

***TENDER  
FOR***

**SUPPLY INSTALLATION TESTING AND  
COMMISSIONING OF HVAC AT HLL CORPORATE  
OFFICE, POOJAPURA**

**PART-III  
PRICE BID**

**TENDER NO. HLL/ID / 15/19  
JULY 2015**



**INFRASTRUCTURE DEVELOPMENT DIVISION  
ADARSH, TC 6/1718, VETTAMUKKU, THIRUMALA P.O.  
THIRUVANANTHAPURAM - 695006  
PHONE: 0471-2365873/ 72  
FAX: 0471-2368144**

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## **1 COMMERCIAL CONDITIONS**

1.0.1 The tendered rate shall inter alia be deemed to include for the provision of all materials, process, operation and special requirements detailed in the particular specification irrespective of whether these are mentioned in the description of equipment schedule and Bill of quantities or not. It is an express condition of the contract that the tendered rates for various items in the Bill of Quantities shall be deemed to include for the full, entire and final condition of the contractor respective items of the works in accordance with the provision of the contract.

1.0.2 The tendered rate shall include for all taxes, duties, etc. as applicable and shall be quoted on the works contract basis for Supply Installation Testing and Commissioning of HVAC at HLL Corporate office, Poojapura

1.0.3 The tendered rate shall remain firm and free from variation due to rise in the cost of materials/equipment, labour or any other reasons whatsoever during the contract period and valid extension on the case may be.

1.0.4 The quantum of excise duty included in the tendered price, the rate at which they were assumed etc. shall be indicated in the tender.

### **1.1 UNIT RATES**

1.1.1 Only approved work will be measured on completion and priced as per rates quoted against the respective items.

### **1.2 BRIEF DESCRIPTION OF PRICING**

1.2.1. Unforeseen difficulties for which provision has not been made in the tender will in no way relieve the successful tenderer from the full execution of the work.

1.2.2 The price quoted shall be the final amount for this finished work.

### **1.3 INCOME TAX**

Any payment to the contractor as per contract, will be made after deducting income tax as per the rules and regulations.

### **1.4 SALES TAX AND EXCISE DUTY**

The tenderer shall clearly indicate sales tax, Excise and other duties as applicable in his offer for carrying out this work.

### **1.6. SUBMISSION OF BILL**

1.6.1. The contractor shall from time to time prepare and submit interim bills of the work executed and on completion of the contract, he shall prepare and submit the final bill. The measurements sheets in support of the interim and final bills shall be prepared by the contractor on the basis of measurements taken by him jointly with the project engineer and the said measurement sheets shall be submitted by him with the relevant bill.

### **1.7. EXTRA ITEMS**

The contractor is bound to carry out any items of work necessary for the completion of the job even though such items may not have been included in the schedule of probable quantities or rates, such items being necessary or essential for completing the job. Variation order in respect of such additional items and their quantities will be issued in writing by the employer.

1.7.1 All shavings, cuttings and other rubbish as it accumulates from time to time during the progress of work and on completion including that of the sub-contractors and special tradesman and all materials condemned by the project engineer shall be cleared and removed from the site by the contractor without any extra charge.

1.7.2 All measuring steel taps, scaffolding, ladders instruments and tools that may be required for taking measurements shall be supplied by the contractor.

## **1.8. OVER TIME WORK**

If the contractor is required to work night or on holidays in order to maintain the time schedule he shall take prior approval from the Engineer-in-charge. He should also provide and maintain at his own cost sufficient lights as may be necessary to enable the work to proceed satisfactorily during the night.

- 1.8.1. The contractor shall give full facilities to all other contractors working on site. He shall also arrange his programme of work so as not hinder the progress of other trades. The decision of the Engineer-in-charge on any point of dispute between the various parties shall be final and binding.
- 1.8.2. It is specifically pointed out that the contractor shall not be entitled to any compensation whatsoever on account of delay in procurement or supply of controlled materials and the rates quoted in the contract are fixed till the completion of the contract.
- 1.8.3. The contractor shall co-operate with other agencies appointed by the owners for the work to proceed smoothly with the least possible delay and to the satisfaction of the owners, architects and the consultants.
- 1.8.4. The owners shall provide a source for power supply at one convenient point at site. The contractor shall at his own cost install a separate meter at the said source and lay additional cables from the said source also at his own cost. For the electricity consumed by the contractor he shall pay the owner the actual cost at the rate charged by the local authority for power for constructional purposes. The contractor shall also obtain the necessary permit for utilizing power for constructional purposes.

## **2 SPECIAL CONDITIONS**

### **2.1. EXECUTION WORK**

2.1.1. The whole of the work as described in the contract (including bills of materials, specification and all drawings pertaining thereto) and as advised by the Engineer-in-charge from time is to be carried out and completed in all parts to the entire satisfaction of the Employer. Any minor details of construction which are obviously and fairly intended, or which may not have been definitely referred to in this contract, but which are usual construction practice and essential to the work, shall be included in this contract.

### **2.2. CERTIFICATE OF COMPLETION**

2.2.1 The contractor shall intimate to the Engineer-in-charge in writing as and when the works are completed and put into beneficial use in order to enable the consultants to check certify to the owners to take over the plants.

2.2.2 The work shall not be considered as completed and put into beneficial use until the consultants have certified in writing that the same has been completed and put into beneficial use.

2.2.3 The defects liability period of one year shall commence from date of such completion or any specific date mentioned therein.

### **2.3. OTHER CONDITIONS**

2.3.1 The contractor has to do all liasoning works and obtain statutory approval from Electricity board, Electrical inspectorate and any another body if required for the successful energisation of electrical supply. However, statutory fees if any will be paid by HLL. All necessary drawings and documents required for the same has to be prepared and submitted by the contractor with the concurrence and approval of the Engineer – in –charge.

## **TERMS OF PAYMENT**

The rate of payment for the contract value under this contract shall be regulated and detailed below:

70% after supply of materials at site in good working condition on pro-rata basis.

20% after completion of installation in all respects.

Balance 10% will be paid after testing, commissioning & handing over to the client, including all required statutory approvals.

## **TECHNICAL SPECIFICATIONS**

Air conditioning System

### **SECTION - I**

#### **BRIEF DESCRIPTION OF WORK**

##### **1.1 SCOPE OF WORK**

The scope of work covers supply, installation, testing and commissioning of Air-conditioning System at New block at HLL, Poojappura.

##### **1.2 SPACE TO BE AIR CONDITIONED**

The space to be air-conditioned is tentatively as per the drawings attached. Tenderers are advised to visit the site before submitting their bids.

