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No. ADG (E)(SZ)/ PUR/NIT/ Spec_Circulation 4/7/2024

To

All concerned

Sub: SITC of 2 X 33 TR Air Cooled Package Type Air Conditioning Plants for Studios of AIR, Hyderabad as replacement of 2x27 TR Water cooled AC Plants - Circulation of draft specification for feedback

Sir,

Please find attached the draft specification for SITC of 2 X 33 TR Air Cooled Package Type Air Conditioning Plants for Studios of AIR, Hyderabad as replacement of 2x27 TR Water cooled AC Plants. Feedback on the scope of the work, specification, eligibility conditions, availability of local content and percentage of local content are invited from industry.

The last date for submission of feedback by email to this office ID adgszprasarbharati.gov.in shall be 19/7/2024

Thanking you

P.Padmavathi
DE (Purchase)
For AD(E)(SZ)

Encl: As above

Specification for SITC of 2 X 33 TR Air Cooled Package Type Air Conditioning Plants for Studios of AIR, Hyderabad as replacement of 2x27 TR Water cooled AC Plants

SECTION- I

GENERAL:

1.1 SCOPE:

1.1.1 This specification for SITC of 2x33 TR Air-Cooled Packaged air-conditioning Plants for Studios of AIR, Hyderabad, at site, including installation, testing and commissioning of complete equipment (under buy back scheme) as a replacement of existing plants. The plants shall work on eco friendly Non-ODS refrigerant as per ASHRAE standards 34 Class A-1 refrigerant.

Plenum chambers are available above the false ceiling to connect the respective group of plants to the **existing ducting system.** The supply ducts are to be connected between new plants and plenum chambers available above the false ceiling with suitable modification (if required) as per local prevailing condition. Whole A/C Plant room will act as return area. Suitable opening is to be done in false ceiling for return air**.**

The plants shall deliver the specified tonnage, both in summer and monsoon seasons. The AC plants are expected to work for about 20 hours a day, 365 days in a year. However, out of two in each group, one shall be working and other shall be the relieving set/stand by.

Existing air conditioning plants 2x27 Tr comprising compressors, condensers, cooling coils fan, old refrigerant pipes, electrical panels etc. shall be taken away by the successful tenderer after the new air conditioning plants are installed. The tenderers may examine the condition of the existing air conditioning plants before quoting the rates. The offered amount for dismantled items may be quoted separately. This will be taken into account for the consideration of lowest tenderer.

2x33TR AC plant AHU shall be installed in First floor of Studio Block and corresponding Air condensing units shall be installed on the ground outside the building.

1.1.2 The following items of work will be carried out by the indenter and need not, therefore, be included in the tender.

a. Main power-supply connection terminated in a cable box near the main switchboard in the plant room.

1.1.3 The prevailing mean Summer/Monsoon dry/wet temperature at these places are as follows:

Sl. No.	Station	Temp- Summer March to May		Temp-Monsoon June to October	
		Dry º C	Wet º C	Dry º C	Wet º C
1	Hyderabad	25 º C	20 º C	24º C	19º C

1.2 GENERAL CONDITIONS OF CONTRACT

Payment terms, insurance cover, SITC schedule and time of completion, inspection, testing and commissioning of equipment and guarantee terms, penalty for delay etc. would be applicable as per AIR terms and conditions on the subject framed by the indentor, namely, Additional Director General(South Zone), AIR & DD, Chennai. The schedule of measurements would be applicable as given in section-IV.

1.3 DESCRIPTIVE TECHNICAL LITERATURE AND DRAWINGS

1.3.1 Site visit

Pre-bid meeting is mandatory. In addition, incase, the tenderer desire to have guidance regarding the existing electrical & refrigerant layout of equipment in plant room, they are advised to inspect the site before submitting their tender.

The installation is to be carried out in phases in order to avoid shut down of the existing A/C Plants, as AIR, Hyderabad is a working station.

1.3.2 Tender Documents

As a part of the technical bid, the tenderer shall submit the following in duplicate along with their tender.

a) Descriptive and technical leaflets giving complete mechanical and Electrical data about the equipment offered including detailed dimensions of the equipment.
b) A Statement of bill of quantities, technical particulars (see Annexure-1) and performance specifications of the equipment offered in the proforma as per Section-II and Section-III of the specifications.
c) Tentative details showing cable sizes and length, equipment capacities, switch-gear rating and number, rating and number of control components.
d) A tentative piping drawing showing layout for the entire refrigerant piping with all diameters, lengths, sizes and number of valves etc. shown clearly.
e) A schedule giving time period from start to finish of the complete work.

1.3.3. Installation Drawings

In the event of an order being placed, the tenderer shall supply to the indenter 3 copies each of the following for approval within 1 month from the date of placement of the order.

a) Dimensional drawings (including sections) giving complete details for erection of plants including foundation in case existing foundation cannot be reused and new foundation is necessary.
b) Electrical wiring diagram and control circuits of all electrical equipment showing cable sizes and electrical rating of the related equipment.
c) Electrical Panel layout/diagram showing various sizes.
~~d) The refrigerant connection from the plants to the outdoor units shall not be laid on the plant room floor, they shall be laid on channels fixed to the wall at suitable height.~~
e) Instruction manuals of various equipment of the A/c plants detailing all adjustment, operation & maintenance/servicing procedures.

Before taking up the installation work at site, the tenderer shall ensure that the indenter approves the installation drawings.

1.3.4. COMPLETION DRAWINGS AND OTHER INFORMATION

Three sets of complete drawings comprising the following shall be submitted by the tenderer while handing over the installation.

a) Electrical drawings for the entire electrical equipment showing cable sizes, equipment capacities, switchgear ratings, control components, control wiring.
b) Schematic control drawings giving detailed notes to explain the sequence of operation of the control circuit.
c) Piping drawing showing layout for the entire piping with all diameters, lengths, sizes and number of valves etc shown clearly. Isometric drawings showing each of the equipment/units shall also be supplied.
d) Detailed drawings and specifications in respect of parts likely to be damaged by wear and tear.
e) Lists of components like themostats, humidistats, other control components, relays, timers, contactors etc. giving their type, designation, function etc.
f) Schedule of items of which the tenderer is not the manufacture/the manufacturer's authorised dealer. This should contain the specifications of each item and the agency from which these items are procured.

1.4. INCLUSIONS

The following items of work shall be undertaken if required, by the indentor and therefore need not be included in the tender.

(a) All the existing supply and return ducts including the plenum chamber & the R.S. joints for the plenum chamber. If required, suitable modification work may be carried out.
~~(b) Main power supply panel is available.~~

1.5 ERECTION

1.5.1. This specification provides complete erection including all the associated civil works like equipment foundation etc. of the air conditioning equipment at site by the tenderer. The entire work shall be carried out as per codes, regulations, detailed in Annexure-II and as per following terms and conditions.

1.5.2. The tenderer shall make his own arrangement for storage of all equipment and materials brought to site from time to time and their safe custody at site till the plants are taken over by the indenter / his representative. The tenderer shall make his own arrangements for providing accommodation for his workmen at site, Tents may, however, be pitched in the site compound at places to be decided upon by the indenter or his representative at site.

1.5.3. The tenderer shall make his own arrangements for procuring necessary labour, skilled and unskilled. He should conform to all local government laws and regulations governing labour and their employment.

1.5.4. The tenderer shall indemnify and hold harmless the purchaser against all claims in respect of injury to any person howsoever arising out of the erection of the equipment in the course of such installation. The tenderer shall discharge all his obligations under the Indian workman's compensation act in as far as it effects workmen under his employ.

1.5.5. The tenderer and his employees shall comply with the regulations in force for controlled entry into the premises where the air-conditioning equipment is to be installed.

1.6. TENDERER'S LIABILITY FOR DAMAGES CAUSED DURING INSTALLATION WORK AND IMPERFECTIONS NOTICED WITHIN THE GUARANTEE PERIOD.

