangement shall not exceed 15 cm from, the joint.

(ii) All trunking body shall be fixed directly on wall or ceiling as above.

(iii) Trunking shall be used only on dry walls and ceiling, avoiding outside walls as far as possible and shall not be buried in walls not fixed in proximity to gas, steam or water pipes or immediately below the heater.

(iv) Adaptable trunking shall be with pill off cover for protection against dust. Pill off cover shall be removed only on completion of painting of walls.

2. Passing through floors or walls

When conductors pass through floors, the same shall be carried in an approved PVC conduit, or heavy gauge steel conduit properly bushed at both ends. The conduit shall be carried 20 cm above floor level and 2.5 cm below ceiling level and neatly terminated into the casing. Steel conduit pipes wherever accessible shall be securely earthed.

3. Joints in casing and capping

(i) The wire ways in straight runs should be in single piece as far as possible so as to avoid joints. Trunking shall be of 2m or 3m standard length for the ' ease of installation.

(ii) All joints shall be scar-fed or cut diagonally in longitudinal section, and shall be smoothed down by filing to make the joints a very close fit as far as possible and without burrs. They shall be screwed at joints with two or more screws as would be necessary.

(iii) Joints arising out of bends or diversion shall be done using standard accessories like Internal angle. External angle, Flat angle (elbows). Flat junction (T) and end caps. For the separation of data and power cables there shall be partition in both trunking and accessories. Internal and external angle shall have variable angle for the alignment at the wall comers. In no case the radius of curvature of the cables inside a bend shall be less than 6 times their overall diameter.

4. Trunking should be of white colour in case of PVC trunking and of white or grey colour in case of Aluminium trunking.

(i) Mini Trunking attached to ceiling shall be carried completely across the ceiling/wall whenever required by the engineer in charge, instead of being stopped at an outlet location and in all such cases, dummy mini trunking must be provided.

5. Attachment of capping

(i) Wherever required by the Engineer in Charge, capping shall not be fixed until the work has been inspected with the wires in position and approved. The inspection will be done from time to time as the work progresses.

(ii) Cover shall be attached to body after all the insulated wires are laid inside.
(iii) No screws or nails shall be used for fixing PVC cover to the body.

(iv) Aluminium cover shall be fixed by using cadmium plated flat head / round head screws with an axial spacing not exceeding 30 cm.

6. Installation of Cables

(i) For ease of maintenance, cables carrying direct current or alternating current shall always be bunched so that the outgoing and return cables are drawn in the same trunking.

(ii) Mini trunking shall be of such a design that it holds the wires inside the trunking body (casing) at suitable intervals, so that at the time of opening ' of the trunking cover (capping), the wires may remain in position in the trunking body (casing) and do not fall out.

7. Earth Continuity

(i) A protective (earth continuity) conductor shall be drawn inside for earthing of all metallic boxes of the installations as well as for connections to the earth pin of the socket outlets.

(ii) In the case of metallic trunking there shall be a metallic link between adjacent trunking covers with screw connections, and also connections from the end casing to the earth terminal of metallic boxes / outlets / switch boards as per the case may be, for the complete body earthing of the system.

TABLE

Maximum number of PVC insulated 650/1100 Volt Grade
Aluminium / Copper conductor cable conforming to IS: 694-1990

| **Nominal cross sectional area** | **10/15 mmx 10 mm** | **20/15 mmx 10 mm** | **25/15 mmx 16 mm** | **32 mmx 16mm** | **40 mmx 25 mm** | **40 mmx 40 mm** |
|---|---|---|---|---|---|---|
| 1.5 | 3 | 5 | 6 | 8 | 12 | 18 |
| 2.5 | 2 | 4 | 5 | 6 | 9 | 15 |
| 4 | 2 | 3 | 4 | 5 | 8 | 12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | | 2 | 3 | 4 | 6 | 9 |
| 10 | | 1 | 2 | 3 | 5 | 8 |
| 16 | | | 1 | 2 | 4 | 6 |
| 25 | | | | 1 | 3 | 5 |
| 35 | | | | | 2 | 4 |
| 50 | | | | | 1 | 3 |
| 70 | | | | | 1 | 2 |

Note: Dimensions shown above are outer dimensions of mini trunking.

## CIRCUIT BREAKERS

### A. MINIATURE CIRCUIT BREAKERS (MCB) :-

Miniature Circuit Breakers (MCBs) are to be used in final power distribution and branch circuits, as well as control circuits for effective protection against overload and short-circuit protection. These shall conform to latest Indian and / or International Standards,

IS : 8828-1996, IEC : 60898-1995

Miniature circuit breakers shall be quick make and break type for 240/415 V AC, 50 Hz application with magnetic thermal release for over current and short circuit protection.

The breaking capacity shall not be less than 10kA at 415V AC.

MCBs shall be C-curve type and DIN mounted.

The offered MCBs should be 'ISI' marked. 'ISI' marking on the MCB should be clearly displayed (printed) on the MCB. It should not be displayed by pasting stickers or printing. Name of the manufacturer shall also be printed clearly on body of MCB. Also make and brand shall be clearly identified on each MCB.

**Technical Features**

- **Isolation** : to ensure complete electrical Isolation of downstream circuit or equipment , when the MCB is switched OFF ( to be marked on the MCB in symbolic form)

- **IP 20 Degree of Protection** : to prevent electrical shocks by accidental touch to any live parts, by providing finger touch proof terminals.

- **Positive Contact Indication** : In accordance with IEC-60947-2, MCBs for this characteristic shall have positive contact indication, so that in the event of accidental contact welding during faults, MCB knob does not show OFF position. This is essential to prevent any serious accidents during maintenance.

- **Energy Limitation Class-3** : to ensure minimum let through energy in the event of a fault, for safety of downstream circuit equipment. ( to be mentioned on the MCB as per standards )

- **Low Power Loss** : MCBs should have low power loss, in any case not more than prescribed limits of standards. Energy efficient MCBs having lesser power loss than prescribed in relevant standards will be preferred.

- **Line-Load Reversibility** : to allow line or load connections from top or bottom terminals without any risk of unsafe operation or protection performance of MCB.

- **Ease of Installation**: MCBs should have design to help easy & fast installation on DIN rail, with provision of dual position bistable clips for secured mounting.

- **Large Terminal Design** : MCBs to have minimum 25 sq.mm. terminals for ratings below 32A, and 35 sq.mm. for ratings of 32A and above, to ensure perfect termination of connections. Terminals of MCBs shall have captive screws.

- **Ease of Identification** : Basic technical parameters, rating, operating voltage, etc. shall be printed on front face of MCB for ease of identification.

- Mechanical Life shall be 20000 operations and Service life at rated load for In below 32A shall be 20000 and for In above 32A shall be 10000 operations.

**B. Earth Leakage Circuit Breaker / Residual Current Circuit Breaker - Current Operated Type (ELCB / RCCB / RCBO)**

Residual Current Circuit Breakers shall conform to IEC 61008.& IS12640.
ISI marking is compulsory on RCCB.
The RCCBs shall have sensitivities of 30 mA, 100mA, 300 mA as per the requirement / as per BOQ. For People Protection the sensitivity must not be more than 30mA.

A 100/300mA RCCB is recommended for Protection against fire

The RCCBs shall have disconnection facility with suitability for Isolation and Positive Contact Indication, and shall be immune towards nuisance tripping due to Transient overvoltages.

The RCCBs shall have trip indication facility on the front face.

- **<u>System of operation</u>**

ELCB/ RCCB/RCBO shall work on the principle of core balance transformer. The incoming shall pass through torroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a pre-determined critical value. ELCB/RCCB/RCBO shall be current operated independent of line voltage. Current sensitivity shall be of 30mA at 240/415V AC or as specified in BOQ / drawings and shall have a minimum

of 10000 electrical operations. The RCBO shall also provide over load and short circuit protection in addition to the earth leakage protection.

- **Mechanical Operation**

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing/opening of all three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

- **Neutral Advance Feature**

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact. First before the phases; and at the time of opening, the neutral shall break last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

- **Testing Provision**

A test device shall be incorporated to check the integrity of earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB/RCCB/RCBO and the operating handle shall move to the "OFF" position.

## C. MOULDED CASE CIRCUIT BREAKER (MCCB's)

The rated normal current should be specified at 40°C

The present specification applies to moulded-case circuit breakers (MCCB) from 16A to 800 Amp for AC (50/60Hz) low voltage electrical installation from 220V to 415V. MCCB shall be equipped with a trip Unit that offers the appropriate level of performance to fit to the application.

MCCBs shall be designed for both vertical and horizontal mounting, without any adverse effect on Electrical performance. It shall be possible to supply power either from the upstream or downstream side.

For a MCCB rating frame given, MCCBs dimensions shall be the same whatever the ultimate breaking capacity.

MCCB shall have a rated operational voltage of 415 V and insulation voltage of 600 V (AC 50/60 Hz),

The breaking capacity performance certificates shall be available for category A to the above mentioned standards. The MCCBs shall have a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu) at defined operational voltage.

The moulded case circuit breaker shall have a breaking capacity as mentioned against each in Schedule of Quantity at 415 volts. Wherever required, higher breaking capacity breakers to meet the system short circuit fault shall be used. In absence of any capacity specifically mentioned in the bill of quantities and drawings, following breaking capacities shall be used –

100 / 125 Amp : 25 KA

160/200/250/300 Amp : 35 KA

400/630/800 Amp : 50 KA

**Compliance with Standards**

| Standard | Title | Usage |
|---|---|---|
| IS /IEC 60947-1 & 2 | Low-voltage Switchgear and control gear<br>Part 2 : Circuit Breaker | Characteristics of circuit-breakers;<br>- operation and behaviour in normal service;<br>- Operation and behaviour in case of overload and operation and behaviour in case of short-circuit.<br>- Dielectric properties |

**Circuit breaker design**

**Safety**

For maximum safety, the power contacts shall be insulated in an enclosure made of a thermosetting material from other functions such as the operating mechanism, the case, the trip unit and auxiliaries (ON/OFF/Trip Contact, Shun t, Under Voltage etc.)

All poles shall operate simultaneously for circuit breaker opening, closing and tripping.

**Isolation**

In order to ensure suitability for isolation complying with IEC 60947-2 § 7-27:

MCCBs shall be actuated by a toggle or handle that clearly indicates the three positions: ON, OFF and TRIPPED.

MCCB should clearly indicate the suitability for isolation in the name plate identified by the symbol.

The operating mechanism shall be designed such that the toggle or handle can only be in OFF position (O) if the power contacts are all actually separated, in OFF position, the toggle or handle shall indicate the isolation position.

MCCBs shall be able to receive a device for locking in the "isolated" position, with up to 3 padlocks, Ø8 maximum.

MCCBs shall be equipped with a "push to trip" button in front to test operation and the opening of the poles.

MCCB rating, "push to trip" button, performances and contact position indication must be clearly visible and accessible from the front, through the front panel or the door of the switchboard.

**Class II Front Face**

MCCBs shall be designed to prevent access to live parts when the cover is removed , means main current path of the circuit breaker should be isolated from auxiliary section i.e MCCB shall offer class –II front face.

**Current limitation, durability**

From 16 A to 800 A rating frame, MCCBs shall equip a double breaking type rotary contact mechanism, having current- limiting feature to limit let through energy on the installation.

The electrical durability of MCCBs, as defined by IEC 60947-2 standard, shall be at least equal to 3 times the minimum required by the standard (8000 operations up to 250A & 4000 operations up to 800A).

**Auxiliaries and accessories**

MCCBs shall be designed to enable safe on-site installation of auxiliaries such as voltage releases (shunt & under voltage releases) and indication switches as follows:

- Field installable auxiliary contacts for signalising different functions, as: open/ closed position, fault signal, electrical fault (including earth fault) signal, all auxiliaries shall be common for the entire range,
- They shall be separated from power circuits,
- All electrical auxiliaries shall be of the snap-in type and fitted with terminal blocks,
- Auxiliary function and terminals shall be permanently engraved on the case of the circuit breaker and the auxiliary itself.
- The addition of auxiliaries shall not increase the volume of the circuit breaker.
- Rotary handle, shall not mask or block device settings, and should indicate three positions O (OFF),I (ON)and tripped.
- Rotary handle should have push to trip button.
- Rotary handle should have provision to install lock and key arrangement for interlocking purpose (Example: 2 lock 1 key ,3 lock two key etc.)
- Rotary handle shall ensure IP40 for direct type and IP 55 for extended Rotary handle.

Protections requirements

**General**

- MCCBs shall comprise a device, designed to trip the circuit-breaker in the event of high-value short-circuit currents. This device shall be independent of the thermal magnetic or electronic trip unit.

- MCCBs up to 250A shall be equipped with Thermal magnetic trip unit.

- MCCBs with ratings over 250A shall be equipped with electronic trip units.

Thermo-magnetic trip unit should have:

- Adjustable thermal protection from 75 – 100% times the current rating
- Protection setting shall apply to all circuit breakers pole thru single knob from the front of MCCB without opening the front cover of the MCCB.
- Fixed magnetic protection for current ratings up to 250 A.

Electronic trip units should have:

- Adjustable over load protection from 50 -100% times the current rating
- Variable short circuit protection from 2 to 10 Ir.
- Protection setting shall apply to all circuit breakers pole thru single knob from the front of MCCB without opening the front cover of the MCCB
- In case of 4 pole MCCB neutral should be adjustable as a Neutral unprotected or Neutral
  Protection.

**Earth protection**

Earth Fault protection,Where ever specified, MCCB should have Earth fault protection as provision. MCCB earth fault protection should have following settings.

- Selection of Ir MCCB rating.
- Earth fault sensitivity selection from 10 – 60% In
- Time delay selection in case of Earth Fault with instantaneous feature.

**Installation**

It should be possible to terminate Aluminium cable of required size for the defined current carrying capacity. The requisite size should be made available by means of extended terminals (as a standard offer) in case the direct terminals are not of adequate size. Adequate phase to phase clearance has to be ensured in case of extended terminations.

The circuit breaker should provide the flexibility of terminating line and load from any direction. Manufacturers should test the circuit breaker for this condition and requisite test certificate should be available.

Phase barrier should be provided as a standard feature.

**Testing**

a) Original test certificate of the MCCB as per IEC/IS 60947 - 2 shall be furnished.

b) Pre-commissioning tests on the switchboard panel incorporating the MCCB shall be done as per standard specifications.

## D. AIR CIRCUIT BREAKER

**General:**

- Circuit breakers shall be of 3pole or 4pole, air break, moulded case, horizontal draw-out type fully interlocked or fixed type as specified and designed to deliver performances without periodical maintenance.

- Air circuit breakers (ACB) shall comply with standards IS/IEC 60947-1 & 2. The breakers shall be tested & certified at CPRI/ERDA.

- Air circuit breakers shall have a rated operational voltage of 600 V AC (50/60Hz).

- The rated insulation voltage should be atleast 1000V AC (50/60Hz) & impulse voltage of 12 kV.

- Circuit breakers shall be capable of carrying the full load current defined for $50^{o}$ C without any derating.

- Circuit breaker main contacts shall be silver plated high grade copper with each pole encased in a reinforced polyester casing completely insulated from each other internally and offer double insulation for the operators on the breaker front face.

- Circuit breakers shall be of single frame having uniform “height x width x depth” with common door cut-outs.

**Performances:**

- The ACB breaking capacity performance certificates shall be available for category B according to IEC 60947-2 standard.

- The tests shall be carried out with a breaking performance during operation (Ics) and admissible short time withstand (Icw) equal to the ultimate breaking capacity (Icu). i.e. Icu = Ics = Icw = 50KA for 1 Sec. or as specified in BOQ.

- All Air circuit breakers can be reverse fed without reduction in performance.

- The Circuit Breaker shall have higher Mechanical life i.e. 20000 operations up to 1600A & 16000 operations for ratings >1600A.

- The breakers shall have high electrical life i.e. 5000 operations up to 1600A & 5000 operations for ratings 1600A without maintenance

- The operating mechanism shall be of the Open/Closed/Open stored-energy spring type. The closing time shall be less than or equal to 70 milliseconds to ensure faster closing.

- The operating mechanism shall be of fast opening type with opening time of breaker should be <40ms & spring charging time of less than 5 seconds.

- All 4 Pole ACBs shall have fully rated neutral equal to rating of the breaker & shall be protected against over-load & short-circuit with provisions for settings at neutral for protection, half protection or no protection.

**Accessories & Auxiliaries:**

- Electrical operated Circuit Breakers shall be operated with remote operation function combined with spring charging motor, closing coil & shunt trip coil having control voltage of 240 VAC. The electrical operated breaker shall also be provided with operating handle for manual closing, mechanical ON/OFF indicator, spring charged indicator, etc.,

- Shunt trip and closing coil shall be of typical design and both should be accessible from the front of ACB after opening the cover, without disturbing any other part/release.

- Circuit breaker shall be provided with under-voltage trip release which shall automatically trip the breaker for voltages in the range of 35% to 70% of the system voltage.

- The ACB design shall be modular in construction that is it shall be possible to mount the coils from the front without removing the breaker from Cradle.

- All electrical auxiliaries including the motor spring charging mechanism shall be field adaptable and should not require any calibration at site or the necessity for any tool (except a screwdriver).

- The Circuit Breaker shall have minimum 6 changeover auxiliary contacts rated at 10 A 240/380V volts 50 Hz. There should exist facility to add one more set of 4 contacts as required.

- Option for fixing Ready-to-close contact shall exist for indicating that all safety parameters are checked & enabling closure of breaker, ensuring at-most safety for the user.

- All accessories & auxiliaries should be common for entire range of circuit breakers.

**Safety:**

- It shall be possible to connect all auxiliary wiring from the front face of the air circuit breaker. This wiring shall be taken through a set of disconnecting contacts, so that all auxiliary wiring is automatically disconnected in the isolated position.

- There exists clear indication of the following parameters in the front panel of the circuit breakers:

  - ☐ON - Circuit breaker closed
  - ☐OFF - Circuit breaker open
  - ☐Spring Charged – Ready-to-close
  - ☐Spring charged – Not ready-to-close
  - ☐Spring discharged
  - ☐circuit breaker in "service" position (drawout only)
  - ☐circuit breaker in "test" position (drawout only)
  - ☐circuit breaker in "isolated" position (drawout only)

- Mechanical and electrical anti-pumping devices shall be incorporated in the circuit breakers as required.

- The circuit breaker shall be fitted with arc chutes on each pole designed to permit rapid dispersion, cooling and extinction of the arc. Arc Chute cover should be integral part of breaker to safeguard persons from arc during extinction & it shall be removable on site.

- The automatic shutters should be integral part of breaker & locking arrangement should be provided as per standards.

- The with-drawable circuit breaker shall have the following three distinct and separate positions, which shall be indicated on the face of the panel.

  - ☐"Service" -- Both main and auxiliary circuits are connected
  - ☐"Test" – All auxiliary circuits are connected & main circuits are disconnected
  - ☐"Isolated" -- Both main and auxiliary circuits are disconnected

- The circuit breaker shall be suitable for moving out to Maintenance Position with the telescopic rails extended and with the cubicle door opened. The routine maintenance shall be capable of being carried out in this position.
- There should be a positive locking at these positions while racking out or racking in for clear & confirmative indications as the position is reached. A push button shall be available to release the lock.

**Interlocks:**

- It shall not be possible to with-draw the breaker from the cubicle in "ON" condition. To achieve this, suitable mechanism shall be provided to trip the breaker before the Breaker is isolated.

- It shall not be possible to switch “ON” the breaker until it is either in the fully inserted position or for testing purposes it is in the fully isolated position.

- It shall not be possible for the Circuit Breaker to be plugged in unless it is in the OFF position.

- A safety catch shall be provided to ensure that the movement of the breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due to its weight.

- A door interlock shall be provided so that it shall not be possible to open the door until the air circuit breaker moving part is in the disconnected position.

- A mis-match interlocking shall be provided to prevent insertion of a draw-out type circuit breaker having a rating higher than the current rating of the fixed part.

- The racking handle shall be stored on the air circuit breaker in such a manner as to be accessible without defeating the door interlocking.

- Provision should exist for fixing key lock to have secured interlocking with the other circuit breakers.

- The breaker shall be locked in disconnected position using key lock or padlock to avoid accidental charging of the breaker during maintenance phase.

**Terminations:**

- All circuit breakers shall be fully tropicalized as standard & suitable for terminating copper or aluminium bus bars.

- Both fixed & draw-out circuit breakers shall have single pole-pitch to ensure sufficient & safer clearances between phases.

- Provision shall exist to change the orientation of rear terminations from to horizontal to vertical connection or vice-versa at installation to enable ease of bus bar/cable terminations.

**Protections:**

- The Circuit breaker protection shall be through micro processor based trip units.

- The micro processor release should be self powered type without any auxiliary power supply during normal operation of the breaker.

- The circuit breaker control unit shall measure the true r.m.s value of the current.

- The protection release shall have following protections as standard.

  - ☐ Adjustable over load current (Ir) settings from 40% to 100% of rating of ACB (In).
  - ☐ Over load time setting (tr) from 0.5s, 1s, 2s, 4s…….24s as field selectable curves
  - ☐ Short circuit setting (Isd) from 1.5 to 10 times of Ir setting
  - ☐ Short circuit time delay adjustable from 0 to 400 msec.
  - ☐ Instantaneous (Ii) protection with an adjustable pick-up and an OFF position.
  - ☐ Earth fault setting adjustable in absolute Ampere with time delay settings from 0 to 400 ms.

- $I^2t$ ON / $I^2t$ OFF options shall be available for short-circuit & earth fault protections to enhance discrimination with downstream devices.
- Individual fault trip LED indications shall be available on the trip unit for easy & faster identifying the cause of fault.

- The trip unit shall have integral test facility to verify the healthiness and to avoid external calibration.

- The release shall be self diagnostic with separate indication in case of mal functioning.

- It shall be possible to change the protection settings on line and the circuit breaker need not be switched of while adjusting the setting.

- Circuit breakers shall conform to Electromagnetic compatibility tests (EMC) as specified in IEC60947-2.

- The Circuit breaker control unit shall be interchangeable on site for adaptation to changes in the installation.

- The control unit shall have thermal memory throughout the range to store temperature rise data in case of repetitive overload or earth fault for protecting the cables and loads.

- Circuit breakers in the outgoing feeders shall be provided with micro processor / Thermo magnetic based trip units (as per BOQ) offering protection against over load (Long time) & Instantaneous protection ensuring total discrimination.

**Testing**

Testing of each circuit breaker shall be carried out at the works as per IEC:60947 and the original test certificate shall be furnished in triplicate. The tests shall incorporate atleast the following:

i) Impulse withstand test

ii) Insulation test

iii) Di-electric rigidity /Insulation test

iv) Mechanical operation checking

v) Thermal protection with a current of 3ith starting from cold conditions.

# EARTHING

## 1. SCOPE :-

This chapter covers the essential requirements of earthing system components and their installation. For details not covered in these specifications. IS code of Practice on Earthing (IS:3043-1987) shall be referred to.

## 2. INSTALLATION :-

### 1. ELECTRODES :-

i. Plate electrode shall be buried in ground with its faces vertical, and its top not less than 3 m below the ground level. The installation shall be carried out as per standard drawing.

ii. When more than one electrode is to be installed, a separation of not less than 2 m shall be maintained between two adjacent electrodes.

iii. a) The strip or conductor electrode shall be buried in trench not less than 0.5 m deep.

b) If condition necessitate the use of more than one strip or conductor electrode, they shall be laid as widely distributed as possible, in a single straight trench where feasible, or preferably in a number of trenches radiating from one point.

iv. Normally an earth electrode shall not be located closer than 1.5 m from any building. Care shall be taken to see that the excavation for earth electrode does not affect the foundation of the building; in such cases, electrodes may be located further away from the building, with the prior approval of the Engineer-in-Charge.

### 3. WATERING ARRANGEMENT :-

i. In the case of plate earth electrodes, a watering pipe 20mm dia. medium class pipe shall be provided and attached to the electrodes. A funnel with mesh shall be provided on the top of this pipe for watering the earth.

ii. The \watering funnel attachment shall be housed in a masonry enclosure of size not less than 30cm*30cm*30cm.

iii. A cost iron/MS frame with MS cover, 6 mm thick, and having locking arrangement shall be suitably embedded in the masonry enclosure.

**4. EARTHING CONDUCTOR (Main earthing lead) :-**

i. The earthing conductor shall be securely terminated on to the plate with two bolts, nuts, check nuts and washers.

ii. A double C-clamp arrangement shall be provided for terminating tape type earthing conductor with GI watering pipe coupled to the pipe earth electrode. Galvanized "C" shaped strips, bolts, washers, nuts and check nuts of adequate size shall be used for the purpose.

iii. The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class 15 mm dia GI pipe in the case of wire, and by 40 mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30 cm deep (to be increased 60 cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.

iv. The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switchboard by:

a) Soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and,

b) Bolt, nut and washer in case of strip conductor.

c) Earthing Terminal / neutral point / earth bus in case of equipments / sub stations.

**5. PROTECTIVE (Loop earthing/earth continuity) CONDUCTOR :-**

i. Earth terminal of every switchboard in the distribution system shall be bonded to the earth bar/terminal of the upstream switchboard by protective conductor(s).

ii. Two protective conductors shall be provided for a switchboard carrying a 3 phase switch gear thereon.

iii. All the mountings of industrial type switchboards shall be bonded to the earth stud/earth bar using a protective conductor looping from one to another. Loop earthing of individual units will not be however necessary in the case of cubical type switchboards.

iv. The earth connector in every distribution board (DB) shall be securely connected to the earth stud/earth bar of the corresponding switchboard by a protective conductor.

v. All metallic switch boxes and regulator boxes in a circuit shall be connected to the earth connector in the DB by protective conductor (also called circuit protective or loop earthing conductor), looping from one box to another up to the DB.

vi. The earth pin of socket outlets as well as metallic body of fan regulators shall be connected to the earth stud in switch boxes by protective conductor. Where the

switch boxes are non-metallic type, these shall be looped at the socket earth terminals, switch or at an independent screwed connector inside the switch box. Twisted earth connections shall not be accepted in any case.

vii. Double earthing strips in rising mains, bus trunking etc. shall be securely connected to the earth bar/earth stud at the sending end switchboard. In the case of overhead bus bar systems, protective conductors shall be provided in addition to feeder cable armouring connection.

## 6. EARTH RESISTANCE :-

i. The earth resistance at each electrode shall be measured. No earth electrode shall have a greater ohmic resistance than 5 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be up to 8 ohms.

ii. Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, such as additional electrode(s), different type of electrode, or artificial chemical treatment of soil etc., as may be directed by the Engineer-in-charge.

## 7. MARKING :-

i. Earth bars/terminals at all switchboards shall be marked permanently either as "E".

ii. Main earthing terminal shall be marked "SAFETY EARTH - DO NOT DISCONNECT".

## LIGHTNING PROTECTION SYSTEM

### 1. GENRAL :-

i. The entire lightning protective system should be mechanically strong to withstand the mechanical forces produced in the event of a lightning strike.

ii. Conductors shall be securely attached to the building, or other object to be protected by fasteners, which shall be substantial in construction, not subject to breakage, and shall be of galvanized steel or other suitable materials, which suitable precautions to avoid corrosion.

iii. The lightning conductors shall be secured not more than 1.2 m apart for horizontal run, and 1.0 m for vertical run.

### 2. AIR TERMINATION :-

All air terminals shall be effectively secured against overturning either by attachment to the object to be protected, or by means of substantial bracing and fixings which shall be permanently and rigidly attached to the building. The method and nature of the fixings should be simple, solid and permanent, due attention being given to the climatic conditions and possible corrosion.

### 3. DOWN CONDUCTORS :-

i. The down conductor system must, where practicable, be directly routed from the air termination to the earth termination network, and as far as possible, be symmetrically placed around the outside walls of the structure starting from the corners.

ii. a) Practical reasons may not be some times allow the most direct route to be followed. While sharp bends, such as arise at the end of a roof are in-escapable (and hence permissible), re-entrant loops in a conductor can produce high inductive voltage drops so that the lightning discharge may jump across the open side of a loop. As a rough guide, this risk may arise when the length of the conductor forming the loop exceeds 8 times the width of the open side of the loop.

b) When large re-entrant loops as defined above can not be avoided, such as in the case of some cornices or parapets, the conductors should be arranged in such a way that the distance across the open side of a loop complies with the requirement indicated above. Alternatively, such cornices or parapets should be provided with holes through which the conductor can pass freely.

iii. Bonding to prevent side flushing :-

Any metal in, or forming a part of the structure, or any building services having metallic parts which are in contact with the general mass of the earth, should be either

isolated from, or bonded to the down conductor. This also applies to all exposed large metal items having any dimension greater than 2 m whether connected to the earth or not.

## 4. JOINTS AND BONDS :-

### 4.1 Joints :-

i. A lightning protective system should have as few joints as possible.

II. Joints should be mechanically and electrically effective, for example, clamped, screwed, bolted, crimped, riveted or welded.

iii. With overlapping joints, the length of the overlap should not be less than 20 mm for all types of conductors.

iv. Contact surfaces should first be cleaned, then inhibited from oxidation with a suitable non-corrosive compound.

v. Joints of dissimilar metals should be protected against corrosion or erosion from the elements, or the environment, and should present an adequate contact area.

### 4.2 Bonds :-

i. Bonds have to join a variety of metallic parts of different shapes and composition, and cannot therefore be of a standard form.

ii. There is the constant problem of corrosion and careful attention must be given to the metal involved, i.e. the metal from which the bond is made, and those of the items being bonded.

iii. The bond must be mechanically and electrically effective, and protected from corrosion in, and erosion by the operating environmental.

iv. External metal on, or forming part of a structure, may have to discharge the full lightning current, and its bond to the lightning protective system should have a cross sectional area not less than that employed for the main conductors.

v. Structures supporting overhead electric supply, telephone and other lines must not be bonded to a lightning protective system without the permission of the appropriate authority.

vi. Gas pipe in no case shall be bonded to the lightning protective earth termination system.

## 5. TEST JOINTS :-

Each down conductor should be provided with a test joint in such a position that, while not inviting unauthorized interference, it is convenient for use when testing.

## 6. EARTH TERMINATION NETWORK :-

i. An earth station comprising one or more earth electrodes as required, should be connected to each down conductor. This shall be specified.

ii. Each of the earth station should have a resistance not exceeding the product given by 10 ohms multiplied by the number of earth electrodes to be provided their in. The whole of the lightning protective system, including any ring earth, should have a combined resistance to earth not exceeding 10 ohms without taking account of any bonding.

iii. If the value obtained for whole of the lightning protection system exceeds 10 ohms, a reduction can be achieved by extending or adding to the electrodes, or by interconnecting the individual earth terminations of the down conductors installed below ground, some time referred to as a ring conductor. Buried ring conductors laid in this manner are considered to be an integral part of the earth termination network, and should be taken into account when assessing the overall value of resistance to earth of the installation.

iv. A reduction of the resistance to the earth to a value below 10 ohms has the advantage of further reducing the potential gradient around the earth electrode when discharging lightning current. It also further reduces the risk of side flashing to metal in, or of structure.

v. Earth electrodes should be capable of being isolated and a reference earth point should be provided for testing purposes.

## CABLES

### A. H.T. CABLE (XLPE insulated)

The cross linked polyethylene (XLPE) cable shall be aluminium conductor PVC outer sheath steel strip armoured over inner sheath construction. XLPE cable shall conform to testing in accordance with IS:7098 (Part-I) 1985 and (Part-II) 1973. The screening shall be done on individual cover. The armouring applied over the common covering shall be flat steel wires. Each and every length of cable shall be subjected to routine test.

The termination and jointing techniques for XLPE cables shall be by using heat shrinkable or push on cable jointing kits.

While laying underground cables in ducts care should be taken so that any underground structures such as water pipes, sewerage lines etc. are not damaged. Any telephone or other cable coming in the way shall be properly protected as per instructions of the Engineer-in-charge.

After laying and jointing work is completed a high voltage test shall be performed and test results submitted for approval in order to ensure that they have not been damaged during or after the laying operation. In case, the test results are unsatisfactory, the cost of all repairs and replacement and all extra work of removal and relaying will be made good by the contractor without any extra cost.

### B. LOW VOLTAGE (L.V.) CABLES

#### 1. Wires

The design manufacture, testing and supply of single core FRLS PVC insulated 1.1 KV grade stranded twisted wires under this specifications shall comply with latest edition of following standards.

IS : 3961 Current rating for cables.

IS : 5831 HRPVC/PVC insulation and sheath of electric cables.

IS : 694 HRPVC/PVC insulated cables for working voltage upto and including 1100 volts.

IEC : 754(i) FRLS PVC/HFFR insulated cable.

Copper/Aluminium stranded twisted conductor HRPVC / FRLS PVC / PVC insulated wires shall be used in conduit as per item of work. Aluminium for power cables and copper for control cables shall be used.

The wires shall be colour coded R Y B, for phases, Black for neutral and Green for earth.

Progressive automatic in line indelible, legible and sequential marking of the length of cable in meters at every one meter shall be provided on the outer sheath of cable.

