



# **Gujarat University**

## **TECHNICAL SPECIFICATIONS**

HVAC WORK

Tender No: GU/ESTATE/ARTM/2021-22/05

**TENDER DOCUMENT  
FOR  
CONSTRUCTION WORK OF ARBORETUM  
AT GUJARAT UNIVERSITY.**

## **TECHINICAL SPECIFICATIONS FOR EQUIPMENTS & MATERIALS**

### **VRV / VRF System**

#### **General**

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.

The system shall consist of suitable Outdoor units, Indoor units as required, interconnecting refrigerant piping, control cabling and accessories as required.

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.

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 800 m.

#### **Outdoor Unit**

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.

Each module of Outdoor units shall consist of scroll/Rotary 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.

The Outdoor unit shall have multiple scroll/Rotary compressors and shall be able to operate even in case of breakdown of one of the compressors. Each ODU shall have all inverter type variable compressor with each compressor having maximum capacity of 14 HP. Each circuit of ODU shall have a minimum of 2 Cans (ODU) for redundancy in case of break down.

The Outdoor unit shall be suitable for mix and match connection of various types and capacities of Indoor units as per demand.

The noise level shall not be more than 55 dB(A) under normal operation, measured horizontally, 1 m away and 1.5m above ground.

The Outdoor unit shall be modular in design and the capacity of the smallest module should not be less than 8 HP, shall allow for side by side installation of multiple Outdoor units, to match the requirement.

All the units shall be provided with built-in microprocessor control panel, for automatic operation and capacity control.

The units shall be suitable for Refrigerant **R-410A**.

All the ODU shall be provided with appropriate foundation.

The outdoor units shall have minimum COP of 3.50 at 100% loading condition in cooling only at outside ambient temperature of 45 deg.c dry bulb temperature and indoor temp. of 19 deg.C wet bulb temp. The ODU shall have condenser fan having multiple speed for saving energy at various loading conditions.

### **Compressor**

Each unit shall have multiple hermetically sealed scroll/Rotary compressor.

The scroll compressor shall consist of two spiral disc, where one is fixed and the other rotate. The disc shall be mounted eccentrically to allow orbital movement. This shall permit compression of Refrigerant gas, as it move up between the eccentric discs.

Both the spiral disc out rotor shall be mounted on a common shaft with antifriction bearing, suitable for handling both radial and axial thrust.

The compressor casing shall be fabricated from mild steel of thickness capable of withstanding the working pressures. The casing shall have built-in oil reservoir with a sump of adequate capacity.

The compressor shall be complete with a suitable High efficiency motor hermetically sealed within the compressor housing.

The compressor housing shall also have oil reservoir for lubrication and suitable means like an oil pump or pressure differential device shall be provided to lubricate all moving parts.

One or more compressor shall be provided with suitable sine wave or equivalent DC Inverter for capacity modulation.

### **Condenser / Heat Exchanger and Fans**

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.

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.

The fan outlet outlet shall be protected by a suitable wire guard on the outside.

Suitable devices and heat exchanger means shall be built-in the unit to provide maximum super-cooling of refrigerant to increase system efficiency.

The unit shall be complete with safety controls and suitable microprocessor based master control module.

The module should be capable of connecting to web or to other devices through common Bacnet or Lan networks.

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.

### **FLOOR MOUNTED AIR HANDLING UNITS:**

The air handling unit shall be of modular type with penta post frame and sandwich panels. The panels and the post shall be fabricated from heavy gauge galvanized steel or aluminium sheet. Panels and frame shall be secured using internally bolted fixings so that welding is avoided and the integrity of the finish is maintained.

The construction shall permit removal of panels for maximum access to fans, coils and filters. The removal of the side panels must not affect the structural integrity of the unit. The panels and frame shall be factory painted with durable oven cured polyester based powder paint or powder coated. The casing shall have double skin construction of **43/25 mm** thick with minimum 22 G GI or 20 G aluminium sheet with plain powder coated/plasticised sheet as the outer skin and perforated sheet for sound absorption or 24 G G.I. plain sheet as the inner skin.

The material of insulation shall be Polyurethane foam. Special protective layer has to prevent flying of the material. The floor panels also shall have double wall construction with 50 mm thick sandwich type polyurethane foam/polystyrene insulation for a rigid non-vibrating construction.

