

U.S. Consulate General, Karachi.



Islamabad, Pakistan
Date: August 11, 2021
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To: Offeror

Request No: 19PK4021Q5028-PR10088639- Supply and Installation of HVAC Solution
From: Contracting Officer
General Services Office
US Consulate General, Karachi
Plot 3-5 New TPX Area,
Mai Kolachi - Karachi.

E-mail: KRCProcurementContracting@state.gov

Phone: 92-21-3527-0000

Subject:

Request for Quotation – Supply and Install HVAC System

The US Consulate General Karachi has an opportunity for the Open Market Contractors to participate in bidding for the “Supply and Install HVAC System”. It will be a Firm-Fixed Price Purchase Order. Bid from all potential offerors will be accepted based on assurance of genuine quality, capability, certification, lead time for delivery and competitive price. You are encouraged to submit your bids before the deadline i.e. August 20, 2021. The vendors dealing in the similar trade are encouraged to participate in this solicitation.

SITE VISIT: August 13 2021 – 1100hrs. Please submit necessary credentials (Names, NIC, Vehicle information: color, make, model, license plate number) to Procurement Contracting unit for security access request no later than August 12, 2021 – 1200hrs.

1. Items Description

Sr. #	Item's Details	Required Quantity	Unit Price in PKR	Total Price in PKR
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1	Supply, Installation, Commissioning, Testing Adjusting & Balancing (TAB) of an 80USRT Modular Chiller per statement of work.	1 Each		
		Grand Total in PKR =>		

2. Quote Submission Due Date:

Quotation must be submitted electronically with subject line "Quotation for RFQ# 19PK4021Q5028 - "Supply and Install HVAC System". Quotations must be received **on or before Close of business (COB) August 20, 2021**. No quotation will be accepted after the deadline. Submit your quotations to the following email address:

KRCProcurementContracting.gov

In order for your quote to be considered, must submit the following documentation: -

Requirements:

Prepare your quotation on your company letterhead in accordance with the requested details of this RFQ.

- a. Please include list of your clients, you sold similar items within the last two years.
- b. Include below information in bid:
 - i Delivery Period after receiving of Purchase Order.
 - ii Bid must be valid for 30 days from the closing date for this solicitation.
 - iii Acceptance of our Net 30 days Payment terms.
 - iv Valid DUNS Number and SAM Registration
- c. Bidder must have a physical business address and good financial health in order to get this award. Provide evidence for business address.
- d. Please provide reference of our Request Number **19PK4021Q5028** in all your correspondence regarding this request for price quotation.
- e. Please note that U.S. Consulate is tax exempted, please submit tax free quote.
- f. Go through all the documents in the solicitation and read them very carefully. Your response must be in accordance with the solicitation and have the bid signed by an authorized representative of your company. Otherwise, the proposal may be considered unacceptable and may be rejected.

3. Terms & Conditions:

a) Mode of Payment:

Payment will be processed through EFT within 30 days of the date that a correct invoice conforming to the provisions of the Purchase Order is received at the US Consulate Financial Management Office and satisfactory completion of work/delivery of acceptable items.

b) Delivery Schedule/ Period of Performance:

Per Statement of Work.

c) Inspection & Acceptance:

A Government representative will inspect the items at the time of delivery or later to determine the quality, required certification, acceptability and payment shall be released accordingly. Any equipment found other than proposed and committed in purchase order, shall be returned to the vendor without entertaining the payment claim.

4. FAR/ DOSAR Clauses applies on this Solicitation:

FAR & DOSAR (attached) clauses will apply to this Procurement. These clauses can be accessed through following link:

FAR 52.252-2 Clauses Incorporated by Reference (FEB 1998)

This purchase order/contract incorporates the following clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this address: <https://www.acquisition.gov/far>

DOSAR clauses may be accessed at: <http://www.statebuy.state.gov/dosar/dosartoc.htm>

FEDERAL ACQUISITION REGULATION (48 CFR Chapter 1) CLAUSES

NUMBER	TITLE	DATE
52.204-7	SYSTEM FOR AWARD MANAGEMENT	OCT 2018
52.204-9	Personal Identity Verification of Contractor Personnel (if contractor requires physical access to a federally controlled facility or access to a Federal information system)	JAN 2011
52.204-13	SYSTEM FOR AWARD MANAGEMENT MAINTENANCE	OCT 2018
52.204-18	COMMERCIAL AND GOVERNMENT ENTITY CODE MAINTENANCE	JUL 2016
52.212-4	Contract Terms and Conditions – Commercial Items (Alternate I (MAY 2014) of 52.212-4 applies if the order is time-and-materials or labor-hour)	OCT 2018
52.225-19	Contractor Personnel in a Diplomatic or Consular Mission Outside the United States (applies to services at danger pay posts only)	MAY 2020
52.227-19	Commercial Computer Software License (if order is for software)	DEC 2007
52.228-3	Workers’ Compensation Insurance (Defense Base Act) (if order is for services and contractor employees are covered by	JUL 2014