##### **1.3 BILL OF QUANTITIES & EQUIPMENT**

The details of equipment and the bill of quantities required are furnished in relevant sections of this document. The technical specifications are also described. The tenderers are required to fill in the prices item wise all inclusive, as per format and submit the Bill of Quantities. The rate quoted should be inclusive of taxes, duties, freight, packing and forwarding, Octroi entry tax, loading, unloading, handling at site, etc. The tenderer shall not be eligible for any extra amount due to change in taxes, duties, etc.

##### **1.4 TECHNICAL DATA**

The tenderers are required to submit technical data documents as per the format. The data proposal sheets are enclosed in the tender document. The tenderer shall fill in all the data required.



## SECTION- II

### TECHNICAL DETAILS

#### **2.1 SCOPE OF WORK**

The complete scope of work shall cover supply, installation, testing and commissioning of Air Conditioning System at New block at HLL, Poojappura including sizing of ducts, pipes routing & exhaust ventilation for toilets including ducting. The contractor shall submit the design & drawings for approval and obtain approval from Consultant/Client before commencement of works. The scope of work includes testing for air changes per hour with fresh air changes, Air velocity, Positive pressure, Air quality - air filtration-(particles test), temperature and humidity, validation of Hepa filters by appropriate tests like DOP.

#### **2.2 Basis of Design**

The entire system has been designed based on climatological data available as given under the section basis of Design. The technical requirements given under here are only indicative and not descriptive and the contractor shall ensure that the whole system supplied is complete in all respects for the smooth operation of the plant and should be suitable for the rated performance.

#### **2.3 Terms and Definitions**

The following terms have been used in the tender specifications, drawings, etc.

BIS Bureau of Indian Standards

ASHRAE American society of Heating, Refrigeration and Air-conditioning Engineers, USA.

ASME American Society of Mechanical Engineers.

ASA American Standard Association.

B.S British Standards

CMH Cubic Meter per Hour

CFM Cubic Feet per Minute

US GPM US Gallons per Minute

IGPM Imperial Gallons per Minute.

RPM Revolutions per Minute

BTU/Hr. British Thermal Unit per Hour

KCal/Hr. Kilo Calories per Hour

HZ Hertz

|                    |                                 |
|--------------------|---------------------------------|
| H.P.               | Horse Power                     |
| Kg/CM <sup>2</sup> | Kilo Gram per Square Centimeter |
| SG                 | Supply Air Grilles              |
| SD                 | Supply Air Diffuser             |
| SAF                | Supply Air Filters              |
| FD                 | Fire Damper                     |
| VCD                | Volume Control Damper           |
| RG                 | Return Air Grilles              |
| RD                 | Return air diffuser             |
| FAD                | Fresh Air Damper                |
| RH                 | Relative Humidity               |
| DB                 | Dry Bulb Temperature            |
| WB                 | Wet Bulb Temperature            |
| MV                 | Mechanical Ventilation          |
| DP                 | Drain Point.                    |
| RO                 | Rate Only                       |

The design, manufacture, identification of material and testing of the equipment covered in this specification shall comply with the latest edition of the appropriate standard of the following:

- 1) Duct Work - IS:655 (latest edition)
- 2) Welding - IS:3589
- 3) Refrigeration and Air-conditioning - As per ASHRAE/ISI air-conditioning and refrigeration institute standards.
- 4) Sluice Valves for Water Lines - IS:778-1980
- 5) Copper alloy Gate/ Globe / Check Valve for water lines - IS:778
- 6) Colour code for the identification of pipe lines - IS:2379-1963
- 7) Specific requirements for the direct switching of the individual motors - IS:4064 (Part-II)-1978
- 8) PVC insulated (HD) Electric Cables for working voltage up including 1100 Volts - IS:1554 (Part I)
- 9) Starters - IS:8554 (Part-I) 1979
- 10) HRC Cartridge fuse links upto 650 Volts - IS:2208
- 11) Inspection and testing of installation IS:732 (Part-III) 1979
- 12) Galvanized steel wire for fencing - IS:277-1977
- 13) Three phase induction motors - IS:325
- 14) Horizontal centrifugal pumps - IS:1620
- 15) Wrought aluminum and aluminum alloy sheet and strip for general engineering purposes - IS:737
- 16) Bourdan tube pressure & vacuum gauges - IS:3624
- 17) Glossary of terms used in refrigeration and air-conditioning - IS:3615

- 18) Code for practice for standard for selection of standard worm and helical gears - IS:7403
- 19) PVC insulated (heavy duty) electric cables for working voltage upto and including 1100 watts: -IS:1554 (Part-I)
- 20) Expanded Polystyrene (EPS) : - IS 4671.
- 21) Resin bonded glass wool: - IS 8183.

## **2.4 Safety Codes**

The following IS codes shall be followed:

- Safety code for mechanical refrigeration - IS:660
- Safety code for air-conditioning - IS:659
- Safety code for scaffolds & ladders -IS:3696
- Code of practice for fire precautions in welding & cutting operations - IS:3016
- Code for safety procedures and practices in electrical works - IS:5216
- Code of practice for safety and health requirements in electrical & gas welding and cutting operations - IS:3696
- Indian Electricity Act 1910
- Electricity Supply Act and Indian Electricity Rules.

## **2.5 MACHINERY**

### **AIR COOLED PACKAGED/DUCTABLE AIR CONDITIONING UNIT**

#### **1.Cabinet**

The packaged split air conditioning units shall have metal cabinet of min 1.6mm thick (16 gauge) galvanized sheet steel. The body should be machine pressed and adequately stiffened. The body should be chemically treated for corrosion resistance and Polyester powder coated.

#### **2.Compressor**

All compressors shall be hermetically sealed scroll type of suitable capacities. Compressor shall be suitable for R22 refrigerant. The compressor shall be electrically interlocked with indoor and outdoor fan motors, HP/LP cutouts and thermostat in the evaporator. The compressor shall be housed inside the Condenser.

#### **3.Condenser (Air cooled)**

The coils shall be made of copper hydraulically bonded with aluminium fins. The tubes shall have a minimum of 9.5 mm outer diameter, firmly bonded with aluminium fins spaced at 12-14 fins/inch. The air velocity across the

face of the coil shall not exceed 200 m/min. The coils shall be designed for a maximum working pressure of 35 kg./sq.cm. The condenser coil shall be protected on the open end by a wire mesh duly powder coated/plastic coated.

#### **4.Evaporator coil**

The coils shall be made of copper hydraulically bonded with aluminium fins. The coils shall be hydrophilic in nature. The tubes shall have a minimum of 9.5 mm outer diameter, firmly bonded with aluminium fins spaced at 12-14 fins/inch. The air velocity across the face of the coil shall not exceed 170 m/min. The coils shall be designed for a maximum working pressure of 35 kg/sq.cm. The circuit should include a thermostatic expansion valve/capillary tube, distributor, liquid strainer, suction line shut off valve and liquid line shut off valve.