## 2. Cables

The design, manufacture, testing and supply of the cable under this specifications shall comply with latest edition of following standards:

| | |
|---|---|
| IS : 8130 | Conductors for insulated electric cables and flexible cords. |
| IS : 5831 | HRPVC/PVC insulation and sheath of electric cables. |
| IS : 3975 | Mild steel wires, strips and tapes for armouring cables. |
| IS : 3961 | Current rating of cables. |
| IS : 694 | HRPVC/PVC insulated (heavy duty) electric cables for working voltage upto and including 1100 volts. |
| IS : 424-1475 (F-3) | Power cable-flammability test. |
| IS : 7098(I) | Specification for cross linked polyethylene insulated XLPE/PVC sheathed cable for working voltage upto 1.1 KV. |
| IS : 1554 | Specification for PVC insulated (heavy duty) electric cables for working voltages upto and including 1100 volts. |
| IS : 10810 | Testing method of cable. |
| IS : 6121 | Cable glands. |
| ASTM-D : 2863 | Standard method for measuring the minimum oxygen concentration to support candle-like combustion of plastics (Oxygen Index). |
| ASTM-D : 2843 | Standard test method for measuring the density of smoke from the burning or decomposition. |
| IEEE : 383 | Standard for type of test Class-IE, Electric cables, field splicers and connections for power generation station. |
| ASTME : 662IEC : 754 (A) | Standard test method for specific optical density of smoke generated by solid materials. |
| IS : 10418 | Cable drums. |

## 3. Technical Requirements

a) The cables shall be suitable for laying in racks, ducts, trenches conduits and under-ground buried installation with uncontrolled back fill and chances of flooding by water.

b) They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating condition.

c) The aluminium/copper wires used for manufacturing the cables shall be true circular/sector in shape before stranding and shall be of uniformly good quality, free from defects. The conductor used in manufacture of the cable shall be of H2 grade.

d) The cable should withstand 1 – 50 KA for 1 sec with insulation armour insulated at one end. Bidder shall furnish calculation in support of capability to withstand the earth fault currents. The current carrying capacity of armour and screen (as applicable) shall not be less than the earth fault current values and duration. Copper screen of each core shall be suitable for carrying full fault/earth current.

e) The fillers and inner sheath shall be of non-hygroscopic fire retardant materials and shall be suitable for the operating temperature of the cable. Filler and inner sheath shall not stick to insulation and outer sheath.

f) Progressive automatic in line indelible, legible and sequential marking of the length of the cable in meters at every one meters shall be provided on the outer sheath of all cables and at every 5 meter 'FRLS' marking in case of 'FRLS' cables.

g) Strip/Wire armouring following method (b) mentioned in IS:3975 shall only be acceptable. For single core cable aluminium wire armouring shall be used.

h) Allowable tolerance on the overall diameter of the cables shall be + 2mm.

i) The normal current rating of all PVC insulated cables shall be as per IS:3961.

j) A distinct inner sheath shall be provided by pressure extrusion process for all multicore armoured and unarmoured cables as per IS:5831.

k) Outer sheath shall be provided by extrusion process as per IS:5031.

l) The breaking load of armour joint shall not be less than 95% of that armour wire. Zinc rich paint shall be applied on armoured joint surface.

m) In plant repairs to the cables shall not be accepted.

n) All the cables shall be supplied in non-returnable drums as per IS:10418.

**4. FRLS Cables**

i) The inner and outer sheath of cables shall have an oxygen index of not less than 29 as per ASTMD : 2863.

ii) The maximum acid gas generation by weight as per IEC:754 (i) shall not be more than 20% for outer sheath material of all cables. Bidder shall also guarantee the maximum theoretical acid gas generation with 20% by weight of outer sheath.

iii) The cables inner and outer sheath shall meet the requirement of light transmission of 40% (minimum and shall be tested as per ASTMD:2843). In case the test for light transmission is conducted as per ASTME:662. The bidder shall furnish smoke density values as per this standard and shall co-relate the anticipated light transmission when tested as per ASTMD:2843.

iv) The cable shall pass the fire resistance test as per SS:42, 41, 475 (I) and flammability test as per IEEE:383.

v) Smoke/light density rated shall be 40% (minimum) and 65% (maximum).

**5. Inspection**

All cables shall be inspected at manufacture place and on receipt of the same at site checked for any damage during transit.

**6. Joint in Cables**

The contractor shall take care that the cables received at site are distributed to various locations in such a manner as to ensure maximum utilization and avoidance of cable jointing. Cable shall be rechecked before cutting in lengths, where the joints are unavoidable, the location of such joints shall be got approved from the Owner/Consultant. The joints shall be done by qualified jointer strictly in accordance with manufacturer's instruction/drawings.

**7. Joint Boxes For Cables**

The cable joint boxes shall be of appropriate size suitable for type of cable of particular voltage rating.

**8. Jointing of Cables**

All cable joints shall be made in suitable, approved cable joints boxes, on the jointing of cables in the joint box and the filling in of compound shall be done in accordance with manufacturer's instructions and in an approved manner. All straight through joints shall be done in epoxy mould boxes with epoxy resins. Straight through joints shall not be permitted unless the length of run is in excess of cable drum.

End terminations of cables more than 1.1 KV grade shall be done with epoxy mould boxed and epoxy resin. Cable glands shall be 1.1KV grade double compression type and made to tin plated heavy duty brass casting and machine finished. Glands shall be of robust construction capable of clamping cable and cable armour, firmly without injury of cable.

All washers and hardwares shall be made of brass tinned. Rubber components used in the glands shall be made of neoprene of tested quality.

Cable lugs shall be tinned copper/aluminium solderless crimping type conforming to IS:8309 suitable for aluminium or copper conductor.

Crimping of terminals shall be done by using Corrosion inhibitory compound, with crimping tool.

The contractor shall liaise fully with all other contractors to achieve an efficient and properly coordinated installation where equipment has to be re-positioned due to lack of site liaison, no extra cost shall be incurred by the client.

**9. Testing of Cables**

Cables shall be tested at factory as per requirement of IS:1554 Part-I. The tests shall incorporate routine tests, type tests and acceptance tests. Prior to dispatch of cables. All the testes will be witnessed by Owner / Consultant in accordance with testing procedure approved by Consultant at no extra cost to Owner. Besides that the following tests shall be carried out:

a) Insulation test between phases and phase to earth for each length of cable before and after jointing.

On completion of cable laying work, the following test shall be conducted in the presence of Architect/Owner.

a) Insulation resistance test (Sectional and overall) 1000/5000V depending upon the voltage grade of cable.
b) Continuity test.

**10. Laying of Cable**

The cable drum shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks. At all changes in directions in horizontal & vertical places, the cable shall be bent with a radius of bend not less than 12 – 15 times diameter and 8 times only at places of space constraints.

The cable of 1.1KV grade shall be laid not less than 750mm below ground level in a 375mm wide trench (throughout), where more than one cable is to be laid in the same trench, the width of the trench shall be increased such that the interaxial spacing between the cables except where otherwise specified shall at least be 150mm minimum or as per site requirements or as approved by the Engineer-in-charge. Where single core cables are used in multiphase systems, the cables shall be installed in trefoil where possible.

In case the cables are laid in vertical formation due to unavoidable circumstance the depth per tier shall be increased by 200mm (minimum). Cable shall be laid in reasonably straight line, where a change in direction takes place a suitable curvature shall be i.e. either 20 times the dia meter of the cable or the radius of the bend shall not be less than twice the diameter of the cable drum or whichever is less. Minimum 3 meter long loop shall be provided at both sides of every straight through joint & 3 meters at each end of cable or as directed at site.

Greater care shall be exercised in handling the cable in order to avoid forming ‘Kinks’. The cable drum shall in-verbally conveyed on wheels and the cable unrolled in right direction as indicated on the drum by the manufacturer. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains.

Cables laid in trenches in single tier formation, 10 cms. in total sand cushioning be provided below and above the cable before a protective cover is laid. For every additional vertical tier. The 30cm of sand cushion be provided over the initial tier. The cable shall be protected by 2nd class bricks of size not less than 230x115x75mm, stone tiles/RCC curved channel be placed on top of the sand breadth wise for the full length of the cable and where more than one cable is to be laid in the same trench the brick shall cover all cables and project at least 8 cms. over the outer sides of the end cables.

Filling of trenches shall be done after the sand cushioning and laying of tiles or bricks are carried out to the satisfaction of the Engineer-in-charge (Refer drawing). Back fill for trenches shall be filled in layer not exceeding 150 mm. Each layer shall be properly rammed & consolidate before laying the next layer.

RCC pipe shall be provided for all road crossing. The size of the pipe shall be according to the cable and a minimum 100mm dia. pipe shall be provided. The pipe shall be laid in ground with special arrangement and shall be cement jointed and concreting shall be made as per relevant IS with latest amendment. Nothing extra shall be paid on this account. Location of cables laid directly underground shall be indicated by cable marker at an interval of 30 meters & with change of direction. Aluminium strip cable tag of 20mm wide with engraved tag no. shall be provided at both ends of cable.

Where the cables are to be laid in ducts (masonry trenches) in side the building, they will have to be laid on MS rack/ on MS cable trays grouted in walls trenches. Cables sizing through floors shall be protected from mechanical damage by a steel channel to a height of one meter above the floor where cable pass through wall they shall be sleeved with PVC/steel conduit.

Where the cables are laid in open (in building) along walls, ceiling or above false-ceiling, cable rack (ladder type) or cable tray shall be provided. The size of the cable tray or rack shall depend on the number of cables to pass over that rack. Cable tray/rack shall be properly supported through wall/ceiling according to the site conditions. Cable laid on tray & riser shall be neatly dressed &clamped at an interval of 1000 mm & 750mm for horizontal & vertical cable run respectively either side at each bend of cable. All power cables shall be clamped individually & control cables shall be clamped in groups of three or four cables. Clamps for multicore cables shall be fabricated of 25x3 GI flats. Single core power cable shall be laid in trefoil formation & clamped with trefoil clamps made of PVC/fiber glass.

Cable openings in wall/floor shall be sealed by the contractor suitably by Hessian tape & bitumen compound or by any other proven to prevent ingress of water.

After the cables are laid, shall be tested as per IS and the results submitted to Architects/Engineer and in case the results found unsatisfactory, all the repairing/ replacing of cables will be done by the contractor free of charge.

Cable shall be installed so that separation shown in the table below are observed.

HV Cable - HV Cable 50 mm

| | | | |
|---|---|---|---|
| ELV & LV 230 V/433 V | - | ELV & LV cable 230 V/433 V | 50 mm |
| HV cables | - | ELV & LV cables 230 V/433 V | 300 mm |
| LV cables 433 V | - | Telephone/Instrument cable | 350 mm |
| All cables | - | All wet / hot pipe work | 600 mm |

**11. Fire Seal System**

a) All the floor/wall opening provided for cable crossing shall be sealed by fire seal system.

b) The fire proof sealing system shall fully comply with the requirements of relevant IS:476 Part-B. The fire proof seal system shall have minimum one hour fire resistance rating.

c) The fire proof seal system shall be physically, chemically, thermally stable and shall be mechanically secured to the masonry concrete members. The system shall be completely gas and smoke tight, ant rodent and anti-termite.

d) The material used in fire proof seal system shall be non-toxic and harmless to the working personnel.

e) Type of fire proof seal system shall be foaming type or flame mastic type compound or approved equivalent.

After laying and jointing work is completed, high voltage test should be applied to all cables to ensure that they have not been damaged during or after the laying operation and that there is not fault in the jointing.

Cables for use on low and medium voltage system (1.1KV grade cables) should withstand for 1 minutes a pressure of 3000V DC applied between conductors and also between each conductor and sheaths. In the absence of pressure testing facilities it is sufficient to test for 15 minute with a 1000V insulation tester In case the test results are unsatisfactory the cost of repairs and replacements and extra work of removal & laying will be made good by the contractor.

**L.T. Panel**

**5.1 System**:-

a) **Declared voltage** :– 3 Phase,400V (±6%) 50 Hz,
b) **Neutral** :– Solidly earthed at substation.

**5.2 General finish**:- Tropical, totally enclosed, metal-clad, weather-proof, vermin and dust proof.

**5.3 Construction :**

**Enclosure**:- Type of enclosure shall be able to provide the degree of protection IP:54

**5.4 Circuit Ways:**

As per the requirement given in the specifications / schedule of requirement.

**5.5 Construction :**

5.5.1 The terminals shall be of sufficient mechanical strength and shall provide adequate electrical contact for the appropriate size of cable used. They shall be capable of receiving appropriate size of Aluminum conductors. They shall be provided with stainless steel nut bolts, plane washers and spring washers for cable connection.

5.5.2 The enclosure shall be of sheet steel of 1.5/2 mm . CRC sheet steel, dust vermin proof, duly powder coated and wired as per standard engineering practice and CPRI tested.

5.5.3 No contact pressure shall be transmitted through insulating material & the gripping of the conductor shall take place between metal faces.

**5.6 Earthing** :

5.6.1 Earthing arrangement shall be provided for earthing each cable, PVC cable gland, neutral busbar, chassis and frame work of the cubicle with separate earthing terminals at two ends. The main earthing terminals shall be suitably marked .The earthing terminals shall be of adequate size, protected against corrosion, and readily accessible. These shall be identified by means of sign marked in a legible manner on or adjacent to terminals.

5.6.2 Neutral bus bar strip shall be connected to Earthing terminal with help of copper strip of suitable capacity & nut-bolt arrangement.

5.7.1 **Accessories:** The following accessories shall be supplied duly mounted..

5.7.2 One incandescent lamp (with necessary fuse) to illuminate the fuse board internally.

## 11 KV SWITCHGEAR

**1. Design Criteria**

a) 11 KV HT Panels shall be used to receive the power from other substation and further feed power to 11 KV Panels through 11 kv Transformers and further details are as per enclosed single line diagram. 11 KV HT Panel shall be used to receive the power from SEB and to feed supply to the installation through the step down transformer to further loads as per SLD.
b) Switchgear shall be located in a clean but hot, humid and tropical atmosphere.
c) For continuous operation at specified ratings. temperature rise of the various switchgears components shall be limited to the permissible values stipulated in the relevant standards.
d) The switch gears and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short circuit current listed in the annexure / BOQ / system description without any damage or deterioration material.
e) Circuit breakers, instrument transformers, bus bars, cable compartment etc. shall be housed in separate compartment within the cubicle. The design shall be such that failure of one equipment shall not affect the adjacent units.
f) Circuit breakers of identical rating shall be physically and electrically interchangeable.
g) Panels shall be fully compatible with substation automation/SCADA
h) All the plant/ apparatus/equipment supplied shall comply in all respect with the requirement of Indian Electricity Rule 1956/ISS and latest amendment thereof during execution of contract wherever applicable

**2. <u>Standards</u>**

All equipment, material and components shall comply with the requirements of the latest editions of Indian Standards with updated amendments. Standards and Regulations applicable in the area where equipment is to be installed shall also be followed.

The equipment offered complying with other standards, these standards shall be equal to or superior to those specified and full details of the differences shall be furnished along with the tender.

Some of the relevant Indian and British Standards are listed below:

| | | |
|---|---|---|
| IEC-60056 / IS 13118 | : | Circuit Breakers |
| IS 3427 | : | Metal enclosed Switchgear & Control Gear |
| BS 162 | : | Safety Clearances |
| IS 2705 | : | Current Transformers (Parts 1 to 4) |
| IS 3156 | : | Voltage Transformers (Parts 1 to 4) |
| IS 1248 | : | Ammeter and Voltmeter |
| IS 3202 | : | Code of Practice for climate proofing of electrical equipment |
| IS 375 | : | Marking & Arrangement for Switchgear Bus Bars, main connections and auxiliary wiring. |
| IS 722 | : | A.C. Electric Meters (digital). |

| | | |
|---|---|---|
| IS 13779 | : | Digital microprocessor based / static) electrical measuring instruments & testing accessories. |
| IS 3231 | : | Electrical Relays for Power System Protection (digital). |
| IS 2544 | : | Epoxy Cast Resin Insulators |
| IS 5082 | : | Electrolytic Copper and Aluminium |
| IS 5792 | : | High Voltage HRC fuses |
| IS 12729/ IEC 298, 694 | : | M.V. switchgear |

**3. Specific Requirements**

**a) Construction Features**

(i) The Switchgear shall be indoor, metal-clad, floor mounted, drawout type.
(ii) The Switchgear shall be such as to allow extension at either end.
(iii) The Switchgear enclosure shall conform to the degree of protection IP4X as per IS : 3427.
(iv) The minimum thickness of sheet steel used shall be 2 mm CRCA.
(v) The switchgear shall be dead-front, free standing type vertical cubicle.
(vi) Switchgear shall have a front hinged door with latches and a removable back cover.
(vii) All covers and doors shall be provided with neoprene gaskets.
(viii) All relays, meters, switches and lamps shall be flush mounted on the respective cubicle door or on control cabinet built on the front of the cubicle.
(ix) The complete structure shall be free, rigid, self supporting, free from twist and bends etc.
(x) Floor mounted cubicles shall be provided with a 50mm high channel base frame. The total height of the cubicle shall not exceed 2500mm

**b) Bus and Bus Taps**

(i) The main buses and connections shall be of high conductivity electrolytic aluminium, sized for specified current ratings with maximum temperature limited to 85 degree C (i.e. 35 degree C rise over 50 degree C ambient) The bus-bars should be rated for 25 KA for 3 sec (FOR 11 kv PANEL)
(ii) Bus bars and connection shall be fully insulated for working voltage with adequate phase / ground clearances. Insulating sleeves for bus bars and cast-resin shrouds for joints shall be provided.
(iii) All buses and connections shall be supported and braced to withstand stresses due to maximum short circuit current and also to take care of any thermal expansion.
(iv) Bus bars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear, when viewed from front of the switchgear assembly.
(v) The bus bars shall be air insulated and housed in a separate compartment, segregated from all other compartments

(V) Direct access to accidental contact with bus bars and primary connections shall be avoided by providing shrouds. All apertures and slots shall be protected by barriers to prevent accidental shorting of bus bars. To provide a tight seal between cubicles,

bushings or insulating panels shall be provided for bus bars crossing from one cubicle into another.

**c) Circuit Breakers**

(i) Circuit breakers shall be triple pole, single throw and shall be Vacuum type for 11 KV Panel

(ii) Circuit breakers shall be draw out type, having SERVICE, TEST and DISCONNECTED position with positive indication for each position.

(iii) The operating time (break time) of the breaker shall be maximum of 3 cycles.

(iv) Circuit breaker shall have motor wound spring charged trip free mechanism with anti-pumping feature and shunt trip. In addition, facility for manual charging of spring shall be provided.

(v) For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close open operation of the circuit breaker shall be possible after failure of power supply to the motor.

(vi) Mechanical safety interlock shall be provided to prevent:

i. The circuit breaker from being racked in or out of the service position when the breaker is closed.

ii. Racking in the circuit breaker unless the control plug is fully engaged.

(vii) Automatic safety shutters shall be provided to fully cover the female primary disconnects when the breaker is withdrawn.

(viii) Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indication, an operation counter and mechanism charge / discharge indicator.

(ix) Each breaker shall be provided with following:

- Auxiliary switch, with 6 NO + 6 NC contacts, mounted on the draw out portion of the switchgear.
- Position / cell switch with 3NO + 1 NC contacts, on each for TEST and SERVICE position.

(x) Control & Indication:

Breaker cubicle shall be equipped with following:

- One (1) No. spring return type TNC switch for closing and tripping of the breaker.
- One (1) No. Push button operated mechanical mechanism for tripping.
- Three (5) Nos. indicating lamps on front of compartment

| | |
|---|---|
| GREEN | Breaker Open and Spring Charged |
| RED | Breaker Closed |
| AMBER | Breaker Trip |
| BLUE | Trip circuit supervision |

- Lamps shall be of LED type. Lamps and lens shall be replaceable from the front.
- Each circuit breaker shall be provided with a anti-pumping relay, Trip coil supervision relay and fast trip relay in addition to those shown in the drawing.
- Metering device and protective relays for switchgear shall be provided as shown in the attached drawings.
- Breaker shall be horizontal isolated and horizontal draw out type.

**d) Current Transformers**

(i) Current transformer shall be cast resin type. All secondary connections shall be brought out to terminal blocks where connections will be made.

(ii) The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses due to the maximum short circuit current of the circuit

(iii) Separate current transformers (core) shall be used for metering and protection

(iv) Accuracy class of Current Transformers shall be :

- Class 5P20 for relaying
- Class PS for differential protection
- Class 1.0/0.5 as specified and ISF<5 for metering.

**e) Voltage Transformers**

(i) Voltage Transformers shall be of cast-resin type having accuracy class of 1.0 / 0.5 and shall be mounted on draw out trolley.

(ii) High voltage winding of voltage transformer shall be protected by current limiting fuse. The voltage transformer and fuse shall be completely disconnected and visibly grounded in fully draw-out position.

(iii) Low voltage fuses, sized to prevent overload, shall be installed in all ungrounded secondary leads. Fuse shall be suitably located to permit easy replacement while the switchgear is energized.

**f) Relays**

(i) Relay shall be of Numerical type, communicable with PLC through RS 485 port on Modbus and with built – in testing facilities. Small auxiliary relays may be in non-drawout execution and mounted with in the cubicle.

(ii) Relays shall be rated for operation on secondary voltage and secondary currents **as shown on drawings**. Number and rating of relay contacts shall suit the job requirements.

(iii) Relays shall be enclosed in rectangular shaped cases, suitable for flush mounting only, dust tight covers projecting from the front cover panel. The case shall be dust tight, damp proof and tropicalised.

(iv) Relays shall be accessible for setting from the front. Access to setting devices shall be possible only after removal of front cover.

**g) Meters**

i. Ammeter and Voltmeter shall be analog type, switch board type .

ii. Energy Analyser shall be digital type, switch board type and accuracy class of + (1% full scale + 1 count).

**h) Secondary Wiring**

(i) The switchgear shall be fully wired at the factory to ensure proper functioning of control, protection, transfer and interlocking schemes.

(ii) Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired upto terminal blocks.

(iii) Wiring shall be done with flexible, 650V grade, PVC insulated, FRLS, switchboard wires with stranded copper conductors of minimum 2.5 sq. mm for control, current circuits and for voltage circuits.

(iv) Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per contractor's Wiring Diagram.

(v) Wire terminations shall be made with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.

**i) Terminal Blocks**

(i) Terminal blocks shall be 660 V grade box-clamp type with marking strips similar to ELMEX 10 Sq. mm or equal. Terminals for CT secondary leads shall have provision for shorting.

(ii) Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.

**j) Cable Termination**

(i) Switchgear shall be designed for cable entry from the bottom. Sufficient space shall be provided for ease of termination and connection.

(ii) Power cables shall be XLPE insulated, armoured, overall PVC sheathed with stranded Aluminium conductor.

(iii) Control cables shall be PVC insulated, armoured, overall PVC sheathed with 2.5 Sq. mm stranded copper conductor.

(iv) The gland plates shall be minimum 4 mm thick. The gland plate and supporting arrangement for I/*C* power cables shall be such as to minimize flow of eddy current. In such case, gland plate shall be non ferrous metal.

(v) Sufficient space shall be provided between the power cable termination (end-boxes) and gland plate. Core accommodated within this space.

**k) Ground Bus**

(i) A ground bus, rated to carry maximum fault current, shall extend to full length of the switchgear.

(ii) The ground bus shall be provided with two sets of bolt drilling with G.I. bolts and nuts at each end to receive 50 x 6 mm G.I flat.

(iii) Each stationary unit shall be connected directly to the ground bus. The frame of each circuit breaker and draw out V.T. unit shall be grounded , through heavy multiple contacts at all times.

(iv) Wherever the schematic diagrams indicate a definite ground at the switchgear, a single wire for each circuit thus grounded shall be run independently to the ground bus and connected thereto.

(v) C.T. and P.T. secondary neutrals shall be earthed through removable links so that earth of one circuit may be removed without disturbing other.

**l) Nameplates**

(i) Nameplates of anodized aluminium shall be furnished at each cubicle and at each instrument, device mounted on or inside the cubicle with full particulars engraved thereon with white letters against black back ground..

(ii) Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.

**m) Space Heaters**

i. Each Cubicle shall be provided with thermostat controlled anti-condensation space heaters.

ii. Space heater/s shall be trip type, rated with operation voltage of 230V, 50 Hz. AC supply unless otherwise specified.

iii. Each space heater shall be complete with a rotary type ON/OFF switch, HRC fuse in the phase, neutral link in neutral and a control thermostat.

**n) A.C/ D.C Power Supply**

(i) The following power supplies shall be made available at each switchgear by the, contractor:

| | | |
|---|---|---|
| AC. Supply | : | Single Feeder |
| D.C supply | : | Double Feeder |

(ii) Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4- pole, single throw for A.C. and 2-pole, double throw for D.C.

(iii) Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch fuse units shall be provided at each cubicle for *AC /* D.C. supplies.

(iv) A.C. load shall be so distributed as to present a balance loading on three-phase supply system.

**o) Tropical Protection**

(i) All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

(ii) Screen of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

**p) Painting and treatment**

The panel shall have eight tank pretreatment process comprising of degreasing, rinsing, derusting, rinsing, activation, phosphating, rinsing, and passivation followed by powder coat painting having a paint thickness of 60 micron or as specified of approved shade of seimens grey (Shade RAL 7032). The powder paint will be subjected to oven heated process.

**4. Tests**

The switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

**Routine Test**

The tests shall include but not necessarily limited to the following:

a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme & proper functioning of the equipment.
b) All wiring and current carrying part shall be given appropriate High Voltage test.
c) Primary current and voltage shall be applied to all instrument transformers.
d) Routine test shall be carried out on all equipment such as circuit breakers, instrument transformers, relays, meters etc.

**Type Test**

Type test reports of similar switchgear shall be furnished.

**Test Witness**

All tests shall be performed in presence of *Owner's* representatives, if so desired by the Owner's. The Contractor shall given at least fifteen (15) days advance notice of the date when tests are to be carried out.

**5. <u>SYSTEM DESCRIPTION & REQUIREMENTS</u>**

**<u>System Description (for 11 KV Panel)</u>**

a) System Details

| | | | |
|---|---|---|---|
| (i) | Voltage | : | 11 / 12 KV (Nom. / Max.) |
| (ii) | Nos. of Phase | : | 3 |
| (iii) | Frequency | : | 50 Hz. ± 5% |
| (iv) | System Neutral | : | Non effectively earthed |

b) Insulation Level

| | | | |
|---|---|---|---|
| (i) | 1 minute 50 Hz withstand | : | 28 KV rms. |
| (ii) | Impulse withstand | : | 75 KV peak |

c) Short Circuit Rating

(i) Interrupting : 350 MVA Withstand time : 1 Sec.

d) Circuit Breaker

| | | | |
|---|---|---|---|
| i) | Breaking Current | : | 18.4 KA |
| e) | Auxiliary Power supply available | : | 24V DC thru battery |
| f) | Heater/Lamp/Socket | : | 415V/240V±10%<br>50 Hz± 5% 3Ph./1 Ph. |
| g) | Spring wound motor for circuit breaker | : | 220V-240V 1 Ph. 50 Hz |
| h) | Shunt trip coil & Closing coil | : | 24V DC thru battery |

## 2. DRAWINGS AND INFORMATION

The Vendor shall furnish following drawings/documents in accordance with enclosed requirements:

i) General Arrangement drawing of the Switchboard, showing front view, plan, foundation plan, floor cutouts/trenches for external cables and elevations, transport sections and weights.

ii) Sectional drawings of the circuit breaker panels, showing general constructional features, mounting details of various devices, bus bars, current transformers, cable boxes, terminal boxes for control cables etc.

iii) Schematic and control wiring diagram for circuit breaker and protection including indicating devices, metering instruments, alarms, space heaters etc. Vendor drawings to be based on Purchaser's Control Wiring Diagram.

iv) Terminal plans showing terminal numbers, ferrules markings, device terminal numbers, function etc.

v) Relay wiring diagrams.

vi) Equipment List.

Vendor shall furnish required number of copies of above drawings for Purchaser's review, fabrication of switch boards shall start only after Purchaser's clearance for the same. After final review, required number of copies and reproducible shall be furnished as final certified drawings.

The information furnished shall include the following:

i) Technical literature giving complete information of the equipment.

ii) Erection, Operation and Maintenance Manual complete with all relevant information, drawings and literature for auxiliary equipment and accessories, characteristics curves for relays etc.

iii) A comprehensive spare parts catalogue.

## TOOLS

One complete set of all special or non-standard tools required for installation, operation and maintenance of the switch board shall be provided. The manufacturer shall provide a list of such tools individually priced with his quotation.

## SPARES

The manufacturer shall include the cost spare required for testing & commissioning for HV Switchgear.

## QUALITY ASSURANCE

Quality Assurance shall follow the requirements of Owner/ Consultant as applicable.

Quality Assurance involvement will commence at enquiry and follow through to completion and acceptance thus ensuring total conformity to Purchaser's requirements.

## DEVIATIONS

Deviation from specification must be stated in writing at the quotation stage.

In absence of such a statement, it will be assumed that the requirements of the specifications are met without exception.

## ERECTION & COMMISSIONING

## 1.0 GENERAL

### 1.1 EQUIPMENT ERECTION

a) The equipment in disassembled condition shall be received at site by the contractor.

b) The contractor shall unpack, assemble all parts, mount and wire up loose equipment, fitting and accessories and complete all connections.

c) The contractor shall mount the equipment on respective foundation/ supports, level & align the same & arrange for necessary grouting/anchoring.

d) The erection work shall be carried out in compliance with manufacturer's instruction and shall include all adjustments, checks and measurements.

e) The contractor shall record results of all erection tests and measurements and furnish copies of the same to the owner for his reference and record.

f) Any internal wiring of the equipment, which has been left incomplete because of shipping, split or which requires minor modifications shall be carried out by the contractor. This includes mounting of items like relays, meters etc. and connecting the same as per wiring scheme diagram furnished by the original manufacturers.

### 1.2 CONSUMABLES AND HARDWARE

The contractor shall furnish all erection materials, hardware and consumables required for the completion of the installation. The materials shall include but not limited to the following:

a) Consumables : welding rods & gas, oil & grease, cleaning fluids, paints, electrical tape, soldering materials etc.

b) Hardware : bolts, nuts, washers, screws, brackets, supports, clamps, hangers, saddles, cleats, sills, shims etc.

c) Materials : junction boxes, terminal blocks, connectors, ferrules, lugs, brass glands, rigid/flexible conduits, cables, ground wires etc.

Supply of cement, sand, stone etc. required for the execution of the contract shall be responsibility of the contractor.

### 1.3 ERECTION TOOLS & TACKLES

a) The contractor shall provide all tools, tackle, implements, module equipment such as chain pulley block, trailers etc. which are required for transportation, handling and erection of equipment.

b) Special erection tools, if any, furnished by the Manufacturer along with the equipment may be used by the contractor. such tools and equipment, however, shall be returned in good working conditions to the owner on completion of the job.

c) The contractor shall also arrange for major testing equipment as list below:

- Insulation Tester : Motor operated Megger 1000V & 10KV grade.
  Hand operated Megger 1000V.
- Hand driven earth resistance megger, range 0-1/3/30 ohms.
- Tong testers of suitable ranges.
- Contact resistance measuring set for micro-ohms.
- Torque wrench.
- Primary / secondary injection set and relay testing kit.
- Multi meters, test lamp, field telephone with buzzer sets, different gauges etc.
- Streamline filter.
- Chain pulley block, cable jacks & spindle, cable, collars, electricians tool kit, jointer's tool kit, fitters tool kit, welding transformer, phase sequence meter, HV testing kit, primary & secondary injection kit.

other test equipment as required for testing and commissioning of the equipment shall have to be arranged by the contractor.

**1.4 METHODS AND WORKMANSHIP**

a) All work shall be installed in a first class, neat workman like manner by mechanics / electricians skilled in the trade involved.

b) The erection work shall be supervised by competent supervisors holding relevant supervisory license from the Government.

c) All details on installation shall be electrically and mechanically correct.

d) The installation shall be carried out in such a manner as to preserve access to other equipment installed.

e) If in the opinion of the contractor any work is insufficiently specified or require modification, the contractor shall refer the same in writing to the owner and obtain his instruction / approval before proceeding with the work.

f) If the contractor fails to refer such instances, any excuse for the faulty erection, poor workmanship or delay in completion shall not be entertained.

g) Equipment and material, which are wrongly installed shall be removed and re-installed to comply with the design requirement at the contractor's expense, to the satisfaction of the owner/consultant.

h) All scaffolding pipes and frames shall be of tubular steel. Bamboo's/ *balliesl* timer frames are not permitted under any circumstances. All vertical & horizontal scaffolds shall be of MS pipes of adequate size to withstand the loads & pressures. The working platforms shall be either of conduit pipes or MS bars.

**1.5 ALLOWABLE WASTAGE**

a) The erection contractor shall make every effort to minimize wastage during erection work. In any case, the wastage shall not exceed 1 %

b) Measurement shall be taken at site jointly by contractor and owner's representative.

c) If the actual wastage be more than the quoted figure then equivalent price of the balance amount will be deducted from contractor's bills.

d) The contractor shall submit a detailed account of materials issued to him after completion of work. The excess materials after completion of job shall be returned back to the owner's store.

**1.6 FOUNDATION AND CIVIL WORK**

a) The contractor shall check the foundations provided by owner before commencement of erection to ensure their suitability.

b) All final adjustments of foundation levels, chipping and dressing of foundation surfaces, drilling holes on foundation channels to suit the equipment setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the contractor including minor modification of civil work as may be required for erection.

c) Any cutting of masonry work which is necessary shall be done by the Contractor at his own cost and shall be made good to match the original work. The contractor shall obtain approval of owner/ consultant before proceeding with any cutting of masonry / concrete work.

**1.7 EXCAVATION AND BACK FILLING**

a) The contractor shall perform all excavation and back filling as required for the scope of work pecified.

b) The contractor shall make his own arrangement for pumping out any water that may accumulate in the excavation.

c) All excavation shall be back filled to the original level with good consolidation.

**1.8 REPAIR OF DAMAGE SUBSTAINED DURING TRANSIT**

The contractor shall repair minor damages sustained during transit or subsequent storage in purchaser's store. The repair charges shall be paid to the contractor on the basis of extra work.

**1.9 INSPECTION**

a) After completion of erection / installation, each piece of equipment shall be thoroughly tested as per approved procedure and inspected in presence of the owner/consultant for correctness and completeness of erection and acceptability for start up.

b) A check list in triplicate will be furnished by the owner/consultant wherein all details to be checked and necessary instruction shall be listed. the inspection and checking shall strictly follow the checklist.

c) on completion of the inspection (2) copies of the check list duly filled-in shall be handed over to the owner/consultant.

d) This check list shall be jointly signed by the contractor and the owner/consultant. Such endorsement, however, shall not relieve the contractor of his obligations under the contract.

**2.0 11 KV SWITCHGEARS**

2.1 11 KV HT Switchgears shall be installed in accordance with IS:3072 and manufacturer's instructions. The contractor shall be required to install and align any channel sills which form part of the foundation. The HT Switchgears shall be made absolutely vermin proof.

2.2 Control wiring (if any) between 11 KV HT switchgears & other electrical equipment shall be carried out as per the instructions of the manufacturers & site-in-charge.

**3.0 TRANSFORMER**

3.1 Installation of the transformer shall be in accordance with the IS : 1886, manufacturer's instructions and as per the enclosed drawings.

3.2 Care shall be taken during handling of insulating oil to preventing ingress of moisture or foreign material. Testing and sampling of oil shall be in accordance with manufacturer's instructions and related IS. If oil filtration is required the same shall be carried out at site by the Contractor.

3.3 Control wiring between Transformer & other electrical panels shall be carried out as per the manufacturer's drawings and as per the instructions of site - in - charge.

**4.0 415 V BUS DUCT**

4.1 Bus duct will be received in transportable pieces. The Contractor shall erect the bus duct including bends, wall seating copper flexible at both ends and complete all connections in accordance with Manufacturer's drawings. The work also includes erection of steel hangers / supports for these bus ducts wherever necessary.

