

**HVAC TECHNICAL SPECIFICATION
FOR
MAYO COLLEGE GIRLS SCHOOL,
AJMER**

DOCUMENT NO. MCGS-N-HVAC-TS.

Disclaimer:

There is no order of precedence. Vendor to adhere to all the tender documents including tender drawings, specifications, boq & standard details

1.0**A. DURING BIDDING**

01. Bidder's confirmation as per the tender format.

02. Technical Data sheet of all Equipment's and material as asked in tender supported by OEM's product data to include Mechanical, Electrical, Hydraulics, thermal and acoustic properties.

B. POST AWARD

01. Shop drawings in 1:100 scale for Each MEP discipline to incorporate,

The general arrangement of systems, sub systems, equipment's, components and assemblies.

Supporting arrangements to include hangers and vibration isolators.

Foundation details Sectional elevations.

Levels, insert levels and gradient

Typical details.

Blown up details.

Construction joints.

Wall and slabs penetrations, levels, sleeves, sealing mechanism, fire stoppers and fire sealants.

Equipment's details containing key engineering performance parameters and equipment tagging

System schematic drawings indicating riser arrangements, sizing on individual floors, tap-offs and system flow.

Isometric representations of piping schematic for key connection details.

Symbols and Legends

02. Good for construction drawings to incorporate.

The coordinated plan showing locations of lighting fixtures, air outlet devices, sprinklers, detectors, speakers and other ceiling terminal devices.

The plan showing services above ceiling to include HVAC duct work, cable trays, equipment's, supports, hangers, surface mounted conduits, concealed conduits.

The coordinated MEP services addressing all clash detection queries indicating various layered services with identification tags and legends.

All GFC drawings shall be vetted by Consultant, Architect & Client

The coordinated MEP services plan showing openings, chase and penetrations in walls and slabs in plans and elevations indicating the opening/sleeve sizes, levels with dimensions indication from column and beams.

The coordinated MEP services plan on Architectural plot layout to show the battery limits and termination points.

03. Product data sheets incorporating the physical, mechanical, electrical, thermal, hydraulic, aerodynamic, chemical and acoustic properties substantiated by OEM's catalogue, equipment computerised selection, performance curves, characteristics curves and relevant standards.

04. Product /Material certifications from relevant authorities, manufacturers, testing labs etc as and where required as per the tender specifications.

05. Calculations to substantiate the design and engineering intent to meet the performance requirement for all mechanical, electrical, vibration, thermal, acoustic and structural considerations. Such Calculations, if required and insisted upon by client/Consultant, shall be carried out by independent experts to be hired by contractor without any extra cost to client.

06. Computerised Fluid Dynamics simulations to ascertain engineered solutions e.g hydraulic balancing, car parking ventilation etc, to be carried out by contractor as required or insisted by consultant/client.

07. Revised Bill of Quantities based on the shop drawings and statement of variation to be pre-approved before execution or commencement of any work beyond the tender quantities and rates.

08. OEM's Quality Assurance Plan (QAP) to indicate the quality check at manufacturer's works.

09. Manufacturer's shop testing procedure as per the relevant standards for the equipment's wherever required.

10. Lifting, access and maintenance strategy for all equipment's.

11. Sample board at site to include all the materials for which data sheets can't be approved or can't be submitted. Physical sample of all materials required for aesthetic and visual approvals.

12. The Contractor shall submit detailed schedules showing the program and the sequence in which the Contractor proposes to carry out the work with dates and estimated completion times for various parts of the work. Such schedules shall be approved by the client before starting the work and shall be binding on the Contractor. If so required by the client, the Contractor shall furnish weekly progress reports.

13. Installation procedures with site QAP indicating material handling, storage, installation methodology, inspection stages, pre commissioning checks, commissioning, testing and validation procedure for each system, subsystem and equipment.

14. Routine, type and specific test reports for the equipments and materials wherever required.

15. AS BUILT DRAWINGS in all the format of shop drawings including coordinated 2D and Exploded views of drawings.

16. Internal Installation check and completion certificates.

17. Pre commissioning procedures

18. Pre Commissioning results

19. Certification of punch list attendance.

20. Commissioning and testing Procedures

21. Commissioning and testing results.
22. System validation report
23. Seasonal test reports during defect liability period
24. Warranty certificates from OEM.
25. Operation and maintenance manuals.
26. List of recommended & mandatory spares and consumables.
27. To Conduct onsite training for Operation & Maintenance of the system

