**File no. EI-D-GA002/7/2014-GA**

**ERNET India**
**(An Autonomous Society under Department of Electronics & Information Technology), Govt. of India)**
**10th Floor, Jeevan Prakash Building**
**25 KG Marg,**
**New Delhi - 110001**

**Tender document**

**for**

# BALANCE ELECTRICAL, FIRE ALARM, LOW SIDE HVAC, FIRE SUPPRESSION, PARTITIONING AND INTERIOR WORK

**AT**

5TH FLOOR, Block-1,
DMRC IT PARK,
SHASTRI PARK, DELHI

**05.09.2014**

**LETTER SUBMITTING TENDER**

To,
THE REGISTRAR & CPO
ERNET India
25 KG MARG,
JEEVAN PRAKASH BUILDING
NEW DELHI - 110001

Dear Sir.

With reference to the tender invited by you for the work.

I/ We hereby offer to execute the work under contract at the respective rates mentioned in the schedule of quantities.

I/ We have seen the site, understood the site condition, general conditions of contract & special conditions.

I/ We agree to execute the work as per specifications, general conditions of contract & special conditions.

I/ We deposit earnest money - by demand draft/ pay order which amount shall not carry any interest. I/we do hereby agree that the sum shall be forfeited by the bank in event our tender is accepted & I/We fail to execute the contract when required to do so.

Yours faithfully,

(Contractor)
Signature of partner/prop. of the firm. In the
presence of our banker

**INVITATION OF TENDER**
MEMORANDUM OF WORK

**ERNET India**, an Autonomous Scientific Society under Department of Electronics & Information Technology, Govt. of India, is a Class `A' Internet Service Provider for the Education and Research community in India.

2. We intend to carry out the Balance Electrical Work, Fire Alarm System, HVAC, Plumbing work and Interior and Partitioning work in our premises at DMRC, Shastri Park, 5th Floor. Bill of Material and Technical specification are enclosed as **Annexure I and Annexure II (A,B &C)** for your reference. Therefore, sealed tenders are invited to carry out Balance Electrical Work, Fire Alarm System, HVAC, Fire Suppression and Interior and Partitioning work at out premises i.e. 5th Floor, DMRC Building, Shastri Park, Delhi – 110053.

**3. Kindly depute your representative to inspect the premises before submitting your quotation, if you so desire.**

4. Kindly submit your sealed quotation strictly as per **Annexure – I and Annexure II(A,B &C)** to the undersigned by **25.09.2014 at 3:00 PM,** failing which it would be assumed that you are not interested. Quotations will be opened on the same day at 03.30 PM.

5. Quotations should be submitted in two separate sealed covers. First cover indicating, **"COVER FOR TECHNICAL SPECIFICATION"** should consist of (i) Tender fee of Rs. 2000/- (in case the tender document is downloaded from ERNET's Website) (ii) EMD of Rs. 1.00 Lac as per para ; (iii) documents as per eligibility criteria detailed below; (iv) unpriced bill of material alongwith technical specifications of the products offered along with literature, pamphlets, drawings etc. Price column in this cover should be kept blank. Second cover indicating, **"COVER FOR PRICE BID"** should consist the same details of first cover as well as price details also. **Both the covers should first be sealed separately**, and then both the covers should be kept **in a single sealed bigger cover.** This cover addressed by name to the officer signing this enquiry should be submitted to ERNET India, 10th Floor, Jeevan Prakash Building, 25 KG Marg, New Delhi – 110001 at or before 3.00 PM on 25.09.2014. Bids will be opened on the same day at 3.30 PM on 25.09.2014. If the office happens to be closed on the date of receipt of the tenders as specified, the tender will be received and opened on the next working day at the same time and venue.

6. All the prospective bidders may submit their queries regarding the contents of the tender document by 10.09.2014 at 11.00 AM. A Pre bid meeting will be held on 10.09.2014 at 11.00 AM in ERNET India, 10th Floor, Jeevan Prakash Building, 25 KG Marg, New Delhi – 110001 to deliberate the queries received and to clarify the issues if any, and to answer the questions on any matter that may be raised at that stage as stated. Responses to the queries of the bidders will only be uploaded on ERNET's Website by 15.09.2014. ERNET India has a right to add any additional information/ alter in the bill of material in the tender document as a result of pre bid meeting with the prospective bidders.

7. All prospective bidders are advised to refer to ERNET's website for any update/additional information, before submission of their bids.

**Eligibility Criteria**

**The bidder can be an organization/ institute/ company/ Corporation/ Society/ Trust/ Firm/ Registered / incorporated in India fullfiling at least the following criteria and must also submit documentary evidences in support of fulfilling these documents.**

(i) The bidder can be a company/ Corporation/ Society / Trust Firm, Registered in India and should be in existence prior to 01.04.2009. Consortium in any form is not allowed.

(ii) The bidder must have successfully competed at least one project of similar nature for a value not less than Rs. 80.00 Lacs or two projects of value not less than Rs. 50.00 Lac each or three project of Rs. 40.00 Lac each in the last three years.

**II. Documents Establishing Bidders Eligibility:**

1. In case bidder is a company- Certified copy of the certificates of incorporations for companies & Memorandum and articles of association.

Or

In case the bidder is a registered society – Certified copy of registration deed with objects of constitution of society.

Or

In case bidder is a corporation – Authenticated copy of the parent stature.

Or

In case of proprietary concern – documents authenticating the same

Certified copies of documents submitted, as above, must be signed in ink and carry the seal of the signatory.

2. List of present Directors/ owners/ Executives Council of Members/ trustees/ Board members as applicable.

3. Copy of Income tax returns filled in last three years.

4. Copy of Service Tax Registration Certificate

5. Audited Balance Sheet and Income Statement for three years of 2010-11, 2011-12 and 2012-13 duly signed in ink by the authorized signatory of the bidder and his/ her auditor.

6. Any other Documentary evidences (signed in ink by authorized signatory) providing that bidder fulfills the eligibility criteria.

7. General Information / profile on the bidders company.

**General Conditions :**

**1. This tender has been divided in to (3) three separate parts/ section. First part consists of Electrification and Fire Alarm System work, (ii) HVAC & Fire suppression systems and (iii) Interior and Partitioning work. Accordingly, it is informed that bidder has a choice to participate either in only one or two section or in all sections. L1 bidder will be decided as per individual section i.e. A,B &C of Annexure II.**

2. Bids should be valid for a minimum period of 180 days after the due date.

3. Envelope should bear the inscription

**"Quotation for Tender for Balance work of Electrical, Fire Alarm, HVAC, Fire Suppression, Interior and partitioning work at DRMC Shastri Park**

**"Tender Enquiry No.: EI-D-GA002/7/2014-GA"**

- **Tender dated : 05.09.2014**
- **Pre bid meeting with queries 10.09.2014 at 11.00 AM**
- **Response to queries 15.09.2014**

- **Date and Time for submission of Bid** **25.09.2014 (3.00 PM)**

- **"Due Date & Time for Opening of Bids:** **25.09.2014 (3.30 PM)**

4. The Bids must reach the undersigned on or before the due date. Bids received after the due date & time i.e. by **25.09.2014 at 3.00 PM** is liable to be rejected. In the event of due date being a closed holiday or declared Holiday for Central Government offices, the due date for submission of the bids will be the following working day at the appointed time & venue.

5. The rates should be quoted in Indian Rupees for provision of deliverables at the premises of ERNET India. All prices shall be fixed and shall not be subject to escalation of any description. The rates must be quoted as per the Performa provided in **Annexure-II (A,B & C).** Price comparison will be made as per bill of material specified in individual section of **Annexure – II (A,B & C) . L1 for each section will be decided individually. Hence bidder will be free to quote for any or all sections of Annexure-II.**

6. Govt. Levies like sales tax, octroi, WCT etc., if any, shall be paid at actual rates applicable on the date of delivery. Rates should be quoted accordingly giving the basic price, Sales Tax etc., if any.

7. It may specifically be mentioned whether the quotation is strictly as per tender specifications/conditions. If not, deviations must be spelt out specifically. **In the absence of this, the quotation would be deemed to be in compliance and the vendor has to accept the conditions as specified in the tender document.**

8. Please give the Registration number of the firm along with the LST/CST/WCT No. allotted by the concerned authorities in your quotation.

9. ERNET India reserves the right to accept or reject any bid or cancel the tender proceedings without assigning any reason there of or :

**(a) To accept or reject any tender in whole or in part.**
**(b) To increase or decrease the quantities of any item and bidder has to execute the same at the rate quoted.**

10. **Incomplete quotations are liable to be rejected.**
11. Bidder shall sign all pages of quotation and drawings forwarded with the quotation.

12. In case of any discrepancy between rates mentioned in figures and words, the latter shall prevail.

13. ERNET India may waive any minor infirmity or may seek any clarification, if so desired.
14. Any attempt of negotiation direct or indirect on the part of the bidder with the authority to whom he has submitted the tender or authority who is competent finally to accept it after he has submitted his tender or any endeavor to secure any interest for an actual or prospective bidder or to influence by any means the acceptance of a particular tender will render the tender liable to be excluded from consideration.
15. The vendor will have to arrange for all the testing equipment and tools required for installation, testing, maintenance etc.
16. The vendors should give clause-by-clause compliance for the technical specification of the equipments in their technical bids.

17. **INSPECTION**

ERNET India or its representative shall have the right to inspect or to test the items to confirm their conformity to the ordered specifications. The supplier shall provide all reasonable facilities and assistance to the inspector at no charge to ERNET India. In case any inspected or tested goods fail to conform to the specifications, ERNET India may reject them and supplier shall either replace the rejected goods or make all alterations necessary to meet specification required free of cost to ERNET India.

18. **EARNEST MONEY DEPOSIT**

i) Bidder firm should submit the Earnest Money Deposit of Rs.1,00,000/- (Rupees One Lakh Only) for every section in the form of Demand Draft/Pay Order/Bank Guarantee of any Nationalized Bank taken in the name of ERNET India, New Delhi. Bank Guarantee should be valid minimum for a period of 180 days from due date of the quotation. **Quotations received without Earnest Money Deposit are liable to be rejected. Example: if one bidder is submitting bids against all the 03 section of the tender, the bidder should submit 03 EMD of Rs. 100,000/- each along with technical bid of respective sections.**

ii) **Tender fee – Bidder is required to submit Tender fee of Rs. 2000/- alongwith technical part of the bid. Tender fee will not be refundable.**

iii) **Security Deposit in the form of Bank guarantee shall be submitted by the Selected vendor within 15 days after issue of work order. Security deposit shall be 10% of the total cost of work order. In case of non submission of Security Deposit, the EMD of the selected bidder will be forfeited in addition to cancellation of Purchase Order.**

iv) **Performance bank guarantee should be valid for a minimum period of 15 months from the date of issue of work order.**

v) Earnest Money is liable to be forfeited and bid is liable to be rejected, if the bidder withdraw or amends, impairs or derogated from the tender in any respect within the period validity of the tender i.e. 180 days.

vi) The earnest money of all the unsuccessful bidders will be returned after placement of order on the selected vendor. No interest will be payable by ERNET India on the Earnest Money Deposit.

vii) The **Performance bank guarantee** of successful bidder shall be returned after successful delivery, installation, furnishing of material and successful completion of 01 year from the date of handover of fully furnished site with respect to their section of work.

**19. Time limit:**

The above said work for all the sections OR any section to be carried out at DMRC premises within one month (30 Days) from the date of issue of Purchase Order. Contractor should keep in mind that the above referred work is critical in terms of time frame and should be completed within a prescribed time i.e. 30 days from the date of issue of Purchase Order.

**20. Payment terms:**

(i) 40% payment will be considered after completion of 50% work at the site with the certification of Project Implementation Team or by ERNET India authorized consultant.

(ii) 50% payment will be consider edand release after completion of work at the site with the certification of Project implementation Team or by ERNET Authorized consultant.

(iii) Balance 10% payment will be considered after Defect Liability Period of 9 months (Refer para 23) from the date of completion of satisfactory work and also after carrying out defect if any observed during defect liability period.

**Special Conditions :**

1. Bidder are requested to read the tender documents, general conditions, special Conditions, drawing, specifications, schedule of quantities, etc. carefully and offer most competitive rate after visiting site.

2. Contractor in their own interest are advised to visit the site & get themselves familiarize in the prevailing situations before submitting their rates. No claim whatsoever for ignorance, misunderstanding shall be entertained later.

3. The contractor shall be responsible for making good in expeditions & workman like manner. Any defects, which may be found within one years of the handing over the premises, shall have to be rectified / replaced by the bidder at no additional cost. In case contractor fails to do so, the same would be got done at his cost & risk. The cost incurred by the ERNET shall be deducted from the PBG or any other dues.

4. Unit rates shall be quoted in English in figures as well as in words with reference to each item and for all items shown in the attached schedule of quantities. The amount of each item should be worked out.

5. The tender shall sign and every page of the tender documents including the layout drawings attached here to.

6. Tender not containing the full particulars as mentioned above or as called for in the special conditions is liable to summarily rejection.

7. The samples of all the material & work item shall be got approved from the Architect/ competent authority/ Project Implementation team before proceeding further on the work.

8. The drawing contains sketches showing salient features details at the various scales indicating extent work & specifications to be followed. These can be modified by the ERNET from time to time in accordance with technical requirements at the site.

9. Any damage done to the property of the ERNET during execution of the work shall be Responsibility of the contractor & it shall be made good by him, at his cost to the entire satisfaction of the ERNET India.

10. ERNET India shall have full power to get the material or workmanship etc. inspected & tested by an independent agency for its soundness & adequacy.

11. The contractor shall examine all drawings before quoting & commencing of actual work & report to the Company/ ERNET India any discrepancies for omission & shortcomings in the drawings.

12. The work shall be of highest standard both as regard to material & workmanship. Modern tools & first-class latest techniques shall be employed for its execution.

**13 Sufficiency of Tender**

The contractor shall be deemed to have satisfied himself before tendering to the correctness and sufficiency of his tender for the work and of his prices for the work and of his prices stated in the schedule, which shall, except in so far as it is otherwise provided in the contract, cover all his obligations under the contract and all matters and things necessary for the proper completion and maintenance of the work.

**14. 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 employer.

**15. Power to make Alterations**

ERNET India 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 implementation committee 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.

**16. Disruption of Progress**

The contractor shall give written notice to ERNET India 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/ ERNET India 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.

**17. Rectification of Defects**

if, it shall appear to the Architect/ competent authority 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/ competent authority specifying the work material or articles complained of shall rectify or remove and reconstruction work so specified in part, as the case may require.

**18. Variation**

In case the quantity of any item of the work executed increases by more than 50% from the quantity given in the tender document, the rate of such item would be settled as under:

a) Rate of the item worked out as per market rate

b) Rate of the item quoted by the contractor.

The rate of such item would be lowest of the two rates mentioned above.

**NOTE : The quantity of items may increase or decrease as per the requirement of the site. The work at the site w.r.t. Interior, HVAC, Plumbing and electrical has been carried out partially. Before submitting the bid, Vendor may inspect the site and note the balance work to be carried out at the site. Due to partial work already done at the site, bill of Quantity, queries of bidders and other specifications/ standard of products shall be discussed and finalized in the pre bid meeting.**

19. The contractor shall submit the samples of various materials for the approval of ERNET India or its representative. The contractor shall use the material only after the approval of ERNET India or its representative.

**20. 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 ERNET officer or its authorized agency. He shall provide facilities and space to the satisfaction of ERNET India or his representative for inspection of any part of work.

**21. Hindrance Register**

A Hindrance Register shall be maintained by the contractor at the site 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 initiated by the ERNET India or his representative.

**22. Contradiction between BOQ, Specifications and Drawings:**

In the event of conflicts between BOQ, Specifications, Drawings, the BOQ shall take precedence over the specifications and drawings. Keeping the general intent of the scope of work under said contract, the Architect/ consultants would interpret the requirement of the design intent & contract and their decision shall be final and acceptable to all concern including the contractors

**23. 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 employer any defect which may develop or may be noticed before the expiry of 9 (nine) 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.

**24. Security**

Security of all thhe materials and labour at site shall be contractor's responsibility at his own cost.

**25. Fire Certificate**

Vendor have to facilitate the Fire Certificate from the Govt. Authority. Charges/ fee in this regard will be paid by ERNET India as per the Bill of material ( Refer Electrical and Fire Alarm System head Sub Head "I")

**26. Insurance of staff:**

The contractor shall insure all his staff working at site against injury, loss of life etc., and claims of compensation will be entertained by the owners, employers in this regard.

**27. Liquidity damages**

If the contractor fails to complete the works within the time for completion stated in the appendix/ elsewhere or within any extended time under Clause here of, the contractor shall pay the employer the sum at the rate of 1% of the contract value per week of the non-completed works subject to a maximum limit of 10% of the contract value as Liquidated Damages for the period during which the said works shall so remain incomplete or the employer may deduct aforesaid sum towards such damages from any monies due to the Contractor.

**28. TERMINATION CLAUSE**

Either party i.e. ERNET India or bidder can terminate the service agreement by giving notice in advance. In case, the bidder stops the work without notice, ERNET India has the right to encash the bank guarantee.

**29. ARBITRATION LAWS**

Except where otherwise provided for in the contract, all questions and disputes relating to interpretation and application of the provisions of the contract shall be settled mutually within thirty (30 days) days (or such longer period as may be mutually agreed upon) from the date of either party notifies in writing that such dispute or disagreement exist, under the Rules of India Arbitration and Conciliation Act, 1996. The venue of arbitration shall be New Delhi, India. The arbitration resolution shall be final and binding upon the parties and judgement may be entered thereon, upon the application of either party, by any court having jurisdiction. This contract shall be governed by the Indian laws.

Yours faithfully,

(Bhupal Singh)

Registrar & CPO

**Annexure I**

**Section A Electrical and Fire Alarm System**

**Specifications for Electrical work**

1. SPECIFICATION FOR ELECTRICAL WORK

2. GENERAL SPECIFICATOIN FOR: FIRE ALARM SYSTEM
Fire fighting

Fire clearance from DMRC/ Delhi Fire Service, MICC cabling if required for fire clearance

## 1.1 SCOPE

1.1 The scope of the contract shall be the design, manufacturer, supply and erection including testing and commissioning of the entire electrical system including all equipment and accessories, in accordance with the specifications and documents, at the site of proposed project.

1.2 The general terms & conditions shall form a part of the specifications and documents.

2.0 **DESIGN:** The Contractor shall design his equipment etc. as per requirements of codes & standards mentioned in the documents. The tenderers shall submit criteria of design adopted by them along with the tender.

In general, the contractor shall supply, store, erect, test and commission all the equipment required for Electrical Installation. The contractor shall furnish all the materials, labour, tools and equipments for the electrical work, as shown in the accompanying drawings and in the bill of quantities and specifications hereinafter described.

## 1.2 CONTRACTOR

The Contractor shall be a licenced electrical contractor, possessing a valid electrical contractor's license in the state, employing licensed supervisors and skilled workers having valid permits as per the Regulation of Indian Electricity Rules and Local Electrical Inspector's requirements. (In case the contractor does not have licence of that state then it should be clearly stated through which local electrical contractor they shall submit the test report & a copy of the valid licence of the contractor be enclosed along with the copy of their own licence of the state of their registration).

**1.3** The installation shall conform in all respects to Indian standard Code of Practice for Electrical Wiring Installation I.S. - 732 and 'National Electrical Code'. It shall be in conformity with the current I.E Rules and Regulations and requirements of the local Electric Supply Authority in-so-far as these become applicable to the installation. Wherever this specification calls for a higher standard of materials and/or workmanship then those required by any of the above regulations, these specifications shall take precedence over the said regulations and standards.

In general, the materials, equipments and workmanship not covered by the above, shall conform to the following Indian Standards (Latest Edition) unless otherwise called for:

### 1.3.1 SWITCHGEAR

| | | | |
|---|---|---|---|
| a. | Requirements of A.C. Circuit Breakers. | : | IS 2516 (Part I) Sec.1,2 & 3 (Part-II) |
| b. | Switches and Switch Isolators above 1000V But Not Exceeding 1.1 KV | : | IS 4710 |
| c. | Markings & arrangements for switchgear bus-bars, main connection & auxilliary wiring | : | IS 375 |
| d. | Specifications for normal duty air break switches & composites unit for air break switches and fuses for voltage not exceeding 1000 Volts. | : | IS 4064 |
| e. | Heavy duty air-break switches and composite units of air-break switches and fuses for voltages not exceeding 1000 Volts. | : | IS 4047 |
| f. | Specification for miniature circuit breakers. | : | IS 8828 |
| g. | Specification for enclosed distribution, fuse boards and cut-outs for voltage not exceeding 1000 Volts | : | IS 2675 |
| h. | Installation and maintenance of switchgear. | : | IS 3072 (Part I) |
| i. | HRC cartridge fuse links 650 Volts. | : | IS 2208 |

### 1.3.2 CABLE

| | | | |
|---|---|---|---|
| a. | Specification for paper insulated and lead sheathed cables | : | IS 692 |
| b. | Code of Practice for installation and maintenance of paper insulated power cables (upto and including 33 KV) | : | IS 1255 |
| c. | Specification for PVC insulated (Heavy Duty) electric cables Part-I for Voltage upto 1100 Volts. | : | IS 1554 |
| d. | Specification for PVC insulated cables (for voltage upto 1100 V) (Part-II) with Aluminium conductors. | : | IS 694 (Part-II) |
| 3. | Specification for rigid steel conduit for electrical wiring. | : | IS 9537 |

| | | | |
|---|---|---|---|
| 4. | Specifications for rigid non metallic conduits for electrical installations. | : | IS 9537 |
| 5. | Specifications for accessories for rigid steel conduits for Electrical wiring. | : | IS 3837 |
| 6. | Box for the enclosure of electrical accessories steel and C.I. Boxes. | : | IS 5133 (Part I) |
| 7. | 3Pin plugs and sockets outlets | : | IS 1293 |
| 8. | Ceiling Roses | : | IS 371 |
| 9. | Adhesive insulating tapes for Electrical purposes (Part- I & II) | : | IS 2448 |
| 10. | General and safety requirements for Electrical lighting fittings. | : | IS 1913 |
| 11. | Watertight electric light fittings. | : | IS 3553 |
| 12. | Flood Lights. | : | IS 1947 |
| 13. | Ceiling fans and regulators. | : | IS 374 |
| 14. | Propeller type AG Ventilating fans | : | IS 2312 |
| 15. | Code of Practices for earthing. | : | IS 3043 |
| 16. | Glossary of terms for electrical cable and conductors. | : | IS 1885 |
| 17. | Code of Practice for buildings (General) Electrical installation | : | IS 1646 |
| 18. | Protection of buildings and allied structures against lighting. | : | IS 2309 |
| 19. | Current Transformers | : | IS 2705 (Part-I to III) |
| 20. | Voltage Transformer | : | IS 3156 (Part-I to III) |
| 21. | Power Transformer | : | IS 2026-1977 (Part-I to IV) |
| 22. | Installation Transformer | : | IS 10029 |
| 23. | Shunt capacitors for Power system | : | IS 2834 |
| 24. | Direct acting electrical indicating instruments | : | IS 1246 |
| 25. | Factory assembled switchgear | : | IS 8623 |
| 26. | Rating for Cable | : | IS 3961 (Part -II) |

27. Earthing : IS 3843

### 1.4 INSPECTION & APPROVAL OF THE WORK BY LOCAL AUTHORITY

On completion of this work, the contractor shall obtain and deliver to the owners the certificates of inspection and approval by electrical inspectorate of local Administration. The fees paid for inspection will be reimbursed on production of challan/receipt. The contractor shall include in his rates all charges necessary for getting electrical installation approved which includes Sub-station, LT distribution, etc. by the Chief Electrical Inspector to the state government or/ and from any other authority required for this job.

### 1.5 APPLICATION FOR ELECTRIC SUPPLY/ LIASON

The Contractor shall be responsible for filing and follow up application for electric supply to the project. The contractor shall carry out all the liason work required for obtaining electric supply at site commencing from filing of application. This liason shall be deemed to be a part of the contract.

## 2. L. T. PANELS (POWER CONTROL CENTERS & SWITCH BOARD PANELS)

**2.1 GENERAL:** Medium voltage power control centres (generally termed as switch board panels) shall be in sheet steel clad cubicle pattern, free floor standing type, totally enclosed, compartmentalized design. This specification shall cover the following types of panels:

a) Air circuit breaker panels - Drawout type with single or double tier arrangement as per design shown on the drawings.

b) Panels with one or more Air circuit breakers with Draw-out arrangement and switch-fuse units of non-drawout design.

c) Panels with switch- fuses of non- drawout type. However, the switch-fuse units can have drawout fuse-carriage if a particular make of switch-fuse is used.

The panels shall generally be of extensible type with provision for bus extension on or both sides as desired at the time of approved of shop drawings.

### 2.2 CODE/STANDARDS :

The panels shall generally conform to the requirements of following codes/ specifications:

a) IS-8623
b) IS-4237
c) IS-2147
d) IS-3072
e) IS-375
f) IS-1248 & 2419
g) IS-5082
h) IS-2705
i) IS-722
j) IS-4064
k) IS-2208
l) IS-6875
m) IS-6005

The equipment shall conform to Indian Electricity Rules as amended up-to-date. The supplier shall examine the provision of these codes and confirm or indicate his comments.

### 2.3 CONSTRUCTION:

Power control centres/ switch board panels shall of free standing type, with sheet steel enclosure having following features :

a) The panel shall be constructed of sheet steel of minimum 2.0 mm thickness. The internal frames shall be made of structural steel angles or made up sections (as per standard design of the manufacturer) specifications of which, shall be submitted along with offers.

b) The panel shall be compartmentalised to accommodate one feeder n each compartment. The main bus bar chamber shall be provided at the top of panel or bottom of the panel as required. The compartments shall be arranged in section with metallic/ phenol barrier in between.

A vertical cable alley of at least 200mm width shall be provided to serve one/ two vertical section of feeders. Cable alley shall have hinged door/ doors with rubber gaskets. Suitable cable clamping arrangement with slotted steel members shall be provided in the cable alley. Similarly, vertical bus bar shall be housed in-between two feeder compartments in a separate bus chambers. The opening between bus chamber and feeder compartments shall be properly covered with Bakelite/ Hylam sheets of 3mm minimum thickness. The vertical bus chamber shall be provided with removable bolted covers on the front and back side. All the interconnecting links to the feeders shall be shrouded so as to avoid accidental contact, by means of phenol barriers.

c) Each compartment shall have its own hinged door with concealed hinges. The doors shall have heavy duty rubber gasket fixed on the inner side of the door. The door shall have interlocking facility with the feeder unit.

d) The Panel shall have punched openings for mounting meters, lamps, push buttons, relays, etc.

e) The dimensions of feeder compartments, bus chambers and cable alleys shall be as shown on the relevant drawings. However, the following minimum dimensions shall be strictly adhered to :

i. ACB compartment: Drawout -600mm wide x 1000mm deep x 900mm high.

ii. SWITCH FUSE UNITS/MOULDED CASE CIRCUIT BRACKER (NON-DRAWOUT TYPE) :

| | | |
|---|---|---|
| Up to 63A/ 100A | : | 300mm wide x 225mm high x 400mm deep |
| 250A | : | 400mm wide x 400mm high x 400mm deep |
| 400A to 630A | : | 400mm wide x 500mm high x 400mm wide. (or vice- versa). |

iii. BUS CHAMBER:

| | | |
|---|---|---|
| Main bus (Horizontal) | : | 400mm high x 300mm deep |
| Vertical bus (Feeder bus) | : | 300mm wide x 400mm deep |

iv. Cable alley : Min. 200mm wide.