	Defense Base Act insurance)	
52.228-4	Workers' Compensation and War-Hazard Insurance (if order is for services and contractor employees are not covered by Defense Base Act insurance)	APR 1984
52.244-6	SUBCONTRACTS FOR COMMERCIAL ITEMS	NOV 2020
52.246-26	REPORTING NON-CONFORMING ITEMS	JUN 2020

5. EVALUATION CRITERIA:

The award will be made to the Lowest Price Technically Acceptable vendor, who can meet the salient physical, functional, performance characteristics.

(End)

1. GENERAL REQUIREMENT

The project is described as “New HVAC Solution Installation.” The Contractor shall furnish all necessary materials, labor, transportation, equipment, investigation, design and supervision. All work will be performed within in firm fixed-price contract.

I-BACKGROUND

Currently the OCGR building is served by a modular air-cooled chiller having two circuits and primary chilled water pumping unit. The existing chiller is not operational and currently floor standing split pack units are doing the HVAC in the building. The existing chilled water (CHW) piping is ok but it’s Insulation and cladding will need to be replaced. The CHW pipe accessories like valves strainers and gauges are rusted/old and will also need replacement at some point. The extent of piping (valves & accessories) to be defined & agreed, either in SOW or during pre-bid walk-through.

II.SOLUTION

Install new chiller, fan coil units, chilled water pumps (primary pumps if not provided as pumping module in chiller & Secondary pumps for chilled water circulation with in the building), replacing existing piping accessories (Valves, strainers, & gauges), with complete CHW pipes reinsulating and recladding, providing electrical panel & motor control center for chiller and pumps, all with up to date design and construction methodology.

III. GENERAL CONDITIONS

CO: Contracting Officer
COR: Contracting Officer's Representative
FM: Facility Manager
RSO: Regional Security Officer
POSHO: Post Occupational Safety and Health Officer
APOSHO: Assistant Post Occupational Safety and Health Officer
Pre-bid walk-through of the work is permitted and should be arranged through Facility Manager's Office. Contact # 021 3527 5315, 021 3527 5290

1. COR:

A Contracting Officer's Representative (COR) will be assigned to ensure quality assurance goals are met.

2. Fixed-Price Proposal:

The Contractor shall provide one fixed-priced Proposal for the complete Project that includes every aspect of the Work. Contractor will be measure and verify quantities needed to complete this project prior to bid submission.

3. Design Criteria:

The Work shall be governed by referenced standards (ASHRAE & SMACNA) and drawings contained within this Scope of Work.

Notify the COR in the event of conflicting design criteria. In general, the more stringent criteria shall be applied, subject to COR approval.

The Contractor is responsible for compliance with all design criteria; Work not in compliance shall be deemed unacceptable.

The Contracting Officer's Representative shall inspect and approve or reject all materials and equipment prior to their use.

4. Execution:

The Work shall be executed in a diligent and workmanlike manner in accordance with the negotiated fixed-price, this Scope of Work, the Project Schedule.

When pursuing the work, the contractor is to take extra care as not to damage existing structures. The Contractor is responsible for preventing any damage to surrounding properties arising from the Contractors performance of the work.

Contractor shall be responsible for repairing any damage to adjacent properties as a result of its activities on the Project Site. If the damage is not repairable, the cost will be calculated by the Facility Manager and deducted from the payment of the final invoice.

5. Work Hours:

The contractor shall work 6 days a week between the hours of 8:00 AM and 4:30 PM.

If any aspect of this work is deemed by the COR, the FM, the RSO or the POSHO/APOSHO to be interruptive of normal consulate operations or mission security or safety, the contractor shall be required to perform that portion of the work on Saturdays and Sundays.

6. Safety:

The Contractor shall be responsible for conducting the work in a manner that ensures the safety of employees and visitors at the US Consulates, and the Contractor's employees.

The Contractor shall be solely responsible for risk assessments, managing health, and safety issues associated with this project. Based on hazard assessments, Contractors shall provide or afford each affected employee personal protective equipment (PPE) that will protect the employee from hazards. At a minimum PPE shall consist of eye protection, hard hats, and closed toe shoes. Sandals or athletic shoes are not acceptable. PPE such as gloves, dust masks, are recommended. These items must be provided at the Contractor's expense.

Workers may use discretion if they feel unsafe in using the equipment in a hostile environment.

Any worker at an elevated location above 1.8 meters, with the exception of a portable ladder, must be provided and utilize a safety harness.

The contractor must document in the bid for work how the hazard controls will be implemented and maintained during the project.