#### **5.Condenser motor**

The condenser motor shall be of IP-55 rating.

#### **6.Refrigeration piping and accessories**

Only hard drawn copper shall be used in piping with brass fittings wherever required. Brazing shall be with silver copper phosphorous alloy. Horizontal lines shall have a grading of at least 1:250 away from the compressor and towards condenser to prevent gravity draining of oil to compressor. Liquid lines shall be sized to ensure that flashing of liquid refrigerant does not occur. The circuit should include a thermostatic expansion valve, distributors, liquid strainer, de-hydrator and liquid lines shut off valve and suction line shut off valve.

Leaks shall be tested with soap solution at a minimum pressure of 21 kg/sq.cm. After all leaks have been repaired, system shall be tested with the test pressure maintained for a period of not less than 8 hours. No measurable drop in pressure should be detected after the pressure readings are adjusted for temperature changes. After satisfactory completion of the pressure test, the system shall be evacuated to reduce the pressure to 0.1 Kg/Sq.cm. for a period of 6 hours and vacuum broken. A vacuum pump connected to the refrigeration system shall be used to create the vacuum and the installed compressor shall not be used to create the purpose. The system shall again be evacuated and a vacuum of 0.01 Kg/Sq.cm. maintain for 24 hours before charging with correct quantity of refrigerant and oil. The system shall be operated for 12 hours and then again tested for leaks.

#### **7.Drain Piping**

Drain pipe shall be of 32mm dia. PVC pipes. All Ductable Split units shall be provided with independent drain lines. And all the drain line above false ceiling shall be insulated. The drain shall be taken to the nearest exit points.

## **8.Fan**

Fan section including wheel and housing shall be of heavy gauge steel/aluminium. Fans shall be centrifugal, forward curved multi-blade type. Fan housing shall have inlets and guide vanes for smooth air flow. Fans shall be complete with drive motor. The fans should be statically and dynamically balanced. The fan motor should be resilient mounted. The fan should deliver a static pressure of 125 mm.

## **9.Dampers**

All fresh air intakes shall be provided with dampers. The fan outlets should be controllable with a damper. The supply collars, wherever mentioned, shall be provided with collar dampers.

## **10. Filters**

All evaporator units shall be provided with air filters capable for filtration unto 20 microns. The filters shall be of washable synthetic fibre type.

## **11. Control Panel**

All units shall have independent electrical control panels housing contactors, overload relays, voltage cutouts, time delays, interlocks, strip connectors, indication lamps, and control fuse. All these have to be housed inside the Outdoor unit of each circuit.

## **12. Thermostat**

The Thermostat shall be control wired with the control panel and shall be placed in the return air path inside the boxing.

## **13. Installation**

Adequate vibration isolation using rubber/neoprene pads/vibration springs in order to reduce transmission of vibrations to the floor shall be provided for all condensing units.

## **14. Testing**

Ductable units after installation shall be tested for its conformity to specifications. Units shall also be tested for the rated capacity and power consumption.

## **15. Electric motor**

The electric motor driving the compressor shall be as per manufacturer's standard for this compressor and motor shall be suitable for operation on A.C. supply. The motor shall be continuous duty rated for the application.

The motor shall be selected such a way that the motor rating is for actual requirement.

The motor shall be provided with suitable bearing to take care of loads/thrust. Necessary lubricators shall be provided to enable the bearings to be correctly greased as required. The tenderer shall also calculate KW/TR.

**16. AHU**

The AHU shall be AR certified floor mounted/ceiling suspended type, double skinned type made of 0.6mm pre-coated GI sheets on both sides min 40mm thick PUF CFC free, 40kg/m<sup>3</sup> between sheets, SS 304 drain pan with nitrile rubber insulation, GSS base channel. Suitable for DX coil of copper 6 rows min, Aluminum fins, with synthetic non woven type pre (EU4) and fine filters (EU 7) filtration up to 3microns. The AHU shall be with suitable static blower DIDW, centrifugal, forward curved blade, belt driven for hepa filter application comprising of suitable rated motor min EFF1 rated. The AHU shall also be provided with manual volume control damper on supply, return and fresh air sides to control the air volume. The AHU shall be UL certified for safety. The AHU shall be provided with access doors for filter cleaning and maintenance etc.

**2.6 DUCTING SYSTEM**

This section deals with supply, erection, testing and commissioning of all sheet metal ductwork conforming to specifications given below. The ducts shall be of factory fabricated.

**2.6.1 Material for Ducting**

All ducts shall be fabricated from galvanized sheet of 120 gm/sq.m (Class VIII) conforming to IS 277-1962 (revised). The fabrication of duct shall strictly conform to ISS 655-1963. The thickness of the sheet shall be as follows:

| Maximum size (mm) | Thickness of sheet (mm) | Type of transverse joint connections          | Bracing (if any) |
|-------------------|-------------------------|---|------------------|
| Upto 300          | 0.63<br>24 G            | S-drive, pocket or bar slips, on 2.5m centres | None             |

|                             |              |  |  |
|-----------------------------|--------------|--|--|
| 301 to 600<br>601 to 750    | 0.63<br>24 G | S-drive, pocket or bar slips, on<br>2.5m centres S-drive,<br>25mm pocket or 25mm<br>bar slips on 2.5m<br>centres drive   | None<br>25x25x3mm<br>angle<br>1.2m<br>from<br>joint                      |
| 751 to 1000<br>1001 to 1500 | 0.80<br>22 G | 40x40mm angle connections,<br>or 40mm pocket or<br>40mm bar slips, with<br>35x3mm bar reinforcing<br>on 2.5m centres     | 40x40x2mm<br>angle<br>1.2m<br>from<br>joint                              |
| 1501 to 2250                | 1.00<br>20 G | 40x40mm angle connections,<br>or 40mm pocket or<br>40mm bar slips, 1 m<br>maximum centres with<br>35x3mm bar reinforcing | 40x40x3mm<br>angle /<br>40x40x3<br>mm<br>angle<br>60mm<br>from<br>joint. |
| 2251 &<br>above             | 1.25<br>18 G | 50x50mm angle connections,<br>or 40mm pocket or<br>40mm bar slips, 1 m<br>maximum centres with<br>35x3mm bar reinforcing | 40x40x3mm<br>angle /<br>40x40x3<br>mm<br>angle<br>60mm<br>from<br>joint. |

The following points shall be also taken into account while fabrication of ducts.