These dimensions are furnished as a guide and the clearances required in between each live bus/ link and between bus/ links to the earth (panel wall/ sheet) shall be as per relevant Indian Standard Code of practice. However, minimum clearance between neutral bus and earth shall not be less than 25mm. The panel supplier shall furnish detailed sectional drawings and also arrange to get the panel inspection done at intermediate stages of fabrication to avoid fault defective fabrication of the panels (however, the compliance of these specifications shall entirely be the suppliers' responsibility).

**2.4 BUS BARS :**

a) The bus bars shall be suitable for 3 phase, 4 wire, 415 volts 50 Hz AC supply. The bus bars shall be made of high conductivity aluminium. The bus bars shall have uniform cross-section throughout the length. The bus bars shall be designed for carrying rated-current continuosly. The bus bars and links shall be designed for a maximum temperature of $75^{O}C$. The max. current density of bus bars shall be as follows:

i. Copper : 1.86 Ampere/ Sq.mm. of cross section area.
ii. Aluminium: 1.28 Ampere/ Sq.mm. of cross section area.

It may be noted that these ratings are the upper limit to which the bus could be stressed. Suitable derating factors shall be applied to arrive at the correct cross section of bus bars.

b. Bus bars shall be supported on suitable non hygroscopic, non combustible, material such as DMC/ SMC at sufficiently close intervals to prevent bus bar sag. All bus bar joints shall be provided with high tensile steel bolts (electro plated with suitable metal such as Nickel/ Cadmium), spring washer and nuts so as to ensure good contact. Alternatively, electroplated/ tinned brass bolts shall be used. The joints shall be formed with fish-plates on either side of bus bar to provide adequate contact area. Bus supports shall be provided on either side of joints (max. unsupported distance from the joint 400mm)

c. Power shall be distributed to feeders in dual section by a set of vertical bus bars (Phases+neutral). Individual module shall be connected to the vertical bus bars through sleeved connections.

d. Bus bars shall be insulated with PVC sleeves (heat shrink type) with colour coding (Red/ Blue/ Yellow/ Black).

e. The bus bars and their supports shall be able to withstand thermal and dynamic stresses due to the system short-circuits. The supplier shall furnish calculations alongwith his drawing establishing the adequacy of bus bars both for continuous duty and short -circuit rating. Short circuit withstand capacity shall be for one second. Calculations for spacing of supporting of supports shall also be furnished.

**2.5 EARTHING:** The panels shall be provided with a copper earth bus running throughout the width of the switchboard. Suitable earthing eyes/bolts shall be provided on the main earthing bus to connect the same to the earth grid at the site. Sufficient number of star washers shall be provided at the joints to achieve earth continuity between the panels and the sheet metal parts.

**2.6 MOUNTINGS:** Panels incorporating switchfuse units shall have suitable compartments of standard width. Each compartment shall incorporate a heavy duty load break switchfuse and HRC fuses. Suitable cable termination arrangement shall be provided for switchfuse/ fuse-switch unit feeders. Equipment shall be provided with proper fastening arrangements to ensure vibration free operation. Proper designation as given on the respective drawings shall be provided for every equipment.

Circuit breakers shall be mounted such that they are accessible from the front of the panel. More than two circuit breakers shall not be incorporated in a vertical section. The breakers compartment

shall be divided into two parts, one for the breaker and the other for incorporating associated control gear. The necessary instrumentation shall be provided on the door of the compartment.

**2.7 INTERLOCKING**

The panels shall be provided with the following interlocking arrangements :

a. The door of the feeder compartments is so interlocked with the switch drive or handle that the door can be opened only if the switch is in "OFF" position. De-interlocking arrangement shall also be provided for inspection.

b. It shall not be possible for the breakers to be withdrawn when in "ON" position.

c. It shall not be possible for the breakers to be switched "ON" unless it is either in fully inserted position or for testing purposes it in fully isolated position.

d. The breaker shall be capable of being racked into "testing", "isolated" and maintenance position and kept in any of these positions.

e. A safety catch to ensure that the movement of the breaker as it is withdrawn, is checked before it is completely out of the cubicle shall be provided.

**2.8 PROTECTION AND INSTRUMENTATION :** Protection and instrumentation shall be as per standard specification.

**2.9 WIRING**: All the interconnections between the incoming, bus and the outgoings of 100A and above rating shall be done by insulated links/ strips of suitable sizes. Switch fuses and equipments below 100A rating shall be wired with PVC insulated copper conductors. The wiring for instrumentation protection and control equipment shall be carried out with PVC insulated flexible copper conductors.

The Power interconnections shall be carried out by means of bolted connections with washers. The wiring shall be terminated by using crimping sockets. Wring shall be laid out neatly in bunches which are fastened to the steel members of the panel. All the potential circuits shall be protected by fuses mounted near the tap-off point from the main connections.

**2.10 TERMINALS:** All the control, instrumentation and protection wiring shall be provided with printed PVC ferrules at both ends. For terminating control cables on to the equipment in the panels, suitable terminals blocks shall be provided. The terminal shall also be numbered for easy identification and maintenance.

**2.11 SURFACE TREATMENT**: All sheet metal accessories and components of power, control centres and switchboard panels shall be thoroughly cleaned, degreased, derusted and phosphatised before redoxide primer is applied. The panel shall be stove enameled to the required final finish. The interior surfaces of the panel shall also be painted to required shade. The supplier shall indicate in his offer, if there is any deviation from the treatment specified above.

**2.12 ENCLOSURES**: The panel enclosure shall be dust and vermin proof and shall be suitable for indoor installation. Enclosure design shall be in accordance with the requirements of IP 54 as per

IS-2147-1962. The supplier shall confirm whether this requirement is met and a type test certificate furnished. If type test certificate for IP-54 is not available, the same shall be brought out clearly in his offer.

**2.13 NAME PLATE**: The panel as well as the feeders compartment doors shall be provided with name plates giving the switchboard/ feeder descriptions as indicated on the drawings.

**2.14 TESTING**: The power control centres shall be tested at factory after assembling of all components and completion of all interconnections and wiring. Tests shall be coducted in accordance with the requirements relevant IS Codes/ specifications.

a. INSULATION TEST

i. Insulation of the main circuit, that is, the insulation resistance of each pole to the earth and that between the poles shall be measured.

ii. Insulation resistance to earth of all secondary wiring should be tested with 1000V megger. Insulation test shall be carried out both before and after high voltage test.

b. HIGH VOLTAGE TEST :

A high voltage test with 2.5KV one minute shall be applied between the poles and earth. Test shall be carried out on each pole in turn with the remaining poles earthed. All units racked in position and the breakers closed. Original test certificate shall be submitted along with panel.

## 3. SPECIFICATION FOR MOULDED CASE CIRCUIT BREAKERS:

**3.1 GENERAL :** Moulded case circuit breakers or fuse free breaker shall be incorporated in the switch board wherever specified. MCCBS shall conform to BS: 3871 Part II or JIS-C-8370 in all respects. MCCBS shall be suitable either for single phase 230V or three phase 415volts.

**3.2 CONSTRUCTION :** The MCCB and case shall be made of high strength heat resistant and flame retardant thermo-setting insulating material. Operating handle shall be quick make/quick break, trip-free type. The operating handle shall have suitable “ON”, “OFF” and “TRIPPED” indicators. Three phase MCCBS shall have a common operating handle for simultaneous operation and tripping of all the three phase. Suitable arc extinguishing device shall be provided for each contact. Tripping unit shall be of thermal-megnetic type provided on each pole and connected by a common trip bar such that tripping of any one pole actuates three poles to open simultaneously. Thermal magnetic/tripping device shall have IDMT characteristics for sustained over loads and short circuits. Contact tips shall be made of suitable are resistant, sintered alloy for long electrical life. Terminals shall be of liberal design with adequate clearances.

**3.3 ACCESSORIES :** MCCBS shall be provided with the following accessories, if specified in schedule of quantities:

i. Under voltage release
ii. Shunt release
iii. Alarm Trip alarm
iv. Auxiliary contacts.

**3.4 INTERLOCKING :** Moulded case circuit breakers shall be provided with the following interlocking devices for interlocking the door of switch board:

a. Handle interlock to prevent unnecessary manipulation of the breaker.
b. Door interlock to prevent the door being opened when the breaker is in "ON" position.
c. De-interlocking device to open the door even, if the breaker is in "ON" position.

**3.5 RUPTURING CAPACITY:** The moulded case circuit breaker shall have a returning capacity of not less that 10KA Rms at 415 volts. Wherever required, higher rupturing capacity breakers to meet the system short circuit fault shall be used. All such ratings shall be as per equipment schedule/B.O.Q.

**3.6 TESTING:**

a . Original certificate of the MCCBS as per BS:3871 or JS-C-8370 shall be furnished.
b. Pre-commissioning tests on the switch boards panel incorporating the MCCB shall be done as per specifications.

## 4. SPECIFICATION FOR METERING, INSTRUMENTATION AND PROTECTION:

**4.1 GENERAL:** The Specifications hereinafter laid down shall cover all the meters, instrumentation and protective devices required for the electrical work. The ratings, type and quantity of meters, instruments and protective devices shall be as per the schedule of quantities and drawings.

### 4.2 INSTRUMENT TRANSFORMERS

**a. Current Transformers :**

Current transformers shall be in a conformity with IS:2705 (Part I, II and III) in all respects. All current transformers used for medium voltage applications shall be rated for 1 KV. Current transformers shall have rated primary current, rated burden and class of accuracy as specified in the schedule. However, the rated secondary current shall be 5A unless otherwise specified. The acceptable minimum class of various applications shall be as given below.

| | | |
|---|---|---|
| Measuring | : | Class 0.5 to 1 |
| Protection | : | Class 5P10 |

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 35 MVA on medium voltage system. Terminals of the current transformers shall be paired permanently for easy identification of poles. Current transformers shall be provided with earthing terminals for earthing chassis frame work and fixed part of the metal casing (if any).

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CTS shall be copper conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

## 4.3 RELAYS:

**a. General**

Protection relays shall be provided wherever required to trip and isolate the particular section under fault. All the relays shall be provided with flag type indicators to indicate the cause of tripping. The flag indicators shall remain in position unit they are resent by hand reset.

Relay shall be designed to make or break the normal circuit current with which they are associated. The relay contacts shall be of silver or platenium alloy. The contacts shall be designed to withstand repeated operation without damage. The relays shall be of draw-out to facilitate testing maintenance Draw-out case shall be dust tight with a finish suitable for tropical country. The relays shall be capable of disconnecting the faulty section of the net work or fault equipment without causing interruption or disturbance to the remaining sections. The analysis of setting shall be made considering relay errors, pick-up and overshoot errors and shall be submitted to the Engineer/Architect for approval.

**b. Over current Relay :** Over current relay shall be induction type with inverse definite minimum time lag charactoristics. The over circuit relays shall be provided with adjustable current and time settings. The setting for current shall be 50 to 200% in step of 25%. The IDMT over current relays shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5Amp.

**c. Earth Fault Relay:** Earth fault relay shall have current setting of 10% to 40% in steps of 10% otherwise, the earth fault relay shall conform to specification laid down for over current relays.

**d. Under Voltage Relays :** Under Voltage Relays shall be induction type and shall have inverse limit operation characteristics, with pick up voltage range of 50-90% of the rated voltage.

## 4.4 TESTING

4.5.1 Instrument transformers shall be tested at factory as per IS: 2705 and IS : 3156. The test shall incorporate the following:

**Routing Tests:**

Original test certificates in triplicate shall be provided.

4.5.2 Meters shall be tested as per IS : 1248. The tests shall include routine tests. Original test certificate in triplicate shall be furnished.

4.5.3 Suitable injection tests shall be applied to the secondary.

a. Circuit of every instrument to establish the correctness of calibration and working order All relays and protective devices shall be tested to establish the correctness of setting and operation by introducing a current generator and an ammeter in the circuit.

## 5. SPECIFICATION FOR POWER FACTOR IMPROVEMENT SYSTEM:

**5.1 GENERAL:** The Power factor improvement system shall comprise of capacitors and associated switchgear and control gear as per the requirements.

**5.2 CAPACITORS:** Power factor correction capacitors shall conform in all respects to IS: 2834-1964. Capacitors shall have approval of fire insurance association of India. The capacitors shall be suitable for 3 phase 415 V, at 50 Hz frequency and shall be available in single phase and three phase units of 5, 10, 15, 20, 25 and 50 KVAR sizes. The capacitors shall be suitable for indoor use upto ambient temperature of $50^0$ C. The permissible overloads shall be as given below:-

a. Voltage overload shall be 10% for continuous operation and 15% for 6 hours in a 24 hour cycle.

b. Current overload shall be 15% for continuous operation and 50% for 6 hours in a 24 hour cycle.

c. Overload of 30% continuously and 45% for 6 hours in a 24 hour cycle. Capacitors shall be hermetically sealed in sturdy corrosion proof, sheet steel containers and impregnated with non-inflammable synthetic liquid. Every element of each capacitor unit shall be provided with its own built in silvered fuse. The capacitors shall have suitable discharge device to reduce the residual voltage from crest value of the rated voltage to 50 V or less within one minute after capacitor is disconnected from the source of supply. The loss factor of capacitor shall not exceed 0.005 for capacitors with synthetic impregnants. The capacitors shall withstand voltage of 2500 V ac (power frequency test voltage) for one minute. The insulation resistance between capacitors, terminals and containers when test voltage of 500V DC is applied shall not be less than 50 megohms.

**5.3 CAPACITOR CONTROL PANEL:**

The capacitor control panel shall generally comprise of following:

a) Power factor correction relay
b) Step controller with reversing motor.
c) Time delay and no-volt relays.
d) Contactor and fuses for individual capacitor banks.
e) Auto- manual selector switch for either manual or automatic operation.
f) Current Transformers (On main LT Panel)
g) ON/OFF indicating lamps with fuses for each bank
h) ON/OFF Push Buttons for each bank.

**5.4 CONTROL PANEL:**

The capacitor control panel shall be fabricated out of 2.0 mm sheet steel suitably rust inhibited and stove enameled. The panel shall have adequate space for mounting the capacitors. The panel shall be of dust and vermin proof construction with suitable ventilation arrangement for capacitors. Panels shall be dead front pattern and floor munting type, complete with cabling arrangement, bus bars and earthing, etc. as per specification No. ELEC- 110/90.

## 6. SPECIFICATION FOR: MEDIUM VOLTAGE CABLES

**6.1 TYPE:** Medium voltage cables shall be aluminium conductor, PVC insulated, PVC sheathed and steel wire armoured or steel tape armoured construction. Aluminium conductors up to 10sq.mm. may be solid, circular in cross section, and sizes above 10sq.mm. shall be stranded. Sector shaped stranded conductors shall be used for sizes above 25sq.mm. The cable shall conform to IS 1554 (Part I).

**6.2 RATING:** The cable shall be rated for a voltage of 650/1100 Volts.

**6.3 CONSTRUCTION:** The conductors for power cables shall be made of electrical purity aluminium & that for control cable from annealed high conductivity copper. The conductors shall be insulated with high quality PVC base compound. A command covering (bedding) shall be applied over the laid up cores by extrusion or wrapping of a filling material containing unvulcanized rubber or thermoplastic material, armouring shall be applied over the inner shath of bedding, over the armouring a tough outer sheath of PVC sheathing shall be extruded. The outer sheath shall bear the manufacturers name and trade mark at every 30 meter interval.

**6.4 CORE IDENTIFICATION :**

Core shall be provided with the following colour scheme of PVC insulation.

| | | | |
|---|---|---|---|
| i. | Core | : | Red/Black/Yellow/Blue |
| ii. | Core | : | Red and Black |
| iii. | Core | : | Red, Yellow, and Blue |
| iv. | 3.5/4 core | : | Red, Yellow, Blue and black. |

**6.5 CURRENT RATINGS :**

The current rating shall be based on the following conditions.

| | | | |
|---|---|---|---|
| i. | Maximum conductor temperature | : | $70^{O}C$ |
| ii. | Ambient air temperature | : | $40^{O}C/50^{O}C$ |
| iii. | Ground temperature | : | $70^{O}C$ |
| iv. | Depth of laying | : | 75cm |

**6.6 SHORT CIRCUIT RATING:**

Short circuit ratings for the cables shall be as specified in IS : 1554 Part -I.

**6.7 SELECTION OF CABLES :**

Cables have been selected considering the conditions of the maximum connected load, ambient temperature, grouping of cables & the allowable voltage drop. However, the contractor shall recheck the sizes before the cables are fixed and connected to the service.

**a. Storing:** All the cables shall be supplied in drums. On receipt of cables at site, the cables shall be inspected and stored in drums with flanges of the cable drums in vertical position.

**b. Laying:** Cables shall be laid as per the specifications given below. The system adopted for this job shall be as per BOQ :

**i. Duct system**

Wherever specified cables shall be laid in underground ducts. The duct system shall consist of a required number of reinforced "HUME" pipes with simplex joints. Wherever asbestos cement pipes are used, the pipes shall be enclosed in concrete of 75mm thick, the ducts shall be properly anchored to prevent any movement. The top surface of the cable ducts shall be laid with a gradient of atleast 1:300. The ducts shall be provided with inspection manholes and all direction changes and at required regular intervals for drawing the cable. The manholes shall be of reinforced concrete either cast-in-situ or precast. The manhole cover and frame shall be of cast

iron and machine finished to ensure a perfect joint. The manhole cover shall be installed flush with ground or paved surfaces. The duct entry to the man holes shall be made leakproof with lead-wool joints. The ducts shall be properly plugged at the ends to prevent entry of water rodents, etc. Suitable duct markers shall be placed along the run of the cable square embedded in concrete, indicating the voltages, no of ducts and the direction of run of the cable duct. Suitable cable supports made of angle iron shall be provided in the manholes for supporting the cables. Proper identification tags shall be provided for each cable in the manholes.

**ii. Cables in outdoor trenches:**

Cables shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not less than 75cm from the final ground level. The width of the trench shall not be less than 45cm. However, where more than one cable is laid, an axial distance of not less than 15cm shall be allowed between the cables. The trenches shall be cut square with vertical side walls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed and levelled. The cables shall be laid in trenches over the rollers placed inside the trench. The cable drum shall be rolled in the direction of the arrow for rolling. Wherever cables are bent, the minimum bending radius shall not be less than 12times the diameter of the cable. After the cable is laid and straightened, it shall be covered with 8cm thick layer of sand. Cable shall then be lifted and placed over this sand. Cable shall then be lifted and placed over this sand cushion. The cable shall then be covered with a 8 cm. Thick sand cushion. Over this, a course of cable protection tiles or burnt brick shall be provided to cover the cables 50mm on either side. Trench shall be backfilled with earth and consolidated. Cables shall be laid in Hume pipes/ stone-ware pipes at all road crossings and in CI pipes at the wall entries. Approved cable markers made of aluminium or CI indicating the voltages, no. of cables and the direction of rep. Of the cables shall be installed at a regular interval of 30 meters.

**iii. Cables in indoor treanches :**

Cables shall be laid in indoor treanches where specified. The trenches shall be made of brick masonry with smooth cement mortar finish. The dimensions of the trenches shall be determined depending upon the maximum number of cables that is expected to be accommodated. Cables shall be arranged in tier formation inside the trenches. Suitable clamps hooks and saddles shall be used for securing the cables in position. Spacing between the cables shall not be less than 15cm centre to centre. Wherever specified, trenches shall be filled with fine sand and covered with RCC precast slabs or steel chequered covers. Unless otherwise called for specifically in BOQ, the making of indoor trenches is outside the scope of this work.

**iv. Cable on Tray/ Racks:**

Cables shall be laid on cable trays/ racks wherever specified. Cable racks/trays shall be of ladder, trough or channel design suitable for the purposes. The nominal depth of the trays/ racks shall be 150mm. The width of the trays shall be as per the design shown on drawing. The cable trays shall be made of steel or aluminum. The trays/ racks shall be completed with end plates, tees, elbows, risers, and all necessary hardware. Steel trays/ Rack shall be painted with two coats of enamel paint of approved shade over a coat of red oxide primer. Cable trays shall be erected properly to present a neat and clean appearance. Suitable cleats or saddles made of aluminum strips with PVC covering shall be used for securing the cables to the cable trays. The cable trays shall comply with following requirements:

1. The trays shall have suitable strength and rigidity to provide adequate supports for all contained cables.

2. It shall not present sharp edged, burrs or projections injurious to the insulation of the wiring/ cables.

3. If made of metal, it shall be adequately protected against corrosion or shall be made of corrosion resistant material.

4. It shall have side rails or equivalent structural members.

5. It shall include fittings or other suitable means for changes in direction and elevation of runs.

### 6.8 INSTALLATION

1. Cable trays shall be installed as a complete system. Trays shall be supported properly from the building structure. The entire cable tray system shall be rigid.

2. Each run of the cable tray shall be completed before the installation of cables.

3. In portion where additional protection is required, non combustible covers/ enclosures shall be used.

4. Cable tray shall be exposed and accessible.

## 7. SPECIFICATION FOR: MEDIUM VOLTAGE DISTRIBUTION BOARDS

**7.1 General:** Distribution boards for Power & light circuit distribution shall be factory builts & shall be suitable for 415volts, 3phase or 230 volts single phase supply as specified in BOQ. The distribution boards shall conform to IS 8623 (for factory built assemblies).

**7.2 Makes:** Makes of DB's shall be as per Acceptable Material / Approved List.

**7.3 Type:** The following boards shall be of cabinet design, totally enclosed and shall provide protection against ingress to IP 42 of IS 2147. Only those types of DBs which have been type tested and passed by a national laboratory for IP 42 shall be offered.

However, if none of the type available from the approved makes meets the above requirement, alternative makes can be offered with technical literature and copy of test certificate.

**7.4 Components :** Distribution boards shall generally be provided with the following major components:

a. Miniature circuit breeders
b. Earth leakage circuit breakers
c. Bus Bars
d. Netural links/bus
e. Earth Bus

**7.5 Miniature Circuit Breakers :** MCBS shall generally conform to IS8828. The breaking capacity of MCBS shall not be less than 6KA the miniature circuit breakers shall suitable for snap fixing on a standard DIN rail. The MCBS shall be suitable for operating under full load under ambient temperature conditions (i.e. $-10^{O}$C to $55^{O}$C in India. MCBS shall have terminals suitable for receiving aluminium cables of adequate cross section. (up ot 32A rating 16sq.mm. & 40, 50, 63A,

35sq.mm. cable). Three phase MCBS shall have common trip bar so that all the poles make and break simultaneously.

**7.6 Earth Leakage Circuit Breakers:** Earth leakage circuit breakers shall be used as incomers in distribution boards wherever specially called for in BOQ ELCB shall be suitable for incorporation in standard DB manufactured by the approved manufacturers. ELCBS shall be of core balance type and shall not cause nuisance tripping. The ELCB shall be rated for 100mA fault circuit tripping. ELCB shall be provided with a test lamp and push button to test the healthiness of the circuit.

**7.7 Bus Bars :** The bus bars shall be of copper and duly tinned or plated. The bus bar rating shall be atleast 100A as per manufacturers design.

Single phase DBS shall have Bus bars shall be solidly anchored with single pole MCBS of specified ratings. The bus bars shall be fully shrouded. The bus bars shall be able to accept single, double or triple pole MCBS.

Three phase DBS shall have single piece bus bar and coupling link avoiding drilling and bolting of bus bars.

However, if the above 'unique bus bars' system is not available from the approved manufacturers alternative makes can be offered with full technical particulars.

**7.8 Cabinet:** The DB cabinet shall be made of atleast 1.6 mm thick sheet steel duly stove enamelled or powder coated (as per standard manufacturing product). The cabinet shall be suitable for either recess mounting or surface mounting.

The cabinet shall be provided with conduit cable entry knock-outs at top and bottom or top and bottom plates shall be of detachable construction. The cabinet shall be dust and vermin proof with proper gaskets for the front door.

The DB cabinet and internal mounting arrangements shall be such that the entire bus and MCB assembly could be easily detachable from the cabinet.

**7.9 DIRECTORY:** Distribution boards shall be provided with a write and protect directory indicating the area of loads served by each circuit breakers, the rating of breakers, size of conductors, etc. The directory shall be mounted in frount of cabinet with an acrylic door.

**7.10 INSTALLATION:** Distribution boards shall be surface mounted or recessed mounted as required. DBS shall be mounted at the locations as shown on the approved execution drawings.

Surface boards shall be fixed with suitable angle iron clamps and bolts. All the cables/ conduits shall be properly terminated using glands/ checknuts etc. Wiring shall be terminated properly using crimping lugs/ sockets & PVC identification ferrules. Distribution boards shall be bonded to the earth atleast on two points using brass bolts & lugs. Suitable name plate and danger plate, indicating the voltage shall be fixed to the front cover.

**7.11 TESTING:** Distribution boards shall be tested at factory as per IS 8623 and original test certificate shall be furnished.

## 8. SPECIFICATION FOR: MEDIUM VOLTAGE DISTRIBUTION SYSTEM (Internal lighting & Power Wiring)

**8.1 GENERAL:** Medium voltage distribution system shall be applicable for wiring 3Phase, 4 wire 415 Volts, 50 HZ, AC supply and single phase, 2 wire 230 Volts, 50 HZ, AC supply.

**8.2 REGULATION AND STANDARDS:** The system shall be governed by the requirements of IS : 732 and I.E Rules and NEC. IS standards and Codes applicable for medium voltage distribution is also listed in specification.

**8.3 REGID STEEL/PVC CONDUIT AND ACCESSORIES:**

**8.3.1** Rigid ERW steel/PVC conduit (as per BOQ) shall of screwed, sheet steel electric resistance welded and black stove enamelled (outside) and shall conform to IS 9537 Part I.

**8.3.2** Makes of DB's shall be as per Acceptable Material / Approved List.

**8.3.3** In case, any of the above makes does not bear ISI certification mark the contractor shall furnish a list of makes, which bear ISI certification mark, to choose from.

**8.3.4** The conduit shall be routine tested at the works as per IS specifications and original test certificate furnished along with each major consignment delivered. The engineer-in-charge will determine size of the consignments requiring the original test certificate.

**8.3.5** In general, conduits shall be of good quality and shall form to the following requirements:

a. Shall be free from welding burrs.
b. Wall thickness shall be uniform as far as possible.
c. Ends shall be screwed.

**8.3.6** Conduit accessories such as bends, inspection, tees, inspection tees, round junction boxes, elbows, drawboxers etc. shall be of good quality and shall generally in conformity with IS specifications. The fittings and accessories shall have threades or shall have internally tapped spouts. Junction boxes/ inspection boxes shall have suitable covers with screws.

**8.3.7 Installation of conduits:**

a. Open/ Surface conduit system :

Wherever, specifically called for, surface conduit system shall be adopted. Conduits shall be run in square and symmetrical lines. Before the conduits are installed the exact route shall be marked at site and approval of the engineer shall be obtained. Conduits shall be fixed by saddles, secured to suitable raw plugs, at an interval of not more than 0.6 meter. Wherever couplers, bends or similar fittings are used, the saddles shall be provided on either side at a distance as directed by the engineer-in-charge. Conduits shall be jointed by means of screwed couplers and screwed accessories only. In long distance, straight runs of conduit inspection type couplers or running type couplers with jamnut shall be provided,. Threading shall be long enough to accommodate pipes to the full threaded portion of the couplers and accessories. Cut ends of conduits shall have no sharp edges nor any burrs left to avoid damage to the insulation of the conductors. The cut ends/edges shall be filed before installation.

