

# **TENDER DOCUMENT**

**FOR SUPPLY WATER COOLED SCREW CHILLER (VFD)**

**FOR DREAMS MALL, KOTTIYAM, KOLLAM**

**TENDER NO: DREAMS MALL/2022 DTD 02/03/2022**

## **CLIENT**

**M/s DESINGANADU RAPID DEVELOPMENT &  
ASSISTANCE CO-OP SOCIETY LTD, Q – 1666,  
KOTTIYAM P.O., KOLLAM, KERALA.**

## **ARCHITECTS**

**M/s ABHILASH ARCHITECTS,  
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**Address: - DESINGANADU RAPID DEVELOPMENT & ASSISTANCE CO-OP SOCIETY LTD, Q – 1666,**

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**NOTE:**

**Vendor/Tenderer/Contractor** - here means Approved Makers.

**Architects** – here means M/s Abhilash Architects

**Client** – M/s Desinganadu Rapid Development & Assistance Co-op Society Pvt. Ltd.

## SECTION A

### NOTICE INVITING TENDER

M/s Desinganadu Rapid Development & Assistance Co-op Society Pvt. Ltd. is inviting tender for “Supply for HT Multi Panel for DREAMS MALL, KOTTIYAM, and KOLLAM”.

The Due date of Submission of Tender is 11/04/2022.

- i) The tenderers are required to submit their tender as per the information mentioned in the tender documents and if there is any deviation in tender specification, the same shall be submitted separately along with the tender documents. Tenderers are required to fill the tender technical specification sheets without fail.
- ii) The successful Tenderer will be required to enter into a formal agreement with Client after the issue of Letter of Intent.
- iii) The tender hard & soft copies should be sent to M/S Desinganadu Rapid Development & Assistance Co-op Society Pvt. Ltd. ([dreamsmall.engineering@gmail.com](mailto:dreamsmall.engineering@gmail.com)) by 16 00Hrs on or before 11/04/2022.
- iv) Tenders shall be valid for days (ninety) from the date of opening of tender.
- v) Client reserves the right to accept or reject any tender and also shall modify the tender dates without assigning any reason depending upon the site conditions. Further, the client does not bind himself to accept the lowest tender.
- vi) The tender should be signed by an authorized official of the company. The tender should be handed over in a sealed cover.
- vii) Client reserves the right to increase or decrease the no. of units proposed before finalization of the order or reserves the right to nullify the tender if needed without assigning reasons.

## SECTION B

### **Terms of Payment AND Taxes & Duties:**

#### **1. Terms of Payment:**

- a. 10% of the Contract Value shall be payable as advance immediately upon signing the Contract and against the submission of Bank Guarantee.
- b. 70% of the Contract Value shall be payable against delivery of material at site/Letter of Credit as per rules
- c. 10% of the Contract Value shall be paid after completion of testing & commissioning and handing over of equipment.
- d. 10% of the Contract Value shall be payable as retention after defect liability period of 12 months. However, this amount can be released against the submission of retention Bank Guarantee.

#### **2. Taxes & Duties:**

- The prices are inclusive of all taxes, duties, levies prevailing on the date of this proposal. And transport charges etc.

## SECTION C

### **GENERAL SPECIFICATIONS**

#### **CONFORMITY WITH STATUTORY ACTS, RULES, REGULATIONS, STANDARDS AND SAFETY CODES**

##### **Indian Electricity Act and Rules**

All electrical works in connection with installation of electric sub-stations shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 and the Indian Electricity Rules, 1956 amended up to date. Wherever I.E. rule numbers have been indicated, they are based on I.E. Rules, 1956 amended up to date.

##### **Indian Standards**

The transformers and their installation shall conform to relevant Indian standards amended up to date.

##### **Safety Codes and Labour Regulations**

In respect of all labour employed directly or indirectly on the work, the tenderer, at his own expense will arrange for the safety provision. In case of default, the client shall be at liberty to make arrangements and provide facilities as aforesaid and recover the cost from the tenderer. The tenderer shall provide necessary barriers warning signals and other safety measures to avoid accidents while installation, testing and commissioning.

Nothing in these specifications shall be construed to relieve the tenderer of his responsibility for the design, manufacture and installation of the equipment with all accessories in accordance with applicable statutory regulations and safety codes in force from the safety angle.