If the tenderer or his/her workmen or servants shall break, deface, injure or destroy any part of the building in which they may be working or any building, road, road kerb, fence, enclosure, water pipe, cable drains, electric or telephone posts or wires, trees, grass or grass lands in the premises on which the work or any part of it is being executed, or if any damage shall happen to the work while in progress from any cause whatsoever, or if any defect, shrinkage or other faults appear in the work within 12 months (after final certificate or otherwise of its completion given by the indentor)arising out of defective or improper materials or workmanship, the tenderer shall, upon receipt of a notice in writing on that behalf, make good at his/her own expense, or in default, the indentor may get the same rectified and deduct the expenses from any amount that may be then due or at any time thereafter may become due to the tenderer or from his security deposit.

1.7 INSPECTION AND TESTS

1.7.1. Inspection: The equipment will be inspected by the indentor or his authorised representative at manufacturer's works before dispatch in accordance with various standards/procedures specified in Annexure-III in Section-IV or modifications thereof that may be carried out by the indentor in consultation with the tender before issuing A/T. The tenderer should intimate the indentor in advance about readiness of the equipment for inspection at a date mutually agreed upon by the indenter and tenderer. The tenderer should furnish in advance photocopies of all the relevant test certificates as per IS as applicable before giving inspection call. The tenderer must satisfy themselves about the readiness of the plant as per AIR specifications before asking the indentor for carrying out inspection and tests. If during the inspection, any components/parts fail, the same shall be replaced by the tenderer at his cost.

1.7.2. Acceptance Tests: Soon after erection of the plants at site, inspection of the plants shall be carried out jointly by the Inspecting Officer and the representative of Indentor/consignee in the presence of tenderer's representative before carrying out acceptance tests. The acceptance test are to be carried out as per Annexure-IV of Section-IV of the specification. Separate capacity tests shall be carried out during summer months (preferably during April to mid July) and monsoon (mid July to end of August). Before offering the plant for capacity test, the tenderer will conduct trial run of the plant for 20 days subject to minimum

aggregate of 120 hours for each plant so as to be sure that the plants are running satisfactorily. In case of a major problem being noticed during initial test run, the period of 20 days/120 hours will start afresh.

1.8 GUARANTEE

The compressors shall be provided with on site guarantee for satisfactory working for a minimum period of five years. The remaining air-conditioning equipment shall be guaranteed for a minimum period of two years. Various defects arising/reported within the guarantee period as stated above will be rectified by repairs/replacement at site by the tenderer free of charge. This shall also include free supply of the refrigerant and compressor oil etc., if required, by the tenderer for optimum running of the plant during the guarantee period of the compressor. In this regard, the tenderers may also refer to other conditions specified in clause 1.6 above.

1.9 QUOTATIONS IN MKS/S.I.UNITS

Values for performance figure given in these specifications are in MKS/SI units. Full particulars of all figures of performance of the equipment offered shall be furnished in MKS/SI unit. The technical data should be furnished in MKS/SI units only. The technical data should be typed or in capitals.

1.10 TRAINING

The tenderer shall undertake to extend free on site training (for a period of not less than five days) in operation & maintenance of air –conditioning plants offered by them to four technical personnel from AIR, Hyderabad. Details of the training offered with period (not less than five days), may be indicated. The training shall be arranged at site.

1.11. PAST EXPERIENCE:

The tenderer should furnish detailed data on experience certificates regarding his past experience in supply, erection and commissioning of air-conditioning plants of similar or higher capacity and type.

1.12. AFTER SALES SERVICE

The tenderer shall ensure adequate and prompt after sales service in the form of maintenance/servicing personnel and spares as and when required with a view to minimizing the breakdown period. The tenderer has also to give a written undertaking from OEM that spare parts required for air-conditioning plants shall be available off-the-shelf for a period of at least 10 years from the date of commissioning of the plants at site. Sufficient advance intimation shall be given to the indentor before phasing out any spare component/part so that indentor is able to stock the same for future use.

1.13. MISCELLANEOUS

1.13.1 Completeness of tender

In order to avoid correspondence and clarifications at a later date, tenderers are requested to indicate clearly all the technical details and information asked for in Section II & III of this specification. Each columns should be filled up. No dash -- should be written.

1.13.2 Net price may be quoted by the tenderer after taking into consideration and deducting the self-evaluated cost of existing dismantled items of old AC plants at site.

SECTION -II

SPECIFICATION FOR SITC OF 2 X 33 TR AIR-COOLED PACKAGED TYPE AIR-CONDITIONING PLANTS
AT AIR, Hyderabad.

SNO	PARTICULARS	AIR'S REQUIREMENT	TENDERER'S OFFER
1.1	**Packaged Air-Conditioner**		
1.1.1	a. Capacity	33 TR	
1.1.2	b. Nominal cooling	99,792 kcal/Hr	

1.2	**Power Supply**		
1.2.1	Operating Power supply	3 Ph, 415 V, +/- 10%, 50+/- 3% Hz	
1.2.2	Starting Current	Not to exceed the limits stipulated by the local electric supply company. Provision of reduced inrush starting system to be confirmed by the tenderer	
1.2.3	Normal (full load) running current	To be indicated by the tenderer	
1.3	**Working Noise**	Silent and smooth-noise level not to exceed 60 dBA at a distance of 1 m from the machine	
2	**AHU – Indoor unit** Supply, Installation, Testing, commissioning of 33TR Capacity /13200 CFM horizontal floor mounted double skin Air handling unit with 50MM thick- 40 KG/Cum Puff insulated detachable Panels, 6 Row/12FP deep DX inner grooved copper Direct expansion cooling coil with distributors, backward curved centrifugal fans of Kruger/Nicotra make driven by 3 Ph/415V/50Hz Sq.Cage induction motors, with outlet canvass and supply air dampers. The AHU Unit should be designed for low energy consumption, little condensation due to high thermal insulation and airtight casings as per EN 1886.		
2.1	AHU Capacity	**1 AHU of 33 Ton capacity**	

2.2	AHU Casing	Double skinned panels shall be made of galvanized steel with 50 mm PUF(40 Kg/cum) insulation which shall be fixed to 2.5 mm thick aluminium alloy thermal break profile frame work with stainless steel screws. Outer sheet of panels shall be made of galvanized 0.6 mm thick pre-painted / pre-plasticised sheet and inner of 0.6 mm GSS. Aluminium profiles shall have internal round corners to avoid accumulation of dust. The housing shall be so made that it can be delivered at site in total / semi knocked down condition, depending upon the requirements.. All the framework shall be assembled using mechanical joints to make a sturdy and strong framework for various sections. The casing shall consists of an independent structural steel frame, properly reinforced and braced for maximum rigidity, having individually removable, double skin construction insulated panels. The casing shall be of sectionalised construction, consisting basically of individual fan section, coil section, access sections, filter section, mixing box section and drain pan. Minimum 450 mm access door shall be provided for easy access to filters, coils, fans etc. Each access door shall be provided with easy release nylon handles and GM Chrome plated locks. Hinges shall be of heavy-duty die cast solid aluminium with SS pivots. A safety "trip-switch" shall be provided to automatically cut off the electrical supply to the fan when the access door is opened Sections shall be joined with continuous gasketing to form an air tight enclosure. Sections shall be so designed that the method of joining can be performed with relative ease and without damage to the insulation and vapour barrier. The frame work shall be constructed of AISC structural rolled shapes having minimum thickness of 3mm or die formed sheet steel. Framework shall be designed with recess suitable to receive enclosure panels, providing neat appearance, air tight enclosure and ease of panel removal. Should the sides or top of a casing shall exceed 1.85sqm(20sft) in area, the panels shall be fabricated of more than one piece, with the individual panels recessed into intermediate structural members. Protection for the insulation edges shall be provided around the perimeter of each panel. Protection shall be in the form of a " U " shaped panel edge or in the form 15mm (1/2") channels welded to the inside surface of each panel. Enclosure panels shall be fastened to the frame work by means of thread cutting sheet metal screws and shall be sealed against air leakage by the use of continuous neoprene gasketting of	