- a) All ducts shall be as per gauges, etc. indicated on the approved drawings.
- b) All ducts of size larger than 450 mm shall be cross broken.
- c) All ducts shall be supported from RCC/truss by means of MS rods, angles, etc.
- d) The ductwork shall not extend outside and beyond height limits as specified on the approved drawings.
- e) All ducts shall be reinforced, if necessary and must be secured in place so as to avoid shifting of the ducts on its supports.
- f) The vanes shall be provided and securely fastened to prevent noise and vibration.
- g) The rubber gasket shall be installed between duct flanges in all connections and joints.
- h) The ductwork can be modified in consultation with Purchaser to suit actual conditions in the building.

- i) All flanges and supports should be primer coated on all surfaces before erection and painted with aluminum paint thereafter.
- j) The flexible joints are to be fitted to the suction and delivery of all fans with double heavy canvass. The length of flexible joints should not be less than 150 mm.
- k) All sheet metal gauges and fabrication procedure as given in BIS specification shall be strictly adhered to. The BIS specification shall form part of this contract.

### **2.6.2 Grilles/Diffusers**

Material of construction - Extruded Aluminum

Supply air and return air grilles shall be continuous type and shall be fixed as given in the approved drawing. The square/rectangular diffusers shall be flush or step down type to match false ceiling pattern. The diffuser blades shall be die formed, flush mounted with single or double direction airflow.

Supply of frames for fixing the grilles/diffusers, if required, is also in the scope of the contractor.

Return air grilles shall be with blanks and return air provisions. The size and appearance shall match with supply air grilles. The supply air grilles shall form part of the continuous return air grilles. The fixing of grilles/diffusers should be done in close co-ordination with false ceiling work and as directed by Purchaser.

The aluminum grilles/diffusers, etc. shall be powder coated of colours to match the interiors. However, successful bidder shall have to obtain prior approval regarding colour, finish, shape, etc. of grilles/diffusers and sample should be submitted to Purchaser for approval.

### **2.6.3 Testing**

The complete duct system shall be tested for air leakage and complete air distribution systems shall be balanced in accordance with the approved drawings for achieving designed values inside the building.

## **2.7 THERMAL / ACOUSTIC INSULATION**

### **2.7.1 Material**

- ◆ Insulation material shall be Closed Cell Elastomeric Nitrile Butadiene Rubber.



- ◆ Insulation material shall have anti-microbial product protection. The antimicrobial product protection shall be an integral part of insulation that is built-in during the manufacturing process and the product protection should not allow the microbes to function, grow and reproduce.
- ◆ Resistance towards microbiological growth on insulation surface should confirm to following standards: Fungi Resistance – ASTM G21 where the fungal growth on the surface is NIL after 28 days of incubation at 28 – 30 deg C and Bacterial resistance – ASTM E 2180 where the reduction of bacterial growth is minimum 99.9% after 24 hours of incubation at 34 – 38 deg C.
- ◆ Thermal conductivity of Elastomeric Nitrile rubber shall not exceed 0.035 W/m<sup>2</sup>K at an average temperature of 20°C in accordance to EN12667
- ◆ The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class ‘O’ Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990.
- ◆ Water vapour permeability shall not exceed  $1.74 \times 10^{-14}$  Kg/m.s.Pa, i.e. Moisture Diffusion Resistance Factor or ‘μ’ value should be minimum 10,000 according to EN 12086
- ◆ Density of Material shall be between 40 to 60 Kg/m<sup>3</sup>.

## 2.7.2 Duct Insulation

External thermal insulation shall be provided as follow:

- ◆ The thickness of Nitrile rubber shall be as shown on drawing or identified in the schedule of quantity. Following procedure shall be adhered to:
- ◆ Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubbers sheets to size with sufficient allowance in dimension.
- ◆ Material shall be fitted under compression and no stretching of material shall be permitted. A thin film of adhesive shall be applied on the back of the insulating material sheet and then on to the metal surface. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. The adhesive shall be strictly as recommended by the manufacturer.

- ◆ The detailed Application specifications are mentioned separately.

### **2.7.3 Insulation of Ducts Exposed Directly to Sunlight**

For installations exposed to sunlight, after giving 36 hours curing time for the adhesive apply manufacturer's recommended UV/Mechanical Protection.

Please refer the separate detailed guidelines on UV/Mechanical Protection.

### **2.7.4 Piping Insulation**

All chilled water, refrigerant and condensate drain pipe shall be insulated in the manner specified herein. An air gap of 25 mm shall be present between adjacent insulation surfaces carrying chilled water or refrigerant. Before applying insulation, all pipes shall be brushed and cleaned. All Pipe surfaces shall be free from dirt, dust, mortar, grease, oil, etc. Nitrile Rubber insulation shall be applied as follows:

- ◆ Insulating material in tube form shall be sleeved on the pipes.
- ◆ On existing piping, slit opened tube of the insulating material (slit with a very sharp knife in a straight line) shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer.
- ◆ Adhesive must be allowed to tack dry and then press surface firmly together starting from butt ends and working towards centre.
- ◆ Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations.
- ◆ The insulation shall be continuous over the entire run of piping, fittings and valves.
- ◆ All valves, fittings, joints, strainers, etc. in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

The detailed application specifications are as mentioned separately. The manufacturer's trained installer should only be used for installation.

### **2.7.5 Recommended Adhesive**

In all cases, the manufacturer's recommended Adhesive should be used for the specified purpose.

## 2.7.6 Acoustic Insulation

Material shall be engineered Nitrile Rubber open cell foam.

The Random Incidence Sound Absorption Coefficients (RISACs) across the octave band frequencies; tested as per ISO 354, and Noise Reduction Coefficients (NRCs) for the Acoustic Insulation should be minimum as per the below chart:

| Freq (Hz) | 125  | 250  | 500  | 1000 | 2000 | 4000 | NRC  |
|-----------|------|------|------|------|------|------|------|
| 10 mm     | 0.03 | 0.04 | 0.14 | 0.40 | 0.88 | 1.00 | 0.40 |
| 15 mm     | 0.01 | 0.09 | 0.29 | 0.74 | 1.08 | 0.83 | 0.55 |
| 20 mm     | 0.04 | 0.13 | 0.40 | 0.90 | 1.04 | 0.90 | 0.60 |
| 25 mm     | 0.05 | 0.25 | 0.86 | 1.14 | 0.88 | 0.99 | 0.80 |
| 30 mm     | 0.07 | 0.32 | 0.99 | 1.16 | 0.93 | 1.08 | 0.85 |
| 50 mm     | 0.23 | 0.73 | 1.29 | 0.99 | 1.09 | 1.11 | 1.05 |