### **WORKS TO BE ARRANGED BY THE CLIENT**

Unless otherwise mentioned in the tender specifications the following works shall be carried out by the client:

Construction of sub-station building. The tenderer should select such equipment for installation as can be properly installed in the spaces shown in specification drawings. While no guarantee can be given minor modification required by the tenderer if mentioned in the tender or intimated immediately after the receipt of tender shall be carried out if structurally possible.

Cable trench, entry pipe for cable, manholes for drawing of cables, manhole covers etc. as per requirements.

Provision of storage space at site.

### **WORKS TO BE DONE BY THE TENDERER**

In addition to supply, installation, testing and commissioning of transformer as per specifications, the following work shall be deemed to be included within the scope of work, to be executed by the tenderer:

Provision of supports / clamps for equipments, cables etc. wherever required.

Small wiring, inter-connection etc. inclusive of all materials and accessories, necessary to comply with the regulations as well as proper and trouble free operation of the equipment.

Tools and tackles required for handling and installation.

Necessary testing equipments for commissioning.

Watch and Ward of materials and/or installation and equipments till their handing over to the client.

### **SITE CONDITIONS**

All the equipments and their installation shall be suitable for the environmental conditions encountered at the location as indicated in Appendix II.

### **INSPECTION OF SITE AND COLLECTION OF DATA**

The tenderer shall be deemed to have examined the tender documents, detailed specification, data etc. and to have visited the site or ascertained all relevant details for offering suitable equipments/ installation.

### **EXTENT OF WORK**

The scope of work shall consist of cost of all materials, labour i/c supervision, installation, calibration, adjustments as required for commissioning of the sub-station. The term complete installation shall mean, not only, major item of the plant and the equipments covered by these specifications, but also, incidental sundry components necessary for complete execution and satisfactory performance of installation with all labour charges, whether or not specifically mentioned in the tender documents, which shall be provided by the tenderer at no extra cost.

### **COMPLETENESS OF TENDER**

All fittings, unit assemblies accessories, hardware foundation bolts, terminals blocks for connections, cable glands and miscellaneous materials and accessories of items of work which are useful and necessary for efficient assembly and working of the equipment shall be deemed to have been included within the scope of the work in the tender and within the overall details for complete item whether they have been specifically mentioned or not.

### **DATA MANUALS AND DRAWINGS TO BE FURNISHED BY TENDERER**

After Award of Work:

The tenderer shall submit the following drawing within a fortnight of the award of the work or as specified in tender document which shall prevail, for approval by the consultant.

- General arrangement or location drawing of the equipment complete with dimensions and clearances.
- Schematics & wiring diagram including control wiring.
- Any other drawing or data that may be necessary for the job.

Before Commencement of Installation:

The tenderer shall also furnish 3 copies of detailed installation, operation and maintenance manuals of manufacturer for all items of equipment together with all relevant data sheet, spare parts catalogues, repairs, assembly and adjustment procedure etc. in triplicate.

### **QUALITY OF MATERIALS AND WORKMANSHIP**

All parts of equipment shall be of such design, size and material so as to function satisfactorily under all rated conditions of loading and operation. All components of the equipment shall have adequate factors of safety. Materials/components which are not conforming to standards laid down by Bureau of Indian Standards (BIS) shall not be approved.

The entire work of fabrication, assembly and installation shall conform to sound engineering practice and on the basis of "fail safe" design. The mechanical parts subject to wear and tear shall be of easily replaceable type. The construction shall be such as to facilitate ease of operation, inspection, maintenance and repairs. All apparatus shall also be designed to ensure satisfactory operation under working conditions as specified.

### **INSPECTION, TESTING AT MANUFACTURERS WORKS**

The tenderer will be required to furnish such facilities as will be necessary for inspection of the equipment before dispatch at the manufacturer's works and also for witnessing such tests, at the works, if so required by the client. The tenderer shall furnish information for this purpose and will also give sufficient notice regarding the dates proposed for such test to Inspection agency.

### **TEST CERTIFICATE**

Copies of all documents for routine, acceptance and type test certificates of the equipment carried out at the manufacturers premise shall be furnished along with supply of the equipment.