4.2 All steel structure / support / hardware for supporting bus duct shall be calculated by the contractor.

## 5.0 MAIN PCC / CAPACITOR PANELS

5.1 All above panels & DBs will be available in split - up - sections for ease of transportation and handling. However in some cases, breakers, busbars relays, meters and control switches may be supplied loose to be mounted and connected at site as per the relevant drawings.

5.2 All alignments leveling, grouting, anchoring and adjustments shall be carried out in accordance with manufacturer's instructions and/or as directed by the Engineer. All boards shall be cleaned by using blower before installation.

5.3 All connections in the panels shall be completed, checked and adjusted to ensure safety and satisfactory operation of the equipment. This includes the following activities:

a) Functional test on circuit breakers.
b) Setting of protective relays and thermal over load relays.
c) Adjustment of zero error of various indicating instruments.
d) Testing of thermal overload relays by primary injection and protective relays by secondary injection.

5.4 In some cases, minor modifications may have to be carried out at site in the wiring of an equipment to meet the requirements of the desired control scheme and the Contractor shall have to do the same at no extra cost.

## 6.0 MISC. ITEMS AND LOCAL PANEL INSTALLATION

6.1 The contractor shall install miscellaneous items such as local control station, start-stop push button stations, and local starter units. control panels, misc. panel etc.

6.2 These equipment will be generally wall or column mounted excepting a few which are floor mounted. The exact locations will be as decided by the Engineer at site.

6.3 All supports or brackets need for installation shall be fabricated by the Contractor.

6.4 All welding, cutting, chipping and grinding as and when necessary shall be carried out by the Contractor at no extra cost.

## 7.0 CABLING SYSTEM

### 7.1 CABLE TRAYS AND RACKS

a) The contractor shall install the cable racks, trays, risers, shafts and supports.
b) Cable trays and risers shall be aligned and leveled correctly. All runs shall be installed parallel to the trench/building walls and floors except otherwise noted on the drawings.
c) The contractor shall provide embedded steel inserts/supports on wall, ceiling or floor by suitable anchoring & shall secure racks and supports by welding these to inserts.
d) The trays in general shall be supported at a distance of 1.5 to 2 meters on horizontal and vertical run.
e) Cable trays shall be installed as per drawings furnished to the Contractor. Any deviation in routes shall have the prior approval of the Engineer In charge.

f) Prefabricated cable trays and accessories shall be assembled and erected at site as per instructions of Manufacturer. Alternately, the Contractor shall fabricate and install all cable trays, risers, shafts and supports as agreed upon during finalization of the award.

g) Sufficient spacing not less than 250 mm shall be provided between trays and maintained to permit adequate access for installing and maintaining the cables.

h) Contractor shall co-ordinate with other contractors (such as for piping etc.) where there is a common support for cable trays and for other services.

i) All necessary steel & all consumables as specified elsewhere shall be provided by the contractor.

**7.2 STORAGE AND HANDLING**

a) Cable drums shall be stored on hard and well drained surface so that they may not sink. In no case the drum shall be stored on the flat Le. with flange horizontal.

b) Rolling of drum shall be avoided as far as practicable. For short distance, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum.

c) In absence of any indication the drums may be rolled in the same direction as it was rolled during taking up the cable.

d) For unreeling the cable, the drum shall be mounted on jacks or on cable wheel. The spindle shall be strong enough to carry the weight without bending.

e) The drum shall be rolled on the spindle slowly so that cable should come out over the drum and not below the drum.

f) While laying cable, cable rollers shall be used at an interval of 2000 mm. The cable shall be pushed over the roller by a gang of people positioned in between rollers.

g) Cable shall not be pulled from the end without having intermediate pushing arrangement. Bending radius of the cable shall not be less than that is specified by the manufacturer.

h) All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends.

**7.3 CABLE LAYING**

a) Cable shall generally be installed in ladder type / perforated trays in trenches or buried in ground except for some short runs in conduit for protection or crossings the roads etc.

b) Each length of run shall be physically measured at site before cutting the cable. Contractor shall furnish cable cutting the schedule to engineer in charge with respect to able drum length available at site and runs of cables & sizes of cables.

c) Cable may also be laid through hume pipes in road crossings etc. The hume pipes shall be supplied and placed in position by the Contractor.

d) Cable laid on trays and risers shall be neatly dressed and clamped at an interval of 3000 mm and 900 mm for horizontal and vertical cable run respectively and at each bend of cable.

e) All power cables shall be clamped individually and control cables shall be clamped in groups of three or four cables.

f) Clamps for multicore cables shall be fabricated of 25 x 3 mm G.I. flats. Single core power cables shall be laid in trefoil formation and clamped with trefoil clamps made of Fiber glass/PVC.

g) Cable openings etc. in walls/floor made by the Contractor or by others shall be sealed by the Contractor suitably by Hessian tape and bitumen compound or by any other proven method to prevent ingress of water.

h) Directly buried cables shall be laid as per detail shown in drawing. These cables shall be laid on and covered with sand/raddle earth and protected by brick barriers as sides and precast concrete slab brick on top. Job also involve digging/excavation of earth and refilling the same after laying of cables. For cables laid underground a loop of diameter of 3 meters shall be provided near each terminating ends.

i) After completion of installation and prior to connection, all High Voltage Power cables shall be given a high potential test. The contractor shall provided this Hipot Test set having provision of leakage current measurement.

j) Laying cost shall include all above activities including supply and fixing of clamps etc.

k) Cables for machines in clean area shall be laid in suitable size of stainless steel conduit.

**7.4 CABLE TAGS AND MARKERS**

a) Each cables and conduit run shall be tagged with numbers that appear in the cable schedules. Cables and conduits shall be tagged at every thirty (30) meters. Cables and conduits shall also be tagged on either side of a floor/wall passage.

b) The tags shall be of PVC or Aluminium with the number engraved on it and securely attached to the cable by not less than two turns of G.!. wire.

c) Location of cables laid directly underground shall be indicated clearly by cable marker made of cast iron.

d) The location of cable joints, if any, shall be clearly indicated with cable marked with an additional inscription "Cable Joint".

e) The marker shall project 100 mm above ground and shall be spaced at an interval of 30 meters at every change of direction.

f) Where cables are cut from the drums the ends of the cables at the drums shall be properly sealed.

g) The power and control cable shall be laid with a provision of extra length at one of the end terminations. This length shall be confirmed by the Engineer in charge before laying.

h) Cost of laying shall also include supply and fixing of tags, cable markers etc.

**7.5 TERMINATIONS JOINTS AND CONNECTION**

a) The termination, Joints and connections of cables shall be done by qualified jointers strictly in accordance with manufacturer's instruction drawings and/or as directed by the Engineer.

b) The work shall include all clamping, fittings, fixing, plumbing, soldering, taping, compound filling, epoxy cable jointing, crimping, connecting, shorting and earthing as required for all such operations should be available with concerned contractor. For all size of L T termination, crimping tool (Hydraulic type) shall be used. Further, inhibiting compound shall be provided before termination.

c) The equipment will be generally provided with blank plates for cable/conduit entry and cable end box for power cables.

d) The Contractor shall perform all drilling, cutting on the blank plates and any minor modification work required to complete the job.

e) If the cable-end box or terminal enclosure provided on the equipment is found unsuitable and requires major modification, the same shall be carried out by the Contractor as extra work item.

f) Control cable cores entering control panel/switch gear / MCC etc. shall be neatly bunched and served with nylon cord or PVC perforated tape to keep in position at the terminal block.

g) The contractor shall provide oil resistance ferrules for all control cable cores at all terminations including at all junction boxes. and at all terminations. The ferrules shall carry terminal numbers as per drawing. The ferrules shall be of interlocked plastic type or approved equal.

h) Spare cores shall be similarly tagged, crimped with lug and taped on the ends. Spare cores shall be tagged with individual cable number.

i) Terminations and connections shall be carried out in such a manner as to avoid strain on the terminals.

j) All cable entry points shall be sealed and made vermin and dust proof. Unused opening, if any shall be effectively closed.

k) Termination kits for HT cables, Straight through joint kits for HT & L T cables, cable of all glands lugs shall be arranged by the Contractor, which includes furnishing consumable materials such as plumbing and soldering material, electrical tape including bitumen compound/resin if not a part of kit shall be included in the erection rates.

## 8.0 IMPORTANT NOTES FOR ERECTION ACTIVITIES

### 8.1 CABLES AND CONDUITS

a) Approximate lengths of cables and conduits runs will be given in the cable schedule. Before commencement of work the Contractor shall take actual measurements and prepare his own cable cutting schedules to reduce wastage to a minimum.

b) During the erection period the Contractor shall furnish weekly / fortnightly report on cable position in an approved proforma so as to keep the Engineer In Charge apprised of the position and to enable him to intimate any procurement action in time.

c) The Contractor shall also maintain and submit when requested, a record of cable insulation value when drawn from store, after laying, before and after termination/jointing.

### 8.2 EXCAVATION AND BACK FILLING

a) The Contractor shall perform all excavation and back filling as required for the scope of work specified.

b) The Contractor shall make his own arrangement for pumping out any water that may accumulate in the excavation.

c) All excavation shall be back filled to the original level with good consolidation.

### 8.3 FOUNDATION AND CIVIL WORK

a) The contractor shall provide foundations wherever required & in case same has been provided by the Owner earlier, same shall be checked for correctness before commencement of erection to ensure their suitability.

b) All final adjustments of foundation levels, chipping and dressing of foundation surfaces, drilling holes on foundation channels to suit the equipment setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the Contractor including minor modification of civil work as may be required for erection.

c) Any cutting of masonry work which is necessary shall be done by the Contractor at his own cost & shall be made good to match the original work.

The Contractor shall obtain approval of Engineer before proceeding with any cutting ,of masonry /concrete work.

## 8.4 STRUCTURAL FABRICATION WORKS

a) All chequered plate covers, cable racks, trays, supports, hangers and brackets wherever necessary shall be supplied/fabricated by the Contactor. Steel for fabrication shall be straightened and cleaned of rust and grease. All fabrication shall be free of sharp edge.

b) Every effort shall be made to minimize the wastage of steel as far as practicable during fabrication. The wastage in no case shall exceed as specified else where in this specification.

## 8.5 TESTING AND COMMISSIONING

a) On completion of erection work, the Contractor shall request the Engineer, for inspection and tests with minimum of fourteen (14) days' advance notice.

b) The Engineer shall arrange for joint inspection of the installation for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the Contractor.

c) The installation shall be then tested and commissioned in presence of the Engineer.

d) The Contractor shall provide all men, material and equipment required to carry out the tests.

All rectification, repairs or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the Contractor, without any extra cost. The handing over of the installation shall be effected only after the receipt of written instruction from the Purchaser/his authorized representative.

## 9.0 SCHEDULE OF PRE-COMMISSIONING TESTS

## 9.1 CIRCUIT BREAKER

a) Insulation resistance test on each pole by Meggar.

b) Insulation resistance test on control circuit.

c) Checking of all joints for leakage in breaker.

d) Measurement of contact resistance for all the Three Phases.

e) Checking the auxiliary circuits associated with circuit breaker.

f) Functional check of breaker operation electrically at 70% and 110% of rated D.C. supply voltage.

g) Checking of interlock provided in Control Circuits and tripping through simulated protective relay contacts.

h) Auto-reclosing duty cycle check wherever auto-reclosing is required.

i) Measurement of resistance of closing and tripping coils.

## 9.2 CURRENT TRANSFORMER

a) Insulation Resistance test on each winding by Megger to earth and between windings.

b) Checking of all ratios on all cores by Primary injection set.

c) Polarity check on each winding.

d) Continuity test.

e) Check for connection to correct taps.

f) Oil level check.

## 9.3 EARTHING

a) Continuity of earthing connection.

b) Testing of Earth Resistance of Individual Electrode.

c) Testing of Earth Resistance of the combined earthing system.

**9.4 SWITCHBOARDS / MCC / DISTRIBUTION BOARD / PANELS**

a) Measurement of insulation Resistance of Bus-bar System.
b) Measurement of I. R. of Control Circuit.
c) Functional check of circuit components
d) Continuity check of different circuits.
e) Calibration test of Relays and Meters.
f) Space heater operation.
g) Annunciations.

**9.5 RELAYS & METERS**

a) Calibration test.
b) Operation *I* performance test.

**NOTE**

Tests required for some of the major items are indicated for Bidder's reference. Apart from the tests listed herein and also as mentioned elsewhere in this specification, any other test as necessary per relevant standards, recommendations, Code of Practice, Manufacturer's recommendations etc., shall have to be carried out by the Contractor without any implication within the quoted price and time schedules.

## LIGHTING FIXTURES AND FANS

(i) The lighting fixtures and fans shall be assembled and installed in position complete and ready for service in accordance with the details drawings, manufacturer's instructions and to the satisfaction of the Architect/consultant. Fixtures shall be suspended true to alignment plumb level and capable of resisting all lateral and vertical forces and shall be fixed as required.

All ceiling fans shall be provided with suspension arrangement in the concrete slab/roof members. It is the duty of the contractor to make these provisions at the appropriate stage of construction. Exhaust fans shall be fixed at locations shown on the drawings. All switch and outlet boxes, fan and light fittings shall be bonded to earth through connector blocks. Wires brought out from junction boxes shall be encased in GI flexible pipes for connecting to fixtures concealed in suspended ceiling.

All lighting fixtures and fans shall be supplied as per the make and catalogue numbers mentioned in the bill of quantities or drawings in the original packing along with all standard accessories & control gears as per manufacturers specifications against that item number. All fans and exhaust fans shall also be provided with the guarantee or warrantee cards as the case may be.

(ii) a) **Lighting fittings :-** Lights, fans and socket outlet shall be so located as to provide maximum comfort to the occupant and to enable him to utilise the electricity in the most economical manner. Every lighting fitting shall be controlled by a switch which shall be in live conductor of the circuit. Where control of the fitting at more than one point is necessary. It shall be done by as many two way and intermediate switches as there are control points.

b) **Fittings Wire :-** These wires shall be of copper and shall be used only for internal wiring of fittings and shall be carried up to the termination of the light point.

c) **Fluorescent tube fittings :-** These fittings shall be high power factor type i.e. shall consist of necessary power factor improvement capacitor. The fittings shall be standard models complete with necessary number of tubes. These shall be complete with all components supplied as original components with standard models and shall be assembled and wired by the manufactured at the factory. The fluorescent tube shall be of the same make as the fitting. In cases where tubes are not manufactured by the fittings, manufactures the fluorescent tube of any approved make as directed by the Engineer-in-charge shall be used.

d) **High Pressure mercury / sodium vapour lamps :-** These fittings shall be complete with necessary vapour lamp, lamp holder, fittings with reflector, condensor, choke and starter etc. of appropriate size and quality complete in all respects with electric connections.

(iv) **Exhaust fans :-**

a) Exhaust fans shall conform to relevant Indian Standards.

b) Exhaust fans shall be erected at the places indicating by the Engineer-in-charge. Exhaust fan may be fixed in a window panel provided for this purpose or in masonry. For fixing an exhaust fan in masonry 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 to the original finish of the wall. The exhaust fan shall be connected to the exhaust fan point, which shall be wired as near to the hole as possible, by means of a flexible cord, care being taken to see that the blades rotate in the proper direction.

c) Exhaust fans for installation in corrosive atmosphere, shall be painted with special PVC paint or chlorinated rubber paint.

d) Installation of exhaust fans in kitchens, dark rooms and such other special locations need careful consideration; any special provisions needed shall be specified.

## TECHNICAL SPECIFICATIONS FOR UPS

## UNINTERRUPTED POWER SUPPLY

### 1 GENERAL REQUIREMENTS

**1.1 This section specifies the requirement of UPS power supply system, installation, testing, commissioning and maintenance of Uninterruptible Power Supply (UPS) System as described herein and shown on the drawings.**

**1.2 The UPS system shall consist of rectifier / battery charger, batteries, inverter, static bypass transfer switch, synchronizing devices, protective devices, bypass switch, filter circuits, and accessories as specified herein that will automatically maintain the continuity of electrical power within specified tolerance, without interruption, upon failure of the normal power supply.**

**1.3 The UPS system shall be manufactured in a modular way so as to enable the power of the UPS system installed to be easily increased on the site by paralleling more than one module to meet the new operating requirements and the desired reliability. In this connection, transformation of unitary module into a multi-module configuration shall be able to be carried out directly on site without returning the equipment to the factory for modification and with a minimum installation down time.**

**STANDARDS**

a) IEEE Standard 446-1987 : Emergency and standby power systems.

b) IEEE Standard 450-1975 :

c) IEEE Paper 4-177 : Some discharge characteristics of lead acid batteries.

**d) IEC 146 : Performance testing of UPS**

e) ANSI C 37.90a, IEEE Standard 472 : Surge withstand capability test.

f) ANSI C 34.2 : Practices and requirements for semiconductor power rectifiers.

g) ANSI C 37.90 : Relays and relay system associated with electrical power apparatus.

h) NEMA PE-1-1983 : Uninterrupted Power System Standard

i) IS 2208 & IS 9224 (Part 1 & Part 2) (I.E.C. 269) : Cartridge fuses for voltages upto and including 650 V

| | | | |
|---|---|---|---|
| j) | IS 9224 (Part - 4) | : | Fuses for protection of semiconductors. |
| k) | IS 8623 (I.E.C 439) | : | Factory-built Assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V DC. |
| l) | BS 2709 (I.E.C 119) | : | The Electrical Performance of Semiconductor Rectifiers. (Metal Rectifiers) |
| m) | IS 694 (I.E.C 228) | : | PVC insulated Cables for switchgear and control gear wiring. |
| n) | IS 1652 & IS 1652 | : | Lead-acid stationary cells and batteries. |
| o) | BD 9720 | : | Custom-built transformers and inductors of assessed quality. |
| p) | IP20 | : | Degree of protection. |
| q) | IEC | : | Semi Conductor Convertor Standards. |

**2. Quality Assurance**

2.1 UPS ratings shall be the final effective valves after the application of all appropriate derating factors. These ratings shall be adjusted to suit local conditions, viz. maximum ambient temperature, etc.. Derating factor due to the non-linearity of the load to be connected to the UPS shall be taken into account.

2.2 The UPS shall be manufactured for continuous reliable operating such that the "Mean-Time-Between-Failures" (MTBF) for individual modules of the UPS viz. Rectifier / charger unit, inverter unit and static switch, etc.. shall be more than 8760 hours.

2.3 To ensure minimum down time, the "Mean-Time-To-Repair (MTTR) of the UPS shall not exceed one (1) hour. The MTTR shall be the time required to diagnose the fault and restore the UPS to normal working condition, say by means of module replacement at site, but excluding the traveling time.

2.4 All battery use shall be heavy duty type of life span of minimum 5 years.

2.5 The factory acceptance test shall include the following as a minimum:

2.5.1 Full load and half load efficiency test.

2.5.2 Frequency and voltage limits over the whole range of load;

2.5.3 Overload voltage and short circuit protection;

2.5.4 Voltage and frequency regulation during sudden load application.

2.5.5 Overload performance

2.5.6 Instrument calibration

2.5.7 Output tests while being supplied for batteries only; and

2.5.8 Battery charging and discharging test.

**3. Submission**

3.1 All technical submissions shall be approved by the Project Manager / Architect.

3.2 As a minimum requirement, the submission shall include the following:

3.2.1 Shop drawings showing the co-ordinated installation detail diagram

3.2.2 Builder's works requirement;

3.2.3 Battery arrangement and manufacturer confirmation on 'zero' gas emission by battery to meet Civil Defence requirement without separate room ventilation requirement.

**4. System Operation**

4.1 The UPS system shall generally include its basic and supporting equipment for the monitoring, control and protection of the system, including input the output AC filters, electronic AC line conditioner, AC and DC input and output circuit breakers, converter, inventor, shielded isolation transformer, static by-pass switch and mechanical bypass switch. The battery bank may be in a separate matching battery enclosure (s).

4.2 Under normal conditions, power from the mains shall be supplied to the rectifier / charger unit. The rectifier / charger unit shall convert the incoming AC power to DC power which is fed into the inverter unit and battery unit. The inverter unit shall convert the DC power to AC power, which is then supplied to the load through the static transfer switch. As long as the operable inverter unit is supplied with DC, it shall supply AC to the load.

4.3 Upon failure of the mains, the battery shall maintain the flow of DC to the inverter unit and the inverter unit shall continue to supply the load without interruption. Upon restoration of mains supply or when the generator supply is available, input power for the inverter unit and for the recharging of the batteries shall automatically be supplied from the rectifier / charger output without interruption. If the battery is exhausted before the availability of the mains or generator supply, the UPS system shall shut down automatically.

4.4 The static transfer switch shall normally connect the inverter output power to the load. Should the inverter malfunction, the static switch shall automatically transfer the load to the bypass source without interruption of the power supply to the load.

4.5 During periods when the UPS system is being serviced, the transfer switch shall be operated to transfer the load to the bypass source.

4.6 In the case of the parallel redundant system, the total system load shall be automatically distributed equally between the two UPS modules under normal conditions. Malfunction in one of the UPS modules shall cause instantaneous isolation of the faulty module from the system and the remaining healthy UPS module shall take over the full critical load without interruption. If both UPS modules fail, the critical load shall be transferred to the bypass source.

## 2. FUNCTIONAL REQUIREMENTS

2.1 Contractor shall furnish On-Line Uninterruptible Power Supply (UPS) system of continuous duty of the ratings mentioned in Bill of Quantities. Each UPS shall give regulated filtered & uninterruptible power supply as described in the specifications.

2.2 Contractor shall note that the KVA ratings of the UPS systems shall be guaranteed at 40 deg.C ambient temperature. In case contractor's standard UPS KVA rating are based at a lower temperature, the contractor must consider a derating factor of atleast 1.5% per deg.C for arriving at the specified UPS capacity at 40 deg.C ambient temperature.

2.3 In case the calculated /specified UPS capacity is not the same as one of the standard KVA ratings of the UPS manufacturer, the next higher standard KVA rating shall be selected. UPS of non standard rating shall not be acceptable.

2.4 UPS system supplied by the contractor shall be the latest state of the art technology system fully digitalized using microprocessor controlled full wave rectification and IGBT inverter.

2.5 Batteries shall be valve regulated lead acid specially meant for UPS application.

2.6 Monitoring and control system shall also be state of the art technology LCD touch panel type providing all relevant data described in this document.

2.7 The monitoring and control system shall be capable of RS232 input software for connecting to customer's computer system for data display and monitoring.

2.8 All necessary components required for protecting UPS equipment and connected inputs and outputs shall be furnished by the Contractor as an integral part of the UPS system.

2.9 The control logic power supply shall have redundant power supply AC input and the system battery as power sources.

2.10 The UPS systems shall include but not be limited to the following equipment :

a. UPS system including 100% capacity float-cum-boost charger with 100% sealed valve regulated lead acid batteries with guaranteed battery life of 5 years.

b. Suitable factory built battery cabinet for housing the batteries, including terminal isolator / breaker and power disconnect device. The enclosure shall conform to IP 20 as minimum.

c. All cables, connectors, accessories like turning, cable trays, conduits etc. required for connection between battery and the UPS unit.

## 3. STATIC CONVERTER

### 3.1 General

The static converter (rectifier) shall be a multi-functional converter providing functions of power conversion, battery charging and shall have the additional functions of input power factor improvement and current harmonics reduction by PWM / IGBT filter. The converter equipment shall include all necessary control circuitry and device to conform requirements like voltage regulation, current limiting, wave shaping, transient recovery, automatic synchronization etc. as given below.

The converter shall be a solid state static PWM converter utilizing Intelligent Power Module (IPM) and shall include intelligent features like the drive circuitry, over current protection, over temperature protection, control power failure protection and short circuit protection.

The IPM transistors shall enable high speed switching at 6 KHz thus reducing the heat dissipation in the UPS and thereby providing high efficiency.

The PWM converter shall utilize the above and achieve unity power factor and reduce input current harmonics as given earlier and thus improve the overall power factor of the converter achieving input KVA savings.

During any step inverter load change (0-100%) the converter shall only supply 100% current to the inverter. The battery shall not be cycled at any time during this step load changes.

### 3.2 Input Current Limit

The converter logic shall provide input current limiting by limiting the DC output current. Two (2) line-side current transformers shall be employed as a means of sensing the current amplitude. The converter logic shall also be capable of providing auxiliary current limited when the logic is signaled to do so via an external dry contact closure (e.g. UPS fed from generator). The converter shall be capable of supplying overload current in excess to the full load rating. It shall also have sufficient capacity to provide power to a fully loaded inverter while simultaneously recharging the system battery to 95% of full capacity within 10 times the discharge time. The DC output current limit values shall be as follows:

- Rectifier output current (maximum) 100%
- Rectifier output current (aux.) 25% - 100% variable.

Note : 100% current shall be under the battery recharging mode.

### 3.3 Battery Charge Current Limited

The converter logic shall provide current limiting function of battery charging to prevent the battery from damage. The following battery current limit and protection shall be provided.

- Battery charge current limit 10% of battery Ah rate.
- Over-current protection at 120% of above item.

### 3.4 Voltage Regulation

The rectifier / charger output voltage does not deviate by more than +/- 1% of the nominal output voltage, due to the following conditions:

- Form 0 to 100% loading.

- Rectifier input variations of voltage and frequency within the limitations set in Section 3.10.

- Environmental condition variations within the limitations set in Section 3.10.

### 3.5 Automatic Input Current Walk-in

The converter logic shall employ circuitry to allow a delayed and timed ramping of input current. Subsequent to energizing the converter input, the ramping of current shall be delayed by a maximum of 3 seconds. Upon starting the walk-in process, the ramping of current is timed to assume the load gradually within 1 through 60 seconds (every 1 second selectable).

### 3.6 Input Overload Protection

The A/C input fuses shall be provided at the converter input as a means of overload protection.

The AC maximum current shall be controlled by the Converter.

### 3.7 Equalizing Charge Timer

The UPS logic shall provide an electronic automatic equalize charge timer which shall be selectable 24 hours for Lead Acid type or 8 hour for Alkaline type batteries. The timer circuit, once activated shall provide a high rate equalizing charge voltage to the system battery for the selected time. The circuit shall also be capable of manual activation via the LCD touch panel mounted on the front door. The level of equalizing voltage shall be equal to that stated by the battery manufacturer. Upon completion of the timer count, the converter output voltage shall automatically return to the specified float voltage.

### 3.8 Step Load Change

During any step inverter load change (0-100%), only the converter shall supply 100% current to the inverter. The batteries SHALL NOT be cycled at any time during these step load changes.

**3.9 Input Voltage**

The converter shall be fed from the Normal Power Supply source.

**3.10.** The converter shall meet the following specifications in addition to other requirements stated herein:

| | | |
|---|---|---|
| Nominal Voltage | : | 415V, 3 Phase, 3 Wire |
| Voltage Range. | : | + 15% / - 30% AC |
| Normal Frequency | : | 50 Hz $\pm$ 5% |
| Frequency Range | : | $\pm$ 5% ($\pm$ 2.5Hz) |
| Input Power Factor | : | 0.98 lagging or more at full load and no load (PF improvement by active – PWM / IGBT filter. |
| Input Harmonic Current THD | : | 3% typical at 100% load and no-load. (by active – DWM / IGBT filter). |
| Duty | : | Continuous at 40 deg.C |
| Cooling | : | Forced cooling using fans with thermal relays using a latched cut out for re-setting as protection for cooling fans. Each individual fan shall have its own thermal relay. |
| Ambient operating temperature range | : | 0 to 40 deg.C maximum. |
| Operating Relative Humidity | : | 0-95% non-condensing. |
| Operating Altitude | : | Sea Level to 1,000 meters. |
| Magnetized sub-cycle in rush current | : | Typically 8 times normal full load current |
| Converter Walk-in time | : | 1 through 60 seconds (every 1 second selectable, (0 to 100% rated load) |
| Input | : | Suitable terminals shall be provided for termination of cables from the AC distribution board. |

## 4. STATIC INVERTER

### 4.1 General

The static inverter shall be of solid state type using proven Pulse Width Modulation (PWM) technique. The inverter equipment shall include all necessary control circuitry and devices to conform requirements like voltage regulation, current limiting, wave shaping, transient recovery, automatic synchronization etc. as given below.

The inverter shall utilize Insulated Gate Bipolar Transistors (IGBT) or Intelligent Power Module (IPM) Transistors which shall provide intelligent features like the drive circuitry, over-current protection, over temperature protection, control power failure protection and short circuit protection.

The IGBT / IPM transistors shall enable high speed switching of 6 Khz thus reducing the heat dissipation in the UPS and thereby providing high efficiency.

The UPS shall utilize both Voltage and Current feedback control circuits so that the inverter shall act not only as a constant voltage source but also as a load required current source. This shall enable the inverter to quickly adapt to the changing load current value and wave shape.

### 4.2 Voltage Regulation

The inverter output voltage shall not deviate by more than + 1% RMS due to the following steady state conditions :

Form 0 to 100% loading
Inverter DC input voltage varies from maximum to minimum.
Environmental conditions variations within the limitations set in the section 4.8.

### 4.3 Frequency Control

The inverter output frequency shall be controlled by an oscillator internal to the UPS module logic. It shall be capable of synchronizing to an external reference (e.g. the bypass source or another UPS module) or operating asynchronously. The oscillator shall maintain synchronization with the external reference within the limitations set hereunder. The inverter shall operate on self run mode without synchronism if the bypass frequency exceeds the set value. The oscillator, while running asynchronously, shall maintain the frequency as 50 Hz $\pm$ 0.01% (or + 0.005 Hz). Automatic adjustment of phase relationship between inverter output and standby bypass source shall be gradual at a controlled slew rate which shall be adjustable at the rate of 0.5, 1.0, 2.0, 3.0 Hz / second. (default 2.0 Hz / second).

The inverter output frequency shall not vary during steady state or transient operation due to the following conditions:

a. From 0 to 100% loading.

b. Inverter DC input varies from maximum to minimum.
c. Environmental condition variations within the limitations set in section 4.8.

**4.4 Output Voltage Harmonic Distortion**

The inverter output shall limit the amount of harmonic content to the values stated in section 4.9. The use of excessive or additional filtering shall not be required to limit the harmonic content thus maintaining a high level of efficiency, reliability and original equipment footprint.

**4.5 Output Overload Capability**

The inverter output shall be capable of providing an overload current while maintaining rated output voltage to the values stated in section 4.8. An LED indicator shall be located on the control panel to identify this condition. If the time limit associated with the overload condition expires or the overload is in excess of the set current amplitude, the load shall be transferred to the bypass source without interruption.

**4.6 Inverter Current Limit**

The inverter output shall be limited to 150% of rated load current. The two sensing locations shall operate separately and independently thus providing redundancy and, in the event of a failure, preventing unnecessary damage to power transistor components / fuses. Load current above 150% shall cause an immediate transfer of the load to the bypass source for fault clearing.

**4.7 Inverter Overload Protection**

The AC output from the inverter shall utilize fuses for overload protection. The inverter shall utilize a contactor to isolate the inverter output from the critical bus.

The inverter fuses shall be the fast acting semiconductor type.

The inverter output isolation contactor shall be located in the UPS module and shall be controlled by the internal UPS module system logic.

**4.8** The inverter shall meet the following specifications in addition to other requirements stated herein:

| | | |
|---|---|---|
| Voltage Input | : | Three Phase UPS :<br>Nominal 360 V DC (Range 290 V to 414 V DC to maximum DC bus voltage during charging the batteries). |
| Nominal Voltage Output | : | 415 V $\pm$ 1% AC 3 Phase, 4 Wire |
| Inverter Capacity | : | |
| Voltage Regulation | : | |
| a. For 0 to 100% loading | : | < $\pm$ 1% |

| | | | |
|---|---|---|---|
| | b. Inverter DC input voltage vary from maximum to minimum | : | < ± 1% |
| | c. Environmental conditions given below | : | < ± 1% |
| | Transient Voltage Regulation | : | |
| | a. AT 100% step load change | : | < ± 3% |
| | b. At loss or return of AC input | : | < ± 1% |
| | c. At load transfer from bypass to inverter | : | < ± 3% |
| | Time to recover from transient to normal voltage | : | 20 milli seconds |
| | Wave form | | |
| | a. Normal frequency | : | 50 Hz |
| | b. Frequency regulation for all conditions of input supplies, loads and temperature occurring simultaneously or in any combination (automatically controlled) | : | ± 0.01% |
| | c. Synchronization limits for synchronism between the inverter and standby AC source. | : | 49 Hz to 51 Hz. |
| | d. Field adjustment range for above | : | 50 ± 0.25 Hz to 50 ± 1.5 Hz |
| **4.9** | Total voltage harmonic distortion | : | < 2% THD for 100% linear load<br>< 4% THD for 100% non-linear load |
| | Duty | : | Continuous |
| | Cooling | : | Forced cooling using fans. |
| | Ambient operating temperature range | : | 0 to 40deg.C maximum continuous. |
| | Operating relative humidity | : | 0-95% non-condensing. |
| | Operating altitude. | : | Sea level to 1000 meters. |
| | Output | : | Suitable terminals are provided for termination of cables for connecting inverter output to AC distribution board. |

**4.10 Built-in Isolation Transformer**

This shall provide neutral separation which shall mean that output neutral will be independent of incoming neutral, hence critical load shall be isolated from the

problems like incoming neutral open or, short or, variations in neutral to earth voltage due to sudden loading in neighboring installation.

**4.11 Reverse Phase Sequence Protection**

In the event of Phase sequence reversal at the input, UPS system shall continue to work on the main power supply, or UPS systems shall go into battery mode, and shall not trip the UPS system.

## 5. BYPASS AND STATIC TRANSFER SWITCH

**5.1** A bypass circuit shall be provided as an alternate source of power other than the inverter. A high speed switch and wrap-around contactor shall be used for the critical load during automatic transfers to the bypass circuit. The static switch and wrap-around contactor shall drive power from an upstream bypass feed circuit breaker internal to the UPS module provided for overload protection. The wrap-around contactor shall be electrically connected in parallel to the static switch and shall at the same time as the static switch, energize and upon closure, maintain the bypass source. The static switch shall only be utilized for the time needed to energize the wrap-around contactor thus increasing reliability. The bypass circuit shall be capable of supplying the UPS rated load current and also provide fault clearing current. The UPS system logic shall employ sensing which shall cause the static switch to energize within 150 microseconds thus providing an uninterrupted transfer to the bypass source when any of the following limitations shall exceed :

Inverter output under voltage or over voltage.
Overload beyond the capability of the inverter
DC circuit under voltage or over voltage
Final end voltage of system battery is reached.
Bypass source present and available
System failure (eg. Logic fail, fuse blown, etc.)