- The material should be fibre free.
- The density of the acoustic insulation should be minimum 140 Kg/m<sup>3</sup>
- The insulation should have Microban®; Built-in Anti-Microbial Product Protection, and should pass Fungi Resistance as per ASTM G 21 and Bacterial Resistance as per ASTM E 2180.
- The insulation should be non-eroding & should pass Air Erosion Resistance Test in accordance to ASTM Standard C 1071-05 (section 12.7).
- The material should have a thermal conductivity not exceeding 0.047 W/m.K @ 20 Deg. C
- The material should withstand maximum surface temperature of +85°C and minimum surface temperature of -20°C
- The material should confirm to Class 1 rating for surface spread of Flame in accordance to BS 476 Part 7 & UL 94 (HBF, HF 1 & HF 2) in accordance to UL 94, 1996.
- The acoustic insulation should be tested and approved by Sound Research Laboratories Ltd., U.K.
- Thickness shall be 10mm for Duct Acoustic Lining
- Duct so identified and marked on Drawings and included in Schedule of Quantities shall be provided with internal acoustic lining for a distance of minimum 6 meters (or 30% of the duct length whichever is more)

- Thickness of the insulation material shall be as specified for the individual application. The insulation should be installed as per manufacturer's recommendation.

### **2.7.7 Accessories**

Adhesive to adhere insulation to the inside walls of the duct shall be from the Insulation manufacturer only.

### **2.7.8 Under deck insulation**

- ◆ Insulation material shall be Closed Cell Elastomeric Nitrile Rubber
- ◆ Density of Material shall be between 40 to 60 Kg/m<sup>3</sup>
- ◆ Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.035 W/m<sup>2</sup>K at an average temperature of 0°C
- ◆ The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O' Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990
- ◆ Material should be FM (Factory Mutual), USA approved.
- ◆ Water vapour permeability shall not exceed 0.017 Perm inch (2.48 x 10<sup>-14</sup> Kg/m.s.Pa), i.e. Moisture Diffusion Resistance Factor 'μ' value should be minimum 7000.

### **2.7.9 Installation procedure:**

- The ceiling surface shall be cleaned with brush to remove all dirt, cement etc. If surface is uneven it should be made smooth prior to carrying out insulation work.
- A layer of synthetic rubber adhesive should be applied on the ceiling with the help of brush so that all the pores are filled and surface becomes smooth and allow it to dry.
- Allow an additional 5 mm to the total dimensions while cutting Insulation sheet. Ensure you measure the cutting dimensions on the top surface of the insulation sheet. This can be identified by the products markings; "they are always on the top surface. This surface is the one you will see after installation.
- All Insulation sheet and ceiling surfaces shall have all-over adhesive coverage. Adhesive should be applied on the side that has no product

markings and identification printing. This side is the one that curves inwards.

- During installation avoid air bubbles. Always apply pressure while fixing the Insulation sheet, this action will ensure maximum bond strength.
- All cut Insulation sheet edges shall be of a “clean cut nature and not cut rough”.
- All seams and joint shall be sealed with synthetic rubber adhesive.
- Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubbers sheets to size with sufficient allowance in dimension. Material shall be fitted under compression and no stretching of material shall be permitted. A thin film of adhesive shall be applied on the ceiling with brush and then on to the back of the insulating material sheet with brush/small piece of sheet metal having smooth edges. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. All joints shall be sealed. The adhesive shall be strictly as recommended by the manufacturer. There is no need to make holes for wires etc. as no supporting wires/screws are required.

While doing installation on the metal roofing, it is important to ensure that metal roof should not face direct sun light, as metal sheets becomes very hot and adhesive may not work. In such conditions work should be done in the evening / night

## **2.8 FIRE DAMPERS**

This section deals with supply, erection, testing and commissioning of fire dampers and box type dampers, conforming to general specification and suitable for duty selected, indicated in schedule of equipment/material.

### **2.8.1 Dampers**

- a) The fire dampers of at least two hour rating shall be provided in all return air ducts at wall crossing. All fire dampers shall be fire tested by CBRI Roorkee for 120 minutes fire rating as per UL555-1995.
- b) 6G GSS sheet blade and frame with 165mm casing, heavy duty interlocking blades and fully enclosed blade linkage mechanism, SS lateral seal blade seals, self lubricating sintered bronze bushes, fire rating as per UL555-1995 tested as per BS-476 part 20 with 18G extended sleeve 450mm and with fusible link, spring mechanism control panel temp sensor, smoke sensor, limit switch with lever for auto shut off in case of fire/smoke

- c) In the normal position the blades of the dampers shall remain open to allow maximum air to flow. The dampers shall be actuated using fusible link and spring mechanism. The fire damper shall also close due to temperature rise above 74°C.
- d) All fire dampers shall be mounted on wall with a duct sleeve 400 mm long depending on the wall thickness. The sleeve shall be factory fitted on the fire damper. The joint at the sleeve end shall be slip on type. Minimum thickness of GI sheet used for sleeves shall be 18G.

### **2.8.2 Exhaust Air Blowers**

line exhaust air flow duct blowers suitable for single phase operations with direct driven class F motor, IP 54 insulation, max 1400rpm, necessary steel frame, and complete with GI box, with an operating sound level not exceeding 60dB at 3m distance.

### **2.8.3 Hepa Filter**

Hepa Filter shall be of efficiency 99.97%. HEPA filters shall be aluminium corrugated and Mini pleat style. All filters shall made up of high quality mico-fine glass fiber media. Filter frames shall made up of Galvanized steel. Hepa filter shall ensure low pressure drop even at high airflows & with Antimicrobial protection.

All filters shall be made in accordance and tested to EN 1822 / ASHRAE 52.2 standards. These filters shall be tested at factory and test cetrtificates from OEM's shall be produced. The Hepa filter shall be fixed in a plenum constructed at the AHU mouth.

## **2.9 PAINTING WORK**

**2.9.1** All equipment shall be painted as specified under respective headings. Grilles/ diffusers shall be powder coated as per approved colour matching with interiors. The contractor has to get approval of the quality and colour of paints for all types of painting work.

All pipes for chilled water shall be painted as per standard code of practice and arrows indicating direction of flow of water shall be marked.