2.3	**AHU Blower & Fan section**		
2.3.1	Type & make of fan	Centrifugal of Kruger/Nicotra make	
2.3.2	Direction of discharge	Vertical	
2.3.3	Nominal fan discharge	13200 CFM	
2.3.4	Fan Features	The fans shall be centrifugal, double inlet double width type with heavy-duty backward curved blades and scroll type housing. The outlet velocity shall not exceed 10 mps. The fan bearings shall be mounted on the fan scroll and not on the AHUs casings. The fan shall have pre-greased ball bearings sealed for life. Fan casing and wheels shall be made of galvanized steel sheet.	
2.3.4	Static pressure at nominal discharge	50 mm WG	
2.3.5	Fan Speed	The fan speed shall be selected for a speed not exceeding 1800 RPM..	
2.3.6	Fan Motor	The fan motor shall be rated for continuous	

		duty and shall conform to the relevant IS:325 - 'Three phase induction motors' specification. Fan Motor should have BEE Star Rating of 5. Fan Motor shall be of squirrel cage, totally enclosed, cooled with Class F insulation and EFF1 rating. Motors shall be specially designed for quiet operation. All rotating parts shall be dynamically balanced individually, and the complete assembly shall be statically and dynamically balanced The fan and the motor shall be mounted on an integral base frame which shall be in turn erected on cushifoot / spring mounts and should be totally isolated from the casings. The frame for mounting the fan and motor shall be isolated from the double skin casing with heavy duty rubberised mounts The fan outlet shall be connected to casing with the fire retardant double canvass. The fan shall be complete with multi 'V' belt drive and adjustable motor mounting base. The opening for the access of the fan section shall be provided with micro-switch and galvanized iron mesh. Drive to fan shall be provided through belt-drive with a standard belt guard housing the bolt and adjustable motor sheave. Belts shall be of the oil-resistant type. Electrical Interlock should trip the fan on opening of AHU Door.	
2.3.7	Power Supply	3 phase, 4 wire, 415V±10%/50Hz ±	
2.3.8	VARIABLE FREQUENCY DRIVE - VFD FOR AHU MOTOR :Supply, Installation, Testing & Commissioning of 3-Phase VFD Drives	Supply, Installation, Testing & Commissioning of 3- Phase VFD Drives. Drives shall have AC Choke. Input Volatge: 3 phase 380V-480V with permitted fluctuation range: -15%～10%. VFD shall have LED Digital keyboard, communication Port for the Integration with BMS: Open protocol RS-485.VFD shall have 5DI, 2AI, 2 AO, 1DO. IP Rating: IP20. VFD shall have Built in C3 Filter. VFD shall be housed in IP 54 Enclosure with Complete wiring and Termination. Enclosure shall have Auto/ Manual Selector Switch, Speed Raise/ Low Provision, with Push Buttons for Start/ Stop and Indication for the same.	
2.4	**AHU AIR FILTER**		

2.4.1	Type	Filters should be Cleanable, non-flammable, HDPE synthetic make of 50 mm thick mounted in frame with section. Pre filter section suitable for flanged G4 filters shall be provided. The efficiency of filters should be as under. - Clean filter : 4 mm pressure drop - Dirty filter : 12 mm pressure drop - Efficiency : 90% down to 10 microns Filtering should confirm to ASHRAE & EUROVENT Standards Separate Pre-Filter, fine and HEPA filter section are to be provided.	
2.4.2	Path	Air filter shall be provided in the return air path.	
2.5	**AHU Cooling coil**		

2.5.1	Cooling coil construction	Cooling coils shall be constructed from 13 mm OD – 27 SWG round seamless copper tubes combined with mechanically bonded 37 SWG Aluminium mild rippled fins and die formed directional guide channels and assembled within a heavy gauge galvanized steel frame work. The fins shall be 12 FPI and mechanically bonded to the copper pipes. Coils shall be provided with air vent and drain plugs. Coil assembly shall be supported on slide frames for easy withdrawal. The bends shall be ready made with solder rings on both ends. The coil shall have continuous aluminium dual sine wave fins.. The tubes shall be staggered in the direction of air flow. Coils shall be mounted on tracks of structural steel and shall be removable from either end of the unit without dismantling or unbolting any sections of the air handling units, other than the coil access panel. Coil headers shall be completely enclosed within the insulated coil casing section. The inlet and outlet connections shall be extended a minimum of 150mm(6”) beyond the exterior of the coil casing through pre-cut openings. Sealing collars shall be provided at the openings for the coil connections. Drain connections shall be furnished for each coil and shall be located on the pipe connections, external to the unit cabinet, for ease of access. Cooling coil shall be complete with drain pan constructed from stainless steel sheet and shall be installed inside the double skin panel to avoid condensation. The drain pan shall be fitted with drainage coupling on both sides. Drain tray shall have the three directional slope. The drain pan should be die-pressed without any brazing joint and insulated with a layer of fire retardant thermal insulation. The coils shall be tested against leaks at a hydraulic pressure of 10 kg/ cm2. This pressure shall be maintained for a period of 2 hours. No drop should be observed indicating any leaks. ~~Each coil shall have galvanised sheet casing of 1.6 mm (1/16”) minimum thickness. Intermediate centre supports shall be provided for all coils exceeding 1.37 M(4’-6’) in length.~~	

2.6	**AHU Expansion Valve**			
	a)	Type	Direct Expansion	
	b)	Capacity	To match the refrigeration capacity.	
3	**Outdoor AIR Condensing Unit** The DX Air-Cooled Condensing Unit shall be self contained factory tested and assembled unit . The units shall be made of Galvanised steel sheets and powder coated. All fasteners used in the outdoor units shall be of good quality. The unit shall be complete with Scroll compressor, condenser coil, fans, charging points and controls. The external panels shall be removable and constructed of 1.2 mm zinc coated sheet steel. The cabinet shall be powder coated .			
3.1	AIR Condensing Unit Capacity and Type		3x11TR (To be indicated by Tenderer) Under "ASHRAE" Conditions of 4.4˚C suction temperatures and 40.5˚C condensing temperature – At least 99,792 Kcal/hr. Not more than three units to form the total capacity of plant	
3.2	AIR Condensing Unit **Construction**		Air-cooled condenser shall be with single or multiple coils of minimum 3 rows deep. The tube thickness 0.3mm and dia of not less than 0.7mm. The tube shall also be internally grooved. Fins shall be made of Aluminium of thickness 0.16mm having 13 fins per inch and the method of bonding of tubes & fins shall be mechanical expansion. The air cooled condenser fan shall be direct driven and motor mounted on fan guard and the motor shall be equipped with double ball bearing. The motor shall have class'F' insulation. Fan shall be propeller type made of mild steel. The Air-cooled condenser shall be the low profile, weatherproof type incorporating high efficiency, direct drive, external rotor motors with axial blade fans.. The condenser shall be constructed from heavy duty aluminum and corrosion resistant through special anti corrosive epoxy coatings for any	

