

GENERAL CONDITIONS**1.0 General**

The work shall be executed as per CPWD General Specifications for Electrical Work Part-I (Internal) 2013, Part-II (External) 2023, Heating, Ventilation & Air-Conditioning (HVAC) - 2024 as amended upto date wherever applicable, as per relevant IS and as per directions of Engineer-in-Charge. The technical specifications are to be read in conjunction with above and in case of variations, technical specifications of tender document shall apply. Nothing extra shall be paid on account of additional features in the technical specifications as the same are to be read along with schedule of quantities for the work.

Location: NIFT, Bhopal.

1.1 The Department shall not issue any T & P and nothing extra shall be paid on this account.

1.2 The work to be awarded by this tender shall be treated as indivisible works contract.

1.3 Before quoting the rates the tenderer should visit the site, so as to acquaint themselves of the site condition.

1.4 Any damage done to the existing structure shall be restored to its original shape & colour by the contractor for which nothing extra shall be paid.

2.0 No foreign exchange shall be made available by the Department for importing (purchase) of equipment, plants, machinery, materials of any kind or any other items required to be carried out during execution of the work. No delay and no claim of any kind shall be entertained from the Contractor, on account of variation in the foreign exchange rate.

3.0 Rate:

The rates quoted by the tenderer, shall be firm and inclusive of all taxes (including GST), custom duty, entry tax, duties and levies and all charges for packing forwarding, insurance, freight and delivery, installation, testing, commissioning etc at site i/c temporary constructional storage, risks, overhead charges, general liabilities/obligations and clearance from local authorities.

4.0 Completeness of tender:

All sundry equipment, fittings, unit assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections, and all other items which are useful and necessary for efficient assembly and installation of equipment and components of the work shall be deemed to have been included in the tender irrespective of the fact whether such items are specifically mentioned in the tender documents or not.

5.0 Storage and custody of materials:

Contractor has to make his own arrangement for storage of material and their safe custody shall be the responsibility of the contractor till the final taking over of the installation by the department.

6.0 Care of the Building:

Care shall be taken by the contractor while handling and installation the various equipment and components of the work to avoid damage to the building. He shall be responsible for repairing all damages and restoring the same to their original finish at his cost. He shall also remove at his cost all unwanted and waste materials arising out of the installation from the site of work.

7.0 Completion period:

The completion period indicated in the tender documents is for the entire work of planning, designing, approval of General arrangement drawings, supplying, installation, testing, commissioning and handing over of the entire installation to the satisfaction of the Engineer-in-charge.

8.0 Performance Guarantee:

8.1 The tenderer shall guarantee among other things, the following vis-à-vis specifications.

a. Quality, strength and performance of the materials used.

b. Safe mechanical and electrical stress on all parts under all specified conditions of operation.

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9.0 Defect Liability Period:

- (i) All the equipment's shall have defect liability period of **24 months** to be reckoned after the date of recording of completion certificate by the department.

The equipment's or components, or any part thereof, so found defective during warrantee period shall be forthwith repaired or replaced free of cost, to the satisfaction of the Engineer-in-Charge. In case it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk and cost of the contractor.

- 10.0** Contractor has to submit OEM test certificate at the time of submission of bills.

11. Proper Shop Drawing Scheme Plan showing piping route & accessories need to be approved before executive of work.

12.0 Power Supply:

Power Supply for the purpose of Installation of plant and equipment shall be arranged by the tenderer.

13. The bidder should submit undertake to use material as specified in the technical specification of tender including makes and declare that no deviation will be taken from the specifications, makes as specified in tender during execution.

14. **Water Supply:-** Contractor has to make arrangement of water for testing of Fire Fighting Work.

15. In case Engineer-in-charge feels that some brand is not meeting the product specifications, the same shall not be allowed even if its brand name is included in list of approved make/brand. No claim of contractor on this account shall be entertained.

16. Bidder should submit original leaflet & letter of authority from the manufacturer.

17.0 Compliance with Regulations and Indian standards

- 17.1** All works shall be carried out in accordance with relevant regulation, both statutory and those specified by the Indian Standards related to this work. In particular, the equipment and installation shall comply with the following:

- a. Factories Act
- b. Indian Electricity Rules
- c. I.S. & BS Standards as applicable
- d. Workmen's compensation Act
- e. statutory norms prescribed by local bodies

- 17.2** Nothing in this tender shall be construed to relieve the successful tenderer of his responsibility for the design, manufacture and installation of the equipment with all accessories in accordance with currently applicable statutory regulations and safety codes.

18.0 Indemnity:

The successful tenderer shall at all times indemnify the department, consequent on this works contract. The successful tenderer shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause and the department shall not be responsible for any accident or damage incurred or claims arising there from during the period of erection, construction and putting into operation the equipments and ancillary equipment under the supervision of the successful tenderer in so far as the latter is responsible. The successful tenderer shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the successful tenderer due to the above.

19.0 Erection Tools:

No tools and tackles either for unloading for shifting the material for erection purposes would be made available by the department. The successful tenderer shall make own arrangement for all these facilities.

20.0 Mobilization Advance:

No mobilization advance shall be paid for this work.

21.0 Verification of correctness of Equipment at Destination:

The contractor shall have to produce all the relevant records to certify that the genuine equipment from the manufacturers has been supplied and erected.

22.0 Painting:

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This shall include cost of painting of entire exposed iron work in the installation. All material works shall be painted at the works before dispatch to the site.

23.0 Quality Assurance:

- 23.1 The conduiting plan, Internal EI layout, schematic diagram as per contract specifications shall be prepared by the respective contractor and will be submitted by contractor duly signed before placing the order. The engineer-in-charge shall approve the shop drawing/ plan /layout as per contract conditions.
- 23.2 All the materials to be used in the work shall be new and of good quality and shall be not older more than 6 months from the date of receipt at site or year of manufacturing should be current. The equipment shall be procured directly from the manufacturer or authorized dealer and delivery challan / proof of dispatch of material of the Agency from where the material is purchased in support of genuineness of material shall be submitted along with bill for verification.
- 23.3 Manufacturer test certificates of all the equipment and material shall be submitted along with supply.
- 24.0 Department may send any material for testing. Testing charges if any shall be borne by the contractor. No amount will be paid for sample material sent for testing purpose.

25.0 Completion Plans:

After completion of work the contractor shall submit three sets of manufacturer's maintenance and operating instructions.

26. The order of preference in case of any discrepancy as indicated in condition No. 8.1 under "Conditions of Contract" give in standard CPWD contract form may be read as the following:
- Nomenclature of items as per schedule of quantities.
 - General conditions, Particular specification and additional condition, if any.
 - CPWD specifications.
 - Architectural Drawings
 - Indian standard specifications of B.I.S.
 - Sound Engineering Practice

A reference made to any Indian Standard specification in these documents, shall imply to the latest version of that standard. Including such revision/amendments as issued by the bureau of Indian standard upto last date of receipt of tenders. The contractor shall keep at his own cost all such publications of relevant Indian standard applicable to the work at site

- 27.0 The material should purchase from OEM or their authorized dealers.
- 28.0 It will be the responsibility of contractor to get the statutory CEA approval from Electricity Board. The statutory payments shall be made/reimbursed by the department on production of receipt/ challan/ demand note etc.,
- 29.0 As the building is operational, contractor has to arrange the work in phased manner.

