

Statement of Work

PROJECT TITLE: Replace HVAC Heating Hot Water Exchangers

PROJECT LOCATION: Heating Equipment Room (EB-135) at Building 100
3801 Miranda Avenue, Palo Alto, California
Veterans Affairs Palo Alto Health Care System (VAPAHCS)

PROJECT NO. 640-13-106P

DATE: December 20, 2012

EXECUTIVE SUMMARY: Replace two (2) existing HVAC heating hot water exchangers with two (2) new heating hot water exchangers and auxiliary components serving HVAC reheat coils in Building 100 at VAPAHCS campus.

PROJECT SCHEDULE: Complete work including field investigation, submittals, shop drawings, construction, inspection, construction touch-up, start-up, commissioning, training, and project deliverables for this project within 100 calendar days from "Notice to Proceed".

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1 BACKGROUND

- 1.1 Two (2) existing heating hot water exchangers are located in Heating Equipment Room (EB-135) at Building 100. Each heat exchanger circulates 804 GPM of heating hot water at 180 Degree F output to HVAC reheat coils. Both exchangers are heated by steam with steam pressure at 25-30 psig. Steam condensate is returned to existing condensate line.
- 1.2 Existing Heating Hot Water Sequence of Operation
- 1.2.1 Hot water Heating Pumps: The hot water heating system is served by three existing hot water heating pumps equipped with variable speed motor controllers (VSMC). Two pumps are required to meet the hot water requirements and the third pump is to be utilized as a standby. The "Lead" pump operates continuously. The Engineering Control Center (ECC), via the DCP, monitors the hot water loop differential pressure transmitter and control pump speeds as required to maintain a differential pressure. If the differential pressure set point cannot be maintained by one pump for a continuous 5 minutes period, the "ECC", via the DCP, enables the second pump in the "Lead-Lag" sequence and the speed of both pumps is equalized and controlled in parallel to maintain set point. If the water flow is less than what one pump can produce at 100% speed for a continuous 5 minute period, the "Lag" pump is de-energized. If an enabled pump's operation is not confirmed by its respective "VSMC" KW output signal and/or the hot water heating flow meter, a pump failure alarm is reported to the "ECC", via the DCP and the next pump in the "Lead-Lag" sequence enable if not already operating. Once a month, the "ECC" selects the pump with the fewest total operating hours to be the "Lead" pump in the "Lead-Lag" sequence.
- 1.2.2 Hot Water Heating System Control: The system is served by two (2) steam to hot water heat exchangers (or call converters). Both converters are needed to meet heating demand. Each converter has a water isolation valve, which is closed when the converter is not operational. Each converter is equipped with two (2) steam control valves (1/3 load and 2/3 load). When one pump is operating, the "Lag" converter isolation valve is closed and the "Lead" converter's small (1/3 load or vernier) steam control valve is enabled for automatic control. When there is a second stage heating demand (2 hot water pumps are operating) the "Lag" converter's isolation valve is open and its vernier steam control valve is enabled to operate in parallel with "Lead" converter's control valve.
- 1.2.3 Vernier control: On a heating demand, the small steam control valve (Vernier steam flow capacity) modulates to maintain hot water supply temperature set point. If the valve reaches the 100% open position, large steam valve (2/3 load) starts to open slowly until set point is attained. If the heating demand decreases, the small (i.e vernier) steam control valve modulates position as required to maintain set point. If the heating demand decreases to the point that attains the small steam valve in close position, the large steam valve is slowly closed with set point maintained by the small valve.
- 2 SCOPE OF WORK: Provide all labor, materials, equipment, transportation, supervision, field investigation, shop drawings, electrical power,

controls, startup, commissioning, training, project documentation, as-built drawings, and warranty necessary to replace two (2) existing heating hot water exchangers with two (2) new heating hot water exchanger and auxiliary components at Building 100. The work includes, but is not limited to the following:

- 2.1 Phasing Sequence: The heating hot water supply to Building 100 shall maintain functioning all the time during the construction. In order to avoid any heating hot water interruptions and shut-down, demolition shall be coordinated with new installation of heat exchangers and auxiliary components (e.g. steam control valves with electric actuators, heating hot water valves with electric actuators, water filter package, etc.). Contractor shall submit construction schedule and detail phasing sequence description or action plan to Contracting Officer's representative (COR) for review prior to performing any works. In addition, Contractor shall notify the COR two (2) weeks in advance of the proposed date of starting work in the construction area.
- 2.2 Demolition Work: Completely demolish the equipment and components that include, but are not limited to, steam/water heat exchangers (100-C1 & 100-C2), water filter package (100-WF5), steam control valves (V-3, V-4, V-5, & V-6) with pneumatic actuators and heating hot water valves (V-1 & V-2) with pneumatic actuators. Disposal of the existing equipment and components. Provide disposal confirmation letter to the COR after completion of the disposal.
- 2.2.1 Existing heating hot water exchanger #1 is made by Adamson, serial # HE568LL1, national board # 58156, 804 gallon per minute (gpm) flow capacity, rated at 125 psi working pressure.
- 2.2.2 Existing heating hot water exchanger #2 is made by Adamson, serial # HE568LL2, national board # 58157, 804 gallon per minute (gpm) flow capacity, rated at 125 psi working pressure.
- 2.2.3 Existing heating hot water filter package is made by Filterrite.
- 2.3 New Construction Work for Heating Hot Water Exchangers/Converters**
- 2.3.1 New heat exchangers shall be designed, constructed, inspected and tested in accordance with the latest edition of the following codes and standards.
- 2.3.1.1 Design, Fabrication and Inspection: Per ASME Boiler and Pressure Vessel Codes Section VIII, Div. 1.
- 2.3.1.2 Materials: Per ASME Boiler and Pressure Vessel Code Section II and ASTM standards.
- 2.3.2 Performance of Each New Heat Exchanger:

Performance	Shell Side	Tube Side
Fluid Circulated	Steam	Heating Hot Water
Total Fluid Entering	6,000 lbs/hr	804 GPM

Temperature In	260 Deg. F	140 Deg. F
Temperature Out	Factory to determine	180 Deg. F
Maximum fluid pressure drop	Factory to determine	10 psi

2.3.3 Each heat exchanger shall be constructed of steel tube sheet, minimum $\frac{1}{4}$ " nominal thick of shell with end plate, minimum 18 gage of 90/10 copper/nickel (CuNi) tubes with removable tube bundle. The shell and tube sides shall be ASME rated and designed at 125 psi of design pressure at 375 Degree F. The tube side shall be factory tested at minimum 250 psi of test pressure. The shell side shall be factory tested at 1.5 times the design pressure.

2.3.4 In order to avoid piping modifications, Contractor shall perform field measurement of the available space and existing utility connection locations in order to fit the new heat exchangers.

2.3.5 Shell insulation shall comply with ASHRAE 890.1 and suitable for operating temperature. The entire shell and nozzles shall be completely surrounded except connections and controls.

2.3.6 Contractor shall provide factory pressure test reports and ASME U-1 certifications to the Contracting Officer's representative for review.

2.4 New Construction Work for Auxiliary Components

2.4.1 Heating Hot Water Filter Package (100-WF5): The water filter package shall consist of single bag housing and at least 5 micron rated bag filter. It shall handle minimum 90 GPM of heating hot water. The filter housing shall be rated at 150 psi of design pressure at 300 Degree F and constructed of 304 stainless steel material. The housing shall be factory hydro-tested. The external surface of the housing shall be coated with chemical resistant coating. The housing lid shall have 3-bolt swing closure with 0.25-inch NPT vent port and Viton O-ring for lid seal. Three (3) drill in-place legs shall be factory welded to the housing. The housing shall include 2-inch side inlet and 90 Degree elbow bottom outlet with NPT connection type, two (2) of 0.25-inch NPT pressure ports and one (1) 0.75-inch NPT drain port. The bag filter material shall be monofilament mesh Nylon, 5 micron size, and rated at 250 Degree F. Contractor shall provide new isolation ball valves, drain valves, calibrated pressure gauges (0-100 psi range), circuit setter (0-200 GPM range), dielectric unions, piping, and fittings.