1.2 QUALITY ASSURANCE

INTENT OF DRAWINGS

- A. Provide complete and functional systems for the project. The systems shall conform to the details stated in the specifications and shown on the drawings. All the drawings, specifications & other relevant data should be read in complimentary. Items or work not shown or specified, but required for complete systems, shall be provided and conform to accepted trade practices. The drawings and specifications are presented to define specific system requirements and serve to expand on the primary contract requirements of providing complete systems. The drawings are diagrammatic and indicate the general arrangement and routing of the systems included in this contractor's work.
- B. Do not scale the drawings. Because of the scale of the drawings, it is not possible to indicate offsets, fittings, valves, or similar items which may be required to provide complete operating systems. Carefully investigate conditions affecting the work associated with this project. Install systems in such a manner that interferences between pipes, conduit, ducts, equipment, architectural and structural features are avoided. Provide items required to meet the project conditions without additional cost to the owner.
- C. These documents may not explicitly disclose final details required for a complete systems installation; however, contractors shall possess the expertise to include the necessary appointments of complete operating systems.
- D. Contractors shall be "Experienced" in this type of construction and realize the extent of the work required.

PRE-BID SITE VISIT

Bidders shall visit the site and become completely familiar with existing conditions prior to submitting their bid. No extra charges shall be allowed as a result of existing conditions. To schedule a site visit, contact client's representative at least 48 hours in advance of desired time of visit.

GENERAL STANDARDS OF MATERIALS

Equipment and materials, unless otherwise noted, shall be new and of first quality, produced by manufacturers who have been regularly engaged in the manufacture of these products for a period of not less than five years.

Equipment of one type shall be the products of one manufacturer; similar items of the same classification shall be identical, including equipment, assemblies, parts and components.

Materials furnished shall be determined safe by a nationally recognized testing organization, such as Factory Mutual Engineering Corporation, CBRI and materials shall be labelled, certified or listed by such organizations. With

respect to custom made equipment or related installations which are constructed specially for this project, the manufacturer shall certify the safety of same on the basis of test data. The Owner shall be furnished copies of such certificates.

PRODUCTS AND SUBSTITUTIONS

Where a specific manufacturer's product is specified, the contract sum shall be based on that product only. Any substitutions from the specified product shall be offered as a Substitution Request. Substitutions shall not be permitted after the bidding phase without a Substitution Request Form included with the bid.

Where several manufacturers' products are specified, the Contract Amount shall be based upon the specified products only. Any substitutions from the specified products shall be offered as a Substitution Request. Substitutions shall not be permitted after the bidding phase without a Substitution Request Form included with the bid. The client reserves the right to select the Make of any product/Equipment from the approved make list.

Where only one manufacturer's product is specified, the associated systems have been designed on the basis of that product. When products other than those used as the basis of design are submitted, the contractor shall agree to accept a unilateral change order that includes additional costs incurred by the Owner for the consultant's review.

CUTTING AND PATCHING

Provide cutting, patching & chasing & making good necessary to install the piping is included as part contractor's scope of work. Patching shall match adjacent surfaces.

No structural members shall be cut without prior approval of the Architect.

Provide ceiling removal and replacement where work above ceilings is required. Replace ceiling components damaged in the process.

WATERPROOFING

No piercing in waterproofing is permitted

AIR PLENUMS

In plenums which are used as part of an air distribution system as defined by NFPA, materials must be of the type rated for air plenum use. The Contractor shall be responsible to utilize the correct materials in ceiling space used for environmental air purposes.

ELECTRICAL CONNECTIONS

Regardless of voltage, provide control wiring, interlock wiring, and equipment control wiring for the equipment provided under this division of the specifications.

Furnish electrical disconnect switches, starters and combination starter disconnects required for equipment provided under this division of the specifications. Circuit breakers furnished shall be rated for motor protection.

Power wiring not used for control functions, complete from power source to motor or equipment junction box, including power wiring through starters, shall be provided as per electrical work specification of the tender.

Coordinate to ensure that electrical devices furnished or provided are compatible with the electrical systems used.

EQUIPMENT FOUNDATIONS, SUPPORTS, PIERS AND ATTACHMENTS

Provide necessary foundations, auxiliary steel, supports, pads, bases and piers required for equipment specified in this division; submit drawings in accordance with Shop Drawing Submittal requirements prior to the purchase, fabrication or construction of same.

Provide adequately thick concrete pads for Fans, rotating equipment, and floor-mounted equipment located in equipment rooms and as indicated on drawings. Pads shall be extended 6 inches beyond machine base in each

direction with top edge chamfered. Anchor equipment pads to the floor in accordance with latest building codes seismic requirements.

Construction of foundations, supports, and pads where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding floor material.