The whole unit shall be mounted on a galvanised steel or aluminium sheet base frame for easy shipment and handling. The base shall have clearance from the floor to ensure air circulation and avoid entrapment of moisture below the unit. The unit shall have a sloped drain pan with a bottom connection to eliminate stagnation of condense water.

Drain pan shall have minimum 20 G thick Stainless steel with a mastic compound to prevent corrosion. All the panels shall be flush mounted. There shall be no sharp edges or corners or fasteners projecting out on the unit, which might cause injury. Sealing shall be by means of a non-hydroscopic gasket compressed between the frame and the panels.

Access panels with hinged doors shall be provided to maintain and service the fan filters. The fan section shall have DIDW centrifugal forward/backward curved blower( AMCA Certified only) mounted on vibration isolation mountings with its bearings fixed on the scroll. The impeller and shaft of the fan shall be both statically and dynamically balanced. The drive package shall also be balanced. **OR**

The fan section consisting of single/multiple fans in order to ensure optimum working parameters. The direct drive Plug fan set consists of single inlet, radial, backward curved free running fan, fan impeller directly installed on the motor shaft. The fan

and motor mounted on common housing, should be separated from AHU casing by set of rubber vibration absorbing mounts.

The drive package shall also be balanced properly. The fan and motor assembly shall be mounted on a common framework entirely isolated from the unit by rubber in shear or spring vibration mountings. The fan discharge shall be isolated from the casing by a canvas. Provision shall be made on the air-handling unit for entry of electrical cables and earth termination.

The coils shall be of fin and tube type having copper tubes and aluminium fins. The tubes shall have a minimum diameter of 12mm. The number of fins shall be 12/13 per Inch. The tubes shall be mechanically expanded by means of mandrel for optimum tube to fin bonding. The fins shall be of spiral and tubes shall be staggered. Headers shall be of Copper.

The air face velocity across the coil shall not exceed 2.5m/sec. The coils shall have capped vent and rain connections provided on the headers. Cooling coils of water duty shall be tested for 7 Kg/cm<sup>2</sup> working pressure. The filter section shall be provided with the same casing constructions as that of the unit.

The face velocity shall not exceed 1.75 mps for 50mm thick filters and 4.25 mps for 150 mm thick filters. The filter shall be of high velocity or bag type. The media shall be of HDPE. The filter shall have an efficiency of 90% down to 10microns. The filters shall be easily removed for cleaning. The vibration of the air handling unit fans on the bearing shall not exceed a peak-to-peak displacement of 75 microns.

Tenderers shall produce test certificates for the fans. If so desired the consultant/customer may depute their authorized representatives to visualize the tests. In case the air-handling unit are to be knocked down for easy shifting into the air handling unit rooms, the reassembling of the units shall be done by the authorized representative from the manufacturers. Wherever specified, the unit shall be provided with factory made missing box, filter plenum and supply plenums for duct connections.

The noise level of unit shall not exceed **65 dBA** at 1m from the filter side. In case the units reach site in completely knocked down condition or the unit has to be dismantled for taking inside the plant room, assembly of the unit has to be done only by the representative of the manufacturer using proper tools and tackles.

The face and bypass damper should be motorized and actuated by return air temp sensor and controller.

**Fresh Air Intakes:**

Galvanised sheet steel fresh air louvers with bird screen, pre-filtered and dampers shall be provided in the clear openings of terrace/handling unit rooms. Louvers damper, fresh air ducts shall be as shown dampers shall be of the interlocking opposed blade louvers type as shown in drawing and motorized to activate by outside air sensor.

Blades shall be made of not less than 16 gauge galvanized sheet steel, edges covered with felt to provide air tight closure, and shall be rattle free. Dampers shall be similar to those specified for air distribution. Fresh air fans and fresh air intake shall be as per the requirements of schedule of quantities.

All AHU shall be connected to fire alarm panel and shall automatically switch off in case of fire. Painting shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with enamel paint to match the finish over the adjoining shop – painted surfaces. However the entire AHU should be Powder Coated at factory.