The Contractor shall prepare and implement an Activity Hazard Analysis (AHA) prior to the start of work.

The Contractor must have a competent person on-site for inspection of equipment, training workers in the safe use of equipment and the recognition of hazards related to their use, supervision, and identifying and correcting unsafe work practices for high hazard work.

All contractor personnel shall wear hard hats, safety glasses, ear-plugs, gloves, close-toes shoes and any other Personal Protection Equipment deemed necessary by the COR.

Safety Training:

1. Provide specific training to supervisory personnel and all craft workers of the Contractor and subcontractors in proper use and care of specific personal protective gear, equipment, and clothing.
2. Contractor and subcontractor employees shall be trained and supervised by qualified persons to perform, safely and confidently, recognized hazardous work operations and work performed with hazardous conditions to which they have been assigned.

If more than 99 and less than 300 persons are employed (greatest number being the total number of employees on a shift), establish and equip, as directed by a licensed physician, a first aid station staffed full time with a professional nurse trained in emergency response. If medical clinics or hospitals are accessible within five minutes of the project site, the facilities may be approved by a licensed physician for use, in lieu of a first aid station.

7. Workforce:

The contractor shall provide all supervision, skilled and unskilled labor needed to perform the work.

The Contractor shall be responsible for total integration of effort and control of the works. The Contractor shall be responsible for planning, monitoring, coordinating, and controlling the works.

The contractor shall provide Foremen and other supplemental staff as necessary to perform the work within the timelines and quality standards specified. Staff shall demonstrate knowledge, skill, and experience with the construction methods, techniques, and standards required by the contract.

8. Accommodations:

Toilets: The contractor shall utilize Consulate toilets for the workers. The Contractor shall ensure they stay clean and usable.

Drinking water: The contractor shall also provide an adequate number of drinking water dispensers, distributed for convenience and efficiency-of-use around the construction areas. Maintain supply of disposable paper cups at each dispenser at all times.

9. Subcontractors:

Contractor shall be responsible for the conduct and workmanship of Subcontractors engaged in the Project, and for Subcontractors compliance with the terms of this Statement of Work. The Contractor is responsible for the behavior and workmanship of Subcontractors while on U.S. Government property.

10. Modification to Contract:

The Contractor shall not incur any costs beyond those described in this SOW unless directed otherwise in writing by the Contracting Officer.

Any work performed by the Contractor beyond this SOW without written direction from the Contracting Officer will be at the Contractor's own risk and at no cost to the U.S. Consulate General Karachi.

11. Stop Work:

At any time during the Project, the Contracting Officer (CO) reserves the right to Stop Work for protection of employees or visitors, security, or any other reason at his/her discretion.

12. General Submittals:

The contractor is responsible to submit a hazard control measure plan for the work.

The contractor is also responsible to submit a detailed construction schedule indicating when the various portions of the work will be commenced and completed within the required schedule in the form of a bar chart. This bar chart shall be in sufficient detail to include all significant milestones.

The contractor shall provide the detailed qualification of all the key personnel.

The contractor shall provide product datas and shop drawing for every portion of the project. This includes but is not limited to: Details on pipes and fitting to be used, Aggregate gradations, Concrete Mix Design, Steel Reinforcement Specification and Source, Joint Filler and mechanical works.

13. Close-out:

Prior to final acceptance, the COR will conduct a QA/QC inspection to check compliance with the SOW.

14. Housekeeping:

The contractor is responsible to clean up daily. The contractor is responsible to dispose of all dirt, concrete, stone and construction debris outside of the property before the close of business each day. Any dirt, concrete, stone and other construction debris may not be piled on the ground. Immediately upon removal, it must be loaded into a truck and disposed of immediately once the vehicle is full. At the end of the day even partially loaded trucks must

be removed from the US Consulate compound and the contents disposed of properly at authorized dump sites.

The Contractor shall coordinate and supervise the protection, cleaning, and maintenance work at the Project Site during receipt, handling, storage, installation, curing, and similar stages of construction execution to affect minimum exposure to hazards by personnel and minimum deterioration to the Consulate compound.

15. Notification to proceed:

The contractor shall start the work within 30 days of Notice to Proceed. However, prior to the commencement of any excavation, the contractor and the COR shall locate and mark any underground water or electric utilities or other lines which may be present. The contractor is required to provide orange spray paint to mark the ground.

16. Point of Contact:

The COR shall be the main point of contact for this Project. The Contractor shall report to the COR on (a) status of the Project, (b) changes in Schedule, (c) accidents and safety issues, (d) disruptions to the property accessibility; and all other important information pertaining to the Project

17. Contractor's Representative:

The Contractor shall provide a representative on-site during all working hours with the authority to make all decisions on behalf of the Contractor and subcontractors.