**5.2** Keeping the above requirements in view, the static switch shall have the following minimum rating.

Capacity continuous equal to 100% of continuous rating of the inverter.
Capacity overload equivalent to overload characteristics specified for UPS.

**5.3**

| | | |
|---|---|---|
| Nominal bypass input voltage | : | 415 V , 3 phase, 4 wire |
| Voltage Range | : | $\pm$ 10% of nominal |
| Nominal Frequency | : | 50 Hz |
| Frequency range | : | $\pm$ 2%<br>Please refer to selectable range of Inverter given in point 4.3 & 4.8 |

Output Fault Clearing :

| | | |
|---|---|---|
| Current | : | 1000% |

| | | |
|---|---|---|
| Duration | : | 20 milli seconds |
| Ambient operating temperature | : | 0 to +40 degree C continuous |
| Operating relative humidity | : | 0-95% non-condensing |
| Operating altitude | : | Sea level to 1000 meters |
| Cooling | : | Natural Convection |
| Duty | : | Continuous |

**5.4 Automatic Re-Transfer**

In the event that the critical load must be transferred to the bypass source due to an overload, the UPS system logic monitors the overload condition and, upon the overload being cleared, perform an automatic re-transfer back to the inverter output. The UPS system logic shall only allow a re-transfer to occur three times within a ten minute period. Re-transfer shall be inhibited on the fourth transfer due to the likelihood of a recurring problem at the UPS load distribution. The re-transfer a load to the inverter shall also be inhibited due to the limitations set in section 5.3.

**5.5 Manual Transfer**

The UPS shall be capable of transferring the critical load to / from the bypass source via LCD touch panel. When performing manual transfer to inverter or automatic re-transfers, the UPS system logic shall force the inverter output voltage to match the bypass input voltage and then parallel the inverter and bypass source providing a make-before-break transition allowing a controlled walk-in of load current to the inverter.

**5.6 Maintenance Bypass Switch (MBS)**

The UPS shall include as standard equipment, a zero energy maintenance bypass switch. Full UPS wrap-around enables personnel to do work inside the UPS module or maintenance bypass switchboard without danger fro high voltage conditions.

## 6 UPS BATTERY SYSTEM

a. The UPS system shall, as an integral part, provide battery system for 20 minutes (Full Load) standby capacity.

b. The latest state of the art Valve Regulated Sealed Maintenance Free Lead Acid Batteries shall be used with a 20 hours discharge rating.

c. The battery system shall be sized to provide 20 minutes back up time when the UPS is supplying 100% rated load at 0.8 load power factor.

d. An ageing factor of 15% shall be applied to the capacity arrived at, to allow for compensation against capacity loss during float operation.

e. The battery system design shall be provided with necessary devices to prevent deep discharge beyond recommended limits to prevent the batteries discharging beyond end cell voltage specified by the battery maker. The connections from battery to battery shall be by using copper bus bar strips and the entire battery system shall be used in IP20 steel cabinet enclosure and shall be similar to the UPS enclosure.

f. All batteries shall be clearly identified and identification numbers marked on the batteries and a schematic diagram along with the complete calculations, including manufacturers supporting curves, shall be submitted with the tender.

## 7. OPERATION

a. Under normal operation, the UPS load will be fed from the Inverter with the bypass switch inhibited. The Converter, apart from providing DC power to the Inverter, also charges the battery under the float charge mode. The battery charge system shall have float charge, equalizing charge and recovery charge modes, to replenish the batteries self-discharging part while the battery is fully charged, equalizing the battery cell voltage to a constant value forcibly, and recharging the battery system to the required values when the batteries have been used, respectively.

b. The Inverter shall constantly monitor the AC source frequency and shall be in synchronization with the AC input source till the frequency of the AC input source is within synchronizing limit and if the frequency of the standby source exceeds the synchronizing limit the Inverter will work on its own internal oscillator maintaining an output frequency of 50 Hz +/- 0.01% under all conditions of load. When the Inverter operates on its internal oscillator, it shall continuously monitor the frequency of the input source and when the input source frequency returns to within synchronization limit, the Inverter shall automatically synchronize itself with the input A/C source frequency and use it as a signal for Inverter output frequency control.

c. Battery Operation:

i) When the A/C input voltage drops below specified limits or in case of a power failure the Inverter continues to supply AC power of constant voltage and constant frequency utilizing the battery system as a power source until the input voltage returns to normal requirement. When the power supply is resumed or the input voltage returns to limits, the Converter shall automatically start and the load fed for normal operation status.

ii) If the power failure continues beyond battery back up time or the battery voltage drops to the final discharge voltage, the Inverter should automatically stop and at the same time transferring the load to the bypass circuit. On resumption of power supply, the Converter shall automatically re-start the operations and charge the batteries whereas the Inverter should inhibit automatic start and should be started manually.

d. Bypass Operation:

When power is supplied from the Inverter in synchronization with the bypass, it shall accomplish the following:

i) When the UPS output current reaches overload status it shall automatically transfer the load to bypass circuit with no interruption and when the overload status is cleared it automatically re-transfers the load to Inverter.

ii) When the battery final discharge condition is reached, the load shall automatically be transferred to the bypass circuit without interruption.

iii) In case of failure of the UPS, the load shall be automatically transferred to the bypass circuit with no interruption and when the failure is cleared, re-transfer the load to the Inverter shall be done manually.

iv) There should be provision made in the system to prevent, when necessary, asynchronous transfer.

v) When the UPS goes on bypass mode in any of the conditions described above and if at that time there is no bypass power supply available due to power failure, the UPS shall remain in standby mode and as soon as the bypass power supply is available will transfer the load to bypass.

v) A maintenance bypass transfer switch shall be provided with lock and key arrangement and should be manually done by authorized personnel only.

## 8. CABINET AND ENCLOSURES

8.1 The entire UPS system, including all components like inverter, static switch, maintenance bypass, shall be housed in free-standing steel type factory-finished enclosures complying with the protection standards of IP20. The enclosure shall be open able using a special tool for internal access. The colour shall be light grey.

8.2 Ventilation

Forced air-cooling shall be provided to allow components to operate within their rated temperature specified. The cooling fans shall have thermal relays protection using a latched cut fire re-setting, as a protection for the cooling fans.

Similarly, the backup battery system shall also be housed as described earlier in an IP20 cabinet.

## 9 CONTROL AND MONITORING

a. The UPS shall utilize state of the art full DDC control software driven Control and Monitoring System.

b. It shall be provided with LED displays. The display system shall have, as a minimum individual LEDs with different colours for the following:

i) Load on Inverter

ii) Battery operation

iii) Load on Bypass

iv) UPS failure

v) LCD failure

vi) Overload

c. The UPS logic should provide one set of normally open dry contact / relay output to allow interfacing of UPS operating status to an external system and should be capable of providing, as a minimum, 10 numbers status and, should the UPS manufacturer's standard product does not provide such software, the bidder must add additional equipment and cost for the same.

d. The UPS shall also have an RS232 port for interfacing to BAS system or client's centralized computer network.

e. **LCD touch panel (Optional)**

i. The UPS shall be provided with a operator friendly large scale LCD touch panel.

ii. The LCD touch panel shall also include graphic measurement display, operational procedures of each activity, fault status display and also have capability to record at least 50 faults.

iii. The touch screen panel shall clearly define specified areas for operational function, execution and message display.

iv. It should be possible to operate the entire UPS system and its components and obtain all measurements and data through the touch screen operation. The measurement software should provide capability to measure phase voltage, current in each phase, frequency, power factor, available battery time etc.

v. Under all operating conditions, the system software should have capability for displaying fault alarm automatically. The tenderer should describe in detail the faults that would be displayed under this mode.

## 10. UPS TESTING

a. The Contractor shall perform the following tests, as a minimum, at site prior to handing over, to confirm the functional and the performance specification

of the UPS as specified. All required test equipment like Digital Oscilloscope, Voltage Regulator, Measurement Meters etc. shall be the responsibility of the Contractor without any additional cost.

b. The Contractor shall demonstrate as a minimum the following features on site by providing all required test equipment, such as power factor improvement, input current THD, output voltage THD, output frequency and all other performance monitoring requirements detailed before as required by the Owner.

## 2. FIRE ALARM SYSTEM
(Life Safety System)

### 1.1 General

This performance specification provides the minimum requirements for the Fire Alarm System (Life Safety System). The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:

Smoke and fire detection.
Sprinkler suppression system monitoring and control.
Off-premise notification.
Smoke control.
Releasing Service
One-way voice communication notification system.
Two-way voice communication system.

### 1.2 Materials & Equipment

All equipment and components shall be the approved manufacturer's current model. The materials, appliances, equipment and devices shall be listed by a nationally recognized approvals agency like UL/FM for use as part of a protected premises protective signaling (fire alarm) system and smoke control system. The authorized representative of the manufacturer, to be designated as the contractor, shall be responsible for the satisfactory installation of the complete system. The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception. All equipment and components shall be the manufacturer's current model. The contractor shall be responsible for the satisfactory installation of the complete system. All control panel assemblies and connected field appliances shall be provided by the same system supplier, and shall be designed and tested to ensure that the system operates as specified. The system shall utilize electronically addressable, microprocessor-based detectors as described in this specification. The equipment to be supplied will be considered only if it meets all sections of the performance specification.

The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph, as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written, and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does

not include a point-by-point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply. The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional fire alarm system (System). The System shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories (UL) listings.
It is further intended that upon completion of this work, the Owner/Consultant be provided with:

a. Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system(s) at a future date.

b. Complete documentation of system(s) testing.

c. Certification that the entire system(s)

## 1.3 CODES & LISTING:

The equipment and installation shall comply with the current and latest edition of the following codes and listing :

A) National Fire Protection Association (NFPA) - USA:

| | |
|---|---|
| NFPA 13 | Sprinkler Systems |
| NFPA 16 | Foam/Water Deluge and Spray Systems |
| NFPA 17 | Dry Chemical Extinguishing Systems |
| NFPA 17A | Wet Chemical Extinguishing Systems |
| NFPA 2001 | Clean Agent Extinguishing Systems |
| NFPA 72 | National Fire Alarm Code |
| NFPA 76 | Telecommunication Facilities |
| NFPA 318 | Clean Room Applications |
| NFPA 101 | Life Safety Code |
| NFPA 90A | Air conditioning & ventilation system |

**Listed**

B). Underwriters Laboratories Inc. (UL) - USA:

UL 268 Smoke Detectors for Fire Protective Signaling Systems
UL 864 Control Units for Fire Protective Signaling Systems **9th Edition**
UL 268A Smoke Detectors for Duct Applications
UL 521 Heat Detectors for Fire Protective Signaling Systems
UL 464 Audible Signaling Appliances
UL 38 Manually Actuated Signaling Boxes
UL 346 Water flow Indicators for Fire Protective Signaling Systems
UL 1971 Visual Notification Appliances
UL 228 Door Holders
UL 1481 Power Supply for fire protective signaling system.

UL 1711 Amplifiers for Fire Protective Signaling Systems.
UL 1635 Digital Alarm Communicator System Units
Factory Mutual (FM) Approval

**ADDENDUMS thereafter in UL Code for Fire Detection(2007).**
UL 9th Schedule Certification
International Standards Organization (ISO)
ISO-9000
ISO-9001
European Union (EU)
EMC Directive 89/336/ EEC
Electromagnetic Compatibility Requirements

C) LOCAL CODES
**NATIONAL BUILDING CODES**
**IS-2189**

D). European Standards

EN54

E). German Standards

**VDS**

## 1.4 Panel Components & Functions

The control panel(s) shall be a multi-processor based networked system designed specifically for fire, one-way and two-way emergency audio communications, smoke control, extinguishing agent releasing system if necessitated, with integration modules for BMS or any third party control/annunciation. The control panel shall be UL/FM listed The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any applications can be configured, and modified . The control panel(s) operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.

The control panel shall include the following capacities:
Support up to minimum 2500 analog/addressable points.
Support network connections up to minimum 64 or other control panels and annunciator.
Support multiple digital dialers and modems
Support multiple communication ports and protocols
Support up to a minimum of 1740 chronological events.
The network of control panels shall include the following features:
Ability to download all network applications and firmware from the configuration computer from the configuration computer from a single location on the system.
Provide electronic addressing of analog/addressable devices.
Provide an operator interface control/display that shall annunciate, command and control system functions.
Provide an internal audible signal with different programmable patters to distinguish between alarm, supervisory, trouble and monitor conditions.

Provide a discreet system control switch provided for reset, alarm silence, panel silence, drill switch, previous message switch, next message switch and details switch.
Provide system reports that provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.
Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
Provide an authorized operator to perform test functions within the installed system.

The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

## 1.5 Operator's Interface

The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Standard LED annunciator may be combined in common enclosures provided that the groups of LED's comprising each of the required annunciator are separated from one another (Detection, Supervisory, Status, and Security) and clearly labeled. A minimum 640-character LCD display shall be part of the main control panel for easy alarm reading and understanding. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.
The annunciator shall contain the following system status indicators:

LCD character Backlit Liquid Crystal Display
System Normal Indicator
System Common Alarm Indicator
System Common Trouble Indicator
System Common Supervisory Indicator
System Ground Fault Indicator
System Common Security Indicator
System Disabled Point(s) Indicator
System Reset Switch with Indicator
System Alarm Silence Switch with Indicator
System Trouble Silence Switch with Indicator
System Message Queue Scroll Switches.
Digit Keypad to Enable/Disable System and Functions.

## 1.6 Audio

The system shall be capable of delivering multi-channel audio messages simultaneously over copper and/or fiber media. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store pre-recorded audio messages digitally. These messages shall be automatically directed to various areas in a facility under program control. The

system shall support remote cabinets with zoned amplifiers to receive, amplify and send messages through speakers over supervised circuits. The one-way emergency audio control shall provide control switches to direct paging messages as follows:
"All Call" to direct the page messages to all areas in the facility, overriding all other messages and tones.
"Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.
"Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones..
"Page to Balance Building" to direct page messages to the areas) in the facility NOT receiving either the evacuation area or alert area messages.
"Page by Phone" switch to select the firefighters telephone system as the source for paging.

The system shall be capable of delivering multiple audio messages simultaneously over copper and / or fiber media. All audio messages and live pages shall originate at the one-way emergency audio control unit. The one-way emergency audio control unit shall store pre-recorded audio messages digitally. These messages shall automatically direct to various areas in a facility under program control. The system shall support remote panels with zoned amplifiers to receive, amplify and distribute messages through speakers over supervised circuits. The two-way voice communications control unit shall provide two-way communications between remotely located phones and the command center. The control unit shall provide the ability to individually select and display each two-way voice communication circuit support up to five (5) remote telephones in simultaneous two-way voice communications.

Audio Amplifiers (Multi-Channel)
Provide as minimum one twenty (20) watt audio amplifier per paging zone. The system software shall be capable of selecting the required audio source signal for amplification. To enhance system survivability, each audio amplifier shall automatically provide a local 3-3-3 1000 Hz temporal pattern output upon loss of the audio communications with the one-way audio control unit, during an alarm condition. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall include a dedicated, selectable 25/70 Vrms output. Provide a standby audio amplifier that will automatically sense the failure of a primary amplifier, and replace the function of the failed amplifier.

## 1.7 DACT Dialer

The system shall provide off premise communications capability using a digital alarm communications transmitter (DACT) for sending system events to multiple central monitoring station (CMS) receivers. The system shall provide the CMS(s) with point identification of system events using Contact ID or SIA DCS protocols. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

## 1.8 Power Supply

System power supply(s) shall provide multiple powers limited 24 VDC output circuits as required by the panel. Upon failure of normal (AC) power, the affected

portion(s) of the system shall automatically switch over to secondary power without losing any system functions. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.
All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as battery trouble and identify the specific power supply affected. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.

All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72 - The AC power circuit shall be installed in raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

**Power supply for all input & output devices to be driven from main Fire Alarm Panel.**

## 1.9 Reports

The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.

The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.

The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.

The system shall provide a report that gives a chronological listing of up to the last 1740 system events.

The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

## 1.10 Graphic & Smoke Control Annunciator -Firer fighters Smoke Control Station ( FSCS)

The FSCS shall provide a graphic representation of the facility HVAC system and stairwell pressurization system. Fan override and control switches and fan/damper status LED’s shall be provided as indicated on the shop drawings. The following system controls and indicators shall be provided on the FSCS: Power ON, Trouble, and Signal Silenced LED’s System Reset, Silence, Trouble Silence, and Drill push

buttons. It shall be possible to annunciate text messages via LCD display mounted in the FSCS enclosure. The FSCS shall provide an integral remote microphone for one-way audio system paging.

Specific zone module shall be used for intelligent messaging to critical areas like stair cases in event of an emergency.

## 1.11 Graphic Command Workstation

The command center shall function as the center point for all operational and administration functions required for the systems provided within the specification. The command center shall contain a console that will display and house any equipment necessary for system operation. Console space shall be provided for other equipment provided under other sections of the specifications. A single graphical workstation shall be provided that will enable primary control of the systems provided by this specification. An operator shall not have to operate multiple workstations to receive, view, process and record system events for each system provided. The graphical command workstation(s) shall display a different color text for each message type and color graphic diagrams/floor plans. Each detector has to be mapped in graphical workstation diagrams/floor plans The graphical command workstation shall simultaneously display the following system event views; system event display, graphical diagram display, detailed event message/instructions, and user event log. The workstation shall be an latest personal computer which can support the all software & have enough memory to handle the data. The workstation shall be an IBM-compatible personal computer listed for UL Standards 864 (Control Units for Fire-Protective Signaling Systems) The workstation(s) shall be capable of annunciation and control of all fire detection and smoke control points. The computer shall be minimum of an Pentium Grade Pentium Processor 2.4 Ghz or higher with a 533Mhz front side bus or higher, 512 MB RAM or higher, 320 GB Hard Drive, and 21" LCD monitor. Installation of the computer or monitor can be either desktop or floor mounting or rack/panel mounting.

The software shall provide multitasking type environment that allows the user to run several applications simultaneously. The operating program shall run within a 32-bit operating system such as Windows® XP. These Windows applications shall run simultaneously with other programs. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel and other Windows based software packages, while concurrently annunciating on-line alarms and monitoring functions.

Equipment included in the command center shall include:
System annunciation and controls for.
Fire detection.
Fire suppression.
Fire pump status
Firefighters smoke control.
Emergency one-way voice communications.
Standby generator status indication and controls.
Automatic transfer switch status indication and controls
Radio communications
Public intercom

Public telephone
Elevator monitor, status and controls

The graphic display screen shall organize and structure system events for easy user comprehension. The workstation display shall use four relational quadrants. When any event occurs:

The "list of events area" shall display the address of the alarm or off-normal point with type and description and time of the event in a prioritized color-coded event list. Highlighting an event in the event list area shall automatically cause the display of a graphical map and other three areas (described below) to display information relating to the highlighted event. The "map area" shall display color graphical representation of the area location in which the alarm or off-normal device is located. It shall be possible for the operator to manually zoom down to any portion of a vector-based graphic without aliasing, artifacting , or pixilation of the image. Preset zoom levels shall not be considered equal. The "event action area" shall display a customized set of written operator instructions for every state (alarm, trouble, restore, etc.) of each point. An event log shall record all events and operator actions to history for future review. An operator's log shall record operator's comments for each event in system history with time and date. The "image area" shall display a stored image of the device relating to the event highlighted in the event list area.

When processing fire alarm events the graphic workstation:

Shall be capable of acknowledging, silencing, and resetting all fire alarm functions.

Shall be capable of manually activating, deactivating, enabling, and disabling individual fire alarm points.

Shall be capable of generating status, maintenance and sensitivity reports for fire alarm components.

Receipt of a fire alarm shall activate an audio WAV file over the workstation speakers alerting the operator

## 1.12 Field Mounted System Components

### Intelligent Smoke Detectors:

**General**

The smoke detector shall have inbuilt microprocessor and shall be capable of taking an independent alarm decision. Preferably a maximum of 127 intelligent smoke detectors should connect to one loop. Each intelligent addressable smoke detector's sensitivity shall be capable of being programmed electronically from Control Panel without any extra tools as most sensitive, more sensitive, normal, less sensitive or least sensitive. In addition to the five sensitivity levels the detector shall provide a pre-alarm sensitivity setting, which shall be settable in 5% increments of the detector's alarm sensitivity value. The detector should continue to give TRUE alarms even if the loop controller on the main panel fails.

An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event. In addition to the five alternate sensitivity levels the detector shall provide an alternate pre-alarm sensitivity setting, which shall be settable in 5% increments of the detector's alternate alarm sensitivity value The detector shall be able to differentiate between a long drift above the pre-alarm threshold and fast rise above the threshold.

The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 75% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% or greater compensation has been used.

The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

**Multi-sensor Photo Thermal Detector :**

The multi-sensor or multi-tech smoke detector which will have both photoelectric as well as thermal detection elements shall have inbuilt microprocessor, and shall be capable of taking an independent alarm decision. The scattering of smoke particles shall activate the photo sensor. Each intelligent addressable smoke detector's sensitivity shall be capable of being programmed electronically from Control Panel without any extra tools as: most sensitive, more sensitive, normal, less sensitive or least sensitive. In addition to the five sensitivity levels the detector shall provide a pre-alarm sensitivity setting, which shall be settable in 5% increments of the detector's alarm sensitivity value. The detector should continue to give TRUE alarms even if the loop controller on the main panel fails.. Alarm condition shall be based upon the combined input from the photoelectric, and thermal detection elements. Each

detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient "environmental thresholds approximately six times an hour..

The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

**4D/Laser Photo Detector.**

The 4D/Laser/equivalent detector shall have the ability to have the sensitivity of 0.08

OBS/FT or better. The detector shall have inbuilt microprocessor and shall be capable of taking an independent alarm decision. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required. The laser photo detector shall include two bicolor LED's that flash green in normal operation and turn on steady red in alarm.

**INTELLEGENT THERMAL DETECTOR:**

The heat detector shall have a thermal sensing element /circuit. The detector shall have inbuilt microprocessor, not microcontroller and shall be capable of taking an independent alarm decision. Detectors shall be rated at 15°F (9°C) per minute rate-of-rise and 135°F (57°C) fixed temperature The detector shall be capable of being addressed electronically from control panel without any extra tool.

**ADRESSABLE BEAM DETECTOR:**

The addressable optical beam detector or projected beam smoke detector shall be used for detection in large volumes and double heights. The set shall consist of a transmitter, receiver and control electronics. The transmitter shall project a modulated infrared light beam to the receiver. If there is smoke in the beam path, the receivers signal shall be reduced by the value proportional to the density of the smoke. If the signal is reduced to a level between the obscuration threshold and 93% for 8-10 seconds, the fire alarm relay shall be activated. The alarm obscuration threshold shall be set at 25%, 35% or 50% obscuration depending on the application. The typical coverage shall be equal or more than 100 m x 15.25 m.

**INTELLEGENT DUCT SMOKE DETECTOR**

The Smoke Detector housing shall accommodate intelligent photoelectric detector. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided. When sufficient smoke is sensed, an alarm signal to be initiated and appropriate action taken

to change over air handling system to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

**SMOKE DETECTOR – PHOTOELECTRIC**

The detectors shall be use the photo electric ( light scattering ) principal to measure smoke density. Provide analog/addressable photoelectric smoke detectors at the locations shown on the drawings. The detector shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit.

It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

**Detector Bases:**

The bases shall be easy to install and mount and shall be of standard type or isolator base type or sounder base type. The sounder base shall be used where local or group alarm signaling is required. The sounder base emits a audible alarm when there is fire. The base shall, contain no electronics and support all series detector types.

## 3.0 Manual Stations

The fire alarm station shall be of polycarbonate construction and incorporate an internal toggle switch. A locked test feature shall be provided. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering.

## 3.1 Speakers
**(Low Profile Speaker)**

The low profile speaker shall not extend more than (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. Wattage setting shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring.

## 3.2 Speaker-Strobes

**Low Profile Speaker-Strobe**

The low profile speaker/strobe shall not extend more than (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft

Strobes shall provide synchronized flash output, that shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd. Wattage and candela settings shall be

visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring.

### 3.3 Programmable Electronic Exit Point Directional Sounders/Hooters:

Electronic sounders shall operate on 24 VDC nominal. Electronic sounders shall be field programmable without the use of special tools, at a sound level of at least 90 dBA measured at 10 feet from the device and shall be flush or surface mounted as shown on plans.

They Shall produce broad band directional sound to guide occupants to safe exists even in complete darkness. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria: The maximum pulse duration shall be 2/10 of one second. Equivalent alternate type will be also acceptable.

### 3.4 Horns

**Explosion proof - Class I**

The horns shall provide 109 dBA output, and be polarized for supervised operation. The horns shall be UL listed for Class I Division 1 and 2, Groups B, C, D hazardous locations.

**Explosion proof - Class I, II, III**

The horns shall provide 109 dBA output, and be polarized for supervised operation. The horns shall be UL listed for Class I Division 1 and 2, Groups C, D; Class II Division 1 and 2, Groups E, F, G; Class III Division 1 and 2 hazardous locations.

### 3.5 Vibrating Bell-Explosion proof

The bells shall provide 83 dBA output and be polarized for supervised operation. The bells shall be UL listed for Class I Groups B, C, D; Class II Groups E, F, G; Class III Division 1 and 2 hazardous locations.

### 3.6 Intelligent Modules

The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes, which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults.

**Control Relay Module:**

The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

**Dual Input Module:**

The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The dual input module shall support the following circuit types:

- Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
- Normally-Open Alarm Delayed Latching (Water flow Switches)
- Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
- Normally-Open Active Latching (Supervisory, Tamper Switches

**Dual Input Signal Module:**

The Dual Input (Dual Riser Select) Signal Module shall provide a means to selectively connect one of two (2) signaling circuit power risers to one (1) supervised output circuit. The dual input signal module shall support the following operation: Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25 Vrms @ 50w or 70 Vrms @ 35w of Audio)

**Isolator Module:**

Provide intelligent fault isolators modules. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating.

**Monitor Module:**
The Monitor Module shall be factory set to support one (1) supervised Class B Normally-Open Active Non-Latching Monitor circuit.

**Single Input Module:**

The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. . The single input module shall support the following circuit types:

- Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
- Normally-Open Alarm Delayed Latching (Water flow Switches)
- Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
- Normally-Open Active Latching (Supervisory, Tamper Switches)

**Single Input Signal Module :**

The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The single input signal module shall

support the following operations:

- Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
- Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)

**Water flow-Tamper Module:**

The Water flow/Tamper Module shall be factory set to support two (2) supervised Class B input circuits. Channel A shall support a Normally-Open Alarm Delayed Latching Water flow Switch circuit. Channel B shall support a Normally-Open Active Latching Tamper Switch.

## 3.7 Telephone Handsets

The contractor shall Provide firefighter's telephone handsets for use with the firefighter's telephone jack stations. The telephone handsets shall be red in color and have a 5 ft (1.3m) coiled cord.

**Telephone Jacks**

The contractor shall provide stainless steel firefighter's telephone jack stations at the locations shown on the drawings. The jack station shall be clearly identified with the words "FIRE FIGHTER'S TELEPHONE" for use with portable fire fighter telephone handsets.

## 3.8 Power Supply

Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for 24 hours and capable of operating the system for fifteen (15) minutes of evacuation alarm on all devices, operating at maximum load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

## 3.9 Sequence of Operations

**General – Audio**

Upon alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler water flow, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.
Display the alarm event on the graphical workstation. The LCD Display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location and time/date. All system activity/events shall be documented on the system printer. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
The following audio messages and actions shall occur simultaneously:
An evacuation message shall be sounded on fire floors (zones) immediately above and below (adjacent to) the fire floor (zone),on the floor in fire condition. It is the intent of this message to advise occupants hearing this message that they are near danger and should leave the building via the stairs (nearest exit) immediately.

Activate visual strobes on the fire floors (zones) immediately above and below (adjacent to) the fire floor (zone) . The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed. An alert message shall be sounded on the remainder of building. It is the intent of this message to advise occupants to prepare for evacuation if necessary. An instructional message shall be sounded in the stairwells instructing occupants to move carefully and quickly down the stairs to exit the building and to exit to a safe floor if you encounter smoke in the stairwell.

An instructional message shall be sounded in the elevator cabs. It is the intent of this message to advise elevator occupants that an emergency exists, the elevator has been directed to the ground floor, and that occupants should quickly exit the building. An instructional message shall be sounded in the lobby. It is the intent of this message to advise lobby occupants to leave the lobby and clear the area for arriving firefighters. An instructional message shall be sounded in the concourses connected to the building's lobby. It is the intent of this message to prevent new entries into the lobby by advising occupants not to attempt to enter the lobby of the affected building.

Provide selective paging to each individual floor (zone). In addition to the message/channels detailed above, a dedicated page channel shall be capable of simultaneously providing live voice instructions without interrupting any of the messages listed above shall be provided.

Transmit signal to the building automation system.
Transmit signal to the central station with point identification.
Activate automatic smoke control sequences.
All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
All stairwell/exit doors shall unlock throughout the building.
All self-closing fire/smoke doors held open shall be released.
Direct the closed circuit TV cameras to the alarm event and start video recording.

**Duct Smoke Activation - Supervisory**
The supervisory activation of any duct smoke detector, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.
Display the event on the graphical workstation and display a pictorial image.
The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
All system activity/events shall be documented on the system printer.
Any remote or local annunciator LED's associated with the alarm zone shall be illuminated. Transmit signals to remote annunciators located in building security desk, the engineer's office and the building management office.
Transmit signal to the building automation system. Transmit signal to the central station with point identification. Shutdown the local air-handling unit.

**Supervisory Operation**
Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.
Display the event on the graphical workstation and display a pictorial image.
The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date. All system activity/events shall be documented on the system printer.
Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated. Transmit signal to the central station PC with point identification.

**Trouble Operation**
Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.
Display the event on the graphical workstation and display a pictorial image.
The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date. All system activity/events shall be documented on the system printer.
Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated. Transmit signal to the central station PC with point identification.

**Monitor Activation**
Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center
Display the event on the graphical workstation and display a pictorial image.
The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
All system activity/events shall be documented on the system printer
Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

**4.0 Notification Appliance Circuits**

**A**ll notification appliance circuits shall have a minimum circuit output rating of: 2 amps @ 24 VDC, 50 watts @ 25V audio, and 35 watts @ 70V audio. The notification circuits shall be power limited. Non-power limited circuits are not acceptable

**4.1.1 NETWORK Wiring**

The system supplied under this specification shall utilize node-to-node, direct-wired multi-priority peer-to-peer network operations. The backbone shall be multi-core wiring or commercial CAT5/6 cable or Single mode, multimode fiber cable depending on application. A Minimum of 64 ten loop panels shall be capable of being networked together and each panel shall have capability of addressing 2500 points .The system shall utilize independently addressed, smoke detectors, heat detectors and input/output modules as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of

node failure or communications failure between a nodes. When a network is wired in a Class B configuration, a single break or short on the network wiring isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network working with their combined databases. When wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted, without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages The remote control panel/network nodes shall meet the same requirements as described in control panel section and shall contain Common control switches with minimum 640 character LCD display, as required with Integral power supply(s) with secondary stand-by power. It shall also have signaling line circuits for communications with analog/addressable devices, as required, Audio amplification, as required, Notification appliance circuits, as required and Auxiliary function circuits and operations, as required.

The network communication shall be based on a Local Area Network (LAN). The network shall use a deterministic token-passing method. Collision detection and recovery type protocols are not acceptable substitutes due to life safety requirements. In addition, there shall be no master, polling computer, central file computer, display controller or other central element (weak link) in the network which, on failure, may cause complete loss of network communications or cause major degradation of network capability. There shall be no cascading of CPUs or master-slave relationships at the network level to facilitate network communications. Failure of any node shall not cause failure or communication degradation of any other node or change the network communication protocol among surviving nodes located within distance limitations

4.1.2 **NETWORK REMOTE MONOITORING**:

The system shall provide off premise or remote communications capability for transmitting system events to multiple Central Monitoring Station using web servers or Netcom cards on main panel using the open TCP/IP protocol The system shall provide the remote location with point identification of system events.

**4.2 Submittals**

It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The contractor shall submit three (3) complete sets of documentation within 30 calendar days after award of purchase order. Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the contract documents. In addition the Contractor shall provide specific notation on each shop drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials

**Product Data**

Data sheets with the printed logo or trademark of the manufacturer for all equipment. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this

specification. The proposed equipment shall be subject to the approval of the Architect/Engineer.

**System Calculations**
Complete calculations shall be provided which show the electrical load on the following system components:
Each system power supply, including stand alone booster supplies.
Each standby power supply (batteries).
Each notification appliance circuit.
Each auxiliary control circuit that draws power from any system power supply.

## 4.3 Quality Assurance

The contractor shall have successfully installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable size and complexity. The owner reserves the right to reject any control components for which evidence of a successful prior installation performed by the contractor cannot be provided.

The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment. Qualified and approved representatives of the system manufacturer shall produce all panel and equipment drawings and submittals, operating manuals. The contractor is responsible for retaining qualified and approved representative(s) of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

## 4.4 Pre-Installation Requirements

The provider shall submit a detailed project plan that will describe in detail how the provider will approach the project, from inception to finalization. The plan must include at a minimum the following information:

Project Staging
Project Management
Equipment Schedules
Installation Time Lines
Other Trade Requirements
Final Acceptance Testing
Personnel Resumes
Progress Report Sample

All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the manufacturers riser/connection diagram and details for all specific system installation/termination/wiring data.

## 4.5 Start and Completion Dates

The starting and completion dates for this work will be established at the pre-bid meeting.

4.6 **Training**

**T**he System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System. The instruction shall be presented in an organized and professional manner by a person trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the Installation. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

## 5.0 SYSTEM OPERATION – FUNCTIONAL SPECIFICATIONS AND PRODUCTS

5.1 **General:** The system shall be integrated into a comprehensive system, to provide the functional performance described as follows:

5.1.1 Fire Detection and Alarm System

5.1.1.1 The fire detection and alarm system shall monitor and display the activation of each device in the system, such as heat detector, smoke detector, manual break-glass unit, sprinkler water flow switch, sprinkler valve tamper switch, hose reel water flow switch and hose reel valve tamper switch or any other input device which may be required.

5.1.1.2 The system shall initiate output functions such as automatic alarm annunciation via speakers, fans shutdown, automatic notification to the Fire main control PC and activation of audible hooters/directional sounders/strobes.