**General Specifications**

Sr. No	Item Description	Specification
1	Material & Thickness of Outer skin	0.80mm pre Powder coated GSS
2	Material & Thickness of Inner skin	0.63 mm plain GSS
3	Panel Thickness approx	45± 2 mm/25mm for air treatment units
4	Material of frame	Self supporting extruded aluminum with Thermal break for air treatment unit and standard profile Frame should be filled with PUF insulation
5	Insulation material	PUF 40 Kg / cum. Density
6	Drain Tray	Stainless steel externally insulated with 12mm thick closed cell polyethylene
7	Type of Fan	DIDW
8	Type of Drive	V-belt driven
9	Make of Fan	Nicotra / Kruger /Comefri
10	Motor	TEFC squirrel cage induction motor fitted for IEC standard
11	Fin Material	Aluminum
12	Fine spacing	2.1 mm
13	Tube material	Copper

14	Tube Diameter	12.5 mm
15	Row Deep	4 or 6 rows as per requirement
16	Nature of bonding	Mechanical
17	Test pressure	21 kg. /sq.m.
18	Pre filter / Fine filter section	Pre filter EU-4 class
19	Coil sections	a. DX coil with copper header
20	Fan section	Belt driven
21	Control panel	Microprocessor based control panel

## **AIR FILTERS**

### **PREFILTER (EU4)**

Filter medium shall be washable high density polythene packed into a frame of aluminum sheet of 18 gauge thickness and stitched onto a galvanized wire gauge support and crimped to form deep folds. Suitable aluminum spacers shall be provided to ensure uniform distribution of air flow through the filter. Filter casing shall be provided with neoprene sponge rubber sealing. The filter shall be dry type with element in several ply to make up 50 mm thickness. Filter frame shall be provided with suitable handle. This filter shall be capable of being cleaned of their accumulated dust by tap water flushing.

The efficiency and pressure drop of the pre filters shall be as follows

- a. Efficiency : As per EU4 and / or Average arresance of 65% - 80 % when tested in accordance with BS: 6540 / ASHRAE-52-76
- b. Initial pressure drop : Not to exceed 5.0 mm WC at rated flow
- c. Final pressure drop : Up to 10 mm WC at rated flow

### **FILTER FACE VELOCITY**

For 50 mm thick Pre Filters, maximum face velocity shall be 2.62 m/s/

### **Refrigerant Piping Capabilities**

The unit shall be capable of long length of piping and for providing lift of Refrigerant due to level difference between the Outdoor unit and Indoor units at the highest levels.

The maximum distance capability of the unit shall be as follows :

Total Piping length of system	Min. 500 m.
Actual length in any circuit	Min. 150 m.

Equivalent piping length any circuit	Min.	175 m.
Level difference between ODU and IDU	Min.	50 m.

➤ **Refrigerant Piping**

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:

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	19	✓	✓
3/4"	19.05	1.00	19	✓	✓
7/8"	22.20	1.00	19	X	✓
1.1/8"	28.58	1.00	19	X	✓
1.3/8"	34.92	1.10	25	X	✓
1.5/8"	41.28	1.25	25	X	✓

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.

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.

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

➤ **Insulation**

**General**

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

**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.



Ref. & Drain Pipe Insulation	:	Closed Cell elastomeric Insulation
Duct Insulation	:	Closed Cell elastomeric insulation
Acoustic Insulation	:	Resin Bonded Fibre glass in roll form
Equipment Insulation	:	Expanded Polystyrene (EP).

### **Drain Pipe Insulation**

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.

The thickness of insulation shall be 6 mm thickness.

### **Drain Piping**

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

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

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.

Damages occurred due to the supports will have to be patched up

## **AIR DISTRIBUTION WORKS :**

### **PRE INSULATED DUCTING-PIR or FABRIC AIR DISPERSION SYSTEM**

(FOR DUCTS FABRICATED IN FACTORY AS PER "SMACNA" STANDARDS)

#### **DAMPERS – GENERAL**

The respective functions, types and general constructional requirements of dampers shall be in accordance with the HVCA ductwork specification unless otherwise indicated, sufficient dampers shall be provided to regulate and balance the system. Dampers on grilles or diffusers shall be used for line control only.

All dampers shall be of flanged type for connection to ductwork and shall be sufficiently rigid to prevent fluttering. Air leakage rate for dampers shall be tested according to EN 1751 Section 3 when the damper is in the closed position. For dampers installed for shut-off purpose, the maximum air leakage rate shall be tested according to EN 1751 Section 4.