30.0 Terms of Payment:

The following percentage of contract rates shall be payable against the stages of work as shown.

SL No.	Stage of Work	All Items
1	After delivery at site in good condition on pro rata basis	75%
2	On completion of pro-rata installation	10%
3	On commissioning and completion of successful running in period	10%
3	On successful testing and commissioning of the system	5%

- 31.0 Specialized agency should be submit association of any enlisted contractor those having ERP certificate within 15 days awarded of work and RFI shall be done accordingly.

Assistant Engineer (E) P.
CPWD, Bhopal

Executive Engineer (E)
CPWD, Bhopal

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COMMERCIAL & ADDITIONAL CONDITION
(For VRV/VRF AC System)

1 General

- 1.1 The work is of extremely urgent and important nature and is required to be completed on priority within the target date, in co-ordination with other agencies.
- 1.2 The firm is required to deliver all the major component of VRV/ VRF AC system as per milestone given in tender.
- 1.3 This Specification covers manufacturing, testing as may be necessary before dispatch, delivery at site, all preparatory work, assembly and installation, commissioning putting into operation of VRV/ VRF AC system.

2 Location

- 2.1 The building premises are situated at **NIFT Bhopal**.
- 2.2 The work shall be executed as per CPWD General Specifications for HVAC works (Other than VRV/VRF units) amended upto date & as per relevant IS and as per directions of Engineer-in-charge. These additional specifications are to be read in conjunction with above and in case of variations, specifications given in this Additional conditions shall apply. However, nothing extra shall be paid on account of these additional specifications & conditions as the same are to be read alongwith schedule of quantities for work.
- 2.3 The tenderer should in his own interest visit the site and familiarizes himself with the site conditions before tendering.
- 2.4 No T&P shall be issued by the department and nothing extra shall be paid on account of this.

3.0 Scope of Work

The work comprises broadly the following items :

- a) Supply, installation, testing and commissioning of VRV/ VRF Air conditioning system comprising of Outdoor units on terrace and ceiling suspended ductable /cassette/High wall indoor units.
- b) Supply, installation, testing and commissioning of centralised system controller in each range.
- c) Fabrication and installation of sheet metal / pre-fabricated duct work.
- d) Insulation/acoustic treatment of equipment, enclosures, piping and ducting as specified.
- e) Supply, installation, testing and commissioning of motor switchgear, sub-distribution boards, cables and earthing system.
- f) Supply, laying and commissioning of electrical power cables in trench/tray/wall/duct.
- g) Supply, installation, testing and commissioning of necessary controls and safeties along with control wiring.
- h) Supply, installation, testing and commissioning of Central control station for HVAC equipment.
- i) All the civil work relating to air conditioning job.
- j) Painting and final finishing of all the works.

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- k) System balancing and prescribed seasonal performance test of all the equipment/system.
- l) Any other work not covered above to make complete system and comply with the full intent of this contract.

4.0 WORKS TO BE DONE BY THE CONTRACTOR

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

- I) Foundations for equipments i/c foundation bolts, channel, baseframe, scafolding for fixing of pipes and vibration isolation spring/ pads.
- II) Excavation and refilling of trenches in soil wherever the pipes are to be laid directly in ground including necessary base treatment and supports.
- III) Sealing of all floor slab/ wall openings provided by the department or contractor for pipes and cables from fire safety points of view after laying of the same.
- IV) Painting of all exposed metal surfaces of equipments and components with appropriate colour, if required.
- V) Making good all damages caused to the structure during installation and restoring the same to their original finish.
- VI) Power supply, Water supply.

5.0 Additional Information Required

(1) Along with the Tender

- a) Each tenderer shall submit the following additional information along with the Bid.
- b) Their conformity to the system design and assurance to achieve the designed inside conditions through the equipment offered by them as per Appendix.

(2) Within one month of award of work

- (a) Submission of drawings including detailed design of the complete HVAC system i/c Heat load calculations and positioning, piping & equipment layout etc. in line with the scheme & BOQ shall be submitted for approval of the department.
- (b) A tentative programme in the form of a PERT/bar chart showing the tenderers proposed sequence of operation together with the estimated times for each activity including preparation of drawings, delivery, erection and commissioning.

This should be in conformity to the Mile stones given in the tender documents.

6.0 Rates:

6.1 The prices to be quoted by the intending tenderer shall include supply, installation, testing and commissioning of air conditioning and ventilation equipment at the site, of all equipment ancillary material and other items whatsoever required for carrying out the job to fulfil the intent and purposes as laid down in the specifications and/or the drawings.

6.2 The tenderer's price shall be deemed to include all nut-bolts, shims, clamps, supports, etc. as required for proper fixing and/or grouting of equipment, ancillary items, etc., whether

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specifically mentioned or not. The Contractor shall also include, in his price, all taxes, duties or other levies (viz. excise duty, customs duty, works contract tax, sales tax, octroi, etc.) which are legally leviable on the air-conditioning and ventilation equipment and installation. Failure to include all leviable taxes and duties will not entitle the Contractor to any extra claims from the Owner. The Contractor's rates shall remain firm and fixed during the currency of the Contract. Service Tax reimbursed will be governed by Clause 37 of GCC.

7.0 Standard Specification and Code of Practices

- 7.1 The complete work shall be carried out as per the BOQ, tender specifications including additional specification & shall conform to CPWD General specifications for HVAC works 2024, Electrical works Internal part-I 2023, External part-II 2023, VRF/VRV Air-Conditioning System - 2019, as amended up to date.
- 7.2 Except where otherwise stated or permitted by Engineer, all materials and workmanship shall conform to latest Indian Standard Specification issued by the Bureau of Indian Standards (hereinafter abbreviated to IS). In the absence of any IS, the work shall conform to latest equivalent British or American Standard. All workmanship shall be best of its particular kind.
- 7.3 Wherever the names of manufacturers are indicated against specified items, it is to be understood that items shall be of established best quality. If contractor desires to offer alternate manufacturer, he should provide sufficient information/documents to allow owner/engineer to decide if the products are of equivalent or superior quality. The Engineer's decision in this respect shall be final and binding on the Contractor.
- 7.4 It is not the intent of this tender to completely specify all details of design and construction. Nevertheless the system, shall conform in all respect to a high standard of engineering design and workmanship and shall be capable of performing in continuous operation in a manner acceptable to owner.
- 7.5 The electrical equipment supplied and installed shall comply in all respects with Indian Electricity Act and Indian Electricity Rules (1956) as amended upto-date.

8.0 Statutory Regulations Inspection and Testing

It will be the Contractor's responsibility to prepare and submit drawings, test certificates and any other information as may be required by the local authorities and to obtain supply and commissioning of the equipment.

