PART 1 - GENERAL

1.01   SUMMARY

Section includes equipment and performance criteria for furnishing all labor and materials for the installation and programming for Energy Management System for HVAC Systems utilizing wireless communication with cloud based servers.

1.02   RELATED SECTIONS:

A.   Division 01: General Requirements

B.   Section 23: Heating, Ventilating, and Air-Conditioning (HVAC)

1.03   SUBMITTALS:

A.   Shop Drawings and product data in accordance with the specifications.

B.   All shop drawings shall be prepared in AutoCAD 2000 or newer. In addition, Contractor shall provide drawings in electronic format with x-ref and layer information to other trades as required.

C.   All submittals shall be bound or in a three ring binder with a table of contents and related section tabs. Five (5) copies shall be submitted to the Architect or engineer for distribution and review.

D.   Shop drawings shall include basic floor plans depicting locations of all equipment and wiring, installed by others, to be controlled by system and locations of thermostats, gateways and other equipment provided under this section. Drawings shall also show location of electrical power, low voltage wiring and data ports, provided by others, required for proper installation of systems of this section.

E.   Submittal data shall contain manufacturer's data on all hardware and software products required by the specification.

F.   Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all documents for accuracy.

G.   The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

1.04   SCOPE OF WORK

A.   Except as otherwise noted, the control system shall consist of all thermostats, and gateways to fill the intent of the specification and provide for a complete and operable system.

B.   The EMS contractor shall review and study existing building/site conditions where applicable and all new construction drawings for the project including HVAC drawings and the entire project specifications to familiarize themselves with the equipment and system operation prior to prior to bidding and submittal of a bid/price and notify the owner immediately of any conflicts between the project and the scope of work of this section, including work to be completed by others.

C.   All equipment and installation of control devices associated with the equipment listed below shall be provided under this Contractor.

D.   When the EMS system is fully installed and operational, the EMS Contractor will make themselves available to meet with the designated representatives of the owner to review the as-installed condition of the system. At that time, the EMS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.

E.   The Contractor shall furnish and install a complete EMS control system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification.   Provide and Install EMS controls for the HVAC Equipment as noted on the drawings:

F.   Provide technical support necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and the owner's team.

G.   Contractor shall provide one training session in the operation of the system, for owner's personnel.

H.   All work performed under this section of the specifications will be in compliance with all codes and regulations as mandated by the authority having jurisdiction.

1.05   SYSTEM DESCRIPTION

A.   The Energy Management System (EMS) shall consist of thermostats, gateways and related accessories as indicated below and all related programming for a complete and fully operational web based management system using a cloud server program complying with the following specifications.

          The entire Energy Management Solution (EMS) shall include a network of commercial Internet programmable thermostats which use IEEE 802.15.4 mesh wireless communication protocol to reach a Wireless Gateway (WG). The WG must connect to the owner's wide area network (WAN) over a TCP/IP connection. Access and control of EMS is through a web based management tool which sits on a cloud server and must be accessible either locally or remotely via the Internet.

1.06   WORK BY OTHERS

A.   The EMS Contractor shall coordinate with other contractors prior to performing the work on this project and cooperate as necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work prior to fabrication and installation. The owner's representative shall be immediately notified if an area of conflict occurs between trades prior to fabrication and installation. EMS Contractor shall provide field supervision to the Mechanical Contractor for pre-installation of control components.

B.   Low voltage thermostat wiring between equipment and thermostat locations shall be furnished and installed by others. Unless noted otherwise all new low voltage wiring shall be multiple conductor thermostat wiring (wire count as indicated in Thermostat Manufacture's installation instructions) installed per owner's specifications. (Wiring in existing installations shall be minimum 3 conductor / 24 gauge wires per EMS manufacturer's standard specifications, multiple c conductor/24 gauge thermostat wiring preferred - see Installation Instructions for specific conductor counts depending on heating and cooling modes of existing equipment.)

C.   Related work provided by others:

    1.   110 V outlets shall be provided within 5 feet of each gateway location.

    2.   1 Data port shall be provided within 10 feet of each gateway location.

D.   Equipment start-up and servicing

1.07   CODE COMPLIANCE

A.   Provide EMS components and ancillary equipment which are code compliant.

C.   All wiring shall conform to the National Electrical Code.

B.   All products of the EMS shall reside with the following agency approvals.

    1.   California 2013 Title 24 Compliant.

    2.   California Energy Commission Occupant Control Smart Thermostat (OCST) certified.

    3.   OpenADR2.0 certified.

1.09   SYSTEM STARTUP & COMMISSIONING

A.   Each EMS component in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the EMS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written

report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.

B.   The EMS Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The EMS Contractor shall have a trained technician available on request during the balancing of the systems. The EMS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract to assist with functional testing of system as it relates to EMS.

