

## Appendix-II(B)

Sr. No.	Name of the item with specifications	Qty.
1.	<p>Computerized Air Conditioning Test Rig for year round application with ventilation and cold room, main and recirculating duct. <b>(Fully Computerized Setup)</b></p> <p><b>Cooling Capacity :</b> 1.0 - 1.5 TR  <b>Refrigerant :</b> R134a/R407C  <b>Test Chamber:</b> 200-240 liters (Approximately Same dimension in all sides and Should be detachable from the setup).  <b>Features Required:</b> Transparent duct for full visibility of the process and the components.</p> <ul style="list-style-type: none"> <li>• Fully instrumented, with temperature and RH sensors at all process stages with maximum accuracy.</li> <li>• Fully computerized control with data logging (including required computer with meeting the specification of the equipment).</li> </ul> <p><b>Technical Details:</b>  <b>Duct size:</b> 200mm x 200mm  <b>Air speed:</b> Variable to &gt; 1m/s  <b>Preheaters:</b> 400-500W  <b>Final heaters:</b> 200-250W  <b>Boiler power:</b> 2KW nominal  <b>Chiller power:</b> 500W nominal</p> <p><b>Air Contact Evaporator:</b>  Type : Direct Expansion Extended Plate Al-Fin Copper Coil</p> <ul style="list-style-type: none"> <li>• Flow pattern : Cross Flow of air &amp; refrigerant Duty : Cooling &amp; Dehumidification of air</li> <li>• Evaporating Temperature : 2 to 5 deg. Celsius</li> <li>• Cooling capacity : 1.0 - 1.5 TR</li> </ul> <p><b>Air Contact Chiller coil:</b>  Type: In-direct Expansion, in separate chilled water tank is connected with Extended Plate Al-Fin Copper Coil.</p> <ul style="list-style-type: none"> <li>• Flow pattern : Cross Flow of air &amp; refrigerant Duty : Cooling &amp; Dehumidification of air</li> <li>• Chilled water operating Temperature: 4.5°C (water inlet) and 14°C (water outlet) with accuracy of +/- 0.5°C.</li> <li>• Suitable design with pass and no. of circuits.</li> <li>• Cooling Capacity : 1.0 - 1.5 TR</li> </ul>	01 Unit

	<ul style="list-style-type: none"> <li>• Cooling coil must have temperature sensors at end of each tube in the middle circuit, to get the temperature profile</li> <li>• Also at the inlet and exit of the chiller to get the temperature of water inlet and exit.</li> <li>• All should be connected to data logger control system.</li> </ul> <p><b>Compressor Specifications:</b></p> <ul style="list-style-type: none"> <li>• Type : Hermetic, Reciprocating/ Rotary type</li> <li>• Refrigerant : Any one of these R134a or R407C</li> <li>• Make : Danfoss/Emerson</li> <li>• Superheat : <math>\Delta T_{sup} = 3 \text{ to } 7 \text{ K}</math></li> <li>• Cooling Capacity : 1.0 - 1.5TR</li> <li>• Digital meters: Volts, Amp and Hz</li> </ul> <p><b>Air Cooled Condenser:</b></p> <ul style="list-style-type: none"> <li>• Type : Air Cooled Extended Plate Al Fin Copper coil</li> <li>• Flow Pattern : Cross flow of fluids</li> <li>• Duty : Sensible Heating of Air</li> <li>• Condensing Temperature : <math>T_{co} = 50^{\circ}\text{C} - 70^{\circ}\text{C}</math></li> </ul> <p><b>Auxiliary Electrical Heaters:</b></p> <ul style="list-style-type: none"> <li>• Extended fin electric heating elements, 1kW Nominal @ 240 V, 50Hz, AC</li> </ul> <p><b>Air Flow Ducting:</b></p> <ul style="list-style-type: none"> <li>• MOC : Acrylic and Sheet Metal, AISI 304 SS</li> <li>• Size : 200mm x 200mm</li> <li>• Air Throughput : 0.3 to 0.4 <math>\text{m}^3/\text{s}</math></li> <li>• Dampers : As required</li> <li>• Air vents: 3 Nos.</li> </ul> <p><b>Fans/Blowers:</b> Type : Heavy Duty axial flow variable speed (VFD control)</p> <ul style="list-style-type: none"> <li>• Power input : 240 V, 50 Hz</li> <li>• RPM : 0-2400</li> </ul>	
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	<p><b>Ultrasonic Humidifier:</b> Humidifier details are as under:</p> <ul style="list-style-type: none"> <li>• Type : Horizontal</li> <li>• Construction: Tank made from 1.3mm S.S Sheet (304), welded construction, Top Operable with Rubber gasket, S.S Bolts &amp; Mist output Nozzle, drain, over flow socket. Outer enclosure with 22 Gauge G.I. Sheet duly epoxy painted</li> <li>• Controls: Water Level Switch for upper &amp; Lower Level, with solenoid valve &amp; filter assembly (5 Micron).</li> <li>• Control Panel: Made from 18gauges CRC sheet (Epoxy painted), Step down Transformer, Contactor / relay with MCB, ON / OFF Switch With light, Control Module &amp; cooling Fan for control circuit.</li> <li>• Power : 220 V-AC</li> </ul> <p><b>Air Washer:</b></p> <ul style="list-style-type: none"> <li>• A portable Air Washer with a provision to connect the main chiller tank.</li> <li>• A small tank with heater for external heating of water,</li> <li>• Fan, water pump, valves etc. with suitable measuring point (digitally) to measure temperature, Relative Humidity, air flow and water flow.</li> </ul> <p><b>Instrumentation &amp; Control:</b></p> <ul style="list-style-type: none"> <li>• Flow Measurement device Air Flow Sensor</li> <li>• (Accuracy error not more than +/- 2%, response, time not more than 1min)</li> <li>• For measuring flow of Water, Refrigerant and Air at all the flow inlet and exit.</li> </ul> <p><b>Temperature Sensors</b></p> <ul style="list-style-type: none"> <li>• All inlet and outlet in Refrigerant Circuit (including compressor, condenser, evaporator, exp device, etc.</li> <li>• all inlet and outlet in air Circuit and Water Circuit (including the detail given in water chiller section)</li> </ul> <p><b>Relative Humidity or DBT Sensors</b></p> <ul style="list-style-type: none"> <li>• At every stage of the conditioning of air (RH/WBT at air side at different outlet and inlet of air flowing from each components including fresh and recirculation air, and test chamber)</li> </ul>	
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**Pressure Sensors**