18. Site Security:

The contractor shall comply with U.S. Consulate General Karachi security policies.

The contractor shall prepare list of all the names of personnel working for the contractor and any subcontractors, with national ID numbers and submit the list to the Facility Manager for vetting of employees by the RSO at least 30 days prior to commencement of work.

The contractor shall also provide a list of all equipment, listing the manufacturer, model, serial number of all equipment to be used on this project at least 30 days prior to the commencement of any work. Any vehicles utilized by the contractor are also considered equipment. The contractor must provide make, year, model number and license plate number. All vehicles will be inspected prior to entering and prior to leaving the premises.

The COR will assign a holding area for the equipment. Equipment, other than vehicles, should remain on site for the duration of the project to avoid having to have a security screening of it each time it enters the compound.

Any vehicle that is leaking oil will be immediately removed from the U.S. Consulate compound.

The contractor must notify the COR in writing at least 24 hours in advance of the pending removal of any contractor owned equipment.

The contractor is 100% responsible for securing their working materials and equipment. Any damage to facilities or infrastructure, which happens due to a lack of security, will be the responsibility of the Contractor to correct at no cost to the U.S. Government.

19. Coordination meetings:

Pre-Construction Conference: The COR shall conduct an initial construction conference on or near the date of Notification to proceed. Agenda items shall include a review of the general plans, conditions, procedures, and requirements as shall be necessary for the effective scheduling and prosecution of the construction work. Further, all parties shall review security and material delivery requirements, personnel assigned, and contract communication procedures as have been established for the Project. This meeting shall be scheduled and conducted at the place agreed to by the COR and the Contractor.

Construction Coordination Meetings: The Contractor and FM will hold weekly construction coordination meetings to discuss schedule and status of outstanding issues. Weekly coordination meetings shall commence immediately upon mobilization to the Project Site. All parties shall seek the expeditious resolution of issues before they become problems. Progress of the work shall be reviewed. Contractor shall revise, balance, and submit an updated project execution. This review shall be based upon a subset report of the Project Execution Schedule in which all project execution activities have been entered. This review shall include:

- Status of continuing activities.
- New activity starts since last meeting.
- Activity planned completion dates.
- Activity interruptions.
- Activity completions.

Activity interruptions should include the reason for the interruption.

An activity will be considered complete only when it has been approved by the COR.

20. Defects in Work:

Where the Contractor's QC procedures, or those undertaken by or for the USG, disclose patent or latent defects in the works, the Contractor shall provide corrective actions. The contractor shall seek to repair, restore, reconstruct, replace, or otherwise correct defects in the works to comply with Contract Document requirements and criteria. The corrective action shall be acceptable to the COR.

Provide re-inspection or re-testing of corrected work, repeat until compliance is achieved.

Neither the required quality control procedure, nor detection of defects, nor correction of defects, nor the re-inspection or re-testing of corrected work, provides a basis for Contractor's claim for Contract Modification/Additional Compensation, or request for extension of Contract Time.

21. Delays:

Delays that are found to be caused by the Contractor's actions or inactions shall not be a cause for a time extension to the contract completion date.

If the Contractor's execution of the works falls behind the accepted Project Execution Schedule, the Contractor shall take any and all steps necessary within the agreed work period parameters to improve progress. These attempts at recovery shall incur no additional cost to the USG. The Contractor shall execute the works diligently and shall seek to complete all works at or before the agreed upon contract completion date.

2. SCOPE OF WORK

The scope includes to supply install commission test adjust and balance an engineered HVAC solution including all required parameters. This scope will include, but not limited to, an 80USRT Modular Chiller, 04Nos. ceiling suspended type CHW FCUs of 05 Ton each for external installation, Electrical wiring & Panels, Control items with wirings and control Centre/Panel, complete Electrical & Control wiring where required, Sets of CHW primary (if not inside chiller) and secondary pumps' skids with N+1 redundancy configuration, Piping & Pipe Accessories like Valves and Gauges where required and agreed by FM & COR, insulation and jacketing if required. Requirements are to be analyzed and finalized by Post per site requirements with vendors during Prebid visits. The project will be a turnkey based solution and vendor will have to submit all engineering design & equipment submittals for technical review of the proposal.

Project Solution to comply with International Building Codes, Local Codes Standards & Industrial practices, and others such as: ANSI/ASHRAE standard 15,16,&34, ASHRAE 34 & 90.1, ANSI/NFPA standard 70 (NEC), SMACNA, ASTM A48, OSHA, AHRI 550/551/590 & 370. Chiller to conform Intertek Testing Services for construction of chillers and provide ETL/ cETL Listed Mark.