### **DISPATCH OF MATERIALS AND STORAGE**

The tenderer shall commence work as soon as the drawings submitted by him are approved. The tenderer should dispatch all materials to site in consultation with the client where suitable storage accommodation may be made available to him temporarily. For this purpose the programme of dispatches of materials shall be framed keeping in view the building progress so that suitable storage accommodation could be made available to the tenderer.



### **COORDINATION WITH OTHER AGENCIES**

The tenderer shall coordinate his work and cooperate with other agencies by exchange of all technical information like details of foundation if required, weight, over all dimensions, clearance and other technical data required for successful and proper completion of his portion of the work in relation to the work of others without any reservation. No remuneration should be claimed from the client for such technical cooperation. Care shall be taken not to damage the water proofing done in the case of substations constructed below ground level. If any unreasonable hindrance is caused to other agencies and any completed portion of the works has to be dismantled and redone for want of the cooperation and coordination by the tenderer during the course of work, such expenditure incurred will be recovered from the tenderer during the course of work, if the restoration work to the original condition of specification of the dismantled portion of the work was not under taken by the tenderer.

### **CARE OF BUILDINGS**

Care shall be taken, while handling/ installing the equipment to avoid damage to the building. On completion of the installation, the tenderer shall arrange to repair all damages to the building caused during plant installation so as to bring to the original condition. He shall also arrange to remove all unwanted waste materials from substation room and other areas used by him.

### **PAINTING AND PROTECTION**

All damages to painting during transport and installation shall be set right to the satisfaction of the client before handing over. All structural frame work for support of various items of equipment shall be given the final coat of paint of approved shade at site after erection is complete.

Additional protection measures against corrosion shall be provided when installed in special environment.

### **TRAINING OF CLIENT STAFF**

The operation and maintenance staff of the client shall be associated with the manufacturer personnel during the installation, testing and commissioning of the equipments.

### **COMPLETION DRAWING**

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

- Equipments layout drawing(s) giving complete details of the entire equipments.
- Electrical drawings for the entire electrical equipments showing cable sizes, equipment capacities, switch-gear's ratings, control components, control wiring etc.

### **FINAL INSPECTION AND TESTING**

When the installation is complete, the tenderer shall arrange for inspection and testing of the installation. Test results obtained shall be recorded. The installation shall not be accepted until it complies with the requirement of these Specifications. The transformer installation shall be got inspected by the tenderer from local licensee and/or Electrical inspectorate and their clearance taken before energizing the Sub Station. All the observations/ deficiencies pointed out by the inspecting authorities shall be complied with by the tenderer on priority. The client shall render all help and pay mandatory charges to local licensee and/or Electrical inspectorate, if any, in this regard.

### **GUARANTEE**

The tenderer shall guarantee the entire installation as per specifications. All equipments shall be guaranteed for **24 months** from the date of acceptance against unsatisfactory performance or break down due to defective design, manufacture and installation. The installation shall be covered by the conditions that whole installation or any part thereof found defective within **24 months** from the date of taking over shall be replaced or repaired by the tenderer free of charge as decided by the client. The warranty shall cover the following:-

- Quality, strength and performance of materials used.
- Safe mechanical and electrical stress on all parts under all specified conditions of operation.
- Satisfactory operation during the maintenance period.
- Performance figures and other particulars as specified by the tenderer under schedule of guaranteed technical particulars.

### **AFTER SALES SERVICES**

The tenderer shall ensure adequate and prompt after sales services in the form of maintenance personnel and spares as and when required with a view to minimizing the break down period. Particular attention shall be given to ensure that all spares are easily available during the normal life of installation.

## SECTION D

### TECHNICAL SPECIFICATIONS

#### A. WATER COOLED SCREW CHILLER

##### 1. GENERAL INFORMATION

###### (a) Scope

Scope of this section includes the supply, installation, testing, commissioning and handing over of Water Cooled Screw Chillers (with VFD compressor) conforming to the specifications and in accordance with the requirement of drawings and of the Bill of Quantities.

###### (b) Documents

Hard and soft copies of following documents and certificates to be submitted along with the unit.

- Equipment selection printout:-
  - Selection printout at design condition showing part load data at 100%, 75%, 50%, & 25% loads.
  - Selection printout at ARI condition showing part load data at 100%, 75%, 50%, & 25% loads with AHRI Relief.
- Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.
- Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
- Single line schematic drawing of the field power hook-up requirements, indicating all items that are furnished.
- Installation, operation & maintenance manual.

