

Statement of Work/Specifications  
575-13-105  
Correct Retro-Commission Deficiencies and Upgrade HVAC Controls  
Grand Junction, CO  
December 4, 2013

## **Project Overview**

The Department of Veterans Affairs (VA) intends to procure services of a qualified contractor to correct specific building mechanical equipment and control deficiencies identified in a recent retro-commission (RCx) study. Included are variable air volume (VAV) box test and balance, replacing orifice type steam traps and hot water tanks, and the annual service/maintenance on the existing building automation system. This contract is primarily a service related contract at the Grand Junction, Veterans Affairs Medical Center (VAMC) located at 2121 North Avenue, Grand Junction, CO. See Attachment 1 for the VAMC campus map and specific task locations.

## **Background**

The VA is pursuing this project as part of the ongoing energy reduction program as prescribed under Federal Mandates for sustainability and energy reduction. In 2010 - 2011 the VAMC completed a comprehensive retro-commission (RCx) study/energy audit that focused primarily on the building air handling units, but included some subsystems. Shortly after the RCx the energy engineers from VISN 19 performed an additional audit that culminated in additional energy conservation measures. The tasks included in this statement of work are a direct result of both the RCx and energy audit. The tasks in this SOW are designed primarily as energy conservation tasks, and secondarily as improved operations and maintenance.

## **Description of Work**

This work includes the list of tasks that follow this general description of work, including the test and calibration of the existing control system, the test and balance of existing VAVs, and the replacement of steam traps and hot water tanks. The work will be described in this scope of work, along with figures and work specifications.

## **Base bid items:**

- 1) Test and calibrate the existing control sequences and sensors as per the schedule in Attachment 1 (AHU Listing). The contractor will provide a minimum of a monthly site visit throughout the year to monitor each of the air handling unit's sequence of operations and the overall Metasys (Johnson Controls) front end operations. Included with these specific deficiency corrections are the following existing control system analysis/service items:
  - a. Network Analysis and Optimization. Contractor shall provide proactive calibration and tuning of the data network including an analysis of mode

- tables, token passes, turn speed, change in values over the network, unresolved points and overall operation. Written pre/post performance reports shall be submitted and reviewed with system administrators.
- b. Control Loop Analysis and Optimization. Contractor shall calibrate control loops to compensate for changes in mechanical efficiencies, building use and climate conditions to minimize overshooting and oscillatory changes.
  - c. Software Analysis and Optimization. Contractor shall review software changes, review any points in alarm, failed points or points in operator priority, making necessary changes, corrections or repairs.
  - d. Contractor will document the above analysis through the use of trending and reports for each piece of equipment, specifically economizer operation, simultaneous heating and cooling, and any other inefficient operation
  - e. The system has the capability to trend either through Metasys or the existing Facility Performance Indexing (FPI) software.
- 2) Test and balance approximately 173 VAVs as per the schedule in attachment 2 (VAV Listing) and the specification section 230593-TAB. The VAVs are located primarily in floors 1 and 2 of building 1, the main hospital. The work includes:
    - a. Site investigation to determine precise locations of the VAVs. The attachment 2 includes room numbers that can be coordinated with Grand Junction VHA facilities existing floor plans.
    - b. Set minimum and maximum air flow as per the attachment and verify that these meet VA ventilation guidelines.
    - c. Establish an occupancy schedule for each VAV unless otherwise directed.
  - 3) Replace all existing orifice type steam traps as per the attachment 3 (Trap Survey Log Sheet Report). The traps to replace include 48 drip and 20 process/coil type of traps and are located by room on the trap survey.
    - a. The drip trap replacement will be a 125 PSI orifice, stainless steel inverted bucket with a packaged "Trap Valve Station." The station includes easy connect to piping, two isolation valves, and strainer.
    - b. The 20 process and coil type replacement traps will be the Float and Thermostatic type of trap with a build in vacuum breaker. The maximum steam pressure for these traps is 15 PSI. The contractor shall size each trap using the existing CFM, GPM, and temperature difference across each piece of equipment.
  - 4) Replace 6 existing semi-instantaneous hot water heaters (Chemline) with instantaneous type heaters. The heater will meet the attached specification 223500 for water heaters. The contractor will size the replacement heaters based on the following existing data:

Location	Storage (Gallon)	Pipe Diameter (in)	Date Installed	Comments
Building 20, Room 148	120	1.5	1993	

Building 1, Room 1	60	3	2001	
Building 1, Room 1	60	3	2001	
Building 1, Room 2639	45	2	1988	
Building 1, Room 2639	45	2	1988	

- a) The replacement heaters will be of the skid mounted, fully operational packaged units ready for operation upon delivery. The units will be connected to the existing steam and hot water lines.
- b) The units will be capable of delivering 140 degrees discharge temperature hot water with a recirculation system. The steam side will be capable of providing steam pressure 100 % the time in the heat exchanger.
- c) The contractor will include a discharge temperature and flow sensor to be added to the existing building automation system.

#### **Roles and Responsibilities:**

- 1) Documentation: The Department of Veterans Affairs (VA),COR will provide the contractor with *copies of documents that are available*.
  - a) The contractor shall request other government documentation deemed pertinent to the work accomplishment directly from the COR. The contractor shall consider the COR as the final source for needed government documentation when the contractor fails to secure the documents by other means. The contractor is expected to use common knowledge and resourcefulness in securing all other reference materials, standard industry publications, and related materials that are pertinent to the work.
- 2) Communications: The contractor shall maintain frequent communications with the COR and other designated Veterans Health Administration (VHA) staff and the VA Team to conduct work in progress reviews. Progress reports shall be delivered to the COR and other authorized assigned VA representative or designee on a monthly basis via electronic mail.

#### **Contractor Requirements, Confidentiality and Non-Disclosure:**

- 1) The contractor shall follow all Government rules and regulations regarding information security to prevent disclosure of sensitive information to unauthorized individuals or organizations.
- 2) Contractor staff and management may have access to some privileged and confidential materials of the United States Government such as budget and strategic

plans. These printed and electronic documents are for internal use only, are not to be copied or released without permission, and remain the sole property of the United States Government. Some of these materials may be protected by the Privacy Act of 1974 (revised by PL 93-5791) and Title 18. Unauthorized disclosure of Privacy Act or Title 18 covered materials is a criminal offense.

- 3) Regulatory standard of conduct governs all personnel directly and indirectly involved in procurements. All personnel engaged in procurement and related activities shall conduct business in a manner above reproach and, except as authorized by statute or regulation, with complete impartiality and with preferential treatment for none. The general rule is to avoid strictly any conflict of interest or even the appearance of a conflict of interest in Government-contractor relationships.

