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1 INTRODUCTION

This specification provides the general technical requirements for the packaged screw type reversible air cooled chiller (heat pump) used in the current project.

The manufacturer shall design, fabricate and assemble the air cooled chiller in accordance with this technical specification and applicable codes and standards given in section 2 and 3 respectively.

2 SCOPE OF SUPPLY

2.1 SCOPE OF WORK

a) The manufacturer shall supply the equipment according to the specification mentioned in Annexure-C.

b) The manufacturer shall supply, install and commission reversible packaged air cooled screw type chillers in accordance with the schedule of quantities. These units shall be completely factory assembled including the compressor, evaporator, condenser, chilled water pump and microprocessor control panel etc.

c) The packaged chiller shall be factory assembled, charged and tested with a full operating refrigerant and oil charge.

d) The refrigerant type shall be environmentally safe and eco-friendly.

e) Capacity of each chiller shall not be less than what is indicated in the Equipment Schedule.

f) The power input requirements for the unit, incorporating all the necessary devices for the satisfactory operation of the unit, included but not limited to the control accessories and oil pumps (s) should be indicated.

g) The unit shall be capable of continuous stable compressor operation even at part load conditions.

h) Heat transfer surfaces shall be adequate for the loads indicated.

i) Manufacturer shall warranty all equipment and material of its manufacture against defects in workmanship and material for a period of eighteen (18) months from date of initial factory start-up or date of shipment, whichever occurs first.

j) Chiller manufacturer shall have a factory trained maintenance team and support office available in the area/country.

k) All the spare parts of the Chiller shall be locally available.

l) Basic tools for Chiller maintenance shall be purchased with Chillers.

m) The manufacturer shall provide the support base for equipment, power supply for illumination of air cooled chiller and local display unit and control instrument fitted upon the frame of the equipment.

n) The manufacturer shall be responsible for complete installation and commissioning of equipment including all the resources required for the installation of electrical and I & C equipment including consumables, and essential manpower.

o) The manufacturer should design and manufacture the unit according to the specification and offer the following services:

i. Furnish the design report of each functional leg.

ii. Minimum spacing and operating corridor must be available for operation, over hauling and replacement of each functional leg.

iii. Installation of the unit will be the responsibility of supplier.

iv. Responsible for packing and shipping of the unit.

v. Provide special tools and spare parts necessary for installation, operation and maintenance.

vi. Provide the necessary instruments and controllers specified in this specification.

vii. Provide certain space to be required for handling and installation of the unit.

viii. Drawings, instructions (including installation operation and maintenance manuals) and other documents should be submitted in English version.

p) The manufacturer should be responsible for any quality problem occurring in products and liable for free replacement including installation.

q) The manufacturer should provide the owner with the same documents as what it issued to the subcontractor, such as procurement specification and plan, etc. the above said documents should meet the requirements stipulated in the specification.

r) The manufacturing, inspection and quality qualification processes of the subcontractor should also be submitted to the owner for its assessments and reference.

2.2 DOCUMENTS PROVIDED BY THE MANUFACTURER

2.2.1 General

a) The required documents stipulated in this specification shall include general assembly drawings, part drawings, design reports, test reports, operation instructions, subcontractor's documents, QA documents, inspection & material certificates, mounting drawing, operation & maintenance manuals and all parts end of manufacturing reports.

b) All provided documents should be marked with designation of the manufacturers, code no., revision no., date, project and contact no. of the owner.

c) Subsequently provide documents stipulated in clause 2.2.2 to 2.2.6 as required by owner after entering into contract.

2.2.2 Drawings

2.2.2.1 ESSENTIAL REQUIREMENTS

a) Project code. Contact no., owner's name, and order no. shall be marked in title block of every drawing.

b) There should be a modification column in every drawing for notifying the details and date of modification.

c) There should be a key material list in every drawing.

d) The manufacturer should provide the following drawings for assessment and approval.

i. General assembly drawing, subassembly drawings, part drawings of air cooled chiller which should include overall dimensions of every functional leg, location of check-door and water pipes and power supply.

ii. The plan and sectional view of filtering leg including overall dimensions, replacing method of filter and parts list attached.

iii. Layout and dimensions of connecting pipes/tubes, structure and draining mode for condensate catch pan of surface cooler and part list must be attached.

iv. The plan and sectional view of fan including detail view of shock mount of air intake and outlet of fans, wiring points of motor and list of parts attached.

v. Diagram of measuring and control instruments and list of parts attached.