1. SYSTEM DESCRIPTION

A. Supply, Installation, Commissioning, Testing Adjusting & Balancing (TAB) of an 80USRT Modular Chiller:

1. Modular Chiller shall consist of primary or “master” chiller module that incorporates the following:
 - i. Project is based on the chillers (Multistack Model No. ASP20A & Frimec Model No. FAMC301B) or equivalent, but screw type compressors are preferred if qualifies to all features with in same monetary tag.
 - ii. Master controller and master power connection.
 - iii. One or more subordinate chiller modules/circuits.
 - iv. Matching pump module and glycol feeding unit.
 - v. Chillers with shell and tube type evaporator are more suitable over Plate type.
 - vi. Selection of complete chiller set including complete project / equipment is to be made at @46°C Ambient and Chilled water entering and leaving at 7°C & 12°C.
2. Each chiller module shall contain:
 - i. Dual compressors feeding a condenser coil.
 - ii. Thermal expansion valve.
 - iii. Evaporator heat exchanger.
 - iv. Condenser fans.
 - v. Quick connect “Victaulic” or “flange” type couplings for interconnection to supply and return manifold piping.
 - vi. Power quick connect.
 - vii. Factory installed controls that do not require onsite programming.
3. Chiller should have built-in protections for all sub systems. These protections and safeties should include (but not limited to) refrigerant system, electrical system, CHW system. It should include various overload protection devices, phase protections, Temperature Pressure & Flow sensors and switches, all to be factory installed for protecting the system when it experiences any failure of component or subject by/to abnormal external factors and thus always ensuring safe operations for prolonged life span. The system should be provided with protective coatings against ambiance of Karachi. This coating should be well design and factory implemented to ensure resilience against extremely corrosive environment at the coast of Karachi-Pakistan.
4. Factory Run Test: Chiller shall be pressure-tested, evacuated and fully charged with refrigerant and oil, and shall be factory operational run tested with water flowing through the vessel.
5. Approved chiller brands are Multistack, York, Carrier, Daikin, Trane, Sanyo, Frimec, LG, Hitachi. Preference will be given to screw compressors modular chillers with built in pumping module and shell & tube type evaporators keeping in view financial impact.

B. Supply Installation Commissioning and TAB of 04Nos. 05Tons Decorative type (if meets sound criteria) ceiling suspended externally installed (if doesn't meet sound criteria) blower coils type CHW FCUs or as per site/location adjustable FCUs described during pre-bid site walk.

1. Project based on Williams DELUXE -HH-D Models and International Environmental Corporation's Double Wall Construction Belt Driven Horizontal Blower Coil Units.
2. FCUs to provide 16.25KW at medium flow rate of around 1500cfm, but better design and quality FCUs of renowned brands will be accepted if qualifies to all features within same project monetary tag.

3. FCUs to be provided with 3 Way valve, Thermostat and a remote control.
4. Equipment to comply with ASHRAE suggested that an open-plan office noise criterion range of 40 that corresponds to 45dBAC. To meet the criteria the contractor can use sound liners in unit or can extend duct lengths with sound liners but only on the external side of the building. Units which already meets this criterion can be installed inside the building if they are decorative type.
5. All hardware used to hang the FCUs should be of SS & from Hilti brand.
6. Contractor to suggest best possible solution for types, locations & installation of FCUs keeping in view maintenance, cabling, and piping constraints.
7. Approved bands are IEC international Environmental, DAIKIN, YORK, TRANE, FRIMEC, WILLIAMS, & NAILOR INDUSTRIES, CARRIER, YORK.

C. Supply Installation Commissioning and TAB of Chilled Water Pumps (CHWP) System.

Preferably primary chilled water pumps (PCHWP) to be integral part of the modular chiller. If not provided as chillers integral part, then it is to be supplied installed commissioned tested & balanced in all respects as a PCHWP skid. Pumping unit to be supplied in redundancy of N+1 with lead lag configuration completely integrated with chiller controls and installed in piping network so as to ensure smooth chiller operations under all circumstances. PCHWP unit to be fully integrated in all aspects to the complete HVAC solution provided. Approved Brands are PACO, BELL & GOSSETT, EBARA, GOULDS, KSB, GRUNDFOS.

D. Supply & Installation of New pipes' fittings where required for system by COR, matching to existing piping network and newly installed systems, supply and installation of all new pipe accessories like valves, strainers and gauges, and all CHW piping to be jacketed better than the existing with new insulation and cladding. Approved bands are ZURIN, WATTS, KITZ, NIBCO, KELE, TECHMATIC INC, ARMACELL, AEROFLEX.

2. SYSTEM PERFORMANCE REQUIREMENTS

A. Site Altitude: Chiller shall be suitable for altitude in which installed without affecting performance indicated. Adjust affected chiller components to account for site altitude.

