TENDER DOCUMENT

NIT No.: DLI/C&E/WI-665/321

FOR

Tender for ‘Design, Engineering, Supply, installation, testing and commissioning of PACKAGE AIR CONDITIONING (PAC) SYSTEM AND ASSOCIATED WORKS’ for the project of “Augmentation of Raw Material Handling Receipt and Handling facilities with new OHP Part- B (Package- 061) of Bhilai Steel Plant, (SAIL)”.

VOLUME – 2B

TECHNICAL SPECIFICATION

ENGINEERING PROJECTS (INDIA) LIMITED
(A GOVT. OF INDIA ENTERPRISE)
Core-3, Scope Complex, 7, Institutional Area,
Lodhi Road, New Delhi-110003
TEL NO: 011-24361666   FAX NO. 011- 24363426
4.0 AIR CONDITIONING SYSTEMS

4.1 Scope of work

The air conditioning systems shall be provided in LT Substation LTSS-1, LTSS-2, LTSS-3 and LTSS-4 as per Annexure-I.

Contractor shall furnish schedule & brief specification of air conditioning/ventilation system with the offer.

4.2 Design Criteria for Air Conditioning and Ventilation Systems

The ambient atmospheric conditions are as follows

<table>
<thead>
<tr>
<th>SEASON</th>
<th>TEMPERATURE (DBT)</th>
<th>°C</th>
<th>RELATIVE HUMIDITY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMMER</td>
<td>45</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>MONSOON</td>
<td>33</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>WINTER</td>
<td>10</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

The different air conditioned rooms will be maintained at 23±2 °C and 55±5 % RH.

AC plant room will be provided adjacent to the served premises. All fasteners will be hot dip galvanized unless stated otherwise.

Noise level of equipment will be limited to 85 dB (A) at 1 m distance from the equipment unless stated otherwise elsewhere. Noise level inside the air conditioned & ventilated premises will be limited to 65 dB (A).

Motor rating will be minimum 20% more than the BKW.

Fusible link type fire damper will be provided at supply air duct for all served electrical premises, cable basement & other susceptible fire hazard premises.

Cooling load calculations (as per CARRIER HANDBOOK GUIDELINES) and system capacity & configuration will be submitted by successful Contractor before submitting any detail engineering drawing.
### 4.3 System Description

#### AIR CONDITIONING FACILITIES

Type of air conditioning system to be provided as per the following guidelines

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of Air Conditioning System</th>
<th>Premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ii)</td>
<td>Split AC</td>
<td>Operator cabin in all machines, office premises &amp; conference room with cooling load less than 5 TR. Minimum 1 no. standby split AC will be provided at operator cabin.</td>
</tr>
<tr>
<td>(iii)</td>
<td>Water cooled package air conditioners (with scroll compressor) for cooling load up to 30 TR. Package A.C - With minimum 1 no. standby Condenser water pump – 1 W + 1 S Induced draft FRP cooling tower – 1 no.</td>
<td>Control room/ PLC room, despatcher room, intelligent MCC room, VVVF panel room</td>
</tr>
</tbody>
</table>

The water cooled package air conditioner or chiller will include refrigeration m/c with starter panel (starting control), microprocessor based control panel (safety & operating controls) and sensors.

The air conditioning system will include make up water tank for cooling tower (water storage capacity of min 8 hours operation), G.I ducting, air supply grills/ diffusers, thermal insulation of ducts (for ducts passing through the non air conditioned area & tail end of ducts in air conditioned area), acoustic insulation of ducts (up to 7 m length) at the outlet duct of package air conditioner or AHU, under deck insulation of all exposed roofs in air conditioned premises, MCC/ starter panels, necessary electrics, instrumentation etc.

Cooling tower & expansion tank will be installed at the highest point of water circuit. Make up water tank will be provided at higher elevation than the cooling tower basin.

Pressure gauge & temperature gauge will be provided at inlet & outlet water line of package AC/ AHU. Pressure gauge at pump inlet & outlet will be provided.

R-22 refrigerant will be used.