Bends in conduit run shall be done by bending conduits by pipe bending machine or any other suitable device as far as possible. Bends which cannot be made by a pipe bends, shall be accomplished by introducing solid bends, inspection bends or cast iron inspection box. Not more than two equivalent $90^{O}$ bends shall be used in a conduit run from the outlet to outlet.

All the conduit openings shall be properly plugged with PVC stoppers/ bushes. A breather-drainer shall be provided in the lowest position of the conduit system. The conduits shall be adequately protected against rust by applying two coats of approved synthetic enamel paint after the installation is completed.

Wherever conduits terminate into point control box, outlet box, distribution board, etc. conduits shall be rigidly connected to the box/board with checknuts on either side of the entry to ensure proper electrical and mechanical continuity.

b. Recessed Conduit system:

All the conduits including, bends, unions, junction boxes etc. shall be cleaned and painted with one coat of bituminous paint before they are fixed in position. Conduits which are to be taken in the ceiling slab shall be laid on the prepared shuttering work of the ceiling slab before concrete is poured. The conduits shall be properly threaded and screwed into sockets, bends, junction boxes, outlet boxes. The conduits in ceiling slab shall be straight as far as possible to facilitate easy drawing of wires through them. Before conduits are laid in the ceiling the positions of outlet points, point control boxes, Junction boxes shall be set-out clearly so as to minimize offset and bends. Conduits recessed in walls shall be secured rigidly by means of steel hooks/ staples at intervals as directed by the engineer. Before conduit is concealed in the walls, all chases, grooves shall be neatly made to proper dimensions to accommodate the required number of conduits. The outlet for drawing wires and proper size earth continuity wire shall be run throughout the length of the conduit with the earth wire being efficiently fastened to the conduit by means of special clamps. Copper clamps shall be used for copper earth wire and GI clamps for GI wires.

## 8.4 CABLE TRUNKING/ RACEWAYS:

**8.4.1** Cable trunking or raceways shall be of sheet steel construction or G.I. sheet. The thickness of sheet steel shall not be less than 16 gauge or as per Mentioned in B.O.Q. The sheet steel before fabrication shall be given a rigorous anticorrosive treatment. The trunking shall be provided with removable, covers of 1 meter length. The trunkings shall be supplied in suitable lengths. However, the maximum, length of a single trunking shall be exceed 6 metre. The trunking shall be complete with $90^{O}$ bends $145^{O}$ bends, adopters, tee-pieces, couplers etc. Removable cable retainers shall be provided wherevere required.

### 8.4.2 INSTALLATION

Trunking/ raceways shall be installed in readily accessible places. Trunking shall be supported at a regular intervals of 1.0 metre to 2.0 metres as required. Trunking shall be aligned properly during the erection to present a neat appearance. Standard lengths of trunkings shall be jointed together by suitable couplers. Wherever required right angles bends, $145^{O}$ bends, tees, etc. shall be provided in the run of cable trunk/ raceways. Trunking shall be so arranged that not more than 30 cables are run in any section. However, not more than 60% of cross-sectional area of the raceway shall be occupied by the conductors at any section. Trunking/raceways shall be

bonded to the earth by a suitable size earth continuity conductor. Trunking shall be painted with two coats of approved synthetic enamel paint.

## 8.5 ENCLOSURE FOR ELECTRICAL ACCESSORIES:

Enclosure for electrical accessories such as switches, sockets, fan regulators, etc. shall be mild steel conforming to IS:5133 Part-I. The dimensions of the enclosures shall be as per clauses 3.1 to 6.3.1 of IS : 5133. The wall thickness of MS enclosures shall be not less than 1.6mm wherever specially called for, galvanised sheet steel boxes shall be provided. The enclosure boxes shall be provided with a minium of four fixing lugs located conveniently for fixing the covers. All fixing lugs shall have tapped holes to take machined brass screws.

Sufficient number of knock -outs of 38mm/32mm/ 25mm/ 20mm dia shall be provided for conduit entries. Enclosures shall be sufficiently strong to resist mechanical damage under normal service conditions. Provisions shall be made for bonding the enclosures to the earth. The enclosures shall be adequately protected against rust and corrosion both inside and outside with suitable air drying paint. The enclosures shall be provided with 3mm thick phenolic terminated cover for mounting switches, sockets, etc. wherever different phase conductors are brought into the same enclosure, phase barriers shall be provided. Phase barriers shall be of MS of hylam inserted in the box with slide-fit arrangement. Alternatively, boxes could be partitioned during construction.

## 8.6 WIRING CONDUCTOR

**8.6.1** All wiring conductors shall be FRLS PVC insulated, standard copper conductors of 1100V Grade. Wiring conductors shall conform in all respects to IS : 694 (Latest Edition). Solid conductors may be used if specifically called for.

The current ratings for wiring conductors shall be based on the following parameters.

i. Ambient temperature - $40^0$C
ii. Conductor temperature - $70^0$C

Wiring Conductor shall be supplied in Red, Black, Yellow & Blue colours for easy identification of wires. The wiring conductors shall be supplied in sealed coils of standard length. The wiring conductor shall bear manufacturer's trade mark, name, voltage grade & size etc.

**8.6.2**Installation of wiring conductors/ cables

The wiring conductors shall not be drawn into the conduits until the works of any nature that may cause damage to the wires are completed. Before drawing the wires the conduits shall be throughly cleaned, drained and ventilated. Proper care shall be taken in pulling the wires. The installation and termination of wires shall be carried out with due regard to the followings:

a. While drawing the wiring conductors, care shall be taken to avoid scratches and kinks which cause breakage of conductors. There shall be no sharp ends in the conduit system.

b. Insulation shall be shaved off like sharpening a pencil.

c. Strands of the wires shall not be cut for connecting to the terminals or lugs. The terminals shall have adequate cross section to take all the strands.

d. Ends of the wiring conductors shall be terminated by using crimping sockets. Soldering of sockets shall not be done unless otherwise approved by the engineer-in-charge.

e. Brass flat washers of large area shall be used for bolted terminals.

f. Bimetallic connectors should be used wherever copper conductors are tapped from aluminium mains or vise-versa.

**8.6.3** Wiring for power and lighting circuits shall be carried out in separate and distinct wiring system. Wiring for emergency system shall also be carried out in a separate and distinct wiring system. Balancing of circuits in a three phase system shall be arranged before the installation is taken up.

**8.6.4** The wiring system envisaged is generaly shown on the layout drawing and line diagrams, however, a brief account of the general wiring system is given below:

a. Submains wiring
Wiring from switch boards to the individual distribution boards.

b. Circuit Wiring
Wiring from switch boards to the individual distribution boards.

c. Power Wiring
Wiring from DBS to the power socket outlets.

**8.6.5** The sub main wiring shall be either in 3 Phase 4 wire, or Single Phase, 2 wire system. Each submain wiring circuit shall also have its own copper earth continuity wire. The number and size of copper earth continuity wire. The number and size of copper earth continuity wire shall be as per the detailed drawings and specification.

**8.6.6** Circuit wiring shall generally be of single phase however, a maximum of 3 to 4 single phase circuits belonging to the same phase/ pole could be installed in the same conduit or raceway. Each circuit wiring shall be provided with suitable copper earth continuity conductor as per Earthing specifications. Not more than ten light points/ fan points shall be grouped on one lighting circuit. The load per circuit shall not exceed 800 Watts. The minimum size of conductor for wiring of lighting circuits shall not less than 2.5sq.mm. in case of copper conductor. Power wiring shall not have more than two sockets connected to one circuit. 4.0sq.mm. copper conductors shall be used upto the power socket. All the wiring shall be carried out in looping-in-loop system.

The maximum number of various size conductors that could be drawn in various sizes of conduits shall be as per table II of IS : 732 (Latest Edition). The wiring shall be colour coded for easy identification of phases and neutral. The following colour code shall be adopted.

| | | | | |
|---|---|---|---|---|
| Phase : | | R | - | Red |
| | | Y | - | Yellow/ White |
| | | B | - | Blue |
| Neutral | : | - | Black | |
| Earth | : | - | Green | |

**8.6.7** All circuit wiring shall be provided with printed PVC identification ferrules at either and bearing the circuit number and designation.

**8.6.8** The circuit wiring may be separately measured or included in point wiring as per the nomenclature given in BOQ equipment schedule/ particular specifications.

## 8.7 SWITCHES, SOCKETS AND ACCESSORIES

**8.7.1** General Requirements

Light control switches shall be 5A rating for controlling upto four light points and 16A rating for more than four light points. Light control switches shall be of moduler type of poly carbonate with PVC moulded frount plate & GI boxes design suitable for flush mounting for general lighting. Wherever specifically called for surface mounting.

**8.7.2** All sockets 6A and 16A ratings shall be moduler type flush mounting with control switches of the same rating as that of the sockets. All socket shall be of poly carbonet with pins made of brass alloy and plated with a noble metal. Sockets shall be mounted on PVC moulded frount plate & GI boxes.

**8.7.3** Industrial type Sockets

Industrial type sockets shall be provided wherever specifically called for. Industrial sockets shall be totally metal clad with porcelain base incorporating the pins. Socket shall have 3Pins for single phase application and 4pins and scrpaing earth for 3 phase application. The sockets shall be provided with suitable metal clad plug top with suitable cable entry. Sockets shall have metal covers with chain. Industrial type sockets shall be provided with a suitable sheet steel housing made of 16 Guage with the sockets mounted in flush with cover of the housing.

**8.7.4** Lamp holders, ceiling roses, etc.

Accessories for, light outlets such as lamp holders, ceiling roses, etc. shall be in conformity with requirements of relevant IS specifications. Only approved make of accessories shall be supplied, if required.

**8.7.5** Installation of Switches, sockets and accessories

All the switches shall be wired on phase. Connections shall be made only after testing the wires for continuity, cross phase etc. with the help of a megger. Switches, sockets, fan regulator etc. shall be housed in proper GI boxes with PVC moulded frount plate covers. Regulators shall be fixed on adjustable MS flat straps inside the enclosure. The arrangement of switches and sockets shall be neat and systematic. Fixed to the enclosure in plumb, with counter sunk head. For wall plug sockets, the conductors shall be terminated directly into the switches and sockets. The outlets, point control boxes etc. shall be set out as shown on the drawings. Before fixing these, the contractor shall obtain clearance from the engineer-incharge with regard to their proper locations. The enclosures of sockets/ and 3$^{rd}$ pin of the sockets shall be connected to the ground through a proper size earth continuity wires as laid out in specification of earthing section.

## 8.8 LUMINAIRES

**8.8.1** General

All the materials used in the construction of luminaries shall be of such quality, design and construction that will provide adequate protection in normal use, against mechanical, electrical failures/ faults and exposure to the risk of injury or electric shock and shall withstand the effect of exposure to atmosphere.

**8.8.2** Fluorescent lamp luminaires

Luminarie shall be supplied as per the design specified in the schedule of quantities (B.O.Q.). Luminaries shall be complete in all respects with basic mounting channel, shock proof insert contact rotor lamp holders, starter with holder, polyester ballast, connector block, internal wiring and decorative attachments, if any. The mounting channel shall be made of mild steel sheet suitably rust inhibited and stove enameled. A dust proof cover stove enameled to white shade shall be provided from the channel to protect the accessories and wiring from dust and vermin and to act as reflector. Ballast shall be silent in operation. Ballast shall have a long life and shall be highly reliable. A suitable capacitor to improve the power factor of luminaire to atleast 0.9 lag shall be provided. Capacitors shall be hermetically sealed.

Diffusers, louvers, etc, shall be of opal acrylic or polystyrene diffusers, louvers, and similar decorative attachements, The attachments shall be guaranteed against discolourisation, warping and deformation under continuous operation. Fluorescent lamps shall conform to BS: 1853 in all respects. Fluorescent lamps shall be of bi-pin pattern. The colour of the light shall be white or cool day light, as required. Unless otherwise specified, the lamps shall be of 40W or 36W and 1200mm long. Luminaires shall be provided with an earthing terminal for bonding the body of the luminaire to earth. Luminaires shall be installed as as specified on the drawing. Wherever luminaires are fixed on the false ceiling, suitable supporting and fixing arrangements independent of the frame work of false ceiling shall be provided. Suspended luminares shall be provided with swivel type hangers, comprising of suspension pipes, swivel sockets, screws, bolts etc., for installing the luminaires. Luminaires shall be suspended true to alignment, plumb and level and capable of resisting all lateral and vertical forces. Lead-in-wires shall be protected from abrasion. Erection of fixtures shall include assembling of all components of the fixtures such as chokes, condensers, starters, decorative attachments, etc.

**8.8.3** Incandescent lamp luminaires

Incandescent lamp luminaires shall be supplied as per the design and type mentioned in the schedule of quantities (B.O.Q.). Incandescent lamp luminaires shall be provided with lamp holders suitable for lamps with standard bayonet cap upto 200 watts. For luminaires suitable for lamps above 200 Watts, holders to suit edison screw or Goliath screw caps shall be provided with lamp holders with cord grips. Incandescent lamp luminaires shall be complete with reflector shade, decorative attachment (if any) and cover as specified any required. Incandescent lamps shall conform in all respects to BS : 161.

**8.8.4** Light Track

Light tracks, wherever required, shall be suitable for flush mounting with all mounting accessories. The light track shall consist of an extruded aluminium **section with two insulated copper conductors on either side, tack adopter/current collectors for fixing the luminaires, and the accessories. Live end and couplers shall be die-cast aluminium with injection moulded ends, cover and connectors. The curret collector/adopter fitting shall be suitable for sliding on the light track with locking arrangement in any position for engaging the live conductos and earthing the track adopter/ current collector.

## 8.9 FANS

### 8.9.1 Ceiling fans

Ceiling Fans shall conform to IS : 374 (Latest Edition**)** all respects fan shall be smooth and silent in operation. The fan motor shall be a capacitor type motor with internal starter and external rotor pattern. The blades shall be made of aluminium sheets painted in off white shade. The design and construction of blades shall be such that maximum quantity of air is displaced in smooth manner. The motor and blades shall be statically and dynamically blanced. The fans shall be provided with ball bearing and bush bearings which are accessible for lubrication. The ceiling fan shall be provided with rubber shackle and a down rod of atleast 12" long. The suspension arrangement shall be jointed to the fan motor by means of a thread joint and a safety locking arrangement. Fans shall be provided with bottom cover and a top canopy. A regulator for 5 speed operation and stop shall be provided with every fan. Electronic stepless regulators shall be provided, if specified. Ceiling fans shall be suspended from the special hooks or special fan hook boxes. Where hooks are used the wiring to the fan shall be from a ceiling rose. Wherever special fan hook boxes are used, the fan wiring shall be terminated in porcelain/ PVC autoway connector. Lead-in-wires shall have cross-section area of not less than 1.5mm (Copper).

### 8.9.2 Exhaust Fans

Propeller type exhaust fan shall conform to IS : 2312 (Latest Edition) in all respects. The motor shall be of diecast aluminium case. The fan motor shall be of sq. cage induction design. Single phase motors shall be capacitor-start and run type. Exhaust fans be provided with a special anticorrosive treatment to withstand normal concentrations of chemical fumes in the environment.

The fan shall be designed to withstand the effects of moisture under normal conditions of use. The design of motor and its windings shall be such that moisture in surrounding is not absorbed by the winding. Exhaust fans shall be complete with mounting rings, ring arms and a resilient suspension. The motor and blades shall be statically and dynamically balanced. The blades shall be of mild steel sheets and so designed that they operate smoothly with minimum noise. The fans shall be finished to be a glossy gray shade with an approved enamel paint. The fans shall also be provided with gravity louvers for exhaust arrangement or bird screen for inlet arrangement.

Exhaust fans shall be fixed at the locations shown on the drawings. The fans shall be fixed by means of rag bolts grouted in wall. Exhaust fan be connected to the exhaust fan point by means of a flexible cord.

## 8.10 POINT WIRING

Point wiring shall be commence from the first point control box/ local control box for the points connected to the same circuit. Point wiring for lights, fans, 5A sockets, call bells, etc. shall be carried out with copper conductor PVC insulated wires of 1.5 sq.mm. cross section or as per BOQ. The point wiring shall be inclusive of 20mm./ 25mm/ 32mm sheet steel conduits of standard and approved make (as specified herein-before) alongwith approved quality conduit accessories such as bends, inspection bends, reducers, junction boxes, etc. together with wiring accessories such as switches, ferrules, PVC bushes, connectors, point control boxes (enclosure for electrical accessories) etc. point wiring shall be provided with 1.5sq. mm. PVC insulated copper earth continuity wire for earthing 3$^{rd}$ poin of sockets, luminaires and fan fixtures. Light control shall be either single, twin or multiple points controlled by a switch as specified.

## 8.11 TESTING AND ELECTRICAL INSTALLATION

**8.11.1** Testing and installation shall be as per IS : 732-1963

a. The insulation resistance shall be measured by applying between earth and the whole system of conductors or any section thereof with all fuses in places and all switches closed and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together, where a direct current pressure of not less than twice the working pressure, provided that it need not exceed 500 Volts for medium voltage circuits. Where the supply is derived from the three wires (A.C. or D.C) or a poly phase system the neutral pole of which is connected to earth direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the outer or phase conductor and the neutral.

b. The insulation resistance measured as above shall not be less than 50 divided by the number of points on the circuits provided that the whole installation shall be required to have an insulation resistance greater than one meg-ohm.

c. Control rheostats, hearing and power appliances and electric signs may, if required, be disconnected from the circuit durig the test, but in event the insulation resistance between the case of frame work and all live parts of each rheostat appliance and sign shall not be less than that specified in the relevant Indian Standard Specification or where there is no such specification shall not be less than half a meg-ohm.

d. The insulation resistance shall also be measured between all conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or the natural or to the other pole or phase conductors of the supply and its value shall not be less than specified I sub-clause (b).

e. On completion of an electric installation (or an extension to an installation) a certificate shall be furnished by the Contractor countersigned by the certified supervisor under whose direct supervision the installation was carried out. The certificate shall be in prescribed from as required by the local electric supply authorities.

**8.11.2 Testing of earth Continuity Path**

The earth continuity conductor including metal conduits and metallic envelopes of in all cases shall be tested for electric continuity and the electrical resistance of the same alongwith the earthing lead but excluding any added resistance or leakage circuit breaker measured from the connection with the earth electrodes to any point in the earth continuity conductor in the completed installation shall not exceed one meg-ohm.

**8.11.3 Testing of polarity of non-linked single pole switches**

a. In a two wire installation a test shall be made to verify that all non linked single pole switches have been fitted in the same conductor throughout and such conductor shall be labelled or marked for connection to an outer on phase conductor or to the non-earthed conductor of the supply.

**b.** In a three wire or four wire installation a test shall be made to verify that every non-linked single switch is fitted in a conductor which is labelled, marked for connection to one of the outer phase conductor of the supply.

## 9. GENERAL SPECIFICAITON FOR: EARTHING FOR ELECTRICAL WORK

## 9.1 General

All non-current carrying metal parts of the electrical installation shall be earthed as per IS: 3043. All metal conduits, trunkings, cable armour, switchgear, distribution boards, meter, light fixtures, fans and all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to earth electrodes. Earthing shall also be in conformity with the provisions of Rules 32, 61, 62, 67 & 68 of IER 1956. These specifications apply to both copper and GI earthing system. The material to be used shall be as per that give in BOQ.

## 9.2 Earthing Conductors

**9.2.1** All earthing conductors shall be of high conductivity copper or GI and shall be protected against mechanical damage and corrosion. The size of earth conductors shall not be less than half that of the largest current carrying conductor. The connection of earth continuity conductors to earth bus and earth electrodes shall be strong and sound and shall be easily accessible. The earth tapes shall be joined together using double rivets. The earthing conductor shall be laid in cable trenches, cable trays or conduits or on cable by using suitable clamps made of non-ferrous metals compatible with the earthing conductor. The following earthing conductors and required to be used for various sections of the installations.

a. All fixtures - lighting, fan and switch enclosures, lighting conduits shall be earthed with 16 SWG bare copper wire or 1.5sq.mm. Copper conductor, PVC insulated wires or 16 SWG GI wire. (As per BOQ)

b. 3rd pin of power socket outlets upto 20A shall be earthed with 1.5 sq.mm. copper conductor PVC insulated wire (As per BOQ)

c. All single phase switches and DBs above 20A and upto 30A rating shall be earthed with one run of 10SWG bare copper wire or GI wire.

d. All single phase switches and DBs above 30A and upto 63A rating shall be earthed with one run of 8SWG bare copper wire or GI wire.

e. All three phase switches/ DBs upto 30A rating shall be earthed with 2 runs of 10SWG copper wire/ GI wire.

f. All three phase switches/ DBs above 30A and upto 63A shall be earthed with 2 runs of 8 SWG copper wires/ GI wires.

g. All three phase switches/DBs above 63A and upto 100A shall be earthed with 2 runs of 25x3mm Copper Strip/GI Strip.

h. All three phase switches/DBs of 200A rating and above shall be earthed with 2 runs of 25x6mm copper Strip / GI Strip.

i. All motor frames shall be earthed by two earthing conductors of specified cross section.

Earth conductors shall be properly terminated with bolts to the frames of panels/eqpts. And provided with crimped sockets in case of wires.

**9.2.2** Main earth bus shall be taken from the main medium voltage panel to the earth electrodes. The number of electrodes required shall be arrived at taking into consideration the anticipated fault on the medium voltage net-work and soil resistivity.

**9.2.3** All the sub mains and sub circuits shall be provided with earth continuity conductors as specified and connected to the main earth bus. Earthing conductors for equipment shall be run from the exposed metal surface of the equipment and connected to a suitable point on the sub main or main earthing bus. All switches shall be connected through double earthing conductor to the earth bus. Earthing conductors shall be terminated at the equipment using suitable lugs, bolts, washers and nuts.

**9.2.4** All conduits, cable armouring, raceway, rising mains, etc. shall be connected to the earth all along their run by earthing conductors of suitable cross sectional area, sprinkler, pipes, LPG pipes, water pipes, steel structural elements, cable trays/ racks lighting conductors shall not used as a means of earthing an installation. The electrical resistance of earthing conductors shall be low enough to permit the passage of fault current necessary to operate a fuse/ protective device a circuit breaker and shall not exceed 2 ohms. As rough guide the following sizes of earth continuity conductors shall be used for circuit wiring.

| Size of circuit wires/ cables | Size of copper or GI earth wires |
|---|---|
| a. 2.5 sq.mm. | 16 SWG or 1.5sq.mm. Cu. PVC insulated |
| b. 4 sq.mm. | 14 SWG or 2.5sq.mm. Cu. PVC insulated |
| c. 6 sq.mm. | 12 SWG or 2.5sq.mm. Cu. PVC insulated |
| d. 10 sq.mm./ 16 sq.mm. | 8 SWG or 4.0sq.mm. Cu. PVC insulated |
| e. 25 sq.mm. / 35 sq.mm. | 6 SWG or 6.0sq.mm. Cu. PVC insulated |

All Single phase wiring have one run of earth wire and three phase wiring shall be provided with two runs of earth wires.

## 9.3 EARTHING ELECTRODES : (REFER IS : 3043)

**9.3.1** Earthing electrodes shall be designed as per the requirements of clause 17.2 of IS : 3043. The number and size of earth electrodes shall be calculated so that under fault conditions no electrode is loaded above its maximum permissible current density. The resistance of earth electrode shall be as low as possible, the maximum allowable value being one ohm. Earthing electrodes of either plate of pipe electrode shall be decided according to the anticipated fault level of the net-work and local soil conditions. Generally, plate electrodes shall be used for sub-stations. Generally, plate electrodes shall be used for sub-stations and large & medium voltage net work and pipe electrodes for small & medium voltage net-work and installations.

### 9.3.2 Plate Electrode (REFER IS : 3043)

Plate electrode shall be made of copper plate of 3.15mm thick and 60x60 cm. Size or as per B.O.Q. The plate shall be buried vertically in ground at a depth of not less than 2 meters to the top of the plate, the plate being encased in charcoal to a thickness of 15cm all round. It is preferable to bury the electrode to a depth where sub soil water is present. Earth leads to the electrode shall be laid in a GI pipe and connected to the plate electrode with brass bolts, nuts and washer. GI pipe of not less than 19mm dia shall be placed vertically over the plate and terminated in a funnel at 5cm above the ground. The funnel shall be provided with a wire mesh. The funnel shall enclosed in masonry chamber of 30cm x 30cm x 30cm dimensions. The

chamber shall be provided with CI frame and CI cover. The earth station shall also be provided with a permanent identification label/ tag.

**9.3.3 Pipe Electrode (REFER IS : 3043)**

Pipe electrode shall comprise of a 4.5 meter long 75mm dia GI pipe or as per B.O.Q. with holes drilled as per IS: 3043 and burried vertically in a pit of 35cm x 35cm size and filled with alternate layers of charcoal, salt and river sand and connected at the top to a GI pipe of 19mm, 1 metre long with a funnel at the other end, 5cm above ground. The earth lead shall be properly clamped to the pipe electrode with brass bolts, nuts and washers. The funnel and earth lead connection shall be enclosed in a masonry chamber of 30cm x 30 cm x 30cm dimensions. The chamber shall be provided with a CI frame and CI cover. Proper permanent identifications tag/ lebel shall be provided for each electrode.

**9.4 PRECAUTIONS :**

**9.4.1** Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance even after passages of fault currents.

**9.4.2** Joints shall be soldered, tinned and double rivertted in case of copper and joints shall be filed and doubled rivertted in case of GI. All the joints shall be mechanically, electrically, continuous and effective.

**9.5 TESTING :**

**9.5.1** On the completion of the entire installation, the following tests shall be conducted.

a. Earth resistance of electrodes.
b. Earth loop impedance as per IS L 3043/NEC.

**9.5.2** All meters, instruments and labour required for the tests shall be provided by the contractor. The results shall be submitted in triplicate to the engineer-in-charge for approval.

**9.6 SUB-STATION AND GENERATOR EARTHING:** H.T panels and transformer body shall be provided with double earthing with copper/ GI tape of suitable size depending upon the anticipated fault level. The contractor shall furnish detailed calculations in respect of the size of earth conductors and number of earth stations.

**10.** GENERAL SPECIFICATOIN FOR: FIRE ALARM SYSTEM

**10.1 GENERAL SPECIFICATION:**

a. Automatic fire detection and Alarm system consists of smoke detectors (Ionisation type), heat detectors (fixed temperature cum rate of rise type) and photocell connected by appropriate cables to local control panels on all floors, which in turn are connected to main control panel in the control room. The type and quantity of detectors, their locations, location of local panels, manual call points, alarm sounders (Rooters and other related equipment shall be as per the drawings/ approved drawings).

b. “Fire Alarm’ means the sound emanating from an electric device loud enough not to be heard on that floor and distinct enough not to be confused with other normal sounds, accompanied by

visual signal on the local control panel and main control panel which will indicate zone/ area/ floor where detector (s) have operated.

c. Local control panel shall perform three important functions. Primary function of the local control panel (LCP) is respond automatically to the operation of one or more detectors on that floor to give 'Fire Alarm on the concerned floor and to transmit the alarm to the main control panel. The secondary function is to provide 'pulse' to operat4e ancillary systems such as smoke stop doors, ventilation, pressurisation fans and to switch off air handling units. The third function of the LCP is to indicate the existence of faults within the system.

d. Manual call points are to be installed on each floor, which will sound fire alarm, if the glass of call point is broken. A telephone socket to be provided within the manual call point in which a telephone handset could be plugged to facilitate fireman to communicate with the control room.