1.10   TRAINING

A.   The EMS Contractor shall provide training for two (2) owner's representatives and/or maintenance personnel.   The EMS   Contractor shall provide on-site training to the District's representative(s) and maintenance personnel per the following description:

B.   On-site training shall consist of a minimum of (1) hours, as indicated above of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include

1.   System Overview

2.   System Software and Operation

3.   System access

4.   Software features overview

5.   Changing set points and other attributes

6.   Scheduling

7.   Editing programmed variables

8.   Displaying color graphics

9.   Running reports

10.   Workstation maintenance

11.   Application programming

12.   Operational sequences including start-up, shutdown, adjusting and balancing.

13.   Equipment maintenance

1.11   OPERATING AND MAINTENANCE MANUALS

A.   The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire EMS. This documentation shall include specific part numbers.

B.   Following project completion and testing, the EMS contractor will submit as-built documentation reflecting the exact installation of the system.

1.12   WARRANTY

A.   The EMS contractor shall warrant the system for 12 months after system acceptance and beneficial use by the District. During the warranty period, the EMS contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification. EMS equipment shall be warranted for a period of 5 years from the time of system acceptance.

B.   Warranty of equipment is limited to replacement of defective products.

PART 2 - PRODUCTS

2.01   Acceptable Manufacturers

A.   Unless noted otherwise, all products shall be of a single manufacturer. The standard of design and quality shall be products as manufactured by Pelican Wireless Systems,

B.   Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional requirements of the specified product. A request for Architect/Engineer's approval must be submitted with complete technical data to allow for proper evaluation. All materials for evaluation must be received by Project Manager at least 10 days prior to bid due date.

2.01   WIRELESS GATEWAY (WG)

A.   A single WG shall be capable of providing communication between a dedicated cloud server using TCP/IP and the on-site Internet Programmable Thermostats using the IEEE 802.15.4 wireless communication protocol. Additional WGs can be used for a single site, but each WG must meet or exceed these requirements

B.   The WG must provide the following hardware features as a minimum:

    1.   Single Ethernet Port.

    2.   One micro-USB 5VDC power input.

    3.   2.4 GHz IEEE std. 802.15.4 built-in communication processor.

C.   The WG shall provide the communication link between the entire system and a cloud based server. Communication with cloud server shall be secured using AES (Advanced Encryption Standard).

D.   The WG shall be able to support 2000 Internet Programmable Thermostats.

 2.02   INTERNET PROGRAMMABLE THERMOSTAT (IPT)

A.   Internet Programmable Thermostat shall be a wireless communicating commercial programmable thermostat that uses IEEE 802.15.4 for networking communication and a wiring terminal block for controlling a single zone HVAC unit.

B.   The IPT shall provide a keypad for setting:

1.   Temperature Set points.

2.   System Mode (Heat, Cool, Auto, Off).

3.   Fan Mode (Auto, On).

4.   Light Button.

C.   The IPT shall include a wiring terminal for controlling a single zone HVAC unit. The wiring terminal must be able to be removed from the IPT for installations where only 3-wires exist or are available between where the IPT will be placed and its connection with the HVAC unit it will be controlling. Over these 3-wires the thermostat must still be able to control the HVAC unit based on these specifications.

D.   The IPT must be configurable using a Web Based App. No thermostat configuration, other than setting the IPT to Conventional, Heat Pump - O, or Heat Pump -B, shall be done at the thermostat. Web based Configuration Setting options shall include:

1. Naming the thermostat

2. Grouping multiple thermostats.

3. Heat Pump or Conventional system setting.

4. If Heat Pump; reversing valve O or B setting.

5. Cycles Per Hour (1 - 6).

6. Anticipation Degrees (0˚F - 0.5˚F)

7. Calibration Degrees (2.0˚F - -2.0˚F)

8. Heat Stages (0 - 2)

9. If Heat Pump; Aux Heat (Disabled and/or Enabled Option)

10.   Cool Stages (0 - 2)

11.   Fan Stages (1 - 2)

12.   Fan Circulation Minutes Per Hour.

13.   Temperature Display (Fahrenheit or Celsius)

14.   Heat Range Temperature Setting Limitation

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15.   Cool Range Temperature Setting Limitation

16.   Ability to disable and enable Keypad Control through schedule.

17.   Heat consumption (kw, btu, ton, or watt)

17. Cool consumption (kw, btu, ton, or watt)

18. Notification Sensitivity (High, Medium, Low)

19. Alarm of exceeding temperature based on a Safe Range

20. Schedule set times (2, 3, 4, or Variable).

E.   IPT settings and control through the Web Base App shall be in real-time and include:

1.   Space Temperature

2.   System Mode (Heat, Cool, Auto, Off).

3.   Fan Mode (Auto, On).

4.   Current set point.

5.   Relay status (Heat/Cool and Fan).

6.   Historical Trend Graphs.

7.   Scheduling

8.   Lock and Unlock Entire Thermostat's Keypad

9.   Lock and Unlock the Thermostat's Fan Mode setting Only

2.03.   WEB BASED GRAPHICAL USER INTERFACE

A.   The Web Based App (WBA) shall be able to run on any PC that uses Safari, Chrome, Firefox, or any other web browser that meets these browsers' functionality.