**Other Personnel Considerations:**

- 1) Personnel assigned by the contractor to the performance of work on this contract shall be acceptable to VA in terms of personal and professional conduct and technical knowledge. Should the assignment to this contract of any person by the contractor be deemed to conflict with the interests of VA, or in the event performance is deemed to be unsatisfactory at anytime during the life of the contract, the Contracting Officer may notify the contractor and request the person be immediately removed from the assignment. The reason for removal will be documented and a request to receive personnel replacement within three (3) business days of the notification will be made. Replacement personnel qualifications shall be equal to or greater than those of the personnel being replaced. Employment and staffing difficulties will not be justification for failure to meet established schedules.
- 2) The contractor must notify Veterans Health Administration (VHA) ten (10) calendar days in advance and the Project Manager (PM) and COR will approve or reject new proposed contractor key personnel for the performance of this contract. The contractor shall submit a resume of qualifications and the Contractor Personnel Change Control form to the PM and COR and all other direct employees proposed for the project. The PM and COR will approve all contractor employees prior to bringing on duty via Contractor Personnel Change Request Form, at any time from date of award to the end of the contract, contractor personnel are no longer available, the VHA will approve the qualifications of proposed replacement personnel and will reject individuals who do not meet the qualifications set forth herein. All contractor employees are subject to immediate removal from performance of this contract when they are involved in a violation of the law, VA security, confidentiality requirements, and/or other disciplinary reasons.

Attachments:

- 1) Grand Junction VAMC Site Map

- 2) Specification (010000, 223500, 230593)
- 3) Appendix 1 -- AHU List
- 4) Appendix 2 -- VAV Inventory
- 5) Appendix 3 -- Trap Survey Log

Grand Junction VAMC Site Map

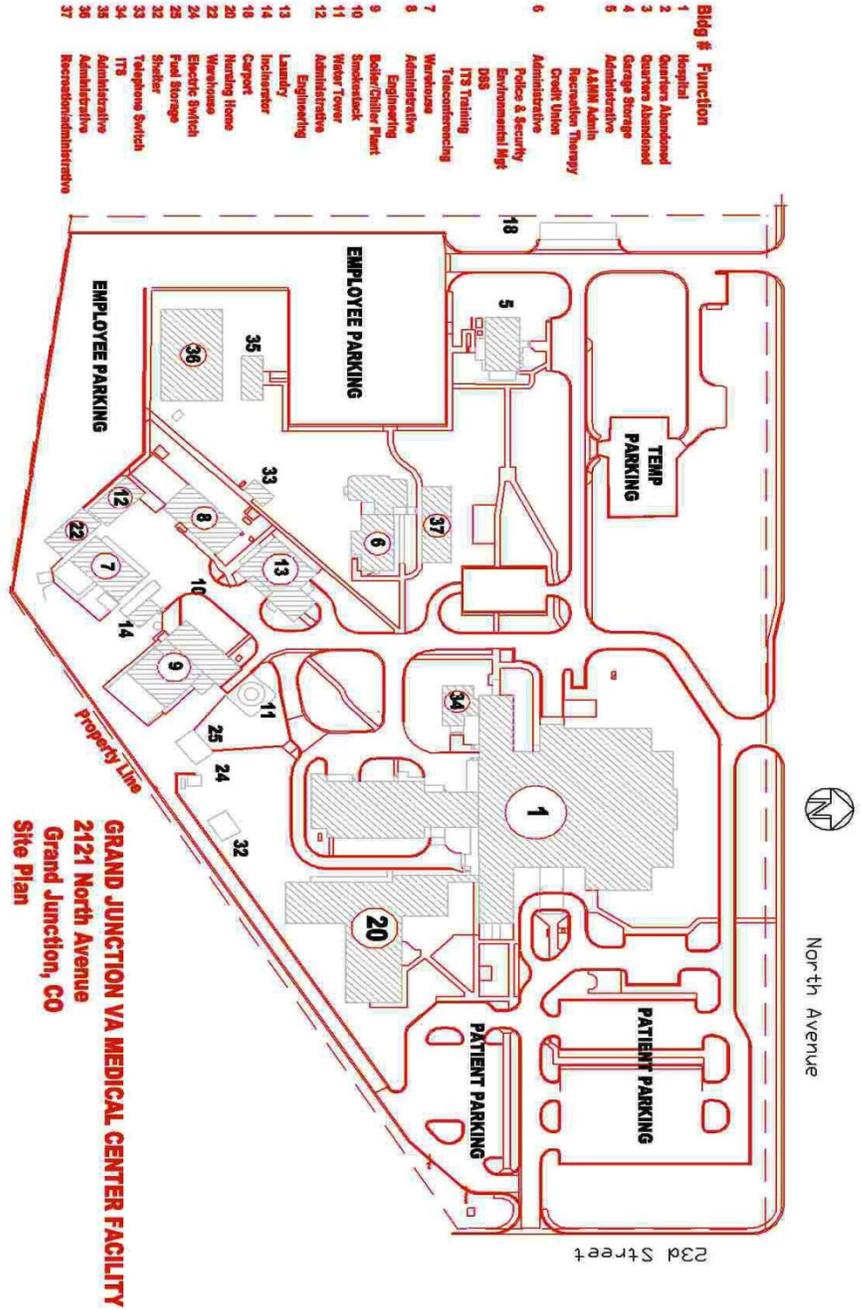


Table 1 – AHU List

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GENERAL REQUIREMENTS

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**SECTION 01 00 00  
GENERAL REQUIREMENTS**

**1.1 GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform as required by scope of work and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Contracting Officer.
- C. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VHA police, be identified by project and employer, and restricted from unauthorized access.
- D. Prior to commencing work, general contractor shall provide proof that a OSHA certified “competent person” (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
  - 1. All employees of general contractor or subcontractors shall have the 30-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
  - 2. Submit training records of all such employees for approval before the start of work.

**1.2 STATEMENT OF BID ITEM(S)**

- A. ITEM I, See separate Statement of Work

### **1.3 SPECIFICATIONS AND SOW FOR CONTRACTOR**

A. AFTER AWARD OF CONTRACT, 6 Digital and 8.5 X 11 Inch

### **1.4 CONSTRUCTION SECURITY REQUIREMENTS**

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that security escort arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Guards:

1. NA

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
4. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
5. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
6. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
7. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".

8. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

**1.5 FIRE SAFETY**

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):
  - E84-2009.....Surface Burning Characteristics of Building Materials
2. National Fire Protection Association (NFPA):
  - 10-2010 .....Standard for Portable Fire Extinguishers
  - 30-2008 .....Flammable and Combustible Liquids Code
  - 51B-2009.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2011 .....National Electrical Code

241-2009 .....Standard for Safeguarding Construction, Alteration,  
and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926.....Safety and Health Regulations for Construction

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR for review. They shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions: NA
- F. Temporary Heating and Electrical: NA
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads.

- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- M. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with // Resident // Project // Engineer // and facility Safety // Manager // Officer //. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.
- N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.
- O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR Obtain permits from facility Safety Manager Officer at least \_\_8\_\_ hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR.
- Q. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached

buildings under construction, smoking is prohibited except in designated smoking rest areas.

- R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- S. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

## **1.6 OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Working space and space available for storing materials shall be as determined by the COR.
- C. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.
  - 1. Do not store materials and equipment in other than assigned areas.
  - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.