2.2.3 Design Reports

2.2.3.1 GENERAL

Before the equipment being manufactured/assembled, the manufacturer should submit the design report to the owner for approval in which the criterion of all devices and parts, applicable formulas, computational steps and results are described in detail. Design reports of equipment mentioned in sec. 2.2.3.2 to 2.2.3.3 shall be provided.

2.2.3.2 COMPRESSOR

Compressor shall have high-pressure protection as required ARI standards and ASHRAE Standard 15.
Compressor shall have high-temperature control devices to protect against overheating and oil breakdown.
Compressor shall have low pressure suction protection on suction side of the compressor. Protection shall also be provided to prevent the compressor from operating with insufficient lubricant pressure.

a) The chiller shall be provided with complete design report of all its components i.e. compressor, cooler, condenser and microprocessor control panel etc.

b) A report shall be provided which should indicate that all the moving parts in the compressor shall be dynamically balanced to minimize the operating noise as per AHRI standard 370, vibration and ensure longer life of the compressor.

c) Compressor capacity control curves shall be provided.

d) The motor operation and maintenance report shall be provided.

e) Complete sectional views.

f) Complete design report of compressor.

g) Manual of compressor.

h) Testing for ratings (performance) shall be in accordance with ASHRAE Standard 23.

i) The following reports of Automatic Protection Controls shall be provided to ensure system reliability

   i. Low suction pressure

   ii. High discharge pressure

   iii. High oil temperature

   iv. Anti-Freeze protection

   v. High motor temperature

   vi. Oil level

   vii. Power loss

   viii. Chilled water flow loss

   ix. Compressor over current

j) The supplier shall provide the motor electrical data and the part load performance curves for the chiller being offered.

k) Test report of hydrostatic, volumetric and refrigerant leak tests shall be provided before the dispatch of the compressor.

l) Compressor shall be manufactured to fulfill the requirements given as in Annexure A.

2.2.3.3 EVAPORATOR & CONDENSERS

a) Evaporator's operational and maintenance manuals.

b) Condenser's operational and maintenance manuals.

c) Complete sectional views.

d) Complete design reports of Evaporator and Condenser.

e) Evaporator and condenser shall be manufactured to fulfill the requirements given as in Annexure A and end of manufacturing reports shall be submitted to client.

2.2.4 Test Reports

The manufacturer shall present all respective test reports one month in advance of acceptance. For details refer Section 6.0.

2.2.5 Quality Assurance Documents

The manufacturer shall QA plan for manufacturing to the client for approval.

2.2.6 Mounting, Commissioning and Maintenance Instructions

Mounting, commissioning and maintenance instruction should be included but not limited to the following items:

a) Cooling fans and motor instructions including fan performance curve.

b) Requirements and procedures of installation.

c) Operation instructions

d) Maintenance instruction which should include the procedure for routine inspection of fan, motor, filters, and the parts replacement schedule and process of the unit.

e) Lists of spare parts

f) List of special tools and operation instruction

3 APPLICABLE DOCUMENTS

3.1 DOCUMENTS

Documents to be included along with the offer (original only):

a) Descriptive catalogues for the equipment & selections data

b) Rating charts and dimensional drawings of equipment offered.

c) Foundation drawings of the equipment.