### **2.9.2 Colour scheme for the plant and equipment**

- |                                 |                     |
|---------------------------------|---------------------|
| i) Compressor                   | .. Battle ship grey |
| ii) Condenser                   | .. Battle ship grey |
| iii) Refrigerant discharge line | .. Red              |
| iv) Refrigerant liquid line     | .. Yellow           |
| v) Steel supports               | .. Black            |

- |       |   |                               |
|-------|---|-------------------------------|
| vi)   | Direction of flow of water                                  | .. White arrows               |
| vii)  | Electrical panels/sub-panel/remote control console approved | .. Light grey or any approved |
| viii) | Cable trays   | .. Black                      |
| xi)   | Supports for ducts/open ducts                               | .. Black.                     |

### SECTION- III

#### MODE OF MEASUREMENT

**THE FOLLOWING MEASUREMENT CODE SHALL APPLY TO THIS CONTRACT:-**

#### **3.1 MECHANICAL ITEMS**

##### **3.1.1 Ducting**

- i) All sheet metal ducting work shall be measured in terms of final sheet area installed in Sq. m.  
 Eg:- Measurement of 600 mm x 300 mm duct of 1 m length = 
$$\frac{[(600+300) \times 2 \times 1]}{1000} = 1.80 \text{ Sq.m.}$$
- ii) Duct fittings such as bends, elbows, tap-offs, collars, transformation pieces etc. shall be treated as ordinary duct pieces with their length measured along their centre line as mentioned in point (i).
- iii) Vanes, splitters, duct dampers, deflectors, access doors, etc. which are required to be installed in the duct work shall not be measured separately as it shall form part of the duct work.
- iv) Duct supports, stiffening members, etc. shall not be measured separately. All such supports/hangers shall form part of duct work.
- v) Equipment connections such as canvas/asbestos/rexine shall be deemed to be part of the duct work, and no separate measurement shall be allowed.
- vi) No separate special measurement shall be made for bends, transformation pieces, tap offset, elbows, etc.

##### **3.1.2 Grilles:**

All grills will be measured in terms of effective area in Sq.m.

### 3.1.3 Diffusers:

Diffusers will be measured in terms of effective area in Sq.m.

### 3.1.4 Ducting Insulation

d) Ducting insulation will be measured on the basis of centerline of insulation and not the outer line of insulation.

Eg:- Measurement of 25mm thick insulation on 600 mmx300mm duct of 1m length =  $\frac{[(600+25)+(300+25)] \times 2 \times 1}{1000}$  Sq.m

- ii) No separate special measurement shall be made for insulation of bends, transformation pieces, tap offs, elbows, etc. All such insulation shall be treated as standard duct insulation.
- iii) Insulation item shall include all accessories and finishes as specified. No separate measurement will be made for such items.

## 3.2 Electrical items

### Mode of Measurement of Electrical Items

The Works shall be measured, as prescribed in the specification of work, notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract. Wherever not specifically mentioned in the Contract, the mode of measurement as prescribed in the relevant IS codes shall be applicable and binding to the Contract. Only the latest editions of all the codes of practices including all latest official amendments and revisions shall be applicable.



## SECTION-IV

### TESTING OF AIR-CONDITIONING SYSTEM

- 4.1 Routine and type tests for the various items of equipment of the system shall be performed at the Contractor's own cost and test certificates are to be submitted.
- 4.2 The performance tests to determine whether or not the full intent of the specification is met shall be conducted by the contractor. After notification to Purchaser that the installation has been completed and the system has run continuously for a period of at least one week, the contractor shall conduct under the direction and the presence of Purchaser such tests as specified to establish the capacity of various equipment supplied and installed by the contractor.
- 4.3 The contractor shall operate, test and adjust the air-conditioning system units, fan, motors, all air handling appliances including adjustment of regulators, dampers, etc. All testing equipments, labour, operating personnel, oil, refrigerant or any other item required for these tests shall be provided by the contractor to enable the plant to be put in a continuous running test.
- 4.4 **TEST PROCEDURE:**
- 4.4.1 Design Conditions:
- The inside and outside conditions shall be recorded on hourly basis. The outside and inside dry bulb and wet bulb temperatures shall be recorded by means of a sling psychrometer with mercury thermometers. The relative humidity shall be computed from the psychrometric chart. The inside dry bulb temperature and relative humidity shall fall within the specified limits. The contractor should conduct performance such tests as indicated in the rated Technical Part and produce sufficient documentary proof that the plant is operating at the rated capacity.
- 4.5 The following readings shall be recorded hourly during the tests and capacity of the plant shall be computed.
1. **Compressor**
- |                        |                            |
|------------------------|----------------------------|
| a. Suction pressure    | - Kg/cm <sup>2</sup> (psi) |
| b. Suction temperature | - °C (°F)                  |
| c. Discharge pressure  | - Kg/cm <sup>2</sup> (psi) |
| d. Condensing Tempr.   | - °C (°F)                  |

- e. Oil pressure
  - f. Compressor Speed
    - Kg/cm<sup>2</sup> (psi)
    - RPM
- 2. Compressor motor**
- a. Rated capacity
  - b. Rated volts
  - c. Rated current
  - d. Starting current
    - HP
    - Volts
    - Amps
    - Amps
- 3. Inside unit**
- a. Air velocity
  - b. Face area
  - c. Air quantity
  - d. Entering air temp. DB
  - e. Entering air temp. WB
  - f. Leaving air temp. DB
  - g. Leaving air temp. WB
    - M/Hr. (FPM)
    - M<sup>2</sup> (SFT)
    - M<sup>3</sup>/Hr. (CFM)
    - °C (°F)
    - °C (°F)
    - °C (°F)
    - °C (°F)
- 4. Air Grilles**
- a. Area of Grilles
  - b. Velocity
  - c. Air flow rate
  - d. Temperature DB
  - e. Temperature WB
    - M<sup>2</sup> (Sft)
    - M/Hr (FPM)
    - M<sup>3</sup> (FPM)
    - °C (°F)
    - °C (°F)
- 5. Air Diffusers**
- a. Area
  - b. Velocity
  - c. Air flow rate
  - d. Temperature DB
  - e. Temperature WB
    - M<sup>2</sup> (Sft)
    - M/Hr (FPM)
    - M<sup>3</sup> (FPM)
    - °C (°F)
    - °C (°F)
- 6. Filters**
- a. Total area
  - b. Effective area
    - M<sup>2</sup> (Sft)
    - M<sup>2</sup> (Sft)

c. Velocity of air

- M/Hr (FPM)

d. Quantity of air

-  $M^3$  (CFM)

## SECTION-V

### TECHNICAL DATA

(To be submitted along with the tender)

- 5.0** The following data shall be furnished along with the offer: (REFER LIST OF APPROVED MAKES)  
(Attach catalogues, brochures, etc.)

#### **1. Ductable Split unit**

Manufacturer

Model

Actual capacity TR

Overall dimensions

Over all weight

Operating weight

Refrigerant

#### **Compressor**

Manufacturer

Model

Type

Capacity at the specified water temp. and flow rates - in TR

Type of capacity control provided

Type of lubrication

KW / TR

#### **Motor**

Model

Manufacturer

Number of motors

Capacity HP

Whether provided with part winding

Type

Class of insulation

Speed RPM

Characteristics

Type of starter

Rating

Whether the following protections are provided.

