



Gujarat University

TECHNICAL SPECIFICATIONS

HVAC WORK

Tender No: GU/ESTATE/GH/2025-26/03

**Tender Document
OF
Construction of Girls hostel at Gujarat University,
Ahmedabad.**

1. VARIABLE REFRIGERANT FLOW/VOLUME (VRF / VRV) Cooling only

General Description

1. All Variable Refrigerant Volume Air Conditioners shall be totally Factory assembled, charged with refrigerant, wired, piped and tested at the factory by OEM.
2. The System shall comprise of Air-Cooled scroll, rotary, inverter / digital compressors type Outdoor units, and a variety of indoor units connected by Common Refrigerant Piping, refnets, piping, etc. and Power and Control Cabling.
3. All bolts, nuts, screws, washers, plates, etc. and all other fittings for all VRV system components shall be plated or passivated to resist corrosion.

VRV/ VRF System

1. The VRV System shall provide stable, trouble free and safe operations, and provide flexibility in operation of Indoor Units with independent control of each Indoor Unit, including steeples partial operation.
2. It shall be possible to switch on only those Indoor Units that require Cooling in individual Areas, zones or shops.
3. The capacity of Indoor and Outdoor Units shall be matched, sleeplessly, and shall include multi-Compressor cut off / speed control, by pass or any other means of capacity Control for stable operations of the System.
4. The System shall be capable of automatic operation even with varying Outdoor and Indoor requirements and make up of low Outdoor Temperatures to achieve lower Power Consumption, without any manual adjustments.
5. All Systems shall be modular in nature and easily upgradeable / inter connectable for larger capacities.
6. Units shall have hermetically sealed Scroll/Rotary Compressors, to ensure high EER.
7. The refrigerant gas shall be necessarily R 410a
8. All Units shall be Air Cooled type.
9. The System shall incorporate all required controls for parallel operation of Compressors, Condensers, Fans, and Indoor Units as well as Refrigerant liquid control.

Power Supply

1. All the units shall be suitable for operation with 415V+ 10%, 50Hz + 3%, 3 phase A.C. supply.

Outdoor Units

The Condenser coil shall be Air-cooled type with copper tubes and aluminum fins. The condenser coils shall be of adequate size and shall have an integral sub cooler circuit for sub cooling of the liquid. Condenser coil shall have a refrigerant side working pressure of 400 psig with anti-corrosive treatment. Condenser shall have multiple piping and cabling connection option. Pump down facility should be provided in the refrigerant system by providing good quality hand / shut off valves to avoid loss of Refrigerant gas during maintenance. The condenser fans shall be propeller type, with aluminum blades, low speed, and low vibration levels and quite in operation with IP 55 Protection.

All the compressors of the outdoor units must be hermetically sealed scroll type. Each module of outdoor unit must have separate 1 No. of inverter compressor, suitable to operate at heat load proportional to indoor requirement.

“Anti-Corrosive” treatment (Blue Fins) for Al fins of Condenser Coils is mandatory and shall carry warranty of at least Five (5) years. The treatment should be suitable for areas of high pollution and salt laden air.

The outdoor units must be suitable for more than 150 Meter Refrigerant piping between outdoor unit & the farthest indoor units and total piping of 300 Meter for all the indoor units. Allowable level difference between outdoor unit & indoor units shall be 50 Meter in case of outdoor unit on top & 40 Meter in case of outdoor unit at bottom. Allowable level difference between various indoor units connected to one outdoor unit shall be up to 15 m.

Back up operation, in case of failure of one of the compressors of outdoor unit, for single module outdoor units or failure of one of the modules in case of multiple modules outdoor units shall be possible. The VRV outdoor unit shall always be supplying at least 33% of back up operation, of the full load capacity.

The outdoor unit shall employ system of equal run time for all the compressors, inverter or on/ off type, within each outdoor unit – Single Module or Multi Module.

Starter for the Outdoor Unit compressor shall “Direct online” type. Inverter compressor of the unit shall start first & at the minimum frequency, to reduce the inrush current during starting.

Refrigerant control in the outdoor unit shall be through Electronic Expansion Valve. Complete refrigerant circuit, oil balancing/ equalizing circuit shall be factory assembled & tested.