Equipment shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Consultant, deemed insufficient shall be replaced as directed, with no additional cost to the Owner.

EQUIPMENT GUARDS AND RAILS

Provide readily removable guards or railings for belt drives and rotating machinery. Guards shall consist of heavy angle iron frames, hinged and latched, with heavy galvanized iron crimped mesh wire securely fastened to frames. Railing shall be 1-1/2 inch pipe and railing fittings.

Multiple V-belt drives shall have band belts to minimize vibration.

CLEANING, PROTECTION AND ADJUSTMENT

Cleaning:

Upon completion of the work, clean the exterior surface of equipment, accessories, and trim installed. Clean, polish, and leave equipment, accessories, and trim in first-class condition.

Protection of Surfaces:

Protect new and existing surfaces from damage during the construction period.

Provide plywood or similar material under equipment or materials stored on floors or roofs. Provide protection in areas where construction may damage surfaces.

Surfaces damaged during the construction shall be repaired or replaced at the cost of the Contractor at fault. The method of repairing or replacing the surface shall be approved by the Owner and Consultant

Protection of Services:

Protect new and existing services from damage during the construction period.

Repair, replace and maintain in service any new or existing utilities, facilities or services (underground, Over ground, interior or exterior) damaged, broken or otherwise rendered inoperative during the course of construction.

Services damaged during the construction shall be replaced at the cost of the Contractor at fault. The method used in repairing, replacing or maintaining the services shall be approved by the Owner and Consultant.

The Contractor shall make good all damages to the Purchaser's building, property, equipments and articles, how so ever arising from the erection of the equipment. The Contractor shall indemnify and hold harmless the employer against all claims in respect of injury to any person how so ever arising out of the erection of the equipment in the course of such installation.

During erection the Contractor shall at all times keep the working and storage areas free from waste or rubbish. On time-to-time, as directed by Employer in charge, he shall remove all temporary structures, debris, insulation bitumen, EPS wastage and leave the premises neat and clean in a satisfactory condition.

All equipment shall be complete with approved safety devices wherever a potential hazard to personnel exists and with provision for safe access of personnel to and around equipment for operational and maintenance functions.

These items shall include not only those usually furnished with elements of machinery but also covers, guards, crossovers, stair ways, ladders, platforms, handrails etc. which are necessary for safe operation of the system. The contractor shall include for all safety devices including but not limited to the following items-

- a. Belt Guards shall be designed with approved provision to facilitate belt inspection, adjustment, replacement and general servicing.
- b. All couplings are to be covered with an approved guard, fabricated from welded plate and structural steel.
- c. Access Ladders and Platforms

Protection of Equipment and Materials:

Equipment and materials shall be stored in a manner that shall maintain an orderly, clean appearance. If stored on-site in open or unprotected areas, equipment and material shall be kept off the ground and out of standing water by means of pallets or racks, and covered with tarpaulins.

Equipment and material, if left unprotected and damaged, shall be repainted or otherwise refurbished at the discretion of the Owner. Equipment and material is subject to rejection and replacement if, in the opinion of the Consultant or the manufacturer's engineering department, the equipment has deteriorated or been damaged to the extent that its immediate use or performance is questionable, or that its normal life expectancy has been curtailed.

The contractor shall make his own arrangements for the storage of materials & their safe custody at site.

During the construction period, protect ductwork and equipment from damage and dirt. Properly cap ductwork.

ACCESSIBILITY

- A. Coordinate to ensure the sufficiency of the size of shafts, and chases, and the adequacy of clearances in hung ceilings and other areas required for the proper installation of this work.
- B. Locate equipment which must be serviced, operated or maintained in fully accessible positions. Furnish access doors under this division for installation by General Contractor. Coordinate during bidding phase with General Contractor.
- C. Indicate the locations of access doors for each concealed control, damper, or other device concealed behind finished construction and requiring service on the coordination drawings. Equipment below floor slab or finished grade shall be also be indicated on the coordinating drawings.

PAINTING

Painting requirements of this section shall confirm to relevant standards.

Provide surface preparation, priming, and final coat application in strict accordance with manufacturer's recommendations.

Provide field painting of all ductwork, hangers, supports, equipment platforms, railings, and miscellaneous metals located outdoors with base coat of zinc chromate primer & 2 coats of epoxy base enamel paint.

WORKMEN PERMIT

The Contractor shall discharge all his obligations under the Indian Workman's Compensation Act & E.S.I & PF in so far as it affects workmen in his employment.