9.0 Competency of Electrical Staff

Accepted norms of good workmanship are required. The related electrical works shall be done by qualified and trained staff having sufficient competency in electrical works and under the overall supervision of electrical contractors licensed by the Central Govt./ Government of MP for such works.

10.0 Drawing, Maintenance Manual, etc.

- 10.1 On the award of the work the Contractor shall immediately proceed with the preparation of detailed fabrication drawings detailing the equipment that are to be installed and the ancillary works that are to be carried out. Three sets of all such drawings shall be submitted to the Engineer for his approval to ensure that the works will be carried out in accordance with the specifications and drawings, including such changes as may have been mutually agreed upon. All the drawings shall be delivered to the Engineer for his approval as per schedule. The approval of the drawings by the Engineer shall in no way relieve the contractor from his obligations to provide a complete and satisfactory installation and operation as per intent and purpose as laid down in the specifications. Any omissions and/or errors shall be made good or rectified whether or not the drawings are approved. Prior to the completion of the work the contractor shall furnish to the CPWD four (4) sets of as built

drawings approved by the Engineer and comprehensive manuals, describing all components and furnishing a list of instructions for the operation and maintenance of the plant.

- 11.0 The Contractor shall also fix in the plant room neatly typed and laminated, instructions in detail, for the starting and running of the plant.
- 12.1 Any special tools required for the operation or the maintenance of the plant shall be supplied free with the plant.

13.0 Time of Completion

The Contractor shall execute the work with due care and diligence within the specified time. This includes testing, commissioning and handing over the systems.

14.0 Insurance and Storage

All consignments are to be duly insured upto the destination from warehouse to warehouse at the cost of the supplier. The insurance covers shall be valid till the equipment is handed over duly installed, tested and commissioned.

15.0 Painting

This shall include cost of painting of entire exposed iron work complete in the installation. All equipments works shall be painted at the works before despatch to the site.

16.0 Storage and custody of materials :

Storage space if any available may be used for storage of sundry materials and erection equipments or else the agency has to make his own arrangement. No separate storage accommodation shall be provided by the department. Watch and ward of the stores and their safe custody shall be the responsibility of the contractor till the final taking over of the installation by the department.

17.0 Co-ordination of Builders Work

- 17.1 The Contractor shall co-ordinate the requirements for holes fixing and other similar builder's work with the Engineer. However, it will be the Contractor's responsibility to carry out all such

work after receiving due clearance from the Engineer.

- 17.2 The Contractor shall ensure that such builder's work as shown on Engineer's drawing are in accordance with the specialist sub-contractor's/suppliers requirements. Details of holes, fixing, etc. which are not shown on Engineer's drawings but are required by the Contractor shall be forwarded to the Engineer for his written approval at least one week before the scheduled date of commencement of such work. No holes or fixing shall be formed without prior approval by the Engineer. Puncturing post concreting as an after thought shall not be permitted.

18.0 Erection Programme to Match with Other Contractor

Time is the essence of the Contract. The Contract shall co-ordinate with other agencies working in the site. If so required the contractor shall suitably modify his program and methodology of work as required and approved by the Engineer to suit the overall program of construction. In case, for whatever reason, it is required by the Owner/Engineer that the contractor delay affecting the delivery of their equipment and/or the program of installation at the site the same shall be done by the contractor and he shall not be entitled to any compensation in terms of time and cost due to idle labour or any other reason due to such delay.

19.0 Works of Owner and other Agencies

The ordinary business and works of the OWNER and other agencies being as carried out on and in the vicinity of the site will be continued during the construction, completion and maintenance of the works and the Contract shall be conducted in such a way as to avoid interference with traffic of every kind by land and with any other works in progress in the vicinity.

20.0 Existing Services

- 20.1 Drains, pipes, cables, overhead wires and similar services encountered in the course of the works shall be guarded from injury by the Contractor at his own cost so that they may continue in full and uninterrupted use to the satisfaction of the owners thereof and the Contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.
- 20.2 Should any damage be done by the Contractor, to any mains, pipes, cables or lines (whether above or below ground) whether or not shown on the drawings and the Contractor must make good or bear the cost of making good the same without delay to the satisfaction of the Engineer and of the owners.

21.0 Scaffolding

The Contractor shall provide all necessary temporary scaffolding for the proper execution and completion of the works. These shall be altered, re-located and adapted from time to time as necessary. The Contractor is to ascertain whether any scaffolding is required by any Sub-Contractor before striking. If the Contractor should strike any scaffolding before it is so required, he shall re-erect it at his own expense.

22.0 Keeping Site Clean

The Contractor shall at all times keep the Site clean and shall dispose of all the rubbish and offensive material in a manner approved by the Engineer.

23.0 Avoidance of Nuisance

23.1 The Contractor shall take all necessary precautions in reducing noise of plant by means of mufflers, silencers, screens, etc.

23.2 Work liable to create dust shall be well wetted before being executed.

23.3 The work shall be carried out strictly in accordance with the time schedule and other instructions given by the Engineer taking care to cause minimum amount of noise, dust and other nuisance at the site.

24.0 Prevention of Fire

Contractor shall provide at all time adequate portable fire extinguishers in his work area and take all adequate precautions against fire hazard.

25.0 Advertising

No advertisement may be placed on any hoarding, fencing, building or scaffolding erected in connection with this contract without the written permission of the Engineer.

26.0 Supervisory Staff

Contractor shall arrange for required supervisory staff as and when required. He shall submit staff deployment schedule at the time of tendering complete with the Bio-data of key personnel proposed to be posted at site for daytime and shift duties. However, it is understood that contractor shall depute a qualified, senior and well experienced Engineer at the site for all the days until the completion and successful handing over of the plant.

27.0 Progress Report

The Contractor shall submit to the Engineer on the first day of each week a progress report for the proceeding week showing upto date progress during the previous period of all important items of each section or portion of the works. He should also submit the plan of activities for the coming week.

28.0 Return and Drawings

All reports, statements, returns, diagrams or drawings, etc., which the Contractor is required to submit during the progress of the works to the Engineer or to the Engineer's Representative shall unless otherwise directed, to be furnished in triplicate and at expense of the Contractor.

29.0 Procurement of Material

It will be the responsibility of the Contractor to procure material such as structural steel, cement, etc. for works. No essentiality certificate for acquiring steel, cement or any other material shall be issued by the Owner.

30.0 Names of Manufacturers and Copies of Orders

Before ordering any material of any description for the permanent works the Contractor shall submit for the approval of the Engineer, the names of the makes and suppliers proposed and any other detail required by the Engineer, Contractor shall also furnish in duplicate the order copies of the material.

31.0 Test Certificates

All manufacturer's certificates of test proof sheets, mill sheets, etc. showing that the materials have been tested in accordance with the requirements of the appropriate Indian Standard, other relevant standard specification or this specification, are to be supplied free of charge.

32.0 Records and Usage of Materials

The Contractor shall maintain a detailed record of all materials received on the site or in his stores or storage and working areas in the vicinity of the Site and shall make such records available to the Engineer at such times or the later as may reasonably be required.