D. Phasing: To insure such executions, Contractor shall furnish the COR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to COR and Contractor, as follows:

1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to VA personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

E. Utilities Services: Maintain existing utility services at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval.

2. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.

F. Coordinate the work for this contract with other construction operations as directed by COR.

## **1.7 INFECTION PREVENTION MEASURES**

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to the COR for review for compliance with contract requirements.
  1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:
1. The COR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
  2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
  2. Do not perform dust producing tasks within occupied areas without the approval of the COR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
    - a. Provide dust proof one-hour temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed

and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the COR and Medical Center.

- b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
- c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved,

debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

#### E. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

## **1.8 DISPOSAL AND RETENTION**

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
1. Reserved items which are to remain property of the Government are identified by attached tags. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.
  2. Items not reserved shall become property of the Contractor and be removed by Contractor.
  3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

## **1.13 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (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 starting, 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 component 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.

- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

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**SECTION 23 05 93  
TESTING, ADJUSTING, AND BALANCING FOR HVAC**

## **PART 1 - GENERAL**

### **1.1 DESCRIPTION**

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
1. Planning systematic TAB procedures.
  2. Design Review Report.
  3. Systems Inspection report.
  4. Balancing air systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
  5. Recording and reporting results.
- B. Definitions:
1. Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of 2007 ASHRAE Handbook, "HVAC Applications".
  2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
  3. AABC: Associated Air Balance Council.
  4. NEBB: National Environmental Balancing Bureau.
  5. Air Systems: Air handling units.

### **1.2 RELATED WORK**

- A. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC:  
Controls and Instrumentation Settings.

### **1.3 QUALITY ASSURANCE**

- B. Qualifications:
1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.

2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the COR. The responsibilities would specifically include:

- a. Shall directly supervise all TAB work.
  - b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
  - c. Would follow all TAB work through its satisfactory completion.
  - d. Shall provide final markings of settings of all HVAC adjustment devices.
  - e. Permanently mark location of duct test ports.
5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB
- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. Tab Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
  2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.

- a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
  - d. Minimum outside air: 0 percent to plus 10 percent.
3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and results shall be demonstrated to the COR for one air VAV:
- a. When field TAB work begins.
  - b. During each partial final inspection and the final inspection for the project if requested by VA.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the COR staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval:
  - 1. Intermediate and Final TAB reports covering flow balance and adjustments, and performance tests.
  - 2. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

## 1.5 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

2007 .....HVAC Applications ASHRAE Handbook, Chapter 37,  
Testing, Adjusting, and Balancing and Chapter 47,  
Sound and Vibration Control

C. Associated Air Balance Council (AABC):

2002 .....AABC National Standards for Total System Balance

D. National Environmental Balancing Bureau (NEBB):

7<sup>th</sup> Edition 2005.....Procedural Standards for Testing, Adjusting,  
Balancing of Environmental Systems

2nd Edition 2006 .....Procedural Standards for the Measurement of Sound  
and Vibration

3<sup>rd</sup> Edition 2009 .....Procedural Standards for Whole Building Systems  
Commissioning of New Construction

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

3<sup>rd</sup> Edition 2002 .....HVAC SYSTEMS Testing, Adjusting and Balancing

## PART 2 - PRODUCTS

### 2.1 PLUGS

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

### 2.2 INSULATION REPAIR MATERIAL

Provide for repair of insulation removed or damaged for TAB work.

## **PART 3 - EXECUTION**

For each VAV listed in the appendix exercise the box to max/min and adjust as necessary. Validate that all valves and dampers work according to the sequence of operation.

### **3.1 GENERAL**

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

### **3.2 SYSTEM READINESS REPORT**

- A. The TAB Contractor shall measure existing air flow rates associated with the systems listed in Appendix B. Submit report of findings to COR.
- B. Inspect each System to ensure that it is complete including installation and operation of controls.

### **3.3 TAB REPORTS**

- A. The TAB contractor shall provide raw data immediately in writing to the COR if there is a problem in achieving intended results before submitting a formal report.

### **3.4 TAB PROCEDURES**

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation. Fan rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off

parts of distribution systems to simulate design operation of variable volume air systems for test and balance work.

C. Air Balance and Equipment Test: Include air handling units.

1. Artificially load air filters by partial blanking to produce air pressure drop of manufacturer's recommended pressure drop.
2. Adjust fan speeds to provide design air flow as per the execution above.
3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
4. Variable air volume (VAV) systems:
  - a. Coordinate TAB with existing design.
  - b. Section 23 36 00, AIR TERMINAL UNITS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates if necessary. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode. Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under all operating conditions).
  - c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint.
5. Record final measurements for air handling equipment performance data sheets.

### **3.5 MARKING OF SETTINGS**

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the COR.

### **3.6 IDENTIFICATION OF TEST PORTS**

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

### **3.7 PHASING**

- A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.
- B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

- - E N D - - -

**SECTION 22 35 00  
DOMESTIC WATER HEAT EXCHANGERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section describes the requirements for domestic hot water heat exchangers including thermometers and all necessary accessories, connections and equipment.

**1.2 RELATED WORK:**

**1.3 SUBMITTALS:**

- A. Submit manufacturer's literature and data pertaining to the water heater in properly bound package, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include the following as a minimum:
  - 1. Heat Exchangers.
  - 2. Pressure and Temperature Relief Valves.
  - 3. Steam Control Valves.
  - 4. Thermometers.
  - 5. Pressure Gages.
  - 6. Vacuum Breakers.
- B. Equipment components in contact with potable water shall meet NSF compliance requirements in document NSF 61, "Drinking Water System Components – Health Effects.
- C. A form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel code.

**1.4.APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):
  - Z21.22-00/4.4A-00.....Relief Valves for Hot Water Supply systems
- C. American Society of Mechanical Engineers (ASME):

B1.20.1-01 .....Pipe Threads, General Purpose

B16.5-03.....Pipe Flanges and Flanged Fittings, NPS ½ through  
NPS 24

B16.24-06.....Cast Copper Alloy Pipe Flanges, Class 150, 300,600,  
900, 1500, 2500

PTC 25.3-02 .....Pressure Relief Devices

Section IV-07 .....Heating Boilers

Section VIII-07 .....Pressure Vessels Division 1

**1.5 AS-BUILT DOCUMENTATION**

- A. The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended.”
- B. Four sets of manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special

systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

## **PART 2 - PRODUCTS**

### **2.1 SHELL AND TUBE OR PLATE AND FRAME, DOMESTIC WATER HEAT EXCHANGERS:**

- A. The shell and tube heat exchangers shall be instantaneous type, vertical with water in the shell and steam in the tubes. The shell and tube or Plate and Frame heat exchanger shall be a packaged assembly of heat exchanger coils, controls, traps, temperature gauges, and all interconnecting steam and hot water piping constructed of ASME code copper lined, carbon steel shell with 1035 kPa (150 psig) minimum working pressure.
- B. The stand shall be factory fabricated for floor mounting.
- C. The tappings shall be factory fabricated of materials compatible with heat exchanger shell. For sizes 50 millimeter or DN50 (NPS 2) and smaller, the tappings shall be threaded ends fabricated in accordance to ASME B1.20.1. For sizes 65 millimeters or DN65 (NPS 2-1/2) and larger, the tappings shall be flanged according to ASME B16.5 for steel and stainless steel flanges and ASME 16.24 for copper and copper alloy flanges.
- D. 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.
- E. The heat exchanger coils shall be constructed from copper and fabricated in a helix wound for steam heating medium. The pressure rating shall be equal to or greater than the steam supply pressure plus 50%.
- F. The temperature controls shall be based upon an adjustable temperature transmitter that operates a control valve and is capable of maintaining outlet water temperature within 2 degrees C (4 degrees F) of setting.
- G. Safety control shall be automatic, high temperature limit shutoff device.