###### (c) Unit

Water cooled screw chiller (with VFD compressor) as specified herein and any local codes in effect.

Each unit shall be completely factory packaged including flooded type evaporator, shell and tube condenser, and hermetic/semi-hermetic screw type VFD compressors with motors, microprocessor control centre and all interconnecting unit piping and wiring. The chiller shall be factory assembled and tested complete in all respects. Unit shall conform to AHRI 550/590 and relevant Indian standards.

Shell and tube heat exchangers shall be designed for a minimum working pressure of 150 psig. Power input to the compressor motor at 400V/3ph/50Hz and to controls at 230/1Ph/50Hz. The chiller shall use R-134A / R410A refrigerant. The electrical power supply will be provided at a single point and further distribution to compressors, etc. shall be under the scope of vendor.

The unit shall be supplied with initial refrigerant charge and lubricant, including vibration isolators for base frame and flexible couplings for water inlet and outlet.

**(d) Performance**

The chiller shall be capable of stable operation to a minimum of 20% of full load. Performance shall be in accordance with AHRI Standard 550 / 590. The full load power consumption at design condition should be less than 0.7 IKW/TR and IPLV should be less than 0.48.

**▪ Test Parameters**

The vendor should submit software generated test parameters sheets of the testing before the despatch of the units under the conditions specified in the technical specification. The testing shall be done in presence of client's representative at the test facility location at specified ambient temperature. The test parameters achieved during the witness testing at the testing facility at the specified ambient and at specified points, in the presence of client's representative shall comply with the technical specification submitted by vendor without any reduction in capacity of the chiller increase in power consumption values.

The chiller unit shall be complete with the following accessories:-

- Electronic/thermostatic expansion valves
- Solenoid valves & filter drier
- Anti-freeze thermostat
- Factory insulated evaporator shell
- All other necessary standard accessories

## **2. COMPONENTS**

### **(a) Compressor**

The compressor shall be multi rotary screw type. With VFD, CI housing, precision machined to provide minimal clearance for the rotors. The rotors shall be manufactured from forged steel and use asymmetric profiles. The compressor shall be incorporated with anti-friction bearing design to reduce power and increase reliability.

The compressor motor should be hermetic, refrigerant cooled with inherent all phase protection and shall be suitable for 415V/3Ph/50Hz power supply. Motor shall be screen protected drip proof squirrel cage induction type, designed for continuous operation at name plate rating and to be suitable for the specified refrigerant. Motor high temperature protection shall be assured with sufficient temperature sensors.

The starter for the motor shall be automatic soft type limit starting current, not more than the full load operating current at any instant, and shall be incorporated with essential safety devices like under voltage release, phase preventing device, overload relays etc.

Lubrication: - An adequate supply of lubricant oil shall be available to the compressor at all times. During operation, oil shall be delivered by positive system pressure differential or full-time operation of an oil pump.

### **(b) Evaporator**

Evaporator shall be shell-and-tube; flooded type designed for minimum 300 psig working pressure on the refrigerant side, and shall be tested in accordance with ASME code or equivalent. The shell shall be fabricated from rolled carbon steel plate with fusion welded seams; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four feet apart. The refrigerant side shall be designed, tested and stamped in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII - Division 1 or equivalent. Tubes shall be high-efficient type, internally and externally enhanced type having plain copper lands at all intermediate tube supports to provide maximum tube wall thickness at the support area.

Each tube will be roller expanded into the tube sheets providing a leak proof seal, and be individually replaceable. Water velocity through the tubes will not exceed 12 fps. A liquid level sight glass will be located on the side of the shell to aid in determining proper refrigerant charge. The evaporator will have a refrigerant relief device to meet the requirements of the ASHRAE 15 Safety Code for Mechanical Refrigeration or equivalent. The evaporator tubes shall be internally coated with anti-corrosive coat.

### **(c) Water Cooled Condenser**

Condenser shall be of horizontal, 2-pass or 4 pass (1,3 pass arrangements not acceptable), shell and finned tube type with steel shell and integral finned copper tubes rolled into steel tube sheets. The condenser shall be equipped with intermediate tube supports and construct in accordance with the requirements of ASME Pressure vessel Codes.( Or equivalent). It shall be designed for 150 psi (1034 KPa) water side working pressure and 203 psi(1400 KPa) refrigerant side pressure. It shall have pressure relief valves. Pressure drop shall not exceed 5 meters water column.