33.0 Quality Certificate of Materials

- 33.1 The Contractor shall be required to produce manufacturer's quality certificates for the materials supplied by the Contractor. Notwithstanding the manufacturer's certificates, the Engineer may ask for testing of materials in approved test houses. The test result shall satisfy the requirements of the relevant Indian Standards.
- 33.2 Whenever quality certificates are missing or incomplete or when material quality differs from standard specifications, the contractor shall conduct all appropriate tests as directed by the Engineer at no extra cost.
- 33.3 Materials for which test certificates are not available or for which test results do not tally with relevant standard specifications, shall not be used.

34.0 Material Samples

- 34.1 Samples of the following materials wherever applicable are to be submitted to the Engineer or Engineer's Representative for testing and approval before use on works.
1. Insulation material
 2. Grilles/diffusers
 3. Gaskets, screws, nuts, bolts, etc.
 4. Any other material being used in the HVAC works.
- 34.2 Sampling of materials for approval and testing as called for under appropriate Indian Standard or other relevant standard specification, and sampling and testing referred to later in this

specification is to be done without charge.

- 34.3 Samples once approved will remain with the Engineer till the completion of works. Samples rejected will have to be replaced for fresh approval.
- 34.4 Samples provided to the Engineer or the Engineer's Representative for the retention are to be in labelled boxes suitable for storage.
- 34.5 Materials and workmanship not corresponding in character and quality with approved samples will be rejected.

35.0 Inspection of materials and equipments

- 35.1 Materials and equipments to be used in the work shall be inspected by the authorized CPWD representative. The contractor shall make the arrangements to carry out the inspections. Such inspection will be of following categories:
1. Inspection of materials / equipments to be witnessed at the Manufacturer's premises in accordance with relevant BIS /Agreement Inspection Procedure.
 2. To receive materials at site with Manufacturer's Routine & Type Test Certificate(s)
 3. To inspect materials at the authorized dealer's godowns to ensure delivery of genuine materials at site.
 4. To receive materials after physical inspection at site.
- 35.2 Adequate care to ensure that only tested and genuine materials of proper quality are used in work shall be ensured by firm. The firm shall ensure that:
- (i) Material will be ordered & delivered at site only with the prior approval of the department to ensure timely delivery.
 - (ii) As and when the order is placed for the panels, fitments, it shall be endorsed to the CPWD Engineer-in-charge.
 - (iii) The firm will be required to procure material like piping, panels, wires & cables, conduits and switchgear etc. directly from the approved manufacturer/ authorized dealers to ensure genuineness & quality. (Refer Appendix for approved makes.)
 - (iv) Inspection at factory or at godown, as required, shall be arranged by the firm on for a mutually agreed date.
 - (v) Delivery of material shall be taken up only with the consent of department, after clearance of the material.
 - (vi) For fabricated equipments, the contractor will first submit dimensional detailed drawings for approval before fabrication is taken up in the factory. Suitable stage inspection at factory also will be made to ensure proper use of materials, workmanship and quality control.
 - (vii) Department shall reserve the right to waive inspection in lieu of suitable test certificate, at its discretion.

360.0 Despatch of Material

Materials shall not be despatched from the manufacturer's works or to the site without authority from the Engineer or his representatives.

37.0 Testing

- 37.1 All types of routine and type tests shall be carried out at the work site of the Contractor or the manufacturers of components. The Engineer in charge or his representative shall be free to witness any or all tests if he so desires.
- 37.2 On the completion of the installation, the contractor shall arrange to carry out various initial tests as detailed below in the presence of Departmental Representative to the complete satisfaction of the Engineer / Owner, and their representatives. Any defects or shortcomings found during the tests shall be speedily rectified or made good by the Contractor at his own expenses.
- 37.3 The initial tests shall include but not be limited to the following:
- To operate and check the proper functions of all electrically operated components viz. compressor, fans, etc. as well as its motors.
 - To check the air distribution of the system and to ensure design air flow in all areas as shown on the drawings.
 - To check the systems against leaks/ condensation in different circuits, alignment of motor, 'V' belt, adjustable control setting and all such other tests which are essential for smooth functioning of the plant.
- 37.4 In addition to the 'Initial' tests the Contractor shall demonstrate the trouble free uninterrupted running of the plant for a period of **not less than 120 hours**.
- 37.5 Contractor shall carry out specified performance tests of various equipment/system including efficiency, capacities noise level etc. during continuous running period and in presence of engineer.
- 37.6 On the satisfactory completion of all above tests the plants be considered to be 'Virtually complete' for the purpose of taking over by the Owner.

38.0 Contractor shall carry out three seasonal tests each of 48 hours during defect liability period on the dates as approved by Engineer.

The Contractor shall provide all necessary tools, instruments, gauges, ammeter, etc., as may be required for conducting the various tests. He shall also provide required personnel for the tests.

39.0 Variation in Quantities

The Quantities for ancillary works given in the drawings and/or specifications are for the guidance of the tenderer. The Contractor shall, however, be paid on the basis of actual quantities of works carried out.

40.0 Measurements

All the measurements are to be taken as per section "mode of measurement". However, in case of any dispute relating to measurements, the Engineer-in-charge's decision shall be final.

41.0 Joint Measurement

In the event of the Contractor having to execute any work or provide any materials in regard to which he may propose to claim extras, he shall immediately notify the Engineer in writing and shall at once make arrangement to take the said work or materials with the Engineer.

42.0 As Built Drawings

The Contractor shall submit 4 sets of following "As built drawings" while handing over the installation.

- a. Plant installation drawings giving complete details of the entire equipment including foundations.
- b. Ducting drawings showing all sizes, dampers including installation details, etc.

43.0 Terms of Payment:- Refer General condition para no. 30.0**43.1 Other Information to be submitted by contractor**

Contractor shall also submit the following information while handing over the plant:

- a. Four sets of detailed drawings and specifications in respect of wearing parts and parts likely to be damaged.
- b. Four sets of manufacturers catalogues of the main equipment and accessories.
- c. Four sets of service and maintenance manuals in respect of the entire air-conditioning and ventilation system detailing all adjustments, operations and maintenance procedures.
- d. Schedule, in quadruplicate, of the items of which the contractor is not the manufacturer or manufacturers authorised dealer. This should contain the specifications of each item and the agency from which items are purchased.
- e. Attested photocopies of the Test Certificates of all the equipment/material supplied and installed.

44.0 DOCUMENT TO BE FURNISHED ON COMPLETION OF INSTALLATION

- 44.1 Three sets of the following shall be furnished to the department by the contractor on completion of work.
- Completion drawings
 - 3 sets of manufacturer's technical catalogues of all equipments and accessories.
 - Operation and maintenance manual of all major equipments detailing all adjustment, operation and maintenance procedure.
 - A proper training and regular checking from the VRF manufacturers representative should be there in order to ensure smooth commissioning and functioning of the system.