5.1.1.3 The system shall be of the addressable intelligent type, completely supervised, such that a break in any wire (loop) shall not prevent any device from operating. The system shall be of the type such that each device connected to the system shall be provided with unique address and separately identified at the Main control panel (MCP).

5.1.1.4 The wiring shall be monitored against faults such as opens, shorts, earth's or data transmission failure. Detection addressable loops, capable of handling minimum of 250 addressable points shall return to the control panel.

5.1.2 Emergency Paging And Voice Alarm

5.1.2.1 The system shall permit communication in the form of paging from the main control panel and telephone switchboard to any floor or group of floors simultaneously. The system shall be capable of manual operation or automatic operation initiated by the fire alarm system. Speakers shall be located as required to achieve acceptable audibility in all Communication addressable loops will be supervised and therefore return to the control panel.

5.1.3 Emergency Telephone

5.1.3.1 The emergency telephone system shall provide two way communications capability between the main control panel and jacks for emergency telephone handsets. The emergency telephone handsets shall be furnished as part of the overall system.

**5.2 Scope**

5.2.1 The Main control panel shall be located in the main control room now called the Fire Command Centre (FCC) as located in the drawings. The appropriate authorities shall approve the exact location.

5.2.2 A active & networkable remote repeater panel shall also be installed at designated places and shall repeat all alarm functions displayed at the main control panel.

5.2.2.1 Graphics software shall be loaded on the PC in the FCC and capable of displaying all information graphically. It shall be capable of uploading drawings in the AutoCAD format and pop up alarms or silence them.

5.2.2 photoelectric type smoke detector shall be with integral microprocessor and shall be capable of taking an independent alarm decision. In case of the failure of the main loop controller the detector shall be capable of operating in standalone mode or degrade mode and continue to take decisions

5.2.3 Heat detectors of the fixed temperature (57 deg.C) type or rate of rise of temperature type shall be used in areas environmentally unsuited for smoke detectors such Kitchens, Valet Laundries, Emergency Generator rooms,

5.2.4 Each fan system shall be provided with a duct-mounted smoke detector, which utilizes full width sensing probes and is suitable for the air velocities to which it is subjected. Duct mounted smoke detectors concealed from view shall be supplied with a remote indicator, located near the location of the hidden detector, appropriately labeled as to the detector's location.

5.2.5 Break-glass stations (manual fire alarm stations) shall be located on the occupied side of the door to each exit stair and at intermediate locations as required (Maximum distance between pull stations shall not exceed 60 m). .

5.2.6 Sprinkler, Hose reel water flow switch and valve tamper switch shall be provided at each sprinkler system valve location (the flow and tamper switches shall be generally furnished and mounted by the sprinkler system installer and wired by the fire detection alarm system installer).

5.2.7 Magnetic hold open devices shall be provided where required for the automatic release of smoke / fire doors.

**5.3 System Operation**

5.3.1 The system shall be arranged for categories of alarm inputs and provide output functions appropriate to each of the categories;

5.3.1.1 Supervisory Monitor input : The following inputs shall be considered supervisory monitoring functions:

5.3.2.1 Sprinkler system shut off valve tamper switch.

5.3.2.2 Hose Reel cabinet tamper switch

5.3.2.3 Removal of a smoke detector from its base.

5.3.2.4 Fire / Sprinkler pump status (i.e. running, power available, malfunction).

5.3.2.5 Wiring faults.

5.3.3 Activation of a supervisory monitoring device shall provide the following indications:

5.3.3.1 The MCP and remote annunciators shall indicate shall indicate an audible and visual "TROUBLE" condition. In addition, the "trouble alarm" shall be displayed on the graphic display unit for the type of alarm.

5.3.3.2 Printer shall print clear next message on the event log indication the device, which initiated a trouble alarm.

5.3.3.3 An alarm signal shall be automatically sent to the local control room as well as REMOTE control room if designed This may be accomplished by means of an web server /Netcom/ digital dialer.

5.3.3.4 In case of fire all lift call and door buttons and signals shall become inoperative, lifts serving that floor shall be signaled to immediately return to the ground floor or as designated by the local Fire department and be held for the exclusive use of the Fire Brigade. Should such an alarm occur on the ground floor, the lifts shall be signaled to return to an alternate floor which is not in alarm.

5.3.3.5 Signals shall be sent directly to heating, ventilating and air conditioning fan motor controllers for status monitoring circuits to confirm the operation of the fan systems.

5.3.3.6 The details of the fan control sequence shall be as follows:

5.3.3.7 All fans serving the areas affected by the alarm condition shall shutdown.

5.3.3.8 Smoke extraction fan system shall have to be started

5.3.3.9 Stair pressurization fans shall be started.

5.4.1.1 Signals shall be transmitted to the paging system to display zone in alarm.

5.4.1.2 The printer shall print a clear text message on the event log printer The printer shall print the device information indicating clearly in plain language which device is in alarm, the time, and the date associated with the alarm. The printer shall print all follow-up information regarding this alarm, such as acknowledge, reset etc.

5.4.1.3 All access control doors shall be released in case of fire condition

shall allow for more than one floor at a time to be displayed.

5.4.1.4 The automatic voice evacuation alarm shall be initiated from the fire alarm system upon activation of an alarm. The alarm shall consist of a “slow whoop” alarm tone for a maximum of fifteen (15) seconds followed by an automatic pre-selected voice evacuation message. At the end of each message the ‘slow whoop’ shall continue for fifteen (15) seconds followed again by the automatic voice evacuation signal. This sequence of alarm shall sound until the signal silence switch is operated at the main fire alarm control panel or the fire alarm has been reset as described previously. The voice evacuation signal shall be distinct, authoritative without any inflection and shall be repeated in several languages as agreed with the fire brigade.

5.4.1.5 The alert tone shall consist of an introductory pulse tone for fifteen (15) seconds followed by an alert message to advise that this floor is not in alarm but the floors that are in alarm shall be stated. The message shall also state that the occupants shall be prepared to evacuate the building when the evacuation alarm is given. The alert tone shall be distinctly different from that of the evacuation alarm.

5.4.1.6 Each stairwell shall receive a voice message without a fire alarm tone. The message shall state that there is an emergency in the building anyone presently in the stairwell shall not re-enter any floors but should proceed immediately to the ground floor exit level. Zone circuits shall be designed for this activity

5.4.1.7 During the automatic transmission of the fire alarm and alert tones, it shall be possible at the main fire alarm panel to permit selective voice paging. Upon activation of manual controls witches and the microphone push-to-talk switch, it shall be possible to transmit a message to the selected areas. The activation of any such switches and microphone switch shall initiate the “slow whoop’ alarm tone for fifteen (15) seconds followed by an announcement or message. The message shall follow the ‘slow whoop and the person making the announcement be cued when to start the announcement by a red indicator located adjacent to the microphone. When the microphone button is released, the “slow whoop’ shall sound for fifteen (15) seconds, after which the system shall return to the automatic voice evacuation or alert mode until reset as mentioned above.

5.4.1.8 It shall be possible to load a variety of prerecorded message plus combinations of floor fire alarms prerecorded message, which shall all be selected by the system software. Amendments to the prerecorded message and any reprogramming of the operating system shall be accomplished by front panel operated push buttons, selector switches and a keypad.

5.4.1.9 It shall be possible to transmit an alarm tone to speakers in one zone while sending a voice message to another zone while the rest of the building is receiving alert tone, all at the same time.

5.4.1.10 Each speaker zone (with dual circuits) shall be connected to its own amplifier. It shall therefore be possible to have as many channels as there are speaker zone. A minimum of three (3) channels shall be supplied; an ALERT channel, an EVAC channel and a PAGE channel.

5.5.1.1 Zoning of speaker circuit shall be as indicated in the drawings.

5.5.1.2 The emergency evacuation and voice alarm system amplification equipment shall be sized to accommodate the total quantity of speakers for each channel (total of three) plus 25% spare reserve capacity in each channel.

5.5.1.3 The system shall be provided with redundant amplifiers arrange in such a manner that failure of an amplifier shall not result in loss of acceptable audibility in any area of the building.

5.5.1.4 Emergency Telephone System: All remote emergency telephones will communicate with the emergency telephone control panel at the main control room:

5.5.1.5. The insertion of any telephone handset into its jack will cause the appropriate phone location indicator to flash and a distinctive audible pulsing sound to be heard in the fire command centre. The subsequent picking-up of the master phone and operation of that phone selector switch will silence the pulsing tone, cause the phone location.

5.5.1.6 The emergency telephone system will provide the capacity to handle simultaneous use of multiple remote phones. All phone jacks will be annunciated and monitored against fault or tampering (i.e. supervised).

5.5.1.7 The removal of all remote telephone handsets from their jacks will cause the restoration of all normal supervisory functions. If any remote phone is not removed, then the appropriate phone zone indicator will flash and the pulsing tone will resume in the fire command centre.

## 5.6 Coordination With Other Systems

The fire detection and alarms system shall have interface with other building systems, which are described under other sections of the report, as follows:

Heating, Ventilating and Air Conditioning (HVAC)

Building Automation System (BAS)

Sprinkler / Pumps system

The life safety system is required to monitor fire hydrant / sprinkler pump status. The pump controllers shall have the necessary volt free output signals available.

## 5.7 Cables

5.7.1.1 Cabling for Fire Alarm System shall be enhanced mineral insulated (MI) cables with an overall LSF (Low Smoke & Fumes) covering. Cable shall be 500 V grade fire survival cables which shall be LPCB approved and tested under fire conditions at 950˚C for 3 hours followed by water spray for 15 minutes and the test for mechanical damage (satisfying C,W&Z performance specified in BS-6337-1994 conducted on single sample)
Overall LSF Covering shall compliant with IEE regulation( BS7671)

5.7.1.2 The cables used shall be exclusively for Fire Detection System. The multi-core cables shall not be shared for other low voltage or high voltage circuits.

5.7.1.3 The cables connected to detectors shall be given S –loop on both the sides of the detectors which shall be properly clamped to the ceiling. Loop shall also be left where cables connects sounders, panels, dampers etc. Appropriate glands shall be provided where the cables enters the junction box.

5.7.1.4 Cables shall be laid by skilled and experienced workmen. Care shall be taken while laying cables to avoid kinks. At all the changes in direction (vertical and horizontal planes) the cables shall be bent smooth with a radius as recommended by the manufacturers.

5.7.1.5 No joints shall be allowed between two points. The sleeve at joints shall be shaved off like a pencil and shall not be cut square to avoid cutting of conductors.

5.7.1.6 Cabling scope shall be supply and laying of cables of core sizes as under

2 core x 2.5 sq mm copper conductor MI LSF Cables.
2 core x 1.5 sq mm copper conductor MI LSF Cables.
(LSF stands here Low Smoke & Fumes)

5.7.2. .1 All cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system. Loop wiring shall be of 1.5 sq mm 500 Volts, solid copper MI LSF cables.

5.7.2.2 All initiating, and supervisory circuit wiring shall be not less than 2.5mm$^2$, 500 volt, copper MI LSF cables.

5.7.2.3 Cabling used for the signaling line circuit (SLC) multiplex communication loop shall be MI LSF cables.

5.7.2.4 All field wiring shall be completely supervised.

5.7.2.5 All speaker and telephone circuits shall be not less than 2.5mm$^2$, 500 volts, solid, copper MI LSF cables.

5.7.2.6 Cabling shall be completely installed, field connections made and tested for stray voltage, short circuits, and ground faults prior to connection to the intelligent modules.

5.7.2.7 All loop cabling shall be identified by ins and outs. Ins is defined as coming from the panel.

5.7.2.8 Red and Black must be used for 24 VDC panel power circuit. Audio visual indicating circuits shall be colour coded. Colour code shall not be duplicated in the same panel.

5.7.2.9 No voltage supply from any other source than the primary power 230 VAC and the panel 24 VDC power supply shall be utilized.

5.7.2.10 Intelligent loop circuits shall be labeled at all junction locations by the panel number and loop number.

5.7.2.11 Intelligent loop circuits shall be provided with adequate junction boxes be expandable and provide a means for connecting to the loop in the junction box.

5.7.2.12 Control and other panels shall be mounted with sufficient clearance for observation and testing. Fire alarm junction boxes shall be clearly marked for distinct identification..

5.7.2.13 All fire alarm junction boxes should be mounted in approved locations for ease of maintenance from floor level.

5.7.2.14 All junction boxes shall be made up in a uniformly and orderly manner.

## 5.8 Fire Alarm Control Panels and GA ( GRPAHICS node ) – OPERATIONAL SPECS

5.8.1 Each network FIRE ALARM CONTROL PANLEL now called FACP shall contain a microprocessor-based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, local and remote operator terminals, printers, annunciators, emergency voice communication systems, public address system, building management system, and other system controlled devices. The Fire Alarm System shall include all required hardware and system programming to provide a complete and operational system, capable of providing the protected premises with the following functions.

5.8.1.1 Modular systems manufacture with a layered application concept, including an “operational layer” and a “human interface layer”, to allow maximum flexibility at the system with a minimum physical size requirement.

5.8.1.2 All system operational software is to be stored in FLASH memory.

5.8.1.3 System response to any alarm condition must occur within 3 seconds, regardless of the size and the complexity of the installed system.

5.8.2 Each FACP on the network shall perform the following functions:

5.8.2.1 Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.

5.8.2.2. Supervise all initiating signaling and notification circuits throughout the facility. Voice evacuation speakers to be monitored by the public address system.

5.8.2.3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.

5.8.2.4. Visually and audibly annunciate any trouble, supervisory or alarm, condition on operator's terminal, panel display, and annunciators.

5.8.2.5. Visually display sprinkler valve and water flow detectors.

5.8.2.6. Visually display status of emergency power.

5.8.2.7. Shall have controls for unlocking stairway doors.

5.8.2.8. Graphically display all zones.

5.8.2.9. Trouble alarm for public address system.

5.8.2.10. Trouble Alarm for Building Management System.

5.8.2.11. System status LED's for Test status, CPU Fail status, Ground Fault status, Disable status

5.8.2.12. Common control switches for reset, Alarm silence, panel silence, drill silence.

5.8.2.13. Other operator control switches such as previous message switch. Next message switch, and more details switch.

5.8.3 .1 Each FACP node shall include a full featured operator interface control and annunciation panel which shall include an individual, colour coded system status LED's and an alpha-numeric keypad for field programming and control of the node.

5.8.3.2. All programming or editing of the existing programming in the system shall be achieved without special equipment or interrupting the alarm monitoring functions of the fire alarm control panel.

5.8.3.3. Each FACP node shall be capable of providing the following features:

5.8.3.4 Block Acknowledge for Trouble Conditions

5.8.3.5 Rate Charger Control

5.8.3.6 Control-By-Time (Delay, Pulse, time of day, etc.)

5.8.3.7 Automatic Day/Night Sensitivity Adjust (high/low)

5.8.3.8 Environmental Drift Compensation (selectable ON or OFF)

5.8.3.9. Smoke Detector Pre-alarm Indication at Control Panel

5.8.3.10 NFPA 72 Smoke Detector Sensitivity Test

5.8.3.11 System Status Reports

5.8.3.12 Alarm Verification, by device, with tally

5.8.3.13 Multiple Printer Interface

5.8.3.14 Multiple CRT Display Interface

5.8.3.15 Non-Fire Alarm Module Reporting

5.8.3.16 Automatic NFPA 72 Detector Test

5.8.3.17 Programmable Trouble Reminder

5.8.3.18 Upload/Download System Database to PC Computer

5.8.3.19 One-Man Walk Test

5.8.3.20 Smoke Detector Maintenance Alert

5.8.3.21 Security Monitor Points

5.8.3.22 Alpha-numeric Pager Interface

5.8.3.23 On-line or Off-line programming

5.8.3.24 Interface with security system, Building Management System public address system.

5.8.3.25 Ground fault detection.

**5.8.4 Fire Alarm Central Processing Unit**

5.8.4.1 "The proposed Fire Alarm System shall be from a single UL listed manufacturer for complete compatibility of the proposed large peer-to-peer networked system. Master-Slave network will not be acceptable. Each occupant shall have its own Fire Alarm Control Panel as a Node in the Network complete with its own Network Control Annunciator, Web Server, Graphics Control Station and BAC net Gateway for integration with the individual Occupants Building Management System.

5.8.4.2 The Fire Alarm System for the areas which Occupants share with other Occupants due to the lack of Fire Compartmentation in the common area shall be controlled by the Network Control By Event Equations, as this area is treated as a Life Safety Risk by all the Occupants. When the fire is sensed by any one Node in the Network for the Shared Area shall be annunciated at the Network Control Annunciator of all the other Occupants. All the Outputs associated with the Fire Alarm Event in the Shared Area shall be actuated / triggered automatically like activation of Pressurization Fans, Fire Dampers to close, Sounder / Strobes to be activated, Ventilation Fans to be run on double speed etc. in the Shared Area, as if the Fire Alarm Event has occurred in all the Nodes which share the Common Area. The Alarmed System for the Shared Area shall only be Controlled and Reset by a separate Network Control Annunciator dedicated for the Shared Area, after due investigation by the authorities concerned."

5.8.4.3 Peer-to-Peer Fire Alarm Network

5.8.4.3.1 Peer-to-Peer Fire Alarm Network is the interface with allows intelligent Fire Alarm Control Panels to form a network. Each local control panel (network node) maintains its own area of protection, while monitoring and controlling other areas (other network nodes).

5.8.4.3.2 Local information shall be displayed at each network node. In areas such as a security office, where the entire network must be monitored, network annunciators shall be required.

5.8.4.3.3 Features:

Fiber optic (multi-mode), wire, or combination wire/fiber communications path.

NFPA Style 4 or Style 7 Network operation.

Based on proven technology.

True peer-to-peer communications. Each node stores its own program and communicates equally with all other nodes.

Token-passing non-collision protocol.

No “master” polling computer or other central weak link.

Inherently regenerative system. Each node acts as a repeater to reshape and regenerate data signals. Failure of any node does not affect any other node / communications among surviving nodes.

High-speed data communications (312, 500 BPS).

Simple plug-in module, the network shall be compatible to panels anywhere on the network.

Multiple Network Control Stations (NCS) may be placed anywhere on the network. Additional NCS’s may be used to provide inherent “hot” backup.

Multiple Intelligent Network Annunciators (INA) may be placed anywhere on the network.

NCS and INA display all network activity. Unlike competitive systems, the point display capacity is NOT held to less than the maximum network capacity.

Single small-gauge twisted pair wire (no shield necessary) for data communications path.

Electrical isolation between nodes.

Network clock synchronization.

History Buffers on INA, NCS and Intelligent Fire Control Panels.

Powerful Cooperative-Control-by-Event allows point(s) on one node to activate point(s) on other nodes. Any input can turn on any output, network-wide.

NCS Network Control Station

The NCS shall based on a UL 864 recognized computer. Special hardware and software are to be added by manufacturer to make the NCS operate as a Command Center.

5.8.4.4 Network Graphics Control Station

5.8.4.4.1 The Network Control Station (NCS) is a high performance desktop computer with text and color graphics display capability of all network events and points. The NCS runs under the user-friendly Windows® environment.

5.8.4.4.2 NCS Hardware Features

- Pentium® based computer consisting of:
- Intel® 800MHz or better Pentium® IV microprocessor or better
- 256 MB RAM with 512 MB option.
- 8 MB video SDRAM or better
- 512 KB cache memory or better
- 80 GB hard drive or better
- 1.44 MB floppy drive windows® 2000 keyboard
- PS/2 mouse
- 350 Watt power supply.
- 52X CD-RW drive/DVD RW drive
- Sound card, microphone and internal speakers
- 10 KA surge protector

5.8.4.4.3 NCS Software Features:

- Windows® 2000 operating system
- As built location of all devices and detectors on the loop.
- Mouse control with extensive use of Windows-type “point and click” operation.
- Vectors to a screen displaying an alarm with or without operator intervention.
- Cursor changes automatically to indicate on-screen action areas.
- New and Acknowledged Event boxes display all off-normal status simultaneously with graphic screens.
- Operator log-on with response tracking.
- History Manager records operator, event, and response with time-and-date stamp to hard drive.

- Multiple search filters make History Manager a power management tool.
- An unlimited number of events can be stored in the history manager. A warning is generated every 100 events after 100,000 events are stored.
- A complete library of device icons is included.
- Custom device icons can be created in the field.
- Add, edit, and delete devices and screens in the field.
- Link devices or system events to voice (*.wav), text, or bitmap files.
- All software backed up on CD-RW.
- Read Status/Program/Edit window – network points (online).
- Walk-test over the network
- Up to five states can be visually represented for each input device: Normal, Trouble, Alarm, Pre-Alarm (detectors), Disabled.
- Up to two states can be visually represented for each system Trouble: Normal, Trouble.
- Off-Normal Event window (color coded).
- Network-wide Disabled Device window.
- Mini-History viewer, last 1,000 events (color coded).
- Programmable access per feature, per node, per user matrix.
- Logs in history any programming changes.
- GSP (Graphic Setup Program) imports DWG-formatted (AutoCAD®) files to BMP.
- Graphic Editing and Navigation aids (on-site modifiable).
- SVGA 1024 x 768 color graphics.
- Programmable Alarm and Trouble tones (variable frequency).
- Control ON/OFF all networked panels
- Archived history files.

5.8.4.5 Network Control Annunciator (Repeater Panel)

5.8.4.5.1The Network Control Annunciator (NCA) shall be a 168 or higher- character backlit LCD display with operator keypad for the network. As a remote node on a network, it provides both system control and display capabilities for all network nodes.

5.8.4.5.2The NCA shall have optional display for the fire control panels. When mounted in the control cabinet and connected to a stand-alone panel, it provides system control and display capabilities for a stand-alone panel. When connected to a networked panel as a primary display, it can provide network control and status/history display capabilities.

5.8.4.5.3 Hardware Features:

- Full supervision of all inputs and network integrity.
- Enhanced-format 168 or higher -character LCD display with backlighting.
- Keyboard interface (EIA-232)
- Ten LED status indicators:
- Power, Fire Alarm, Pre-Alarm, Security Alert, Supervisory, Trouble, Signal Silence, CPU failure, Point Disabled, Other Event.
- Alphanumeric keypad with tactile and audible feedback.
- Four status relays: Alarm, Trouble, Supervisory, Security (Form-C).
- Nonvolatile real-time clock can be synchronized with network by master node.
- Optional Security Key switch enable to NCA.
- Optional Security Tamper switch.
- Individual Enable / Disable or Group Enable/Disable local and networked zones.
- Control ON/OFF of local (the panel in the same cabinet and networked control points.
- Read Status of local (the panel in the same cabinet) and networked points and zones.
- Network event display and optional CRT with keyboard.
- Network master fire phone, paging control, HVAC control.
- Network-wide: Acknowledge, Silence, Reset.
- Lamp Test (local to NCA).
- History Buffer ( 1,000 System events).

- Report status of networked panels and their respective field devices to a central station.
- One master level and nine user level passwords. The Master can assign each User access levels (programming, alter status).
- Interactive Summary Event Count display, event handling package.
- Online programming and alter-status programs.
- Intuitive user guidance program including interactive soft keys.
- Enhanced Read Status / Alter Status displays.
- New history filters for report displaying and printing: All Events, Only Alarms, Only Troubles, Only Supervisory, Only Security, Time Interval, Point Range.
- Fully programmable node-mapping subsystem.
- New Advanced / Basic Walk-test program.
- Timer control for Auto Silence, AC Fail Delay.

5.8.5 Web Server

The Web Server or equivalent Network card with TCPIP connectivity shall be a web-based device that acts as an HTML server, allowing remote access to the network via the internet or an intranet. With the NWS interface, users can view fire alarm control panel (FACP) event history, event status, device properties and other information based on access permissions defined by the system administrator. Features: For the Web Server and Serial Configuration Tool:

- Access network device statuses and properties remotely via the Internet or an Intranet.
- Standard Ethernet over IP connection.
- Supports up to 64 operator and 64 administrator accounts.
- Online Authorization log keeps a record of the username, time and date of the last 50 users to access the system.
- Built-in password security and user-access record.
- Multiple users can access the web server at the same time.
- Supports standard Microsoft® Internet Explorer 5.0 or higher.
- Intuitive Explorer-style user interface.

5.8.6 BAC net/MODBUS/LONWORKS Gateway

The BAC net/eqv Gateway shall provides an interface between fire panel network and a network using the BAC net/IP/eqv. communication protocol. BAC net protocol is an American National Standard (ANSI/ASHRAE 135-1995). With the Gateway interface, devices on fire alarm control panels are represented as BAC net objects to the BAC net client. The user subscribes to Event Notification objects per FACP, and the BAC net device receives events from objects on the FACP as a result of this subscription.

5.8.7. Loop Controller (LC)

Loop Control boards shall be provided to monitor and control each of the Signaling Line Circuit (SLC) loops in the network node. The loop Control board shall contain its own microprocessor and shall be capable of operating in local mode in the case of a failure in the main CPU of the control panel. In local mode, the loop interface board shall detect alarms and activate output devices on its own SLC loop.

The LIB shall not require any jumper cuts or address switch settings to initialize SLC Loop operations.

The loop interface board shall provide power to, and communicate with, all of the intelligent detectors and addressable modules connected to its SLC Loop over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 7.

The loop interface board shall receive information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The loop interface board software shall include software to automatically adjust and compensate for dust accumulation to maintain detector performance as it is affected by environmental factors. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

The LCB shall communicate with each intelligent addressable detector and addressable module on its SLC loop and verify proper device function and status.

5.8.8. Enclosures

Control panels shall be housed in FM/UL-listed or BS/IEC Standards cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and the manufacturer's standard finish. The back box and door shall be constructed of 1.5mm steel with provisions for electrical cable connections into the sides and bottom. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

5.8.9 Field Programming

The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.

All local FACP node programming shall be accomplished through the FACP keyboard or through a portable laptop.

All field defined programs shall be stored in non-volatile memory.

The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Multi-levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.

5.8.10 Specific System Operations

Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all intelligent detectors in the FACP node from each system keypad or from the keyboard of the video terminal. Sensitivity range shall be within allowed UL limits.

Alarm Verification: Each of the intelligent addressable detectors in the system may be independently selected and enabled for alarm verification. Each FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

5.8.11 System Point Operations

All devices in the FACP node may be enabled or disabled through the local keypad or video terminal.

Any FACP node output point may be turned on or off from the local system keypad or the video terminal.

Point Read: The FACP node shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:

Automatic Detector Maintenance Alert: Each FACP node shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.

If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system shall enter the trouble mode, and the particular intelligent detector shall be annunciated on the system display, network display and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

## 5.9 **Conventional Heat Detectors ( For Parking Area )**

Conventional heat detectors shall have a combination rate of rise and fixed temperature rated at 57°C for areas where ambient temperatures do not exceed 38°C, and 93°C for areas where the temperature does not exceed 65°C.

Conventional heat detectors shall be a low profile, ceiling mount type with positive indication of activation.

The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 °C per minute.

The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.

Conventional heat detectors shall have a smooth ceiling rating of 250 square meter.

5.10 **Addressable Dry Contact Monitor Module**

Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.

The monitor module shall mount in a 100 mm square, 100 mm deep electrical box.

The IDC zone shall be suitable for Style D operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 60 mm x 30 mm x 13 mm.

**5.11 Batteries and External Charger**

5.11.1 Battery
Battery shall be of 12 volt, Cd type or better and shall not be hazardous to humans or environment

The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills and leakage shall not be required.

Battery shall be heavy duty type of life span of minimum 5 years.

**5.12 Fire Fighter's Smoke Control Panel ( Optional )**

A fire fighter's smoke control panel shall be provided to manually control or override automatic control through the Building Management System for mechanical smoke control systems. The control panel shall graphic display all floors with each smoke control zone that utilizes exhaust method. Size of panel shall have layout indicated at 1:400 or bigger.
All related smoke control zones, shall be graphically shown on the fire fighter's smoke control panel.

Zone indicators shall be provided for all smoke control zones to illuminate the zones using LED's. Each zone shall have a distinctive colour.

Each smoke control zone on the fire fighter's smoke control panel shall have an on-auto-off switch associated with each smoke control zone.

In the auto position, the smoke control sequence in the respective zone shall be activated by zone smoke detectors.

In the on position, the smoke control sequence shall be automatically activated in the respective zone.

In the off position the smoke control fans and associated equipment cannot start in the respective zone or shall shutdown.

The fire fighter's smoke control panel shall communicate with the Building Management System to initiate startup and/or shut down of related smoke control fans, air handling units, dampers, and other related smoke control equipment.

## 5.13 Uninterruptible Power System ( Optional )

The Contractor shall furnish and install an Uninterruptible Power System (UPS) with the following features:

Voltage:

Input – 240 Volts, single phase, two wire plus ground

Output – 240 Volts, single phase, two wire plus ground.

Output load capacity – to be designed by the contractor as per load.

Surge protection

Overload capacity – 200% for 60 seconds in normal operation.

Monitoring and control

**Installation**

Installation shall be in accordance with the IFC, NEC, NFPA 72, local codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

All cables ,junction boxes, cable supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

Manual Pull Stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 1 m nor more than 1.2 m above the finished floor.

**Typical Operation**

Actuation of any manual station, smoke detector, heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:

. Activate all programmed speaker circuits in a zone or throughout.

Actuate strobe units until the panel is reset in a zone or throughout.

Light the associated indicators corresponding to active speaker circuits.

Release all magnetic door holders to doors to adjacent zones on the floor from which the alarm was initiated.

Where required, return all elevators to the primary or alternate floor of egress.

A smoke detector in any elevator lobby shall, in addition to the above functions, return all elevators to the primary or alternate floor of egress.

Smoke detectors in the elevator machine room shall return all elevators in to the primary floor. Heat detectors installed to shut down elevator power shall do so in accordance with ANSI A17.1 requirements and be coordinated with the electrical installation. Smoke detectors at the primary level elevator lobby shall return elevation to an alternate level.

Duct type smoke detectors shall, in addition to the above functions, shut down the ventilation system or close associated control dampers as appropriate.

. Activation of any sprinkler system low pressure switch, on valve tamper switch, shall cause a system supervisory alarm indication.

**Commissioning**

Commissioning shall include pre-testing, troubleshooting, acceptance testing, and punch list.

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. The Contractor shall pre-test the system before the final acceptance testing and shall submit a pretest report to the Engineer:

Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

Verify activation of all flow switches.

. Open initiating device circuits and verify that the trouble signal actuates.

Open signaling line circuits and verify that the trouble signal actuates.

Open and short notification appliance circuits and verify that trouble signal actuates.

Open and short (wire only) network communications and verify that trouble signals are received at network annunciators or reporting terminals.

Ground initiating device circuits and verify response of trouble signals.

Ground signaling line circuits and verify response of trouble signals.

Ground notification appliance circuits and verify response of trouble signals.

Check alert tone and prerecorded voice message to all alarm notification devices.

. Check installation, supervision, and operation of all intelligent smoke detectors using smoke test.

Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

. Check each zone smoke control sequence under “automatic,” “on” and “off” operation.
Perform the following tests for the public address/fire alarm system:

Simulate a fire condition using each of the following initiating devices in each zone: 1) manual pull station – water flow switch 2) area smoke detector - projected beam smoke 3) heat detector - detector 4) duct smoke detector

After alarm verification time has exceeded ensure that proper voice institution messages are transmitted to the proper zone.

Simulate live voice announcements in all zones using All Call, All Call Minus, Page to Evac ., and Page to Alert functions to ensure that proper voice instruction messages are transmitted to the proper zones. Stairways shall be on an independent zone separate from all other zones.

**Test & Inspection**

All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message. All wiring shall be tested for continuity, shorts, and grounds before the system is activated. All test equipment, the installing

contractor, shall make instruments, tools and labor required to conduct the tests available.

The system including all its sequence of operations shall be demonstrated to the Owner, his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

At the final test and inspection, a factory-trained representative of the system manufacturer shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision, and participate during all of the testing for the system.

A letter from the Contractor certifying that the system is installed entirely in accordance with the system manufacturer's recommendations and that the system is in proper working order.

## 4. TESTING

1 GENERAL

At the completion of the work, the entire installation shall be subject to the following tests in the presence of the Owner's site representative.

Wiring continuity test.
Insulation resistance test.
Earth continuity test.
Earth resistivity test.
Test as per Appendix `E' of IS:732 -1989

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the Contractor at his own cost.

2 TESTING OF WIRING

All wiring systems shall be tested for continuity of circuits, and earthing after wiring is completed and before installation is energized.

3 INSULATION RESISTANCE TEST

The insulation resistance shall be measured between earth and the whole system of conductors, or any section thereof, with all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 660 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 divided by the number of points provided on the circuit, the whole installation shall have an insulation resistance greater than one megaohms. The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant standard specification or where there is no such specification, shall not be less than one a megaohms. All equipments, cables shall be inspected at works by the Architect as per relevant IS and testing commissioning of installation as per Appendix `E' of IS:732-1989 shall be done and all record to be maintained.

4 TESTING OF EARTH CONTINUITY PATH

The earth continuity conductor metallic envelopes of cables 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.