Chemical dosing system will be provided at air conditioning system recirculating water.
4.4 Equipment Specification

001 PUMP

Mono block pump will be provided for capacity 15 m3/hr & less. Pump will conform to IS: 9079-1989. Pump casing will be of C.I & impeller will be of bronze & will have stuffing box arrangement for gland packing. IP-55 protection motor will be provided.

Horizontal back pull out pump will be provided for capacity more than 15 m3/hr. Specification of horizontal back pull out pump will be as clause no. 04.08A.01.04

002 COOLING TOWER

Type : Induced draft counter flow
Casing/ Basin : FRP
Frame Work : MS hot dip galvanized
Fills : PVC
Nozzles : Brass
Bolts, nuts, miscellaneous hardware : MS electro galvanized
Fan hub & blades : Cast Aluminium
Fan type : Axial flow, direct drive
Fan speed : 720 rpm
Degree of protection of motor : IP 55 (temperature rise limited to class B)
Ladder : Galvanised steel ladder with safety cage & hand railing up to the top of tower. Inclined to 30° to the vertical
Eliminators : No. of deflector to be arranged to reduce drift loss < 0.2% of water circulation.

Cooling Tower Accessories:

(i) Level switch at cooling tower basin (to be interlocked with pump)
(ii) Make up connection with float valve (float made of copper) & back up ball valve
(iii) Quick fill connection with ball valve
(iv) Overflow connection
(v) Drain connection with ball valve
(vi) GI wire mesh 18 gauge strainer
(vii) Equalizing line of cooling towers with isolation valves

Note :- Approx. distance from Cooling tower to PAC unit shall be 20-25 mtrs. for the purpose of calculating pipe length.

003 PRE-FILTER

Filtering media will be of 5 ply HDPE mesh, stiched and pleated to provide maximum filtration area. Filter media will be supported on either side by galvanised wire mesh. Suitable aluminium spacer will be provided to
segregate the folds to ensure uniform distribution of air flow through the filter. Filter frame will be fabricated from 18 G GI sheet. Filter frame will be provided with suitable handles. Filter frame will be provided with neoprene sponge rubber. Filters will be capable of being cleaned by compressed air/water flushing. Face velocity of air through filter will be limited to 2.5 m/s. Efficiency of filter will not be less than 90% for dust sizes down to 10 micron.

004  **GI DUCTING**

The following codes & standard will be followed

- **IS : 226** Specification for structural steel (standard quality)
- **IS : 655** Specification for metal air duct.
- **IS : 277, 2003** Specification for galvanised steel sheets (Zn coating 120 gms/m2)

SMACNA Sheet Metal and Air Conditioning Contractors National Association

The air distribution system will be sized to have a constant frictional drop along its length. The maximum air velocity will be restricted to 7.5 m/sec for air conditioning and 10 m/s for ventilation ducts.

Ducts will be supported by 10 mm MS Rods and 40x40x3 MS angles. The duct supports will be at a distance of not more than 2500 mm. The MS rods will be hung by dash fasteners fixed to the ceiling slab.

Flexible connection of at least 150 mm width will be provided where the duct connects to the package AC, fan etc. Flexible connection will be closely woven, rubber impregnated double layer canvas or neoprene coated fiber glass.

005  **DIFFUSERS AND GRILLS**

Diffusers/grills will be of extruded aluminium powder coated (for air conditioning system). All supply air diffusers/grills will be complete with volume control dampers. Supply air grills/diffuser will be double deflection type. Air volume control damper will be operated by a key from the front of grills/diffusers.

Thickness of Grills, Diffuser, Damper will be as follows:

(a) Frame 16 gauge
(b) Louvers 18 gauge

Suitable vanes will be provided in duct collar to have uniform/proper air distribution. Bank of baffles wherever required will also be provided.

Air velocity through diffusers & grills will not exceed 2 m/sec (for A/C system) and 4 m/sec (for ventilation system).
INSULATION

The surface to be insulated both thermally and acoustically will be thoroughly cleaned. Pressure/Hydrostatic tests will be carried out before application of insulation.

Two coats of primer paint will be applied on the clean surface and then CPRX Compound (Shalimar Tar products or equivalent) will be uniformly applied @ 1.5 kg/sqm on the surface to be insulated. Thereafter insulation will be fixed. Vapour barrier will be applied over the insulation followed by 24 G Al cladding or sand cement plaster in 2 layers, totaling 12.5 mm.