45.0 Interpreting Specifications

In interpreting the specifications, the following order of descending applicability shall be followed in case of contradictions:

- Schedule of quantities.
- Technical specifications.
- Drawing (if any).
- CPWD General Specifications.
- Relevant BIS or other international code in case BIS code is not available.

46.0 Guarantee

- 46.1 The installation will be handed over to the department after necessary testing and commissioning. The installation shall be guaranteed against any defective design/workmanship. Similarly, the materials supplied by the contractor will be guaranteed against any manufacturing defect, inferior quality. The guarantee period will be for a period of 1(One) years from the date of handing over to the department. Installation/ equipments or components thereof shall be rectified/ repaired to the satisfaction of the Engineer-in-charge without cost during the guarantee period.
- 46.2 If the defects are not removed within a reasonable time department may arrange to do so at the risk and cost of the contractor with out prejudice to any other right.

TECHNICAL SPECIFICATION

Section-1

1. General

- 1.1 The system design, basis of design, estimated requirements and other relevant data are outlined in this section. The detailed specifications and specific requirements are outlined in the subsequent sections.

2. Location

- 2.1 The proposed HVAC System (VRV type) is to be installed at **NIFT, Bhopal** as it is already constructed. Precautions are to be taken while doing work specially while taking supports for installing Indoor, outdoor units / ducting.

3. Scope of work

- 3.1 The work proposed under this tender includes providing and fixing Air Cooled Variable Refrigerant Volume air conditioning system, Refrigerant piping, drain piping, Air distribution work, insulation, Ventilation System, electrical work etc. for the above project.
- 3.2 The work shall also include chasing of walls for piping, rough plaster to seal the chases, embedding of drain piping under floor, wiring from electrical point upto unit etc.

4 System Design

- 4.1 It is proposed to provide Air cooled variable refrigerant volume system (VRV/VRF).
- 4.2 All VRV/VRF system will be Micro Processor based inverter type scroll compressor.
- 4.3 It is proposed to use different types of Indoor units, to suit the requirement as required.
- 4.4 Each type of Indoor unit will have individual temperature controller.

5. Performance guarantee

- 5.1 The contractor shall guarantee that the air conditioning system shall maintain the design inside temperature within $\pm 1.0^\circ \text{C}$ tolerance under the worst ambient condition specified and the relative humidity shall not exceed the specified limit.
- 5.2 The contractor shall guarantee that the capacity of various components as well as the whole system shall not be less than specified.
- 5.3.1 The contractor shall ensure, that the system shall be free of all objectionable vibrations and disturbing sounds under all conditions of operation.

6. **Items to be provided by other Agencies**

The following items of works shall be provided by other agencies. The HVAC contractor shall be responsible for the adequacy and accuracy of these works and shall ensure that these are completed as per the required time schedule.

- 6.1 Necessary false ceiling and return air boxing where ever required as shown in the drawings.

10 **Drawings**

Tender drawings are diagrammatic only and indicate arrangement of system and the extent of work covered in the contract. These drawings indicate point of supply and point of termination and suggest the route to be followed. The architectural drawings and details shall be examined for exact location of equipment, cutouts etc. Contractor shall follow the tender drawings in preparation of shop drawings and for subsequent installation work and will coordinate with other services also. The contractor shall submit shop drawings prior to commencement of low side work for the approval of the Owner. As built drawings shall be submitted as part of acceptance of work.

11. **Test data**

The whole system shall be tested as per specifications given elsewhere and complete test data shall be furnished on prescribed data sheet.

12. **Deviation from specifications**

Deviation from specifications may be accepted, provided such deviations are found necessary and appropriate, in order to conform to the design of established foreign collaborators/manufacturers.

13. **Completeness of Items**

The prices of each equipment shall include the cost of all accessories or miscellaneous items listed in the respective section, except for the items where "Price Separately " is indicated. The item shall be complete regardless of whether or not it is listed in the BOQ.

VRV / VRF System

1. **General**

- 1.1 The equipment for variable refrigerant volume/flow (VRV/VRF) system shall be air-cooled consisting of Outdoor units and multiple Indoor units for cooling the space in summer and heating in winter.
- 1.2 The system shall consist of suitable Outdoor units, Indoor units as required, interconnecting refrigerant piping, control cabling and accessories as required.

- 1.3 It shall be possible to connect multiple Indoor units on a single refrigerant circuit. The Indoor units on any circuit may be of different type and should allow individual control.
- 1.4 The minimum length of Refrigerant piping in a branch circuits or all circuits shall be as per chart given later on but the total piping length shall not be more than 300 m.

2. **Outdoor Unit**

- 2.1 The Outdoor unit shall be a factory assembled unit housed in a sturdy weather proof casing, constructed from rust-proofed mild steel panels complete with powder coated finish.
- 2.2 Each module of Outdoor units shall consist of scroll compressor(s), air-cooled condenser as Heat Exchanger, high efficiency propeller fans with low noise motor, internal Refrigerant piping, safety controls, Air Inlet grilles, fan protection grille etc. all enclosed in weather proof housing.
- 2.3 The Outdoor unit shall have multiple scroll compressors and shall be able to operate even in case of breakdown of one of the compressors.
- 2.4 The Outdoor unit shall be suitable for mix and match connection of various types and capacities of Indoor units as per demand.
- 2.5 The noise level shall not be more than 62 dB(A) under normal operation, measured horizontally, 1 m away and 1.5m above ground.
- 2.6 All the units shall be provided with built-in microprocessor control panel, for automatic operation and capacity control.
- 2.7 The units shall be suitable for Refrigerant R-410A.
- 2.8 All the ODU shall be provided with appropriate foundation.

3. **Compressor**

- 3.1 Each unit shall have single/multiple hermetically sealed scroll compressor.
- 3.3 The scroll compressor shall consist of fully inverter.

4. **Condenser / Heat Exchanger and Fans**

- 4.1 The condenser shall be air-cooled type, where heat exchanger shall be fabricated from copper tubes, mechanically bonded to aluminum fins to form a cross fin coil. The aluminum fins shall be given anti-corrosion treatment. This treatment shall be suitable for areas of high pollution, moisture and salt laden air.
- 4.2 The condenser fans shall be with multi blades of aerofoil design for low noise level, high efficiency and fitted with an high efficiency fan motor.

- 4.3 The fan outlet shall be protected by a suitable wire guard on the outside.
- 4.4 Suitable devices and heat exchanger means shall be built-in the unit to provide maximum super-cooling of refrigerant to increase system efficiency.
- 4.5 The unit shall be complete with safety controls and suitable microprocessor based master control module.
- 4.6 All the above component shall be housed in a compact mild steel cabinet having air Inlet louvers, safety guard on the condenser fan. The ambient shall be made weather proof using suitable anti corrosion treatment and finishing point.

5. Indoor Units (IDU)

- 5.1 The system shall permit connection of a variety of non ductable or ductable Indoor units on to single refrigerant piping circuits, as per description given later.
- 5.2 The capacity of the IDU shall vary as per the requirement of the given area.
- 5.3 The types of IDU which may be connected may be any of these given below:
- 5.3.1 High Wall mounted Unit.
- 5.3.2 Cassette type of different configuration.
- 5.3.3 Ceiling Suspended High static Unit.
- 5.3.4 IDU should be provided with appropriate power cable upto the units.