2.4.2 Steam Control Valves (V-3, V-4, V-5, & V-6): Modulating steam control valve (V-3 or V-4) shall be 2-inch globe type valve, class 250 with electric actuator and able to modulate 2,000 lbs of steam capacity load at 25-30 psig steam pressure to its respected new heat exchanger. Floating steam control valve (V-5 or V-6) shall be 3-inch globe type valve, class 250 with electric acutator and able to regulate 4,000 lbs of steam capacity load at 25-30 psig steam pressure to its respected new heat exchanger when V-3 or V-4 is either full open or closed. The electric actuators shall accept 24 VDC power and include 4-20 mA analog

input signal, UL listed. The valves shall be spring return (i.e. fail in a closed position).

- 2.4.3 Heating Hot Water Control Valves (V-1 & V-2): Provide 8-inch lugged body butterfly valves, 2-position non-spring return electric actuators, open/closed end position switch status feedback, and manual override wheels. Each valve shall be able to regulate 804 GPM of heating hot water to its respect heat exchanger. The electric actuators shall accept 120 VAC power and include on/off digital output (DO) signals, UL listed.
- 2.4.4 Provide a new transformer panel (120 VAC/24VDC, 500VA) and new Building Automation System (BAS) modules in the existing BAS heating plant control panel.
- 2.4.5 Provide all electrical power supply (including wiring and conduit) to the new actuators from the nearest available electrical panel (120 VAC, 15 Amp). The panel shall have emergency backup. Provide control signals (e.g. 4-20mA, on/off) with wiring and conduit to/from the new BAS modules to the new electric actuators. Program the BAS to execute the new sequence of operations. Configure new points in the BAS. Modify the existing graphic to correctly represent the new points of control. Test the system and complete commissioning forms. Provide an As-Built documentation package of the final system installation and commissioning including all the original submittal documents updated as executed.
- 2.5 After connecting the new equipment to the existing piping system, perform pressure test to the new equipment and make sure the test is passed per the latest version of applicable codes. After completion of the work, provide test reports and as-built documentation package to the Contracting Officer's representative (COR).
- 2.6 Provide labor and materials to perform system start-up and commissioning to make sure the system is fully operating.

3 DELIVERABLES

- 3.1 At the pre-con, Contractor shall provide a baseline project schedule with adequate detail of construction activities, including construction phasing.
- 3.2 At the pre-con, Contractor shall provide one (1) set of system start-up and commissioning plan.
- 3.3 Shop Drawings: Drawings shall indicate layouts, dimensions, materials, and other information required to fully describe the items being installed. In addition to shop drawings for review, submit one reproducible (vellum), full size, set of as-built shop drawings at completion of contract work. If drawings are prepared using computer aided drafting, electronic files shall be compatible for use with AutoCad file format. AutoCad files shall follow VHA National CAD Standard Application Guide. Submit electronic files in addition to hard copy drawings.

- 3.4 Catalog Cuts: Catalog cuts shall contain manufacturer's description, specifications and sketches of the material and equipment provided. The catalog cut shall contain sufficient information which can be used to determine compliance with these specifications.
- 3.5 As-Built Drawings: Contractor shall provide labor and perform final installation verification along with the COR. Contractor shall provide as-built drawings in AutoCad and pdf file formats. Besides four (4) sets of as-built drawings hard copies (24 x 36 inch), provide complete set of CD Rom disks of as-built drawings in AutoCad (in no earlier version than 2000) and pdf file formats to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR. AutoCad files shall follow VHA National CAD Standard Application Guide.
- 3.6 Operation and Maintenance Manual: (four copies each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for startup, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all components parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory, and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- 3.7 Test Results: Submit test results as described in the scope of work and individual referencing specification section.
- 3.8 Instruction/Training: Contractor shall furnish the services of a competent instructor to give full instruction to VA's HVAC maintenance and operational personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the Re-circulating water heating system. Instruction shall be provided for minimum of four (4) hours.
- 3.9 Standard Compliance: When materials or equipment must conform to the latest standards of organizations such as the American Society for Mechanical Engineering (ASME), the American Society for Testing and Materials (ASTM), and Underwriters Laboratories (UL), proof of such conformance shall be submitted to the COR for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform the test. The certificate shall state that the item has been tested in accordance with the specified organization's standard.