The contractor shall indemnify client against any claims arising due to action or omission of contractors

The Contractor shall make his own arrangements for procuring the necessary labour, skilled and unskilled. He should conform to all local government laws and regulations concerning labour and their employment.

The contractor and his employees will submit to the regulations in force for controlled entry into the premises where the air conditioning equipment is to be installed.

Provisions shall be made for access ladders and platforms with handrails as necessary to provide operator's safe access to inspection.

Access to the work shall be allowed only to the Contractor and his duly appointed representatives. The Contractor shall not object to the execution of work by other Contractors or tradesman and shall afford them every facility for execution of their works simultaneously with his own.

Work shall be carried out in conformation with the specifications, accompanying drawings and with the requirements of the general architectural and structural plans after approval by the Employer. The Contractor shall be responsible for taking actual measurements at site and effecting variations in the work in details, if required, to meet the site conditions. Such deviations shall however be subject to the approval of the Employer.

CO-OPERATION

The Contractor shall also co-operate with other Contractors employed by employer, compare plans, specification & time schedules & shall forward to the Employer copies of all correspondence & drawings so exchanged. Failure to check plans and conditions will render the Contractor responsible for bearing the cost of any subsequent change.

NEGLIGENCE

If the Contractor shall neglect to execute the work with the due diligence or shall contravene the provisions of the contract, the Employer may give notice in writing to the Contractor, calling upon him to make good the neglect or contravention complained of. If the Contractor fails to comply with such notice within a reasonable period, the Employer shall have the option and be at liberty to determine the contract and to take the work wholly or in part out of the Contractor's hands and complete it either by himself or his agents at a reasonable price. The Employer shall then be entitled to retain any balance payment which may otherwise be then due on the contract.

The cost of execution of such work as aforesaid will be adjusted against the payment due to the Contractor. If the cost of execution shall exceed the balance due to the Contractor, the Employer shall be at liberty to dispose off any of the Contractor's material or construction system that may be at site and apply the proceeds for payment of the difference of such cost and recover the balance by process of law, or from any moneys due to the Contractor.

INSPECTION

The Employer is at liberty to inspect the system during installation and the Contractor free of cost shall remedy defects found. The Contractor shall furnish all instruments and services needed for the tests. Any defects and deficiencies that are noticed during these inspections will have to be attended by the Contractor from time to time.

Only after the entire installations are satisfactorily completed and the defects found during inspections rectified, the system will be ready for commissioning and then will be subjected to run at least 48 hours to demonstrate its satisfactory performance.

The contractor shall undertake to extend free training in operation and maintenance of Air conditioning System offered by them to two technical persons of Client/ End users at their works for a period of 15 days and 15 days at the site of Employer. A certificate in this regard will have to be obtained from the Employer by the contractor. The expenditure in respect of journey and stay necessary for this training will be borne by the contractor. The choice of dates for training is to be decided in consultation with the Employer.

1. Piping, pipe hangers, pipe insulation, and supports
2. Ductwork, duct insulation.
3. Mechanical equipment and supports.
4. Heat exchangers.
5. Tanks.
6. Accessory items.

1.2 The Contractor shall guarantee that all material, machinery, Consumables and components, supplied, fabricated, designed and installed by him shall be free from defects due to faulty material and/or workmanship and

that the system shall perform satisfactorily, and the efficiency of the system and all the components shall not be less than the values laid down in the specifications and the capacities shall be at least equal to those specified. The period of the guarantee shall be **twenty four (24) months** from the date of commissioning & handing over of system. During defect liability period any or all components found to be defective shall be replaced or repaired free of charge and shortcoming found in the system as specified shall be removed at no extra cost. The Contractor shall make good any loss of refrigerant and oil at his own cost. The Contractor shall provide the necessary personnel and tools for fulfilling the guarantee.

1.3 If the defects are not remedied within a reasonable time, the Client may proceed to get the defects remedied at the Contractor's risk & expenses without prejudices to his right.

1.4 The Contractor shall without any cost to the Employer carry out during the guarantee period all routine and special maintenance of the system and attend to any defects that may arise in the operation of the system.

BIDDER'S CONFIRMATION

The Bidder shall submit his confirmation with offer as under on a Legal Stamp Paper valid until end of the guarantee period.

01. We confirm that tender package comprising of tender documents volume 1 and volume 2, drawings and relevant documents have been thoroughly studied and verified by us. We confirm that design of MEP systems outlined by above documents and drawings meets the performance requirement of various sub systems, equipment's and components as specified in the tender documents and drawings. In our opinion, the design outlined in the tender documents is the most economical and energy efficient to achieve the building services performance requirements which we are guaranteeing.