5.4 Common features of Indoor Units

- 5.4.1 The cooling / heating evaporator coils of the various types of Indoor Units shall be of direct expansion type.
- 5.4.2 The coils shall be fabricated from copper tubes of min 8 mm dia. with extended aluminium fins and designed for low velocity..
- 5.4.3 The fins shall be bonded to the tube using hydraulic expansion of tubes ensuring tight bonding between tube and fins for efficient heat transfer.
- 5.4.4 The coils shall be complete with well designed tube circuiting and liquid distributor.
- 5.4.5 All types of units shall have a built in electronic expansion valve and suitable control units.
- 5.4.6 The control units shall control temperature, fan speed and features specific to each unit such as night mode, set back, etc.
- 5.4.7 Suitable drain pan made up of stainless steel and drain arrangement shall be part of all IDUS.
- 5.4.8 The control units shall permit control from a wireless remote controller.

6. Indoor Control Unit

6.1 All types of indoor unit shall have one of the following controllers:

6.1.1 Cordless Type

6.2 Unless otherwise specified the controller to be provided shall be as follows:

6.2.1 **Cordless Remote:** Wall units or other units which are located in an enclosed cabin.

7. Refrigerant Piping

7.1 All refrigerant piping for the VRV/VRF system shall be carried out using hard drawn seamless copper pipe using either soft, half hard or hard pipes as per chart below:

7.1.1 The piping thickness shall be as follows:

OD(Inch)	OD(mm)	Min. Wall Thickness (mm)	Insulation thickness (mm)	Soft	Half Hard or Hard
1/4"	6.35	0.80	13	√	√
3/8"	9.52	0.80	13	√	√
1/2"	12.70	0.80	13	√	√
5/8"	15.88	1.00	13	√	√
3/4"	19.05	1.00	13	√	√
7/8"	22.20	1.00	13	X	√
1.1/8"	28.58	1.00	19	X	√
1.3/8"	34.92	1.10	19	X	√
1.5/8"	41.28	1.25	19	X	√

7.2 The branching of refrigerant piping from the main line shall be carried out using either specially designed 'Tee' connectors or 'Y' joints. These joint should ensure that each branch receives the required refrigerant flow.

7.3 All pipe sizing shall be on the basis of sizing data of the concerned manufacturer and should ensure adequate oil return back upto the compressor.

7.4 Sleeves in masonry walls and ceiling to be provided for refrigerant pipes to be embedded.

8. Pipe Insulation

8.1 Refrigerant Pipe Insulation

8.1.1 The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19 mm thick Nitrile close cell rubber, so that condensation does not occur.

- 8.1.2 The joints shall be properly sealed with synthetic glue to ensure proper bonding of the ends.

9. **Drain pipe insulation**

- 9.1 Drain pipe carrying condensate water shall be insulated with 6 mm nitrile rubber insulation having K value 0.037 W/mk at a mean temperature of 20°C at min. density of 55 kg./m³.
- 9.2 The joint shall be properly sealed with synthetic glue to ensure proper bonding of the ends.

10. **Centralized Intelligent Touch Remote controller**

- 10.1 A multifunctional compact centralized controller shall be provided with the system.
- 10.2 The Graphic controller shall act as an advanced air conditioning management system to given complete control of VRV air conditioning equipment. It shall have ease of use for the user through its touch screen. Icon display and colour LCD display.
- 10.3 It shall be able to control up to 106 groups of Indoor Units or the complete VRV system to be installed with the following functions:
- 10.3.1 Starting/stopping of air-conditioning as a zone or group of individual units.
- 10.3.2 Temperature setting for each Indoor units of zone.
- 10.3.3 Switching between temperature control modes, switching of the fan speed and direction of airflow, enabling/disabling of individual remote controller operation.
- 10.3.4 Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, trouble shooting information.
- 10.3.5 Display of air conditioner operation history.
- 10.3.6 Daily management automation through yearly schedule function with possibility of varying schedules.
- 10.3.7 The controller shall have wide screen, user friendly colour LCD display which could be wired by a non polar 2 wire transmission cable to a distance of 1 km. away from the Indoor unit.

Section 5**Electric Wiring/ Cabling****1. General:**

The work shall be carried out as per CPWD specification Part_1 Internal 2023, Part –II Extrernal (2023), VRF/VRV Air-Conditioning System - 2019, as amended upto date.

2.0 Miscellaneous :

- 2.1 The final connections to the equipment shall be through flexible connections in case of conduit wiring and also where the equipment is likely to be moved back and forth, such as on slide rails.
- 2.2 An isolator switch shall be provided at any motor which is separated from the main switch panel by a wall or partition or other barrier or is more than 15 metres away from the main panel.
- 2.2 Two separate and distinct earthing conduits shall be connected from the equipment upto the main switch board panel.
- 2.3 The branch lines from the main panel to each equipment shall be separated and should not criss cross other lines.
- 2.4 The entire installation shall be tested as per electricity rules and I.S.S 732-1973 with amendments 1,2&3 prior to the commissioning of the plant and a suitable test report furnished by a competent and authorised person. The test report will be obtain by contractor himself at his own expenses.

Section 6**Insulation****1. General**

The Insulation of water piping, air handling units, ducting, chillers etc., shall be carried out as per specifications given below :

2. Materials

The materials to be used for insulation shall be as follows, unless some other material is specifically mentioned elsewhere. The detailed specifications of the materials are listed under respective sub heads.

- | | | | |
|-----|-----------------------|---|---------------------------------------|
| 2.1 | Drain Pipe Insulation | : | Closed Cell elastomeric Insulation |
| 2.2 | Duct Insulation | : | Closed Cell elastomeric insulation |
| 2.3 | Acoustic Insulation | : | Resin Bonded Fibre glass in roll form |
| 2.4 | Equipment Insulation | : | Expanded Polystyrene (SE) (EP). |

3. Drain Pipe Insulation

- 3.1 The material for insulation of drain pipes shall be pipe sections of flexible closed cell elastomeric insulation having a 'K' value of 0.037 W/mk at a mean temperature of 20°C and a minimum density of 55 Kg./cubm.

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3.2 The thickness of insulation shall be 6 mm thickness.

3.3 **Drain Piping**

3.3.1 The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.

3.3.2 Then pipe section closed cell elastomeric insulation of 6 mm thick insulation shall be fixed on the pipe.

3.3.3 The longitudinal cut along the length of the insulation section shall be sealed with rubber based adhesive as recommended by the insulation manufactures. The joints between pipe sections shall also be sealed similarly.

Section 8

Testing and Commissioning

1. **General**

1.1 The contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the architect, in accordance with the provisions of the applicable ASHRAE standards or approved equal in addition to furnish necessary test certificates from manufacturers.

1.2 The system shall then be commissioned, tested and balanced to fulfill the intent and purpose for which it is designed.