B. Full-Load Efficiency (EER): Provide standard chiller unit with minimum EER of 9.5 at AHRI design of conditions.

C. IPLV: Provide standard chiller unit with IPLV less than 0.85 kW/ ton.

D. Seismic Performance: Chillers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

E. Corrosion Resistance: Use materials suitable and coated to resist corrosive environment of Karachi.

3. SUBMITTALS

A. Product Data: Provide a data sheet (cut sheet) that includes: refrigerant type; oil type; rated capacities; IPLV, EER, shipping instructions; voltage, frequency, and maximum amperage; operating weights; furnished specialties; and accessories for each model indicated. Indicate breakdown points for chillers shipped in segments.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

C. Seismic Design Calculations: Provide calculations for selecting vibration isolators and seismic restraints, and for designing vibration isolation bases.

D. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

E. Wire Diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring. Wiring diagram shall indicate operating voltage and frequency which matches power available at location.

F. Coordination Drawings: Floor plans and elevations drawn to scale and coordinating the following, as appropriate:

1. Structural Supports
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements. Determine spaces reserved for electrical equipment.
4. Access requirements around other work, including working clearances to mechanical controls and electrical equipment, and to any building obstructions which may reduce airflow to condenser coils.

H. Product Certificates: Provide certifications required in "Quality Assurance" Article as well as certification that chillers have been started and function properly. Submit chiller's rated capacity, energy efficiency, and water pressure drop.

I. Source quality-control test reports as required in Article on "Source Quality Control." Include copy in Operating and Maintenance Manual. Submit an extra copy for Post Facility Manager.

J. Field Report: Prepare written startup report that records results of tests and inspections. Include copy in Operating and Maintenance Manual. Submit an extra copy for Post Facility Manager.

K. Maintenance Data: For each chiller to include in maintenance manuals.

Note: - All equipment and material quoted to be specified on manuals & submittals with supportive documents (in original i.e. no photocopies) as technical part of proposal for review of the competent authorities. Vendor to approve samples of all material before start of project for approval by POST (COR).

4. QUALITY ASSURANCE

A. ASHRAE Certification: Signed by manufacturer, certifying compliance with ASHRAE 15 for safety code for mechanical refrigeration. Comply with ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements, Product tested in accordance of AHRI STANDARD 550/551.

B. Comply with the OBO Electrical Code (NFPA 70, National Electrical Code as amended by OBO).

C. Comply with UL 465 and 1995.

5. DELIVERY, STORAGE, AND HANDLING

a) Ship water chillers from the factory fully charged with refrigerant or nitrogen.

6. COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs and roof penetrations while doing chilled water piping.

7. WARRANTY

A. Refrigeration Chiller & Compressor Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace chiller and compressors that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.

2. Warranty Period: Five years from date of Substantial Completion for the compressor and one year for all other parts and services/workmanship provided under this SOW.

8. SPECIFICATIONS

A. Air-Cooled Modular Chiller Description: Factory-assembled and tested water chiller complete with casing, compressor, heat exchanger(s), condenser coils and fans, pumps, glycol shot feeder fill system, expansion tank, buffer tank, controls integrated with

compressor operation, interconnecting unit piping and wiring, indicated accessories, and mounting frame. Provide:

1. Cabinet: Provide lifting base, structural frame, and weatherproof housing. Coat base, frame, and housing with a corrosion-resistant coating capable of withstanding a 1000-hour salt-spray test according to ASTM B 117 with a minimum ASTM 1654 rating of "6." If base and frame are constructed of stainless or hot dipped galvanized steel, coating is not required. Provide pitched roof on cabinet to prevent water accumulation.
 2. Acoustical compressor wrap.
 3. Fans: Propeller type, statically and dynamically balanced, with vertical air discharge for high efficiency and low sound; and equipped with heavy-gage, weather-protected fan guard. Fans shall be FRP (Fiberglass Reinforced Plastic) type with corrosion treated hub suitable for use in a marine environment.
 4. Fan Motor: Direct drive, weatherproof, with bearings permanently lubricated, and having built-in current- and thermal-overload protection.
 5. Each module shall include manifold supply and return mains for chilled water constructed of the material required in Tables 2.2-1 and 2.2-2. Provide grooved end connections for interconnection to DN 100 (4 inch standard (4-1/2 inch outside diameter)) piping with Victaulic or flanged type couplings.
 7. Electrical connections, piping, pumps and chiller location shall be capable of accepting additional modules or larger replacement modules to incrementally increase chiller capacity for the space served.
 8. Provide chiller master module with a single point power connection. This shall include pre-engineered wiring for field installation and connection to a factory mounted chiller junction box. The electrical junction box shall incorporate a through the door disconnect with over-current protection. Junction box shall include individual circuit breakers for each Module Set and two spares, and provide a single point of connection to building power.
 9. Provide flexible connections for pump suction and discharge piping.
 10. Each air-cooled modular chiller shall have the following: minimum 2 independent refrigerant circuits; each circuit shall include a thermal expansion valve, a liquid shutoff valve, a filter drier, a site glass with moisture indicator, a liquid line solenoid valve and insulated suction line.
 11. Provide motorized variable flow valves on each module when pumps are variable speed.
- B. Fabricate water chiller mounting frame and attachment to the pressure vessel with reinforcement strong enough to resist water chiller movement during a seismic event.