02. We confirm that we have visited the site and are well aware of site conditions and status. We confirm that site location, layout and conditions are suitable for executing the MEP services work outlined in the tender and has no bearing on completion period specified in the tender.

03. We confirm that the design on which this tender is prepared has been verified by us and that it meets with the requirements of all Government, Semi-Government, Municipal, local and other authorities, whose permission would become necessary for the completion of the project. We confirm that all such necessary approvals will be obtained by us without any extra cost to client.

04. We confirm that the design outlined in the tender meets all safety standards and services built in eventually shall be suitable for public from all walks of life and will not create any hazard.

05. We confirm that the design outlined in the tender meets all life safety requirements expected out of MEP and Life safety services in accordance with the latest global standards and practices. We also confirm that life safety systems specified in the tender supports the performance based fire engineering approach for the issues not explicitly specified in the standards.

06. We confirm that we have studied the drawings furnished along with the tenders and all equipments layouts shown in the drawings are meeting the requirement of installation, access, removal and maintenance of all systems, sub systems, equipments and components. We confirm that proposed layouts indicated in the tender also suit the requirement of man power access to all equipments for necessary maintenance and handling.

07. We confirm that we have understood the intent of project building services requirement and all necessary computerized simulation studies, analysis, software programming, graphic developments and hiring expert services to substantiate the design will be provided by us without any additional cost as required by client/ Consultants.
08. We have reviewed the quantities specified against each item in BOQ with respect to project intent, drawings and performance requirement outlined in the tender. We confirm that quantities specified in the BOQ, is sufficient to achieve project requirement specified in several terms in the tender.
9. We confirm that items specified in the BOQ are adequate to achieve the project requirements specified in several terms in the tender. We confirm that we shall be supplying and executing any such items missed out in the tender but required for completeness of contract and to meet the project requirement without any additional cost to client.
10. We have reviewed the list of approved makes and confirm to adhere to it during entire contract period. We also confirm that makes specified in the tender has no bearing on completion period.
11. We confirm that there shall not be any deviation to tender terms and conditions.

6.0 TECHNICAL SPECIFICATION

SPLIT AIR CONDITIONING UNITS

EVAPORATING UNIT:

The Cooling coils shall be made of Copper tubing having extended aluminium Fins. The tubes shall be mechanically expanded for positive bonding between tubes and fins. The cooling coil circuit shall be fed with liquid refrigerant through the expansion device & distributor. The blower shall be statically and dynamically balanced and designed for silent operation at required airflow rates against required static pressure. The filters shall be washable synthetic media type arranged for convenient cleaning and replacement. The drain pan shall be fabricated out of heavy sheet steel, insulated with ¼” expanded polyethylene sheet. The casing shall be of heavy gauge G.I., duty powder coated for weather protection.

DX Cooling Coils-

The DX cooling coils shall be fabricated out of copper tube and Aluminium fins spaced @ 12 fins / inch. Aluminium fins & copper tubes will have foam bond provided by hydraulic expansion method at the high pressure above yield point. The capacity of the coils shall be as required under the schedule of equipment. Velocity of air across coil face shall not exceed 500 FPM for 4 Row coil and 600

Fan motors-

Fan motors shall be 3 phase 440V 50Hz , sq. cage, and T.E.F.C. induction type, together with starters, specified in “ELECTRICAL ITEMS” separately. The motors shall be capable of high initial starting torque requirement of fans.

CONDENSING UNIT:

The compressor(s) shall be inverter type and designed for continuous operation even at high ambient temperatures of 46°C. The condenser shall be air cooled, made of Cu. Tubes with extended aluminium fans. Cabinets shall be fabricated out of heavy gauge steel, properly formed for close fit and structural rigidity. All access panels shall be so constructed as to be quickly and easily removable. All outside surface shall be finished with powder coating for protection against humid weather. The condenser fans shall be directly driven and designed to achieve low condensing temperatures and operate continuously and silently.

NOTE: THE DISTANCE BETWEEN IDU & ODU SHALL BE 15 MTR. ALL OUTDOOR UNITS SHALL BE MOUNTED ON M.S. ANGLE FRAME STRUCTURE. THE M.S ANGLE FRAME STRUCTURE SHALL BE PAINTED WITH EPOXY PAINT. THE SHADE OF THE PAINT SHALL BE APPROVED BY THE ARCHITECT / CONSULTANTS / CLIENT.