B.   The WBA Platform shall be able to run on any Internet Accessible Smartphone and/or Tablet that has a Web Browser compatible with HTML5.

C.   The WBA shall allow up to a minimum of 100 simultaneous users/clients to access the Energy Management System.

D.   The Web Based client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required.

2. HTML programming shall not be required to display any graphics or data on the Web page.

3. Storage of data shall reside within the cloud server and shall not sit within the client's computer or device. EMS that requires data storage on a client computer or an on-site server is not acceptable.

    4. Users shall have administrator and user definable access privileges.

    5. OpenAPI interface with XML data output.

E.   Schedules:

    1. The WBA shall provide user with access to setting Internet Programmable Thermostat (IPT) schedules. Up to 12 schedule periods per day shall be available for each IPT.

    2. Schedules shall be available as Weekly (7-day), Daily, or Weekday/Weekend (5-2).

    3. The WBA shall provide the user the ability to:

        a. View Schedules.

        b. Add/Modify Schedules.

        c. Assign Thermostat to a Group Schedule.

        d. Delete Schedules.

F. Trending

    1. The WBA shall provide real-time trend information on:

    a. Each IPT's space temperature.

    b. Each IPT's temperature set points.

    c. Each IPT's current call; heat, cool, and/or fan.

    d. Each IEE's call for economization

    2. The WBA shall be able to record and provide at least two years of past trend data for every thermostat in the wireless network. Trend data shall include:

    a. space temperature; with resolution of every 1/10th of a degree Fahrenheit.

    b. IPT's temperature set points.

    c. indication of whether the thermostat was calling for; heat, cool, and/or fan.

3.   Trend data shall be viewable on the WBS

G.   Alarm Notifications

    1. The WBA shall provide automatic alarming functionally based on real-time monitoring of at least:

    a. space temperature and temperature change.

    b. IPT's temperature set points.

    c. IPT's current call; heat, cool, and/or fan.

    2. The WBA shall be able to provide a user with the ability to:

    a. View Alarms.

    b. Set Alarm Notification sensitivity level to High, Medium, or Low.

    c. Delete Alarms.

3. Alarms shall be able to be sent via email and/or text message to up to 100 or more clients.

H.   Consumption Usage

1. The WBA shall be able to calculate and graphically display the consumption of running a single zone HVAC unit based on a user defined HVAC unit heat and/or cool consumption rate multiplied by the thermostat heat/cool call time.

2. The WBA shall be able to calculate and graphically display the cost of consumption of running a single zone HVAC unit based on taking a user defined HVAC unit heat and/or cool consumption and multiplying that by the client defined cost per kw and/or therm.

3. The WBA shall be able to display consumption usage for a single thermostat, multiple thermostats at a single time, or all the thermostats in the EMS.

4. The WBA shall be able to record and display up to at least two years of consumption usage information.

2.04. Wired Remote Temperature Sensors and Digital Alarm Input

A.   Input Temperature Sensor (ITS).

   a. The ITS shall connect to the Internet Programmable Thermostat over 3-wires.

   b. ITS shall provide at least one external 10K Type II thermistor temperature sensor input.

   c. Web Based App shall be able to record and provide at least two years of past temperature data for ITS.

   d. The trend data shall be viewable on the WBA.

   e. ITS must be accurate to ±1.0°F

   f. ITS must be able to be installed up to 500' away from IPT using standard thermostat wiring.

2.05. Internet Enabled Economizer (IEE)

   a. The IEE shall connect to the Internet Programmable Thermostat (ITS) with ONLY 3-wires. No additional wiring must be required between the IEE and the ITS to gain complete Title 24 compliant economization control.

   b. IEE shall provide up to three 10K Type II external thermistor temperature sensor input.

   c. Web Based App shall be able to record and provide at least two years of past data for IEE. Data must represent historical representations of:

      a. Calls for Economization

      b. Outside Air Damper Position

      c. Supply and Outside Air Temperature

d.   The trend data shall be viewable on the WBA.

e.   IEE must be able to send California Title 24 Fault and Diagnostics codes to the WBA, email addresses, and or text messages.

f.   IEE must be able to be installed up to 500' away from IPT using standard thermostat wiring.

g.   IEE must have a settable 0-10VDC output for Outside Air Damper Actuator control.

h.   IEE must have a settable 0-10VDC output for Variable Frequency Drive (VFD) control.

   a.   IEE must be configurable for different VFD speeds based on calls for cold, heat, and ventilation.

i.   IEE must have a 0-10VDC input for Outside Air Damper Position Feedback.