The condenser tube shall be at least 12 mm OD and 1mm thick seamless copper with integral fins. The shell shall be provided with removable end plates. An adequate number of de-scaling points to be provided for permitting draining and cleaning of the tubes.

The shell is of carbon steel plate with fusion welded seam it shall be fitted with machined steel tube sheets on either end. The shell will be fabricated from rolled carbon steel plate with fusion welded seams or carbon steel pipes; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four feet apart. The construction shall permit field removable of tubes for maintenance.

The shell is of carbon steel plate with fusion welded seam it shall be fitted with machined steel tube sheets on either end. The shell will be fabricated from rolled carbon steel plate with fusion welded seams or carbon steel pipes; have carbon steel tube sheets, drilled and reamed to accommodate the tubes; and intermediate tube supports spaced no more than four feet apart. The construction shall permit field removable of tubes for maintenance.

**(d) Refrigerant System**

Refrigerant flow to the evaporator will be metered by a single fixed orifice with a solenoid bypass to accommodate varying head conditions. The condenser tubes shall be able to contain the entire system refrigerant during unit maintenance. Manually operated isolation valve shall be provided at the inlet and outlet for the same. An additional valve to facilitate the removal of refrigerant shall also be provided.

**(e) Control Panel**

The entire chiller unit shall be controlled by stand-alone factory installed and wired microprocessor based weather proof control panel.

The control panel shall comprise of 10 inch diagonal colour liquid crystal display (LCD) (in English Language) surrounded by soft keys which are redefined based on the screen displayed at that time. This shall be mounted in the middle of a keypad interface and installed in a locked enclosure. The screen shall detail all operations and parameters, using a graphical representation of the chiller and its major components.

The control panel shall be provided with necessary TPN isolator for termination of incoming power cable. A contactor shall be included in the control centre for each compressor and a pair of fan motors.

The control system shall automatically control the operation of the unit from the time the unit is started, through the operating period, until the unit is stopped. The internal components shall be arranged for easy access. The panel shall incorporate necessary interlocking between equipment as required. The motor control centre should include safety devices to protect the unit from mal-functions. These controls should shut down the unit and signal the operator with their respective lights. The protective controls shall be as listed below.

- High condenser pressure cut-out.
- Low oil pressure cut-out.
- High oil temperature cut-out.
- High discharge temperature cut-out.
- Solid state motor over current cut-out.
- Solid state low evaporator temperature control

The control panel shall incorporate hardware cards/control units for complete integration of chillers to building automation system (BMS). The Software shall be stored in a long term persistent storage , with programmed set-points retained in lithium battery backed real time clock memory for minimum 5 years.

**Set Points:-**

- Display Language
- Water temperature set point & range
- Remote reset temperature range
- Manual override (For service)
- High & low ambient cut-offs
- No. compressors (idle & operating)
- Low liquid temperature cut-off
- Low suction pressure cut-off
- High discharge pressure cut-off
- Compressor start cycle timer
- Delay compressor start timer

**Display Screen Data:-**

- Water entering & leaving temperature
- Low leaving water temperature setting
- Low ambient temperature cutoff setting
- Outdoor air temperature data
- Suction pressure cutoff setting
- BMS Link data
- System 'ready to start' status
- System Running
- Compressor run status

- Zero cooling load condition
- Date & time
- Daily start/stop timer
- Holiday status
- Refrigerant valve status
- Water pump status

**(f) Safety Protocol**

System Safety: - Shall cause individual compressor systems to perform auto shut down; for high discharge pressure, low suction pressure, high pressure switch, and motor protector. Compressor motor protector shall protect against damage due to high input current or thermal overload of windings

Unit Safety: - Shall be automatic reset and cause compressors to shut down when low ambient, low leaving chilled liquid temperature, under voltage, and flow switch operation. Contractor shall provide flow switch and wiring as per chiller manufacturer requirements.

Alarms: - Low ambient, low leaving chilled liquid temperature, low voltage, low battery, and (per compressor circuit): high discharge pressure, and low suction pressure.

Manufacturer shall provide any controls not listed above, necessary for automatic chiller operation. Mechanical Contractor shall provide field control wiring necessary to interface sensors to the chiller control system.