- H. The relief valves shall be ASME rated and stamped for combination temperature and pressure relief valves. One or more relief valves with total relieving capacity at least as great as heat input shall be included. The pressure setting shall be less than the working pressure rating of the heat exchanger minus 10 percent.
- J. Controls:
1. Steam control valve shall regulate the control of steam flow to the heating coil to control water temperature and shall be electronic operated. The outlet water temperature shall not vary more than  $\pm 1$  degrees C ( $\pm 2.5$  degrees F).
  2. A drip trap, steam condensate trap (if required), Y strainer, vacuum breaker, and pressure gage shall be factory sized and piped with steam control valve.
  3. A normally closed solenoid Valve shall be rated at 5 amps, 120-volt solenoid valve shall close the steam supply to the heating coil, should the water temperature in the tank reach the high set point.

## **2.2 THERMOMETERS:**

- A. Thermometers shall be rigid stem or remote sensing, dial type with an aluminum, black metal, stainless steel, or chromium plated brass case. The thermometer shall be back connected, mercury, vapor, BI-metal or gas actuated, with circular dial 90 mm (3 1/2 inches) in diameter graduated from 4 to 100°C (40 to 210°F), with two-degree graduations guaranteed accurate within one scale division. The socket shall be separable, double-seat, micrometer-fittings, with extension neck not less than 65 mm (2 1/2 inches) to clear tank or pipe covering. The thermometer shall be suitable for 20 mm (3/4 inch) pipe threads. Thermometers may be consoles mounted with sensor installed in separate thermometer well.

## **2.3 SAFETY VALVES FOR SHELL AND STEAM HEATERS:**

- A. Separate temperature relief valve and pressure relief valve or combination pressure/temperature relief valves shall be provided on each water heater. The safety valve discharge shall be routed to nearest floor drain.
- B. Temperature Relief Valves shall be constructed from all brass or bronze material. The temperature relief valves shall be automatic, self-closing reseating type valve, equipped with a noncorrosive metal thermostat with bulb extending into tank that can be manually displaced from its seat for test purposes. The

temperature relief valve shall be tested and approved as to its BTU capacity by ASME or an independent laboratory satisfactory to the Contracting Officer. In no case shall total rated BTU relieving capacity of temperature relief valve, or valves, be less than BTU input into water heater. Temperature relief valve shall be completely open before temperature reaches 98°C (210°F) and shall close when temperature goes below 93°C (200°F).

- C. Pressure relief valves shall conform to requirements of ASME, Section IV. BTU relieving capacity of pressure relief valve, or valves, shall be not less than BTU input of the water heater. The pressure relief shall be set at 690 kPa (100 psig) pressure.
- D. A double solenoid safety system shall be provided for each shell and steam coil heater to function as a safety over temperature prevention system. System shall consist of aquastat, pilot light, solenoid steam safety valve and solenoid water safety valve located in the control circuit. The aquastat shall be set at 60°C (140°F).

## **2.4 HEAT TRAPS**

- A. Heat traps shall be installed in accordance with ASHRAE 90.1, latest edition.

## **2.5 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES**

- A. The combination temperature and pressure relief valves shall be ASME rated and stamped and include a relieving capacity at least as great as the heat input and include a pressure setting less than the water heater's working pressure rating.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION:**

- A. The water heaters shall be installed on concrete bases.
- B. The water heaters shall be installed level and plumb.
- C. Water heaters shall be installed and connected in accordance with manufacturer's written instructions.
- D. All pressure and temperature relief valves discharge shall be pipe to nearby floor drains.
- E. Thermometers shall be installed on water heater inlet and outlet piping.

F. The control thermostats shall be set for a maximum setting of 54°C (130°F).

**3.2 LEAKAGE TEST:**

A. Before piping connections are made, the water heaters shall be tested at a hydrostatic pressure of 1375 kPa (200 psi) for water heaters rated at less than 1103 kPa (160 psig) and 1654 kPa (240 psig) for units with an maximum working pressure of 1103 kPa (160 psig) or over. Any failed test shall be corrected and the water heater shall be retested at no additional cost to the VA.

**3.3 PERFORMANCE TEST:**

A. Ensure that all of the remote water outlets will have a minimum of 49°C (120°F) and a maximum of 54°C (130°F) water flow at all times. If necessary, make all correction to balance the return water system or reset the thermostat to make the system comply with design requirements.

--- E N D ---

**SECTION 23 22 13  
STEAM AND CONDENSATE HEATING PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Steam, condensate and vent piping inside buildings.

**1.2 RELATED WORK**

**1.3 QUALITY ASSURANCE**

**1.4 SUBMITTALS**

- A. Submit in accordance with COR requirements
- B. Manufacturer's Literature and Data:
  - 1. Steam traps and valve stations.

**PART 2 - PRODUCTS**

**2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES**

**2.2 STEAM SYSTEM COMPONENTS**

- A. Steam Trap: Each type of trap shall be the product of a single manufacturer. Provide trap sets at all low points and at 61 m (200 feet) intervals on the horizontal main lines.
  - 1. Floats and linkages shall provide sufficient force to open trap valve over full operating pressure range available to the system. Unless otherwise indicated on the drawings, traps shall be sized for capacities indicated at minimum pressure drop as follows:
    - a. For equipment with modulating control valve: 1.7 kPa (1/4 psig), based on a condensate leg of 300 mm (12 inches) at the trap inlet and gravity flow to the receiver.
    - b. For main line drip trap sets and other trap sets at steam pressure: Up to 70 percent of design differential pressure. Condensate may be lifted to the return line.

2. Trap bodies: Stainless steel and cast iron, or semi-steel, constructed to permit ease of removal and servicing working parts without disturbing connecting piping.
  3. Balanced pressure thermostatic elements: Phosphor bronze, stainless steel or monel metal.
  4. Valves and seats: Suitable hardened corrosion resistant alloy.
  6. Floats: Stainless steel.
  7. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.
- H. Thermostatic Air Vent (Steam): Brass or iron body, balanced pressure bellows, stainless steel (renewable) valve and seat, rated 861 kPa (125 psig) working pressure, 20 mm (3/4 inch) screwed connections. Air vents shall be balanced pressure type that responds to steam pressure-temperature curve and vents air at any pressure.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- B. Install replacement traps in existing locations with separate trap valve station and two bolt trap attachment. The station shall include strainer, blow down, and isolation valving.