- |  |        |
|--|--------|
| i) Overload  | Yes/No |
| ii) Under voltage  | Yes/No |
| i) Single phase protection<br>(for three phase motor starters) | Yes/No |

## **2. Inside units**

Manufacturer  
Model  
Type of fan  
Fan speed (R.P.M.)  
No. of fans.  
Fan wheel diameter (mm)  
Drive arrangement  
Material and thickness of fan wheel and blades.  
Materials and thickness of housing.  
Fan outlet area  
Outlet velocity.  
Total air quantity  
Static pressure at outlet. (mm. of water)  
Whether statically and dynamically balanced.  
B.H.P. Consumed  
Total weight of all items

### ***Cooling Coil***

Material of Tubes  
Material of fins  
Tube diameter  
Tube thickness  
Fin thickness  
Method of bonding of fins  
No. of fins/cm.  
Total tube surface outside  
Test pressure  
Coil face area

### **Filter**

Manufacturer

Type of filters  
Filter medium  
Material of frame work and its thickness  
Face area  
Face velocity across filters  
Pressure drop across filters (mm of water)

***Motor***

Manufacturer  
Model  
Number of motors  
Capacity HP  
Type  
Class of insulation  
Speed RPM  
Characteristics  
Type of starter  
Rating  
Whether the following protections are provided.

- |  |        |
|--|--------|
| i) Overload  | Yes/No |
| ii) Under voltage  | Yes/No |
| iii) Single phase protection<br>(for three phase motor starters) | Yes/No |

**3. Ducting**

Material  
Manufacturer

**4. Insulation (for ducting)**

Manufacturer  
Material  
'k' Value at 10 (°C) mean temperature  
Thickness.  
Density  
Fire Retardant property

Note : Any other data relevant to each equipment shall also be furnished.

### **LIST OF APPROVED MAKES**

#### **Approved make of items -HVAC**

|    |  |   |   |
|----|--|---|---|
| 1. | AC Condensing Outdoor Units/Ductable Units /Split AC | - | Blue star/ Voltas/ Carrier /Hitachi/ ETA/Daikin/Samsung/General       |
| 2. | AC Compressor  | - | Danfoss/Koplan/Emerson  |
| 3. | AC AHU's& IDU's                                      | - | Blue star/ Voltas/ Carrier/ Edgetech/ ETA/ Daikin/ General/ VTS/ Zeco |
| 4. | De-humidifier  | - | Bry Air/Dessicant Rotor   |
| 5. | Air- curtain   |   | Almonard, Russel  |
| 6. | Copper Pipes   | - | Totaline/Mandev/Piyush  |
| 7. | Three phase motors                                   | - | Siemens/Kirloskar/Crompton/Bharath Bijlee / ABB / Alsthom             |
| 8. | Aluminium Conductor Cables                           | - | Finolex/NICCO/Havells//Gloster  |
| 9. | Stabilizer   | - | V Guard/VOLTAS/Everest  |
| 10 | GI/Al Sheets   | - | SAIL/TATA/JINDAL/HINDALCO/NACL  |
| 11 | Resin bonded Glass wool                              | - | UPTWIGA /Owens Coning/KIMMCO  |
| 12 | Nitrile Rubber Insulation                            | - | Armaflex/K Flex   |
| 13 | Grilles/Diffusers                                    | - | Airmaster/ Carryaire/ Cosmic/ Air Flow/Ravistar                       |
| 14 | Pressure gauges                                      | - | Feibig/H-Guru/Jaspin  |
| 15 | Industrial type thermometers                         | - | Feibig/H-Guru/Jaspin  |
| 16 | Fire/Volume Control Dampers                          | - | Carryaire/ Airmaster/ Air Flow/ Ravistar                              |
| 17 | Exhaust/ Duct Fans                                   | - | System Air/Kruger/Nicotra/ Almonard                                   |
| 18 | Paints   | - | ICI/Asian/Berger  |

|    |                            |   |   |
|----|----------------------------|---|---|
| 19 | PVC pipe                   | - | Any ISI marked                            |
| 20 | Hepa Filter                | - | Aerofoil/Pyramid/AAF/Thermodyne           |
| 21 | Valves                     | - | Audco, Leader, Kirloskar, Advance,        |
| 22 | Factory Fabricated Ducts   | - | ZECO, Western Air Ducts, Rolstar, Camduct |
| 23 | Double Skin Aluminum Panel | - | Lloyd, Rinac                              |



**The bidder should specify 100% service tax in their quoted price irrespective of whether any portion of the Service tax is directly payable by the contractor or to be remitted by the client. This total price will be taken for comparison and deciding the lowest bidder. However, due to the constitution of the bidder being proprietary or otherwise, if any portion of the service tax is to be borne by the HLL statutorily, the same shall be borne by the HLL. This shall be clearly indicated as given in the abstract as shown below.**

**BILL OF QUANTITIES**  
**ABSTRACT**

| <b>SL.<br/>NO</b> | <b>ITEM</b>   | <b>AMOUNT (Rs.)</b> |
|-------------------|---|---------------------|
| <b>1</b>          | <b>Supply Installation Testing and Commissioning of Supply Installation Testing and Commissioning of HVAC at HLL Corporate office, Poojapura including all taxes &amp; duties except service tax.</b> |                     |
| <b>2</b>          | <b>Service tax component to be paid by the bidder.</b>  |                     |
| <b>3</b>          | <b>Service tax component to be directly paid by the HLL in case the bidder is a Proprietary firm</b>  |                     |
|                   | <b>Total Amount</b>   |                     |

| Sl No | Item Description  | Unit | Qty   | Rate in Words and Figures | Amount in Words and Figures |
|-------|---|------|-------|---------------------------|-----------------------------|
| 1     | Supply, intallation, testing and commissioning (SITC) of 17 TR, 6800 cfm capacity aircooled Ductable split / package air conditioner with scroll compressor, Ceiling Suspended Indoor Units (IDU) and all standard fittings, IDU SS drain pan, as per specifications complete with suitable capacity drive motor, air cooled condenser with all accessories, hermetically sealed multiple scroll compressors, electronic microprocessor pendant controller with digital display, first charge R 22 refrigerant gas, vibration isolator pads and saftey devices like thermal protector, pressure relief valve, over load relays single phase preventor, high-low pressure cut out, suitable for three phase 440V supply. | Nos  | 3.00  |                           |                             |
| 2     | Supply, installation, testing and commissioning of suitable hard drawn copper refrigerant piping for 17 TR machine with 13 mm nitrile rubber insulation interconnecting the condensing unit to evaporating unit for packaged units as per site condition (in case of multiple compressor machine, unit length will be 1m of multiple pipes as required) .   | Rmts | 30.00 |                           |                             |