3.2 CODES AND STANDARDS

If any national standard and code come into conflict with this specification, the manufacturer should point out the conflicting item and offer the proposals to deal with it for the review and approval of the owner. The latest versions of the following codes/standards or their equivalents but not limited to, shall be applied during design, material selection, construction, shipping and testing.

a) AHRI 550/590

Water Chilling Packages Using the Vapor Compression Cycles

b) AHRI 520

Performance rating of positive displacement condensing units

c) AHRI 540

Performance rating of positive displacement refrigerant compressors and compressors units

d) ASHRAE Standard 23

Methods of testing for rating positive displacement refrigerant compressors & condensing units

e) AHRI 370

Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment

f) ANSI/ASHRAE Standard 15

Safety Code for Mechanical Refrigeration

g) ASHRAE 34

Number Designation and Safety Classification of Refrigerants

h) ASHRAE 90.1

Energy Standard for Buildings except Low-Rise Residential Buildings

i) ANSI/NFPA Standard 70

National Electrical Code (N.E.C)

j) ANSI/ASME B 16.5

Steel pipe flange and Flanged fittings

k) ASME Boiler and Pressure Vessel Code, Section II & VIII

Boiler and Pressure Vessel Code, Section VIII including its appendices Section II, Material Specification

l) ASTM A48

Gray iron castings

m) ASTM 700

Recommended practices for packaging

n) ISO 12944-5

Paints and varnishes, Corrosion protection of steel structures by protective paint systems

o) Manufactured in facility registered to ISO 9000-2000 & ISO 14000

p) Packing and shipping shall conform to EJ/T 564-1991or equivalent.

4 DESIGN CONDITIONS

4.1 DESIGN LIFE

The air cooled chiller shall be designed with a heavy duty structure and shall be designed according to codes and standards specified in sec. 3.2 to assure the unit continuous service for 60 year life time of project.

4.2 PHYSICAL APPEARANCE/CONDITION OF THE UNIT

Surfaces of the unit should be smooth without visible scratch, rusty-spot, press marks and the paint coating be uniform, consistent colored and free from flow fold, blister & flaking. Painting of the chillers shall be done according to ISO-12944-5.

4.3 NOISE REQUIREMENTS

Noise level of the unit should be according to the AHRI 370.

5 MATERIAL AND PROCUREMENT ACCEPTANCE

All the material used in the unit shall have the chemical and physical properties consistent with the codes and standards mentioned in section 3.2 of this specification. The material shall be compatible for environmental conditions as mentioned in Annexure-A.

All purchased material shall be under a quality program with certified material test reports. The manufacturer shall accept and mark the purchased materials and record the certificates under an applicable document control procedure for subsequent follow up with traceability.

6 ACCEPTANCE REQUIREMENTS

a) The manufacturer must inform the owner one month in advance before acceptance.

b) The manufacturer should present all documents including drawings, design report and every item test report one month before acceptance for the review of the owner.

c) The manufacturer should submit the above said documents together with a copy of nonconformance list and disposal reports.

d) Before overall acceptance of complete unit, prior acceptance of each individual sub-unit devices such as evaporator, condenser, and expansion tank, etc. shall be done.

e) Measurement of noise should be performed according to the AHRI 370.

7 PACKING AND SHIPPING

a) The manufacturer should submit packing and shipping procedure to the owner for its approval.

b) Before shipping, all parts of the unit should be cleaned up and all the openings and interfaces be fitted up with wooden protectors and properly enclosed, to protect them from any dust, moisture and other foreign particles during shipping and storage.

c) During shipment the chiller will be provided with protective coverings to vulnerable components (condenser coils, cooler nozzles, control center etc.)

d) Motors and other electrical parts should be separately packed and enclosed in nylon bag with desiccant in it.

e) All parts should be individually packed in wooden crates or boxes and marked with labels.

f) The package for the equipment should be with a fastening base pad to protect the equipment against damage during shipping and transportation.

g) The equipment package shall be in compliance with the requirement of international shipment and container transportation and well protected against rain, shock, sunshine and transported securely to the site in Pakistan, and shall be capable to be stored for two years in local environmental conditions.

h) The manufacturer shall display a written description fixed on boxes/crates of handling cautions.

i) The package shall be marked with equipment weight, handling position and center of gravity.

j) The manufacturer shall include all essential accessories and auxiliaries necessary for complete functionality of the offered quoted item which are not specifically mentioned here but are otherwise required to complete the functioning of the equipment offered in every respect for its satisfactory performance and safe operation.

k) The required foundation material (foundation bolt/ level wedge/anchor system, anti-vibration mounting pads, grouting chemical etc.) shall be included as essential part of supply.

l) The manufacturer shall provide the list of consumables, spares and tools, standard and optional accessories while submitting the quotation.