--- E N D ---

**ATTACHMENT 1**

<b>AIR HANDLING UNIT SCHEDULE</b>			
<b>MARK</b>	<i>1-A-1</i>	<i>1-A-2</i>	<i>1-A-3</i>
<b>GENERAL DATA</b>			
BUILDING NO.	<i>1</i>	<i>1</i>	<i>1</i>
LOCATION	<i>1633</i>	<i>1689</i>	<i>1002</i>
SERVES	<i>1ST FLOOR OPC W</i>	<i>1ST FLOOR OPC E</i>	<i>1ST FLOOR E&amp;W</i>
MANUFACTURER	<i>CARRIER</i>	<i>CARRIER</i>	<i>CARRIER</i>
MODEL	<i>39ED19</i>	<i>39ED23</i>	<i>39ED29</i>
SERIAL NO.	<i>1087 T 48669</i>	<i>1087T48670</i>	<i>1087 T 48672</i>
SYSTEM TYPE	<i>VAV</i>	<i>VAV</i>	<i>VAV</i>
<b>SUPPLY FAN DATA</b>			
FAN TYPE	<i>AF</i>	<i>AF</i>	<i>AF</i>
WHEEL DIA. (IN)	<i>21</i>	<i>21</i>	<i>24</i>
AIRFLOW (ACFM)	<i>10,440</i>	<i>11,900</i>	<i>14,040</i>
MIN. OUTDOOR AIRFLOW (ACFM)	<i>1,800</i>	<i>2,000</i>	<i>1,760</i>
FAN SPEED (RPM)	<i>2204</i>	<i>2346</i>	<i>2085</i>
FAN MOTOR SIZE (HP)	<i>15</i>	<i>20</i>	<i>20</i>
ELEC. CHAR.	<i>460/3/60</i>	<i>460/3/60</i>	<i>460/3/60</i>
<b>RETURN FAN DATA</b>			
MANUFACTURER	<i>ACME</i>	<i>ACME</i>	<i>ACME</i>
MODEL	<i>QB270N</i>	<i>QB500N</i>	<i>QB330N</i>
SERIAL NO.	<i>PLD494201</i>	<i>PLD494202</i>	<i>PLD494203</i>
FAN TYPE	<i>AF-SW</i>	<i>AF-SW</i>	<i>AF-SW</i>
WHEEL DIA. (IN)	<i>27</i>	<i>30</i>	<i>33</i>
AIRFLOW (ACFM)	<i>8280</i>	<i>9500</i>	<i>11930</i>
EXT. STATIC PRES. (INWC)			
FAN SPEED (RPM)	<i>1050</i>	<i>1549</i>	<i>785</i>
FAN MOTOR SIZE (HP)	<i>5</i>	<i>5</i>	<i>5</i>
ELEC. CHAR.	<i>460/3/60</i>	<i>460/3/60</i>	<i>460/3/60</i>
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)	<i>171.4</i>	<i>163.8</i>	<i>167.6</i>
AIRFLOW (ACFM) (MIN/MAX.)	<i>10,440</i>	<i>11,900</i>	<i>14,040</i>
ENTERING AIR TEMP. (°F)	<i>35.2</i>	<i>38</i>	<i>40</i>
LEAVING AIR TEMP. (°F)	<i>53</i>	<i>53</i>	<i>53</i>
COIL FACE VEL. (FPM)	<i>550</i>	<i>550</i>	<i>550</i>
WATER FLOW (GPM)	<i>8.9</i>	<i>8.6</i>	<i>8.8</i>
STEAM FLOW (#/HR)			
STEAM PRESSURE (PSIA)			
<b>COOLING COIL DATA</b>			

TOTAL CAPACITY (MBH)	325.3	379.8	453.5
AIRFLOW (ACFM) (MIN/MAX.)	10,440	11,900	14,040
COIL FACE VEL. (FPM)	550	550	550
ENTERING AIR TEMP. (DB/WB)	82.1/63	82/63	81.3/63.3
LEAVING AIR TEMP. (DB/WB)	52.1/51.3	51.9/51	51.9/51
WATER FLOW (GPM)	47	54	65

## AIR HANDLING UNIT SCHEDULE

MARK	1-A-4	1-A-5	1-A-6
<b>GENERAL DATA</b>			
BUILDING NO.	1	1	1
LOCATION	2639	2639	2663
SERVES	1ST FLOOR OPC ER	2ND FLOOR OPC W	2ND FLOOR OPC E
MANUFACTURER	CARRIER	CARRIER	CARRIER
MODEL	39ED08	39ED29	39ED29
SERIAL NO.	1087 T 48673	1087 T 48675	1087 T 48667
SYSTEM TYPE	CV	VAV	VAV
<b>SUPPLY FAN DATA</b>			
FAN TYPE	AF	AF	AF
WHEEL DIA. (IN)	13	24	21
AIRFLOW (ACFM)	2,410	14,630	12,910
MIN. OUTDOOR AIRFLOW (ACFM)	620	1,910	2,860
FAN SPEED (RPM)	2831	2051	2381
FAN MOTOR SIZE (HP)	3	20	20
ELEC. CHAR.	460/3/60	460/3/60	460/3/60
<b>RETURN FAN DATA</b>			
MANUFACTURER	ACME	ACME	ACME
MODEL	QB161G	QB365N	QB300M
SERIAL NO.	PLD494204	PLD494205	PLD494206
FAN TYPE	BI	AF-SW	AF-SW
WHEEL DIA. (IN)	15	36	30
AIRFLOW (ACFM)	1670	12340	9480
EXT. STATIC PRES. (INWC)			
FAN SPEED (RPM)	1280	618	813
FAN MOTOR SIZE (HP)	0.5	5	3
ELEC. CHAR.	460/3/60	460/3/60	460/3/60
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)	42.3	160.4	202.3
AIRFLOW (ACFM) (MIN/MAX.)	2,410	14,630	12,910
ENTERING AIR TEMP. (°F)	34	41.1	36
LEAVING AIR TEMP. (°F)	53	53	53
COIL FACE VEL. (FPM)	550	550	550
WATER FLOW (GPM)	2.2	8.3	10.5
STEAM FLOW (#/HR)			
STEAM PRESSURE (PSIA)			
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)	69.6	461.4	392.5
AIRFLOW (ACFM) (MIN/MAX.)	2,410	14,630	12,910

COIL FACE VEL. (FPM)	550	550	550
ENTERING AIR TEMP. (DB/WB)	83.6/62.5	81.3/63.3	83/62.7
LEAVING AIR TEMP. (DB/WB)	53/51.7	52.3/51.5	52.1/51.3
WATER FLOW (GPM)	10	66	56