Insulation Material Specification

Resin bonded glass wool: Density 48 Kg/m3, IS :8183
PUF: Density 35 + 3 Kg/m3, IS: 12436
PUF pipe support block: Density 120 Kg/m3, IS: 12436

Type of Insulation

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Surface Material</th>
<th>Insulation material</th>
<th>Insulation</th>
<th>Thickness (mm)</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Acoustic insulation</td>
<td>Resin bonded glass wool</td>
<td>Slab</td>
<td>12</td>
<td>Fiber glass tissue &amp; perforated Al sheet</td>
</tr>
<tr>
<td>(ii)</td>
<td>Under deck thermal insulation</td>
<td>PUF</td>
<td>Slab</td>
<td>50</td>
<td>22 GI sheet cladding</td>
</tr>
<tr>
<td>(iii)</td>
<td>Duct thermal insulation</td>
<td>PUF</td>
<td>Slab</td>
<td>25 (tail end ducting) 40 (exposed ducting)</td>
<td>Al cladding</td>
</tr>
</tbody>
</table>

MAKE UP WATER TANK & EXPANSION TANK

Tanks will be MS (5 mm thick) & inner surface spray galvanised. Make up water line with float valve & backup ball valve, quick fill line with ball valve, drain line with ball valve, overflow & vent line, level gauge (with isolation valves) will be provided. Low level switch will be provided at tank & interlocked with pump.
008  TEMPERATURE GAUGE

Type : Bi-Metal thermometer  
Rigid Stem  
Accuracy : ± 1% of FSD  
Stem of connection metals: AISI 316SS  
Immersion length : To suit pipe size  
Enclosure : Cast Al stove enameled black with weather proof as per IP65  
Dial Size : 100 mm  
Sensor : Bi-Metal strip  
Stem dia : 8 mm  
Connection : ½” BSP (m)  
Mounting : Vertical  
Entry : Bottom  
Range : 0-60 °C  
Thermo well : To be provided

009  Pressure Gauge

Manufacturing Standard : IS 3624  
Range : 0 – 6 Kg/ cm² or 0-10 Kg/ cm²  
Range (at pump suction) : (-)2 to (+) 2 Kg/ cm²  
Dial Diameter : 100 mm  
Accuracy : ± 1% of FSD  
Degree of protection : IP 65  
Sensing element : Bourdon tube  
Bourdon tube material : AISI SS316  
Connection : Screwed  
Connection size : ½ ” BSP (M)  
Mounting : Direct with bottom entry  
Case : Die cast Al stove enameled black finish  
Bezel (screwed) : Die cast Al stove enameled black finish  
Dial window : Shatter proof glass  
Pointer : Al anodised black  
Dial : Al white with black letters  
Movement assembly : AISI 304SS  
Shank : AISI 3166SS  
Adjustable pulsation damper : Yes

Pressure gauges will be provided with isolation valves (Ball valves)

010  Water Piping and Fittings

Water piping up to 150 mm NB size will be GI, ERW, heavy class and conforming to IS-1239 Part- 1. The pipes above 150 NB will be MS, spirally welded, 6 mm thick and conforming to IS:3589. Pipe ends will be beveled. Pipe fittings will be as per IS 1239, Part -2 for pipes of size up to 150 NB. Fabricated fittings manufactured from the pipes may be provided for pipes of sizes 200 NB & above.
Plate type pipe flanges (as per IS 6392) will be provided.

Pipes will be of welded joints. Welding (manual metal arc welding) will be as per relevant IS code and only certified welders will be employed. All piping systems will be hydro tested at 1.5 times the design pressure.

Auto air venting valves will be provided at highest point of the pipe lines & drain valves will be provided at lowest points of the pipelines in different segments. Pipe supports comprising pipe shoes, saddles, base plate, clamps & structural members like channels, angles etc. will be provided.

**Valves**

Butterfly Valves will be provided in water line of size 65 NB and above and ball valve will be provided for pipe size below 65 NB. However, ball valve will be provided in the pipe line (irrespective of sizes) when flow control is required.