## 5 TESTING OF POLARITY OF NON-LINKED SINGLE POLE SWITCH

In a two wire installation a test shall be made to verify that all non-lined single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three or four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Owner's site representative as well as the local authorities.

| LIST OF APPROVED MAKES FOR PLUMBING SYSTEM | | |
|---|---|---|
| **SL. NO.** | **MATERIAL DESCRIPTION** | **NAME OF MANUFACTURER** |
| 1 | G.I. pipes (Up to 150 mm dia) | Jindal Hissar/API APPOLO/TATA/Prakas /Suriya |
| 2 | Sanitareware | Jaquar/Hindware |
| 3 | CP fittings | Jaquar/Hindware/Bolan |
| 4 | Poly propylene Pipes & Fittings | ASTRAL/Poloplast/Mcalpine |
| 5 | CPVC Pipes/UPVC PIPES | SFMC/Astral/AASHIRWAD/AKG/Finolex |
| 6 | G.I.Fittings (Malleable) | UNIK / KENT |
| 7 | G.I./ M.S Forged Steel fittings IS:1239 (Part-II) | VS / DRP / True Forge / Simless |
| 8 | Stoneware pipes & Gully Trap | Anand/Perfect |
| 9 | Horizontal Soil/Waste hanging supports | Chilly/Lovely |
| 10 | Gunmetal Valve (Fullway valve) | |
| 11 | (a) Class–I | Zoloto / Leader / Sant/AIP/ LEHRY |
| 12 | (b) Class-II | Leader / Sant |
| 13 | Ball valve | CIM/TIMME/AIP/LEHREY |
| 14 | Butterfly Valve | Audco / KSB / CRI/LEHREY |
| 15 | Air Release Valve | Kirloskar / IVC / RBM |
| 16 | C.I double flanged sluice valve | Kirloskar / Leader |
| 17 | C.I Disk Type non return valves (65mm dia and above – Dual plate type) | Kirloskar / Leader / Inter Valve / KSB |
| 18 | Float valve (gunmetal) upto 40mm | Leader / Sant |
| 19 | Float valve (C.I) 50mm and above | Leader / Sant / Sarker |
| 20 | Manhole Covers | KGM Or Equivalent |
| 21 | Plastic Encapsulated Foot Rest | KGM Or Equivalent |
| 22 | Grating for Floor Trap & Floor Drain | Vijay / GMGR |
| 23 | C.I Strainer more than 65mm dia. | Leader / Kartar |
| 24 | Insulation | |
| 25 | For Internal | Super Cera / Kaiflex |
| 26 | For External | Pykote / Makpolykote |
| 27 | Water Supply/Sump Pumps | Grundfoss/Wilo/Newage/KBS |
| 28 | Motors for Water supply/Sump Pumps | ABB/Siemens |
| 29 | Magnetic Float Swich | Waveteck |
| 30 | Motor Control Panel | Advance/Adlec/Application |
| 31 | RCC Pipes | KK/Pragati/Laxmi |
| 32 | Swichgear for Motor Control Panel | Schnieder/ABB |
| 33 | Cables | Finolax/ Polypack |
| 34 | Water Level controller | Minilac/Waree |
| 35 | P or S Trap | Poloplast/Mcalpine/Astral |
| 36 | Water Treatment Plant | ION Exchange/Thermax |
| **NOTES :** | | |
| 1 | Contractor has the option to use any of the Approved Makes as mentioned above. However to maintain look & uniformity, contractor shall use one make itemwise throughout the project in consultation with Engineer. | |
| 2 | In case, any other item/ material required to complete the work for which makes are | |

| | |
|---|---|
| | not specified<br>above, the Contractor shall take prior approval of the Engineer.-in-charge at site. |

## 11. LIST OF APPROVED MATERIALS FOR INTERIOR WORKS (SAMPLES TO BE CHECKED AT CONTRACTOR'S COST)

| Material | Approved Make/Brand |
|---|---|
| Laminated sheet (1.0 mm thick) Premium | Formica, Greenlam, Merino, |
| Comm. Board /Flush door shutter | Duro, , century,Green |
| Commercial Ply wood | Duro, , century , Green |
| MR grade ply Conforming to IS 303 | Duro, , century , Green |
| Marine grade Ply wood Conforming IS 710 | Greenply, Duro, Century |
| BWP grade Block Board /ply | Duro, Merino, Century |
| Melamine /PU Finish | MRF/Asian Paints /Nerolac |
| Ceramic Tiles/vitrified homogeneous glazed tiles. | Kajaria , Nitco, HR Johnson,Somany,Marbonite |
| Glazing (Clear) | St. Gobain, Indo Asahi, Modi float |
| Aluminium Sections | Indal, Jindal ,Hindalco |
| Veneers | Duro, |
| Glue | Fevicol |
| Paints/Distemper/Arcylic/Enamel/Plastic | Asian / Shalimar / ICI / Nerolac / Berger |
| M.S pipes,plates,flats,angle | Sail,Sail,HSL/Equivalent |
| Pvc water tank | Sintex/Frontier |
| Door locks | Godrej,golden locks,dorset |
| Door closer | Dorma, Dorset, |
| Anti termite/fire retardent paint | Viper Firestar Fr – 881 paint |
| | |
| | |

## 12. LIST OF APPROVED MAKES FOR ELECTRICAL WORK:

Make indicated in the under mentioned list of Approved Makes is for general guidance of contractor. Final choice of make & model out of List of Approved Makes shall be of Architect/ Consultant/Owner.

| | | |
|---|---|---|
| 1. | 11 KV H.T. Metering Panel. | - As approved by UPPCL |
| 2. | 11 KV VCB Panel | - Schneider<br>- ABB<br>- Siemens<br>- L & T |
| 3. | 11 KV / 0.415 KV Transformer | - Kotson<br>- Universal<br>- Sudhir Intravidyut<br>- Danish |
| 4. | XLPE 11 KV Cable. | - Skytone<br>- KEI<br>- Havells<br>- Polycab<br>- Finolex |
| 5. | 11 KV Termination Kits. | - Raychem.<br>- XICON<br>- Denson<br>- J-Sea) |
| 6. | L.T. Cable, 1.1 KV grade. | - KEI<br>- Finolex<br>- Polycab<br>- LAPP |
| 7. | Distribution Boards with Miniature Circuit Breakers, ELCB | - Legrand<br>- Schneider<br>- Hagger |
| 8. | Cable Lug (Tinned Copper) | - Schenider.<br>- Dowells<br>- Jainson. |
| 9. | Cable Gland | - Peeco<br>- Commet<br>- Gripwell |
| 10. | Cable Tray / Raceway | - CTM Engineers<br>- KME<br>- MEM |

| | | |
|---|---|---|
| 11. | Telephone Cable | - Delton<br>- KEI<br>- Polycab |
| 12. | Co-axial cable for TV | - KEI<br>- D Link<br>- Polycab |
| 13. | Splitters, Tap Off & Amplifier etc. | - Unidac<br>- Shyam |
| 14. | Telephone Tag Block | - Krone<br>- TVS R&M |
| 15. | M.S. Conduit | - BEC<br>- RMCON<br>- AKG |
| 16. | PVC Conduit | - BEC<br>- AKG<br>- Polycab |
| 17. | Fire Alarm System, MCP, FACP, Hooter, Detector etc | - Esser Honeywell<br>- Tyco Simplex<br>- Notifier<br>- Simens Fire Finder |
| 18. | Modular Switches & Sockets | - Crabtree Athena<br>- MK Wrapround Plus<br>- Schenider Opale |
| 19. | LV System Wire (Cat 6) | - Amp<br>- Systemax |
| 20. | Telephone / Data Outlet | - Amp<br>- Systemax |
| 21. | Lightning Protection | - ABB<br>- LPI |
| 22. | Earthing | - ABB<br>- Obo Betterman |
| 23. | Air Circuit Breaker | - Schenider<br>- L & T<br>- Mitsubishi |
| 24. | DC Miniature Circuit Breaker & Distribution Board | - Schenider<br>- L & T<br>- ABB |

| | | |
|---|---|---|
| 25. | Moulded Case Circuit Breaker with rotary operating handle. | - Schenider<br>- L & T<br>- Mitsubishi |
| 26. | Contactors, Timers | - Schenider<br>- L & T<br>- Mitsubishi |
| 27. | Capacitors | - L & T<br>- Schenider<br>- Neptune |
| 28. | Voltmeter & Ammeter | - Schenider<br>- Enersol<br>- Neptune |
| 29. | Selector Switch | - Kaycee<br>- L & T |
| 30. | Current Transformer | - Kappa<br>- Matrix<br>- AE |
| 31. | Indicating Lamp | - L & T<br>- Siemens |
| 32. | PLC | - Siemens<br>- Allen Bradley |
| 33. | Protective Relays | - Schenider<br>- Siemens<br>- L & T |
| 34. | APFC Relay (Microprocessor based) | - Schenider<br>- L & T<br>- Neptune |
| 35. | Batteries | - Exide<br>- Prestolite<br>- Ameron |
| 36. | Battery Charger | - Mahamaya<br>- Volstat Electronics.<br>- AE. |

| | | | |
|---|---|---|---|
| 37. | Energy Analyzer Meter | - | Conzerve<br>- Enersol<br>- Neptune |
| 38. | Dual Source Energy Meter (For Panel) | - | Conzerve<br>- Enersol<br>- Neptune |
| 39. | Bus bar | - | Hindalco |
| 40. | Synchronizing Relay | - | Woodword<br>- Dief |
| 41. | 11 KV RMU | - | Schenider<br>- ABB<br>- Siemens |
| 41. | Package Substation | - | Ambit Switchgear<br>- Jackson<br>- Universal |
| 42. | Main L.T. Panel, Capacitor Panel & Distribution Panel. | - | Tricolite<br>- Advance Panel<br>- Ambit Switchgear<br>- Sudhir Genset<br>- SPC Electrotech<br>- Madhu Electricals |
| 43 | Exhaust Fan | - | GEC/Crompton/Orient |
| 44 | Bakelite sheet 2.8 mm thick (I.S.I.) | - | Super Hylem / Formica |

| LIST OF APPROVED MAKES FOR FIRE-FIGHTING WORKS D-392,NEW SABZI MANDI AT AZADPUR MANDI,NEW DELHI-110033 | | |
|---|---|---|
| SL. NO. | MATERIAL DESCRIPTION | NAME OF MANUFACTURER |
| 1 | G.I./ M.S Forged Steel fittings IS:1239 (Part-II) | VS / DRP / True Forge / Simless |
| 2 | MS Pipe | Jindal, Hissar/Appolo API/Prakash Surya |
| 3 | Gunmetal Valve (Fullway valve) | |
| 4 | (a) Class–I | NVR/LEHRY/Deepak/Zoloto |
| 5 | (b) Class-II | NVR/LEHRY/Deepak/Zoloto |
| 6 | Ball valve | NVR/LEHRY/Deepak/Zoloto |
| 7 | Butterfly Valve | NVR/LEHRY/Deepak/Zoloto |
| 8 | Air Release Valve | NVR/LEHRY/Deepak/Zoloto |
| 9 | Float valve (gunmetal) upto 40mm | NVR/LEHRY/Deepak/Zoloto |
| 10 | Float valve (C.I) 50mm and above | NVR/LEHRY/Deepak/Zoloto |
| 11 | Fire Extinguishers | Swastik/Kalpex/Exflame/Life Guard |
| 12 | Fire fighting first-aid hose reel | Swastik/Kalpex/Exflame/Life Guard |
| 13 | Hose Reel | Swastik/Kalpex/Exflame/Life Guard |
| 14 | Rubber Tubing | Swastik/Kalpex/Exflame/Life Guard |
| 15 | Thermo Plastic Hose Reels | Swastik/Kalpex/Exflame/Life Guard |
| 16 | R.R.L. Hose | Swastik/Kalpex/Exflame/Life Guard |
| 17 | Fire Fighting Equipment not covered else where | Swastik/Kalpex/Exflame/Life Guard |
| 18 | Landing Valves | Swastik/Kalpex/Exflame/Life Guard |
| 19 | Welding rods | Adore/Ishab |
| 20 | Flow Switch | System Sensor/Grinell |
| 21 | Motor Control Panel | SHIVALIC/ RISHA |
| 22 | **Fire Fighting Pumps** | **Marther and Platt/Luby/Kirlosker** |
| 23 | **Motor for Fire Pumps** | **ABB/Siemens/Bharat Bijlee** |
| 24 | **Sprinklers/Escutcheon plate/Flexible Pipes** | **Grinell/Tyco** |
| 25 | **Deluge Valve/Water Curtain nozzles** | **Grinell/Tyco** |
| 26 | **Cables/Wires** | **Finolex/Polycab/Batra** |
| 27 | **Cable Glands** | **Comet/Polycab** |
| 28 | Dash fasteners | Hilti/Fischer |
| 29 | Clamps | Chilly/Lovely/Dyena |
| 30 | Y Strianers | NVR/LEHRY/Zoloto/Deepak |
| 31 | Foot Valve | NVR/LEHRY/Zoloto/Deepak |
| NOTES: | | |
| 1 | Contractor has to take approval from consultant/Architects for using any one of the above Approved Makes | |
| | as mentioned above. | |
| 2 | In case, any other item/ material required to complete the work for which makes are not specified | |
| | above, the Contractor shall take prior approval of the Architects/Consultants | |

**Annexure-I**

## Integrity pact

National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED), an apex level Co-operative Marketing Federation, registered under the provisions of Multi State Cooperative Societies Act, 2002 (as amended up to date), having its Head Office at Nafed House, Siddhartha Enclave, Ashram Chowk, New Delhi-110014 through ..... (hereinafter referred to as the “The Principal”, as the context may require or admit, which expression shall, unless excluded by or repugnant to the subject or contextor meaning thereof, be deemed to mean and include its representatives, nominees, affiliates, successors and permitted assigns) of the ONE PART

And a Proprietorship firm or a Cooperative organization or a Partnership firm duly registered under the provisions of Indian Partnership Act of 1932 or a Company registered under the relevant provisions of Companies Act of 1956 or 2013 (In case of Partnership Firm, the intending bidders shall submit a self-attested copy of partnership deed along with authorization in favour of signatory of the bidder documents, while in case of a Company, the Intending Bidder shall submit Certificateof Incorporation, Memorandum of Articles of Association and a Board Resolution in favour of authorized signatory, duly certified by a Company Secretary) through its Director/Partner/Proprietor Mr./Mrs. and having its registered office at (hereinafter referred to as "Vendor/Bidder/Contractor") which expression shall, unless repugnant or contrary to the context or meaning thereof, be deemed to mean and include its successors, authorized signatories and permitted assigns) of the OTHER PART

### PREAMBLE

A. The Principal intends to award, under laid down organizational procedures, contract/s for ..... The Principal values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relations with its Bidder(s) and/or Contractor (s).

B. In order to achieve these goals, the Principal will appoint Independent External Monitors (IEMs) to monitor the tender process and the execution of the contract with the bidders/contractors/vendors for compliance with the principles mentioned in this Integrity Pact.

### Article 1 – Commitments of the Principal

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

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

b) The Principal will, during the tender process treat all Bidder (s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/additional information through which the Bidder(s) could obtain an unfair advantage in relation to the tender process or the contract execution.

c) The Principal will exclude from the process all known prejudiced persons.

2. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

**Article 2 – Commitments of the bidder (s) / Contractor(s)**

1. The Bidder(s)/Contractor(s)/Vendor(s) commit themselves to take all measures necessary to prevent corruption. The Bidder(s)/Contractor(s) /Vendor(s) commit themselves to observe the following principles while participating in the tender process and during the contract execution.

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

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

c) The Bidder(s)/Contractor(s)/Vendor(s) will not commit any offence under the relevant IPC/PC Act; further the Bidder(s)/Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on toothers, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder(s)/Contractor(s)/Vendor(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly

the Bidder(s)/Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further details of Indian Agents of Foreign Suppliers shall be disclosed by the Bidder(s)/ Contractor(s) /Vendors. Further, all the payments made to the Indian agent/ representative have to be in Indian Rupees only.
e) The Bidder(s)/Contractor(s)/Vendor(s) while presenting their bid, will disclose any and all payments made, are committed to or intend to make to agents, brokers or any other intermediaries in connection with the award of the contract.

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

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

**Article: 3 – Disqualification from tender process and exclusion from future contracts**

If the Bidder(s)/Contractor(s)/Vendor(s), before award or during execution has committed a transgression through a violation of Article 2, above or in any other form such as to put their reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action as per the laid down procedure.

**Article: 4 – Compensation for Damages**

1. If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Article 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/Bid Security.

2. If the Principal has terminated the contract according to Article 3, or if the Principal is entitled to terminate the contract according to Article 3, the Principal shall be entitled to demand and recover from the Contractor/vendor liquidated damages of the Contract value or the amount equivalent to Performance Bank Guarantee.

**Article: 5 – Previous transgression**

1. The Bidder declares that no previous transgressions occurred in the last three years with any other firm/Company/organization in any country conforming to the anti corruption approach or with any Public Sector Enterprise in India that could justify its exclusion from the tender process.

2. If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as per the procedure mentioned in “Guidelines on Banking of business dealings”.

**Article: 6- Equal treatment of all Bidders / Contractors /Subcontractors**

1. In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Subcontractor.

2. The principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.
3. The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

**Article: 7 - Criminal charges against violating Bidder(s) / Contractor(s) / Subcontractor(s)**

If the Principal obtains knowledge of conduct of a Bidder, Contractor or subcontractor, or if an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer.

**Article: 8 - Independent External Monitor**

1. The Principal appoints competent and credible Independent External Monitor for this Pact after approval by Central Vigilance Commission. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.

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

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

4. The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Sub-contractor(s) with confidentiality. The Monitor has also signed declarations on ‘Non- Disclosure of confidential Information’ and of ‘Absence of Conflict of interest ‘. In case of any conflict of interest arising out at a later date, IEM shall inform the Managing Director, Nafed and recues himself/herself from that case.

5. The Principal will provide to the Monitor sufficient information about all the meetings among the parties related to the Project provided such meetings could have any impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

6. As soon as the Monitor notices, or believes to notice, violation of this agreement, he/she will so inform the management to discontinue or take corrective action, or to take relevant action. The monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

7. The Monitor will submit a written report to the Managing Director, Nafed within 8 to10 weeks from the date of reference or intimations to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

8. If the Monitor has reported to the Managing Director, Nafed, a substantiated suspicion of an offence under relevant IPC/PC Act, and the Managing Director, Nafed has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioners.

9. The word “Monitor” would include both singular and plural.

**Article 9 – Pact duration**

1. This pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the contract, and for all other Bidders 6 months after the contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

2. If any claim is made/lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/determined by the Managing Director, Nafed.

**Article 10 : Other Provisions**

1. This agreement is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal, i.e. New Delhi.

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

3. If the contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

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

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

6. In the event of any contradiction between the Integrity Pact and its Annexure, the Clause in the Integrity Pact will prevail.

(For & on behalf of the Principal) (For & on behalf of bidder/Contractor)
(Office Seal) (Office Seal)

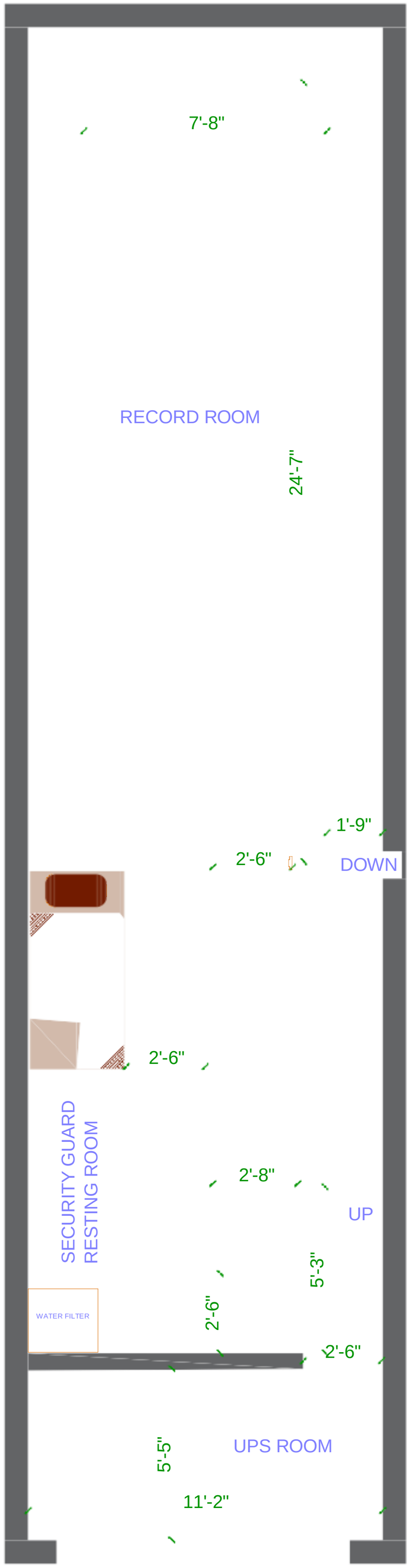
Place: _____

Date _____

Witness 1: (Name & Address)

Witness 2: (Name & Address

# DRAWINGS




## NOTES:



NOTE :--

1. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSION ONLY.
2. ALL DIMENSIONS AND LEVELS ARE IN MM.
3. 450-750 WIDE PLINTH PROTECTION TO BE PROVIDED ALL AROUND THE BUILDING.
4. SKIRTING SHALL BE 100MM. HIGH FROM FINISHED FLOOR LEVEL.
5. TOILET, PANTRY, KITCHEN VERANDAH & BALCONY FLOOR LEVEL SHALL BE 13 MM. DOWN FROM GENERAL FLOOR LEVEL.
6. THE GRADE OF CONCRETE TO BE USED IS M-25.
7. THE DIMENSIONS OF BRICK TO BE USED SHALL BE 230 x 115 x 75 MM.
8. LOCATION, SIZES & LEVELS OF MANHOLES TO BE CO-ORDINATED WITH EXTERNAL SEWERAGE LAY OUT PLAN GOT APPROVED BY ENGG. INCHARGE/ ARCHITECT.
9. ALL MEASUREMENT MUST BE CHECKED AT SITE BY CONTRACTOR.
10. ALL SHOP DRAWINGS TO BE PROVIDED BY THE CONTRACTOR.

## REVISIONS:

| S.NO. | DATE | DESCRIPTION |
|---|---|---|

# BASEMENT

| DRAWN BY | DATE | DRG NO. |
|---|---|---|
| ADHITHYA K S | 07-01-2023 | |
| CHECKED BY | SCALE | JOB NO. |
| AR. ANKIT BHATIA | | |

PROJECT:

NAFED AZADPUR BRANCH
INTERIOR LAYOUT

DRAWING TITLE:

BASEMENT FLOOR INTERIOR LAYOUT

CONSULTANTS:

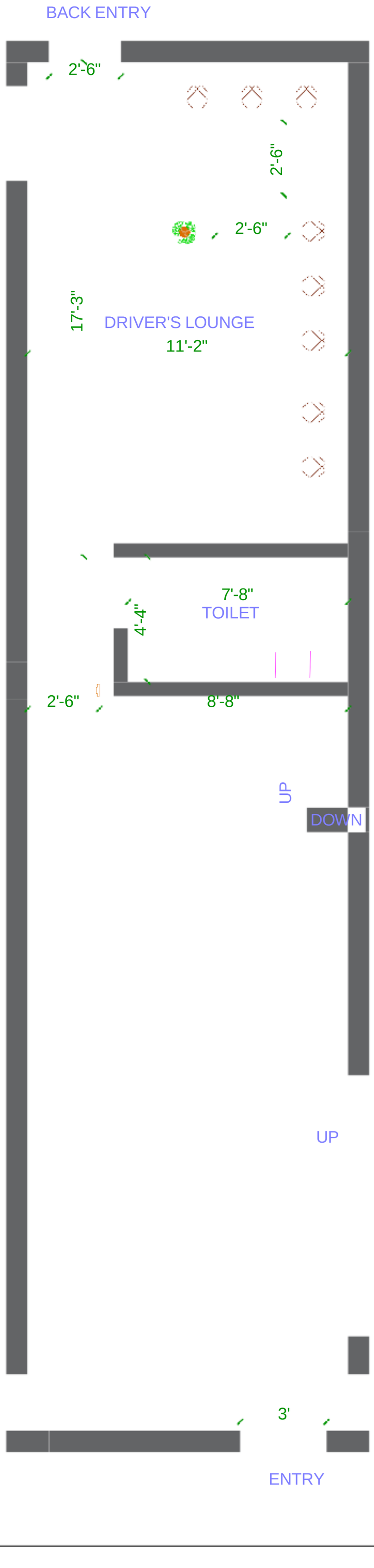
NAFED AZADPUR

N

ARCHITECTS:

**SPACE ACE**
ARCHITECTS, ENGINEERS & PLANNERS

V - 20A / 5 ,
D.L.F. CITY III,
GURGAON, HARYANA - 122002
PH - 0124-4106618,FAX: 0124-2365329
E-MAIL : spaceace.india@gmail.com

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## REVISIONS:

| S.NO. | DATE | DESCRIPTION |
|---|---|---|

# GROUND FLOOR

| DRAWN BY | DATE | DRG NO. |
|---|---|---|
| ADHITHYA K S | 07-01-2023 | |
| CHECKED BY | SCALE | JOB NO. |
| AR. ANKIT BHATIA | | |

PROJECT:

NAFED AZADPUR BRANCH
INTERIOR LAYOUT

DRAWING TITLE:

GROUND FLOOR INTERIOR LAYOUT

CONSULTANTS:

NAFED AZADPUR

N

ARCHITECTS:

**SPACE ACE**
ARCHITECTS, ENGINEERS & PLANNERS

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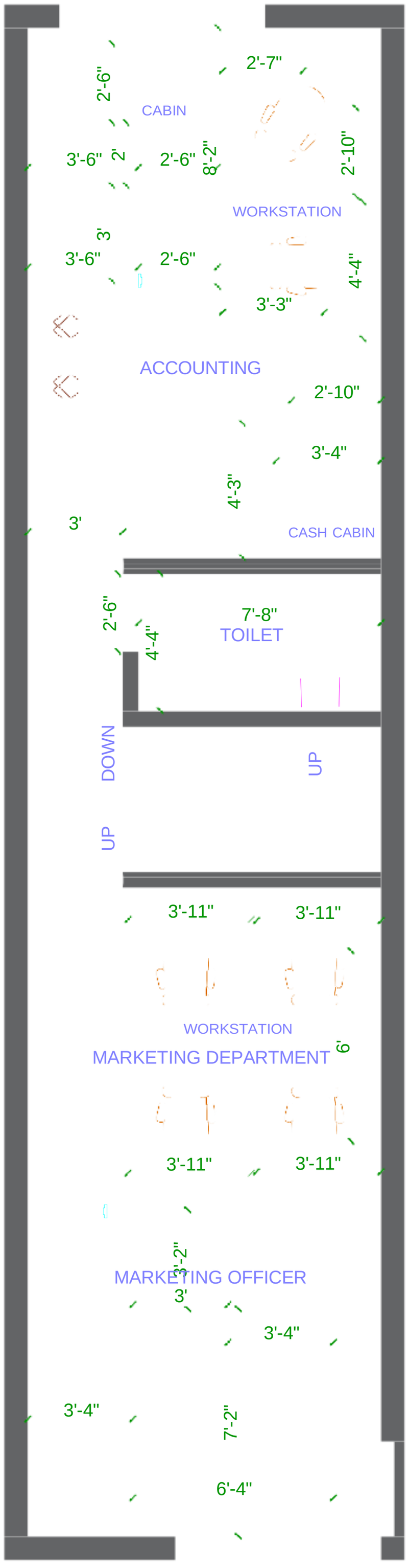


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| S.NO. | DATE | DESCRIPTION |
|---|---|---|

# FIRST FLOOR

| DRAWN BY | DATE | DRG NO. |
|---|---|---|
| ADHITHYA K S | 07-01-2023 | |
| CHECKED BY | SCALE | JOB NO. |
| AR. ANKIT BHATIA | | |

PROJECT:

NAFED AZADPUR BRANCH
INTERIOR LAYOUT

DRAWING TITLE:

FIRST FLOOR INTERIOR LAYOUT

CONSULTANTS:

NAFED AZADPUR

N

ARCHITECTS:

**SPACE ACE**
ARCHITECTS, ENGINEERS & PLANNERS

V - 20A / 5 ,
D.L.F. CITY III,
GURGAON, HARYANA - 122002
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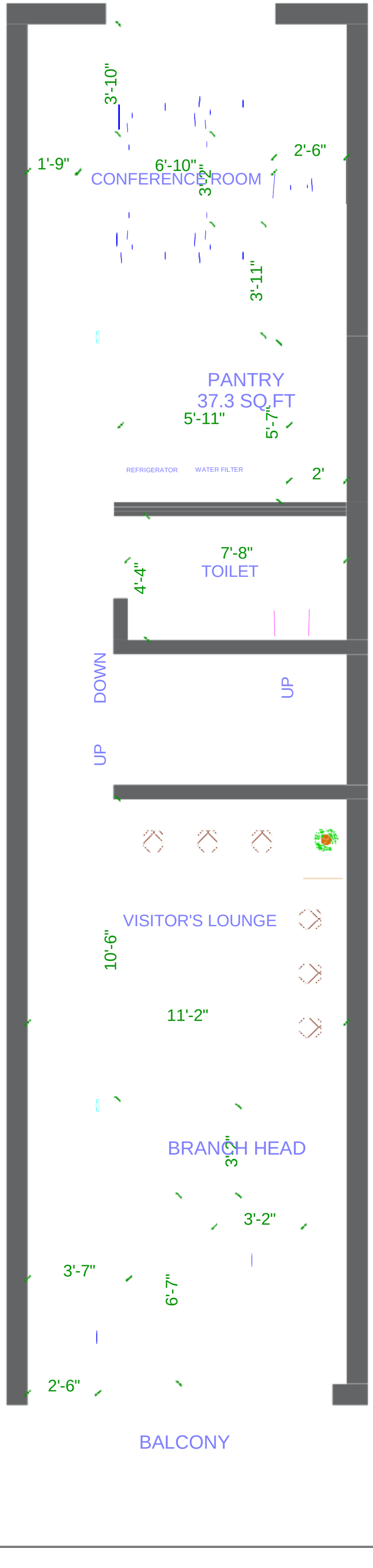


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## REVISIONS:

| S.NO. | DATE | DESCRIPTION |
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# SECOND FLOOR

DRAWN BY: ADHITHYA K S
DATE: 07-01-2023
DRG NO.:

CHECKED BY: AR. ANKIT BHATIA
SCALE:
JOB NO.:

PROJECT:
NAFED AZADPUR BRANCH
INTERIOR LAYOUT

DRAWING TITLE:
SECOND FLOOR INTERIOR LAYOUT

CONSULTANTS:
NAFED AZADPUR

N

ARCHITECTS:

**SPACE ACE**
ARCHITECTS, ENGINEERS & PLANNERS

V - 20A / 5 ,
D.L.F. CITY III,
GURGAON, HARYANA - 122002
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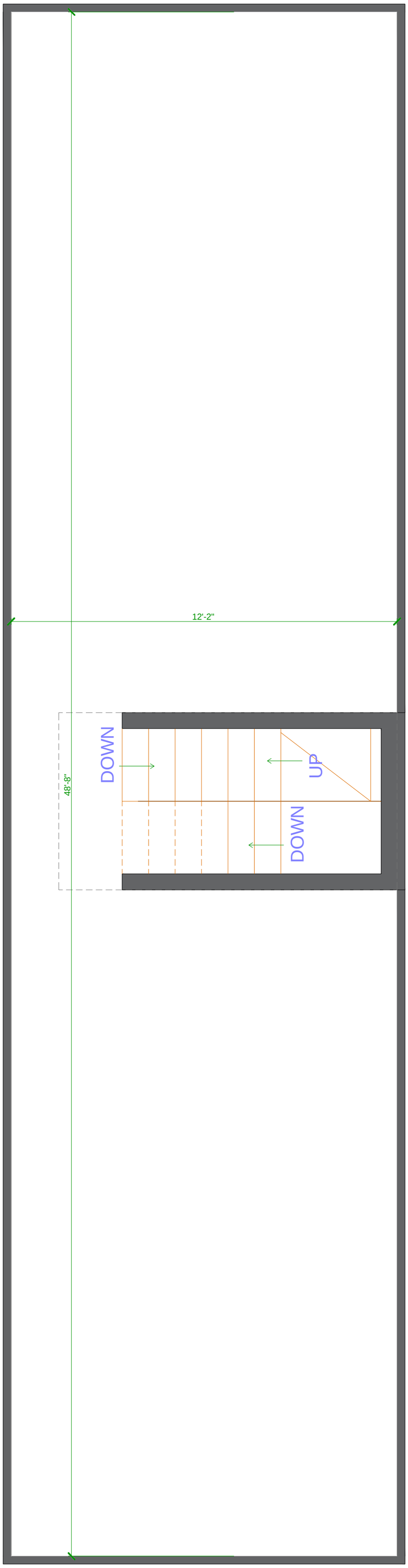


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# TERRACE

| DRAWN BY | DATE | DRG NO. |
|---|---|---|
| ADHITHYA K S | 07-01-2023 | |
| CHECKED BY | SCALE | JOB NO. |
| AR. ANKIT BHATIA | | |

PROJECT:

NAFED AZADPUR BRANCH
INTERIOR LAYOUT

DRAWING TITLE:

TERRACE FLOOR PLAN

CONSULTANTS:

NAFED AZADPUR

N

ARCHITECTS:

**SPACE ACE**
ARCHITECTS, ENGINEERS & PLANNERS

V - 20A / 5 ,
D.L.F. CITY III,
GURGAON, HARYANA - 122002
PH - 0124-4106618,FAX: 0124-2365329
E-MAIL : spaceace.india@gmail.com

**Civil, Interior, Furnishing, Plumbing, Electrical, HVAC works of NAFED Building at D-392, New Subzi Mandi, Azadpur Mandi, New Delhi- 110033**

**NATIONAL AGRICULTURAL COOPERATIVE MARKETING FEDERATION OF INDIA LTD.**

**(FINANCIAL BID)**

**Architects**

**M/s SPACE ACE**

**ARCHITECTS & INTERIOR DESIGNERS**
**V-20A/05 DLF CITY-III, GURGAON,**
**HARYANA - 122002**
**TEL. PH. No. :- 8527253808**
**Email: spaceace.india@gmail.com**