m) All quoted items shall have warranty of at least 1-2 years of trouble free operation after successful commissioning of equipment.

n) Pre shipment inspection shall be performed by the indenter/designer (all expenses shall be borne by supplier for 2 to 3 personnel). Quoted items shall be shop tested as per specified internationally accepted standard test procedures prior to shipment. Relevant test certificates/ results and procedures shall be made available to purchaser upon pre-shipment inspection and shall be provided along with quoted item. The particulars/ acceptance standards of factory final testing should be provided at the time of submitting quotation. Inspection by the purchaser/ consultant shall not absolve the supplier from his responsibility to fulfill the requirements and performance detailed in this specification.

o) Final acceptance will be based on inspection at site by the purchaser or his designee based on successful commissioning of quoted item.

p) Manufacturer shall be responsible to specify any special environment conditions required for quoted item operation in advance while submitting the quotation.

q) All quoted items shall equipped with short-circuit and overload protection devices (where applicable).

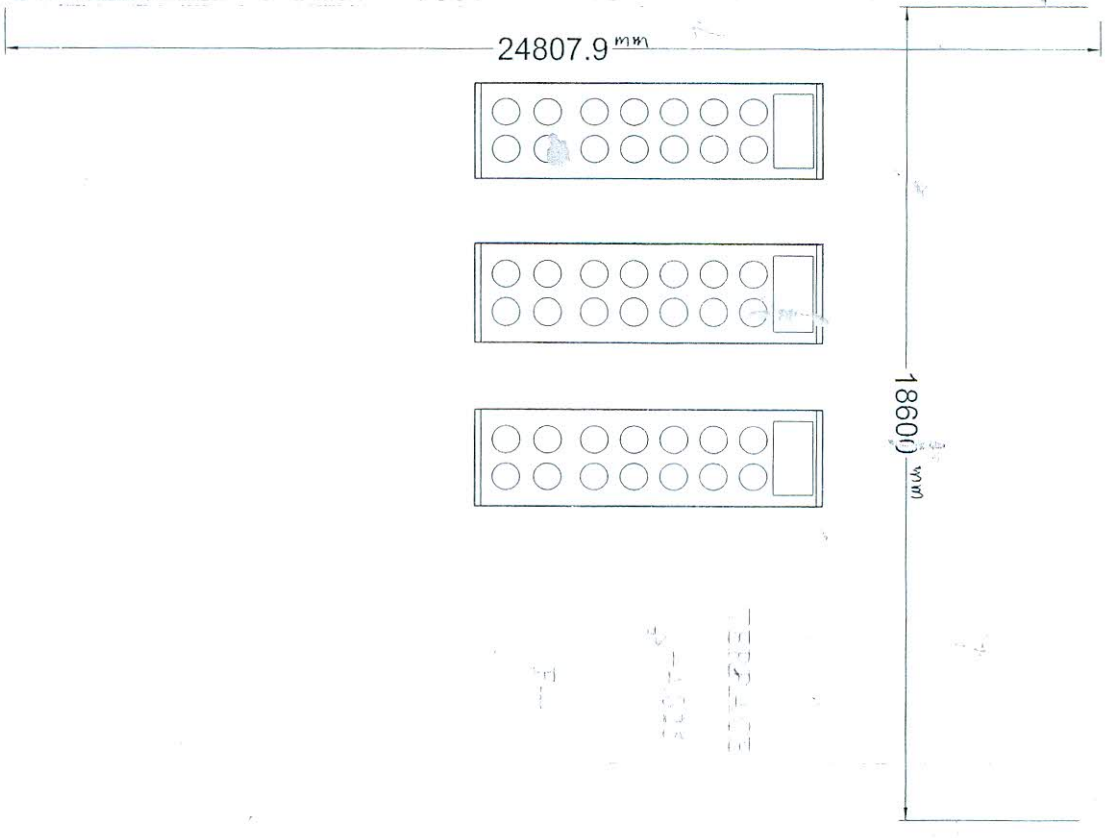
r) All technical documentation, quoted item specification plates, control panel, software (where applicable) or any other should be in English language.