- At all inlet and outlet in Refrigerant Circuit.
- At all inlet and outlet in air Circuit.

**Power measurement:**

- Electrical Energy Meter: Watt-hour type for recording electrical input to compressor, fans & auxiliary heaters.
- Analogue Voltmeter: For Compressor, fans & auxiliary heaters.

**Cut off:**

- High temperature cut out (Thermostat) : Located after auxiliary heater to limit the maximum temperature to 80°C
- HP/LP cutout
- MCB'S for all electrical components
- Thermostatic Expansion Valve with provision for changing the superheat point.
- Residual current circuit breaker (RCCB) if  $i > 300\text{Ma}$
- Fan-Heater interlocking
- Power Transmitters 03 Nos
- Provisions for condensate drain and collection tray (SS)
- Data logger / Acquisition system for measuring/recording
- Panel Board: with controls, meters, indicators, displays, main switch and indicator lights.

**Computer Control:**

The system is to be provided by vendor with required PC and SCADA Software with following features :

- 2-way communication for control & data acquisition.
- Auto/Manual Control mode.
- P,PI,PD and PID modes
- Live mimic diagram of the process including SP, OP and PV.
- Online data display in tabular chart and graphical form.
- Bump less transfer between open & closed loop operations.
- Powerful graphics with trends and bar page
- Data printing facility
- Event recording facility
- Window based user - friendly software.

**Computer, Graphics and Software**

The system should meet or exceed the following specifications :

- Processor (CPU): intel core i7 processor
- Operating system: 8GB RAM
- Storage: Minimum 500 GB internal Hard Drive
- Sustainability: EPEAT Silver Rating (preferably EPEAT Gold)
- CD-ROM: DVD +/-RW
- Monitor /Display: 21.5" LCD monitor
- Other: Dual-band Wifi-certified 802.11 a/b/g/n- compliant adapter, optical mouse, keyboard, 2serial port & 2 parallel port USB part in front. Interfacing cards: ADC Card 1 no. DAC card. 1 No. communication RS. 232 ports.

**Temperature controller and Rh Controller****Input**

- Thermocouple: J. K. T. E. B. R. S. N.C
- RTD: DIN PT-100; JIS PT-100
- Linear: 4~20mA; 0~50mV; 1~5V; 0~10V...

**Accuracy**

- T/C $\pm 1^{\circ}\text{C}$ ; RTD $\pm 0.2^{\circ}\text{C}$ ; Linear $\pm 3\mu\text{V}$

**Control**

- Proportional band: 0.0~300.0% F.S
- Integral time: 0~3600 sec
- Derivative time : 0~900 sec
- Hysteresis: 0.0~200.0 or 0.0~2000
- Cycle Time: 0~100 sec

**Cycle Time (0~100)**

- Relay 15 sec.
- Pulsed voltage to drive SSR: 1sec.
- Continuous current (Voltage): 0 sec.

**Output**

- Relay contact output: 10A/ 240 VAC (Resistive load)
- Pulsed Voltage Output to Drive SSR: DC 0/24V (Resistive 250Omin.)
- Current Output: 4~20mA; (Resistive 600 Omax.)
- Continuous Voltage Output: 0~50mV; 1~5V; 0~10V.... (Resistive 600 Omin.)

**General**

- Rated Voltage: 90~250VAC 50/60HZ; DC 24V
- Ambient Temperature: 0~50°C
- Ambient Humidity: 0~90 %
- Consumption: Less than 5VA

**Note:** All the control of refrigeration side is Danfoss make and for electrical side Siemens/L&T make.

	<p><b>Water Motor:</b></p> <ul style="list-style-type: none"> <li>• CRI 0.5 HP SS PRESS. PUMP 3 PHASE,</li> <li>• IN LET , OUT LET 25 MM X 25 MM PUMP</li> <li>• CASING : S.S. 304,</li> <li>• IMPELLER : S.S. 304</li> <li>• MOTOR FRAME : ALUMINUM</li> <li>• SHAFT SEALING : MECHANICAL SEAL (CARBON &amp; CERAMIC)</li> </ul> <p><b>Note:</b> Tentative schematic diagram or Photographs of the quoted setup (complete setup) must be provided along with the technical specification.</p> <p><b>Other Requirement:</b>  Steady state time for whole system should not be more than 15min. Integrated software, computer and DATA Acquisition system with USB, compatible with window 7 also.  Software should be capable to produce psychometric diagram for all air conditioning process and the measurement data.</p> <ul style="list-style-type: none"> <li>• The system should be complete in all respect with commissioning and training.</li> <li>• Warranty of full setup with repairing and maintenance for three year from commissioning of room.</li> <li>• Detail of Individual component, complete circuit diagram for electrical, mechanical and all other connection should be provided.</li> <li>• Lab manual should be provide in soft and hardcopy along with the sample calculation and validations.</li> </ul>	
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