|   |   |      |        |  |  |
|---|---|------|--------|--|--|
| 3 | Supply, intallation, testing and commissioning (SITC) of 11 TR, 4400 cfm capacity aircooled Ductable split / package air conditioner with scroll compressor, Ceiling Suspended Indoor Units (IDU) and all standard fittings, IDU SS drain pan, as per specifications complete with suitable capacity drive motor, air cooled condenser with all accessories, hermetically sealed multiple scroll compressors, electronic microprocessor pendant controller with digital display, first charge R 22 refrigerant gas, vibration isolator pads and saftey devices like thermal protector, pressure relief valve, over load relays single phase preventor, high-low pressure cut out, suitable for three phase 440V supply. | Nos  | 1.00   |  |  |
| 4 | Supply, installation, testing and commissioning of suitable hard drawn copper refrigerant piping for 11 TR machine with 13 mm nitrile rubber insulation interconnecting the condensing unit to evaporating unit for packaged units as per site condition (in case of multiple compressor machine, unit length will be 1m of multiple pipes as required) .   | Rmts | 5.00   |  |  |
| 5 | Supply, Laying and Fixing of control wiring of suitable size required from the Indoor to outdoor units for all units as per specification.  | Rmts | 200.00 |  |  |
| 6 | Supply, installation, testing and commissioning PVC drain pipe of 25mm dia ISI marked, connecting the drain lines from the indoor units to floor sump, with 9mm nitrile rubber insulation as per specification  | Rmts | 200.00 |  |  |

|   |   |      |       |  |  |
|---|---|------|-------|--|--|
| 7 | Supply, installation, testing and commissioning Ceiling Suspended Cassette type room Air-conditioner following capacity unit three phase 415V, compact cooling coil, electronic expansion valve, suction air grill, in built drain pump coated with silver ions to prevent slime, mould and bacterial growth, air filter with anti-mould and anti bacterial treatment & decorative panel. Out door unit with highly energy efficient Compressor with copper coils, first charge refrigerant gas and with MS stand. Unit to be capable of maintaining 22±1° C indoor condition with cordless remote with various features like 3 speed, auto manual selection etc also. Unit capable of 30 meter maximum interunit piping length and 15 maximum installation level difference. Decorative panel to be part of supply of units. |      |       |  |  |
| a | 2 TR 5 star rated as per BEE  | Nos  | 1.00  |  |  |
| b | 3 TR 5 star rated as per BEE  | Nos  | 9.00  |  |  |
| c | 4 TR 5 star rated as per BEE  | Nos  | 1.00  |  |  |
| 8 | Supply & installation Copper Refrigerant piping suitable for Cassette units, duly insulated with closed cell elastomeric nitrile rubber insulation, class-o, covered with two layers of shield coating, complete with elbows, T joints, sleeves etc., with GSS slotted rail supporting arrangement from ceiling/ wall and GI clamp for individual pipes.  | Rmts | 90.00 |  |  |

|               |  |     |       |  |  |
|---------------|--|-----|-------|--|--|
| 9             | Supply, installation, testing and commissioning of Air Cooled High Wall mounted Split Air Conditioner of following capacity consisting of high wall mounted type room unit (fan coil) with cordless remote control and one number outdoor condensing unit comprising of energy efficient suitable rotary compressor for operation on single phase, 230 V, 50Hz supply, fixing the outdoor unit on a raised platform as per manufacturers recommendation and fixing of room (fan coil) unit on wall, standard 4 m distance refrigerant copper piping with 13mm nitrile rubber insulation, providing and making interconnection between room & condenser as per site conditions, comprising of 1" dia drain PVC pipe with insulation 4m, canvas connections, full electrical cabling from power plug near indoor unit and to outdoor unit, ODU MS stand, first charge refrigerant gas, suitable stabilizer etc complete as required. |     |       |  |  |
| a             | 1 TR 5 star rated as per BEE   | Nos | 10.00 |  |  |
| b             | 1.5 TR 5 star rated as per BEE   | Nos | 16.00 |  |  |
|               |  |     |       |  |  |
| <b>PART B</b> | <b>AIR DISTRIBUTION</b>  |     |       |  |  |

|    |   |        |        |  |  |
|----|---|--------|--------|--|--|
| 10 | Supply, installation balancing and commisnioning of factory fabricated GSS sheet metal ducts rectangular/round ducting complete with neoprene rubber gaskets,elbows,splitter,dampers,vanes,hangers,supports etc as per approved drawings & specification of following sheet thickness |        |        |  |  |
| a  | 24 g ducting  | Sq mts | 245.00 |  |  |
| b  | 22 g ducting  | Sq mts | 190.00 |  |  |
| c  | 20 g ducting  | Sq mts | 70.00  |  |  |
| 11 | SITC of External thermal insulation on supply air ducts using min 13mm thick nitrile rubber class "O" closed cell type with antimicrobial protection as per specifications  | Sq mts | 455.00 |  |  |
| 12 | Supply, installation, testing and commissioning of Acoustic duct lining using 10mm nitrile rubber insulation open cell type inside the ducts, antimicrobial protection at the outlets of all indoor units upto 4m distance from fan outlet as per spec provided.                      | Sq mts | 50.00  |  |  |
| 13 | Supply, fabrication, installation, testing of flexible connections made out of fire resistant flexible double canvas sleeve.  | Set    | 4.00   |  |  |

|    |   |        |        |  |  |
|----|---|--------|--------|--|--|
| 14 | SITC of multi blade type volume control dampers made of extruded aluminium for ducts/ collars to be provided with suitable links, levers and quadrants for manual control of volume of air flow and for proper balancing of the air distributions system in main ducts, return ducts & other area as per specification. | Sq mts | 8.00   |  |  |
| 15 | Supplying, fixing testing commissioning of supply air diffusers of powder coated aluminium with aluminium volume control dampers with anti smudge ring & removable core.  | Sq mts | 15.00  |  |  |
| 16 | Supplying, fixing testing commissioning of Return air diffusers of powder coated aluminium with out aluminium volume control dampers with anti smudge ring & removable core.  | Sq mts | 15.00  |  |  |
| 17 | SITC of underdeck insulation with 20mm thick closed cell elastomeric Nitrile rubber density of 40Kg/m <sup>3</sup> on ceiling with necessary adhesive, fixtures 600x600 mm GI wire netting, supports etc.   | Sq mts | 120.00 |  |  |
|    | <b>Grant Total</b>  |        |        |  |  |