8.1 POSITIVE DISPLACEMENT COMPRESSORS (SCROLL/SCREW)

A. Description: Positive displacement direct drive with, crankcase oil heater and suction strainer. Provide suction and discharge service valves when modules contain multiple independent refrigeration circuits. The compressor system shall be capable of operating at part-load conditions without increased vibration over normal vibration at full-load operation and shall be capable of continuous operation at its lowest step of unloading. Screw compressor solution is preferred over scroll.

B. Refrigerant: HFC-134a, HFC-407c, or HFC-410a with compatible oil.

C. Refrigerant Compatibility: Seals, O-rings and internal water chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

D. Rotating parts shall be statically and dynamically balanced to ISO 1940/1-1986, G16, or G6.3 as specified.

E. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.

1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
3. Factory-installed and pressure-tested piping with isolation valves and accessories.
4. Oil compatible with refrigerant and chiller components.
5. Positive visual indication of oil level

8.2 HEAT EXCHANGERS

A.1- Evaporator (If Plate Type Heat Exchanger)

1. Description: Provide brazed plate design, fabricated and tested in accordance with ASME code.
2. Material: 316 Stainless steel.
3. Working pressures: Refrigerant side: 3100 kPa Water-side: 1035 kPa.
4. Connections – Refrigerant: Threaded or brazed.
5. Connections – Water-side: Victaulic or flanged

A.2- Evaporator (If Shell & Tube Type Heat Exchanger)

- a) Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
 - b) Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.
1. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code

2. Shell Material: Carbon steel.
3. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
4. Fluid Nozzles: Terminated with mechanical-coupling end connections for connection to field piping.
5. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.
6. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 29 deg C.
7. Remote Mounting: Designed for remote field mounting where indicated. Provide kit for field installation.

B. Air-Cooled Condenser

- a) Condenser Coil: Seamless copper tubes with mechanically bonded copper/aluminum fins. Integral subcooling circuit, leak tested at 3100 kPa.
 1. Fins: Provide copper/aluminum fins. Fins shall be spaced at a minimum of 4.7 fins per centimeter and mechanically bonded with coils.
 2. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
 3. Corrosion-Resistant Coat Coating: Where required, coating method and dry film thickness shall be in accordance with coating manufacturer recommendations and equipment suitable in all aspects for corrosive ambience of Karachi-Pakistan.
- b) Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
 1. Fan Motors: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.
 2. Fan Guards: Steel safety guards with corrosion-resistant coating.

8.3 BUFFER TANK

- A. Provide an ASME labeled, insulated tank (38 mm thickness, closed coil flexible elastomeric thermal insulation), with internal baffle to maximize utilization of tank volume without mixing, pressure rated at 1035 kPa minimum.

8.4 INSULATION

- A. Cold Surfaces: Closed-cell, flexible elastomeric, thermal insulation with thermal conductivity of 0.26k (BTU/HR-FT²-deg F)/in.) maximum. Insulation shall conform to ASTM C 534, Type II, for sheet materials. See tables in Division 23 Section "HVAC Piping Insulation."
 1. Thickness: 19 mm minimum.
 2. Adhesive: Provide adhesive recommended by insulation manufacturer.

3. Insulation: Provide Factory applied insulation over entire surfaces of water chiller components.

- a. Apply adhesive to 100 percent of insulation contact surface.
- b. Seal seams and joints.

8.5 CONTROLS

A. Control Panel: Stand-alone, microprocessor based control panel shall be located on the chiller. Additionally, a separate Motor Control Center (MCC) Panel is to be provided for integrated operations of HVAC systems including pumps and chiller and is to be installed remotely from the chiller. MCC panel to be furnished in complete compliance with IEC & NFPA for outdoor installation in corrosive environment with all protective gears/steps required at the time of manufacturing.

B. Enclosure: Unit-mounted, NEMA 250, Type 1 enclosure, hinged or lockable; factory wired with a single-point power connection and a separate control circuit.