**e.** Local Panels shall be located close to lifts/ stairways which are designed to be smoke free in case of occurrence of fires. Manual call points shall be located near each exit.

## 10.2 COMPONENTS OF FIRE ALARM SYSTEM

### a. SMOKE DETECTOR

* Smoke detectors shall be listed with UL 268 FM/FOC/DIN approved. The working voltage of the detector shall be 24V or less.
* The smoke detector shall be of Ionisation chamber type with dual chamber and dual source. The radioactive source shall have a strength of less than one micro-curie.
* The smoke detector shall be provided with an LED indicator on the base of the detector.
* Smoke detectors shall be plug-in type and installation shall be as per manufacturer's recommendations. Smoke detector shall be have a coverage of not less than 90 smt. The supplier shall furnish technical details and electronic circuit of the detector before installation. Wherever smoke detectors are installed in path of air stream, the detector shall be provided with hood (aspirators) to reduce the velocity of air current.

### b. HEAT DETECTORS:

Heat detectors shall be listed with UL/ FM/ FOC or any approved by any other recognised international standard. Heat detectors shall be of rate of rise temperature cum fixed temperature type. The detector shall be of plug- in type and shall have a LED indicator on its base to indicate the operation of the detector. The detector shall have a coverage of 30 smt (min.).

### c. ACCEPTANCE OF DETECTORS:

The detector shall be subjected to smoke detector aerosol tester or the standard fire test given FOC/UL/IS standards. Only those detectors which pass the acceptance test shall be installed in the premised.

**B). <u>LOCAL CONTROL PANELS</u>:**

a> Local control panels shall be of wall mounting type and shall be baked enamel painted. Panels shall be dust, moisture and vermin proof.

b> Local control panel together with components and accessories shall be so selected and assembled as to maintain a high degree of reliability and accuracy of operation even under ardourous environmental conditions such as high temperature and high humidity. The panels shall have a fairly long MTBF between failures and shall have service life of at least 15 years.

c> The panel shall be completely solid state type. Electro-magnetic relays shall be avoided as far as possible. The panel shall be of plug-in type zone PCB cards. The PCB cards shall be of glass epoxy with contact gold plated. The PCB shall be provided with protective coating to prevent corrosion due to moisture/ contamination in the environment. The LCP shall be of modular design and it shall be possible to extend the number of zones at later date.

d> The local controls panels shall be provided with the following display on the front of the panel for each zone :

i> Red LED's for fire alarm indication (2 Nos. per zone).

ii> Orange LED's for fault indication (2 Nos. per zone).

iii> Yellow LED's for zone isolation indication.

e> In addition the following LED indicators shall be provided on each local control panel :

i> 'SYSTEM ON'
ii> 'STANDBY ON'
iii> 'AC FAIL'
iv> 'DC FAIL'
v> 'BATTERY LOW'

f> Further each local control panel shall be provide the following push buttons / actuators :

i> RESET
ii> ACCEPT
iii> TEST
iv> Selector switches on each zone card for testing of indicators and deliberate isolation of the zone.

g> Panel shall have capacity to be connected to all the zones on the floor. The panel shall have facility to sound five to six pairs of external sounders/ hooter, actuate ancillary services such as shut off AHU's operate ventilation/ pressurisation fans, operate fire doors, etc. The panel shall provide actuation signal only, the power to operate ancillary services will be provided separately.

h> **FIRE ALARM:**

i) The fire alarm shall be arranged as follows:

* Audible two-stage alarm, the panel shall provide on panel hooter and external hooters an alert alarm, which is discontinuous (1 second on & one second off). The operation of detectors shall intimate transmission of signals which results in :
* Indication on response indicators.
* Visible fire alarm on LCP.
* Alert audible alarm on the floor.
* Audible and visual alarm on main control panel.

ii). The alarm on the main control panel must be silenced with 30 seconds. This will set the pulse timer on to a set time limit of 3 minutes for local fire party to a reach the affected floor to reconnaissance. The fire party mush be acknowledge (silence) the alarm on LCP within the time limit.

- If the alarm in first instance is not acknowledge within 30 seconds on MCP, then a general evacuate alarm shall sound on that floor.

- If the alarm party does not acknowledge the alarm on LCP within 3 minutes, evacuate alarm shall sound on the floor and on the MCP.

iii). The audible alarm shall continue until silenced by a manual push button on the panel. The alarm shall not silenced automatically. The silencing of audible indication for that zone till the whole system reset.

i> **FAULT SIGNALS:**

i). Fault on any zone of the local panel shall be indicated as below :

* Visual indication on LCP.
* Audible signal and visual indication on MCP.

ii). Audible Fault shall be distinct & shall not be similar to fire alarm.

iii). The fault signal indicator on LCP may be displayed on ‘OPEN’, SHORT’ separately or a codified digital display be provided to pin point the fault in that zone. The silencing of audible alarm on one particular zone shall nor prevent transmission and display of alarms

on other zones on the LCP. Manual operation of the silencing button shall automatically result in giving distinct audible and visual signal on the panel till the system is reset. This alarm, shall be of low power and shall distinct from fire alarm.

iv). Operation of manual call point shall sound evacuation alarm on the floor and on the main control panel.

v). Any fault signal which local control panel may be giving shall not prevent a fire alarm being given on other zones if the detectors fire.

vi). The LCP zone cards shall be so designed as to provide easy indication of the fault in the circuit. This may be accomplished by providing 'trouble' LED lamps to pin point trouble location on PCB. The design of LCP shall such that faulty card /cards may be replaced easily.

vii). Fault warning shall be provided to indicate the occurrence of the following faults :

1. Short circuit.
2. Disconnection leads to detectors.
3. Removal of detectors.
4. Short circuit or disconnection leads to external hooters unless they are connected in a ring circuit.
5. Failure of fuses or protective devices.
6. Earth fault.

viii). Zone isolation facility shall be provided for each zone of LCP. This facility on operation of the same shall provide visual indication on LCP and fault indication on MCP. Audible signal shall be provided.

ix). Operation of any fire alarm sounder or transmission of signal to main control panel shall not depend on the operation of indicators and shall not prevented by any defect/ failure of indicator.

x). Besides the facilities indicated before on LCP, a facility to test panel sounder as well as external hooters shall be provided on LCP.

xi). Local control panels shall be provided with DC supply at appropriate voltage required for monitoring and operation of detectors. The power supply circuit shall have overload cut out device. The voltage drop in cables from the main power supply unit to various LCPs shall be considered and a suitable device (AVR) for correcting voltage received at LCP shall be incorporated in LCP.

xii). The local control panel shall have a hinged transparent door with a lock and key.

**C). <u>MAIN CONTROL PANEL</u>**:

a) Main control panel shall be of table mounted type and shall baked enamel painted. The panel shall be dust, moisture and vermin proof.

b) Main control pane together with components and accessories shall be so selected and assembled as to maintain a high degree of reliability and accuracy of operation even under ardourous

environmental conditions such as high temperature and humidity. The panel shall have a fairly long MTBF between failures and shall have a service life at least 15 years.

c) Main control panel shall be completely solid state type. Electromagnetic relays shall be avoided as far as possible. The panels shall have plug in type zone PCB cards. The PCB shall of glass epoxy with contacts Gold plated. The PCB shall be provided with a protective coating to prevent corrosion due to moisture/ contamination in the normal environmental.

d) The main control panel shall be modular design and it shall be possible to extend the number of zones at a later date.
   i) A pair RED LEDS to indicate the origin of fire.
   ii) A pair ORANGE LEDS to indicate the origin of fault.
   iii) One YELLOW LED to indicate zone isolation from MCP.

e) In addition the following LED indicators shall be provided on MCP.
   i) System 'ON' & system 'OFF'.
   ii) Standby 'ON'.
   iii) AC fail.
   iv) DC fail.
   v) Battery Low.
   vi) Charger fail.

f) One voltmeter for AC and one voltmeter for DC and one DC ammeter shall be provided on the panel.

g) Distinct audible fire alarm and fault signal for each LCP shall be provided on MCP.

h) The MCP shall have the following push buttons/ switches :

   i) Power supply switch.

   ii) Zonal isolation switch for each zone.

   iii) Audible signal / alarm silencing button and LEFC lamp to indicate its operation.

iv) One "Call- All" switch and individual switch for actuation of evacuate alarm on all floors (simultaneously) or any floor/ floors individually shall be provided.

   v) Reset push button.

   vi) Test switch or push button to test alarm circuitry and lamps (LEDS) shall be provided.

i) **<u>ALERT/ EVACUATION ALARM FACILITY</u>**:

As brought out in LCP, operation of any detector on any floor, shall sound alert fire alarm on main panel which shall be silenced within 30 seconds. If alarm is not silenced/ acknowledged within 30 seconds, thereafter if not acknowledged from the panel (LCP) within 3 minutes, the

main panel shall provide actuation to sound evacuate alarm on that particular floor. For this purpose, a pulsar – timer shall be incorporated in the main control panel.

j) "Call all" alarm is a manual facility which shall sound evacuation alarm on the floor of the building by operation of a toggle switch or a push button. The main control panel shall have proper solid state circuitry and suitable capacity amplifier to provide this general evacuation alarm.

k) Failure of any indicator circuit shall not prevent the fire alarm sounding, nor acknowledgement/ silencing of alarm from one floor should prevent another alarm coming from another zone on the same floor or any other floor.

l) The following indicators to acknowledge operation of ancillary systems shall be provided on main control panel :

i. AHU shut- off on each floor.
ii. Fire doors in each floor.
iii. Fire pumps.

m) The main control panel shall be provided with 2 way voice communication system from any manual call point. The facility shall have a telephone instrument, indicators to identify the floor from which communication is desired. The system shall be actuated insertion of telephone handset plug-in socket provided in manual call point.

n) Main control panel shall provide the following fault warnings :

i. Any fault on floor < Refer Article B (i) (vii).
ii. Failure or disconnection of normal supply.
iii. Failure or disconnection of standby supply.
iv. Failure or disconnection of battery charging eqpt.
v. Earth circuit.
vi. Connection of battery with reversed polarity.

o) The main control panel shall be rugged and shall have all manual controls which are robust and positive in action. The controls shall be so located as to avoid accidental operations. All controls and indication shall be properly labeled. The panel shall have transparent door with a lock and key.

**D> <u>FIRE ALARM < SOUNDER/ HOOTERS></u>:**

a) Depending on the floor area and its layout, external audible fire alarm devices should be provided with a minimum of a pair of devices in parallel.

b) The circuit feeding power from local control panel to these fire alarm devices should be a ring circuit. If a rising circuit is not provided, then design provision to give fault signal on local control panel in the event of short circuit or disconnection of power circuit to sounders, should be made.

c) Audible fire alarm device should be an electronic hooter (bells are favoured) having frequency range of (500 HZ to 1000 HZ). The sound level should be 75db (a) above any loud noise likely to persist for more than 30 seconds.

**E>** **MANUAL CALL POINTS**:

a> On each floor one more manual call points should be installed. The call points should form the integral part of the fire detection system.

b> Manual-call points should be wall-mounting Type. The housing should be of mild steel and should be dust proof. The glass surface should be min. 150 x 150 mm and glass thickness should not exceed 1 mm. Once the glass broken, the alarm should sound on the floor as well as on the main control panel and visible indication should glow to indicate its operation. The alarm should be maintained by the control equipment, even if someone pressed subsequently.

c> Within the box a telephone (handset) socket should be provided, so that when telephone handset plug is inserted, audible and visual indication is received on the main control panel for voice communications.

**F>** **POWER SUPPLY**:

a> Main control panel should drive 240 V AC single phase, power, 50 HZ, from emergency power panel (separate from the panel supplying power to lighting and services of the building) fed from normal and emergency supply.

b> The voltages and capacity should be compatible with the voltages specified by the detector manufactures and the total power consumption of the entire system, plus that of all the sounders and 25 % detectors in alarm condition. Power feed grid may be used to feed various floors at different voltages so that the calculated voltage drop, the voltage at various LCP approximates to the specified voltage. Voltage stabilizer and ripple smoother should be used.

c> In case of mains of failure, a standby power supply should come on automatically and get automatically switched off when the mains supply is restored. A standby power shall be drawn from a battery exclusively for detection system. The battery used shall be such that all the equipment will operate at its 'final voltage'. It shall have long life of 4 years.

d> The battery charging equipment should incorporate automation control features which match the output, with limits specified by the battery manufacturer taking into account quiescent load imposed by the associated system.

e> Low battery voltage condition shall be monitored and indicated on MCP by visual and audible alarm.

f> The standby power supply should be capable of automatically maintaining the system in normal operation for a period of not less than 24 hours after the feature of regular supply after which sufficient capacity should be left to operate the general alarms on all the floors for 30 minutes.

g> The rate of battery charging should be such that having been discharged to is final voltage, the battery should be capable of complying with the recommendations in 8.6 after a charging period of 48 hours.

**G> <u>ACCEPTABLE TESTS FOR CONTROL PANELS</u>**:

The manufactured of the equipment shall produce a certificate from any nation or well known laboratory that the local control panels and main control panel have been subjected to tests given below and that they have come up to the performance requirements. A standby production sample of local control panel and main control panel excluding the batteries and sounders external to the equipment shall subjected to environment test and functional tests :

a. **<u>TEST PROCEDURE</u>**:

i. Pre- conditioning procedure.
ii. Functional tests.
iii. Pre-conditioning procedure.
iv. Environment test.
v. Functional test at the end of environment test.
vi. Recovery test.
vii. Functional test.
viii. Inspection.

b. **<u>PRE-CONDITIONING PROCEDURE</u>**:

Before and after each environment test, the temperature of the local control panels and main control panels shall be stabilised in an environment having the normal conditions of the place where the equipment is to be used. Usually temperature variations between 20° C to 30° and humidity of 45 % to 75 % should be allowed for. The temperature and humidity should be substantially constant during the precondition.

c. **<u>FUNCTIONAL TESTS</u>**:

- Operate a smoke detector from any one zone to ensure correct functioning of LCP and MCP.
- Operate alarm silencing control to ensure correct functioning.

Operate another detector from another zone to ensure correct functioning of local control panel and main control panel.

SUMMARY SHEET

| | | | |
|---|---|---|---|
| 1. | SUB HEAD "A" CABLES AND EARTHING | | |

| | | | |
|---|---|---|---|
| 2. | SUB HEAD "B" DISTRIBUTION BOARD AND INVERTER | | |
| 3. | SUB - HEAD "C" POINT WIRING | | |
| 4. | SUB - HEAD "D" LOW CURRENT SERVICES | | |
| 5. | SUB - HEAD "E" SUPPLY & FIXING OF LIGHTING FIXTURES | | |
| 6. | SUB HEAD "F" P.A. SYSTEM | | |
| 7. | SUB HEAD - "G" FIRE ALARM SYSTEM | | |
| 8. | SUB HEAD "H" OTHER ITEMS | | |
| _ | **TOTAL** | | |
| _ | **TOTAL Labour and Supply** | | |

**Terms & conditions**

1. Warranty one year from the date of commisioning
2. Any extra item not mentioned in above BOQ shall be charged extra as per rates mutually agreed upon.
3. All Raceways are of GI sheet
4. For light point wiring the rates given are for the PVC pipe.

LIST OF APPROVED MAKE OF MATERIALS

| S.NO. | DETAILS | MANUFACTURERS NAME |
|---|---|---|
| | | |
| 1) | M.C.C.B.S. | L&T / Schiender. / ABB |
| 2) | Fuses and Switches | L&T / Schiender. / ABB |
| 3) | Contactors and over load relays | L&T / Schiender. / ABB |
| 4) | Indicating lamps | L&T / Schiender. / ABB |
| 5) | Toggle Switches | Kaycee |
| 6) | Bakelite Moulded fuse bases | English Electric / L&T |
| 7) | Connector Block | Elmax / Tosha |
| 8) | CTS and Meters | Automatic Electric / IMP |
| 9) | MCBS/ DB's | Schiender / Haggar / MDS |
| 10) | 1100 Volts Armoured cables | Skytone / Finolex / Rallison |
| | (PVC cables) | Havells/Polycab/Gloster |
| 11) | Light Fixtures | Thorn / Wipro / Philips |
| 12) | M.S. Conduit | A.K.G./ B.E.C. / M-Kay |
| 13) | PVC insulated Copper Wire | Skytone / Bonton / ESC |
| 14) | Telephone/ T.V. Cables | Skytone / ESC / Bonton |
| 15) | Switch/ Sockets | M.K. / Crabtree / North West |
| 16) | Music Speaker | Bosch / Boss |
| 17) | Fire Alarm System | As per Existing System |
| 18) | Floor / Ceiling, Trunking / Box Type Cable Trays | Beeco Make |
| 19) | MICC Cable Wire | L&T or equivalent |

**Section B (Air Conditioning work)**

**Specifications for Air Conditioning work**

1. **General**

   This document pertains to supply ,installation ,testing and commissioning of Low Side HVAC system and intended to be read in conjunction with the relevant IS codes and IS Specifications (latest).

2. **Details of Site**

   The site is situated at 5th Floor of DMRC IT Park, Block-A, Shashtri Park, New Delhi. Chilled /Hot water at requisite temperature from existing High Side Installation shall be provided at AHUs by the Developers. .

3. **Contractor's Scope of Work**

   The scope of work proposed under this contract includes supply, installation, testing and commissioning of the low side HVAC system as elaborated in design drawings, detailed specifications and bill of quantities.

   The scope shall cover Supply and Installation of all necessary equipment including inline fans/propeller fans etc.

   Scope of work also includes supply, fabrication and installation of GSS ductwork, grilles/diffusers and insulation as required.

   Routine testing , pressure testing of fabricated components, balancing and Commissioning of the entire low side HVAC system and performance testing as per system requirement shall also be covered in the scope .

   The Contractor shall be responsible to complete the entire work under scope in all respect in line with the contract documents and with the directions of and to the satisfaction of the Architects/Consultants and Owners.

   The Contractor shall furnish all labour, materials and equipment ( except those to be supplied by the Owners, if any) as listed under bill of quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of complete HVAC system.

The scope shall also cover supply and installation of materials, equipment, appliances and incidental work not specifically mentioned herein or noted on the drawings or documents as being furnished or installed, but which are necessary and customary to make a complete installation. Supply of such material/equipment and execution shall be carried out in accordance with the most latest IS codes and IS specifications. In the event of non availability of relevant IS codes/specifications, good engineering practices shall be adopted.

4**. Quantities**

a) Quantities of items listed in schedule of Quantities may be increased, reduced or omitted to any extent. Exact quantity of every item shall be measured and paid as per actual work done at site.

b) The owner reserves the right to exclude any items from the scope of work of the main contract and may appoint a sub- contractor for the work directly.

c) All tenders in whom any of the prescribed conditions are not fulfilled are liable to be rejected.

5**. Engineering Responsibility of the system**

The responsibility of system design, manufacturing, erection, working and safety for low side will solely be responsibility of the Contractor for the parameters as mentioned in the tender documents prepared by the consulting engineers.

The system after commissioning shall be handed over to the Owners and thereafter they will monitor the performance of the items in the scope of work for standard designed parameters for 30 days continuously. In case during this period the performance is not found satisfactory and rectification/ replacement, design improvement or any other change is felt necessary, will be made by the Contractor at no extra cost to the Owner. Though these improvements can only be done after getting the approval from the Owners/Architects.

6. **Certificate of Inspection**

The contractor shall obtain and deliver to the owner, a certificate of final inspection by the local authorities concerned, if required at site. The inspection fee shall be reimbursed as per actual on the production of receipt in original.

Further the Owners/Architects shall have full powers to order the materials or work to be tested by an independent agency at the Contractors expense in order to prove its fault & in-adequacy.

**7**. **Design Drawings**

The drawings prepared by the Consultants are indicative only of the general arrangement of the entire installation. The Contractor shall follow these drawings and specifications in preparation of his shop drawings and subsequent installation. He shall check the drawings of other trades to verify space for his installation. The Contractor shall examine all relevant architectural, structural, plumbing, electrical and other services layout drawings before preparing the shop drawings for this installation, and report to the Architects/Consultants any discrepancy and obtain clarifications. Any changes found necessary for co-ordination and installation of this work with

other services and trades shall be made with prior approval of the Architects/Consultants and Owner without any additional cost to the Owner.

**8. Site visit & Shop Drawings**

The contractor shall visit the site and shall satisfy himself as to condition under which work is to be performed. No claim for consequences of ignorance at the later date shall be entertained. He should also check and ascertain the location of existing structure or equipment or any other situation which may effect the work.

The contractor shall submit five sets of shop drawings for air distribution system layout, Electrical panels & Equipment Layout drawings for approval of the Owners/Architects. Contractor shall also submit technical submittals for all major items including packaged units, split units, cooling towers, pumps, piping, valves, GS sheet, grilles, diffusers, fire dampers, insulation material, electrical components etc. for the approval of the Owners/Architects.

Five sets of detailed shop drawings of all equipment and materials including plant room, ducting, piping, ventilation system, electrical work associated with the HVAC system required to complete the project as per specifications and as required by the Architect/ Consultant. These drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all equipment, also the details of all related items of work by other Contractors. Each item of equipment proposed shall be a standard catalogue product of an established manufacturer as per specifications.

If the Architect/Consultants make any amendment in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated, along with the drawings on which corrections were made. After final approval has been obtained from the Architect/Consultant, the Contractor shall submit a further six sets of shop drawings for the exclusive use of and retention by the Architect/Consultant. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawings for the particular material or equipment.

The shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material to allow Architects/ Consultants ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved CPM charts.

Samples, drawings, specifications, catalogues, pamphlets and other documents submitted for approval shall be in quadruplicate, each item in each set shall be properly labeled, indicating the specific service for which material or equipment is to be used, giving reference to the governing section and clause number of Specifications clearly identifying in ink the items and the operating characteristics. Data of a general nature shall not be accepted.

Approval rendered on shop drawings shall not be considered as a guarantee of measurements of building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail nor does it any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract.

Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign and all new drawings and detailing required thereof, shall be prepared by the Contractor at his own cost and approved by the Architect/Consultant.

Where the work of the Contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make satisfactory adjustments. If so directed by the Architect/Consultant, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1:50, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the Owner.

Within two weeks of approval of all the relevant shop drawings, the Contractor shall submit to the Architect/Consultant four copies of comprehensive itemized price list of recommended imported and local spare parts and tools covering all equipment and materials in this contract. The Owner shall make arrangements to procure these spare parts and tools.

**9. Material & Workmanship**

All material used in work shall be of the best quality, obtainable and of approved list of manufacturers and shall conform to latest Indian Standard specifications unless otherwise stated.

**10. Erection and Supervision**

The Contractor shall depute engineers from time to time of commencement of installation work to inspect all relevant foundation/fabrication and other necessary facilities to make improved action if felt necessary. However, a qualified experienced engineer to be deputed at site beginning from commencement of HVAC activities at site & till handing over of the project.

**11. Testing and Commissioning**

On completion, the installation shall be tested for conformity with the stipulated performance specifications. Any defect, shortcoming detected in the system/material/workmanship shall be rectified by the Contractor to the entire satisfaction of the Consultants without any extra cost to the Owner. The installation shall be tested again after the removal of the defects and shall be commissioned only after approval by competent inspecting authority or the Consultants and the Owner. All tests shall be carried out in the presence of the Consultants and Owner's representative.

Testing and commissioning shall include furnishing all labour, materials, instruments etc. and incidentals necessary for complete testing of each component as per the specifications and manufacturer's recommendations.

Maintenance Services for the complete HVAC installation in scope of the contractor shall be provided during the defects liability period of one year.

**12. Records**

Contractor shell keep complete and daily records as per standard system of all the materials, labour, drawings, work done at site and the Architect / owner can Inspect all/ any records whenever he desires.

**13. Samples & Technical Submittals**

Samples, make or brand of all the materials must be got approved by the Architect/ Consultants/Owner in writing before they are brought to the site. Nothing extra shall be paid for presenting samples of any item as desired by Owner/Architect/Consultants.

Technical submittals of all the major items or as desired by the Architects/Consultants incorporating complete technical details in line with the tender specifications & catalogue prior to procurement of equipment/material shall be submitted for the approval.

**14.** Owner reserve the right to relax or modify any condition listed in conditions of the contract in overall interest of the work. .

**15.** All tools, plant and machinery provided by the contractor shall, when brought to the site, be deemed to be exclusively intended for construction and completion of this work and the contractor shall not remove the same or any part thereof without the consent of the Architect/ Owner.

**16**. The equipment and materials to be supplied shall conform to the requirements of the relevant IS standards.

**17**. The work shall be executed strictly as per the specifications drawn and " Approved for Construction Shop Drawings" and to the entire satisfaction of the Owners/Architects.

**18**. Completion Drawings & Documents - After completion of the work, the contractor shall furnish four sets of completion documents complete with "As Built Drawings".

**19**. The contractor shall ensure good conduct of the workman at the site of work.

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"**SPECIFICATIONS - DUCTWORK AND AIR TERMINALS"**

1. **General:**

a. The scope under this section covers supply, fabrication, installation and testing of all GS sheet metal ducts and supply, installation, testing and balancing of grilles, diffusers conforming to these specifications and the general arrangements shown on the tender drawings.

b. Duct work shall mean all ducts, dampers, access doors, joints, stiffeners, supports and hangers.

2. **Duct Work Fabricated at Site as per BIS Standards**

2.1 Duct Material and Fabrication

Material used for ducts shall be galvanized steel sheets class VIII conforming to IS:277-1962(revised) or aluminium sheets conforming to IS:737-1955 as specified in the Bill of Quantities. All ducts shall be fabricated and installed in a workman like manner, generally conforming to IS : 655-1963 (Revised) with amendment- I(1971 edition).Fabrication of ducts shall be through well conditioned Triplex lock former or multiple lock formers, conforming to relevant BIS Codes. Round exposed ducts shall be die formed for achieving perfect circle configuration.