**(g) Electrical Power Panel**

Electrical power panel shall be weather proof, powder painted steel cabinets with hinged, latched, and gasket sealed outer doors. Provide main power connections, control power connections, compressor and fan motor start contactors, current overloads, and factory wiring. Power supply shall enter unit at a single location, be 3-phase of scheduled voltage, and connect to unit terminal blocks. Exposed compressor, control and fan motor power wiring shall be routed through liquid tight conduit.

All equipment, cables and wiring shall be designed, manufactured and installed so as to secure a service life as shown below:

- |                                |   |              |
|--------------------------------|---|--------------|
| ▪ Main switchboards            | : | Min 25 Years |
| ▪ Sub – main switchboards      | : | Min 25 Years |
| ▪ Cables                       | : | Min 25 Years |
| ▪ Luminaries                   | : | Min 25 Years |
| ▪ Tray, trunking and supports  | : | Min 25 Years |
| ▪ All other equipments minimum | : | Min 25 Years |



Switchboards, equipment, and components shall be rated for operation in ambient temperatures of 50 °C and relative humidity up to 75%.

**(h) Chiller plant manager**

The chiller shall be offered with factory built Plant Manager as specified. The plant manager shall be able to compute the capacity in TR (measured by external gadgets), entering and leaving chilled water temperatures and entering condenser water temperatures and power consumed in KW using the voltage, current, and power factor for various Compressor loads. The results are to be logged in the form of a table. The capacity obtained and power consumed shall be compared with the performance charts for performance evaluation.

Wherever specified, Microprocessor controlled Plant Manager shall be provided for controlling multiple chillers. The plant manager shall sequence chillers for uniform wear and tear and shall select and run compressors efficiently resulting in power saving.

The plant manager shall have ASHRAE, BACNET or Modbus protocol for hooking on the same.

**3. CHILLER INSTALLATION**

**(a) General Information**

The installation of the machine shall be carried out with proper foundation and proper supporting. The contractor shall prepare all the necessary drawings with norms, design, specification given by consultants and shall be approved by the consultant before carrying out the installation work. The installation process shall be

- Coordination with low side contractor in strict accordance with manufacturer's requirements, shop drawings, and contract documents.
- Coordinate controls with control contractor.
- Provide all accessories required to ensure for a fully operational and functional chiller.
- Adjust and level chiller in alignment on support / foundations.
- Coordinate electrical installation with electrical contractor.
- Provide all accessories required to ensure for a fully operational and functional chiller.
- Rig and install in full accordance with manufacturer's recommendations and shop drawings.
- Locate & erect the chiller as indicated on drawings, including cleaning and service maintenance clearance as per manufacturer's instructions.
- The complete chilling unit shall be installed over a RCC foundation and shall be adequately isolated against transmission of vibration to the building structure. Special attention shall be paid to the alignment of the driving and driven shaft. Final alignment shall be checked at site in presence of the Engineer – in – charge using a dial indicator.

Necessary foundation bolts, nuts, levelling screws etc. whatever required for mounting the unit shall be provide by the contractor.

- The chiller shall rest on vibration isolation mountings to avoid transmission of vibrations to the building structure.
- Adjust and level chiller on pedestals. Contractor shall provide and install all auxiliary devices and accessories for fully operational chiller.
- Coordinate electrical requirements and connections for all power feeds with electrical contractor.
- Unit shall be installed in such a way that, all the parts requiring maintenance shall be easily accessible.
- All electrical works shall be followed as per the safety regulations with identifying tag for easy maintenance. All wiring shall be neatly bunched and cramped.
- The electrical wiring diagram shall be pasted on the inner cover of the control panel.

**(b) Pressure Test**

- The refrigeration circuit, after complete assembly and after completion of the refrigeration piping, shall be subjected to about 1.5 times the design pressure. (Or as required as per manufacturers design), and this pressure shall hold without drop, for at least 24 hours.
- The entire chilling unit shall be pressure tested with dry nitrogen gas at the following test pressure (or specified by manufacturer) for specified refrigerant.
- High Pressure side: 20 -(Kg/Sq.cm.(gauge))
- Low Pressure side: 8 -(Kg/Sq.cm.(gauge))
- After the successful above mentioned test, the refrigeration system shall be vacuumed using a vacuum pump and the hold for minimum 8 hours.
- All test certificates shall be documented and attached to the handing over report.