**Butterfly valve**

Type : Wafer design, flange less  
Body : SG iron with nitrile rubber/ EPDM lining  
Disc : SG Iron with teflon (PTFE) coating  
Stem : High tensile stainless steel

The valves will be provided with integrally moulded & bonded body liner to provide perfect seating and complete isolation of body material from fluid. The body liner will provide the seating to valve disc, primary seal to the stem & gasket joint with mating pipe flanges. Valves will be provided with self locking lever operation from open to fully closed position with intermediate positions marked on the indicator plate mounted on the top flange. The valves will conform to BS : 5155 / IS : 13095. Extended valve shaft will be provided so that the lever can be operated without any obstruction on the insulated pipes. Gear operated valves will be provided for sizes more than 250 NB.

**Ball Valve**

Body : Cast steel  
Body liner : Nitrile rubber/ EPDM  
Ball : ASTM A351 Gr CF8  
3 piece design  
Socket welded type

Ball valves will be with 200 mm length welded joint pipes from manufacturer works.

**Check valve**

Type : Dual plate check valve with two springs hinged on a central hinge rod  
Body : SG iron  
Body liner : Nitrile rubber/ EPDM  
Disc : ASTM A351 Gr CF8 Wafer design
## TENTATIVE PACKAGE AIR CONDITIONING (PAC) AREA DETAILS

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Area Description</th>
<th>Size (LxWxH) in mtr. (APPROX.)</th>
<th>Quantity of PAC (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>LT Substation LTSS-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a IMCP, UPS and RIO area at <strong>First Floor</strong></td>
<td>12.30x4.12x3.66</td>
<td>1 Set</td>
</tr>
<tr>
<td></td>
<td>b Occupancy in above area</td>
<td>3 persons</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i UPS load</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii RIO load for 3 nos. (1 kW for each)</td>
<td>3 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii IMCP load for 3 nos. (1.43 kW for each)</td>
<td>4.3 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>LT Substation LTSS-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>A</strong> <strong>FIRST FLOOR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a IMCC, RIO and UPS area at First Floor</td>
<td>19.05x11.25x3.66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b Occupancy in above area</td>
<td>3 persons</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i UPS load</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii RIO load for 5 nos. (0.5 kW for each)</td>
<td>2.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii IMCC-2A load</td>
<td>8.8 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv IMCC-2B load</td>
<td>3.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>v IMCP load for 7 nos. (1.43 kW for each)</td>
<td>10 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>B</strong> <strong>UPS and Panel &amp; Server ROOM AT SECOND FLOOR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a Server and RIO area at Second floor</td>
<td>13.30x8.50x3.66</td>
<td>1 Set</td>
</tr>
<tr>
<td></td>
<td>b Occupancy in above area</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i Processor Panel load</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii UPS load</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii Server 1 no.</td>
<td>2 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv CCTV Panel</td>
<td>1 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>v RIO load for 3 nos. (0.5 kW for each)</td>
<td>1.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vi Computers -8 Nos. (0.2 kW for each)</td>
<td>1.6 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>C</strong> <strong>OPERATOR CABIN AT SECOND FLOOR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a Area</td>
<td>7.00x8.50x3.66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b Occupancy in above area</td>
<td>6 persons</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i UPS load</td>
<td>2.5 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii Computers -8 Nos. (0.2 kW for each)</td>
<td>1.6 kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
<tr>
<td>Sr. no.</td>
<td>Area Description</td>
<td>Size (LxWxH) in mtr. (APPROX.)</td>
<td>Quantity of PAC (No.)</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>---------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>3</td>
<td><strong>LT Substation LTSS-3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>FIRST FLOOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>IMCC, and RIO area at First Floor</td>
<td>15.67x6.25x3.66</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Occupancy in above area</td>
<td>3 persons</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>MCP load for 4 nos. (1.43kW for each)</td>
<td>5.72 kW</td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>RIO load for 4 nos. (0.5kW for each)</td>
<td>2 kW</td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>IMCC-3 load</td>
<td>3.4 kW</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>UPS, RIO and PLC AT SECOND FLOOR</td>
<td>10.50x6.10x3.66</td>
<td>1 Set</td>
</tr>
<tr>
<td>a</td>
<td>Server and RIO area at Second floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Occupancy in above area</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>RIO load for 4 nos. (0.5 kW for each)</td>
<td>5 kW</td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>UPS load</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>Processor Panel</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td>iv</td>
<td>Computers -8 Nos. (0.2kW for each)</td>
<td>1.6 kW</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>OPERATOR CABIN AT SECOND FLOOR</td>
<td>7.00x8.50x3.66</td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Occupancy in above area</td>
<td>6 persons</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>UPS load</td>
<td>1 kW</td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>CCTV Panel</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>Computers -8 Nos. (0.2kW for each)</td>
<td>1.6 kW</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>LT Substation LTSS-4</strong></td>
<td>9.75x2.95x3.66 +16.90x4.18x3.66</td>
<td>1 Set</td>
</tr>
<tr>
<td>a</td>
<td>IMCC,UPS and RIO area at First Floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Occupancy in above area</td>
<td>3 persons</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Equipment Heat load for A/c purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>UPS load</td>
<td>0.5 kW</td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>RIO load for 4 nos. (0.5kW for each)</td>
<td>2 kW</td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>IMCC-4 load</td>
<td>7.43 kW</td>
<td></td>
</tr>
<tr>
<td>iv</td>
<td>MCP load for 4 nos. (1.43kW for each)</td>
<td>5.72 kW</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Fresh Air Change per Hour to be considered</td>
<td>1.5 FACH</td>
<td></td>
</tr>
</tbody>
</table>
1.0 TECHNICAL DATA SHEETS (To be filled by the vendor)