Specifications Sheet of Pacakaged Reversible Air Cooled Chillers (Heat Pump)

Specification Sheet ACC		Name of Equipment		Project		Code No.	Room No.	Level (m)
		Packaged Reversible Air Cooled Chiller (03 Nos)		-		-	Roof	4.825
1	*	General Requirements		43	*	Piping Connections		
2		Type	Reversible Air Cooled Chiller (Heat Pump)	44	-- --	Inlet		
3		Quantities	3	45		Nominal Diameter	DN 200	
4		Compressor Drive	VFD	46		Material and Rating	CS, Sch 40	
5		Communication Protocol	RS-485	47		Outlet		
6		Nominal Cooling Capacity (Kw/Ton)	880/251 each	48		Nominal Diameter	DN 200	
7		Chilled Water Entering temp. (°C)	12 Cooling/ 40 Heating	49		Material and Rating	CS, Sch 40	
8		Chilled Water Leaving temp. (°C)	7 Cooling/ 45 Heating	50				
9		Ambient temp. (°C)	41	51	*	Refrigerant		
10		Size (Width:Dia:Height) mm	-	52		Type	R-134a	
11		Model	-	53		Refrigerant Charge (kg) Per Refrigeration Circuit	-	
12		Configuration	Floor Mounted	54				
13		No. of Circuits per Chiller	2	55				
14		Vibration Isolators	Yes	56				
15		Paint	As per ISO 12944	57				
16	*	Compressor		58				
17		Type	Screw Type	59				
18		Number	2 per chiller	60	*	Indoor Conditions		
19		Control Stages %	25%-100 %	61		Winter air conditioning dry-bulb temp. (°C)	22~26	
20		Power Supply	380 V/3 Ph/50 Hz	62		Winter air conditioning wet-bulb temp. (°C)	-	
21		Max. Running Current (A)	-	63		Winter air conditioning Relative Humidity (%)	50~55	
22		Startup Current (A)	-	64		Summer air conditioning dry-bulb temp. (°C)	22~24	
23		Motor Input (kW)	≤ 300 kW	65		Summer air conditioning wet-bulb temp. (°C)	-	
	*	Condenser (Air Cooled)		66		Summer air conditioning relative humidity (%)	50~55	
1		Type	Air Cooled Condenser	67				
2		Nominal Flow Rate (L/s)		68	*	Outdoor Conditions		
3		Pressure Drop (kPa)		69		Winter dry-bulb temp. (°C)	2	
4		Fouling Factor (m^2 °C/W)		70		Winter dew point temp. (°C)	-4.9	
5		Tube Material	High Efificiency Copper	71		Winter Relative Humidity (%)	-	
6	*	Evaporator		72		Winter Wind Speed (m/s)	10.3	
7		Type	Shell and tube	73		Summer dry-bulb temp. (°C)	41	
8		Available Flow Rate (L/s)	44 (Tentative)	74		Summer wet-bulb temp. (°C)	28.1	
9		Pressure Drop (kPa)	≤ 40 (Tentative)	75		Summer Relative Humidity (%)	-	
10		Fouling Factor (m^2 °C/W)	0.000018	76		Summer Wind Speed (m/s)	5	
11		Tube Material	High Efificiency Copper	77				
12	*	Fan		78	*	Conditions for Cooling/Heating Coil of Chiller		
13		Type	-	79		Water side entering temp. (°C)	12 Cooling/ 40 Heating	
14		Type of Fan	-	80		Water side leaving temp. (°C)	7 Cooling/ 45 Heating	
15		No. of Fan	-	81				
16		Air Flow Rate (m^3/ h. Each)	-	82				
17		Fan Motor Power (kW)	-	83				
18		Fan Max. Current (A/ Each)	-	84				

Notes:

1. The chiller should be complete with all of its associated systems/ Motor Control Centers including Power & Control Panels having intrnational protection rating IP55.
2. Country of origin of components: **Western Europe** or equivalent.
3. The scope of foundation design, equipment installation, equipment commissioning and equipment balancing lie in the scope of equipment supplier.
4. Chiller shall be compatible with Building Management System (BMS).


24807.9 mm
18600 mm