Thickness of the sheet shall be as given hereunder:

**Sheet thickness**

| **Size of Duct** | **GSS** | **Aluminium** |
|---|---|---|
| | | |
| Up to 750 mm | 24 Gauge (0.63mm) | 22 Gauge (0.80mm) |

| | | |
|---|---|---|
| 751 mm to 1500mm | 22 Gauge (0.80mm) | 20 Gauge (1.00mm) |
| 1501 mm to 2250mm | 20 Gauge (1.00mm) | 18 Gauge (1.25mm) |
| 2251 mm and above | 18 Gauge (1.25mm) | 16 Gauge (1.6mm) |
| All Round Ducts | 20 Gauge (1.00mm) | -- |

Joints and bracing of ductwork shall generally be as per IS Specifications. However, minimum size of accessories involved shall be as given hereunder :

| Size of Duct | Joint Type | Bracing |
|---|---|---|
| Up to 750 mm | G.I. Flange | -- |
| 751 mm to 1000 mm angle iron frame with 8 mm dia nuts and bolts. | 25 mm x 25 mm x 3 mm iron frame at 1000 mm centre | 25 mm x 25 mm x 3 mm angle |
| 1001 mm to 1500 mm angle iron frame with 8 mm dia nuts and bolts. | 40 mm x 40 mm x 5 mm iron frame at 1000 mm centre | 40 mm x 40 mm x3 mm angle |
| 1001 mm to 1500 mm angle iron frame with 8 mm dia nuts and bolts. | 40 mm x 40 mm x 5 mm iron frame at 1000 mm centre | 40 mm x 40 mm x 3 mm angle |
| 1501 mm to 2250 mm angle iron frame with 10 mm dia nuts and bolts. at 125 mm centre. | 50 mm x 50 mm x 5 mm iron frame at 1200 mm centre (diagonally cross braced) | 40 mm x 40 mm x 3mm angle |
| 2251 mm and above | 50 mm x 50 mm x 6 mm angle iron frame with 10 mm dia nuts and bolts. at 125 mm centre. | 40 mm x 40 mm x 3 mm angle iron frame at 1200 mm centre (diagonally cross braced) |

2.1.2 GI sheets shall be produced using hot deep galvanization process and minimum acceptable coating of zinc shall be 120gm/Sq M.Sample of GI sheet along with test certificate to be submitted for approval prior to supply of GI sheets.

2.1.3 GI sheets shall be checked for hardness/flexibility and water marks prior to dispatch. Zinc coating if found peeled –off or duct work with water marks after fabrication shall be rejected..

2.1.4 Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made air tight.

2.1.5 All exposed ducts within conditioned spaces shall have only slip joints and no flanged joints. The internal ends of slip joints shall be made in the direction of air flow.

2.1.6 Change in dimensions and shape of ducts shall be gradual. Curved elbows, unless otherwise approved, shall have a centre line radius equal to one and half times the width of the duct. Air turns shall be installed in all abrupt elbows and shall consist of curved metal blades or vanes, arranged to permit the air to make the turns without appreciable turbulence.

2.1.7 GI splitter dampers complete with brass metal lever shall be installed at each bifurcation / trifurcation point of duct for proper flow of air quantity in each duct.

2.1.8 Ductwork shall be fabricated strictly in accordance with the "Approved for Construction" Shop drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees or angles of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

2.1.9 All sheet metal connections, partitions and plenums required to confine the flow of air to and through the filters and fans, shall be constructed out of 18 gauge galvanized steel sheet, thoroughly stiffened with angle iron braces mentioned above and fitted with all necessary doors as required by the Consultants, to give access to all parts of the apparatus. Doors shall not be less than 45cm x 45cm in size. All hardware fittings such as thunder bolts, hinges, handles etc shall be in extruded aluminium construction.

2.2 Installation of Ductwork

2.2.1 During construction, the contractor shall temporarily close the duct openings with sheet metal covers to prevent debris and any foreign material entering ducts and to maintain opening straight and square.

2.2.2 All ducts shall be installed generally as per the drawings and in strict accordance with approved shop drawings to be prepared by the contractor.

2.2.3. The contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent of these specifications and drawings. This work shall meet with the approval of the Architects/Owners in all its parts and details.

2.2.4. All ducts shall be supported from the ceiling /slab using 9mm to 12mm dia MS rods depending upon the size of the duct unless & until mentioned otherwise in the BOQ. MS angle iron of size not less than 40mmx40mmx5mm or more if duct size is large enough shall be used at the bottom. The MS rods shall be anchored to RCC slab using suitable metallic expansion fasteners.

2.2.5 All necessary allowances and provisions shall be made by the contractor for beams, pipes or other obstructions in the buildings, whether or not the same are shown on the drawings. Where it becomes necessary to avoid beams or other structural work, plumbing or other pipes, and /or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained as approved or directed by the Architects/Consulting Engineer.

2.2.6 If a duct can not be run as shown on the drawing, the contractor shall install the duct between the required points by any path available, subject to the approval of the Architect/ Consultant.

2.2.7 All duct work shall be independently supported from building elements or as required by the Architect/ Consultant. All horizontal ducts shall be rigidly and securely supported, in an approved manner, within hangers formed of MS rods and angle iron under ducts

not greater than 2 M centers. All vertical duct work shall be supported by structural members at each floor.

2.2.8 Ducting on top of the ceiling shall be supported from the slab above, or from beams with the help of adequate strength dash fasteners, after obtaining approval of the Architect/ Consultant. In no case shall a duct be supported from the ceiling hangers or be permitted to rest on a hung ceiling.

2.2.9 All metal work in dead or closed down spaces shall be erected in time to occasion no delay to other contractors in the building.

2.2.10 All air turns of 45 degrees or more shall include curved metal blades or vanes so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration. All supply air collars shall be provided with GI vanes properly secured using rivets.

2.2.11 All ducts shall be totally free from vibration under all conditions of operations. Whenever duct work is connected to fans, that may cause vibrations in the duct, ducts shall be provided with two flexible connections located close to the unit in mutually perpendicular directions. Flexible connection shall be constructed of fire resistant flexible double canvas sleeves at least 150mm long, secured properly and bolted at both ends. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both ends. The flexible connection shall be suitable for pressures at the point of installation.

2.2.12 The two mating flanges of the ducts being joined with each other shall be made air tight by providing 4mm thick rubber gasket fixed on both mating flanges by means of good quality adhesive. Rubber strip shall also be provided between bottom surface of duct and angle iron at each duct support to avoid metal to metal contact.

2.2.13 All duct supports including MS rods, cleats and angle iron shall be primer coated and thereafter, painted with black enamel paint.

2.3 <u>Round Ductwork</u>

Spiral/round ductwork wherever required shall meet following parameters :

a. Conform to BIS round ductwork requirements.

b. Round Ducts shall be constructed out of galvanized sheet steel as per relevant BIS standards.

c. Upto 1200mm dia ducts spiral lock seam shall be provided.

d. Ducts more than 1200 mm diameter shall be provided with welded longitudinal or spiral seam.

e. Lap or snap lock seams are not permitted for round ductwork of any size.

f. Provide beaded sleeve or flanged and gasketed joints for ducts.

g. Provide all welded long radius elbows.

h. Provide conical tees, all welded.

i. Butt tees or butt taps are not permitted.

All round ducts, 750 mm and larger, shall be supported with two hangers at each support point in an approved manner.

## 3. Duct Work Fabricated in Factory as per SMACNA Standards

### 3.1 Duct Material and Fabrication

Material used for ducts shall be galvanized steel sheets class VIII, light coating of zinc, nominal 120gm/SqM surface area conforming to IS:277-1962 (revised) or aluminium sheets conforming to IS:737-1955 as specified in the Bill of Quantities. GI sheet shall be of Lock Forming Quality prime material along with mill test certificates. In addition, if deemed necessary, samples of raw material, selected at random by Client's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense.

### 3.2. Recommended Thickness and Type of Joints

3.2.1 For Ducts with External Static Pressure (SP) upto 250 Pa (25mm) :

| **GSS Rectangular Ducts** | **Pressure 250 Pa (25mm)** | | |
|---|---|---|---|
| | **Duct Section Length 1.2 m (4 ft)** | | |
| **Maximum Duct Size** | **Gauge as per BOQ** | **Joint Type** | **Bracing Spacing** |
| 1–750 mm | 26 or 24 | "C & SS" OR **"4 Bolt Transverse Duct Connector-E (TDC) with built in sealant" as per BOQ .** | Nil |
| 751 – 899 mm | 26 or 24 | 4 Bolt Transverse Duct Connector-E (TDC) with built in sealant | Nil |
| 900 – 1200 mm | 24 or 22 | 4 Bolt TDC –E | Nil |
| 1201 – 1500 mm | 24 or 22 | 4 Bolt TDC-H | Nil |
| 1501 – 1800 mm | 22 or 20 | 4 Bolt TDC-H | Nil |
| 1801 – 2100 mm | 20 | 4 Bolt TDC-J | Nil |
| 2101 – 2700 mm | 18 | 4 Bolt TDC-J | Nil |

3.2.2 For Ducts with External Static Pressure (SP) upto 500 Pa (50mm) :

| **GSS Rectangular Ducts** | **External Pressure 500 Pa (50mm)** | | |
|---|---|---|---|
| | **Duct Section Length 1.2 m (4 ft)** | | |
| **Maximum Duct Size** | **Gauge** | **Joint Type** | **Bracing Spacing** |
| 1–600 mm | 26 or 24 | "C & SS" OR **"4 Bolt Transverse Duct Connector-E (TDC) with built in sealant" as per BOQ .** | Nil |

| | | | |
|---|---|---|---|
| 601-750 mm | 26 or 24 | 4 Bolt Transverse Duct Connector-E (TDC) with built in sealant | Nil |
| 751-1000 mm | 24 or 22 | 4 Bolt TDC-E | Nil |
| 1001-1200 mm | 22 or 20 | 4 Bolt TDC-H | Nil |
| 1201-1300 mm | 20 | 4 Bolt TDC-J | Nil |
| 1301-1500 mm | 18 | 4 Bolt TDC-J | Nil |
| 1501-1800 mm | 18 | 4 Bolt TDC-J | Nil |
| 1801-2100 mm | 18 | 4 Bolt TDC-J | Nil |
| 2101-2250 mm | 18 | 4 Bolt TDC-J | Nil |
| 2251-2400 mm | 18 | 4 Bolt TDC-J | Nil |
| 2401-2700 mm | 18 | 4 Bolt TDC-J | 600 * |

'C'-cleat; 'S'-S cleat; 'SS'-Standing S cleat; 'AI' -Angle Iron in mm
* Distance of reinforcement/bracing from each joint. Bracing material to be same as of material used for joining of duct sections.

For Aluminium ducts material shall be one commercial gauge higher with 22 gauge as minimum.

3.3 Fabrication Standards and Equipment

Installation shall be in accordance with SMACNA standards. In addition ducts shall be factory fabricated utilizing the following machines to provide the requisite quality of ducts.

3.3.1 Coil (Sheet metal in Roll Form) lines to facilitate location of longitudinal seams at corners/folded edges only, for required duct rigidity and leakage free characteristics. No longitudinal seams permitted along any face side of the duct.

3.3.2 All ducts, transformation pieces and fittings to be made on CNC profile cutter for requisite accuracy of dimensions, location and dimensions of notches at the folding lines.

3.3.3 All edges to be machine treated using lock formers, flangers and rollers for turning up edges.

3.4 Duct Construction

All ducts shall be fabricated and installed in workmanlike manner, conforming to relevant SMACNA codes.

a) Ducts so identified on the Drawings shall be acoustically lined and insulated from outside as described in the section “Insulation” and as indicated in schedule of Quantities. Duct dimensions shown on drawings, are overall sheet metal dimensions inclusive of the acoustic lining where required and indicated in Schedule of quantities. The fabricated duct dimensions should be as per approved drawings and care should be taken to ensure that all connecting sections are dimensionally matched to avoid any gaps.

b) Ducts shall be straight and smooth on the inside with longitudinal seams shall be airtight and at corners only which shall be either Pittsburgh or snap button as per SMACNA practice, to ensure air tightness.

c) All concealed ducts up to 750mm width within conditioned spaces shall have slip and drive (C & S/SS) joints. The internal ends of slip joints shall be in the direction of airflow. Care should be taken to ensure that S/SS Cleats are mounted on the longer side of the duct and Cleats on the shorter side. Ducts and accessories within ceiling spaces, visible from air-conditioned areas shall be provided with two coats of mat black finish paint.

d) Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Air-turns (vanes) shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.

e) Ducts shall be fabricated as per details shown on Approved for Construction Shop Drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees, or angles, of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

f) All sheet metal connection, partitions and plenums, required to confine the flow of air to and through the filters and fans, shall be constructed of 18 gauge GSS / 16gauge aluminum, thoroughly stiffened with 25mm x 25mm x 3mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Access doors shall be not less than 450mm x 450mm in size.

g) Plenums shall be shop/factory fabricated panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i.e. towards GS sheet and riveting shall be done from outside.

h) Self adhesive Neoprene rubber / UV resistant PVC foam lining 5mm nominal thickness instead of felt, shall be used between duct flanges and between duct supports in all ducting installation.

3.5 Duct Installation

All ducts shall be installed generally as per tender Drawings, and in strict accordance with approved shop drawings to be prepared by the Contractor. The contractor shall also carry out the feasibility study at site, coordination with other services and interior drawings before fabrication of duct at the factory. Any fabricated duct rejected due to these reasons shall not be paid and only final measured and installed duct shall be certified for payment.

a. The Contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent of these Specifications and Drawings . The work shall meet with the approval of Architects/Consultants/Client's site representative in all its parts and details.

b. All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the Drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes, and conduits, the ducts shall be transformed, divided or curved to one side (the required area being maintained) all as per the site requirements.

c. If a duct cannot be run as shown on the Drawings, the Contractor shall install the duct between the required points by any path available, in accordance with other services

and as per approval of Client's site representative. Fabrication of duct shall be commenced only after verifying the feasibility at site.

d. All duct work shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of fully threaded galvanized steel rods and galvanized steel angle/channel under ducts at no greater than 2 meter centre. All vertical duct work shall be supported by structural members on each floor slab. Galvanised steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles/ channels shall be hung through these cleats. Duct support shall be through dash /anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats. Size of supports shall be as given hereunder :

| Larger Size of Duct | "C" channel size | Fully threaded GI Vertical Rod size | Maximum spacing between supports |
|---|---|---|---|
| Up to 900mm | 40mmx40mmx6mm | 10mm | 2000mm |
| 901mm to 2400mm | 50mmx50mmx6mm | 12mm | 2000mm |
| 2401mm & above | 65mmx65mmx6mm | 12mm | 2000mm |

e. Ducting over false ceiling shall be supported from the slab above, or from beams, after obtaining approval of Client's site representative/Architects. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other Contractor's work in the building. All supports of ducts shall be taken from structural slab/wall by means of fastener.

f. Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick TF quality expanded polystyrene around the duct and totally covered with mortar for complete sealing. Contractor shall ensure that contact between metal duct and mortar is avoided.

g. All ducts shall be totally free from vibration under all conditions of operation. Whenever duct work is connected to fans, air handling units or blower coil units that may cause vibration in the ducts, ducts shall be provided with a fire resistant double flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve atleast 100mm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation.

h. In case of grid type false ceiling, the entire diffuser assembly with plenum shall be independently hung from the ceiling through adjustable GI wires and the same shall be connected to the main duct through a flexible round duct.

i. Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

j. Suitable arrangement shall be provided in duct for fixing of duct smoke sensor (supplied by other vendor).

j. Toilet exhaust duct shall be provided with goose necking as shown in design drawings and exhaust shall continue operation in case of fire.

## 4. **Air Terminals**

### 4.1 Dampers

4.1.1 Opposed blade type louver dampers with quadrant and thumb screw lock shall be used at supply air collars for balancing of air distribution system and box type volume control dampers having lever operation shall be used at the outlet of air conditioning equipment or as shown on the approved shop drawings.

4.1.2. All dampers shall be multi blade type of robust construction of galvanized steel unless and until specified otherwise in the Bill of Quantities and tightly fitted. The design, method of handling, and control shall be suitable for the location and service required.

4.1.3 Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation ; control or setting devices shall be made robust, easily operable and accessible through suitable access doors in the ducts. Every damper shall have an indicating device clearly showing the damper position at all times.

4.1.4 Dampers shall be placed in ducts and at each supply air collar, whether or not indicated on the drawings, for the proper volume control and balancing of the system.

4.1.5 Automatic and manual volume control opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed out of 1.6mm steel sheets and blades shall not be over 225mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8mm thickness with fine mesh.

4.1.6 Wherever required for system balancing, a volume balancing opposed blade damper with quadrant and thumb screw lock shall be provided.

4.1.7 After completion of the duct work, dampers are to be adjusted and set to deliver air flow as specified on the drawings.

### 4.2 Double Louvered Grilles

4.2.1 The supply air grilles shall be fabricated from extruded aluminium sections. The supply air grilles shall have double adjustable louvers i.e. front horizontal and rear vertical louvers, both adjustable. The louvers shall be suitable to hold deflection settings under all conditions of velocity and pressure. The grilles shall be provided with outer frame. The louvers shall be pivoted in Nylon bushes for smooth operation for return air grilles similar to supply air as described above will be provided but with out volume control damper. The grilles shall be painted as per approved powder coated shade.

4.2.2 Volume control dampers in extruded aluminium construction shall be factory fitted for supply air grilles.

4.2.3 Longer grilles having size more than 45cm shall have intermediate supports for the horizontal louvers. The sample of grille shall have to be got approved by the consultants before delivery.

4.3 Linear Grilles

4.3.1 The linear supply cum return air grilles shall be fabricated from extruded aluminium sections. Flanges shall be of minimum 1.3 mm thick extruded aluminium suitable to hold the louvers tightly in fixed position.

4.3.2 Louvers shall be minimum 3mm thick throughout of extruded aluminium construction with 15 degree deflection unless and until specified otherwise. Grilles shall be provided with removable/fixed internal core as mentioned in the BOQ. The sample of grille shall have to be got approved by the consultants before delivery.

4.3.3 All sections of grills shall be powder coated for color and shade as approved by the Architects to match interior finishes.

4.3.4 Linear grilles at each supply air outlet shall be provided with volume control dampers as mentioned above and accounted for in BOQ separately. The linear grilles shall be fixed in to a plenum chamber having GI spacers with concealed screws. End pieces or corner pieces shall be provided as required.

4.4 Diffusers

4.4.1 Square ceiling diffuser shall be anti-smudge ring type fabricated out of extruded aluminium sections. The four directional air flow diffuser shall consist of outer ring fixed to duct collar with concealed screws. Foam gasket shall be provided between outer ring and suspended ceiling. The central core shall be clip fixed to the outer ring.

4.4.2 Opposed blade volume control damper in extruded aluminium construction shall be fixed to the neck of diffuser. The damper shall be adjusted after removing the central core.

4.4.3 All sections of diffusers shall be powder coated for color and shade as approved by the Architects to match interior finishes. The sample of diffuser shall have to be got approved by the consultants before delivery.

4.5 Multislot Linear Diffuser

Linear ceiling diffuser shall be multislot type. The diffuser shall be fabricated out of extruded aluminium sections. Each slot shall be 19mm wide. Each slot shall be equipped with air flow direction control louver mechanically fixed. Integral sliding type hit & miss type volume control damper in extruded aluminium construction shall be provided for each slot for fine control of air flow in supply air portion only. The damper shall be fabricated out of anodized extruded aluminium sections.

Other sections of ceiling diffuser shall be powder coated in colour & shade approved by the Consultants/Architects.

The linear diffuser shall be fixed in to a plenum chamber with concealed screws. Side end pieces or corner pieces shall be provided if required.

4.6 Air Transfer Grille

4.6.1 Air transfer grilles shall be in extruded aluminium construction. The grilles shall be complete with single /double frame suitable to be fixed on the door panel from both sides. The central core shall be no-see-thru type.

4.6.2 The grilles shall be anodized or powder coated in colour and shade as approved by the Architects. The grilles shall be provided with insect screen.

4.6.3 The ATGs shall be provided at the door of pantry and toilets as shown in the approved drawings. The sample of grille shall have to be got approved by the consultants before delivery.

5. Painting

5.1 All grilles and diffusers shall be powder coated at factory prior to delivery at site of approved color and shade.

5.2 All ducts immediately behind the grilles/diffusers etc. to be applied with two coats of black paint in matt finish.

6.Fire cum Smoke Dampers

**Bare Dampers**

a. All supply and return air ducts/ return air spaces at AHU room crossings and at all floor crossings shall be provided with approved make motorized fire and smoke dampers of at least 90 minutes fire rating as certified by CBRI Roorkee, India as per clause 10 of UL:555-1995. These dampers shall be multi-leaf type –Ruskin.

b. Fire damper blades and outer frame shall be formed out of 1.6mm (16G) galvanized steel sheet of length as mentioned in the approved for construction shops drawings tilted as AHU Room Blow Up. The damper blade shall be pivoted on both ends using chrome-plated spindles in self-lubricated bronze bushes. Stop seals shall be provided on top and bottom of the damper housing made of 16 gauge galvanized sheet steal. For preventing smoke leakage, metallic compression side seals shall be provided. Dual side leakage shall be provided for better structural stability. The construction of the fire damper shall allow maximum free area to reduce pressure drop and noise in the air passage, in normal position damper blade shall be held in open position with the help of a 220 V operated electric actuators thereby providing maximum air pressure without creating any noise or chatter.

c. For wall mounted fire dampers retaining MS angles duly painted with black enamel paint shall be supplied and installed by HVAC Contactor as per established installation procedure. Whereas the fire damper is also used for Smoke management (Smoke and fire damper) the same shall be as per UL-555 S-Class-II.

d. Every motorized fire damper/ Smoke and fire damper shall be tested in the factory and will be certified by the manufacturer in form of the test certificate.

e. Fire dampers shall also be supplied with spring locked fusible link rated for $72^0$C (UL stamped) to close fire damper in event of rise in duct temperature.

f. For fire dampers/ smoke fire dampers of size higher than one approved by certifying agency the damper shall be supplied in multiple units of size not exceeding the tested damper by CBRI. All the multiple units shall be housed in a common factory fitted sleeve.

g. The fire dampers shall be mounted in fire rated wall with a duct sleeve 400mm/ 500mm long depending upon the wall thickness. The sleeve shall be factory fitted on fire damper. The joints at sleeve end shall be slip on type. Minimum thickness of galvanized sheet shall be 18 gauge.

h. The damper shall be installed in accordance with the installation method recommended by the manufacturer.

**Actuators**

The actuator shall be maintenance free coupled spring return type suitable to work on 24V electric supply. The torque rating of the actuator shall exceed at least by 15% over torque required to open/ close the damper. The selection of actuator size shall be the responsibility of the manufacturer of the fire damper. Spring return time shall be 20 seconds or less at ambient temperature. Other features of the damper actuator shall be as under:

a. Actuator shall have tamper proof housing with IP-54 protection rating.

b. Actuator shall have mechanical integrity of at least one hour at $900^{o}C$.

c. Actuator shall have minimum 600000 safe position at rated torque. It shall be capable to withstand temperature of $75^{o}C$ for 24 Hrs.

d. Actuator shall have electronic over load or digital sensing circuit to prevent damage to actuator.

e. Should be capable of changing direction of rotation by changing mounting orientation .

f. Actuator shall have manual over ride facility.

Damper actuator shall be such that it should close the damper in the event of power failure automatically and open in the same manner in case of power being restored.

**Control Panels**

The control panel shall be supplied by damper manufacturer fitted on damper compatible with damper actuators. The control panel shall have at least following features:

a. Power on lamps with 230 V/ 24 V Transformer.
b. Damper close and open indication.
c. Reset push button.
d. Push button for manual running of actuator for periodic inspection.
e. Auxiliary contacts 24V/ 230V.
f. Contact points to receive signal from smoke detector/ fire alarm panel.
g. Additional terminal shall be provided to have signal (audio or visual) in central control room.

In addition the Control panel shall have following features as well :

- Potential free contacts for AHU fan/Pkg Unit ON/ Off and remote alarm indication.
- Accept signal from external smoke / fire detection system for tripping the electrical actuator.
- Test and reset facility.
- Indicating lights / contacts to indicate the following status:
- Power Supply On
- Alarm

.

The control panel shall receive 230V A/C supply and interconnecting wiring between control panel and actuator shall be carried out using fire proof cables.

The Contactor shall ensure that all electrical connections are suitably terminated. The HVAC Contractor shall also check continuity of electrical circuit as recommended by the manufacture. Fire damper inspection door will be provided in AC duct to facilitate access to the system.

7. **Testing and Balancing**

7.1 After completion of the installation of the complete air distribution system, all ducts shall be tested for air leaks.

7.2 Before painting the interiors, air distribution system shall be allowed to run continuously for 48 hours for driving away any dust or foreign material lodged within ducts during installation.

7.3 The entire air distribution system shall be balanced using approved anemometer. Air quantities at the fan discharge and at various outlets shall be identical to, or less than 5 percent in excess of, those specified and quoted. Leakage in each air distribution system shall be within 3 percent so that supply air volume at each fan shall be identical to , or no greater than 3 percent in excess of, the total air quantity measured at all supply outlets served by the fan. Branch duct adjustments shall be made by volume or splitter dampers. Dampers shall be permanently marked after air balance is complete so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted to the Consulting Engineer for scrutiny and approval, and six copies of the approved report shall be provided with completion documents.

## "SPECIFICATIONS - INSULATION"

1. **Scope**

The scope of this section comprises of supply and application of insulation conforming to these Specifications and as shown on the drawings & BOQ.

2. **Duct Insulation (External)**

**Material**

Insulation material shall be closed cell elastomeric material (nitrile rubber) having fire retardant Class "1" properties followed by Class "O". Density of insulation material shall range between 0.04-0.07 gm/Cucm. Thermal conductivity (K value) at 40 C mean temperature and Service temperature limit shall be 0.039 W/M.K and –40C to 105C respectively. Water vapour permeability shall not be less than 7000 Kg/Pa/s.m.Water absorption shall not be more than 1.5% by weight. Insulation material shall have excellent ozone resistance properties. Excellent Thermal Stability. Insulation material shall be tested for the said properties in accordance with the relevant international codes including BS 874 Part 2 1986 ,DIN 52612(K Value),DIN 52615 (Water vapour permeability), BS 476 Part6 & Part7 (Flammability).

**Application**

Duct insulation shall be applied as follows :

a. External surface of the ducts to be cleaned vigorously to remove dirt and any other foreign material from the surface of the ducts.

b. Apply adhesive SR-505 on the surface of ducts.

c. Wrap closed cell insulation material having thickness as mentioned in BOQ butting all joints. All joints to be sealed with adhesive.

## 3. Accoustic Lining

### 3.1 Material

Insulation material shall be resin bonded fibreglass. The Thermal conductivity of the insulation material shall not exceed 0.034 K cal./ hr-SqM C/M or 0.27 Btu/hr sft- F/inch at 32 C (90 F) mean temperature, and density shall not be less than 24 Kg/ CuM (1.5 lb/c.ft). Thickness of the insulation shall be as specified for the individual application. Samples of insulation material shall be submitted for approval.

### 3.2 Application

#### 3.2.1 Duct Lining (Internal)

Accoustical lining of duct wherever specified shall be applied as under :

a. Internal surface of the ducts to be cleaned vigorously to remove dirt and any other foreign material from the surface of the ducts

b. 22 gauge G.S. sheet channel frames having size 25mm wide & depth equal to thickness of insulation to be fixed at maximum 600mm centre, screwed to the sheet metal using brass metal screws.

c. Fibre Glass blankets of 32 Kg/CuM density and thickness as mentioned in the BOQ to be fixed in the G.S.sheet channel frame work with joints well butted together. Thereafter, insulation shall be covered with R.P tissue.

d. Finally cover the insulation with 26 SWG perforated aluminium sheet having atleast 20% perforation with joints overlapped and screwed to the G.S. sheet channel frame using brass metal screws, to produce an even surface.