## AIR HANDLING UNIT SCHEDULE

MARK	1-A-7	1-A-8	1-A-9
<b>GENERAL DATA</b>			
BUILDING NO.	1	1	1
LOCATION	2600	2663	1232
SERVES	2ND FLOOR E&W	2ND FLR. OPC DEN.	CANTEEN KIT.
MANUFACTURER	CARRIER	CARRRIER	
MODEL	39ED36	39BA040A69	
SERIAL NO.	1087 T 48668	871333672	
SYSTEM TYPE	VAV	CV	CV
<b>SUPPLY FAN DATA</b>			
FAN TYPE	AF	FC	
WHEEL DIA. (IN)	24	9	13.5
AIRFLOW (ACFM)	14,900	1,780	4,300
MIN. OUTDOOR AIRFLOW (ACFM)	4,580	1,780	1,700
FAN SPEED (RPM)	2150	1532	
FAN MOTOR SIZE (HP)	25	1	5
ELEC. CHAR.	460/3/60	460/3/60	
<b>RETURN FAN DATA</b>			
MANUFACTURER	ACME		
MODEL	QB300N		
SERIAL NO.	PLD494207		
FAN TYPE	AF-SW	-	VANE AXIAL
WHEEL DIA. (IN)	30	-	14
AIRFLOW (ACFM)	9540	-	2600
EXT. STATIC PRES. (INWC)		-	1.3
FAN SPEED (RPM)	861	-	1830
FAN MOTOR SIZE (HP)	5	-	1.5
ELEC. CHAR.	460/3/60	-	208/3/60
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)	283.1	87.4	112
AIRFLOW (ACFM) (MIN/MAX.)	14,900	1,780	4300
ENTERING AIR TEMP. (°F)	32.9	2	41.5
LEAVING AIR TEMP. (°F)	53	55	70
COIL FACE VEL. (FPM)	550	644	610
WATER FLOW (GPM)	14.8	4.5	
STEAM FLOW (#/HR)			116
STEAM PRESSURE (PSIA)			14
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)	464.8	-	154.8
AIRFLOW (ACFM) (MIN/MAX.)	14,900	-	4,300
COIL FACE VEL. (FPM)	550	-	575

<b>ENTERING AIR TEMP. (DB/WB)</b>	<i>84.4/62.1</i>	-	<i>86.7/65.3</i>
<b>LEAVING AIR TEMP. (DB/WB)</b>	<i>51.9/50.5</i>	-	<i>54.2/52.8</i>
<b>WATER FLOW (GPM)</b>	<i>67</i>	-	<i>31</i>

# AIR HANDLING UNIT SCHEDULE

MARK	1-A-10	1-A-11	1-A-12
<b>GENERAL DATA</b>			
BUILDING NO.	1	1	1
LOCATION	1219	1202	2239
SERVES	CANTEEN DIN.	MORGUE	2ND FLOOR LAB
MANUFACTURER		TRANE	ENERGY LABS
MODEL		3	
SERIAL NO.			
SYSTEM TYPE	VAV	CV	VAV
<b>SUPPLY FAN DATA</b>			
FAN TYPE	SWSI	FC	
WHEEL DIA. (IN)	22	9	
AIRFLOW (ACFM)	4,670	1,300	13,000
MIN. OUTDOOR AIRFLOW (ACFM)	1,170		13,000
FAN SPEED (RPM)			1660
FAN MOTOR SIZE (HP)	7.5		25
ELEC. CHAR.		208/3/60	208/3/60
<b>RETURN FAN DATA</b>			
MANUFACTURER			
MODEL			
SERIAL NO.			
FAN TYPE	VANE AXIAL		
WHEEL DIA. (IN)	21		
AIRFLOW (ACFM)	4280		
EXT. STATIC PRES. (INWC)	0.375		
FAN SPEED (RPM)	1596		
FAN MOTOR SIZE (HP)	1.5		
ELEC. CHAR.	208/3/60		
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)	27.8		
AIRFLOW (ACFM) (MIN/MAX.)	4670		8700
ENTERING AIR TEMP. (°F)	53.4	7	-10
LEAVING AIR TEMP. (°F)	60	100	60
COIL FACE VEL. (FPM)	570		500
WATER FLOW (GPM)			34
STEAM FLOW (#/HR)	29		
STEAM PRESSURE (PSIA)	14	27	
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)	175.1	45.3	505.6
AIRFLOW (ACFM) (MIN/MAX.)	4,670	1,300	13,000
COIL FACE VEL. (FPM)	520		553
ENTERING AIR TEMP. (DB/WB)	82.1/63.8	94/63	94/60
LEAVING AIR TEMP. (DB/WB)	52.2/50.5	57	52
WATER FLOW (GPM)	31	9	64

# AIR HANDLING UNIT SCHEDULE

MARK	1-A-13	1-A-14	1-A-15
<b>GENERAL DATA</b>			
BUILDING NO.	1	1	1
LOCATION	GROUND	ROOF	ROOF
SERVES	3RD FLR. WARD 3	3RD FLR. KITCHEN	SPD
MANUFACTURER	MCQUAY	ENINEERED AIR	TRANE
MODEL	RPS-040B		
SERIAL NO.			
SYSTEM TYPE	VAV	MAKE-UP AIR	CV
<b>SUPPLY FAN DATA</b>			
FAN TYPE			
WHEEL DIA. (IN)			
AIRFLOW (ACFM)	14,250	9,700	6,000
MIN. OUTDOOR AIRFLOW (ACFM)		9,700	6,000
FAN SPEED (RPM)		1815	1100
FAN MOTOR SIZE (HP)	15	10	7.5
ELEC. CHAR.	208/3/60	208/3/60	208/3/60
<b>RETURN FAN DATA</b>			
MANUFACTURER			-
MODEL			-
SERIAL NO.			-
FAN TYPE			-
WHEEL DIA. (IN)			-
AIRFLOW (ACFM)	12500		-
EXT. STATIC PRES. (INWC)			-
FAN SPEED (RPM)			-
FAN MOTOR SIZE (HP)	15		-
ELEC. CHAR.	208/3/60		-
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)		889	200.8
AIRFLOW (ACFM) (MIN/MAX.)		9700	4375
ENTERING AIR TEMP. (°F)		-20	2
LEAVING AIR TEMP. (°F)		80	53
COIL FACE VEL. (FPM)			750
WATER FLOW (GPM)			
STEAM FLOW (#/HR)		936	212.5
STEAM PRESSURE (PSIA)		40	27
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)	379.4	90% EVAP	256
AIRFLOW (ACFM) (MIN/MAX.)	14,250		6,000
COIL FACE VEL. (FPM)	549		425
ENTERING AIR TEMP. (DB/WB)	80/63		102/68
LEAVING AIR TEMP. (DB/WB)	54.5/53.3		54.3/52.2
WATER FLOW (GPM)	76		37.4