2.06. Wireless Proximity Sensors

A.   Wireless Proximity Sensor (WPS).

a.   The WPS shall connect with the Internet Programmable Thermostat over the 802.15.4 wireless network.

b.   WPS shall be powered by 2 AA batteries or equivalent.

c.   WPS must be able to be used for either:

   i.   Accepting a motion sensor's 2-wire dry contact output.

      1.   The WPS shall be able to notify an Internet Programmable Thermostat if a motion sensor's dry contact is in either the open or closed position.

      2.   Dry contact open positions will indicate that the space is occupied and the IPT must be able to automatically setback its temperature setting by a range of 0°F - 10°F or OFF.

      3.   Dry contact closed position will indicate that the space is unoccupied and set the temperature to a comfort setting when the space is occupied.

      4.   Setback settings and comfort settings must be settable through the Internet Programmable Thermostat's schedule through the Web Based App (cannot be settable at thermostat).

      5.   Web Based App must be able to display when a space is "Unoccupied".

   ii.   Detecting if a Window OR Door is Opened or Closed.

      1.   The WPS must have a built-in magnetic sensor and come with a magnet that can be installed on a door OR window.

> 2. The WPS must be able to notify an Internet Programmable Thermostat if the door is open and the IPT must automatically turn to the OFF position.
>
> 3. The WPS must be able to notify an Internet Programmable Thermostat if the door is closed and the IPT must automatically return to its last temperature and system settings.
>
> 4. Web Based App must be able to display when the Door OR Window is Open and must be able to be set to indicate "Door" or "Window".

d. Web Based App shall be able to notify if the WPS batteries are low and record and provide at least two years of past history on occupancy and/or door/window status for each space a WPS is installed in.

e. The trend data shall be viewable on the Web Based App.

f. Internet Programmable Thermostat must be able to connect with at least 8 WPS, each WPS must have a unique serial number and each WPS shall be settable, through the Web Based App, as either a motion sensor input or as a door/window sensor.

PART 3 – EXECUTION

3.01   Contractor Responsibilities

A.   General

1.   Installation of the Energy Management System shall be performed by an approved Contractor.   The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor without prior written approval of the owner.

B.   Demolition

1.   Remove controls which do not remain as part of the Energy Management System. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.

C.   Access to Site

1.   Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the District or the District's Representative.

D.   Code Compliance

1.   All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations.

E.   Cleanup

1.   At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.02   Wiring, Conduit, and Cable

A.   All control wires between HVAC units and thermostat locations to be furnished and installed by others. The EMS contractor shall not begin work on this contract until all wiring is installed to the satisfaction of the EMS contractor. The EMS contractor shall provide wiring between remote temperature sensors, TA1 and thermostats as required, unless noted otherwise in drawings or specifications.

3.03   Hardware Installation

A.   Installation Practices for Devices

1.   All devices are to be mounted level/plumb and per the manufacturer's installation documentation.

B.   Identification

1.   Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.

2.   All field enclosures, other than controllers, shall be identified with a back lite nameplate. The lettering shall be in white against a black or blue background.

3.   Junction box covers will be marked to indicate that they are a part of the EMS system.

4.   All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.

5.   All I/O field devices inside FIP's shall be labeled.

C.   Existing Controls.

1.   Existing controls are not to be reused. All EMS devices will be new.

D.   Control System Switch-over

1.   The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.

E.   Location

1.   The location of sensors is per mechanical and architectural drawings.

2.   Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.

3.   If Input Temperature Sensor(s) (ITS) is used as Outdoor air sensor, Outdoor air sensors will be mounted on the north building face directly in

the outside air. Install sensors such that the effects of heat radiated from the building or sunlight is minimized.

    4.   If any line voltage electrical control is being installed, field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.04   System Programming

A.   General.

    1.   The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software.

    2.   Contractor shall work with owner's representative to determine programming parameters including but not limited to hours of operation, set points, system variables, thermostat naming, and site naming. Thermostat & Site naming shall be performed by the contractor. Naming convention (equipment # or name, or space served) shall be provided by or agreed upon with the Owner.

3.05   Commissioning and System Startup

A.   EMS device functional testing.

    1.   Each system for which a EMS device has been installed shall be tested for proper installation and functional operation. Test shall include on-site control test to verify each wireless device is responding to signals sent from cloud based servers and responding in accordance with manufacture's specifications.

<div align="center">END OF SECTION</div>