The outdoor units shall confirm to Technological Guideline for Harmonic Suppression – JAEG 9702-1995. High Harmonic Environmental Target Level for Power Distribution system shall be 5%.

Safety Devices to be provided such as High-Pressure Switch, Overload protector, Fusible plug, Overload relay etc. Should be part of standard fitments in VRV systems.

ODU shall have all variable speed compressors with its controls to work at 415+/- 20 Volts with all necessary protections for overload, voltage fluctuations.

VRV Systems should meet or exceed the efficiency requirements as per below table.

Reference: ANSI/AHRI standard 1230 (ECBC Code-2017, pg. 42, Table No 5-6)

ECBC REQUIREMENTS	PROPOSED
AIR COOLED VRV	AIR Cooled

2. Indoor Units

Hiwall:

Hi-wall Mount AC units shall be ready-to-operate type and shall comprise of an indoor type Fan-Coil unit (installed within the room). Hi Gloss finish all fiber body. Highly efficient 3 layered air purification system to remove dust/bacteria and odor from the return air. noise level of indoor Unit at operating speed shall not be exceeding 46 dB measured at a distance of 1.5 M from source. The unit will be connected in series to a suitable outdoor unit & it must be possible to operate the unit independently, through cordless remote.

Cassette Unit

The units shall be ready-to-operate type and shall comprise of an Indoor type Fan-Coil unit (installed within the room). noise level of Indoor Unit at operating speed shall not be exceeding 46 dB measured at a distance of 1.5 M from source.

Each indoor unit must have electronic expansion valve operated by microprocessor thermostat-based temperature control to deliver cooling as per the heat load of the room.

The unit will be connected in series to a suitable outdoor unit & it must be possible to operate the unit independently, through cordless remote.

Ductable Unit

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for Ductable arrangement. Ductable unit shall have provision of inbuilt drain pump capable of lifting condensate upto 600mm.

Refnet/Refoints

Each indoor unit must be connected (with VRF outdoor unit) by means of individual Copper Refrigerant network or Y distribution joints only. The mentioned "Y" joint or refnet joints must factory make & tested by OEM. The individual size of refnets or "Y" joints connecting to individual indoor units, to be calculated & supplied by OEM / Bidder /OEM approved bidder only.

3. Refrigerant Piping & Insulation:

All refrigerant piping shall be in high Gauge (1.21 grade copper 18 mm) including all connections, Tees, Reducers, etc. Required nos. of Refrigerant joints with insulation should be provided for uniform flow of refrigerant through all Indoor units.

All refrigerant piping shall be insulated with minimum 19mm thick insulation for the entire length; and flexible braided pipe (for external runs of pipe). Insulation shall be nitrile rubber covered with glass-cloth having density of 200GSM. All exposed piping insulation shall be with UV Protection/UV Coating with glass cloth fabric. Pipes should be installed in an accessible position wherever possible. Exposed to sun & visible piping shall be covered by braided PVC pipes/sleeves for mechanical protection and aesthetics. Additionally, pipes on terrace shall be covered with minimum 24G GI sheet cover for mechanical protection. GI cover shall be painted for rust-prevention.

Necessary filters, driers, gauges, sight glass, safety cut-outs, etc. shall be provided in each refrigerant circuit as per the manufacturer's standards. Number of joints shall be kept to a minimum, and all joints must be located in the accessible runs of the pipes. Continuous, joint-less pipes must be used for all concealed/buried/inaccessible piping. Adequate extra length of pipes shall be left during piping work to avoid unnecessary joints during installation of indoor & outdoor units.

Provide high-density insulated pipe supports (e.g., Armafix-T) supplied by the insulation manufacturer, at each pipe support and clamp to prevent insulation compression, thermal bridging and condensation. Alternatively provide PVC pipe sleeves over the normal insulation at all supports cable ties & clamps to prevent insulation compression.

Pipes or ducts entering into the building through external wall cutouts should slope away from the building cutout, to stop rain water entering the building along through any gap between duct/pipe and the closed cutouts.

Pipe and duct ends shall be kept closed at all times before and during installation to prevent ingress of moisture, dust and construction debris.

All pipe supports shall be strong enough to withstand bending stresses in the pipes and shall be spaced not more than 1800mm apart.