1.1 PACKAGE AIR CONDITIONER (PAC)

1. Make & Model :
2. Quantity :
3. Capacity in TR :
4. Overall dimension of Package AC Unit :
5. Air flow capacity of blower m3/h :
6. Total Pressure, mm WC :
7. Fan Motor kW :
8. Fan RPM :
9. Compressor type, model :
10. Compressor motor kW :
11. Refrigerant type :
12. Condenser type :
13. Condenser material of construction :
14. Overall size of condenser :
15. Material of construction and its thickness of casing :
16. Insulating material of casing :
17. Total Power consumption. :
18. Noise level at 1m distance in dB(A) :
19. Vibration isolation pad :
20. Performance curve :
21. Fixing details :
22. Refrigerant drier and strainer :
1.2 COOLING TOWER FOR PAC

1. Make & Model :
2. Type :
3. Quantity :
4. Overall size of cooling tower :
5. Capacity of cooling in TR. :
6. Water flow m3/h :
7. Air flow :
8. Design water inlet temperature, outlet temperature :
9. Material of construction and its thickness :
10. Speed in rpm :
11. Drive details :
12. Shaft Power consumption :
13. Wheel diameter :
14. Efficiency :
15. Size of fan :
16. Static & Dynamic weight of fan & motor assembly :
17. Bare weight and operating weight of cooling tower :
18. Noise level at 1m distance in dB(A) :
19. Fixing details :
20. Vibration level :
21. Water spray nozzle type :

1.3 RE-CIRCULATING WATER PUMPS

1. Pump capacity & head, motor KW :
2. Re-circulating piping & fitting :
3. Strainer & valve :
4. Instruments – pressure gauge, temperature gauge, water flow switch, manometer :
1.4 DUCTING NETWORK FOR PAC SYSTEM

a) Ducting

1. $m^2$ of duct work :
2. Weight of duct work :
3. Weight of support and flanges :
4. Material and thickness of duct work :
5. Duct support type and material :
6. Velocity of air :

b) Supply Air Grills (Adjustable louver grills)/Diffuser with volume control facility

1. Size :
2. Quantity offered :
3. Material of construction & thickness:
4. Provision of horizontal & vertical direction control :
5. Weight :
6. Velocity of air :
7. Methods of volume control :

e) Return air grills/intake air louvers

1. Size :
2. Quantity offered :
3. Material of construction :
4. Weight :
5. Velocity of air :
1.5 WATER LINE VALVES

1. Make & Model : 
2. Type : 
3. Quantity : 
4. Size : 
5. Pressure rating : 
6. Material of construction : 
7. Operating system : 
8. Drive details : 
9. Gland packing : 
10. End connections : 
11. Service : 
12. Test pressure :