REFRIGERANT PIPING

The indoor and outdoor units shall be connected with refrigerant piping. All piping connections for the units should be performed inside the unit. The refrigerant piping should be insulated with nitrile foam of minimum 19 MM thick. Lastly, cover up the pipes sections with the help of 36 G Aluminium sheets on straight pipes and 28 G Al. sheet on bends, tees, valves etc. All refrigerant piping to be done with hard copper pipes only.

DESIGN REQUIREMENT

The parent material used for air – conditioning system refrigerant tubing should be Copper tubes, tubes and fittings conforming to following specifications:

Material composition should be conforming to C-1220 (JIS-H-3300) or C-12200 (ASTM). It should have a minimum Copper content of 99.9 % and Phosphorus content between 0.015 % and 0.040 %. It should have low residue (below 0.038 gm. / sq. mtr). The material should also be as per the RoHS norms specified by EU; that is, Mercury, Chromium and Lead contents below 1000 ppm, and Cadmium content below 100 ppm.

Physical properties of the material should conform to JIS-H-3300 or ASTM-B-68 & B-75, should be tested for Tensile / elongation / hardness / grain size tests as per ASTM B – 280.

Dimensional tolerance should be as per JIS-H-3300 or ASTM-B-251. The tubes should be tested Using non-destructive Eddy current test before the final anneal, as per JIS-H-3300 or ASTM-E-243.

Heat treatment should be carried out in non-oxidizing atmosphere to ensure oxygen-free and cuprous oxide-free surface.

Proper certificates describing composition and results of all tests carried out must be supplied with each consignment. These certificates, along with check results for dimensional and thickness accuracy are recommended to be carried out for every delivered lot, should be maintained till handing over of the project.

Tubes should have 360 degree concentric wall thickness along their entire length.

Wall thickness for soft tubes (bright annealed mirror finish) should be 0.8 mm for ¼”, 3/8” & ½” tubes, 1.0 mm for 5/8” tubes, 1.2 mm for ¾” tubes. Wall thickness for hard tubes should be 1 mm for 7/8”, 1” and 1.1/8” tubes, 1.1 mm for 1.1/4”, 1.2 mm for 1.3/8” and 1.3 mm for 1.5/8” tubes.

Wall thickness for elbows and fittings should be minimum 0.2 mm more than corresponding tube / tube size.

For sizes up to ¾”, pulley type benders should be used and brazed joints should be avoided as far as possible. Similarly, for tubes of size 7/8” or more, one side expanded tubes must be used and use of couplings should be avoided as far as possible.

Packaging, Storage and Traceability of Copper tubes:

Cleaned tubes end are sealed with plastic end caps for identification, traceability and authenticity of genuine product.

The inside bore of straight tubes and coils can be kept clean by covering their ends with plastic end caps, so that no dust gets into it.

The tubes are then sealed in polythene bags to prevent any tarnish on the finish due to its exposure to atmosphere.

For better storage use of vacuumed polythene shrink wrapping of coil tubes is also done.

As per packing list and customer order of product matrix, these packed copper tubes are further put in transport-worthy corrugated boxes with appropriate packing material stuffing to prevent any damage during transit.

For specific needs especially for soft annealed tubes, final packing is done in wooden boxes to prevent any damage to the tubes during transit.

DRAIN PIPING

Condensate from the evaporator unit shall be drained through properly installed drain piping designed to prevent any accumulation of condensate in the drain pan. Drain piping of specified sizes and suitable of 6 Kg/Sq cm. pressure rating with water tight threaded connections, leading from the room unit to a suitable drain point. Complete drain piping shall be made leak proof and water tight by means of precise installation and the use of leak proof sealant/adhesives. Drain piping shall be insulated with 9 mm nitrile foam.

VIBRATION ISOLATORS

Outdoor units shall be provided with ribbed rubber pad vibration isolators.

CONTROL SYSTEM

1. Wireless Remote Controller.

Wireless remote controller shall be supplied as specified in the “Bill of Quantities”

The same operation modes & settings as with wired remote controllers must be possible.

Compact light receiving unit to be mounted into wall or ceiling shall be included for all type of IDU's.

QUALITY ASSURANCE

The unit manufacturer shall confirm the quality system in accordance to International standards and norms. Before dispatch unit shall be tested for capacity & performance. The manufacturer shall have stringent quality control & stage wise inspection during all stages of manufacturing processes to obtain reliable performance at specified operating conditions.

DX Cooling Coils

DX cooling coils shall be fabricated using **copper tubes and aluminium fins**, with fins spaced at **12 FPI (fins per inch)**.

The aluminium fins shall be bonded to copper tubes using hydraulic expansion at high pressure for maximum thermal efficiency.

The coil capacity shall be as per the equipment schedule.