C. Phase Monitor: Provide SymCom brand or approved equal. This device shall prevent chiller from operating during periods when incoming power is unsuitable for proper operation. Power Phase Monitor shall provide protection against the following conditions:

1. Over and Under Voltage (Brown-Out)
2. Phase Rotation
3. Loss of Phase
4. Phase Imbalance

D. Status Display: Multiple-character liquid-crystal display or light-emitting diodes and keypad.

Display the following conditions. Edit list below to suit Project. Verify availability; status displays may vary depending on unit size:

1. Date and time.
2. Operating or alarm status.
3. Operating hours.
4. Outside-air temperature if required for chilled-water reset.
5. Temperature and pressure of operating set points.
6. Entering and leaving temperatures of chilled water.
7. Refrigerant pressures in evaporator and condenser.
8. Saturation temperature in evaporator and condenser.
9. No cooling load condition.
10. Elapsed time meter (compressor run status).
11. Water pump status.
12. Anti-recycling timer status.
13. Percent of maximum motor amperage.
14. Load-limit set point.
15. Number of compressor starts.

E. Control Functions: Edit list below to suit Project. Verify availability; functions may vary depending on unit size:

1. Manual or automatic startup and shutdown.
2. Entering and leaving chilled-water temperature, control set points, and motor load limit.
3. Chilled-water temperature shall be reset based on return-water temperature.
4. External water chiller emergency stops.
5. Anti-recycling timer.
6. Automatic lead-lag switching.
7. Capability for all compressors and pumps to run simultaneously at 100% capacity, initiated at the remote control panel.

F. Manually Reset Safety Controls: The following conditions shall shut down the respective compressor module in which they occur and require manual reset. Edit list below to suit Project. Verify availability; conditions may vary depending on unit size:

1. Low evaporator pressure or high condenser pressure.
2. Low chilled-water temperature.
3. Refrigerant high pressure.
4. Control device failure.
5. Compressor motor current-overload.
6. Starter fault.

G. Accessories:

1. Factory-furnished, chilled-water flow switches for field installation.
2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
3. Factory-furnished neoprene or spring isolators for field installation

8.6 MOTORS

A. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

1. Open-drive motors shall have flanged or flexible coupling suitable for direct connection to compressor.

9. EXECUTION

9.1 EXAMINATION

A. Before water chiller installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping, and electrical to verify actual locations, sizes, and other conditions affecting water chiller performance, maintenance, and operations.

1. Final water chiller locations indicated on Drawings are approximate and will be shared during walk-through. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

9.2 INSTALLATION

A. Install water chillers on existing concrete base.

B. Concrete Bases: Anchor chiller mounting frame to concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 450-mm centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Vibration Isolation: Restrained spring isolators with a minimum deflection of 25 mm.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Charge water chiller with refrigerant and oil if not factory charged.

F. Install separate devices furnished by manufacturer.

9.3 CONNECTIONS

A. Install piping adjacent to chiller to allow service and maintenance.

B. Evaporator Connections: Connect inlet to evaporator with controller-bulb well, shutoff valve, thermometer, strainer, pressure gage, and union or flange. Connect outlet to evaporator with shutoff valve, flow switch, balancing valve, thermometer, pressure gage, and union or flange.

C. Condenser Connections: Connect inlet to condenser with shutoff valve, thermometer, plugged tee, and pressure gage. Connect outlet to condenser with shutoff valve, thermometer, drain line and shutoff valve, strainer, and plugged tee.

D. Refrigerant Pressure Relief Valve Connections: Extend vent piping to the outside without valves or restrictions.

E. Chiller shall be provided with factory installed and wired main disconnect switch and a single point power connection. This includes pre-engineered wiring for field installation and connection to a factory mounted chiller junction box. Junction box shall include individual circuit breakers for each Module Set and two spares, and provide a single point of connection to building power.

H. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

9.4 STARTUP SERVICE

A. Engage a technician, factory trained on equipment being installed, to inspect field-assembled components and equipment installation, including piping and electrical connections, and to perform testing startup service.

1. To facilitate OBO/PDCS/DE/ME representative witness of testing and start-up service, notify Project Director/COR of testing date and location 14 days in advance.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period according to manufacturer's written instructions.
5. Check bearing lubrication and oil levels.
6. Verify proper motor rotation.
7. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
8. Verify and record performance of chilled- and condenser-water flow and low-temperature interlocks.
9. Verify and record performance of water chiller protection devices.
10. Verify proper compressor phasing in response to increasing and decreasing load conditions.
11. Test and adjust factory-mounted (and if used remote panel) controls and safeties.
12. Replace any and all damaged or malfunctioning controls and equipment.

9.5 DEMONSTRATION AND TRAINING

A. Engage technician, factory-trained on equipment being installed, to demonstrate and train Government's maintenance personnel to adjust, operate, and maintain chillers and complete HVAC Solution thus provided. Provide minimum of two 4-hour training sessions, with each session held at a distinctly different time period to accommodate personnel identified by COR based on input from Post's Facility Manager. Review data in maintenance manuals with post maintenance personnel.