3.9.1 ASME U-1 certification for Heat Exchangers.

3.9.2 Calibration certification for Pressure Gauges.

- 4 TECHNICAL SPECIFICATIONS:** The work shall conform to the attached specifications sections (as applicable) listed below, which form a part of these specifications and scope. The specification sections are:

SECTION 01 00 00 GENERAL REQUIREMENTS

SECTION 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT

SECTION 02 41 00 DEMOLITION

SECTION 13 05 41 SEISMIC RESTRAINTS FOR NON-STRUCTURAL COMPONENTS

SECTION 22 35 00 HEAT EXCHANGERS AND FILTER PACKAGE

SECTION 23 05 11 COMMON WORK RESULTS FOR HVAC

SECTION 23 07 11 HVAC AND BOILER PLANT INSULATIONS

SECTION 23 12 13 HYDRONIC PIPING

SECTION 23 22 13 STEAM AND CONDENSATE HEATING PIPING

SECTION 26 05 11 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

SECTION 26 05 21 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)

SECTION 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

NOTE: For other related specification sections (not included above, but are required to accomplish the project) follow applicable specification sections of, VA master specs.

Its web site is <http://www.cfm.va.gov/TIL/spec.asp>

- 5 REGULATIONS:** All construction work shall meet the latest edition of VA design manuals, VA master specs, VA Standard, NFPA, ASHRAE, SMACNA, NEC, ADA, federal, state, local codes and regulations, and all other applicable codes.

- 6 CONCEPTUAL DESIGN DRAWINGS:** The drawings listed below are included for conceptual only.

Drawing #	Drawing Title
GI-001	Vicinity Map, Location Map, Drawing Index, Legend and Schedules
MP-101	Demolition and Construction Plans

MP-601 Heating Water and Steam Piping Flow Diagram

- 7 **REFERENCE DRAWINGS:** The drawings listed below are included for reference only. They are known not to accurately reflect all existing conditions. Field verify all necessary information.

Drawing #	Drawing Title
100-H3.1.1	Chilled Water Plant - Lower Level Plan
100-H5.4.1	Control Diagram & sequence of Operation - Heating Water System
100-H7.3.1	Heating Water & Steam Piping Flow Diagram

- 8 **LIAISON:** The technical project point of contact (POC) is Karen Lee at (650) 650-5000, ext. 67322 or Mr. Duke Falcon at (650) 650-5000, ext. 64952.
- 9 **SITE VISIT:** Investigate the site per FAR 52.236-3 to ascertain the general and local conditions which can affect the work or its cost. Access to the site will be available during normal working hours. Contact Mr. Duke Falcon at (650) 650-5000, ext. 64952 to arrange site access.
- 10 **CONTRACTOR SECURITY REQUIREMENTS:** At no time will the vendor be in contact or have access to VA sensitive information. VA sensitive information procedures will be followed per VA Handbook 6500.6. The Contractor will adhere to VAAR 852.252-75, Security Requirements for Unclassified Information Technology Resources (Interim-October 2010).
- 11 **CONTINUITY OF STATION OPERAITON:** Schedule work to minimize interference with the facilities' normal operations. Perform all on-site work between the hours of 7:30 AM and 4:30 PM ("regular hours"), Monday through Friday (Federal Holidays excluded). Shutdowns, final connection works, and system startup are required to be performed during weekends, Federal holidays, or off hours unless instructed, otherwise without any extra premium.
- 12 **RECYCLING AND DISPOSAL OF REFUSE:** Refuse, excess or waste materials resulting from construction operations shall become the property of the Contractor and shall be recycled and/or disposed of off Government property. All disposals shall be done in accordance with federal, state, and local laws and regulations and as specified in Section 01 74 19.
- 13 **WARRANTY:** Provide manufacturer's standard warranty for the heating hot water exchangers, water filter package, steam control valves, and actuators. Contractor shall provide labor, materials and instruments for 12-month warranty from the date of acceptance.

END OF SECTION