1.3 In addition continuous Run Tests shall be carried out during peak weather condition.

2. **Compressors Condensers/Out Door Units/Evaporators/**

2.1 Hydraulic test for various components and assembled equipments at 1.5 times design pressure or double the operating pressure, whichever is higher.

2.2 Pneumatic leak test after assemblies at design pressure

2.3 Static and dynamic balancing on electronic precision machine for rotating parts, links, impeller/ crank shaft assemblies etc.

2.4 **Testing of oil passages in compressor at 1.5 times pump discharge pressure.**

2.5 Pressure drop test for condenser, chiller and evaporator.

2.6 For compressor assembly, electronic leak, air running test, pneumatic test with dry nitrogen and leak test in water.

3. **Indoor Units**

3.1.2 Performance test as per applicable codes.

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3.2 **Coils**

3.2.1 Pneumatic test.

3.3 **Filters**

3.3.1 Test of filter elements as per B.S. 2831 B.S. 1701 as applicable. This is to ascertain filtration efficiency by weight at inlet and outlet.

3.3.2 Manufacturer's test certificates also to be produced for the assembled unit. Final dimensional check will be done. Inspection may be done during assembly of components for quality of workmanship, painting etc.

3.3 **Piping**

Materials check for specifications and size.

3.6 **Instruments and Controls**

Visual examination.

3.7 **Special Note**

Vendor to note that above procedure is to be followed in addition to the specifications attached with the tender.

4. **Associated Works at Site.**

4.1 All electrical items will be subjected to inspection at any stage during manufacturing activity. Routine electrical test as per relevant codes. Inspection of manufacturer's test certificates.

4.2 Inspection of raw materials to be used for fabrication and assembly and inspection of manufacturer's certificates.

4.3 Inspection of welding including welders qualification as desired by inspection engineers. Inspection of fabricated items.

4.4 Pressure testing of pipe fittings used for the refrigerant and water and other services.

4.5 Checking of electrical circuits (power & controls) and checking functioning of controls of refrigerant systems and other circuits of air conditioning plant.

4.6 Checking of calibration of controls and instrumentation

4.7. Checking of assemblies or electrical control panel, instruments panels, local panels (dimensional and functional) annunciator panels etc.

4.8 Inspection of complete electrical installation at site.

4.9 Performance testing of completes VRV system as per specifications.

5. **Vendor Responsibility**

- 5.1 The above inspection procedure is given for general guidance and information of vendors. The inspection of purchaser/consultant is strictly not limited to these.
- 5.2 The inspection engineer of purchaser/consultant will have full right, to have detailed inspection at any stage right from placement of order to completion of project, as and when desired by inspection engineer.
- 5.3 Co-ordination of inspection agency of purchaser/consultant with his factory/sub-vendor's factory/erection site will be the sole responsibility of successful vendor, subsequent to placement of order for complete air conditioning plant, covered under these technical specifications.

6. **Piping System**

- 6.1 In general pressure tests shall be applied to piping only before connection of equipment and appliances. In no case shall piping, equipment or appliances be subjected to pressure exceeding their test ratings.
- 6.2 Tests shall be completed and approved before any insulation is applied.
- 6.3 After tests have been completed, the system shall be drained and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fittings, and debris.

7. **Electrical Equipment**

- 7.1 All electrical equipment shall be cleaned and adjusted on site before application of power.
- 7.2 The following tests shall be carried out :
 - 7.2.1 Cables and Wires continuity tests.
 - 7.2.2 Insulation resistance tests, phase to phase and phase to earth, on all circuits and equipment, using a 500 Volts meggar. The meggar reading shall be not less than one megaohm.
 - 7.2.3 Earth resistance between conduit system and earth must not exceed half (1/2) CMH.
 - 7.2.4 Phasing out and phase rotation tests.
 - 7.2.5 Operating tests on all protective relays to prove their correct operation before energizing the main equipment.
 - 7.2.6 Operating tests on all starters, circuit breakers etc.

8. **Commissioning of the System**

The system shall be commissioned by adopting the following procedure.

- 8.1 The installation as a whole shall be balanced and tested upon completion, and all relevant information, including the following shall be submitted to the architects.
 - 8.1.1 Air volume passing through each unit, apertures.
 - 8.1.2 Differential pressure readings across each filter, fan and coil, and through each pump.
 - 8.1.3 Electrical current readings, in amperes of full and average load running and starting, together with name plate current of each electrical motor.
 - 8.1.4 Continuous recording over a specified period, of ambient wet and dry bulb temperatures under varying degrees of internal heat loads and use and occupation, in each zone of each part of the building.

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- 8.2 Daily records should be maintained of hourly readings, taken under varying degrees of internal heat load and use and occupation, of wet and dry bulb temperatures, upstream "On-Coil" of each cooling coil. Also suction temperatures and pressures for each refrigerating unit. The current and voltage drawn by each machine.
- 8.3 Any other readings shall be taken which may subsequently be specified by the architect.
- 8.4 If these air quantities cannot be delivered without exceeding the speed range of the pulley or the available horse power, the architect shall be notified, before proceeding with the balancing of air distribution system.
- 8.3 A proper record shall be maintained as per Test Performa given else where.

9. **Miscellaneous**

- 9.1 The above tests and procedures are mentioned herein, for general guidance and information only, but not by way of limitation to the provisions of conditions of contract and specification.
- 9.2 The date of commencement of all tests listed above, shall be subject to the approval of the architect and In accordance with the requirements of this specification.
- 9.3 The contractor shall supply the skilled staff and all necessary instruments and carry out any test of any kind on a piece of equipment, apparatus, part of system or on a complete system, if the architect requests such a test for determining specified or guaranteed data, as given in the specification or on the drawings.
- 9.4 Any damage resulting from the tests shall be repaired and/or damaged material replaced, to the satisfaction of the architect.
- 9.5 In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be recommenced after the adjustment or repairs have been completed.
- 9.6 The contractor must inform the architect when such tests are to be made, giving sufficient notice, in order that the architect or his nominated representative may be present.
- 9.7 Complete records of all tests must be kept and 3 copies of these and location drawings must be furnished to the architect.
- 9.8 **The contractor may be required to repeat the test as required, should the Ambient conditions at the time, do not give, in the opinion of the architect, sufficient and suitable indication of the effect and performance of the installation as a whole or of any part, as required.**

LIST OF APPROVED MATERIALS (ELECTRICAL)

Note :

1. Unless otherwise specified, the brand/make of the material as specified in the item nomenclature or in the particular specifications or in the list of approved materials attached in the tender, shall be used in the work.
2. The Contractor shall obtain prior approval from the Engineer-in-charge before placing order for any specific material/ Brand/ Make.
3. Whenever the specified brand of material is not available than, the Engineer-in-charge may approve any material equivalent to that specified subject to proof being offered by the Contractor for its equivalence and its non-availability to his satisfaction.