# AIR HANDLING UNIT SCHEDULE

MARK	1-A-16	1-A-17	1-A-18
<b>GENERAL DATA</b>			
BUILDING NO.	1	1	1
LOCATION	6TH FLOOR ROOF	PENTHOUSE	2421
SERVES	WD-5	SURGERY	
MANUFACTURER	MAMMOTH	TRANE	
MODEL	CEHBR-351-S483		
SERIAL NO.	19546-01-01	K90M36671	
SYSTEM TYPE	DUAL DUCT	CV	
<b>SUPPLY FAN DATA</b>			
FAN TYPE	AF		
WHEEL DIA. (IN)	22		
AIRFLOW (ACFM)	14,750	5,000	
MIN. OUTDOOR AIRFLOW (ACFM)	3,430	5,000	
FAN SPEED (RPM)	1590	1255	
FAN MOTOR SIZE (HP)	20	5	
ELEC. CHAR.	208/3/60	208/3/60	
<b>RETURN FAN DATA</b>			
MANUFACTURER		-	
MODEL		-	
SERIAL NO.		-	
FAN TYPE	FC	-	
WHEEL DIA. (IN)	18	-	
AIRFLOW (ACFM)	9640	-	
EXT. STATIC PRES. (INWC)	1.5	-	
FAN SPEED (RPM)	815	-	
FAN MOTOR SIZE (HP)	7.5	-	
ELEC. CHAR.	208/3/60	-	
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)	702		
AIRFLOW (ACFM) (MIN/MAX.)	13570		
ENTERING AIR TEMP. (°F)	52.9	-20	
LEAVING AIR TEMP. (°F)	110	55	
COIL FACE VEL. (FPM)	700		
WATER FLOW (GPM)		34	
STEAM FLOW (#/HR)	730		
STEAM PRESSURE (PSIA)	42		
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)	426	220	
AIRFLOW (ACFM) (MIN/MAX.)	14,750	5,000	
COIL FACE VEL. (FPM)	480	434	
ENTERING AIR TEMP. (DB/WB)	84.2/63.5	100/61	
LEAVING AIR TEMP. (DB/WB)	54.2/52.6	49.2/41	
WATER FLOW (GPM)	63.5	33	

# AIR HANDLING UNIT SCHEDULE

MARK	1-A-19	1-A-20	1-A-21
<b>GENERAL DATA</b>			
BUILDING NO.	1	20	20
LOCATION	5TH FLR. ROOF	148	148
SERVES	4TH FLR. WEST	PATIENT ROOMS	DAY ROOM
MANUFACTURER			
MODEL			
SERIAL NO.			
SYSTEM TYPE		CV	CV
<b>SUPPLY FAN DATA</b>			
FAN TYPE		BI	BI
WHEEL DIA. (IN)		16	12
AIRFLOW (ACFM)		4,830	2,450
MIN. OUTDOOR AIRFLOW (ACFM)		2,850	950
FAN SPEED (RPM)			
FAN MOTOR SIZE (HP)		5	3
ELEC. CHAR.		208/3/60	208/3/60
<b>RETURN FAN DATA</b>			
MANUFACTURER			
MODEL			
SERIAL NO.			
FAN TYPE		IN-LINE	IN-LINE
WHEEL DIA. (IN)		13.5	12.25
AIRFLOW (ACFM)		1980	1500
EXT. STATIC PRES. (INWC)			
FAN SPEED (RPM)		1660	1700
FAN MOTOR SIZE (HP)		0.75	0.5
ELEC. CHAR.		208/3/60	208/3/60
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)		123.6	38.8
AIRFLOW (ACFM) (MIN/MAX.)		2850	1100
ENTERING AIR TEMP. (°F)		-3	-3
LEAVING AIR TEMP. (°F)		45	36
COIL FACE VEL. (FPM)		470	360
WATER FLOW (GPM)			
STEAM FLOW (#/HR)		128	40
STEAM PRESSURE (PSIA)		22	22
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)		142.3	69.2
AIRFLOW (ACFM) (MIN/MAX.)		4,830	2,450
COIL FACE VEL. (FPM)		500	500
ENTERING AIR TEMP. (DB/WB)		88.6/63.3	85/64.4
LEAVING AIR TEMP. (DB/WB)		56/52.4	56/54.7
WATER FLOW (GPM)		21.4	10.5

# AIR HANDLING UNIT SCHEDULE

MARK	1-A-22	1-A-23	1-A-24
<b>GENERAL DATA</b>			
BUILDING NO.	33	34	
LOCATION	100	100	
SERVES		<i>COMMUNICATIONS</i>	
MANUFACTURER			
MODEL			
SERIAL NO.			
SYSTEM TYPE			
<b>SUPPLY FAN DATA</b>			
FAN TYPE			
WHEEL DIA. (IN)			
AIRFLOW (ACFM)			
MIN. OUTDOOR AIRFLOW (ACFM)			
FAN SPEED (RPM)			
FAN MOTOR SIZE (HP)			
ELEC. CHAR.			
<b>RETURN FAN DATA</b>			
MANUFACTURER			
MODEL			
SERIAL NO.			
FAN TYPE			
WHEEL DIA. (IN)			
AIRFLOW (ACFM)			
EXT. STATIC PRES. (INWC)			
FAN SPEED (RPM)			
FAN MOTOR SIZE (HP)			
ELEC. CHAR.			
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)			
AIRFLOW (ACFM) (MIN/MAX.)			
ENTERING AIR TEMP. (°F)			
LEAVING AIR TEMP. (°F)			
COIL FACE VEL. (FPM)			
WATER FLOW (GPM)			
STEAM FLOW (#/HR)			
STEAM PRESSURE (PSIA)			
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)			
AIRFLOW (ACFM) (MIN/MAX.)			
COIL FACE VEL. (FPM)			
ENTERING AIR TEMP. (DB/WB)			
LEAVING AIR TEMP. (DB/WB)			
WATER FLOW (GPM)			

# AIR HANDLING UNIT SCHEDULE

MARK	1-A-25	1-A-26	1-A-27
<b>GENERAL DATA</b>			
BUILDING NO.	5	13	8
LOCATION	005 BASEMENT	ROOF	ROOF
SERVES	OFFICE		
MANUFACTURER	TRANE		
MODEL	TYPE 17		
SERIAL NO.	U79B08625		
SYSTEM TYPE	MULTIZONE		
<b>SUPPLY FAN DATA</b>			
FAN TYPE	FC		
WHEEL DIA. (IN)	2EA-13		
AIRFLOW (ACFM)	8,000		
MIN. OUTDOOR AIRFLOW (ACFM)	1,200		
FAN SPEED (RPM)			
FAN MOTOR SIZE (HP)	10		
ELEC. CHAR.	208/3/60		
<b>RETURN FAN DATA</b>			
MANUFACTURER			
MODEL			
SERIAL NO.			
FAN TYPE			
WHEEL DIA. (IN)			
AIRFLOW (ACFM)			
EXT. STATIC PRES. (INWC)			
FAN SPEED (RPM)			
FAN MOTOR SIZE (HP)			
ELEC. CHAR.			
<b>HEATING COIL DATA</b>			
TOTAL CAP. (MBH)	300		
AIRFLOW (ACFM) (MIN/MAX.)	8000		
ENTERING AIR TEMP. (°F)	60		
LEAVING AIR TEMP. (°F)	95		
COIL FACE VEL. (FPM)	1000		
WATER FLOW (GPM)			
STEAM FLOW (#/HR)	315		
STEAM PRESSURE (PSIA)	17		
<b>COOLING COIL DATA</b>			
TOTAL CAPACITY (MBH)	235		
AIRFLOW (ACFM) (MIN/MAX.)	8,000		
COIL FACE VEL. (FPM)	500		
ENTERING AIR TEMP. (DB/WB)	78/63		
LEAVING AIR TEMP. (DB/WB)	56/54		
WATER FLOW (GPM)			