## 4. AHU Room Lining

Accoustical lining of Packaged unit rooms wherever specified shall be applied as under :

a. Wall surface to be cleaned vigorously to remove dirt and any other foreign material .

b. 24 gauge factory pressed G.S. sheet channel frames having size 25mm wide & depth equal to thickness of insulation to be fixed at maximum 600mm centre, screwed to the walls or ceiling. A grid work of 600mm x600mm shall be formed on the walls using frame work.

c. Fibre Glass blankets of 32 Kg/CuM density and thickness as mentioned in the BOQ to be fixed in the G.S.sheet channel frame work with joints well butted together. Thereafter, insulation shall be covered with R.P tissue.

d. Finally cover the insulation with 24 SWG perforated aluminium sheet having atleast 20% perforation with joints overlapped and screwed to the GI frame work using brass metal screws, to produce an even surface.

e. All longitudinal joints to be covered with 20mm wide & 3mm thick aluminium strip secured with cup washers and brass metal screws.

5. **Chilled Water Pipe Insulation**

5.1 All chilled water piping shall be insulated using specified insulation material as described here under :

**Material**

Insulation material shall be closed cell elastomeric material (nitrile rubber) having fire retardant Class "1" properties followed by Class "O". Density of insulation material shall range between 0.04-0.07 gm/Cucm. Thermal conductivity (K value) at 40 C mean temperature and Service temperature limit shall be 0.039 W/M.K and –40C to 105C respectively. Water vapour permeability shall not be less than 7000 Kg/Pa/s.m.Water absorption shall not be more than 1.5% by weight. Insulation material shall have excellent ozone resistance properties. Excellent Thermal Stability. Insulation material shall be tested for the said properties in accordance with the relevant international codes including BS 874 Part 2 1986 ,DIN 52612(K Value),DIN 52615 (Water vapour permeability), BS 476 Part6 & Part7 (Flammability).

OR

Chilled water pipes shall be insulated with rigid preformed sections of TF quality expanded polystyrene of density not less than 24Kg/CuM and thickness as indicated in the Schedule of Quantities. For a temperature range of 1.1-3.9C and pipe size ranging 12-80mm & 100-300mm,75mm & 100mm thick expanded polystyrene material respectively shall be used. For a temperature range of 4.4-12.2C and pipe size ranging 12-100mm & above 100mm,50mm & 75mm thick expanded polystyrene material respectively shall be used. For a temperature range of 12.8-15.6C and all pipe sizes 40mm thick expanded polystyrene material shall be used.

Application

No insulation shall be applied on pipes until the pipes are satisfactorily tested, as specified in section "PIPING".

Using closed cell elastomeric insulation

a. Pipes to be thoroughly cleaned with brush & linen and rendered free from all foreign material and grease.

b. Apply SR –998 adhesive on the bare surface of pipes.

c. Closed cell Elastomeric Thermal insulation preferably in tubing form shall be fixed tightly to the surface.

d. All joints to be sealed properly using same adhesive forming proper bonding.

Using Expanded Polystyrene insulation

a. Pipes to be thoroughly cleaned with wire brush and rendered free from all foreign material and grease.

b. One coat of Zinc chromate primer and two coats of CPRX compound shall be applied on the cleaned pipe surface.

c. TF quality expanded polystyrene rigid sections as mentioned in "Bill of Quantities" shall be fixed tightly to the surface. All joints to be sealed properly with CPRX compound.

d. Two layers of 500 G polythene sheet to be wrapped over the insulation to work as vapour barrier.

e. Insulated surface shall be cladded with 24 G aluminium sheet in a neat & clean manner with joints wall butted to give true surface.

For chilled water pipes buried in trench, 24 gauge x19mm square mesh GI wire netting shall be applied over polythene sheet butting all joints and shall be faced down with 20 gauge GI wire. Finally insulated surface shall be finished with two layers of sand cement plaster and there after painted with synthetic enamel paint after necessary curing.

Condensate drain piping and refrigerant piping shall be insulated in the manner specified above.

All valves, fittings, strainers, etc in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and applied generally in the manner specified above, valves bonnets, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

Chilled water pump shall be insulated to the same thickness as the pipe to which they are connected and applied generally in the manner specified above. Care shall be taken to apply the insulation in a manner as to allow the dismantling of pumps without damaging the insulation.

Tanks, wherever required in chilled water piping system i.e. expansion tanks shall be insulated to the same thickness as for the pipes to which they are connected. The mode of the insulation shall generally be as above.

## PREAMBLE TO BILL OF QUANTITY FOR AIR CONDITIONING WORK

1. All equipment described hereafter shall be in accordance with the specifications.

2. All equipment shall be selected and installed for the lowest operating noise level.

3. Supply of various equipment shall include all expenses for correspondence with manufacturers, submission of shop drawings, documents and their approval by the Architects , procurement of equipment, transportation, shipping, payment of all taxes and levies, storage, supply of equipment at the point of installation, furnishing all technical literature required, replacement of defective components and warranty obligations for the individual equipment.

4. Installation of various equipment shall include all material and labour associated with hoisting and lowering of equipment in position, insulation of the components and vibration isolation as required, grouting & anchoring or suspension arrangements and all incidentals associated with the installation as per the specifications and manufacturer's recommendation.

5. Vibration isolators as specified or as recommended by the manufacturer shall be installed with each component. Performance ratings, power consumption and sound power data for each component shall be verified at the time of testing and commissioning of the installation, against the data submitted with the tenders.

6. Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirit, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop painted surfaces.

7. Testing and commissioning shall include furnishing all labour, materials, equipment, instruments and incidentals necessary for complete testing of each component as per the specifications & manufacturer's recommendations, submission of test results to the Owners/Architects, obtaining their approval and submission of necessary completion documents & drawings. providing minor dressing of walls and floor, providing and installing pipe sleeves as required and treatment to pipes as per the specifications.

8. All piping should be installed conforming to the relevant Indian Standards, approved shop drawings and the specifications. All water re- circulation piping should be tested as per the specifications.

9. Piping installation should include all costs towards supplying and fixing of pipes and fittings (elbows, tees, reducers) cutting, threading, joining, welding, soldering and affecting connections are required, providing non- hardening sealing material as well as rubber gaskets for screwed flanges, providing and installing adequate number of clamps, hangers, saddles, brackets, rawl plugs and other accessories for pipe supports, providing minor dressing of walls and floor, providing and installing pipe sleeves as required and treatment to pipes as per the specifications.

10. Exposed steel pipes shall be given two coats of approved paint as per the relevant Indian Standards for color coding of pipes and direction of flow of fluid in the pipes shall be visibly marked with identifying arrows.

11. Valves, union, strainers, drain, air- valves, expansion joints, pressure gauges and thermometers shall be provided in the various pipe lines as per the approved shop drawings and specifications.

12. After completion of the installation, the entire piping system shall be tested for leak in accordance with the specifications.

13. All ducts shall be fabricated and installed conforming to the relevant Indian Standards, approved shop drawings and the specifications.

14. Duct installation shall include fabricating and installing the ducts, splitter dampers, turning vanes, distribution grids within the ducts in position extruded aluminium hardware fittings such as handles thunder bolts hinges, factory fabricated access door and providing , installing , MS hangers with dash fasteners, foam rubber insertions, nuts, bolts and screws as required. Making all joints air tight using rubber insertions in addition multi-louvered manually adjustable dampers shall be provided in various branch ducts as required or shown on drawings for proper balancing of air flow. All primer coated MS hangers, dampers, base frames etc. shall be painted with black enamel paint.

15. All registers and diffusers shall be provided with a soft continuous rubber gaskets between their periphery and the surface on which these have to be mounted.

16. MS registres and diffusers shall be given, at the factory, a rust resistant primer coat and enamel paint finish of approved color. Aluminium grilles and diffusers shall be fabricated out of extruded aluminium sections.

17. After completion of the installation, the entire air distribution system shall be tested for leaks and balanced in accordance with the specifications.

18. All equipment and material to be supplied under this contract shall be conforming to the relevant latest Indian Standards and international standards as applicable.

19. Appropriate troughs in the suspended ceiling be provided for terminating duct collars for diffusers and grilles by other agencies to achieve desired interior finishes.

20.Contractor to verify the static pressure of various air handling units and Head of pumps in accordance with the approved for construction shop drawings before selection of motor.

## 14. **Mode of Measurement**

The mode of measurement for the various items, unless otherwise specified, shall be as follows:

### 14.1 Ducting

Payment for ducting shall be made on the basis of the external surface area of the ducting including all material and labour for installed duct.

The rates per Sft of the external surface shall include MS angle iron /GSS flanges, gaskets for joints, nuts & bolts , duct supports & hangers, vibration isolation pads or suspenders, dash fasteners, inspection doors, dampers, turning vanes, major hardwares such as thunder bolts, hinges, handles in extruded aluminium construction and any other item which will be required to complete the duct installation except external insulation and acoustic lining.

The external area shall be calculated by measuring the overall width and depth (including the corner joints) in the centre of the duct sections and overall length of each duct section from flange face incase of duct lengths with uniform cross section. Total area will be arrived at by adding up the areas of all duct sections.

In case of taper pieces average width and depth will be worked out as follows :

W1 = width of small cross section
W2 = width of large cross section
D1 = depth of small cross section
D2 = depth of large cross section

$$\text{Average width} = \frac{W1 + W2}{2}$$

$$\text{Average depth} = \frac{D1 + D2}{2}$$

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct sections fitted with angle iron flanges, otherwise at the bottom of the flange where flanges are of duct sheet.

For the circular pieces the diameter of the section mid-way between large and small diameters shall be measured and adopted as the mean diameter for calculating the surface at the taper piece.

For the face length of taper piece shall be the mean of the lengths measured face to face from the centre of the width and depth of flanges.

For the special pieces like bends, branches, and tees etc. same principle of area measurement as for linear lengths shall be adopted except for bends and elbows, the length of which shall be the average of the lengths of inner and outer periphery along with curvature or angle of the piece.

### 14.2 Duct Insulation

This item is provided separately for various thickness and shall be paid for on area basis of un-insulated duct. The area of the duct to be insulated shall be measured before application of insulation.

14.3 Grilles & Diffusers

All extruded aluminium grilles and diffusers shall be paid on the basis of actual measurement at site on area basis using neck size as base for diffusers having outer size less than 600mm. For 600mm x600mm size diffusers being installed in grid ceiling, shall be counted at site and payment shall be made on unit basis.

14.4 Un-insulated Piping

Payment for un-insulated piping shall be made on the basis of linear measurement including all material and labor for installed pipes. The linear rate per meter/feet for each nominal diameter shall include all pipe fittings, flanges, unions, gasket for joints, nuts & bolts, pipe supports & hangers, vibration isolation arrangement, flexible connections and any other item required to complete the pipe installation except valves of any kind and strainers. The length of the pipe section with flanges shall be from flange face to flange face.

For fitting like bends, elbows, branches , reducers , tees etc. same principle of linear measurement as for pipe sections shall be adopted except for bends, the length of which shall be the average of the lengths of inner and outer periphery along the curvature.

14.5 Chilled Water Piping Insulation

Payment for CHW pipe insulation shall be made on the basis of linear measurement of un-insulated piping including all material and labor for installed pipes. The linear rate per meter/feet for each nominal diameter shall include insulation for all pipe fittings, flanges, unions etc. except valves of any kind and strainers for which payment shall be made based on the linear length of valve but size same as nominal diameter of pipe on which valve/strainer has been installed.. The length of the pipe section with flanges shall be from flange face to flange face.

14.6 Valves & Strainers

Payment shall be made on unit basis.

15. All quantities reflected in the schedule are for contractor's guidance only.

**LIST OF EQUIPMENT & ACCESSORIES WHICH AIRCONDITIONING CONTRACTOR HAS TO BRING, KEEP AND MAINTAIN, AT HIS OWN COST, AT SITE DURING THE CURRENCY OF THE CONTRACT IN GOOD CONDITION.**

| S.No. | PLANT/EQUIPMENT | NUMBER |
|---|---|---|
| 01. | Hydraulic Test Machine | 1 |
| 02. | Floor mounted drill machine | 1 |
| 03. | Hand drill machine | 2 |
| 04. | Lock forming machine for duct fabrication | 1 |
| 05. | Hand held lock closing machine | 1 |

| | | |
|---|---|---|
| 06. | Collar cutting machine | 1 |
| 07. | Mechanized saw for cutting angles & channels | 1 |
| 08. | Duct smoke test kit | 1 |
| 09. | Thermometers | 2 |
| 10. | Water line pressure testing kit | 1 |
| 11. | For application of closed cell elastomeric insulation | |
| | i. 1200 long steel scale | |
| | ii. 1200x900 size 40mm thick | 1 |
| | iii. Commercial ply board | 1 |
| | iv. Paper cutter of different sizes | 12 |

and any other equipment required for efficient execution of work within the stipulated period.

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**(Section C) Civil and Interior Work**

**Specifications for Civil and Interior Work**

**LIST OF INDIAN STANDARD REFEREED TO**

1. I.S. NO. 1200 – latest measurement of building and civil engineer work.
2. I.S. NO. 287 – 1973 recommendation for maximum permissible moisture content of timber used for different purpose in different climatic zones
3. I.S.NO. 1141 – 1973 code of practice for seasoning of timbers.
4. I.S.NO. 6534 – 1971 guiding principals for grading and inspection of timber.
5. I.S.NO. 1200 (part XXI) 1973.
6. I.S.NO. 3845 – 1966 code of practice for joints used in wooden furniture.
7. I.S.NO. 4450 – 1967 wooden flush doors. Type to method of test for.
8. I.S.NO. 4970 – 1973 key for identification of commercial timber.
9. I.S.NO. 3364 (part II) – 1975 methods of measurements and evaluations of defects in timber, part II converted timber.
10. I.S.NO. 1708 – 1969 methods of testing shall clear specimens of timber.
11. I.S.NO 6342 – 1971 Rose wood logs for production of sliced veneers.
12. I.S.NO 5248 – 1969Teakloges for production of sliced veneers.
13. I.S.NO. 2202 (part I) 1973. Specification for wooden flush door shutters (solid core type cat I plywood).
14. I.S.NO. 2338 (part 1) 1967 code pf practice for finishing of wood based materials part 1 operations and workmanship.
15. I.S. No. 7360 – 1975 Methods of sampling of plywood.
16. I.S.NO. 303 – 1975 Specification for plywood for general purposes.]
17. I.S.NO. 3129 – 1965 Specification for article board for insulation purposes.
18. I.S.NO. 3513 – 1966 (part – III & part iV) High and medium density wood based laminates part III general purposes. Part IV sampling test.

19. I.S. NO. 1659 – 1979 Block boards.

20. I.S.NO. 7916 – 1974 Decorative plywood using plurality or veneers for decorative faces.
21. I.S NO. 3478 – 1966 Height density wood particle boards.
22. I.S. NO. 1734 (part 1 to XX) Plywood method of test for
    Part I-General
    Part II-Plywood
    Part III-Battens
23. I.S.NO. 1328 – 1970 veneer decorative plywood.
24. I.S. NO 710 Marine ply.
25. I.S.NO 3087 – 1965 Wood particle boards (medium density)

26. I.S. NO. 3087 – 1965 Specification for synthetic rising adhesives for plywood (phonolic & Amino plastic)
27. I.S.NO. 2046 – 1969 Specification for decorative laminate.
28. I.S. NO. 8273 – 1976 Fibrous gypsum plaster boards.
29. I.S. No. 2095 – 1964 Gypsum plaster boards.

30. I.S.NO. 2542 (part 1) – 1978 Gypsum plaster concrete products, methods of test for part 1 – plaster and concrete.

31. I.S NO. 8272 – 1976 Gypsum plaster for use in the manufacture of fibers plaster boards.
32. I.S.NO. 2441 – 1963 Fixing coiling covering code of practice for.
33. I.S.NO. 2835 – 1977 Specification for flat transparent sheet glass.

34. I.S NO. 2395 (part 1) – 1966, 2395 (part 11) – 1967 painting to concrete masonry, plaster surface code of practice for part –1 operation and workmanship part II schedule.

35. I.S.NO. 3548 – 1966 Glazing in building code of practice.
36. I.S.NO 6279 – 1965 Specification for ready mixed paint brushing, matt or egg-shell flat finishing, interior.
37. I.S.NO. 137 – 1965 Specification for ready mixed paint brushing, matt or egg-shell flat finishing, interior to Indian standard colours as required.
38. I.S.NO. 133- 1975 Specification for ready mixed paint brushing, wooden coating, interior ti Indian standard colours.
39. I.S. NO 129 – 1950 Specification for enamel interior (a) under coating (b) finishing.
40. I.S.NO. 120- 1950 Specification for ready mixed paint brushing, finishing interior oil glass, for general purposes to Indian standard colours.

41. I.SNO. 533-1973 Specification for gum spirit of turpentine (oil of turpentine.)
42. I.S.NO. 101 – 1964 Methods of test for ready mixed paints and enamel.
43. I.S.NO. 75-1973 Specification for linseed oil, and refined.
44. I.S.NO. 77 – 1973 Specification for linseed oil, and refined.
45. I.S.NO. 124 (part1) – 1976 Specification for ready mixed paint brushing finishing semigloss for general purpose.
46. I.S.NO. 5884 – Specification for woolen carpets.

47. I.S.NO. 104- 1979 Specification for ready mixed paint Brushing finishing, zinc chrome primer.
48. I.S. NO 5391 – 1969 Adjustable metal chairs for use of typist and operators in telephone exchanges.
49. I.S.NO. 8756 – 1978 Ball catches for use in wooden almirahs.

50. I.S.NO 3499 – 1976 (part 11) chairs for office purposes metal revolving and tilting.

51. I.S.NO. 5416-1969 General purposes wooden chairs methods of test for.
52. I.S NO. 6185 – 1971 High chairs specification and safety requirements for.

53. I.S.NO> 4116 – 1976 Joints used in wooden furniture code of practice for.
54. I.S.NO 3485 – 1966 Joints used in wooden furniture code of practice for.
55. I.S.NO. 7070- 1973 Shelving racks wooden (adjustable and non-adjustable)type.
56. I.S.NO 4414-1977 table tops (wooden)
57. I.S.NO. 5967-1969 Tables, wooden method of test for.

58. I.S.NO. 3564 –1975 Door closures (hydraulically regulated).
59. I.SNO. 3564 – 1979 Drawer locks, cupboards and box locks.
60. I.S.NO. 7981 – (part1) – 1975 Glossary of terms relating to builders hardware – part 1locks.
61. I.S.NO. 204- (part 1 & 11) 1978 Tower bolts ferrous metals and non-ferrous metals.

Note: The various items to be used in the interior decoration work shall be of ISI standards. When ever the items/ products do not have ISI marks standard, shall be got tested for its quality etc. at the laboratory and necessary testing charges shall be borne by the contractor.

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**LIST OF APPROVED MAKES & GENERAL SPECIFICATION (FURNISHING & CIVIL)**

| SR. NO. | ITEMS | PRODUCT |
|---|---|---|
| 1 | **TEAK WOOD** | Only Seasoned Timber to be used |
| | FOR EXTERNAL USE | 1st quality Ghana Teak Wood, or Steam beach as suggested in details specifications: brown in color without knots, joints & bend wood. |
| | FOR INTERNAL USE | 1st quality C.P. Teak Wood, as suggested in details specifications: without knots, joints & bend wood. . |
| | FOR WOODEN MOLDING & BIDDING | 1st quality either Ghana Teak Wood, or steam beach. wood as specifications in detail specification of each item. |
| 2 | **GLASS** | |
| | 1. Glass | Modi float & frosting effect is provided where specified |
| | 2. Mirror | Modi float |
| 3 | **HARD WARE** | |
| | 1. Adhesives | Fevicol SH or Approved by interior |
| | 2. floor spring | Everite, ozonal or equivalent |
| | 3. Door stop | E.G Ozonal or eq |
| | 4. Locks | Efficient Gadget/ Godrej |
| | 5. Hinges | C.P fittings, C.P polish or good qualities/ Heavy Duty/ on design Approval |
| | 6. Stoppers, Aldrap, Knobs | C.P polish or bit make fixtures/ Heavy duty/ M.S powder coated/ on design approval |
| | 7.Drawerchannel<br>Door closer<br>Key board drawer channel, Telescopic channel, Cable organiser | E.F.G or equivalent<br><br><br>EBCO or eq. |
| | 8. Screw | Nettle fold ‘GKW’ or equivalent |
| 4 | **PLYWOOD, PARTICLA BOARD, M.D.F** | |
| | 1Commercial ply wood & B.W.P.I.S.303 | Greenply, Amul, Mayur or equivalent |
| 5 | **LAMINATE** | Silicon, Bravia, Century or eq. as per Bank standard shade or suggested by Architect |
| 6 | **PAINT & POLISH** | |
| | 1. Polish | N.C. clear Lacquor polish Duco/ Asian Melamine as suggested |
| 7 | **PAINTS** | |

| | | | |
|---|---|---|---|
| | 1. Paint | Goodlass Nerolac- Asian paint I.C.I | |
| | 2. Cement base paint | Snow cem plus | |
| 8 | **AlUMINIUM** | | |
| | 1. Alluminium sections | 12 G jindal/ Hindalco or eq. | |
| | 2. Powder coating | 50 microns | |

| | | |
|---|---|---|
| 9 | **AEROCON PARTITION** | Hydrabad cement |
| 10 | **Mineral fibre Ceiling** | Armstrong ,company or eq. |
| 11 | **GYPSUM BOARD CEILING & ARTITION** | Gypsum company |
| 12 | **VITRIFIEDFLOORING** | Euro., Asian Griffti or eqvi. company |
| 13 | **Veenear** | Archid, Euro or Eq. |
| 14 | **VERTICAL BLINDS** | Aerolux or eq |
| 15 | **MINERAL FIBRE CEILING** | Armstrong,Saint gobin |
| 16 | **CEMENT** | Ambuja, Laxmi, Chetak, L& T or eq. |
| 17 | **Tile Adhesive** | Saint gobin or eq. |

Note: In case of non-availability of any material of specified make, the alternative should be used only after its due approved by the ERNET/ Architect.

The last decision of the choice of any of the agency rest with Interior.

All unexposed wooden surface to be protected with good quality enamel paint or polished.
All Dimensions given are for considerations can be changed as per site dimensions. All ply particleboard & wood surface shall be treated by anti termite treatment at site.

All hardware / color shade shall be approved by site in charge or interior.

For all items only exposed elevation measurement shall be taken for bill amount hidden supporting members of furniture / supporting member of partition will not be taken in to account

**SIGNATURE OF CONTRACTOR**

**DATE:**

**Annexure II**

**PART B FINANCIAL BID**

**Section A Bill of Material for the Low Side HVAC Works**

| S.No | Description | Measurement | Qty | Unit Rate | Total Amount |
|---|---|---|---|---|---|
| 1 | Supply, Installation, Testing and Commissioning of Un-Insulated Square/ Rectangular sheet metal ducts as per requirement at site complete with threaded rods, channel, tie, fastners, brackets/slotted "C" channel for supply air ducting as per the approved shop drawings.(Quantities Quoted here are only for estimation purpose on tentative basis and However they are to be Charged as per actual measurement at site on Sq.mt. basis as applicable) | | | | |
| | 24/22 Gauge | SqM | 250 | | |
| 2 | Supply, Installation, Testing and Commissioning of Closed cell crossed linked polymers XLPE insulation with aluminium perforated sheet over the duct (one layer externally on the duct). | | | | |
| | 6/9 mm | SqM | 200 | | |
| 3 | Supply, Installation, Testing and Commissioning of acoustic lining glass wool insulation of 25mm thick with density of 24Kg/cum fiber glass covered with perforated aluminuim 26 SWG sheet, tissue paper, fly mesh, GI nuts, bolts and washers etc.(Quantities Quoted here are only for estimation purpose on tentative basis and However they are to be Charged as per actual measurement at site on Sq.mt. basis as applicable) | Sqm | 50 | | |
| 5 | Supply, Installation, Testing and Commissioning of extruded aluminum powder coated supply air grills/difusers with dampers and return air grills/diffusers without dampers. | | | | |
| a | Diffusors | Sets | 100 | | |
| b | Air Grills 150mm wide | sq m | 30 | | |
| 6 | Supply & Installation charges of Accessories Fire Retardent Canvas Connection as required for Ducting to AHU Units. | set | 4 | | |
| 7 | VC Dampers | set | 10 | | |
| 8 | Collar damper | sqm | 130 | | |
| 9 | Chagres for fixing of exisiting material with hardware as required | job | 1 | | |
| | TOTAL | | | | |
| | **TOTAL Labour and Supply** | | | | |