## **LOW LEAKAGE DUCT DAMPER**

Air volume control dampers shall be of the aerofoil, double skin, opposed blade type with low pressure drop and noise regeneration characteristics. Damper blades in rectangular ductwork shall not exceed 225 mm in width and 1500 mm in length. Blades shall be of hollow section constructed from the same material of the ductwork or of stainless steel encapsulating an internal double contoured stud longitudinal reinforcing bar, mounted on square section steel spindles. Bearings shall be of nylon material and the units shall be of low-leakage design by incorporation of synthetic trailing edge seals and a peripheral gasket which shall be tested according to BS 476. All manually and automatically operated dampers shall include a means for indicating externally the position of the blades. Manual dampers shall include a device for positioning and locking the damper blades. The positions of all dampers 'as-set' after final regulation shall be indelibly marked at the adjusting device.

Each air volume control damper in the ductwork shall be fitted with a non-corrodible label stating the actual air flow in m<sup>3</sup>/s when in the fully open position, its overall cross sectional area, and the degree to which the damper has been closed in order to achieve the design or actual air flow.

Unless otherwise indicated, quadrants and operating handles shall be of die-cast aluminum or other material approved by the Architect with the words 'OPEN' and 'SHUT' marked on the quadrant. Quadrants shall be securely fixed and the damper spindles shall be closely fitted in the quadrant hubs to prevent any damper movement when the damper levers are locked.

Access openings with readily removable air sealed covers shall be provided adjacent to all dampers. Subject to limitations of ductwork size the dimensions of access openings shall not be less than 300 mm x 300 mm and shall be located so as to afford easy access for inspection and maintenance.

## **SUPPLY AND RETURN AIR REGISTERS ( GRILLES)**

Supply & return air registers shall be of either steel or aluminium sections as specified in schedule of quantities. Steel construction registers shall have primer Coat finish whereas extruded aluminium registers shall be either Anodised or Powder Coated as specified in Schedule of Quantities. These registers shall have individually adjustable louvers both horizontal and vertical. Supply air registers shall be provided with key operated opposed blade extruded aluminium volume control damper anodised in matt black shade.

The registers shall be suitable for fixing arrangement having concealed screws as approved by Architect. Linear continuous supply cum return air register shall be extruded aluminium construction with fixed horizontal bars at 15 Deg. inclination & flange on both sides only (none on top & bottom). The thickness of the fixed bar louvers shall be minimum 5.5 mm in front and 3.8 mm in rear with rounded edges. Flanges on the two sides shall be 20 mm/30 mm wide as approved by Architect. The grilles shall be suitable for concealed fixing. Volume control dampers of extruded aluminium anodised in black colour shall be provided in supply air duct collars. For fan coil units horizontal fixed bar grilles as described above shall be provided with flanges on four sides, and the core shall be & suitable for clip fixing, permitting its removal without disturbing the flanges.

- a. All registers shall be selected in consultation with the Architect. Different spaces shall require horizontal or vertical face bars, and different width of margin frames. These shall be procured only after obtaining written approval from Architect for each type of register.
- b. All registers shall have a soft continuous rubber/foam gasket between the periphery of the register and the surface on which it has to be mounted. The effective area of the registers for air flow shall not be less than 66 percent of gross face area.
- c. Registers specified with individually adjustable bars shall have adjustable pattern as each grille bar shall be pivotable to provide pattern with 0 to +45 degree horizontal arc and up to 30degree deflection downwards. Bars shall hold deflection settings under all conditions of velocity and pressure.
- d. Bar longer than 45 cm shall be reinforced by set-back vertical members of approved thickness.
- e. All volume control dampers shall be anodised aluminium in mat black shade.

### **SUPPLY AND RETURN AIR DIFFUSERS**

Supply and return air diffusers shall be as shown on the Drawings and indicated in Schedule of Quantities. Mild steel diffusers/dampers shall be factory coated with rust-resistant primer. Aluminium diffusers shall be powder coated & made from extruded aluminium section as specified in schedule of quantities.