The air velocity across the coil face shall not exceed:

- **500 FPM for 4-row coils**
- **600 FPM for 6-row coils**

Fan Motors

Fan motors shall be **3-phase, 415/440V, 50 Hz**, squirrel cage induction motors, TEFC type.

Motors shall be suitable for continuous operation and capable of handling high starting torque requirements of centrifugal blowers.

Motor starters shall be provided under the electrical scope.

CONDENSING UNIT (OUTDOOR UNIT)

The condensing unit shall consist of **inverter-driven compressors**, suitable for continuous operation at ambient temperatures up to **46°C**.

The condenser shall be **air-cooled type**, made of copper tubes with aluminium fins.

The outdoor unit casing shall be fabricated from **heavy gauge steel**, powder-coated for weather resistance.

All access panels shall be easily removable for maintenance.

Condenser fans shall be **direct driven**, designed for low noise and efficient heat rejection.

INSTALLATION NOTE

- Maximum distance between IDU and ODU: **15 meters**
- Outdoor units shall be mounted on **M.S. angle frame structures**
- Frame shall be coated with **epoxy paint**, shade to be approved by Architect/Consultant/Client

DESIGN REQUIREMENTS (COPPER PIPING)

The refrigerant piping material shall conform to:

- **ASTM B-280 / B-75 / B-68**
- **JIS H-3300 (C1220) / ASTM C12200**

Material properties:

- Copper purity: $\geq 99.9\%$
- Phosphorus: **0.015% – 0.040%**
- RoHS compliant (Lead, Mercury, Chromium <1000 ppm, Cadmium <100 ppm)

Testing requirements:

- Eddy current testing
- Tensile, hardness, elongation tests
- Dimensional tolerance as per standards

Wall thickness:

- As per pipe size (same as split system specifications)

All tubes shall have **uniform wall thickness and smooth internal finish.**

PACKAGING, STORAGE & TRACEABILITY

- Tube ends shall be sealed with plastic caps
- Tubes shall be packed in polythene to avoid contamination
- Coils shall be shrink-wrapped where required
- Transport packaging shall include corrugated boxes or wooden crates

All test certificates and inspection records shall be maintained till project handover.

DRAIN PIPING

Condensate drain piping shall be provided to remove water from indoor units.

- Pipes shall be of suitable size with **6 kg/cm² pressure rating**
- Proper slope shall be maintained to avoid water accumulation
- All joints shall be leak-proof

Drain piping shall be insulated with **9 mm nitrile foam insulation**

VIBRATION ISOLATION

Indoor and outdoor units shall be mounted on **anti-vibration rubber pads** to minimize noise and vibration transmission.

CONTROL SYSTEM

Wired / Wireless Controller

- Unit shall be provided with **wired wall-mounted controller** (preferred for ductable units)
- Wireless remote may be provided where specified

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- All standard modes (cooling, fan, temperature control, timer, etc.) shall be available

QUALITY ASSURANCE

The manufacturer shall comply with **international quality standards**.

- Units shall be factory tested for **performance and capacity**
- Strict quality control shall be maintained during manufacturing
- Stage-wise inspections shall ensure reliability under design conditions

2.02 COMPRESSORS

A. Inverter EVI Scroll Compressors

The unit shall be equipped with **Full DC Inverter Enhanced Vapor Injection (EVI) scroll compressors**, designed for high efficiency and wide operating range.

Key features shall include:

a) High-pressure chamber design

- Enhanced displacement buffering
- Reduced operational noise and vibration

b) Asymmetric scroll design

- Improved efficiency under part-load (APF conditions)
- Enhanced sealing and compression performance

c) Non-contact oil film sealing

- Oil membrane formed between axial and radial surfaces
- Reduced friction and improved reliability

d) Concentrated winding motor

- Reduced copper losses
- Better performance at low and medium speeds
- Compact design

e) Relief valve mechanism

- Improved part-load efficiency
- Adaptability to varying pressure ratios

f) High-performance bearings

- Self-lubricating materials
- High load-bearing capacity
- Increased operational life

g) Optimized oil circulation system

- Reduced overheating losses
- Lower oil carryover
- Improved compressor durability

h) Positive displacement gear oil pump

- Ensures adequate lubrication at all speeds

- Integrated oil filtration system to prevent contamination

i) Direct suction design

- Minimal suction superheating
- Improved volumetric efficiency

j) Enhanced Vapor Injection (EVI) cycle

- Lower discharge temperature
- Increased heating capacity
- Wider operating envelope
- Improved performance in extreme climates

SUBMITTALS

BIDDING STAGE

1. Manufacturers catalogue.
2. G.A drawings of all the products and models used in the project.
3. The test procedure for the noise level as per the International Standard and test certificates for all equipment's.