Dated: _____

**BOQ FOR THE PROPOSED CIVIL, INTERIOR-FINISHING, FURNITURE, PLUMBINGEL,ECTRICAL & HVAC WORKS OF NAFED BUILDING AT AZADPUR MANDI, NEW DELHI.**

| S.No | Particulars | Quantity | Unit | Rate | Amount | Refrence Image |
|---|---|---|---|---|---|---|
| I.0 | **CIVIL WORKS** | | | | | |
| 1 | **DISMANTLING / REPAIR WORKS** | | | | | |
| 1.1 | Dismantaling/Demolishing removing existing counter's, partitions, windows, false ceiling, electrical fitting, electrical wiring , conduict switch boxes,switch sockect, fans and fixture, brick work,wall / floor tiles, flooring , toilet fittings & fixtures etc. to accommodate the proposed new layout including stacking of servicable material to the space provided by the employer and disposal of unserviceable material to a place permitted by the municipal authorities including making good any damages complete. No unservicable dismantalled material will be allowed to be accumulated at site. Decision of the architect/ employer as to what constitute servicable/unservicable material will be final and binding. The amount should include cost for carrying out any other unforseen items required for the proper execution of the work. All complete as per approval and instructions of the Architect/ employer. | 1 | L.S. | | | |
| 1.2 | Dismantling/ carefully removing, breaking, demolishing of the following existing items like (dismantalling existing plaster, grit wash from external walls, manually/ by emechanical means & Chiseling the existing plaster wherever required for reparing the cracks etc. other works as specified by the architect / employer) :-<br>Includes labeling, packing, tagging the packages, shifting, formally handing over, stacking the scrap as directed and carting away the debris, cleaning the site etc. and disposal of all surplus unserviceable materials to authorized Municipal dumping grounds. including scaffolding, staging, tools & tackles, saftey measures etc. all complete. | 1 | L.S. | | | |
| 1.3 | Dismantaling and removing loose concrete to expose the reinforcement in columns, Lintels, Beams,slabs, Arches, chajjas and walls, including scrapping of rust, | 198 | sq.m. | | | |
| 1.4 | Chipping of concrete material from r.c.c. structural member with manual operation /mechnical means (pneumatic/electric chisel) or as directed by engineer in charge upto 50mm (excluding plaster) average depth to a sound base including sawcutting of all edges,making square shoulders of the cavities as per direction of the engineer in charge complete including disposal of mulba to authorized municipal grounds including all lifts, leads, loading, unloading and stacking charges as per direction of Engineer - in - charge. Beams & Other horizontal bands, Suspended slab & chajjas & Columns & other vertical members. | 198 | sq.m. | | | |
| 1.5 | Surface prepration by cleaning chipped concrete/reinforced concrete surface to loose and foreign materials,by means of sand blasting with coarse sand/grit(as directed)followed by and including cleaning with compressed air wherever required as per directions of engineer in charge at all floor and heights.No extra payment for scaffolding and for working platform shall be made for this item as per direction of Engineer in-charge complete. | 198 | sq.m. | | | |
| 1.6 | Epoxy Grouting: Providing and injecting two componewnts of epoxy based grouting at the pressure of 224 kg / sq.cm. Including scaffolding, staging, tools and tackles etc. all complete. | 198 | sq.m. | | | |
| 1.7 | Provide and apply 940 gsm unidirectional glass fibre sheet and wrapping over the existing RCC member as per design & direction of consultant / architect / employer (on cracked columns) | 502 | sq.m. | | | |
| 1.8 | Cutting reinforcement bars in RCC or reinforced brickwork, carefully without damaging the Existing structure and its finishes as per direction of Engineer in-charge complete.. Bars of dia 2mm or less | 200 | R.MT. | | | |
| 1.9 | Cleaning of old reinforcement steel by rust remover chemical after manually by wire brush and emery paper projecting out of old r.c.c. work including scraping,wherever required bending and bending reinforcement steel to desired position and shape for r.c.c. work including Straightening, wherever required.No extra payment for scaffolding and for working plateform shall be made for this item as per direction of Engineer in-charge complete. To existing reinforcement of all Dia's | 342 | R.MT. | | | |
| 1.10 | Reinforcement cement concrete by using Microconcrete including core cutting holes (1 hole per 1.24 m x1.24 m grid) for pouring of micro concrete and reparing the same in wall, column,<br>suspended slab, slab, roofs, beam having slope upto 15 degree, landing, balconies, shelves, chajjas, lintel, bands, plain window sills, staircase and sprial stair case upto floor five level including the cost of leak proof centring, shuttering of ply with joints taped, finishing and reinforcement but excluding cost of renforcement. Note: Core cutting will be only for slabs. With micro concrete (mixed with 30% stone aggregate by weight) in concrete mix M30 over prepared surface | 5.00 | cum. | | | |
| 1.11 | GUNITING WORKS (under roof slab) Providing and laying in position machine batched and machine mixed cement and washed coarse sand in ratio 1:2 with epoxy resin primer chemical applied (5 litres/50 kg cement) with pressure guniting machine 40mm thick including welded mesh 3.2 mm dia (cost of welded mesh to be excluded) All works for slabs/beams/columns | 55 | sq.m. | | | |
| 1.12 | Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete including welding with existing reinforcement by electric welding (with electrodes) including transportation of electric welding plant to site etc.complete as per instruction<br>of Engineer Incharge/drawing attached. Mild steel and Medium Tensile steel bars | 9000 | KG | | | |
| | | | | | | |
| 2 | **CIVIL WORKS** | | | | | |
| | | | | | | |
| 2.1 | **BRICK WORK** | | | | | |
| 2.1.1 | Providing and laying 230mm thick brick work above Plinth with bricks of class designation 75 in cement mortar 1:6 (1 cement : 6 coarse sand) including curing, raking of joints, all material, labour, tools & plants etc. Complete in all respects as directed by the Architect. | 5.00 | cum. | | | |
| 2.1.2 | Providing & Constructing Half Brick masonry with bricks of class, designation 75 in superstructure above plinth level in cement mortar 1:4 (1 cement : 4 coarse sand) in any shape, size etc. Including providing and placing in position 2 nos. 6mm dia. M.S. bars at every third course of brick masonry. | 300.00 | sq.m. | | | |
| | | | | | | |
| 2.2 | **PLASTER** | | | | | |
| 2.2.1 | Plastering of walls in 12mm th. smooth cement plaster on existing block masonary, RCC columns, RCC Walls, of any profile, in 1:4 cement mortar, (1unit- cement, 4unit- fine screened sand), incl. of hacking on column/wall, making surface wet before applying plaster and proper curing after plaster etc complete. all plaster works will have provision of chicken mesh with more than 2" overlap between RCC member and wall so as to avoid cracks due to thermal expansion, chicken mesh to be also provided on all chased surfaces such as ,conduit chasing , pipe line chasing etc. and then chased area to be replastered . Cost to be inclusive of all including scafolding at all heights . **(For internal works)** | 500.00 | sq.m. | | | |
| 2.2.2 | Plastering of walls in 18 mm cement plaster in two coats under layer 12 mm thick cement<br>plaster 1:5 (1 cement: 5 coarse sand) and a top layer 6 mm thick cement<br>plaster 1:3 (1 cement : 3 coarse sand) finished rough with sponge incl. of hacking on column/wall, making surface wet before applying plaster and proper curing after plaster etc complete. all plaster works will have provision of chicken mesh with more than 2" overlap between RCC member and wall so as to avoid cracks due to thermal expansion, chicken mesh to be also provided on all chased surfaces such as ,conduit chasing , pipe line chasing etc. and then chased area to be replastered . Cost to be inclusive of all including scafolding at all heights. **(For external works)** | 81.00 | sq.m. | | | |

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|---|---|---|---|---|---|---|
| **2.2.3** | 6 mm cement plaster of mix : 1:3 (1 cement : 3 fine sand) incl. of hacking on RCC surface making surface wet before applying plaster and proper curing after plaster etc complete. Cost to be inclusive of all including scaffolding, staging, tools and tackles etc. all complete. **(For ceiling surfaces)** | **220.00** | **sq.m.** | | | |
| | | | | | | |
| **2.3** | **R.C.C** | | | | | |
| **2.3.1** | Reinforced cement concrete work in beams, suspended floors, roofs having slope up to 15° landings, balconies, shelves, chajjas, lintels, bands, plain window sills, staircases and spiral stair cases up to floor five level, excluding the cost of centering, shuttering, finishing and reinforcement, with 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size). | **10.00** | **cu.m.** | | | |
| | for Toilet, Kitchen, Pantry counter & for Lintel of doors, strong room RCC walls, etc. in brick works | | | | | |
| | | | | | | |
| **2.4** | **P.C.C** | | | | | |
| **2.4.1** | Providing and laying plain cement concrete 1:2:4 mix (1 cement :2 coarse sand :4 hard stone aggregate 20 mm nominal size) under floors. For raceways, electrical conduits in floors etc. over existing R.C.C Slab, necessary shuttering, curing, compacting, etc Complete & all to be included in cost & quoted rate shall for all levels of floor & height. | **5.00** | **cum.** | | | |
| | For raceways, electrical conduits in floors etc. | | | | | |
| | | | | | | |
| **2.5** | Structural steel work in single section, fixed with or without connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. ISMB Section of required size and shape as per instructions of the architect / employer. | **2000.00** | **kg** | | | |
| | | | | | | |
| **3** | **WATER PROOFING** | | | | | |
| **3.1** | Providing and laying water proofing treatment to vertical and horizontal surfaces of depressed portions of W.C., kitchen and the like consisting of: | | | | | |
| | Ist course of applying cement slurry @ 4.4 kg/sqm mixed with water proofing compound Conforming to IS 2645 in recommended proportions including rounding off junction of vertical and horizontal surface. | | | | | |
| | IInd course of 20 mm cement plaster 1:3 (1 cement : 3 coarse sand) mixed with water proofing compound in recommended proportion including rounding off junction of vertical and horizontal surface. | | | | | |
| | IIIrd course of applying blown or residual bitumen applied hot at 1.7 kg. per sqm of area. | | | | | |
| | IVth course of 400 micron thick PVC sheet. (Overlaps at joints of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 kg/sqm). | **25** | **Sq.m.** | | | |
| | | | | | | |
| **3.2** | Providing/applying polymer modified, flexible cementatious negative side waterproofing coating with elastic waterproofing polymers on interior wall plaster surface in three coats @14.35 kg/10 sq.m. one coat of self priming cementitous waterproofing polymer (dilution with water in the ratio of 1:1) and two coaats of cementitous waterproofing polumer ( dilution with water in the ratio of 3:1) after scrapping and properly cleaning the surface to remove pre-existing paint & loose particles till plaster is visible including scaffolding etc. complete in all respect as per the direction of Engineer-in-chrage. | **160** | **Sq.m.** | | | |
| | | | | | | |
| **4** | **FINISHING WORKS** | | | | | |
| | | | | | | |
| **Notes:** | Painting rates to include cost of covering/ protecting all finishing materials including switches, lighting fixtures, AC equipment etc. | | | | | |
| | Applying painters putty & scrapping the surface and repeating the process as many times as is required to achieve a thoroughly smooth surface for partitions paneling and walls | | | | | |
| | | | | | | |
| **4.1** | **PUTTY** | | | | | |
| | Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete. | **600** | **Sq.m.** | | | |
| | | | | | | |
| **4.2** | **Plastic Emulsion paint (internal faces)** | | | | | |
| | Providing and applying three coats of pre-approved Plastic acrylic emulsion paint to walls, partitions etc. including surface preparation with two coats of putty, primer and sanding all complete. With the necessary drying periods for each coat. The final finish should be of a uniform and neat finish to the satisfaction of the Architect. Cost to be inculde for all height and surfaces.(Low VOC contain paint) Make: ICI DULUX ,Asian Paints | **600** | **Sq.m.** | | | |
| | | | | | | |
| **4.3** | **Wall PAPER** | | | | | |
| | Providing & pasting in position of Wall Paper or Wall Covering of approved shade over Gypsum Board as directed by the architect The Item to be Quate complete including Base preparation same as above for paint upto 1-2 ccoats, screws, nail, polish and all necessary fixing arrangement etc. all complete as per shown in drawing and directed by the Architect. Base Rate of Wall Covering 350 Rs/Sq.ft leaving taxes and transportation charges | **50** | **Sq.m.** | | | |
| | | | | | | |
| **4.4** | **WOOD POLISH** | | | | | |
| | Melamine polish with matt finish of required shade over doors, window shutters, jambs and soffits wooden panelling including removing and scratching the existing polish and repair works complete. | **100** | **Sq.m.** | | | |
| | | | | | | |
| **4.5** | **SYNTHETIC ENAMEL PAINT** | | | | | |
| | Painting with synthetic enamel paint of approved brand and manufacture of required colour two or more coats on new work over and under coat of suitable shade with ordinary paint of approved brand and manufacture to give an even shade. Make: Asian (Apcolite)/ICI Dulux (Gloss)/Nerolac (Full Glass Hard Drying) | **500** | **Sq.m.** | | | |
| | Scrapping, sand papering wooden/ metal surfaces | | | | | |
| | Applying 01 coat of wood/ metal primer | | | | | |
| | | | | | | |

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| **4.6** | **TEXTURE PAINT (For external façade)** | | | | | |
| | Wall painting with Texture paint interior grade of Unitile make or approved equivalent of approved shade and quality (2 or more coats) on new work to give an even shade including preparation of surface complete as directed. Make: Spectrum/Unitile/ pidilite/ | **200** | **Sq.m.** | | | |
| | Base Rate 80 Rs/Sq.Ft leaving taxes and transportation charges. | | | | | |
| | | | | | | |
| **5** | **GLASS PARTITION** | | | | | |
| **5.1** | Providing and Fixing Full height straight glass partitions using 12mm thk toughened glass inclusive of the glass surface as indicated on the drawings and as per the instructions of the Architect. Glass to be fixed with SS "U" CHANNEL, concealed properly with requisite sealant within partition / MDF frame as per detail. All exposed edges of the glass shall be machine polished.All glass-to-glass joints to be sealed with pre-approved silicon sealants/ 3M tape, as required (GLASS MAKE Modiguard/Asahi float/Saint-Gobain/Asahi India) | | | | | |
| | For all Glazed partitions the solid partition above and below the glazed portions, upto a max. dimension of 300 mm, shall be measured as part of the glazed partitions; if more than 300 mm, then the relevant portion, more than 300mm, shall be part of the soild partition. For solid vertical portions of the glazed partitions which would be framework and gypsum skin (s), all portions less than 600mm shall be measured as part of the glazed partitions and if more than 600mm shall be measured as part of solid partitions. | | | | | |
| | Height of glazed partition - 2400mm | **25** | **Sq.m.** | | | |
| | | | | | | |
| **5.2** | **FULL HEIGHT GLASS door (12mm Thk ToughEened Glass door)** | | | | | |
| | Providing and fixing Single/Double leaf glass door made of 12 mm thick toughened glass fixed on stainless steel fittings of required section of chrome finished,**100mm high Stainless steel plate at top and bottom both side of the glass shutter as per drawing, including floor spring, patch fittings, SS top pivot, door handle, lock** of approved make (sample approved by the Architect/ Client) and all necessary hardwares and fixing arrangement complete as shown in drawing and directed by the Architect. make of Fitting as approved: Kich/Ozone/Neki/Dorma. & Glass Make : Modiguard/Asahi float/ Saint-Gobain/Asahi India | | | | | |
| | with cylinderical locks and kitch handles both sides 30mm dia and 600mm long in buffed SS 304 finish. | | | | | |
| | Item same as above but overall size of Glass door is 750 to 900 x 2100mm. | **4** | **Nos.** | | | |
| | | | | | | |
| **5.3** | **Frosted Film** | | | | | |
| **5.3.1** | Providing and fixing frosted film on both sides of Glass Partition/Glass door with MCS warranty of 5 years as per the manufacturer specification. (Finished works to be measured as smt). To include cost of printing designing, and sample approvals. | | | | | |
| | 3M forsted film on glass as per design<br>Ref. Name & No.: Dusted Crystel white 7725 - 314<br>Dot pattern or as per architect approval<br>applied on glass with full/half frosting (As per Design) | **35** | **Sq.m.** | | | |
| | | | | | | |
| **6** | **FALSE CEILING** | | | | | |
| **Note:** | **Quoted Rates are for all heights , scaffolding, depths, levels, leads and lifts and for all design and pattern shown in drawings** | | | | | |
| | **Contractor to include the cost of members & all required accessories for installation compelet finished ceiling in his quoted rate** | | | | | |
| | **Actual finished area to be measured and paid for** | | | | | |
| | **Vendor Shall submit & get approved all type of board/Tiles /plank sample by Architect before execution.** | | | | | |
| | | | | | | |
| **6.1** | **ARMSTRONG CEILING** | | | | | |
| **6.1.1** | **Modular Grid Ceiling** | | | | | |
| | Providing and Fixing of false ceilings at all heights of 600mm x 600mm Grid ceiling tiles with Microlook Edge laid on prelude XL exposed **silouette grid systems** with 15mm wide T- section flanges colour white. The framework comprise of main runner spaced at 1200mm centers securely fixed to the structural soffit by approved hangers at 1200mm maximum centers. Hangers (GI wire of 4.0mm dia) to be fixed by approved roof plug/ fastener, level adjusters and screws etc. The last hanger at the end of each main runner should not be greater than 450mm from the adjacent wall. Flush fitting 1200mm long cross tees (with double stitching) to be interlocked between main runners at 600mm centers to form 1200 x 600 modules. Cut cross tees longer than 600mm to be supported independently. | | | | | |
| | 600mm x 600mm modules to be formed by fitting 600mm long flush fitting corss tees centrally between the 1200mm cross tees. Perimeter trim to be Armstrong wall angle secured to walls at 450mm maximum centrers. The quoted rate shall be inclusive for making opening for light fixtures, diffusers & AC fittings. The quoted rate shall be inclusive of suspenders at all heihgt & extra member required for all openings. (Basic rate of only ceiling tile Rs 1000/- per Sqm.)**(Contractor to include the cost of members & all other accessories mentioned above in his quoted rate)** | | | | | |
| | **ARMSTRONG silhouette grid system** | **150** | **Sq.m.** | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **6.2** | **GYPSUM BOARD CEILING** | | | | | |
| **6.2.1** | Providing and fixing suspended false ceiling in microlook , which includes providing and fixing GI perimeter channels of size 0.55mm thick having one flange of 20mm and another flange of 30mm and a web of 27mm along with perimeter of ceiling, screw fixed to brick wall/partition with the help of nylon sleeves and screws, at 610mm centers. The suspending GI intermediate channels of size 45mm 0.9mm thick with two flanges of 15mm each from the soffit at 1220mm centers with ceiling angle of width 25mm x10mm x 0.55mm thick fixed to soffit with GI cleat and steel expansion fasteners. Ceiling section of 0.55mm thickness having knurled web of 51.5mm and two flanges of 26mm each with lips of 10.5mm are then fixed to the intermediate channel with the help of connecting clips and in direction perpendicular to the intermediate channel at 457mm centers. All sections, channels, etc to be in Gypsteel make as specified by manufacturer as per shown in drawing and directed by the Architect. | **60** | **Sq.m.** | | | |
| | 12.5mm tapered edge Gypboard (conforming to IS-2095 - 1982) is then screw fixed to ceiling section with 25mm drywall screws at 230mm centers. Screw fixing is done mechanically either Finally the boards are to be jointed and finished so as to have a flush look which includes filling as finishing the tapered and square edges of the boards with jointing compound, paper tape and two coats of primer suitable for Gypboard and three or more coats of Acrylic emulsion paint (as per recommended practices of India Gypsum or equivalent) etc. complete including opening to be made for AC grills, light fittings, trap door etc. (Plan area to be measured and paid for) **(cost to include paint also) (all material including chanels etc. Make: Lafarge (Boral)Gypsum/ Saint-Gobain/ India Gypsum/USG)** | | | | | |
| | | | | | | |
| **6.3** | **Trap door for Gypsum False ceiling** | | | | | |
| **6.3.1** | Providing and fixing trap door in false ceiling, made of 12 mm thick prelaminated partical board resting/ fixed including all hardware, hard wood lipping etc. complete as per drawing and drawing. | | | | | |
| | Make: Knuff Size: 600x600 | **8** | **Nos.** | | | |
| | | | | | | |
| **7** | **ROLLER BLINDS** | | | | | |
| **7.1** | Roller Blinds- Normal | | | | | |
| | Providing & fixing roller blinds comprising of polymer coated fibre fabric with minimum openness factor of 3% as per AS standards. The fabric shall be fire retardant and have high heat reflection ratios. The roller mechanism shall be a moulded unit made from engineering grade plastic polymer with steel spring support. The fabric shall be finished on the sides with edge tape duly welded for waviness control. The fabric shall be attached to the roller tube with high quality self adhesive tape. Average width of blinds shall be 2000mm and fall of 3000mm with manual operation. | | | | | |
| | **Headrail:** shall be .812" high x 2" deep extruded aluminum headrail with a wall thickness of 0.045" and painted to coordinate with fabric color. | | | | | |
| | **Cord lock:** shall be a snap-in design of injection-molded thermoplastic incorporating a metal, free-floating, serrated cord-locking roller. | | | | | |
| | Lift cord: shall be 1.2mm polyester and concealed for a clean appearance. A snap tassel and joiner ball connect to a single Danskord for raising and lowering the shade. Cord, tassel and joiner ball are color coordinated with fabric. | | | | | |
| | Installation: Bracket shall be low profile, hidden snap-in design made of 0.025" zinc-plated spring steel. | | | | | |
| | Bottomrail: shall be 0.375" high x 2" deep extruded aluminum with a wall thickness of 0.045" and painted to coordinate with fabric color. | | | | | |
| | Fabrication Shades shall be fabricated according to specifications and accurate to tolerance established by SWF engineering standards | | | | | |
| | Basic Cost: Rs 3000 per sm + taxes | **15** | **Sq.m.** | | | |
| | make: Hunter douglas/ Roselle/winfab . | | | | | |
| | | | | | | |
| **8** | **FLOORING WORK** | | | | | |
| **S.No** | **Particulars** | **Quantity** | **Unit** | | | **Refrence Image** |
| **Note:** | (Quoted Rates are for all heights, depths, levels, leads and lifts and for all design and pattern shown in drawings) | | | | | |
| | Stones shall be procured in slabs of varying sizes quoted rates also to include cutting of stones as per required sizes from slab. **Note: Actual finished area to be measured and paid for.** | | | | | |
| | Note :- **Vendor Shall submit & get approved all type of stone/Tiles sample by Architect before execution.** | | | | | |
| | Make Vitrified Tiles: Granito/ Kajaria/ Restile/ Somany/Qutone/ Nitco | | | | | |
| | Make Ceramic Tiles: Kajaria/Somany/Bell/Nitco/Qutone | | | | | |
| | | | | | | |
| **8.1** | Providing and laying polished granite stone in choice shade laid in floors and counter tops over 20mm (average) thick base of cement mortar 1:4 (1 cement :4 coarse sand) followed by laying and fixing with highly polymer single component adhesive of LATICRETE / BAL ENDURA or equivalent with minimum 6 mm thickness and jointed with white cement slurry mixed with matching pigment, including rubbing and polishing and curing etc. complete at all levels. (Sample of stones shall be got approved by Architect. Basic cost @Rs. 250/- per sq.ft.) | | | | | |
| **8.1.1** | item same as above in flooring, Staircase steps, landing etc. the cost shall be included with necesarry groove, joints chamfer, edge moulding, nosing etc. all complete as drawings to be provided by the architect/as per instuction of site in charge. | **10.00** | **Sq.m.** | | | |
| | | | | | | |
| **8.1.2** | item same as above in skirting, risers of steps, Ledge of pantry counter etc., on 12mm thick cement plaster 1:3 (1 cement : 3 coarse sand) with necesarry groove, joints chamfer, all complete as drawings to be provided by the architect/as per instuction of site in charge. | **5.00** | **Sq.m.** | | | |
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| **8.2** | Providing and laying 10-12mm thick Dual charged Vitrified tiles of Kajaria/ Marbonite/ Somany/ Nitco make or approved equivalent and of approved shade of size as per drawing in floors over 20mm (average) base of cement mortar 1:4 ( 1 cement :4 coarse sand) required thickness to match finished floor level mentioned and to match the neighboring floor finish and jointed with epoxy grout of approved shade from Bal Endure or equivalent brand all complete as directed complete. Rate to include forming pattern in the flooring like border, skirting, cut tiles, Protecting of the tile till hand over date by POP., etc all complete as per detailed architectural drawing. | | | | | |
| **8.2.1** | same as above With Vitrified Tiles of **Base rate of Vitrified tiles Rs. 75/- per Sft leaving taxes and freight and loading un loading charges )** | **210.00** | **Sq.m.** | | | |
| | | | | | | |
| **8.3** | **Providing and fixing William Tape for protecting floor &glass from dust during construction. Item includes removing the tape after completion of work and cleaning the area.** | **210.00** | **Sq.m.** | | | |
| | | | | | | |
| **8.4** | **Tile Dado** | | | | | |
| | Providing and Laying tile dado of approved make, shade and pattern as approved by Architect, with epoxy grouting ,making grooves using 2/ 3mm PVC spacers and epoxy grouted with tile groute of matching shade of tile including cutting, grouting the joints with epoxy grout of endure or equivalant and pigment to match the shade of tile including cutting, etc. complete in all respects as per pattern and drawing. | | | | | |
| | | | | | | |
| **8.4.1** | With Tile **(Basic rate of tiles Rs. 80/- Sft leaving taxes and freight and loading un loading charges)** for Toilets walls other then higlighter | **75.00** | **Sq.m.** | | | |
| | | | | | | |
| **8.4.2** | Same as above but Pioneer exposed brick tiles of Royal Bell Series- Terracotta 230x50x20 mm in dados. | **20.00** | **Sq.m.** | | | |
| | | | | | | |
| **9** | **DOOR/WINDOW WORKS** | | | | | |
| **Note:** | Providing and fixing phenol bonded solid core flush door shutters of approved quality and make non decorative type core of block board construction with internal frame of teak wood | | | | | |
| | **Door Frame:** Made overall size 60 x 150 mm finished with polish finish as shown in drawing .**(Steem beech wood basic cost Rs. 3500.00 per/cft ) Note:- for partition frame size - 50 x 100 or as per partitions width.** | | | | | |
| | Architraves of overall size 40 x 12 mm fixed to wooden frame both side as shown in drawing.**(in teak wood. Ivory cost/ghana teak)** | | | | | |
| | **Including providing & fixing of all hardware & accessaries,** hinges, door handle, door closer, door stopper, lock, tower bolt, door buffer, making of grooves, providing & applying wood preservative, **antitermite proof paint, polish,** screws, nails, wooden studs, wooden beading, all necessary fixing arrangement etc complete as per design and drawing. **all hardware to be dorma/Hettich or equivalant Make** | | | | | |
| | Make for Doors & Fittings | | | | | |
| | Hardware / Locks : Dorma XLC, Kitch, Geze, Hettich, Dorset, Halflae | | | | | |
| | Hardware : Dorset, Ingersoll Rand, Hettich, Kitch, | | | | | |
| | Door Closers : Dorma | | | | | |
| | Door Locks: DORSET,Golden | | | | | |
| | Door Seals: Enviroseals | | | | | |
| | | | | | | |
| **9.1** | Veneer / Laminated Doors : Same as above Description with 30-35 mm thick shutter finish with 4 mm thick veneer (Duro group B ) / 1 mm premium laminate in both side of the shutter of approved make & shade and edge polishing / enamel painting, including 200x1800mm vision panel made of 6mm thick non toughened clear Glass with wooden frame duly polished on each shutter complete with all necessary fixing arrangement including melamine polish of desire shade complete as per shown in drawing and directed by the Architect. | | | | | |
| | Each door to have 4 Nos of 6" railway barring hinges in SS finish<br>door shall be with the dorma heavy duty door closer code no ITS96GSR with necessary tower bolts and pivots<br>Doors to have cylindrical locks .<br>Door to have 400mm long 30mm dia SS buff finish handles on both sides.<br>Basic cost of the veneer Rs.175per/sqft leaving taxes and transportation charges<br>etc all complete as per detailed architectural drawing. | | | | | |
| **9.1.1** | Item same as above but with overall size of shutter is 750 x 2100mm. | **12.00** | **Nos.** | | | |
| | | | | | | |

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|---|---|---|---|---|---|---|
| **9.2** | **WINDOWS** | | | | | |
| **9.2.1** | P & F of UPVC windows made out of hollow Multi-Chambered UPVC Sections with isolated drainage and reinforced with galvanized steel. The corners and joints shall be mitre cut and fusion welded. The overall dimensions of windows are as per eisiting windows with wall thickness of frame being 2.3mm ± 0.3mm. Openable Frame with shutters (internal of window) for Mosquito Sash shall be provided. The Window System shall be externally glazed with single glazing in 6mm glass. window installation shall be executed through specialized agencies authorized by the manufacturers. The windows shall be installed so as to provide a completely water proof and air tight solution for the purpose.The UPVC profile of frames and sash shall be mitered cut and fusion welded at all corners, including drilling of hole for fixing hardware & drainage of water etc. making arragement for fixing hardware, EPDM gasket, with 1.2 +_ 0.2 mm thick galvanized steel profile to be inserted in required profile, frame shall be fixed to the wall with 8 mm x 100 mm long fastners all complete as per direction of Architect. All screws to be used shall be of S.S of make as approved by the Architect. Glazed window shall consist mainly of :<br>1. Casement frame of size : 67 mm x 62 mm<br>2. Casement window sash/mullion (67 mm x 75 mm)<br>3. Casement glazing bead (35 mm x 18 mm)<br>4. S.S - 304 grade, friction hinges of size 250 x 19 x 1.9 mm.<br>5. Tinted single glazing of thickness 5.5 mm with necessary gasket.<br>6. Multi-point lock with handles.<br>Note: The new windows shall be installed after removing the exisitng M.S framed windows. After installing the new windows propoer sealing shall be done by the installer so as to ensure that there is no leakage of water, and outside making sides/edges & slope. (All plastering, scaffolding, removal of debris is included in the cost.) | **15.00** | **Sq.m.** | | | |
| | | | | | | |
| **10** | **PARTITION / PANNELING WALL FINISHING WORKS** | | | | | |
| | | | | | | |
| **Note:** | 1.G.I Frame for Partitions consisting of G.I vertical studs of size 50mm & horizontal members @ 600 x 600 | | | | | |
| | 2. At all services out lets such as switch sockets, data out lets, AC grills, etc. Horz. member of adequate size and section to be provided | | | | | |
| | 3. All full ht. partitions, unless otherwise specified will go up to RCC slab, complete with insulation, Gypsum Board etc. except second skin which can be stopped at flase ceiling. **Actual Area executed will be paid for.** | | | | | |
| | 4. All paneling framework, unless otherwise specified will go up to bottom of true ceiling except the second skin which can be stopped at false ceiling | | | | | |
| | 5. All exposed wooden surfaces in this Item or anywhere else in the BOQ to have melamine polish as per approved sample | | | | | |
| | 6. All wooden/mdf framework under this item or anywhere else in the BOQ to be treated with anti termite and fire retardant paint ( viper or equiv.) | | | | | |
| | 7. All the wooden framework under this Item or anywhere else in the BOQ will have well seasoned wooden members of species as defined in the individual item | | | | | |
| | 8. All Glass to Glass, Glass to wood and Glass to SS joints shall be sealed with Dow Corning Glass sealant with minimum contact surface to be not less than 6mm after cleaning and masking procedure with full tool & tackle .Silicon works to be got done by an approved specialized Agency. | | | | | |
| | 9. All panel like, gypsum board, MDF, Ply veneer etc to be fixed to the frame with dry wall screws, jointed and finished with requisite filler, paper tape, finisher and and primer suitable for the surface. | | | | | |
| | 10. The outer skin on either side shall have 10mm grooves with aluminum 'L' angle bends fixed to the thickness of board at the edges, neatly finished | | | | | |
| | 11. Partitions to have extra skin of wire mesh only when specified by the client for security reasons in given areas. The same will be paid separate extra only for the wire mesh | | | | | |
| | | | | | | |
| 10.1 | **DRY PARTITION** | | | | | |
| | Providing and fixing G.I Frame for Partitions consisting of G.I vertical studs of size 50mm & horizontal members @ 600 x 600 or where ever required as per manufacturer, specs, using Gypsteel sections, hardwood will be inserted as may be required to fix door frames skirting etc. with all necessary fixing arrangement complete as per shown in drawing and directed by the Architect. Quote only for framework. All components to be of India Gypsum or LA gyp (la farge) or equivalent. | | | | | |
| | The cost to be included of 50 mm thick 24 kg/m3 density glass wool insulation inside the partition frame work including jointing and finishing. and To facilitate the skriting bottom channel to be cladded with 6mm marine plywood on both sides resist by 5-10mm groove on both sides. includning Providing and fixing of prefabricated alumnium skirting as per product details, 50-75mm high of jeb/bottomline or equivalant make. all inclusive as per architects instruction. | | | | | |
| | **FRAME WORK FOR FULL HEIGHT PARITION:** Frame work of Partition in G.I | **60** | **Sq.m.** | | | |
| | | | | | | |
| 10.2 | Providing and applying the claddings on the G.I framework erected for Solid partitions. | | | | | |
| | Cladding under this section shall be considered to be applied only to one side. | | | | | |
| | Cost for fixing plywood/ MDF etc. and fixing/cladding laminate/ veneer to be quoted as per case. Each side of the partition finishes will be measured as per the case. | | | | | |
| | Contractor to make provision for all electrical/ networking boxes and to provide 30mm dia cut-outs as required. Electrical/ Network boxes/ other services to be provided at desired height and location as indicated in the drawing or as instructed at site. | | | | | |
| | All junctions between materials, columns, walls, etc to have a 6mm groove with Aluminium `L'/ 'U' sections as per details. And all grooves joint and design pattern shall be included in quoted cost. | | | | | |
| | All exposed edges/ corners/ grooves to have proprietary corner/ edge bead sections/ channels as per Architect's instructions. | | | | | |
| | All exposed gyp board edges to be fixed with BeadEx self adhesive. | | | | | |
| | At all locations where services are penetrating the partition above false ceiling to have additional GI frame work around the duct/ cable tray/ pipe and the gaps between the frame work and service to be filled with appropriate acoustic sealant or with fire stop material as directed. | | | | | |
| | **Approved make** | | | | | |
| | Laminates: Merino/Green Lam | | | | | |
| | Veneer: Duro group B | | | | | |
| | Commercial Ply: Century/ Green/ Garnet/ Alpro/Durian/ merino/ Duro | | | | | |
| | | | | | | |
| 10.2.1 | **SKIN TYPE-1 OVER G.I FRAMING: 6 mm PLY + 6mm PLY + 1mm Laminate** one side of Partition. The PLY should be Leed certified Green Products, FSC certified and CE certification. which insure the quality of the products to the international standards. | **50** | **Sq.m.** | | | |
| | | | | | | |
| 10.3 | Providing and Fixing designer screens with necesarry G.I framework above false ceiling to support or fix with screen with ceiling and same arrangement to made in floor. | | | | | |
| 10.3.1 | **GLO Panel Screen thickness 12mm**. Providing & Fixing GLO Panels On back Drop wall of meeting lounge and visitors area as per design of panel approved or given by the Architect or as mentioned in detail drawings. The quoted cost to include making arrangement for fixing the designer panel in floor and same to be fixed in ceiling with G.I support above false ceiling lvl. | **10** | **Sq.m.** | | | |
| | GLO Panel base cost - 200 Rs. Sq.Ft leaving taxes and transportation charges | | | | | |
| | | | | | | |