**(c) Performance Test**

- The performance of the unit shall be proved at site at the time of testing and commissioning along with power consumption.
- The power consumption shall, in any case, should not exceed the conformed rating throughout the period of service of the equipment.
- The manufacturer should stand guarantee for the mentioned condition and shall compensate the client in the case of more power consumption than the indicated power.
- The contractor shall submit along with the rating charts of the machines offered in terms of percentile capacity at maximum ambient conditions along with the tender

#### **(d) Factory Tests**

Following tests shall be conducted in the presence of client's representative at manufacturers' facility.

- The chillers are to be tested at the manufacturers facility at specified capacity, power and ambient conditions
- The testing is to be done for each chiller, at 100%, 75%, 50% and 25% load conditions, as per AHRI test standards and in an approved AHRI test bed.
- Hydrostatic, volumetric and refrigerant leak tests shall be carried out at the facility before the dispatch of the unit.
- The testing is to be done at the prevailing ambient conditions as on the day of testing and the test results are to be computed for the ambient specified in the tender.

#### **4. PRE-COMMISSIONING CHECKS**

The following parameters have to be checked prior to commissioning of the chiller.

- The major equipments like compressor, condenser, expansion valve, evaporator, motor, controls, etc. installed according to the specification and design.
- The system is charged with refrigerant.
- The control circuit logic is tested.
- The fuse rating is correct.
- The overload relay is properly set.
- The earth protection is provided.
- The compressor motor continuity.
- The pressure gauges and thermometers are installed.
- Whether any air in the chilled water system.
- Whether any loose component in the electrical circuit.
- Crankcase heater is 'ON' condition.
- All the chilled water valves are opened.
- The insulation resistance of motor winding and power cable are connected properly
- The chilled water circuits are cleaned properly before start up.

#### **5. COMMISSIONING CHECKS**

The following parameters have to be checked during the commissioning of the chiller.

- Ensure that the crank case heater shall be kept energized at least 8 hours prior to start up.
- Ensure input voltage is available within the specified requirements.
- Ensure the phase sequence is correct.
- Ensure all valves are in open condition.
- Check water level in expansion tank.
- Ensure water quality is within recommended parameters.
- Ensure all control bulbs are inserted completely in their respective wells with heat conductive material coating.
- Check whether recommended fuses are in the power circuit disconnect switch and then close the switch.
- Start chilled water primary & secondary pumps
- Start indoor air handling units (if installed)
- Set desired water temperature values
- Switch on compressor switch
- Check the operation of the safety control switches and indicating lights on the control panel to be sure that they function to stop compressor motor in case the settings are exceeded.
- Check the settings of controls like LP cut-out, HP cut-out, antifreeze and thermostat as per requirement.

## **6. PERFORMANCE EVALUATION TESTS**

- Measure the Chilled Water Inlet / Outlet / Differential Pressure (.P) in PSIG / kPa / Pa
- Measure the Chilled Water Inlet / Outlet Temperature in °C / °F
- Measure the Ambient Temperature in °C / °F
- Measure the Ref. Suction / Ref. Discharge Pressure in PSIG / kPa / Pa
- Measure the Amperage / Voltage / RPM
- Measure the Ref. Suction / Ref. Discharge / Ref. Liquid Line Temperature in °C / °F
- Measure the Super Heat in °C / °F
- Measure the Sub Cooling in °C / °F

## **7. HANDING OVER**

The HVAC Contractor shall start up the chillers and give training to the operating staff through a factory trained personnel along with vendor provided operating & maintenance manual.

## SECTION E

**TECHNICAL DATA SHEETS****TECHNICAL DATA SHEETS**

Supplier/contractor shall fill and submit the technical data of all equipments in the format given below. Fail to do so may end up in the cancellation of his/their tender participation.