		specific polluted areas. Heavy duty mounting legs and all assembly hardware shall be included. Condensers shall be suitable for 24 hours operation and be capable of providing vertical or horizontal discharge. The condenser shall be fully factory wired and require a 230 volt, single phase, 50 Hz electrical service. The high performance heat exchanger shall include mechanically expanded cross-hatched copper tubes and louvered aluminum fins for maximum heat transfer.	
3.3	AIR Condensing Unit Heat Rejection Capacity	Shall be adequate to match the compressor	
3.4	AIR Condensing Unit Type of Cooling	Air-cooled	
3.5	Design material of Condenser Coils	Copper Tubes with Aluminium fins	
3.6	AIR Condensing Unit Outdoor Unit Cabinet	The cabinet of the outdoor unit shall be weatherproof and necessary arrangement for placing the cabinet shall be made with MS Angle Iron frame work.	
3.7	AIR Condensing Unit Outdoor Unit Mounting	The outdoor unit shall be mounted on a vibration proof mounting at a suitable place. (Location to be decided by zonal offices in consultation with the station with minimum refrigerant pipe length).	
3.8	AIR Condensing Unit Routing of copper pipe	The refrigerant Pipes from Plant room to Outdoor unit shall be secured by routing them through Proper Cable Trays	
3.9	**AIR Condensing Unit Compressor**		
3.9.1	Type	Scroll type Multi-compressor	
	Capacity	At least 99,792 Kcal/hr.	
3.9.2	Refrigerant	Non-ODS refrigerant as per ASHRAE standards 34 Class A-1only	
3.9.3	Make of compressor	By standard and reputed manufacturer as per Annexure - V	
3.9.4	Compressor Type and construction	The compressor shall be of the high efficiency compliant scroll design, with E.E.R (Energy Efficiency Ratio) of not less than 11.1 BTUH/Watt (C.O.P not less than 3.25) at ARI rating conditions. The compressor shall be charged with mineral oil and designed for operation	

		on Non-ODS refrigerant as per ASHRAE standards 34 Class A-1 only. Each compressor shall have internal motor protection and be mounted on vibration isolators. Compressor shall be hermetically sealed scroll compressor suitable for 3-phase operation with operating voltage between 380 – 420V and operating frequency of 50HZ. Compressor shall be mounted on to the base of the packaged unit on top of resilient rubber grommet mounting with steel sleeve bolts and nuts	
3.9.5	Mounting	The compressor should be suitably mounted on vibration absorbers.	
3.9.6	Protection Circuits	The compressor units shall be rated for continuous working under tropical conditions and shall be provided with suitable starter incorporating overload, under voltage protection and also with single phasing preventers. The compressor shall be provided with thermal protector, preferably winding embedded to ensure automatic switching off the motor when the winding temperature tends to go beyond safety limits.	
3.9.7	Interlocking of Compressor with Blower & Condenser units	Provision for interlocking the compressor with blower motor and condenser cooling fan motor shall be available.	
3.10	**Microprocessor based controller with LCD display for compressor and condensing unit**		
3.10.1	Features	The unit controller shall be microprocessor based and include a large LCD backlit graphic display for clear visibility of text and graphics. The display and control buttons shall be accessible from the unit front without removing any external panels. Control strategies shall be for accurate temperature control. A selection of return or supply air control shall be provided to suit the application. The controller shall have a user-friendly menu driven interface with supporting help screens. Access to the controller settings to prevent against unauthorized access. In normal operating mode, screen shall display unit number and temperature set points and actuals, time, date and operating status. Dynamic icons	

		identify the system operating mode. **Control system** The control system shall allow programming of the following conditions: • Temperature set point • High Temperature Alarm • The control system shall include the following settable features: • Unit identification number. • Startup Delay, Cold start Delay and Fan Run on timers • Sensor Calibration. • Compressor Sequencing according to life served. **Alarms** The microprocessor shall activate an audible, visual and general alarm in the event of any of the following conditions: • High Temperature • High Pressure • Low Pressure The unit shall also incorporate the following protections: • Single phasing preventors. • Reverse phasing • Phase imbalancing • Phase failure Overload tripping (MPCB) of all components.	
3.11	First charge of Refrigerant and oil	The first charge of refrigerant and oil shall be included in the supply.	
3.12	AIR Condensing Unit **Refrigerant Circuit:**	The refrigeration system shall be of the direct expansion type and incorporate one or more hermetic scroll compressors, complete with crankcase heaters. A hot gas bypass solenoid valve shall be used on single compressor models. The system shall be include a manual reset high pressure control, auto reset low pressure switch, externally equalized thermal expansion valve, high sensitivity refrigerant sight glass, large capacity filter drier and charging/access ports in each circuit. Each refrigeration circuit shall include rigidly mounted isolation valves in the discharge and liquid lines to aid servicing and installation (air cooled units only).	

3.13	**Thermostat for shutting off the plant.**	1. A separate thermostat to be provided in the return air circuit. 2. The thermostatic Switch shall be operational between the temperature ranges of 20°C to 30°C for cutting out and bringing in the compressor. 3. Each plant shall have separate set of thermostats. 4. Thermostat shall be of adjustable type. 5. Accuracy shall be within +/- 1°C	
3.14	**Refrigerant, electrical & Control Circuits**	The air conditioning unit shall be complete with all refrigerating piping, electrical wiring and control switches necessary for the control and operation of the equipment within the unit.	
4	**Plenum Chamber**		
	Location	Plenum chamber (located above the false ceiling of AHU Room) shall be connected to the ac units with provision of connection from supply air outlet of each plant to plenum chamber and from plenum chamber to existing supply ducts..	
4.1	Coupling to AC Plant	Double folded canvas coupling shall be provided between the supply outlet of plants and duct connecting the plenum chambers, in each plant.	
4.2	Control Dampers	Control damper shall also be provided in supply duct, located below false ceiling level for convenience of operation, and with open and close position of the damper clearly marked.	
4.3	Ducting	i)Plant outlet is to be connected to the existing Plenum chamber with GI Duct. ii)Interconnecting GI duct has to be constructed with 26 G perforated aluminium sheet or with Acoustic insulation with 25mm thick fibre glass rigid board with RP tissue.	

5	**Location of AHU, AIR Condensing units and Electric switch Gear panels**	AHU has to be installed in First Floor by replacing the Existing AHU. AIR Condensing Units has to be installed on the Ground. Electric switchgears of the New AHU shall be installed at the old electric switchgear of replaced AC plant so that routing of cable in the existing trenches can be done.	
6	**Installation of Piping**		
6.1	Installation of Piping	1. All necessary piping shall to be provided to make the AC equipment complete and ready for regular and safe operation. The equipment connection shall be as per recommendation of manufacturer. 2. All condensate drainage to be pitched in the direction of flow to ensure proper drainage. 3. Necessary precautions shall be taken to close ends of pipes to prevent debris entering the piping system. 4. The pipes shall be cut accurately to measurements established at site so as to place them in position without forcing.	
6.2	Piping Support:	1. Proper supports shall be provided for all piping or tubing, to prevent vibration or excessive deflection of piping or tubing. 2. Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stresses on the pipes. 3. Independent supports shall be provided for piping so that equipment is not stressed by piping weight.	
6.3	Piping Sleeve:	1. Where pipes pass through walls, steel pipe sleeve of size 50 mm larger than outside diameter of pipe shall be provided. 2. Where pipes are insulated, sleeve shall be large enough to have ample clearance for insulation also.	
7	**Indicators for filter clogging & condenser clogging**		

7.1	Filter clogging indicators	Necessary sensors (Differential pressure or other electronic) with indicators for indicating clogged air filter shall be installed either by OEM of Packaged Unit or by project Implementing Agency	
7.1	Condenser Clogging indicators	Necessary sensors (Differential pressure or other electronic) with indicators for indicating clogged air filter shall be installed either by OEM of Packaged Unit or by project Implementing Agency	
8	**Civil Works**		
8.1	Foundation blocks & Vibration isolation	The tenderer shall provide the foundation blocks, suitable mounting arrangements with vibration isolation for the AHU& Outdoor units for effective control of transmission of vibrations & structure borne noise. Various Instruction as per Annexure-II 'Noise & Vibration Control' should be followed.	
8.2	Repair of existing False Ceiling	Existing False ceiling has to be replaced with standard make Fire retardant calcium silicate sheets of 8 mm thickness of Ramco/ Amstrong/ equivalent make. These sheets should be approved by department before procuring the same. Specifications are enclosed at Annexure – V . Approximate area is 18ft x 16 ft. Payment will be made as per actuals.	
8.3	Fresh Air opening and Stale Air Opening	A stale air opening of size 1200x600 shall be provided above false ceiling just above the window Sun shade shall be provided at stale air opening.Lever arrangement shall be made for opening & closing of stale air opening. Provision for fresh air intake shall be made by reducing the size of existing window or on the wall.	
8.4	Heat Insulation Treatment in AC Plant Room	Necessary Heat insulation treatment from false ceiling up to real ceiling shall be carried out as indicated in the sketch drg no.SC-14849. Necessary under-deck heat insulation treatment shall be carried out on the roof of AC Plant Room over false ceiling.	