1.	FRLS PVC insulated Copper wire/TV/ Telephone Cable	:	R.R. Kabel /Finolex / Polycab/ Havells / Plaza / Grandlay / V-marc (All with ISI Marked)
2	PVC Conduit & accessories (ISI Marked)	:	AKG/ BEC/ Polycab/Precision
3	Steel Conduit & its accessories	:	AKG / BEC/ RMCON/NIC (ISI Marked)
4	Modular 6/16 Amp. Switch / Socket / Blanking Plate / Metal Switch Box (the gauge of switch Box shall not less than 18 SWG & of the same make that of Switch) Front Plates, Telephone, T.V. Outlets Socket / Computer Socket / Fan Regulator. (ISI Marked)	:	Honeywell MK (Orna) / Legrand (Arteor)/ Schneider (Unica Pure)
5	XLPE insulated PVC sheathed 1.1 KV grade Aluminum/Copper conductor Armoured Cable (ISI Marked)	:	R.R. Kabels / Finolex / Polycab / Universal (Unistar)/Havells/Grandlay/ Plaza / V-marc
6	Cubical Panel Board /Feeder Pillar/APFC Panel	:	Adlec Power Pvt. Ltd. /Tricolite/Milestone/SPC Electrotech Pvt. Ltd., Delhi/Techno System Sand Switchgear Pvt. Ltd., Indore/Pristine/Solution System, Bhopal.
7	DWC HDPE Pipe	:	REX/Duraline/Gemini/Durton/Kisan/Jain Irrigation.
8	G.I. Pipe / M.S Pipe	:	Jindal (Hissar) / Tata /Prakash Surya/TT Swastik/ SAIL (All With ISI Marked)
9	VRV/VRF Indoor and Outdoor AC Units	:	O-General / Mitsubishi / Toshiba / Daikin / Blue Star
10	Copper Refrigerant Pipes	:	Godrej /Mehta /Mandev / Rajco / Nippon / Totaline / Maxflow
11	UPVC Drain Pipes	:	Astral/Supreme/Press Fit / Prince / Ashirvad
12	GSS Sheet	:	Sail / Tata / Jindal / National
13	Factory Fabricated Duct (MS/GSS)	:	Dustech / Ductofeb / Zeco / Rolastar / Atco

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14	EPS Thermal Insulation	:	Beardcell / Styrene / SHI/ Lloyd/Armaflex/U.P. Twiga
15	Pump	:	Grundfos / Kirloskar / Xylem / Armstrong/Wilo
16	Variable Frequency Drive (VFD)	:	Danfoss / Siemens / ABB / Allen Bradley/ Honeywell
17	Cooling Tower	:	Bell / Paharpur / Mihir / Advance / Belden
18	Air Handling Unit (AHU)	:	Zeco Aircon/System Air/ Edgetech/ Carrier / Flaktwood
19	Cooling Coil	:	Zeco Aircon/System Air / Edgetech / Bluestar / Voltas / Carrier / Waves
20	Plug Fan	:	Kruger / Nicotra / Greenheck/ Camtree
21	Centrifugal Fan	:	Kruger / System Air / Nicotra / Greenheck / Camtree / KanalFlakt
22	Wet Scrubber	:	Zeco Aircon/ System Air / Edgetch/Waves /Casvent Aircon
23	Servo Voltage Stablizer	:	Servocon / Servomax / Recons / NEEL / APLAB
24	Air Filter	:	Airtech / Puromatic / Purafill / ARW / Athelete / Anfilco / Thermodyne / Spectrum
25	Propeller fan	:	Marathon / Sphere / Flaktood/ Systemair/ Kruger / KanalFlakt/ Greenheck
29	Fibreglass Wool	:	Owns Canning/Lloyd Insulation /Armaflex/U.P. Twiga / FGP
30	Flexible pipe connection	:	Resitoflex / Dunlop / Easyflex / Cori
31	Butterfly Valve	:	Advance / Audco / Honeywell / Belimo
32	Y-Strainer	:	Rapidcool / Emerald / Honeywell / SM
33	POT Strainer	:	Rapidcool / Emerald / Honeywell / SM
34	Non Return Valve	:	Audco / Advance / Honeywell
35	Balancing Valve	:	Audco / Advance / Honeywell
36	Two way Control Valve with Actuator, Motor and Thermostat	:	Honeywell / Siemens / Belimo / Danfoss
37	Ball Valve	:	Sant / Rapidcool / Danfoss / Belimo
38	Auto Air / Purge Valve	:	Anergy / Rapidcool / AIP / Flamco
39	Thermometer / Pressure Gauge	:	Fiebig / H-Guru / Emerald / Libra
40	Water Flow Switch	:	Siemens / Anergy / Omiron / Danfoss . Honeywell
41	Temp & RH Sensor	:	Honeywell / Siemens/ Omiron / Schineider
42	Air Differential Pressure Switch	:	Honeywell / Siemens/ Omiron / Schineider
43	Air Differential Sensor	:	Honeywell / Siemens/ Omiron
44	Fire Damper with Actuator	:	Caryaire / Systemair / Air-master / Dynacraft / Greenheck / Ravi Star
45	Grilles & Dampers	:	Pineair/Conaire/Caryaire/Greenair/Systemair/Sevea/Tristar
46	Under deck Insulation	:	Beardsell, Styrene, Lloyd, Modifoam
47	Motor for Centrifugal Fan	:	Crompton Greaves / Siemens / Havells / ABB / Marathon

ADDITION NIL, CORRECTION NIL

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48	VFD Enclosure (Flameproof)	:	Siemens / Schneider / L&T / Crompton Greaves / Sudhir/Balliga/Flexpro/FCG I
49	Single Phase Preventor	:	Minilec / LK(GIC)/Ellsco
50	Current Transformer (Cast Resin)	:	AE / Kappa / LK
51	Switch / Fuse Unit / HRC Fuse	:	L&T / Siemens / ABB
52	Ammeter / Voltmeter (Digital Type)	:	AE / LK / Crompton Greaves / Siemens / Conserve
53	LED indicating Lamp / Push Button.	:	Siemens / GE Power / ABB / LK / Schneider Electric
54	Selector Switch	:	AE / LK / Kaycee
55	Relay / Timer / Contactor / Starter / Push Button	:	Siemens / LK / Schneider Electric / ABB / BIL
56	Paint	:	Nerolac / Asian / Berger
57	Fire Survival Power / Control Cable	:	Belden / Fusion Polymers / Tyco / RR Kabel
58	Termination Kit	:	Raychem / densons / Xicon / ABB
59	Perforated Cable Tray	:	OBO / Indiana / Pilco/ Apex / legrand
60	Fastener	:	Hilti / Wurth / Fisher
61	ACB, Change Over Switch	:	L&T / Legrand / Schneider / Siemens
62	Any other item not mentioned above	:	As per samples approved by Engineer-in-charge

Assistant Engineer (E) (P)
C.P.W.D., Bhopal

Executive Engineer(E)
C.P.W.D., Bhopal

ADDITION NIL, CORRECTION NIL

INSERTION NIL, CUTTING NIL

AE(E.)(P)

EE(E.)