SL	DESCRIPTION	UNIT	VALUE
<b>I</b>	<b>General</b>		
a	Total Cooling Capacity	TR	
b	Refrigerant	-	
c	Rated Power Supply	V/Ph/Hz	
d	Total Power Input	KW	
e	COP At AHRI condition	-	
f	COP At Design condition	-	
g	<b>IKW/TR At AHRI Condition</b>		
	IKW/TR At 100% Load	Kw/TR	
	IKW/TR At 75% Load	Kw/TR	
	IKW/TR At 50% Load	Kw/TR	
	IKW/TR At 25% Load	Kw/TR	
	<b>IKW/TR At Design Condition</b>		
	IKW/TR At 100% Load	Kw/TR	
	IKW/TR At 75% Load	Kw/TR	
	IKW/TR At 50% Load	Kw/TR	

SL	DESCRIPTION	UNIT	VALUE
	IKW/TR At 25% Load	Kw/TR	
h	Noise Level At 100% Load	dB A	
<b>II</b>	<b>Working Conditions</b>		
a	Compressor Type	-	
b	Compressor Quantity	Nos	
c	Compressor Power Input	KW	
d	Evap .Inlet Water Temperature	Deg C	
e	Evap. Outlet Water Temperature	Deg C	
f	Cond. Inlet Water Temperature	Deg C	
g	Cond .Outlet Water Temperature	Deg C	
h	Evaporator Type	-	
i	Compressor Running Current	A	
j	Compressor Maximum Current	A	
k	Compressor Starting Current	A	
<b>II</b>	<b>Physical Data</b>		
a	Length	MM	
b	Width	MM	
c	Height	MM	
d	Weight	KG	

SECTION F

**APPROVED MAKES**

<b>SL</b>	<b>ITEM</b>	<b>APPROVED MAKES</b>
1	WATER COOLED CHILLER	CARRIER, TRANE, DAIKIN, BLUESTAR, KIRLOSKAR, CLIMAVENETA, VOLTAS.

**SECTION G**

**BILL OF QUANTITIES AND ANNUAL MAINTENANCE CONTRACT**

SL.NO	ITEM DESCRIPTION	UNIT	QTY	RATE	AMOUNT
<b>A</b>	<p><b>WATER COOLED SCREW CHILLER</b></p> <p>Supply, installation, testing, commissioning &amp; handing over of <b>Water Cooled Screw Chiller Units</b> with <b>VFD Compressor</b> of below mentioned capacity &amp; operating conditions, with <b>R134 A / R410 A</b> refrigerant, hermetic/semi hermetic sealed <b>Screw Compressor</b>, driven by high efficiency VFD drive (suitable for 415V/3Ph/50hz power supply), complete with water cooled shell and tube condenser &amp; flooded type evaporator, flow switches at condenser and evaporator outlet, refrigerant piping, refrigerant &amp; oil (first charge), micro-processor based control panel, motor starter &amp; accessories, etc. all mounted on a MS frame with cushy foot type vibration isolator, quote shall be complete in all aspects conforming to the technical specifications.</p> <p>Capacity :- <b>190 TR (2W + 1S)</b> Nos. 3</p> <p>Evaporator Flow Rate :- 456 USGPM</p> <p>Condenser Flow Rate :- 570 USGPM</p> <p>Chilled Water Out Temperature :- 44 0 F (6.67 °C)</p> <p>Chilled Water In Temperature :- 54 0 F (12.2 °C)</p> <p>Condensed Water Out Temperature :- 100.5 °F (38 °C)</p> <p>Condensed Water In Temperature :- 90.5 °F (32.5 °C)</p> <p>Fouling Factor (cooler) :- 0.0001 Btu-hr./sq.-F</p> <p>Fouling Factor (condenser) :- 0.00025 Btu-hr./sq.-F</p> <p>Power at full load (kW/TR) :- &lt; 0.7</p> <p>IPLV(kW/TR) :- &lt; 0.48</p>				
<b>B</b>	<b>ANNUAL MAINTENANCE CONTRACT</b>				



2	Comprehensive Annual Maintenance Contract of installed water cooled chiller units of total chiller plant capacity & its associated electrical & mechanical accessories, complete in all aspects conforming to the technical specifications. (2 years warranty. AMC starts from third year of handing over date)		
i	For Third year	Lot	1
ii	For Fourth year	Lot	1
iii	For Fifth year	Lot	1
iv	For Sixth year	Lot	1
v	For Seventh year	Lot	1

Prices quoted shall be for at site inclusive of all taxes, duties and statutory levies. Prices shall be firm and escalation of prices on no account is permissible. Prices quoted should indicate the percentage of taxes

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