POST BIDDING

1. Manufacturer test certificate.
2. Installation and assembly procedure of all the equipment's.
3. Civil foundation details for Floor mounting and supporting details for ceiling suspended equipment's.
4. Material thickness and other technical data of cooling coil.
5. Pressure testing report of cooling coils with respect to operating pressure zones.
6. Technical data sheet of motor and selection data.
7. Software selection of the wheel to justify pressure drop and efficiency calculation.

POST COMMISSIONING AND HANDOVER STAGE

1. Manufacturers catalogue.
2. Operation and maintenance manual.
3. Operation and calibration process for all types of VFDs.
4. Technical data sheet of control valve and thermostat.
5. Factory certification of powder coating details.
6. All drive set belt, pulleys, bearing details.

7. Records of the capacity test conducted at site

9. TECHNICAL DATA SHEET TO BE FURNISHED BY THE TENDERER ALONG WITH THE TENDER DOCUMENT

Split Air Conditioning Units

1. Type / Refrigerant
2. Make / Model
3. Quantity
4. KW – Indoor Unit
5. KW – Outdoor Unit
6. Full load current
7. Refrigerant capacity

At 5°C suction & 43°C discharge

Condenser

- 1) Type
- 2) Air quantity
- 3) ESP
- 4) TSP
- 5) Coil face area
- 6) No. of rows
- 7) By pass factor
- 8) Fan motor KW/RPM
- 9) Full load current of fan motor
- 10) Static pressure of fan
- 11) Copper tube thick/diameter
- 12) Aluminium fins spacing/Guage

Evaporator

- 1) Type
- 2) Air quantities
- 3) Coil face area
- 4) No. of rows
- 5) By pass factor
- 6) Fan motor KW/RPM
- 7) Full load current of fan motor
- 8) Static pressure of fan
- 9) Copper tube thick/diameter
- 10) Aluminium fins spacing/Gauge
- 11) Dessicant rotor Make & Model
- 12) Dessicant rotor dimension
- 13) Dessicant rotor RPM

Overall dimensional details

1. Condensing unit
2. Evaporating unit

INSULATION FOR PIPING

1. Manufacture.
2. Type
3. Application
4. Material of virgin nature.
5. “K” value
6. Thickness
7. Density
8. Fire retardant property
9. Moisture Diffusion Resistance Factor
10. Fire Performance Class & Code
11. Factory Lamination Protection Material
 - a. Thickness
 - b. Type

INSULATION FOR DUCTING

1. Manufacture.
2. Type
3. Application
4. Material of virgin nature.
5. “K” value
6. Thickness
7. Density
8. Fire retardant property
9. Moisture Diffusion Resistance Factor
10. Fire Performance Class & Code
11. Factory Lamination Protection Material
 - a. Thickness
 - b. Type

INSULATION FOR UNDER DECK

1. Manufacture.
2. Type
3. Application
4. Material of virgin nature.
5. “K” value
6. Thickness
7. Density
8. Fire retardant property
9. Moisture Diffusion Resistance Factor
10. Fire Performance Class & Code
11. Factory Lamination Protection Material
 - a. Thickness
 - b. Type
9. Moisture Diffusion Resistance Factor
10. Fire Performance Class & Code
11. Factory Lamination Protection Material
 - a. Thickness
 - b. Type

Variable Air Volume

1. Manufacture.
2. Type
3. Casing Material & Thickness
4. Damper Material & Thickness
5. Conforming to standard
6. Static Differential Pressure range

GALVANISED STEEL SHEETS

Make
Thickness/Gage
Class of Galvanizing

GRILLES / DIFFUSERS / DAMPERS

Make, material and gauge of the following:

1. Fire damper, rating, make of damper motor
2. Smoke damper, rating, make of damper motor
3. Grilles/Diffuser
4. Slot Diffuser
5. Duct Damper
6. FA Damper

7. Access Panel.

10.DEVIATIONS STATEMENT

10.1 COMMERCIAL DEVIATIONS STATEMENT

The Tenderer shall fill this Deviation statement for any deviations made in the standard Tender Terms & Conditions.

Sr. No.	Original Tender Conditions	Deviations
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1.

2.

3.

4.

5.

10.2 TECHNICAL DEVIATIONS STATEMENT

The Tenderer shall fill this Deviation statement for any deviations made in the standard Tender Specifications.

Sr. No.	Original Tender Conditions	Deviations
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1.

2.

3.

4.

5.

6.