Each support shall be isolated from the supported pipe or fitting by anti-vibration springs or durable, non-deteriorating liner of rubber or neoprene.

Wherever pipes are laid in two layers, an additional strip/support to be provided between the two layers so the pipes do not rest on each other.

Before gas charging, the entire piping system should be vacuumized and pressure tested with nitrogen at 10 Kg/sqm (or as required for the system pressure rating) for 24 hours. Air tight factory supplied rigid

insulation should be provided on all Ref-Net Joints / Y-Joints after pressure testing. Each Ref. Joint / Y-Joint should be properly supported to keep it in perfectly horizontal position.

All copper pipes except 6mm diameter shall be insulated with minimum 19mm thick Nitrile Rubber insulation for the entire length. Pipes up to and including 6mm may be insulated with 13mm thick Nitrile Rubber insulation

PVC sleeves or high-density insulation sleeves to be provided wherever pipes passes through cutouts in walls or wooden partitions to avoid compression of insulation.

Avoid installing pipes directly above the A/C machines.

All exposed insulation on terrace or in open shafts should be protected with UV paint / UV coating & glass cloth having density of 200GSM (Arma Chek GC or equivalent), and finally covered with removable GI sheet cover for mechanical protection. UV protection must be applied immediately after installation of insulation to prevent damage from sun-light. Sufficient valving shall be included to allow compressors to be removed for service & to allow the refrigerant to be pumped in to and contained in the condenser. The unit shall be equipped with a liquid line shut off valve, filter drier, liquid line sight glass, and solenoid valve & insulation where required to prevent condensation forming.

Pressure Testing & Evacuation

After brazing of the complete piping, the next step is to test the system for leakages if any. Complete leak testing and proper evacuation is a must as non-condensable gases and moisture in the system will have ill-effects on system behavior as below:

- Pressure in the system rises.
- Operating current rises.
- Cooling or heating performance drops drastically.
- Moisture in the system may freeze and block the small opening of valves and capillaries.
- Moisture in the system reacts with oil in presence of refrigerant and forms organic and inorganic acids, which in turn react with copper. Copper gets deposited on hot surfaces like bearing surface of compressor shaft, discharge side of scroll set etc. and can damage the compressor severely.
- Therefore the tubing connecting the indoor unit and outdoor unit must be pressure tested and evacuated properly to expel the non-condensable gases and moisture from the system.

Pressure Testing

Check visually that all piping is properly brazed.

Note that all service valves of the outdoor unit are closed at this stage.

- Use a TEE connection for connecting both liquid and suction service valve.
- The Oil balance tube leak test is not necessary if only one outdoor unit is installed.
- Add a Pressure Test Oil Equalizer line also in case of multiple ODU's installation.
- Always pressurize both suction and liquid side of piping system.
- Pressurize the system in steps of 100, 200, 300, 400 and 550 psig. Check for any leak at each step using soap bubbles. Pressure must be within 2 psig after two hours.
- Do a leak-test of all joints of the tubing; any bubbles indicate a leak. Wipe off the soap with a clean cloth after a leak test.
- Keep pressurized for 12-24 hours and check for any drop in pressure.
 - After the system is found to be free of leaks, release the nitrogen pressure by loosening the charge hose connector at the nitrogen cylinder.
- When the system pressure is reduced to normal, disconnect the hose from the cylinder.

Pressure testing shall be carried out thrice: on completion of piping work, on installation & connection of Indoor Units, and on installation & connection of Outdoor Units.

Drain Piping for Ceiling Suspended/Wall mounted units:

Condensate from the Indoor unit shall be drained through properly installed drain piping designed to prevent any accumulation of condensate in the drain pan. Drain piping shall be made of rigid PVC pipe of 6 Kg/cm sq. pressure rating with water tight threaded connections & 9 mm thick nitrile rubber insulation. Leading from the Indoor 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.

All Drain pipe shall be rigidly and securely supported, in an approved manner, with 8mm galvanized steel rods. The spacing between supports should be not greater than 2.0 meter.

Drain Piping for floor mounted AHUs: 40mm dia GI "B" Class drain piping insulated with 8mm Class O Nitrile Rubber insulation; from each AHU to nearest drain point. Provide suitable U traps.