- a. Rectangular Diffusers shall be steel / extruded aluminium construction, square & rectangular diffusers with flush fixed pattern for different spaces as per schedule of quantities These shall be selected in consultation with the Architect.  
These shall be procured only after obtaining written approval from Architect for each type of diffuser.
- b. Supply air diffusers shall be equipped with fixed air distribution grids, removable key-operated volume control dampers, and anti-smudge rings as required in specific applications, and as per requirements of schedule of quantities. All extruded aluminium diffusers shall be provided with removable central core and concealed key operation for volume control damper.
- c. Linear Diffuser shall be extruded aluminium construction with removable core, one or two way blow type. Supply air diffusers shall be provided with volume control/ balancing dampers within the supply air collar. Diffusers for different spaces shall be selected in consultation with the Architect, and provided as per requirements of schedule of quantities. All diffusers shall have volume control dampers of extruded aluminium construction anodised in mat black shade.
- d. Slot Diffuser shall be extruded aluminium construction multislot type with air pattern controller provided in each slot. Supply air diffusers shall be provided with Hit & Miss volume control dampers in each slot of the supply air diffusers. Diffusers for different spaces shall be selected in consultation with the Architect and provided as per requirement of Schedule of Quantities.

### **DOCUMENTATION & MEASUREMENTS FOR DUCTING**

All ducts fabricated and installed should be accompanied and supported by proper documentation viz:

- a. Bill of material/Packing list for every duct section supplied.

Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.

Each and every duct piece to have a tag number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement and verification.

Unless otherwise specified, measurements for ducting for the project shall be on the basis of centerline measurements described herewith

Ductwork shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the center of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections. Plenums shall also be measured in a similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the centerline distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centerline.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 5mm thick between duct and support, vibration isolator suspension where specified or required, inspection chamber/access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the specifications. These accessories shall NOT be separately measured nor paid for.

**Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith :**

1. **Grilles and registers** - width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.
  2. **Diffusers** - cross section area for air flow at discharge area, excluding flanges. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.
  3. **Linear diffusers** - shall be measured by cross-sectional areas and shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.
1. **Fire dampers**- shall be measured by their cross sectional area perpendicular to

the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross section outside the air stream.

5. **Flexible connection** - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for- fire requisite length of canvas cloth.

#### **TESTING AND BALANCING**

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leaks by visual inspection.

The entire air distribution system shall be balanced using an anemometer. Measured air quantities at fan discharge and at various outlets shall be identical to or less/excess than 5 percent in excess of those specified and quoted. Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted for scrutiny and approval, and four copies of the approved balance report shall be provided with completion documents.

## **INFORMATION TO BE FURNISHED BY THE TENDERER ALONG WITH THE TENDER**

### **VARIABLE REFRIGERANT VOLUME/FLOW SYSTEM**

#### **OUTDOOR UNIT**

**(32.0 H.P.)**

1. Overall dimensional details
2. Type of Compressor
3. No. of Compressors
4. Power supply
5. Noise Level –dB (A)
6. Comp. motor output –KW
7. Cond. Fan Motor output-KW
8. Cond. Fan Air Volume (CFM)
9. C.O.P. ( Higher than 3.50 )

#### **INDOOR UNIT - AIR HANDLING UNIT**

1. Make
2. Model No.
3. Overall Dimensions-Wx D xH
4. Operating weight – Kgs.
5. Material of Construction
  - Inner skin- Thickness
  - Outer skin-Thickness
6. Type of Fan
7. Air flow- CFM
8. Static Pressure-mm of Wg
9. Operating speed
10. Critical speed
11. BHP
12. Motor H.P.
13. Fan Outlet Velocity- MPS
14. Types of bearings

15. Noise level

**Cooling Coil**

1. Coil fin and tube material
2. Fin spacing mm.
3. Grand total heat capacity Kcal / hr.
4. Air quantity through coil
5. Entering air temperature DB
6. Entering air temperature WB
7. Leaving air temperature DB
8. Leaving air temperature WB
9. S. H. F.
10. A. D. P.
11. Bypass factor
12. Pressure drop mm Air side
13. Face are m<sup>2</sup>
14. Rows deep

**Salient features**

1. Type of filter
2. Filter area
3. Filtration level
4. Any other details

**Total power consumption of the unit**

- A. For all Outdoor units at full capacity  
32.0 HP

TOTAL INSTALLED KW : \_\_\_\_\_ KW.  
(including Indoor & Outdoor unit,etc.)

TOTAL POWER CONSUMPTION AT 100% LOAD : \_\_\_\_\_ KW.  
(including Indoor & Outdoor unit etc.)