**Section B Bill of Material for Civil and Interior Work.**

| IT.NO | DESCRIPTION | QTY | UNIT | Unit rate | Total Amount |
|---|---|---|---|---|---|
| 1.1 | Dismantling existing brick masonry, ceramic tiles, Gyp Board , Plaster of any thickness at all levels including RCC patti/plaster/ dado etc at site and carting away the debris from site.Rate is inclusive of scaffolding etc. Complete as directed . | 1.00 | LS | | |
| 1.2 | Dismentaling of PCC as per requirements & directions of the company etc at site and carting away the debris from site. Rate is inclusive of scaffolding etc. Complete as directed . | 10.00 | Cum | | |
| 1.3 | Dismsntaling/removing Electrical conduits,wires, switches, sockets,D.B., cables, light fixtures & fittings as per directions and disposal of waste & unservicable items and stacking safely the servicable items for reuse as per directions. | 1.00 | job | | |
| | TOTAL FOR DISMANTLING | | | | |
| 2 | **SANITARY FIXTURES/ FITTINGS** | | | | |
| 2.1 | Providing and fixing Stainless Steel AISI 304(18/8) Kitchen Sink without drain board of size 610mm x 510 x 200 mm including CI bracket and 32 mm dia CP waste coupling & 32 mm PVC waste pipe and including single lever CP kitchen Sink mixer all complete as directed at site . | 1.00 | Each | | |
| 2.2 | Providing and fixing below counter wash basin ( Hind ware or equivalent approved make) having Rectangular shape , White colour including CI bracket , 32 mm CP waste coupling, 32mm bottle trap including CP connection pipes, Jaquar make premium range pillar cock and angle valve including cutting & make good the wall ,all complete as directed at site. | 1.00 | Each | | |
| 2.3 | Providing and fixing folded paper towel dispenser of high capacity KIMBERLY make complete in all respect. | 1.00 | Each | | |
| 2.4 | Providing And Fixing fully automatic "No Touch" hand drier suitable to operate on 220 volts, single phase 50 hz., A.C. power supply all complete. | 1.00 | Each | | |
| 2.5 | Providing and fixing KIMBERLY (or eq.) make window series-i one pack liquid soap dispenser complete in all respects. 500 ml | 1.00 | Each | | |
| 2.6 | Providing And Fixing Stain less Steel Pictogram at door shutters with stainless steel screws complete. | 18.00 | Each | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.7 | Providing & fixing 18mm thick edge moulded & mirror polished granite top of jet black colour (approved quality) for wash basin and kichen counter top over water proof board of cabinet fixed with AEALDITE & joints finished with Silicon etc. complete . | 6.00 | sqm | | |
| 2.8 | Providing and fixing Bottle trap for wash basins with all necessary accessories. | 2.00 | Each | | |
| 2.9 | Providing and fixing C.P. brass angle valve a) 15 mm nominal bore | 2.00 | Each | | |
| 2.10 | Providing and fixing C.P. brass stop cock (concealed) of standard design and of approved make conforming to IS:8931a) 15 mm nominal bore. | 1.00 | Each | | |
| 2.11 | Providing and fixing C.P. brass short body bib cock of conforming to IS:8931a) 15 mm nominal bore | 1.00 | Each | | |
| 2.12 | Providing & Fixing 25 ltr Geyser including all fittings accessories complete in all respect. | 1.00 | Each | | |
| 2.13 | Cutting in granite for desired shape & size & edge polishing for recieving wash basin & kichen sink etc. | 2.00 | Each | | |
| | C.I PIPE & FITTINGS | | | | |
| 2.14 | Providing and fixing in position SCI floor traps with vent holes (of self cleaning design) lead caulked joints, necessary bend arm complete including embedding the trap in 1:2:4 cement concrete of following size: | | | | |
| a | 100 mm dia | 2.00 | Each | | |
| b | 75 mm dia | RO | | | |
| 2.15 | Providing and fixing 100 x75 mm C.I (deep 50 mm seal ) heavy duty nahani trap with CP heavy grating and frame,all complete as directed . | 2.00 | Each | | |
| 2.16 | Providing and fixing 100 x 100 C.I “P” traps up to 450 mm long arm and CP Heavy duty grating with lead caulked joints and necessary supports etc complete | 1.00 | Each | | |
| | G. I. Pipes and fittings | | | | |
| 2.17 | Providing and fixing concealed G.I. pipes ,"B" class , Jindal or other equivalent approved make ,all complete with G.I. fittings and clamps,including painting, cutting and making good the walls etc. (internal work) | | | | |
| a | 15mm dia. nominal bore | 10.00 | metre | | |
| b | 20mm dia. nominal bore | 8.00 | metre | | |
| 2.18 | Supply & fixing "Leader make "ISI G.M full way gate valves | | | | |
| | 25 mm nominal bore | 1.00 | each | | |

| | | | | | |
|---|---|---|---|---|---|
| 2.19 | Providing and fixing 32 mm dia heavy duty PVC pipes in chases complete with wrapping and coating with FRP tape including necessary fittings, making holes in slab & making good the holes as directed | 15.00 | Rmt | | |
| 2.20 | Providing and fixing brass clean out plugs of 100 mm dia with all fittings complete | 1.00 | Each | | |
| 2.21 | Providing and fixing GI inlet fitting with one or two supply inlet as required suitable for site conditions. | 1.00 | Each | | |
| | C. I. Pipes and specials | | | | |
| 2.22 | Providing and fixing soil, waste pipes : | | | | |
| | Centrifugally cast (spun) iron S&S pipe as per IS:3989, 100mm dia including CI bend / tee etc. as required for fixing EWC, urinals & W.B. as per drgs & directions. | 17.00 | metre | | |
| | Do as above but 75 mm dia CI pipe | RO | metre | | |
| 2.23 | Providing and fixing mirror of 6 mm thick with S.S studs including 100 mm wide frosting along the edge including polishing of edges etc.complete ( MODIGUARD or Eq.) | 1.00 | Sq m | | |
| 2.24 | P/f 6 mm thick Mirror of superior glass of approved quality complete with 12mm thick BWR & fixed to wooden cleats with CP brass screws & washers including fixing teak wood prepolished moulding of size 25x12 mm around the perimeter of glass all as directed at site . ( MODIGUARD or Eq. ) | 9.00 | sqm | | |
| | TOTAL OF PLUMBING & SANITARY FIXTURES/ FITTINGS | | | | |
| **3. CIVIL WORKS (BRICK WORK, FLOORING ETC.)** | | | | | |
| | Civil work | | | | |
| 3.1 | Providing and erecting in line, level and plumb half brick walls at all levels with necessary scaffolding ,in cement mortar 1:4 including 75 mm high RCC bands at approximately one meter c/c with 2 nos of 8 mm dia Tor steel reinforcement bars as required, watering, curing, scaffolding at all level, rate to include chiselling of existing floor to required width, cleaning and making good the floor etc, complete and as directed. | 11.00 | Sqm | | |
| 3.2 | Providing and applying 15mm thick plaster on brick masonry / concrete internal walls with CM 1:4, including prewetting of walls, hacking wherever required, curing and necessary scaffolding, etc, complete in line and level, complete as directed. | 22.00 | Sqm | | |
| | Water proofing for Pantry | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 3.3 | All items of waterproofing are to be carried out by approved water proofing agency only. The work shall carry a guarantee for 10 years . All the chasing & cutting in the walls / floors shall be done by the plumber before the commemcement of the work: | | | | |
| (a) | Plastering : Providing & applying cement slurry to the horizontal / vertical RCC /Brick work including prepapartion of surface to receive 12-15 mm thick waterproof plaster in Cement Mortar 1:4 follwed by two coats of polymer modified cement slurry( minimum thickness 2mm) in cross direction over plastered RCC/ Brickwork surface . The cement slurry shall be prepared with 1 volume of FOSROC Nitobond SBR , 1 volume of cement . This layer of polymer modified cement slurry shall be protected by a top layer of 12- 15 mm thick waterproof plaster of C:M 1:4 . The water proofing chemical in cement mortar for plaster shall be mixed as per manufacturers specification. The treatment is to be extended on walls / vertical surfaces of sunken area for full depth or upto 600 mm as required at site. Finally all plaster work shall be finished with a coat of neat cement left rough to recieve the brick bat coba filling. | 7.00 | Sqm | | |
| (b) | Brick bat coba filling: After laying of soil pipes, floor traps are completed, the floor of the sunken protion shall be covered with Brick bat coba embedded manually with 15-20mm wide joints in 20mm thick water proofing mortar 1:4, in layers up to the full height of sunken portion, having top layer of 25mm thick Water proofing mortar using specialised W.P. chemical, finished smooth/rough with floating coat of neat cement all complete and as per specification. | 6.00 | sqm | | |
| 3.4 | Providing and laying in line and level up to average 50 mm thick concrete (1 : 4 : 8) (1 cement : 4 coarse sand : 8 graded stone aggregate 20mm nominal size) under floor filling to level the floor to receive flooring | 15.00 | Cum | | |
| 3.5 | Providing and fixing Vitrified tiles in dado on walls , size 450x 450/600x600 mm and of approved make fixed with cement slurry over CM 1:3 backing of 12 mm thickness and joints filled with white cement blended with matching pigment (Tile price Rs. 900/- Sqm ). The item rate to ( vary) be added/deducted based on the selected tile price in all vitified items. | 10.00 | sqm | | |
| 3.5A | Extra for Providing and fixing Vitrified tiles in dado on ply with Araldite instead of CM 1:3 | RO | sqm | | |

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| 3.5B | Providing and fixing first quality Group IV/ V ceramic tiles in dado on walls , size 300x 450 mm and of approved make and design with borders and motifs fixed with cement slurry over CM 1:3 backing of 12 mm thickness and joints filled with white cement blended with matching pigment ( Tile price Rs. 600/- Sqm as approved). | RO | Sqm | | |
| 3.6 | Providing and fixing 18 mm thick pre polished granite slabs ( as per design & pattern) of approved colour in flooring laid over 20 mm thick base of cement mortar CM 1:4, with floating coat of neat cement including finishing of joints with white cement mixed with matching color pigment all complete as directed. ( Basic rate of stone 1500/- per sqm.) | 241.00 | Sqm | | |
| 3.7 | Providing and fixing 18 mm thick prepolished granite slabs of approved colour in wall cladding / dado etc. fixed with cement paste over a 20 mm thick backing of CM 1:3, including finishing of joints with white cement mixed with matching color pigment ,all complete as directed.( Basic rate of stone 1500/- per sqm.) | 11.00 | Sqm | | |
| 3.8 | Providing and laying approximately 9 mm thick vitrified tiles of Ist quality of approved make & shade in flooring , fixed with tile adhesive and joints filled with silicon complete in all respect. (Basic rate of tile including tax 900/- per sqm.) | 835.00 | Sqm | | |
| 3.9 | Providing and fixing vitrified tiles of ist quality and of approved make & shade ,thickness appx. 9 mm in skirting using tile adhesive including finishing the joints with silicon/ white cement mixed with matching pigments. (Basic rate of tile 900/- per sqm.) | 4.00 | Sqm | | |
| 3.10 | Providing POP punning, minimum 6 mm thickness over a plastic sheet covering to vitrified tiles and removing the same as and when directed | 626.00 | Sqm | | |
| 3.11 | P/L 40 mm thk. IPS flooring as per CPWD schedule as base work for carpet tiles / Laminate. | 67.00 | Sq m | | |
| 3.12 | P/L PCC 1:2:4 in floor etc wherever required | 15.00 | Cum | | |
| 3.13 | Extra for Providing & Fixing Italian Marble ( Basic rate of stone 4000/- per sqm.) instead of Granite flooring (Extra Rate over Item no. 3.7). | RO | sqm | | |
| 3.14 | Providing & Fixing river stone floor tile ( Ventura India or as approved ) using tile adhesive including finishing the joints with silicon/ white cement mixed with matching pigments. | RO | sqm | | |
| | TOTAL FOR CIVIL WORKS (BRICK WORK, FLOORING ETC.) | | | | |
| 4.0 | False ceiling & POP Work | | | | |
| 4.1 | Providing and fixing 12.5 mm gypsum board seamless false | 648.00 | Sqm | | |

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| | ceiling on metallic grid conforming to IS 2095:1982. and maufactured by M/s India Gypsum or as approved | | | | |
| | G.I. Perimeter channels of size 27mm and 0.5mm thick having one flange of 20mm and another flange of 30mm. G.I. intermediate channel of size 45mm, 0.9mm thick with two flange of 15mm each at 1200mm centre to centre. | | | | |
| | G.I. Hanger of size 25mm x 10mm, 0.5mm thick at 1200mm centre to centre distance. G.I. cleat and steel Expansion Fasteners. Ceiling section of 0.5mm thickness having curled weedge of 51.5mm and two flanges of 26mm each with lips of 10.5mm at 450mm centre to centre, connecting clips and 12.5mm dreive all screws at 230mm centre to centre. | | | | |
| | The Metallic grid shall be installed as follows: The perimeter channel along with the perimetere of the ceilding with screw fixed to0 brickwall/partition with the help of rawlplugs and screws. The intermediate channels shall be suspended from the ceiling with steel G.I. hanger fixed to the slab soffit with G.I.cleat and steel expansion fastereners. The intermediate channels shall be at 1200 mm centre to centre distance. | | | | |
| | The ceiling section placed in a direction perpendicular to the intermediate channel at 450mm c/c distance shall be fixed to the intermediate channel with the help of connecting clips and 12.5mm dry wall screws at 230mm centre to centre distance. | | | | |
| | Finally, the 12mm thick Gypsum boards shall be fixed to the metal frames and the tapered/square edges of the boards shall be finished to a flush joint with requisites filler, paper tapes, finisher and primer suitable for Gypsum plaseter boards (as per recommendations of manufacturers, Indian Gypsum or equivalent). | | | | |
| | For Light fittings, grills, diffussers, speakers, smoke detectors, sprinklers etc, cut outs have to be made with provision of the frame along perimeter of the cut outs/opening with channels/ply to support the ceiling adequately. Rate is also inclusive of making vertical drops , design & patterns in false cieling ,all complete as directed at site . | | | | |
| 4.1A | Extra for making Light cove with a profile as per design ( Only facia of cove to be measured . Other vertical & horizontal surafce to measured in ceiling). | 28.00 | RM | | |

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| 4.2 | Providing 10mm thk plaster of Paris (anhydrous gypsum) ceiling at all floor levels as per design. Frame work with India Gypsum or equivalent G.I. Channels 50x12 mm main member & 25x12 mm cross member with grid spacing of 1200x450 mm . Rabbit wire mesh fixed to to be fixed over this frame including cost of fasteners / hangers etc. all complete as directed . | 134.00 | Sqm | | |
| 4.3 | Providing and fixing in true horizontal levels Armstrong False Ceiling System (Microlook Ultima) of grid size 600 x 600mm with G.I.ceiling framework as per manufacturer's specifications using 15mm grid and laying Ultima acoustic ceiling tiles 19mm thick of size 600 x 600mm, NRC-0.70 and R.H.-95% - microlook. (OR) AMF Performance Ceiling System, Thermotex Feinstrotos M.P. complete ceilings, size-600 x 600 x 19mm; NRC-0.70 and RH-90%. | 369.00 | Sqm | | |
| | The cost to include the cost of frame work for fixing light fixtures. The light fixtures shall not be fixed directly on to the tiles, complete in all respects. Cut outs will not be deducted while measuring the ceiling area. | | | | |
| 4.4 | Providing and fixing Openable Trap Door Shutters for Access in ceiling in 19mm thick BWR grade ply with brass hinges of 75 x 18x 18mm, on Aluminium/ Salwood framework of 75x50mm. All exposed edges shall be finished with 5mm thick T.W. Lipping. The frame work shall be secured to the ceiling with proper vertical M.S/Salwood sections. All the exposed and internal surface shall be finished with white enamel paint matching the ceiling colour. Brass Hinges "L" end key Trap door lock, etc, shall form part of standard fittings & fixtures as per directions. | 20.00 | Sqm | | |
| 4.5 | Providing and applying Plaster of Paris (Sakrani or equi.) Punning not less than 6mm thickness on existing /new walls to proper level & plumb, including making grooves, complete as per the directions of the architect. The rate should include for hacking and preparing the surfaces of walls and removal of existing paint if required. | 221.00 | SQM | | |
| 4.6 | Extra for POP cornice upto 3" x 3", with a curved profile, as per design | 79.00 | RM | | |
| 4.7 | Providing 6 mm wide grooves in Plaster of paris as per design | 200.00 | RM | | |
| 4.8 | Providing half round flutings in POP as per design & directions | 50.00 | Sqm | | |
| | **TOTAL FOR FALSE CEILING & P.O.P. WORK** | | | | |
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| 5.1 | Providing and fixing 83 mm thick full height double skin plain partitions using 50x25 mm , 18 gauge MS tubular sections welded together @ 600 mm c/c in both directions or part thereof in frame work (including additional members wherever needed for Elect. boxes, skirting etc.) and fixed with floor / walls / ceiling with screws & anchor bolts etc. The frame work shall be provided with 12 mm thick BWR plywood on both side upto false ceiling . The base of ply upto 150 mm ht. shall be painted with antitermite chemical emulsion as manufactured by fevicol industries i.e terminator brand or equivalent. The partition to be filled with insulation material "32 kg Fibre Glass in a roll form" of approved sample pasted with advesive as/ approved on ply. Rate shall be inclusive of making cutting in frame work & ply etc. for recieving electrical condiuts & installtions etc. Finally the partition shall be finished with laminate / MDF Board/ Veneer/ which shall be paid extra . (measurement for partition to be done from finished floor upto ceiling plus 75 mm excluding the area of door/Window opening including frame ) | 616.00 | Sq m | | |
| 5.1 | Extra for Using 50x25 mm, 18 gauge MS tubular sections welded together in item no 5.1 | 29.00 | Rmt | | |
| 5.2 | Providing and fixing 83 mm thick low height double skin plain partitions using 50x25 mm , 18 gauge MS tubular sections welded together @ 600 mm c/c in both directions or part thereof in frame work and fixed with floor / walls with screws & anchor bolts etc. The frame work shall be provided with 12 mm thick BWR plywood on both side. The base of ply upto 200 mm ht. shall be painted with antitermite chemical emulsion as manufactured by fevicol industries i.e terminator brand or equivalent . Rate shall be inclusive of making cutting in frame work & ply etc. for recieving electrical condiuts & installtions etc. Finally the partition shall be finished with laminate/ veneer of approved make & shade which shall be paid extra under separate item. The partition shall be provided on top/ sides with Steam Beech wood/Teak rail of size of appx. size of 90x32 mm including melamine polishing/DUCO paint etc. complete as per design/directions. | 61.00 | Sq m | | |

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| 5.03 | Providing and fixing 75mm thick wide partitions with 12.5mm thick Gyp. Board on both faces of 50mm wide 22-24 gauge thick GI sheet studs with flange placed at 610mm centres vertically in 50mm wide 0.55mm thick GI channels with flange on top and bottom of the patitions fixed with self drilling screws to existing floor and ceiling members. The Gyp. Board joints shall be covered with Fabric tape and finished with POP including providing 1-1/2"x1-1/2" seasoned Kail wood sections around door/window frames inside the GI sections & leaving opening for doors and glazings and providing necessary additional frame work wherever required including providing holes for electriclal/data conduits all complete as per drawing. | 241.00 | Sq m | | |
| 5.4 | Deduction for P & F bison board on partitions instead of 12mm thk. BWR Ply wherever required including finishing the joints and making grooves/ pattern etc., all complete as directed at site. | 22.00 | Sq m | | |
| 5.5 | Providing and fixing 1.0 mm thick laminate of approved make & shade on partitions or wherever required including making grooves / patterns all complete as directed ( base price around 30/-Sft). Deduction for not fixing the laminate shall also be made on this rate . | 693.00 | Sq m | | |
| 5.6 | Providing and fixing 1.0 mm thick laminate of approved make & shade on partitions or wherever required including making grooves / patterns , all complete as directed ( base price around 65/-Sft). Deduction for not fixing the laminate shall also be made on this rate . | 715.00 | Sq m | | |
| 5.7 | Providing and fixing 1.0 mm thick laminate of approved make & shade on partitions or wherever required including making grooves / patterns ,all complete as directed ( base price around 75/-Sft). Deduction for not fixing the laminate shall also be made on this rate . | 112.00 | Sq m | | |
| 5.8 | Providing and fixing 4mm mm thick one side decorative veneer of approved make on partitions or whrever required including making grooves/patterns & Superior grade melamine polish etc., complete as per drawing (base price around Rs. 35/- Sft). | 32.00 | Sq m | | |
| 5.9 | Providing and fixing 4mm mm thick one side decorative veneer of approved make on partitions or whrever required including making grooves / patterns & Superior grade melamine polish etc., all complete as per drawing ( base price around Rs. 90/- Sft). | 49.00 | Sq m | | |
| 5.10 | P/F BWR ply wood of any thickness on partitions or whrever required . Rate is inclusive of nails , addhesive & making grooves / patterns as directed at site. Dedeuction for not fixing the ply as mentioned below shall also be made on the same rate as given here in this item (item other than partition ply - R.O.) | | | | |

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| A | 3.5 MM thick BWR ply | ##### # | sqm | | |
| B | 6mm thick BWR Ply | RO | sqm | | |
| C | 9 MM thick BWR Ply | 112.00 | sqm | | |
| D | 12 mm thick BWR ply | RO | sqm | | |
| E | 19 mm thick BWR Ply | RO | sqm | | |
| 5.11 | Providing and fixing 3.5/4 mm mm thick MDF board of approved make on partitions or whrever required including making grooves / patterns , all complete as per drawing. | 201.00 | Sqm | | |
| 5.12 | P/F wall / col paneling with 9 mm thick BWR ply on 47 mm x 25 mm salwood frame work having members at 450 mm c/c in verticals and horizontals and fixed to walls in plumb & line with wooden cleats / nails etc. The panelling shall be finished with laminate/ veneer / MDF board etc.which shall be paid extra under separate item. Rate is inclusive of antitermite treatment to frame work . | 169.00 | Sqm | | |
| 5.13 | Providing and fixing Leatherite panel made out of 0.6 mm thick GI Sheet with an inlay of 6mm thick cross line foam having density 50-60 kg/ cum .The Leatherite shall be of approved quality and make (basic cost around Rs.500.00 per sqm). The work to be completed as per design & as directed at site . | 47.00 | Sqm | | |
| 5.14 | Providing and fixing 12 mm thick teak wood skirting of 100 mm height , approved shape & design and finished with melamine polish ,all complete as directed at site. Rate is inclusive of antitermite treatment to wood work . | 31.00 | Rm | | |
| 5.15 | P & F 6 mm thk. float Glass in Windows in partition, as per detail. (The cost of ply & Laminate fixing in the window all around the jamb to be part of cost of partition.) | 39.00 | sqm | | |
| 5.16 | Providing and fixing Beech/Teak wood moulding of following sizes and finished in melamine polish, all complete as directed. | | | | |
| (a) | 12 mm x 12 mm ( Rate only) | RO | Rm | | |
| (b) | 18 mm x 18 mm ( Rate only) | RO | Rm | | |
| (c) | 37 mm x 20 mm ( Rate only) | RO | Rm | | |
| (d) | 25mmx12mm | 169.00 | Rm | | |
| (e) | 37mmx19mm | 907.00 | Rm | | |
| 5.17 | Providing and fixing first quality wood door frame of sizes 125 x 62 mm, 75 x 50 mm or any other size with 12 mm rebate for door shutter including Superior grade melamine polishing etc.The base & side touching the floor/ partition to be applied with Anti termte treatment The rate shall be inclusive of fixing ncessary hardware for fixing the frame to partition. The rate are for following wood types: | | | | |

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| a) | Using Beech Wood | 0.85 | cum | | |
| b) | UsingTeak wood | 0.10 | cum | | |
| 5.18 | Providing and fixing 40 mm thick wood glazed door shutter having 150 wide styles, top rail & 200 mm wide bottom rail and glazed with 6 mm thick clear float glass panel fixed with 18 x 18 mm wood beading in the following wood: | | | | |
| | a) Using C.P. Teak wood | 6.00 | Sq m | | |
| | b) Using Beech wood | 80.00 | Sq m | | |
| | Rate is inclusive of melamine spray polish & hardware as detailed below. | | | | |
| | 1.Pair of Ozone make Mortice handle set (Model no OMH-11 N) | | | | |
| | 2. ISI marked door closers Ozone make - OMC-22-K2K-N-60, Make- Ozone | | | | |
| | 3. Ozone make mortice lock | | | | |
| | 4. Ozone make heavy Class 100 mm long BEARING SS hinges - 3 nos. | | | | |
| | Hardware Fittings | | | | |
| | ( The deduction for not fixing any hardware item shall also be made on these rates .) | | | | |
| 5.19 | Providing and fixing sound proof door using 9mm ply both side over frame of teak wood and filling insulation material as approved, finished with 1mm thk. Laminate/4 mm thk. Veneer over 9mm thk. Ply, including teak wood margin on all exposed faces with polish & required hardware same as in above item (cost of laminate/veneer/polish to be paid seperately). | 12.00 | sqm | | |
| 5.20 | Providing and fixing 35 mm thick solid core non decorative flush doors of approved make including fixing Beech/teak wood lipping of 10 mm thickness on the perimeter of flush door.The shutter shall be fixed using 3 numbers of 125 mm heavy duty brass oxidised /crome finish hinges with S.S. pin. The shutter shall be finished with laminate / veneer which shall be paid extra under separate item . The lipping shall be fixed after finishing of door shutter with laminate / veneer etc. Rate shall be inclusive of melamine spray polish on lipping , nails & adhesive etc. | 2.00 | Sqm | | |
| | The door shall have the following hardwares which are inclusive of rate . | | | | |
| | 1.Pair of ozone make mortice handles | | | | |
| | 2. ISI marked door closers ozone make | | | | |
| | 3. Ozone make mortice lock | | | | |
| | 4. Ozone make heavy Class 100 mm long BEARING SS | | | | |

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| | hinges - 3 nos. | | | | |
| 5.21 | Supply and fixing floor springs , DORMA make | RO | Each | | |
| 5.22 | Providing and fixing Ozone make mortice Handle Set (Model no OMH-11 N) | 2.00 | Each | | |
| 5.23 | Providing and fixing Mortise Locks Model - OMC-22-K2K-N-60, Make- Ozone | 2.00 | Each | | |
| 5.24 | Providing and fixing ISI marked Door closures Model- NSK 680 Ozone make. | 2.00 | Each | | |
| | | | | | |
| 5.24A | Providing and fixing ISI marked Door closures Model - CDC 3900 LEFT / RIGHT (AS PER DOOR OPENING) Ozone make. | 2.00 | Each | | |
| 5.25 | Providing and fixing S.S. -304 finished Dorset make Tower bolts of 200 mm long with matching screws | 2.00 | Each | | |
| 5.26 | Providing and fixing SS Hinges model no. OZ-SSBH 4x3x3 make - Ozone including stainless steel screws comlete. | 10.00 | Each | | |
| | TOTAL OF WOOD WORK | | | | |
| 6. STORAGES AND FURNITURES | | | | | |
| 6.1 | Full height storage Unit: Providing and fixing appx. 2400mm high storage unit made out of 19 mm BWR ply for verticals, top, bottom and intermediate vertical partitions @ 900 c/c or part thereof and backing of 6mm th. BWR ply . The top & exposed sides of storgae to be finished with laminate and complete in all respects as per design. | | | | |
| | Shutters shall be in 19 mm BWP grade Block board with teak wood lipping all-round. The front & back to be finished with 1 mm thk laminate. | | | | |
| | Shelves: Shelves are made of 19 mm BWR grade plywood with teak wood lipping and fixed @ 375 mm c/c supported on heavy duty S.S pins. The teak wood lipping shall be polished. | | | | |
| | Locks shall be Godrej make Universal drawer/cupboard lock (model No 5041) dead lock with S.S key-master key for groups as required. | | | | |
| | Handles shall be Kich make AISI 316 grade 96 mm long 12 mm dia for each shutter. | | | | |
| | Skirting: 100 x 19 mm ply for skirting. All external / visible surfaces including top/ back if exposed, shall be finished with 1.0 mm laminate of approved make & shade . | | | | |

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| | All internal surface of almirah including top of shelves , sides etc. shall be laminated with 1.0 mm thick laminate of white shade . The bottom of shelves to be painted with flat paint of approved shade. The top of storage unit also to be finished with a mm thk lamianate. | | | | |
| | The depth of storage to be as under: | | | | |
| a) | 450 mm deep | 10.00 | Sq m | | |
| b) | 600 mm deep | 52.00 | Sq m | | |
| c) | 750 mm deep | 32.00 | Sq m | | |
| c) | 945 mm deep | 3.00 | Sq m | | |
| | | | | | |
| 6.2 | Low height storage Unit: 450 mm deep, Similar to the above item but with height ranging from 750-1200 mm .The top & exposed sides of storgae to be finished with laminate and complete in all respects as per design. | 8.00 | Sq m | | |
| | | | | | |
| 6.03 | Providing and fixing storage unit 600 mmm deep and approx. 800 mm high under the counter for kitchen | | | | |
| | Caracass shall be made out of 19 mm Marine Ply for verticals, bottom and top and intermediate horizontal and backing of 6mm marine Ply as per design. | | | | |
| | One shelf made of 19 mm ply supported on Heavy duty pins. | | | | |
| | Shutters shall be from 19 mm Th. BWP block board with teak wood lipping, fixed with copper oxidized 75 mm long hinges. | | | | |
| | Hardware: Brass brush steel finish 50 mm long tower bolt for one shutter and SS 96 mm long 8 mm dia CHC 104 C Kich make combination finished C type Bow handles @ one for each shutter. Locks shall be Godrej make cupboard lock with S.S key with master keys for groups. | | | | |
| | All the exposed/ visible surfaces shall be provided with 1.0 mm thick approved laminate . | 7.00 | Sq m | | |
| | All the Internal surfaces shall also be finished with 1 mm thick white laminate . | | | | |
| | TOTAL OF STORAGES | | | | |
| 7 | PAINTING | | | | |
| 7.1 | Providing and applying on all exposed surfaces of walls, columns, beams, ceiling etc 2 or more coats Plastic Emulsion paint of approved make and shade over a coat of primer and putty, etc, complete. | 50 | Sq m | | |