8.5	Platform for outdoor condenser unit	**Supply, Fabrication , Cutting, Welding , Erection at site and painting of M. S. Angle structural steel work** for mounting of the condenser units**.. The work should be carried out as per good manufacturing and installation practices in concurrence with approved drawing. The structural steel materials should confirm to IS: 2062 (latest version) as per drawings. All welding electrodes to confirm to relevant IS codes. Fabrication and erection of the structural steel works shall be as per IS : 800 and welding work as per IS:816 and IS : 822. Finally all steel work to be painted with one coat of zinc chromate primer and two coats of synthetic enamel paint.**	
8.6	Outdoor Piping	Refrigerant Pipes from AHU located on First Floor to Outdoor unit on Ground shall be secured by routing them through Proper Cable Trays	
8.7	Heavy Duty Flooring	The existing flooring has to be replaced with heavy duty flooring ceramic tiles of 0.75inch thickness and area 12x12 inches/24x24 inches of RAK/ Kajaria/ Johnson/ equivalent. Existing flooring has to be removed and new tiles has to be laid as per CPWD standard/rules . Flooring tiles has to be pre-approved by Department before procurement. Approximate area is 720 Sq.ft. Payment will be made as per actuals.	
8.8	Miscellaneous	i) Any other work not specifically mentioned above but necessary for satisfactory completion of entire job shall be the responsibility of the tenderer. ii) The holes if any made by the tenderer in the walls for passage of pipes, conduits, trenches, cables etc. shall be repaired & original finish shall be given by the tenderer.	

9	**Electric Control Panel** Supply, Installation, Testing & Commissioning of Electrical panel (wall mounted) with 1 no of MCCB as incomer, power contactors,1 no selector switch with auto, manual & OFF etc. Control Wiring, Provision for fire interlock, ON,OFF Push button, ON, OFF & Trip indication lamp, Power and control wiring, terminals, backup MCB, Metering -1 no. Multidata meter (V,A & Hz),CT's & RYB phase indication lamp control MCB, 1 no 230/24V Transformer 12 VA etc. Control/distribution panel should supply power for operation of AHU, Out door Condensing Units, Monitoring of status of AHU, at local as well as remote monitoring at Control Room with all necessary interconnecting cables. Should include end termination of cables including providing single compression type cable gland, sockets, crimping lugs, insulation tape including gland earthing with adequate copper clamps and adequate bare copper wire connecting to the main bus bars.		
9.1	Construction	One cubicle type switchboard with appropriate ratings of an incoming MCCB, bus bar and individual MCCB units for each plant has to be provided in the AC plant room.	
9.2	Wiring of Control circuit of AC Plant	Normally plants shall run on main supply. In case of failure of main supply, only blowers will run on D/G supply. Necessary arrangement shall be made for the same by the Firm.	
9.3	Bus-bar	The bus bar shall be three phase and neutral copper bus bar adequately rated for the load.	
9.4	Electrical Earthing	Two nos. of Earthing shall be provided as per Annexure-VI. The value of earth resistance of each earthing shall be less than 1 Ohm. The earth shall be connected to electrical switch gear of AC plants with 25mm x3mm copper strip.	
9.5	Indicator/Instruments	The switchboard shall be provided with at least the following minimum indicators/instruments etc. i) Voltmeter with selector switch for measuring the voltage of all the 3 phases. ii) Separate ammeter of suitable range for each plant. iii) The switchboard shall be provided with neon lamp/LED type phase indicator in each phase. Indicators shall be provided on the switchboard to indicate the functioning of individual plants.	

9.6	Remote status indication Panel	1. A Panel with status indications of the working of packaged unit shall be wired & installed in control room. 2. The panel shall have indication lamps i.e. Green Lamp/LED for OFF & Red for ON conditions of the equipment. 3. The tenderer shall carry out SITC of Remote Indication panel Including cabling from A/C plant room to Control Room.	
9.7	Electrical Wiring	The wiring in AC plant room for AC equipment shall be carried out in concealed conduits as per site condition. Necessary conduits shall be provided and buried in walls/floor by the tenderer. Alternatively cables may be neatly taken on cable trays above 2300 mm heights.	
9.8	Cables	Copper conductor PVC cables of 1100 V rating shall be used for wiring of various plants. 4 Core x 6 Sq.MM to be used for AHU Motor.	
9.9	Conformity to IS Standards	The switch board, electrical equipment and wiring shall conform to the relevant IS specification.	
9.10	Lighting arrangement above false ceiling	Wiring for incandescent lamps- 4 Nos. above false ceiling with On/ Off switch below false ceiling shall also be carried out for inspection purpose.	
10	**Dismantling of old plants:** Existing air conditioning plants comprising compressors, condensers, cooling coils, fans, old refrigerant pipes, electrical panels etc. of air conditioning plants only, shall be taken away by the successful tenderer after the new air conditioning plants are installed. The tenderers may examine the condition of the existing air conditioning plants before quoting the rates. The offered amount of dismantled items may be quoted separately. This will be taken into account for the consideration of lowest tenderer.		
	Make:	Voltas – 2 X 35 ton	
	Year of Installation	1995	

SECTION-III

SCHEDULE OF REQUIREMENTS FOR SITC OF 33 TR AIR-COOLED PACKAGED AIRCONDITIONING PLANTS

Sl.No	Description	Qty &Unit	Ref. to paras for technical specifications	Tenderers' Compliance
1.	Supply, Installation, Testing , Commissioning of 33 TR (3 x11TR in each plant) Capacity Air cooled scroll condensing unit with three nos separate hermetic scroll compressors with eco friendlyNon-ODS refrigerant as per ASHRAE standards 34 Class A-1only	2Sets	3 of Section-II	
2.	Supply, Installation, Testing commissioning of 33TR Capacity / 13200 CFM horizontal floor mounted double skin Air handling unit with 50mm thick Puff Panels , 6 Row deep copper Direct expansion cooling coil with distributors, backward curved centrifugal fans of Kruger/Nicotra make driven by 3 Ph .Sq.Cage induction motors , with outlet canvass and supply air dampers.	2Sets	2& 4 of Section-II	
3	Supply, Installation, Testing & Commissioning of 3-Phase VFD Drives. Drives shall have AC Choke. Input Volatge: 3 phase 380V-480V with permitted fluctuation range: -15%～10%. VFD shall have LED Digital keyboard, communication Port for the Integration with BMS: Open protocol RS-485.VFD shall have 5DI, 2AI, 2 AO, 1DO. IP Rating: IP20. VFD shall have Built in C3 Filter. VFD shall be housed in IP 54 Enclosure with Complete wiring and Termination. Enclosure shall have Auto/ Manual Selector Switch, Speed Raise/ Low Provision, with Push Buttons for Start/ Stop and Indication for the same.			
4	Supply & laying of 18G copper pipe		3.8, 8.6, 6 of Section-II	
a	1-3/8" Copper Pipe for Suction Line with Nitrile Rubber Insulation of 19mm thick (As per actuals)	~120 RMT approxi.		
b	7/8" Copper Pipe with 13mm thick insulation for Liquid Line (As per actuals)	~120 RMT approxi.		
5	Supply, installation and testing of GSS construction of 16G opposed blade volume control dampers / back drop damper within ducts to be provided with suitable links, levers and quadrants for manual control of the volume of air flow. The end flanges should be of TDF GI ducting with Acoustic insulation with 25mm thick fibre glass rigid board with RP tissue & 26G perforated aluminium sheet with control dampers and canvas	2 jobs	4 of Section-II	
6	Supply &Installation of G.I perforated cable tray with top cover with supports Size: 300x75mm Make: JSW / Intech / PROFAB	50 RMT		
7	Modification in existing plenum Chamber. The plenum chamber shall be connected to the plants to		9 of Section-II	