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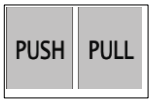
|---|---|---|---|---|---|---|
| **11** | **FURNITURE** | | | | | |
| | | | | | | |
| | **Important Notes:** | | | | | |
| | all veneer (Duro group B ) are of Base Rate 175 Rs./Sq.ft unless or otherwise specified. | | | | | |
| | all furniture in veneer are with melamine polish included in desire color shade as to be approved by architect's | | | | | |
| | all necessary hardware such as handle, drawer channels, hinges shall be inclusive in the quoted cost. | | | | | |
| | Every invidual table to be considered with drawer' and shelf built in as per design and quoted cost shall include this also. | | | | | |
| | all Laminates make Merino/Green Lam | | | | | |
| | | | | | | |
| 11.1 | **TABLES** | | | | | |
| 11.1.1 | **Meeting TABLE** 750mm ht. as per design with round edges of all 4 corners, Table top to be made of 35mm thick commercial plywood, top and base of the table to be finished in 12mm solid acrlyic top (corian) of approved shade, Table to be constructed in hardwood framework with necessary provisions for wire management. Finished in 1 mm premium laminate as/design and detail. All visible surfaces to be finished in same 1 mm premium laminate & internal area's of Table to be finished in 1mm laminate of approved shade. with pop up boxes in SS finish Legrand Make (approximately 2 boxes of 8 module). and also to be co-ordinate with services for the provision of speaker, data, telephone etc. | | | | | |
| | Table to have provision of trap door's in table base for service's purpose in same laminate finish. | | | | | |
| | Size: 6'10" x 3'2" | **1** | **Nos.** | | | |
| | | | | | | |
| 11.2.1 | **BRANCH HEAD / MARKETING OFFICER ROOM Table Size: 7'6" x 3'0" x 2'6" ht.** as per design Table top to be made of 35mm thick commercial plywood, top, base and visible sides of the table to be finished in 12mm solid acrlyic top (corian) of approved shade. Table to be constructed in hardwood framework with necessary provisions for wire management. Finished in 1 mm premium laminate as/design and detail. All other internal area's of Table to be finished in 1 mm laminate of approved shade. Cost to be include for **Back storage Size: 7'6" mm x 1'6" x 2'6" ht. with solid acrlyic (corian) 12 mm top and side storage of Size: 3'6" x 1'6" x 2'6" ht. with solid acrlyic (corian) 12 mm top as and whever prescribed** Including providing & fixing of all hardware & accessaries, hinges, door handle, lock, making of grooves, providing & applying wood preservative, antitermite proof paint, polish, screws, nails, wooden studs, wooden beading, all necessary fixing arrangement etc complete as per design and drawing. all hardware to be Hemm x 100 mm long fastners all complete as per direction of Archit | **2** | **Nos.** | | | |
| 11.2.1.1 | Item same as abovew with following table sizes | **8** | **Nos.** | | | |
| | Table of size : 4'0" x 2'0" in linear of curvilinear profile (as per the drawing / as prescribed by the Architect) | | | | | |
| | | | | | | |
| 11.3 | **Providing and fixing low height storage of following size storage:** fabricated out of 19mm BWP commercial board in **1.0mm thk approved premium laminate** from the outside and 0.8 mm laminate on the inside. All storages to have a backing of 12 mm thk MARINE PLY. rate to include back splash of 150mm above the counter in same finish. Shelves also to be lined with 0.8mm laminate from inside. All exposed edges to be finshed with 2mm thk PVC edge binding or TW edge duco painted as per detail drawings. Cost of the storage units to be inclusive of brushed steel finish handles, SS soft close hinges, tower bolts, Shutter magnets (Medium), locks, tower bolts, magnetic ball catch, hinge etc and all necessary hardware of approved make all complete as per drawing and detail and as per the instructions of the architect. The storages to have a support member of SS brushed steel section as per detail/design/design as provided by the Architect. **Note only BWP Board to be Used** | | | | | |
| 11.3.1 | Toilet under counter storage Size: same as above but Size of : 600mm depth x 750 mm Ht. | **5** | **sq.m.** | | | |
| | | | | | | |
| 11.3.2 | Pantry under counter storage Size: **same as above but Size of** length as per layout x 600mm depth x 800mm Ht. | **5** | **sq.m.** | | | |
| | | | | | | |
| **11.4** | P/F full height 1'-6" deep (area calculated as length x breadth ) storage in cabins as / dwg.made up of 19mm commercial blockboard shutters,sides & shelves with melamine polished european/german steemed beech ¾"x ½" mouldings on margin and 11/2"x 1"European/German Steemed Beech. moulding on all edges sides and 3/4" X 3/4"Ex Steam beech moulding melamine polished at 2" high skirting level with 6mm plywood back,with 1mm thick premium laminate Merinolam/ greenlam/ Formica normal on visible areas as per design and .8 mm thk laminate of approved shade on inner surfaces, including efficent gadgets/godrej locks. stainless steel handles , and magnetic ball catchers with necessary hettich/haffle hardware,hinges, godrej locks and SS handles as per architects instructions including shelves as per design . **(with shutters)** | **75** | **sq.m.** | | | |
| | | | | | | |
| **12** | **MISCELLANEOUS ITEMS** | | | | | |
| **12.1** | Provoding and Fixing Logo for NAFED WITH TEXT AND LOGO for main reception area made with S.S and Back Led lighting (with necessary connections) of approved color as shown in drawing or as directed by the architect. | **1** | **Nos.** | | | |
| | | | | | | |
| **12.2** | Supply & Installtion of Pull - Push Signages :<br>Brush finish stainless steel etched signs<br>Size : 2.5"(H) x 2.5"(W)<br>set includes 1 pull & 1 push | **14** | **Nos.** | | |  |
| | | | | | | |
| **12.3** | Toilet Mirror | | | | | |
| | Providing and fixing 6mm thick (of any shape & size ) fixed with 40mmx40mm hard wood frame of ivory cost teek wood section as shown in the drawing, mirror with 12 mm thick waterproof ply backing supported with 20mm thick water proof board fixed to wall with hard wood pegs including providing and fixing 300 micron HDP film as vapour barrier, all necessary fixing arrangement like nails/ screws dash fastner, wood preservative paint, providing and fixing polythene bubble sheet between mirror and backing ply, stainless steel caping to bolt head, melamine polish on wooden frame etc. complete. All visible wood would be steam beech | **5** | **sq.m.** | | | |
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|---|---|---|---|---|---|---|
| **13** | **SANITARY WORKS** | | | | | |
| **13.1** | Providing and Fixing G.I. pipes (medium quality of Jindal/Tata make complete with galvanised iron fitting (UNIK) brand or all descriptions, such as tees, elbows, reducers, clamps. suspenders, unions, check nut bends etc., including cutting, threading, chasing and making good the walls, floors RCC work etc., and filling the same with cement concrete 1: 2: 4 (1 cement: 2coarse sand: 4graded stone aggregate 20mm nominal size) after embedding the pipes , including painting the pipes (with desired shade of 2 coats enamel paint over coat of primer, where pipes are exposed) and painting with 2 coats of anticorrosive bitumnistic paint including necessary excavation upto the required depth, in trenches and back filling, and covering the pipes with 75mm thick sand all around the pipes, complete, as per detailed specifications and P/F C.I. (R.I.F. ) pipes and Making necessary additions to existing CI and G.I pipe work including new work for G.I and C.I upto connection in all floors in one pantry and two water cooler points .Including shifting of points, if required, and sealing of joints including waterproofing and P/F all p traps etc complete. | | | | | |
| **13.1.1** | For ONE PANTRY , THREE TOILETS | **LUMPSUM** | **4** | | | |
| **13.1.2** | P/F Powder coated Square/Round C.P. jali (chilly make)125 mm on floor trap. | **No.** | **8** | | | |
| | | | | | | |
| **13.2** | Providing and fixing kitchen sink with RS CI brackets under granite top, CP brass chain with rubber plugs 40mm C.P. brass waste and 40mm C.P. brass trap with necessary unions complete including painting and fitting, cutting and making good the wallls wherever required:<br>a) Stainless steel sink (AMC / Neelkanth/Nirali) with drainboard size 400 x 350 x 152mm. | **No.** | **1** | | | |
| **13.3** | Providing and Fixing 15mm nominal bore C.P. brass kitchen mixer with swiveling spout (hot and cold ) and deluxe head of approved make. Jaquar of basic price (Rs. 2500/- each) | **No.** | **1** | | | |
| | | | | | | |
| **13.4** | Providing and Fixing white glazed vitreous china single trap syphonic pattern having back inlet ,supporting Cast iron chair ,wall hung water closet with composite Concealed cistern (European type) water closet with seat and lid, with C.P. brass hinges and rubber buffers, adapter, rubber joints fixed to W.C., C.P. brass screwed washers including cutting and making good the walls and floors wherever required and HDPE WC pan connector including jointing with Ivory cement coomplete in all respects. | | | | | |
| | Wall hung W.C. pan with white plastic seat & lid "Thermoset moulded ( bakelite ) IS 2548 Part I Model no Veil wall-hung toilet K-75708IN-0<br>**cost with WC , concealed Kholer cistern & Kholer fittings all included** | **No.** | **3** | | | |
| | | | | | | |
| **13.5** | Providing and fixing white glazed vitreous china wash basin with R.S. or C.I. brackets painted Ivory, C.P. brass chain with rubber plug 32mm C.P. brass waste of standard pattern, 32 mm dia. C.P. brass bottle trap and union 32 mm dia C.P. pipes to wall flange. complete including cutting and making good the walls wherever required. Model no: Parliament Vessels lavatory - K-14715IN-1, leavinf cost of angle valves . | **No.** | **3** | | | |
| | Square wash basin 560x440mm for mounting under the counter with 15mm C.P. brass single hole mixing fitting. | | | | | |
| | | | | | | |
| **13.6** | Providing fitting and fixing vitreous china flat back type lipped front urinal basin of with automatic flushing cistern with standard flush pipe and CP brass spreader and brass unions, etc.all complete including painting of fittings and brackets, cutting and making good the walls & floors wherever required. Model no: Bardon urinal - K-4904-ET white colour | **No.** | **3** | | | |
| | | | | | | |
| **13.7** | Providing fitting and fixing Urinal Divider plate of Toughened glass as per detail. including fitting and fixing all compete as directed. Make Jaquar Model no- IARA : 1810-UC size 900x450x8mm | **No.** | **3** | | | |
| | | | | | | |
| **13.8** | Providing And Fixing 15 mm dia C.P. brass angle valves( kholer make ) with C.P. copper connecting pipe union nut C.P. cast brass wall flange. | **No.** | **11** | | | |
| | | | | | | |
| **13.9** | Providing and fixing C.P. brass finish toilet paper holder( Kholer/equivalent) of approved make complete . | **No.** | **3** | | | |
| | | | | | | |
| **13.10** | Providing ad fixing C.P. brass health faucet with angle valve complete. ( all Kholer make ) | **No.** | **3** | | | |
| | | | | | | |
| **13.11** | Providing And Fixing 15mm dia C.P. brass single lever wash basin Mixer for wash basin ( all kholer make ) | **No.** | **3** | | | |
| | | | | | | |
| **13.12** | Providing and Fixing liquid Dline soap dispenser in AISI316 SS grade in stain finish. with indicator , and brackets fixed to wooden cleats with C.P. brass screws. | | | | | |
| | Euronics SS soap dispenser (800 ml) (model no ES 04) | **No.** | **3** | | | |
| | | | | | | |
| **14** | **LOOSE FURNITURE** | | | | | |
| **14.1** | **CHAIRS (Featherlite/Godrej/Durian/Geeken make)** | | | | | |
| **14.1.1** | BRANCH HEAD & MARKETING HEAD CHAIRS | | | | | |
| | ERGON MB ML 'B' of FEATHERLITE MAKE<br>* Ergon Medium Back<br>* Mesh Chair<br>* Kneetilt - Multilock Mechanism<br>* Two Way Adjustable Arms<br>* Fine Tunning Adjustable Lumbar Support<br>* Aluminium Back<br>* Nylon Base | **2** | **no.** | | |  |
| **14.1.2** | BRANCH HEAD & MARKETING HEAD VISITOR CHAIRS | | | | | |
| | ASTRO VISITOR of featherlite make<br>* Astro Medium Back Visitor Chair<br>* Synchro Mechanism<br>* Two Way Adjustable Arms<br>* Nylon Base | **6** | **no.** | | |  |
| | | | | | | |

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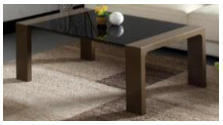
|---|---|---|---|---|---|---|
| **14.1.3** | STAFF / OFFICER CHAIRS | | | | | |
| | Click - MBGS 'B' Type Arms<br>* Click Medium back chair<br>* Synchro Mechanism,<br>* Two Way Adjustable Arms<br>* Nylon Base | **13** | **no.** | | |  |
| | | | | | | |
| **14.1.4** | **SOFAS** | | | | | |
| | | | | | | |
| **A** | Providing and fixing fully upholstered double/triple seater sofa as per design with lining with bhor leatherite upholstery @ Rs 550/-RM over markene ,over ½" poly foam, on 6" m.m foam, over no sag springs with necesary hard wood frame work fully upholstered sofa. | per seat | 16 | | | |
| | | | | | | |
| **B** | Supplying and placing centre table of dimensions: 1100 x 700 x450 • Combination of glass + MDF. • 10 mm glass top • High Gloss PU , acquer on MDF in mocca shade • Black tampered glass • Load Bearing Capacity : 30 kg. | No. | 2 | | |  |
| | | | | | | |
| **C** | Guard room single bed | No. | 1 | | | |
| | | | | | | |
| **II.O** | **ELECTRICAL WORKS** | | | | | |
| **1** | Wiring for light point / fan point/exhaust fan/ / light socket switch with 3X1.5 (P+N+E) sqmm copper conductor FRLS insulated 1100v grade multi strand wire in concealed / surface using 20/25/32 rigid MS conduit 16swg thick with all bend, tees, saddle mounting box, cover plate ceiling rose, etc. wherever required etc.& chromium plate brass screw/rawl plug etc..The circuit wiring start from DB to point control box /switch box using 3x2.5 (P+N+E) sqmm copper conductor FRLS insulated 1100V grade multistrand wire with notification ferrules at both end complete in all respect. The conduit must be fixed with MS saddle at every 80cm on surface and conduit to be laid in ceiling with proper clamps/wall floor filling the chase with cement mortar and finish the same in original form/wooden partition above false ceiling chases filled with cement mortar as required at site Each circuit shall have separate earth wire.All switch socket must be for modular type with M.S. Boxes and plate etc. as required.<br>Note:-.Each circuit shall have independent earth wire each point shall be earthed. Circuit wiring is to be included in wiring. | | | | | |
| **1.1** | One light controlled by one 6A modular one way switch. | **5** | **Nos** | | | |
| **1.2** | Two light controlled by one 6A modular one way switch. | **10** | **Nos** | | | |
| **1.3** | Three light controlled by one 6A modular one way switch. | **10** | **Nos** | | | |
| **1.4** | Four light controlled by one 6A modular one way switch. | **5** | **Nos** | | | |
| **1.5** | Six light controlled by one 6A modular one way switch. | **5** | **Nos** | | | |
| **1.6** | Eight light controlled by one 6A modular one way switch. | **2** | **Nos** | | | |
| | | | | | | |
| **2** | Wiring for Exhaust fan point with 2.5 sq. mm. insulated copper conductor 1100 volts grade stranded flexible FRLS wires of approved make in 25 mm dia heavy duty FRLS PVC conduit including providing & fixing of 6 amps flush mounted switch at the normal switch level in 1.6 mm thick GI box and 6 amps 3 pin flush mounted socket near exhaust fan and earthing of exhaust fan through the third pin of the socket outlet and GI box with 2.5 sq.mm. PVC insulated copper conductor flexible FRLS wire. | **3** | **Nos** | | | |
| | | | | | | |
| **3** | WIRING FOR Three nos. 6A Universal UPS power socket oulet Shuttered controlled with one no. 16A switch mounted side by side with 2 x 2.5 sq.mm. PVC insulated single core **FRLS flexible copper** conductor **in concealed/exposed RIGID PVC conduits 2mm thick and EARTHING WITH** one no. 1.5 sq.mm. insulated **green color** earth wire.( Max. 3 Points to be looped from one circuit). All switch socket must be for modular type with M.S. Boxes and plate etc. as required. | **12** | **Nos** | | | |
| | | | | | | |
| **4** | **POWER POINTS** | | | | | |
| **4.1** | Wiring for 250 volts single phase and neutral 16 amps switched socket outlet with 4 sq.mm PVC insulated copper conductor 1100 volts grade stranded flexible FRLS wires in concealed or surface mounted 25 mm dia with heavy duty FRLS PVC conduit including providing and fixing of 16 amps 3 pin switched sockets of approved make and design in 1.6mm thick GI box with grid plates and earthing the third pin of each socket outlet with 4 Sq mm PVC insulated copper conductor stranded flexible FRLS wire ( Power points). Note: Circuit wiring to be included and one power point to be in one circuit.All switch socket must be for modular type with M.S. Boxes and plate etc. as required. | **10** | **Nos** | | | |
| | | | | | | |
| **5** | **AC POINTS** | | | | | |
| **5.1** | Wiring for 250 volts single phase and neutral 20 amps switched socket outlet with 6 sq.mm PVC insulated copper conductor 1100 volts grade stranded flexible FRLS wires in concealed or surface mounted 25 mm dia with heavy duty FRLS PVC conduit including providing and fixing of 2 Nos. 20 amps each 3 pin switched sockets of approved make and design in 1.6mm thick GI box with grid plates and earthing the third pin of each socket outlet with 4 Sq mm PVC insulated copper conductor stranded flexible FRLS wire. Note: each point to be one circuit.**( Contractor should note and qoute that that there are 2 nos 20 amp each 3 pin switch sockect of modular type with MS boxes to be installed with each point )** | **7** | **Nos** | | | |
| | | | | | | |

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|---|---|---|---|---|---|---|
| **6.0** | **DISTRIBUTION BOARD** | | | | | |
| **6.1** | Supplying & fixing following way, three pole and neutral, sheet steel, MCB distribution board , 415 volts, on surface/recess, complete with tinned copper bus bar, neutral busbar, earth busbar, din bar, detachable gland plate, interconnections powder painted including earthing etc. (But without MCCB/RCCB/MCB) | | | | | |
| **6.1.1** | 12 way ( 8 + 36) double door (for light, plug,power,AC normal DB-& Emg DB) | **4** | **No** | | | |
| **6.2** | Supplying and fixing of following rating four pole ( three phase and neutral) 415 volts, residual current ciecuit breaker (RCCB)having a sensitivity up to 100 milliamperes in the existing MCB DB complete with connections, testing and commissioning etc. as required. | | | | | |
| **6.2.1** | 63 amps | **4** | **No** | | | |
| | | | | | | |
| **6.3** | Supplying and fixing 5 amps to 32 amps rating, 240 volts, 'B' series, miniature circuit breaker suitable for lighting and other loads of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required. | | | | | |
| **6.3.1** | Single pole | **48** | **No** | | | |
| **6.4** | Supplying, fixing, connecting, testing and commissioning of following rating, ISI marked (IS 8828) 240 / 415 volts, 10 KA, Miniature Circuit Breaker (MCB) of single / double / three / four poles in the existing MCB DB or in existing MS enclosure complete in all respects. | | | | | |
| **6.4.1** | 63 Amp. FP MCB | **4** | **No** | | | |
| | | | | | | |
| **7** | **SUBMAINS/MV CABLES** | | | | | |
| **7.1** | **SUPPLY** | | | | | |
| | Supply of following sizes of FRLS 1.1 KV stranded compact circular aluminium conductor screened with extruded semi conducting compound, XLPE insulated,Al round wire armoured & overall PVC sheathed cable conforming to IS to IS 7098 (Part-I) with latest amendments | | | | | |
| **7.1.1** | 3.5 x 95 sq.mm. | **60** | **RM** | | | |
| | | | | | | |
| **8** | **CABLE LAYING** | | | | | |
| | Laying of one number XLPE insulated and PVC sheathed power cable of 1.1 KV grade of following sizes in open duct or on surface as required. | | | | | |
| **8.1** | Above 35 sq. mm and upto 95 sq. mm | **60** | **RM** | | | |
| | | | | | | |
| **9** | **CABLE TERMINATION** | | | | | |
| **9.1** | Supply & making end termination with brass compression gland and aluminium lugs for following following size of PVC insulatedand PVC sheathed/XLPE aluminium conductor cable of 1.1 KV grade as required. | | | | | |
| **9.1.1** | 3.5 x 95 sq.mm. | **4** | **Nos** | | | |
| | | | | | | |
| **10** | **SUB MAIN WIRING** | | | | | |
| **10.1** | Wiring of submain wiring along with earthwith following sizes of FRLS PVC insulatd copper conductor single core cable in surface/recessed medium class PVC conduit as required | | | | | |
| **10.1.1** | 4x16 sq.mm. | **100** | **RM** | | | |
| | | | | | | |
| **10.1.2** | **SUPPLY AND LAYING OF CABLES** | | | | | |
| **a** | 185 sqmm 3 1/2 core | **25** | **RM** | | | |
| **b** | 240 sqmm 3 1/2 core | **30** | **RM** | | | |
| | | | | | | |
| **11** | **TELEPHONE WIRING FOR VOICE** | | | | | |
| **11.1** | Supply and fixing of RJ11 moduler Telephone outlet in zinc chromate passivated M.S.Box and moduler plate including connections atc. As required. | **12** | **Nos.** | | | |
| **11.2** | Providing, drawing, connecting and testing of **telephone wire** 0.5 sqmm tinned annealed high conductivity copper conductor with high density Polyethylene insulation, paired, polyster taped and FR PVC sheathed in existing MS/PVC conduit from telephone outlet box to the junction box/tag block as required. | | | | | |
| **11.2.1** | 4 pair 0.51 sq. mm. | **12** | **per point** | | | |
| | | | | | | |
| **11.3** | Supply & fixing the following sizes of Krone telephone tag blocks housed in suitable sizes of power coated MS boxes with hinge cover complete as required. | | | | | |
| **11.3.1** | 20 pair telephone tag block | **1** | **Nos.** | | | |
| | | | | | | |
| **11.4** | Supplying & laying the following sizes of PVC insulated or overall sheathed taped telephone cables of 0.61mm dia size inground including excavation, refilling and making good the damage etc. as required. good the same and connection etc. complete as required | | | | | |
| **11.4.1** | 20 Pair telephone cable | **300** | **RM** | | | |
| | | | | | | |
| **12** | **FAN AND LIGHT FIXTURE** | | | | | |
| | | | | | | |
| **12.1** | a) Providingand fixing in gypsum/armstrong ceiling, connecting testing and commissioning of following luminaires including the cost of necessary inter-connections required 2'X 2' Luminare all complete.in 42 W(a) Wipro Pure LED/Phillips RC 380B LED-25-6500 PSE OD WH/GE Mapple.) equivalent models in Havells | **37** | **Nos** | | | |
| **12.2** | Providing and fixing in gypsum ceiling, connecting testing and commissioning of following luminaires including the cost of necessary inter-connections required. Philips BBS170I x DLED-5000 PSU WH, Low depth recessed technical, downlighter inclusive of gearbox.(Luminare all complete) (Wipro Maxi iris/Green Led/Phillips BBS 170)/Equivalent model in Havells | **20** | **Nos** | | | |
| **12.3** | Supplying, installation, testing and commissioning of surface mounted luminaries with required wiring, suitable for LED lamp complete of make philips LL199 1xDLED40-5000 PSE ODWH or equivalent make in wipro/havells/syska. | | | | | |
| **A** | PHILIPS LL199 1xDLED40-5000 PSE ODWH | **10** | **No.** | | | |
| **B** | FOS LED Hanging Profile Light 48W 4-feet Tube Light (Warm White 2700k, Black) | **8** | **No.** | | | |
| **C** | IMPRESSION LIGHTS Corner Profile 1 Meter Long Profile Without LED Straight Linear | **100** | **No.** | | | |
| **12.4** | P/F of following Main Streem Battens (Phillighs make including lamps) | | | | | |
| **12.4.1** | MIROLTA Slim (Phillips) T5 TMS540 HF. For Lamp - 1xTLS-28W | **10** | **Nos** | | | |
| **12.5** | P/F Philips Linea Flexible LED Strip / Tape 30W 5m 4500K (With Driver)<br>Tech Overview<br>Length: 5m<br>Voltage: 12V<br>Wattage: 30W<br>Colour Temperature: 4500K<br>Lumen output: 360 lm/m<br>Colour Rendering Index (CRI): 75<br>Beam Angle: 120 degrees<br>Design and finishing<br>• Material: Synthetics<br>• Colour: White<br>Technical specifications<br>• Mains power: Range 220 V - 240 V<br>• IP code: IP20, protection against objects bigger than 12.5 mm, no protection against water<br>• Class of protection: II - double insulated | **20** | **mtrs.** | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **12.6** | Supplying, installing, testing and commissioning of **wall bracket fan** of 400 mm, complete with moulded propeller type blades, and accessories suitable for operation on 230 / 240 Volts, 50 Hz, single phase, A.C. supply. | **17** | **Nos** | | | |
| **12.7** | Providing & fixing BELL POINTS on wall /Partition with 2x1.0 sqmm copper conductor in PVC medium gauge conduit(IS:9537) with call bell switch(Push Type) including call bell Multi Tune Bell etc. complete. | **2** | **Each** | | | |
| | | | | | | |
| **13** | **DATA CABLING** | | | | | |
| **13.1** | Supply & fixing the following size of PVC conduit in Floor/Surface of wall, including cutting the Floor/Wall and make the good the same as required (Data Cabling per lan point ) | **12** | **no.** | | | |
| **13.2** | Supply & fixing flush steel box for computer data outlet dully recessed in wall complete with modular cover plate, computer outlet RJ-45 including connections etc. required. | **12** | **Nos** | | | |
| | | | | | | |
| **13.3** | Supply and drawing of cat 6 Data cable in existing conduit complete as required per lan point . | **12** | **no.** | | | |
| | | | | | | |
| **15** | **EARTHING** | | | | | |
| **15.1** | Supply and fixing of 32mm x 6mm thick copper strip insulated with PVC sleeve from existing earthing pit to proposed Distribution Boxes on all floors (one for body and one for complete wiring) from earth electrode including connection etc as required. | **50** | **RM** | | | |
| | | | | | | |
| **16** | **RACEWAY: including cutting of the floor and fixing as and wherever required.** | | | | | |
| **16.1** | Supply, fixing, laying, hanging and embedding in wall of MS powder coated raceway top cover openable with counter sunk screws, painted stove enamelled approved colour the cover should be tight on channel with counter sunk screws to avoid entry of vermins. It should be tightened in such a way to avoid ingress of mosquito, moisture and dust. The MS Powder coated raceway / wire ways shall be complete with all accessories required such as bends, tees, reducers, offsets, cover, junction boxes etc. as reqd. | | | | | |
| **16.1.1** | Supply, laying, testing and commissioning of 100 MM wide x 2mm raceway with all requirements. | **20** | **RM** | | | |
| **16.1.2** | Supply, laying, testing and commissioning of 150 MM wide x 2mm raceway with all requirements. | **30** | **RM** | | | |
| **16.1.3** | Supply, laying, testing and commissioning of 300 MM wide x 2mm raceway with all requirements. | **20** | **RM** | | | |
| | | | | | | |
| **17** | **TELEVISION CABLE** | | | | | |
| **17.1** | Providing, drawing, connecting and testing of **Television cable,** Electrolytic grade solid annealed high conductivity copper conductor, gas injected physical polyethylene foam insulated, wrapped with aluminium tape and aluminium alloy wire braided, jelly flooded and PVC jacketing in black colour (Compatible to DTH TV signal), in existing MS/PVC conduit from television outlet box to the junction box / splitter / subscriber or dwelling unit / Dish antenna as required. (Make : Finolex / RR / Polycab / Skytone) | | | | | |
| **17.1.1** | RG - 6 | **50** | **rmt.** | | | |
| | | | | | | |
| **18** | **MAIN PANEL** | | | | | |
| | Design, fabrication, assembling, supply, installation, testing and commissioning of Main panel suitable for 415 V, 3 phase, 50 Hz, 4 wire power supply system. | | | | | |
| | Panels shall be fabricated out of 2 mm thick CRCA sheet steel in cubical formation, compartmentalized in Form 3b Construction, floor mounted, free standing and shall be dust and vermin proof. 3 mm thick cable gland plate, shall be provided both at the top and the bottom of the panel. | | | | | |
| | 125 amps MCCB & 200 AMP Bus Bar. | | | | | |
| | | | | | | |
| | 0-500 Volts digital electronic volt meter with selector switch shall be protected by 2 amps TP MCB's. | | | | | |
| | | | | | | |
| | 0- 125 Amps digital electronic ammeter with selector switch and 60/5 amps 10 VA, CL 1 CTs . | | | | | |
| | | | | | | |
| | ON/OFF/TRIP indicating light shall be protected by 2 amps SP MCB's. | | | | | |
| | | | | | | |
| | Bus Bars | | | | | |
| | 1. Krypton Power Controller | | | | | |
| | 200 amps TPN aluminium bus bars with heat shrinkable insulation sleeve. | | | | | |
| | 2.Amptech Electric India. | | | | | |
| | 3. Advance Controls Pvt. Ltd. | | | | | |
| | Outgoing | | | | | |
| | 63 amp TPN MCB - 1 Nos. | | | | | |
| | 40 amp DP MCB - 2 Nos. | | | | | |
| | 63 amp DP MCB - 1 No. | | | | | |
| | Spare MCB's of the following | | | | | |
| | | | | | | |
| | 63 amps TPN MCB - 1 No | | | | | |
| | 40 amps DP MCB - 1 Nos | | | | | |
| | All MCB shall be of 15 KA breaking capacity. | | | | | |
| | | | | | | |
| **18.1** | Main panel as described above | 1 | nos. | | | |
| | | | | | | |
| | **TOTAL OF ECTRICAL/LIGHTNING/DATA/TELEPHONE CABLING/FIRE ALARM/RACEWAY etc.** | | | | | |
| | | | | | | |
| **III.O** | **HVAC WORKS** | | | | | |
| | | | | | | |
| **1** | **OUTDOOR UNIT** | | | | | |
| | Supply, Installation, Testing, Commissioning of Outdoor condensing unit comprising of scroll type inverter multi compressor's , Heat Exchanger, propeller / axial fans, refrigerant Circuit, Safety Devices & Oil Recovery System and in built starter. The starter unit shall be operated both from local and remote Necessary Refrigerant Gas and oil charge.Compressor shall be equipped with inverter controller to be efficient & quiet. The outdoor unit shall have the multi-step of capacity control to meet load fluctuation and indoor unit individual control. Heat Exchanger shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross fin coil. Refrigerant shuold be R410A<br>MAKE : TOSHIBA / MITSUBISH | | | | | |
| **1.1** | **12 HP** | **1** | **Nos.** | | | |
| | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2** | **INDOOR UNIT** | | | | | |
| | Supply, Installation,Testing & Commissioning of following capacity modulating type 4 way cassette VRV system Indoor unit along with cordedless remote, necessary supports, nuts & bolts etc complete. | | | | | |
| | 4-Way Casette Type Units : | | | | | |
| **2.1** | Cassette Type : 1.0 TR | **9** | **Nos.** | | | |
| | | | | | | |
| **2.2** | Cordless Remotes | **6** | **Nos.** | | | |
| | | | | | | |
| **3** | **CENTRAL REMOTE CONTROLLER :** | | | | | |
| **3.1** | Central Remote Control | **1** | **Nos.** | | | |
| | | | | | | |
| **4** | **Y' JOINTS** | | | | | |
| **4.1** | Supply, Installation, Testing & Commissioning of Y-joints . | **12** | **Nos.** | | | |
| | | | | | | |
| **5** | **COPPER PIPE** | | | | | |
| | Supply, installation, testing & commissioning **refrigerant liquid line and suction line (duly insulated )piping** with nitrile foam insulation of 13mm up to 25mm & 19mm for above size. | | | | | |
| **5.1** | 06.35 mm | **10** | **Rmt.** | | | |
| **5.2** | 09.52 mm | **15** | **Rmt.** | | | |
| **5.3** | 12.70 mm | **20** | **Rmt.** | | | |
| **5.4** | 15.88 mm | **25** | **Rmt.** | | | |
| **5.5** | 34.92 mm | **15** | **Rmt.** | | | |
| | | | | | | |
| **6** | **TRANSMISSION CABLE** | | | | | |
| | Supply, installation, testing & commissioning of **transmission cabling** between indoor & outdoor in PVC Conduit | | | | | |
| **6.1** | 2 C * 1.5 sq.mm Cable | **150** | **Rmt.** | | | |
| | | | | | | |
| **7** | **POWER CABLE** | | | | | |
| | Supply of Electrical Power cable between the indoor unit and power socket with unshielded copper cable, with 1 no. plug top for each IDU. | | | | | |
| **7.1** | 3 Core, 2.5 sqmm Cable | **15** | **Rmt.** | | | |
| **7.2** | 4 Core, 16 sq mm cable | **30** | **Rmt.** | | | |
| | | | | | | |
| **8** | **DRAIN PIPING** | | | | | |
| | Supply, installation, testing & Commissioning of following sizes insulated **PVC** drain pipes. | | | | | |
| **8.1** | 25mm | **20** | **Rmt.** | | | |
| **8.2** | 32mm | **30** | **Rmt.** | | | |
| **8.3** | 40mm | **40** | **Rmt.** | | | |
| | | | | | | |
| **9** | **ISOLATOR SWITCH FOR VRV OUTDOOR UNIT** | | | | | |
| **9.1** | Supply, Installation, Testing & Commissioning of isolator switch for Outdoor Unit with sheet metal enclosure, rain protection etc. as required to suit the site condition. | **1** | **Nos.** | | | |
| | | | | | | |
| | | | | | | |
| | **TOTAL OF HVAC WORKS** | | | | | |
| | | | | | | |
| | **ABSTRACT OF CIVIL, INTERIOR-FINISHING, FURNITURE, PLUMBING, ELECTRICAL & HVAC WORKS** | | | | | |
| **1** | **TOTAL AMOUNT - CIVIL - INTERIOR FURNISHING, PLUMBING WORKS** | | | | | |
| | | | | | | |
| **2** | **TOTAL AMOUNT - ELECTRICAL WORKS** | | | | | |
| | | | | | | |
| **3** | **TOTAL AMOUNT - HVAC WORKS** | | | | | |
| | | | | | | |
| **4** | **TOTAL AMOUNT OF ALL THE WORKS (1+2+3) [excluding GST]** | | | | | |
| | | | | | | |
| **5** | **DISCOUNT (IF ANY)** | | | | | |
| | | | | | | |
| **6** | **TOTAL AMOUNT FOR CIVIL, INTERIOR-FINISHING, FURNITURE , PLUMBING, ELECTRICAL & HVAC WORKS (AFTER DISCOUNT) [4-5]** | | | | | |
| | | | | | | |
| **7** | **ADD GST @18%** | | | | | |
| | | | | | | |
| **8** | **FINAL AMOUNT (INCLUDING GST) [6+7]** | | | | | |