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| 7.2 | Painting with minimum 2 coats of Lustre paint of approved shade and make on the walls, plywood, Gyp board including all necessary surface preparation ,application of putty and primer etc. complete. | 33.00 | Sq M | | |
| 7.3 | Providing and applying Texture paint of approved make as per design and pattern all complete as per manufacturer's specifications | 66.00 | Sq m | | |
| 7.4 | Providing and applying DUCO paint of approved make shade all complete as per manufacturer's specifications | 35.00 | Sq m | | |
| 7.5 | Providing and applying DUETTE (ICI or eq.) paint of approved make , design and pattern all complete as per manufacturer's specifications | 66.00 | Sq m | | |
| | | | | | |
| 7.6 | Providing and applying on all exposed surfaces of flush door/Ply ceiling 2 or more coats of flat paint of approved make and shade over a coat of primer and putty including surface preparation etc. complete. | 5.00 | Sq m | | |
| 7.7 | Providing and applying synthetic enamel paint whrever required in 2 or more coats over a coat of primer etc. complete. Rates are inclusive of surafce preparation. | 10.00 | Sq m | | |
| 7.7A | Providing and applying on all exposed surfaces of walls, columns, beams, ceiling etc 2 or more coats of O.B.D. of approved make and shade over a coat of primer and putty including surface preparation etc. complete. | 30 | Sq m | | |
| 7.8 | Providing & applying Premiun quality melamine spray polish using superior quality material (only approved sample / material to be used) over door / window frames including moulding / door shutters / wall paneling etc. as per std. steps complete in all respect desired shade as directed at site. ( measurement to be done for length / area) | | | | |
| 7.8A | Area of glazed door shutter, only area of one side to be measured. | 17.47 | sqm | | |
| 7.8B | on door / window frames including mouldings attach to frame | 20.58 | sqm | | |
| 7.8C | Moulding 37x19mm | 164.98 | Rm | | |
| | TOTAL OF PAINTING | | | | |
| 8 | MISCELLANEOUS | | | | |
| 8.01 | Providing and fixing Roller blinds of " Mac" or "Vista" or "Hunter Douglas" make (Basic price of Product 1800/- after discount) of approved shade all complete as per manufacturers specifications. | 84.00 | Sqm | | |

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| 8.02 | P/F Garware film on glazing in door , partitions etc., all complete as per manufacturers specifications . | 174.00 | Sqm | | |
| 8.02A | P/F 3M designer film (Base rate of film 225/-) on glazing in door , partitions / wall etc., all complete as per manufacturers specifications . | 10.00 | Sqm | | |
| 8.03 | P/doing Steel work in MS angles, flats, sq bars as per drawing , design & directions including painting with two or more coat of synthetic enamel paint over a cost of primer . | RO | Kg | | |
| 8.04 | P/F of frame less 12 mm thick toughened glass edge polished fixed in partition as per drawing & design. Rate shall be inclusive of aluminium floor u channels , fittings ,joint filling with silicon sealant etc. complete as directed. | 39.00 | Sqm | | |
| 8.05 | P/F of fully glazed door shutter of 12mm toughened edge polished glass single/double leaf including patch fitting, 450 mm long S.S Handle set,door locks and floor spring as approved. Rate is inclusive of all hardware fittings such as etc. complete as directed at site. | 8.00 | Sqm | | |
| 8.06 | P/Fixing 10 mm thk Laminated wooden Flooring (AC4 class) & skirting of approved make & shade complete in all respect .The flooring to be laid over PU foam over existing floor.The wooden laminated flooring panels to be 12 -15 mm thk tongue & groove joint | 32.00 | Sqm | | |
| 8.07 | P/Fixing 500 x500 mm carpet tiles of approved shade & make with following specifications: | | | | |
| | The tile to be made of multi level loop of 100% PP with 1/16" gauge with 21 OZ/Sqyard pile wt. with 4 mm average ple height with PVC fibreglass backing for a heavy commercial classification. | 47.00 | Sqm | | |
| 8.08 | P/F wall paper of approved make , shade & quality as directed (base price Rs 1000/- per sqm) | 34.00 | Sqm | | |
| 8.09 | P/F 3D Board ( GLO 8011 or as approved ) over existing partition ply including advesive etc. complete as per drawing / design. | 35.00 | Sqm | | |
| 8.10 | P/F 6mm Lacquer glass Sant gobin make ( base price of glass 300/- after discount) over existing partition ply including advesive etc. complete as per drawing / design. | 14.00 | Sqm | | |
| 8.11 | P & Fixing dining Counter 2500x600x900 supported on 3 nos. 75 dia S.S. 304 grade pipes with 150 dia connecting pracket in pantry finished with 19 mm thk Zed Black granite on 19mm BWR Ply (cost of granite to be paid extra) fixed with Araldite as per design/drawing. | 1.00 | each | | |

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| 8.12 | P/F 600 wide Cash counter made of 19 mm thk commercial board finished with 1 mm thk laminate with facia finshed with 38 x19 mm thk. Beech/teak wood half round moulding includive of a 750x450 laminate top key board with telescopic channels including hardware & melamine polish complete as per drawing. | 1.00 | RM | | |
| 8.13 | P/F Reception Table with 19 mm thk commercial board finished with 12 MM thick Du pont or equivalent acrylic material and laminate with complete hardware , accessories & finishes as per design/drawing. | 1.00 | each | | |
| 8.14 | P/F Commercial Board U shape box 100x100x100 mm finished with 4 mm thk. Veneer ( Rs. 35/- Sft) Superior grade melamined polished & fixed to partition & ceiling as per design & directions. | 10.00 | RM | | |
| 8.15 | P/F 4 mm thk back painted glass in existing panelling as per directions | 50.00 | Sqm | | |
| 8.16 | P/F 6 mm thk back painted glass in existing panelling as per directions | 5.00 | Sqm | | |
| 8.17 | P/F white board as per directions | 5.00 | Sqm | | |
| | TOTAL OF MISCELLANEOUS WORKS | | | | |
| 9 | **FIRE FIGHTING WORK** | | | | |
| 9.1 | Disconnecting/reconnecting & carrying out the job mentioned below including testing & commissioning to the company/premises owners satisfaction as per existing site conditions. | 1.00 | LS | | |
| | | | | | |
| 9.2 | Providing, fixing and jointing including testing heavy quality Mild Steel pipes conforming to IS:1239/partI/1974 including cutting, threaded or welded (all type) joints as per detialed specifications.and providing suitable flanges wherever required,complete with necessary fittings viz bends, tees, reducers etc.required including fixing the pipes on wall/ceilling/ beam/floor with suitable hangers, clamps and painting the pipe of following sizes complete. Pipes should be welded joint(all type of welded joints) | | | | |
| A | 50 mm dia | 42 | RM | | |
| b. | 25 mm dia | 56 | RM | | |

| | | | | | |
|---|---|---|---|---|---|
| 9.3 | Providing and fixing 15mm gunmetal sprinkler head with quartzoid bulb and set to operate at specified temperature pendent/upright/side wall as per the location indicated on the drawings. Sprinklers 68degree C FOC/UL/FM approved complete with socket nipple, adaptor etc. sprinkler shall be pendant type. Temperature of operation 68 deg. C Make: Tyco | | | | |
| | a. Up right type | 35.00 | No | | |
| 9.4 | Providing and fixing of SS sprinkler connector pipe (1000 mm long ) | 54.00 | No | | |
| | TOTAL OF FIRE FIGHTING WORK | | | | |
| | | | | | |

| ESTIMATE CIVIL & INTERIOR WORKS. | | | | Unit rate | Total Amount |
|---|---|---|---|---|---|
| | | | | | |
| S.NO. | DESCRIPTION | UNIT | Qty | | |
| 1 | Wooden doors with glass as | | 19 doors | | |
| | per drawings. 2100*840 mm | | | | |
| 2 | Wooden doors with glass as | | 8 doors | | |
| | per drawings.2100*1100 mm | | | | |
| 3 | Windows glass 8mm | Sqft | 480 sqft | | |
| 4 | Ceiling | sqft | 9000 sqft | | |
| 5 | Granite flooring | Sqft | 850 sqft | | |
| 6 | Wooden flooring | Sqft | 350 sqft | | |
| 7 | Carpet tile flooring | Sqft | 450 sqft | | |
| 8 | Tile scatting | Rft | | | |
| 9 | Laminate on existing panelling | Sqft | 1800 sqft | | |
| 10 | Laminated panelling | Sqft | 1100 sqft | | |
| 11 | Plastic emulsion paint | Sqft | 4000 sqft | | |
| 12 | Polish in conf. room | Sqft | 700 sqft | | |
| 13 | All windows and doors polish | | | | |
| 14 | Floor polishing | Sqft | 2500 sqft | | |
| 15 | Reception table | 1 no'S | | | |
| 16 | PANTRY: | | | | |
| A | Wall punning | Sqft | 350 sqft | | |
| B | Granite counter/cabinet | | | | |
| C | Plumbing work | | | | |
| D | Wall tiles | | | | |
| 17 | TOILETS: | | | | |
| A | W.C Hindware | | 8 no's | | |
| B | Urinal Hindware | | 4 no's | | |
| C | Wash basin Hindware | | 8 no's | | |

| | | | | | |
|---|---|---|---|---|---|
| D | Wall tiles 300*600 mm | Sqft | 1400 sqft | | |
| E | Floor tiles 450*450 | Sqft | 650 sqft | | |
| F | Removing of existing tiles | | | | |
| 18 | Removing of debris from site | | | | |
| | | | | | |
| | TOTAL | | | | |

**Section C – Electrical and Fire Alarm System**

| S.NO. | DESCRIPTION | QTY. | UNIT | Unit rate | Total Amount |
|---|---|---|---|---|---|
| | The rates quoted under this sub head shall include the following: | | | | |
| a) | Providing proper tools and plants for doing proper cabling job. | | | | |
| b) | Cutting chases, providing clamps hangers etc. for fixing the cable/cable tray earth strip / earth wire in position. | | | | |
| c) | Excavation back filling and disposal of surplus earth as required. | | | | |
| d) | The cables in proper way taking into consideration the turning radius of cable. | | | | |
| **S.NO.** | **DESCRIPTION** | **QTY** | **UNIT** | | |
| 1) | Supply, Installation, Testing & Commissioning of Advance Miantenance Free Chemical Gel Earthing System of 10 feet length, 2 inch dia, 2 mm thick electrolytic grade copper tube duly filled with conducting chemicals with the permenant sealings at the both the ends with the lead terminal at the top along with 5 Kgs of Part A GRIP & 5 Kgs of Part B GRIP combined to form a chemical gel to retain the life span of 30 years with the heavy duty poly plastic earth pit cover. | | Sets | | |
| | Rate only presently buidling earth will be used. | | | | |
| 2) | Supply, installation, effecting proper connection testing and commissioning of the following size copper earth strips / G.I. Wires as required. | | | | |
| a) | 25 x 3 mm G.I. Strip | | RM | | |
| b) | 25 x 3 mm Cu Strip | 0 | RM | | |
| c) | 8 SWG G.I. Wire | | RM | | |
| d) | 35sqmm copper flexible | | RM | | |
| 3) | Supply, laying, installing, testing & commissioning in position of the following size XLPE aluminium conductor armoured cables as per IS: 1554. On cable tray in massonary trench / directly burried in ground. The quoted price shall be inclusive of clamping while laying on tray cost of sand cushioning and brick protection while directly burrying in ground and sadding in case of laying in massoinary trench. | | | | |
| a) | 4 X 95 sq mm Al Arm | | RM | | |
| b) | 4 x 16 sq. mm cable | | RM | | |
| c) | 4 x 10 sq. mm cable | 0 | RM | | |
| d) | 4 x 6 sq. mm cable copper Arm | | RM | | |
| e | 2 x 6 sq. mm cable (Inverter) | | RM | | |

| | | | | | |
|---|---|---|---|---|---|
| 4) | Supplying, installing, effecting connection testing and commissioning cable and joints with solderless crimping lugs, double compression glands etc. as required with earthing of cable glands. | | | | |
| a) | 4 X 95 sq mm Al Arm | 4 | Sets | | |
| b) | 4 x 16 sq. mm cable | 4 | Sets | | |
| c) | 4 x 10 sq. mm cable | | Sets | | |
| d) | 4 x 6 sq. mm cable | 6 | Sets | | |
| e | 2 x 6 sq. mm cable | 6 | Sets | | |
| | **TOTAL SUB HEAD "A"** | | | | |

**SUB HEAD "B" DISTRIBUTION BOARD AND INVERTER**

| S.NO. | DESCRIPTION | QTY | UNIT | Unit Rate | Total Amount |
|---|---|---|---|---|---|
| **A.** | **DISTRIBUTION BOARDS** | | | | |
| | Design, manufacture, supplying, installing testing and commissioning of distribution boards manufactured out of 18 S.W.G. C.R.C.A. sheet double door type duly painted, complete with copper bus bars, neutral link, earth strip, cable alley etc. as required. | | | | |
| 1. | **8 WAY T.P.N. (FOR LIGHTING)** | | | | |
| | MCB FP 63A | 3 | Sets | | |
| | MCB 4P 40A | 3 | sets | | |
| | MCB SP 0.32A | 144 | sets | | |
| | BLANK | 24 | sets | | |
| 2. | **12 WAY T.P.N. VERTICAL AS MAIN PANEL** | | | | |
| | 12 WAY TPN FOR UPS OUTPUT PANEL | 2 | Sets | | |
| 6. | **12 WAY S.P.N. (FOR INVERTER)** | | | | |
| | 12 Nos. S.P.M.C.B.S. as outgoing and 40 Amps. DP M.C.B. with as incomer. | 1 | Sets | | |
| | **TOTAL SUB HEAD "B"** | | | | |

**SUB - HEAD "C" POINT WIRING**

POINT WIRING: The rates for Point Wiring shall include the following:

a) Point Wiring shall include with circuit wiring (2.5 sq. mm.) of light / fan / outlets of any length from the distribution board via switch to the point.

b) All the light fixtures, ceiling fans, exhaust fans, third pin of outlets, switch and outlet boxes shall be earthed with 1 mm dia. Insulated copper wire.

c) Providing & Embedding conduits and allied fittings in walls / floors etc. cutting chases and making the surfaces good or fixing in partition cutting chases paneling false ceiling work with proper hangers / clamps. (Conduits & wiring for power out-lets only shall be paid seperately on linear measurements basis).

d) All accessories necessary to complete the wiring as specified.

e) Most of conduiting shall be done on surface, boxes may be urea type in place of G.I.

| S.NO. | DESCRIPTION | QTY | UNIT | Unit rate | Total Amount |
|---|---|---|---|---|---|
| 1 (i) | Wiring for the following light points with 1.5 sq.mm. PVC insulated copper conductor FRLS wires in proposed concealed / exposed PVC Conduit called for the specification including providing 6 amp modular type switches cover plate to switch boxes and earthing. | | | | |
| a) | One point controlled by one 6 Amp switch | 300 | Nos. | | |
| | Switch 5A | 120 | Nos. | | |
| | Blank plate for 3M speaker boxes. | 40 | Nos. | | |
| 2 (i) | Wiring for 6 Amp **primary** light plug outlets with 1.5 sq.mm. PVC insulted copper conductor FRLS wires in proposed concealed / exposed M.S. conduits as called for including providing 6 Amp 3 pin socket outlet and 6 Amp switche sockets, cover plate to outlet boxes and earthing etc as rquired. | 60 | Nos. | | |
| (ii) | Wiring for 6 Amp **secondary** light plug outlets with 1.5 sq.mm. PVC insulted copper conductor FRLS wires in proposed concealed / exposed M.S. conduits as called for including providing 6 Amp 3 pin socket outlet and 6 Amp switche sockets, cover plate to outlet boxes and earthing etc as rquired. | 90 | Nos. | | |
| 3) | Wiring for exhaust fan / ceiling fan / Bracket fan points with 1.5 sq.mm. PVC insulated copper conductor wires in concealed/ exposed M.S. conduits as called for including providing 6 Amp 3 pin socket near exhaust fan G.I. box for housing switches 6 Amp socket outlet and cover plate to switch and outlet boxes and earthing etc as required. | 5 | Nos. | | |

| | | | | | |
|---|---|---|---|---|---|
| 4) | Wiring for following light points directly controlled by DB's with 2.5 sq.mm FRLS copper conductor wires in concealed/exposed M.S. conduits as called for including terminating wires in DB as well as fixtures. | | | | |
| a) | One point controlled by MCB in DB (cost of MCB included in the cost of D.B) | 0 | Nos. | | |
| b) | Extra for every additional point in the same set. | 0 | Nos. | | |
| 5. | Supplying, Laying and Fixing of 15/5 Amp **power plug primary** outlets with 2 X 4 + 2.5 sq.mm. PVC insulated copper conductor wires in concealed / exposed GI conduits as called for including providing 15 Amp 6 pin socket outlet and 15 Amp switch, cover plate to outlet boxes and earthing etc as required. | 6 | Nos. | | |
| 6. | Supplying, Laying and Fixing of 15/5 Amp **power plug secondry** outlets with 2 X 2.5 + 1.5 sq.mm. PVC insulated copper conductor wires in concealed/exposed **GI** conduits as called for including providing 15 Amp 6 pin socket outlet and 15 Amp switch, cover plate to outlet boxes and earthing etc as required. | 0 | Nos. | | |
| 7. | Supplying, Laying and Fixing of 20 AMP SP Industrial Socket controlled by 20 Amp SP MCB with 2 X 6 + 2.5 sq.mm. PVC insulated copper conductor wires in concealed / exposed **PVC**. conduits as called including providing of MS enclosure etc. as required. | 2 | Nos. | | |
| 8. | Supply and fixing of **primary** UPS points with 3 X 2.5 sq.mm. copper wire in exposed / concealed proposed **PVC**. conduit comprising of 2 Nos. 5 Amps. 5 pin sockets controlled by 1 Nos. 5 Amps. switch with indication lights complete with cover plate, M.S. boxes etc. | 60 | Nos. | | |
| 9. | Supply and fixing of **secondary** UPS points with 3 X 1.5 sq.mm. copper wire in exposed / concealed proposed **PVC** conduit comprising of 2 Nos. 5 Amps. 5 pin sockets controlled by 1 Nos. 5 Amps. switch with indication lights complete with cover plate, M.S. boxes etc. | 90 | Nos. | | |
| 10. | Supply, Installation of following GI conduits with junction boxes complete. | | | | |
| i) | 20 mm dia conduit | 0 | RM | | |

| | | | | | |
|---|---|---|---|---|---|
| ii) | 25 mm dia conduit | 150 | RM | | |
| iii) | 32 mm dia conduit | 0 | RM | | |
| iv) | 40 mm dia conduit | 0 | RM | | |
| v) | 20 mm dia. flexible conduit. | 500 | RM | | |
| 11. | Supply and drawing effecting of the following FRLS wires in the existing conduits. | | | | |
| i) | 2 x 4 sq.mm. wire along with 1 No. 2.5 Sq.mm FRLS insulated copper wire. | 2 | Coil | | |
| ii) | 2 x 6 sq.mm. wire along with 1 No. 2.5 Sq.mm FRLS insulated copper wire. | 0 | coil | | |
| iii) | 2 x 10 sq.mm. wire along with 1 No. 4 Sq.mm FRLS insulated copper wire. | 0 | coil | | |
| iv) | 2 x 2.5 sq.mm. wire along with 1 No. 2.5 Sq.mm FRLS copper wire. | 6 | Coil | | |
| v) | 2 x 1.5 sq.mm. wire along with 1 No. 1.5 Sq.mm FRLS copper wire. | 6 | Coil | | |
| | **TOTAL SUB HEAD "C"** | | | | |

**Note : Requirement of GI Pipes/ PVC conduits will discussed in the pre bid meeting specifically.**

**SUB - HEAD "D" LOW CURRENT SERVICES**

a) The rates under this sub head shall include:
b) Embedding conduits and allied fittings in walls / floors etc. by cutting chases and making the surface good or fixing in partition cutting chase paneling / false ceiling work with proper hangers / clamps.
c) 2 mm dia GI pull wires in conduit work.

| S.NO. | DESCRIPTION | QTY | UNIT | Unit rate | Total Amount |
|---|---|---|---|---|---|
| | Providing and fixing in position GI 65mm x 100mm x 50mm T.V. outlet boxes with cover plate and T.V.socket. | 2 | set | | |
| | Supply and laying of Co- axial cable RG - 6 in existing conduit complete as required. | 100 | m | | |
| | Supplying, fixing, testing & commissioning of Computer data cable, Cat-6 including terminating with numbering ferrules on both ends | 6 | Boxes | | |
| | Supply and fixing 2 pair 0.6 mm dia copper conductor (ATC) wires from junction box to outlet complete with effecting connections with numbering ferrules. | 30 | coil | | |

| | | | | | |
|---|---|---|---|---|---|
| (ii) | Providing and fixing in position following GI/MS conduits including providing all accessories concealed or exposed as required including cast iron junction boxes and approved cover plate complete with GI pull wire. | | | | |
| a) | 20 mm dia GI/MS conduit | 0 | RM | | |
| b) | 25 mm dia GI/MS. conduit | 150 | RM | | |
| c) | 32mm. dia GI/MS. conduit | 40 | RM | | |
| d) | Providing and fixing in position GI / 65 mm x 100 mm x 50 mm Computer outlet boxes with cover plate & RJ-45 outlet | 35 | set | | |
| e) | Providing and fixing in position GI / 65 mm x 100 mm x 50 mm Telephone outlet boxes with cover plate & RJ-11 sockets. | 120 | set | | |
| 5. | Supply and fixing of 150 pair tag (krone type) blocks duly housed in MS / wooden enclosure | 1 | No. | | |
| | | | | | |
| 6. | Supplying and fixing 10 pair 0.6mm. dia copper conductor (ATC) wire. | 50 | RM | | |
| | **TOTAL SUB HEAD "D"** | | | | |

**SUB - HEAD "E" SUPPLY & FIXING OF LIGHTING FIXTURES**

The rates quoted under this sub head shall include the followings:-

a) Receiving, assembly, testing and commissioning of all fixtures issued free for fixing
b) Safe custody of fixtures during execution time shall be the responsibility of contractor and and damages of caused shall be charged to contractor account.
c) Earthing of all fixtures with copper wire
d) Painting of all supports and down rods as required and called for

| S.NO. | DESCRIPTION | QTY | UNIT | Unit Rate | Total Amount |
|---|---|---|---|---|---|
| 1. | Receiving fixing in position effecting proper connection testing and commissioning of prewired fluorescent fixtures of all sizes on ceiling or on walls with all fixing accessories complete as required. | 131 | Each | | |
| 2. | Receiving and fixing in position effecting proper connections testing and commissioning of incandescent / CFL / halogen ceiling bracket / pendent bulk heads lights as required. | 235 | Each | | |
| b) | 2 x 36 watts CFL mirror optic luminaire with paralite P5 louvers surface mounted light fixture "Philips CAT FBS450 2x36PLL D-6, DF | 131 | Nos. | | |
| c) | 2x 18 watts CFL recessed mounted light fixture, "Philips CAT FBH 150M 2xPL-C/4P18W EBW complete with lamps, ballast etc. as required. | 175 | Nos. | | |

| | | | | | |
|---|---|---|---|---|---|
| d) | 1 x 28 watts T5 decorative type light fixture, Wipro CAT GCF 31128 SGW 1x28 w complete with lamps etc. as required. | 35 | Nos. | | |
| e) | 1 x 28 watts T5 decorative type light fixture, "PHILIPS Cat No. TMS 122M 1xTL5-28w EBW complete with lamps etc. as required. | 27 | Nos. | | |
| g) | Supply of 300 mm. dia 900 R.P.M. exhaust fan with louvered shutters. | 5 | Nos. | | |
| | **TOTAL SUB HEAD "E"** | | | | |

**SUB HEAD "F" P.A. SYSTEM**

| S.No. | DESCRIPTION | QTY | UNIT | Unit Rate | Total Amount |
|---|---|---|---|---|---|
| | Supply, installing, testing and commissioning of following P.A. System equipment. | | | | |
| 1) | **SPEAKERS** | | | | |
| | Ceiling mounted speakers with 8 ohm impedence and 5 watt rated output, in metal casing with line matching transformers with tappings of 5W, 3W & 1W. | 0 | Nos. | | |
| 2) | **VOLUME CONTROL SWITCHES** | | | | |
| | Rotary volume control switches heavy duty type for above transformers with `ON' `OFF' facility. The volume control switch can be either in stepless version or 7 stepped click free version housed in G.I. box. | 0 | Nos. | | |
| 3) | **SPEAKER WIRING** | | | | |
| | Speaker wiring in 20 mm dia M.S. conduits with twin twisted 40/0.2 mm 2 core loudspeaker cable. | 0 | RM | | |
| 4) | Amplifier 200 watts P.M.P.O. with 2 inputs with speaker matching 4,18,16 ohms. 70/100 volts. | R.O. | Nos. | | |
| | **TOTAL SUB HEAD "F"** | | | | |

**SUB HEAD - "G" FIRE ALARM SYSTEM**

| S.NO | DESCRIPTION | QTY | UNIT | Unit rate | Total Amount |
|---|---|---|---|---|---|
| | **FIRE DETECTION SYSTEM** | | | | |
| | Supply, installation, testing and commisioinng of microprocessor based expandable Analogue addressable type fire alram control panel with min 160 characters display. The panel should be equipped of 1 loop expandable to 2 loop with each loop capacity to take 99 addreessable detectors/ devices in one loop, 1000 event history, four acess levels, system protocol, suffiecnt numbers of programmable relays controls for controlling AHU etc. | 1 | each | | |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Supply, installation and commisioing of UL listed repeater panel with minimum 160 charaters backlit LCD display & with event and audiable status LED'S scroll button to view additional events, local sounder and provided in its encloser | 1 | Each | | |
| 2 | SITC of UL listed intelligent addressable photo electric smoke detectors with base built in isolators for distributed intelligence and electronic intelligence & electronic addressing | 63 | Each | | |
| 3 | SITC of UL listed intelligent addressable heat detectors with base built in isolators for distributed intelligence and electronic intelligence & electronic addressing | 38 | Each | | |
| 4 | SITC of UL listed intelligent addressable manual call points /pull station. | 3 | Each | | |
| 5 | Supply, installation, testing and commissioning of Addressable hooters of intensity minimum 90db suitbale for alram siren | 3 | Nos. | | |
| 6 | Supply, installation, testing and commissioning of Addressable resposne indicators | 43 | No. | | |
| 8 | Supplying, installing, testing and commissioning 2 x 1.5 Sq.mm Copper conductor PVC insulated, PVC sheathed armoured MICC cable including cable end termination. | 1000 | RMT. | | |
| | Supply and installation of sprinkler system by extending it with GI flexible pipe and new sprinkler | 30 | set | | |
| | **TOTAL SUB HEAD "G"** | | | | |

**SUB HEAD - "H" OTHER ITEMS**

| **SS covers for the junction boxes** | Qty | Unit | Unit rate | Total Amount |
|---|---|---|---|---|
| 350x300mm | 4 | each | | |
| 450x200 mm | | each | | |
| 550x350 mm | | each | | |
| Cable trey 200x40mm GI Perforated | 50 | meter | | |
| | | | | |
| **TOTAL SUB HEAD "H"** | | | | |

**SUB HEAD "I" FIRE CLEARANCE CERTIFICATE**

| **DESCRIPTION** | CHARGES/ FEE |
|---|---|
| Fire Clearance Certificate from the Govt. Authority | |