	accommodate the two units. Minor repair work, if required shall be done by the firm			
8	Supply and installation of 32 mm diaCPVC / UPVC drain piping insulated with 9mm nitrile rubber for AHU : Note: Payment will be made as per Actuals	~20 Rmt approx.		
9	Supply & fixing of control panel/ distribution panel including remote monitoring at Control Room regarding the status of AHU, compressor etc., with all necessary interconnecting cables and power supply to be extended upto the present LT panel with copper cable. Copper cable of correct size (3 ½ core, 25 sq.mm armoured cable) to be provided by the tenderer. Length to be decided in the pre-bid meeting	2 Sets	9 of Section-II	
9.1	Control Panel and Wiring of supply and control circuits	2 Set	9 of Section II	
9.2	Providing visual remote indication at control room with necessary electrical wiring	1 set combining for both AHUs		
9.3	Earthing	2Nos		
10	Civil works:		8 of Section-II	
10.1	SITC of False ceiling	18x16 ft		
10.2	SITC of Flooring			
10.3	Providing Heat Insulation Treatment in AC Plant Room			
10.4	Providing Under Deck insulation			
10.5	Providing Stale Air window above False ceiling			
10.6	Resizing of Fresh air window			
10.7	Providing Iron Angle platform Arrangement for Outdoor Condensing Units			
10.8	Supply of 2ftx2ft Return Air Grills	6Nos		
10.9	Supply of 2ftx2ft LED 36W Recessed LED Lights and its wiring	6Nos		
10.10	Miscellaneous Works			
11	Provision of Indicators for filter clogging & Condenser clogging	Lumpsum	7 of Section-II	
12	Dismantling & Shifting of Existing Units , Cooling Towers, AHU's.	1 job		
13	Any other materials/works requirement to complete the SITC.	1 job		
14	Buyback of existing AC plant	lumpsum		
15	**Accessories:** The price/Charges of each item of spares shall be quoted separately along with make.			
15.1	Belts for Blower	2 Sets		
15.2	Pressure Gauges for refrigerant & oil	2 Nos. each of High Pr., Low Pr. & Oil Pr.		

		Gauge.		
15.3	Dial type thermometer	2 Nos. each for suction and discharge side		
15.4	Air-Filters	Two complete sets used in one plant.		
15.5	Empty Gas cylinder with regulating valve adopter & pressure gauge.	1 Nos.		
15.6	Liquid line strainer	2 Nos.		
15.7	Whirling Psycho meter	2 Nos.		
15.8	Anemometer	2 Nos.		
15.9	Thermometer	2 Nos.		
15.10	Valve Key	2 Nos.		

SECTION-IV

SCHEDULE OF MEASUREMENTS AND CHECKS

S.No.	Component	Measurement	Reading	Remarks
1.	Compressor	i) Insulation of compressor motor	Ohm	
		ii) Power consumption	V.A.	
		iii)Refrigerant gas suction pressure	KG/Sq.cm	
		iv) Refrigerant gas discharge temperature	Deg.C	
		v) Refrigerant gas discharge pressure	Kg./Sq.cm	
		vi) Speed of compressor	RPM	
2.	Condenser	i) Insulation of condenser fan motor	Ohm	
		ii) Speed of condenser fan motor	RPM	
		iii) Cross section area		
		iv) Airflow	CFM	
		v) Power consumption	V.A	
3.	Fan cooling coil	i) Quantity of air flowing (Reading at return intake).	CFM	
		ii) Air temp. entering -DB & WB	Deg.C	
		iii) Air.temp leaving -DB & WB	Deg.C	
		iv) Static pressure developed by each fan(pilot tube to be used)	mm of W. G	
		v) Insulation of blower motor	Ohm	
		vi) Power consumption of blower motor	V.A	
		vii) Speed of the blower motor	RPM	
		viii)Speed of the blower	RPM	
		Ix) Cross section area		

4.	Any other item suggested by indenter/representative			

CHECKS

The following checks will be made before the plants are operated for trial run.

S.No.	Item to be checked	Remarks
1.	Qty. of oil and refrigerant	To be ensured.
2.	Refrigerant leakage	With halide leak detector
3.	Pressure test with nitrogen before charging	To test the strength of joints pressure of 24 Kg/sq.cm shall be applied to the high side and 7 Kg/sq.cm on low pressure side.
4.	Vacuum test	A vacuum of 0.0014 Kg/sq.cm (0.2 Psig) shall be created and maintained for 24 hours before charging the refrigerant.
5.	Working of protective devices: i) L.P cutout ii) HP cutout	
6.	Working of thermostat: i) Operating temp. for total shut down of compressor	
7.	Working of expansion valve	Check for any hissing noise.
8.	Uniformity of temp. over the entire surface of cooling coil.	
9.	Undue heating of component such as switch gear panel, motors, refrigerant pipes etc.	
10.	Temp. of fuses of AC plants after 4 hours of working.	
11.	Overload settings of motors	
12.	Noise level at supply outlet with supply duct disconnected and system working normally.	Sound pressure meter to be used 'A'scaleand'C' scale to be taken.
13.	Noise level at a distance of 1 mtr. from air cooled condenser.	-do-

ANNEXURE-I

STATEMENT OF TECHNICAL SPECIFICATION AND PERFORMANCE:

The tenderer should submit the following technical data of the equipment offered along with the tender (vide clause 1.3.2 of section I).

Sl. No.	ITEMS	
A. AIR CONDITIONER:		
i)	Packaged air conditioner make	
ii)	Packaged air conditioner type	
iii)	Guaranteed refrigerating capacity of packaged air conditioner for return Air conditions of 26.7° C DB and 17.9° C WB	Kal/Hr
iv)	% De-rating of capacity with increase in ambient temp. by	
a)	5° C ----%	
b)	10° C----%	----%
B. COMPRESSOR UNIT:		
i)	Refrigerating capacity under ASHRE Kcal/Hr. rating conditions & 50 Hz operation of the motor	Kal/Hr
ii)	Number of compressors per packaged AC plant	
iii)	Capacity	
iv)	BHP required for the compressor	
v)	Operating speed of the compressor	
vi)	Refrigerant (name) & Quantity	
C. BLOWER:		
i)	Blower (Fan) speed	R.P.M.
ii)	Static pressure developed	W.G.
iii)	Make, Model & HP of blower motor	
iv)	Speed of blower motor	R.P.M
D. COOLING COIL:		
i)	Coil face area	Sq. mtr.
ii)	Number of Rows	
iii)	Fins per cm.	
iv)	Make, Model & H.P of fan motor	
E. AIR COOLED CONDENSER:		
i)	Coil face area	
ii)	Number of Rows	
iii)	Fins per cm.	
iv)	Make, Model & HP of the fan motor	
v)	Speed of condenser Fan	R.P.M.
vi)	Heat rejection capacity	

ANNEXURE -II

CODES, REGULATIONS, NOISE AND VIBRATION CONTROL

The latest codes, regulation shall be followed in execution of the work; however some details are given below:

1	Safety code for air-conditioning	IS 659:1964(reaffirmed 1991)
2	Safety code for mechanical refrigeration	IS 660 :1963(reaffirmed 1991)
3	Testing of refrigeration compressors	IS 5111 : 1993
4	Air-cooled heat exchangers(Amendment 1)	IS:10470:1983(reaffirmed 1991)
5	Hermetic compressors	IS :10617 : Part I, II & III1983 (reaffirmed 1991)
6	Thermostats for use in refrigeration etc	IS:11338:1965(reaffirmed 1991)
7	Steel for general structural purpose	IS :2062:1992
8	Piping work up to 150mm Dia	IS 1239 Part I & II 1990/1992 & BS:3601
9	Hot Dip Zinc coated steel Tubes	IS 4736;1968
10	Gaskets	IS 638 : 1979 (reaffirmed 1993)
11	Mild steel Tubes & fittings	IS 1239 Part I & II
12	Colour code for the identification of pipe lines	IS:2379:1963
13	Specific requirements for the direct switching	IS 4064 (Part II) : 1978 of the individual motors
14	PVC Insulated (HD) Electric Cables for working voltage up to 1100 volts and up to 11 KV grade respectively.	IS: 1554 (Part I & II)
15	Starter	IS 8554 (Part I); 1979
16	Inspection and testing of installation	IS 732 (Part III) 1979
17	Three phase induction motors	IS 325
18	Code for practice for electrical wiring installation	IS 732:1989
19	Code for practice for earthing	IS 3043 : 1966
20	Wrought aluminium&aluminium alloy sheet and strip for general engineering purposes	IS : 737
21	Burden tube pressure and vacuum gauges	IS 3624
22	Glossary of terms used in refrigeration and air-conditioning.	IS :3615
23	Specification for single phase small AC & Universal motors	IS : 996
24	Circuit breaker A.C.	IS 2516 : 1980 (Part I & II)
25	Contactors for A.C.Voltageupto 1100V	IS:2959 1975
26	Low voltage switch gear and control gear Assemblies	IS 8623:1993 (Part I & II)
27	Code of practice for selection of Starters for AC induction motors	IS 3914
28	Code for selection, installation & maintenance of switch gear and control gear Part I & IV	IS 10118;1982
29	Conduits for electrical installations	IS 9537;1981 part I to IV

30	Permissible limits of noise level for rotating electrical machines	IS 12065:1987
31	Code of practice for installation and maintenance of motors	IS 3106;1966
32	Electrically welded steel pipes for water gas and sewage	IS 3589
33	Method for testing panel type air filters and AC purposes	IS 7613 :1975 (reaffirmed 1991)
34	Unbonded glass wool for thermal insulation	IS 3690 : 1974
35	Expanded polystyrene for thermal	IS 4671 :1984 (reaffirmed)
36	Centrifugal fans (Ist Revision)	IS 894 :1987 (reaffirmed 1991)
	SAFETY CODES The following IS codes shall be followed:	
1	Safety code for air-conditioning (Revised) amendment.	IS : 659 : 1964 (reaffirmed 1991)
2	Safety code for mechanical refrigeration	IS : 660 : 1963 (reaffirmed 1991)
3	Safety code for scaffolds & ladders	IS: 3696
4	Code of practice for fire precaution in welding & cutting operations	IS 3016
5	Code for safety procedures and practices in electrical works	IS:5216
6	Code of practice for safety and health requirements in electrical & gas welding and cutting operations	IS:3696

SPACE:

All shop drawings shall be prepared by the Tenderer after examining Architectural and other drawings, site conditions and shall be based and designed on the spaces shown on them.

NOISE AND VIBRATION CONTROL:

The tenderer must take all necessary precautions to have a minimum noise generation and its transmission as deemed necessary. Minimum vibration as permitted by IS relevant code shall be ensured. A few points for guidance are given below:

a) Double fire retardant flexible connection shall be made from air discharge to the duct.

b) Vibration isolation pads of suitable thickness and loading for elimination of vibration shall be provided under packaged unit, air cooled condensers etc. as per recommendations of the manufacturer.

c) Flexible conduits of suitable diameter and length are to be provided for making flexible electrical connection to the motors. All conduit connections where conduits are 60mm and large shall be made of at least 1.2 times the minimum length and installed in U shape, grossly slack to provide maximum vibration isolation. The floor supported piping shall be mounted on rubber pads with 7.5 mm ribbed neroprene pads between the base plate and the support.

d) All suspended ceiling shall be isolated on hangers. The vibration hangers shall have stable steel spring. A neoprene neck shall be provided where the hanger rod is connected to the supporting element to prevent metal-to-metal contact. The steel spring element shall have static deflection equal to half the static deflection of the isolated equipment and shall be used to support all equipment from the vibration equipment or from the floor or ceiling of the equipment room.

e) All other mechanical equipment such as expansion tanks etc. shall have double deflection

neoprene in compression for overload of 9 mm. The top and bottom surface shall be ribbed and boltholes shall be supplied in the base.

f) In case of conduits, pipes, tubes, the annular space between construction and penetrating element shall be filled with fibrous material and both sides sealed with hardening resident sealant. Details given in para 3.3.2 of Section III.

g) All floor mounted vibration isolated equipment shall be supported on steel frames or concrete block.

h) The air conditioning tenderer shall take all other precautions or provide on his own if not specified above for reducing noise level to within limits or minimise vibrations in all mechanical equipment without any additional cost.

ANNEXURE-III

INSPECTION PROCEDURE FOR INITIAL INSPECTION OF PACKAGED AC PLANTS AT MANUFACTURER/TENDERER WORKS.

I. **AIR CONDITIONING PLANT COMPRISING COMPRESSOR & CONDENSER:**

1. Physical verification of the unit for its make, model, type, capacity etc. shall be carried out of the equipment offered at Manufacturer's/tenderer works with reference to A/T.
2. Manufacturer's test certificate shall be scrutinized to check compliance with the requirement as specified in the order.

II. **FAN AND COOLING COIL:**

1. Salient features such as model, size, physical dimensions and other details of various sections, fan motor detail, fan dimension etc. shall be verified against the contract requirements.
2. Manufacturer's test certificate for the motor and air-handling unit shall be furnished and scrutinized as per contract requirements.
3. Test certificate for static and dynamic balancing of the fan/blower shall be furnished for verification.
4. Manufacturers internal test certificate on salient features like type, material, no. and gauge of fins and tubes and No. of rows shall be furnished and verified with reference to contract requirements.
5. Hydralic pressure to the extent of 24 Kg/cm^2 shall be applied and this pressure should be maintained for 15 minutes and no drop should be observed indicating any leaks. Alternatively pneumatic submerged pressure test shall be carried out for 15 minutes with compressed air or dry nitrogen at a pressure of 24 kg/cm^2 to ensure that there is no leakage.

III. SWITCH GEAR, CONTROL GEAR AND MEASURING INSTRUMENTS:

1. It shall be verified that control panel is of CPRI approved make.
2. Manufacturer's test certificate for MCCB shall be verified as per contract requirement.
3. Availability of measuring instruments of required accuracy for conducting different tests shall be verified.

III. **ELECTRIC MOTOR:**

1. It shall be verified that the electric motors are of approved make.

NOTES:

i) All the components where initial inspection at manufacturer's works is not stipulated shall be of approved make.

ii) Accuracy of testing instruments shall be as mentioned in the inspection procedure laid down in this Section.

INITIAL TEST AT SITE AFTER INSTALLATION WITH TEST READINGS:

Tenderer's representative shall witness all type of routine tests. Performance tests of equipment/control installed shall be carried out at site.

On completion of installation, the tenderer shall conduct initial test. Any defects found shall be rectified immediately. The test readings during initial test run shall be recorded in the Test Readings Proforma enclosed with this Annexure.

The initial test, which has to be carried out by the tenderer, shall be (but not limited to) as follows:

a) Pressure tests for all refrigerant circuit as given in this specification/as recommended by the manufacturer before charging the system.

b) To check satisfactory functioning of all electrical motors, switchgear, control, pressure testing of all air handlers' etc.

c) To check alignment of motors.

NOTES:

All necessary test instruments such as thermometers, pyrometer, pressure gauges, anemometer, dust-count meter, Sound level (decibel) meter, personnel, and required quantity of gas, oil and lubricants etc. shall be arranged by the tenderer at his own expense. However, power for testing and commissioning of the system shall be provided free of cost by the indenter.

In addition to the initial test as explained in Section I and above, the tenderer shall also give two continuous running tests of the system during peak summer and monsoon each of 24 hour duration or for 3 days each of 10 hour duration when the ambient conditions are close to the design conditions. The capacity test shall be conducted in presence of representative of the indenter and inside and outside conditions shall be recorded on hourly basis.

CAPACITY OF PLANT:

Before capacity tests are conducted, the following aspects shall be checked:

a) The tests shall be conducted during the peak season only. In case the outside design conditions are not available, then tests shall be conducted at design conditions closest to outside design conditions.

b) All internal loads such as light load, occupancy or equipment load shall be close to design loads. Otherwise, artificial load shall be generated to satisfy internal design loads.

c) Hourly readings of temperature, relative humidity, electric current, power consumption etc. shall be recorded. The capacity of the system components shall be computed as given in the TEST READING-PROFORMA given below.

d) Test readings shall be furnished in duplicate prior to handing over the plants.

1. OUTSIDE DESIGN CONDITIONS:

a) Season :

b) Dry bulb temp. Deg.C. :

c) Wet bulb temp. Deg.C. :

2. INSIDE DESIGN CONDITIONS:

a) Dry bulb temp. Deg. c. :

b) Wet bulb temp. Deg.C. :

c) Relative Humidity % :

3. <u>COMPRESSOR :</u>

a) Suction Temep. Deg. C. :

b) Suction Pressure kg./Sq.cm. :

c) Discharge temp. Deg. C. :

d) Discharge pressure kg/Sq.cm. :

e) Oil Pressure kg./Sq.cm. :

f) Capacity of compressor motor (HP) :

g) Starting current (Amps) :

h) Readings of voltmeter, Ammeter and power factor meter.

Power computation at various loads of 100 % 75 %, 50 % & 25 %

Motor current - Amps :

Voltage - Volts :

Starting current - Amps. :

4. <u>CONDENSER:</u>

a) Air flow rate CFM :

b) Heat rejection capacity :

5. <u>FAN AND COIL SECTION</u>

a) Coil face area Sq.mt. :

b) Maximum air quantity CFM :

c) Actual air quantity CFM :

d) Air velocity m^3/hour :

e) Entering air temp. DB/WB Deg.C :

f) Leaving air temp. DB/WB Deg.C :

g) Motor drive for air handlers

i) Rated horse power (HP) :

ii) Rated voltage/current/volt/ampere :

iii) Actual voltage/current/volt/ampere :

iv) Starting current amperes :

The above data should be recorded for each individual unit.

1. **<u>FILTERS:</u>**

a) Area of filters m^2 :

b) Effective area m^2 :

c) Velocity of air m/hr. :

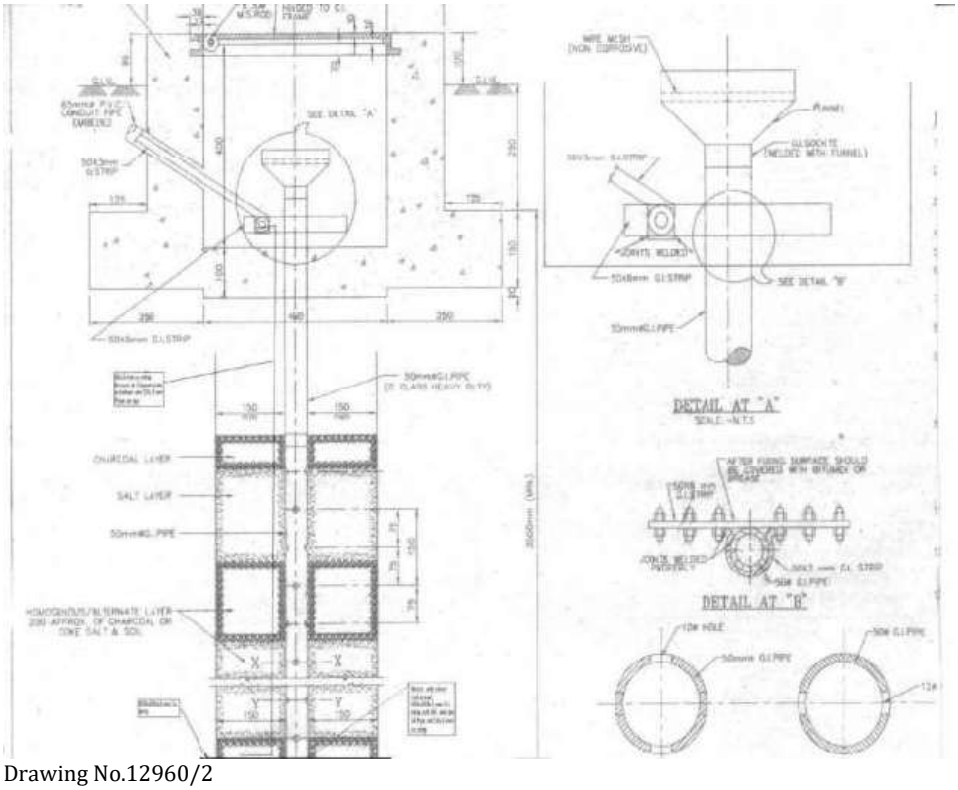
d) Quantity of air m^3/hr. :

ANNEXURE-V

LIST OF APPROVED MAKES OF DIFFERENT EQUIPMENT:

1	Whole Packaged Air cooled AC plant (with scroll compressor)	VOLTAS/BLUESTAR/CARRIER/ DAIKIN/O'GEN/HITACHI
2	Industrial Type Thermometer	EMERALD/D.S. ENGINEERS/JAPSIN
3	Glass Wool	U.P. TWIGA/KIMCO/OWENS CORNING
4	Expanded Polystyrene	METTUR BEARDELL/THERMOLLOYD/ STYRENE
5	Fibre Glass Rigid Board	U.P. TWIGA/KIMCO/OWENS CORNING
6	Paints	ICI/ASIAN/JENSON & NICHOLSON/ GOODLASS NEROLAC/SHALIMAR
7	Air-Circuit Breakers/MCCB	L & T/SIEMENS/CROMPTON/ABB/SCHNEIDER
8	MCB	LEGRAND/GE/MDS
9	Power Cable	ICC/CCI/GLOSTER/GRANDLAY/ UNIVERSAL / INCAB/HAVELLS/FINOLEX/POLYCAB
10	Control Cable	GLOSTER/GRANDLAY/NATIONAL/ HENLEY/BATRA/INCAB/UNIVERSAL
11	Voltmeter/Ammeter	A.E/IMP (Digital)
12	Switches	L&T/SIEMENS/GE
13	Current Transformer	A.E/KAPPA/PRECISE
14	Contactors and over load Relays	L&T/SIEMENS/GE/ABB/SCHNEIDER
15	Indicating Lights/Push Buttons	SIEMENS/L&T/VAISHNO
16	Selector/Toggle Switch	KAYCEE/L&T/LAKSHMI
17	Changeover Switch	ELECON/L&T
18	Time Delay Device	SIEMENS/L&T/BCH
19	Single Phase Device	L&T/MINILEC
20	Electrical Panel, Sub Panels, etc.	ASPL/MILESTONE/TRICOLITE/CPRI Approved firms

Annexure VI



Drawing No.12960/2