<b>VA VISN 19 Retro-Cx - Grand Junction VA Medical Center</b>	
A-10	CHW pumps not running. REC: Verify operation.
A-10	Return Fan Flow Station Failed. (reading 0 cfm) REC: Troubleshoot and repair.
A-10	Unit running continuous REC: Implement start stop program for unoccupied times
A-9	Start /Stop AHU with Kitchen exhaust. REC: Verify programming
A-14	Unit running continuous. REC: Implement Occupied/Unoccupied schedules with Hood Exhaust to function when OAT is above 40°F.
A-3	Mixed air temp sensor calibration is 2.5°F high. REC: Calibrate or replace sensor.
A-1	Heating temp sensor calibration is 4.8°F high. REC: Calibrate or replace sensor.
A-4 CV-164 Room 1622	Room temp sensor calibration is 2.5°F high. REC: Calibrate or replace sensor.
A-1	Return air humidity sensor calibration is 21% low. REC: Calibrate or replace sensor.
A-1, VAV 160, Room 1600	Room temp sensor calibration is 2.9°F low. REC: Calibrate or replace sensor.
A-1 VAV 162 Room 1609	Room temp sensor calibration is 2.8°F low. REC: Calibrate or replace sensor.
A-2	HR supply temp sensor calibration is 3.5°F low. REC: Calibrate or replace sensor.
A-2	Supply air temp sensor calibration is 3.6°F low. REC: Calibrate or replace sensor.
A-2 VAV 128 Room 1692	Room temp sensor calibration is 2.4°F low. REC: Calibrate or replace sensor.
A-2 VAV 130 Room 1670	Room temp sensor calibration is 2.5°F low. REC: Calibrate or replace sensor.
A-2 VAV 139 Room 1697	Room temp sensor calibration is 3.1°F high. REC: Calibrate or replace sensor.
A-2 VAV 147 1st flr hall	Room temp sensor calibration is 3.2°F low. REC: Calibrate or replace sensor.
A-2 VAV 150 Room 1677	Room temp sensor calibration is 3.3°F low. REC: Calibrate or replace sensor.
A-10	Mixed air temp sensor is 3.5°F low. REC: Calibrate or replace sensor.
A-4 CV 166 Room 1622	Room temp sensor calibration is 2.5°F high. REC: Calibrate or replace sensor.

<b>VA VISN 19 Retro-Cx - Grand Junction VA Medical Center</b>	
Steam Convertor C1B	Insulation missing on discharge side of pump. REC: Replace insulation.
A-7	Return hum sensor calibration is 6.4% low. REC: Calibrate or replace sensor.
A-5	Supply air temp sensor calibration is 3.2°F high. REC: Calibrate or replace sensor.
A-12 VAV 124 Room 2422	Room temp sensor calibration is 3.0°F high. REC: Calibrate or replace sensor.
A-12 VAV 132 Room 2217-3	Room temp sensor calibration is 3.3°F high. REC: Calibrate or replace sensor.
A-12 VAV 133 Room 2223	Room temp sensor calibration is 3.5°F high. REC: Calibrate or replace sensor.
A-12 VAV 134 Room 2215	Room temp sensor calibration is 2.1°F high. REC: Calibrate or replace sensor.
A-12 VAV 138 Room 2217-2	Room temp sensor calibration is 2.2°F high. REC: Calibrate or replace sensor.
A-12 VAV 139 Room 2234	Room temp sensor calibration is 2.9°F high. REC: Calibrate or replace sensor.
A-12 VAV 143 Room 2227	Room temp sensor calibration is 2.1°F high. REC: Calibrate or replace sensor.
A-12 VAV 145 Room 2219	Room temp sensor calibration is 4.7°F high. REC: Calibrate or replace sensor.
A-13 VAV Room 3210	Room temp sensor calibration is 3.5°F low. REC: Calibrate or replace sensor.
A-14	Supply air temp sensor is 5.6°F low. REC: Calibrate or replace sensor.
A-15	Supply air temp sensor is 12.3°F low. REC: Calibrate or replace sensor.
A-5	Mixed air temperature sensor is failed. REC: Replace sensor.
A-5	Supply air temp sensor calibration is 3.2°F high. REC: Calibrate or replace sensor.
A-5	Supply hum sensor calibration is 13.4% high. REC: Calibrate or replace sensor.
A-6	Return air temp sensor calibration is 2.6°F high. REC: Calibrate or replace sensor.
A-5	Return air temp sensor calibration is 2.6°F high. REC: Calibrate or replace sensor.
A-6	Return humidity sensor calibration is 7.0% low. REC: Calibrate or replace sensor.
A-6 VAV 222 Room 2659	Room temp sensor calibration is 7.9°F high. REC: Calibrate or replace sensor.

<b>VA VISN 19 Retro-Cx - Grand Junction VA Medical Center</b>	
A-6 VAV 279 Room 2019	Room temp sensor calibration is 4.9°F high. REC: Calibrate or replace sensor.
A-28 VAV SS-1	Room temp sensor calibration is 3.1°F low. REC: Calibrate or replace sensor.
A-28 VAV SS-8	Room temp sensor calibration is 2.2°F low. REC: Calibrate or replace sensor.
A-9	3-way control valve on CHW return. REC: Remove bypass or close bypass and repipe as necessary to provide 2-way control valve operation
A-16	Unit is controlled by Tracer Summit. REC: Retrofit unit to JCI control for monitoring and programming to the front end.
A-1	Chilled water valve on unit is open (mech cooling) while outside air dampers are not fully open (64%) to take advantage of full free airside cooling. REC: Program modification or loop tuning.
A-3	Chilled water valve on unit is open (mech cooling) while outside air dampers are not fully open (57%) to take advantage of full free airside cooling. REC: Program modification or loop tuning.
A-4	Chilled water valve on unit is open (mech cooling) while outside air dampers are not fully open (59%) to take advantage of full free airside cooling. REC: Program modification or loop tuning.
A-5	Chilled water valve on unit is open (mech cooling) 20-60% when OAT is 40°F while outside air dampers are not fully open (23%) to take advantage of full free airside cooling. SAT loses it above 59 OAT, poor coil performance also. REC: Program modification or loop tuning.
A-9	Supply fan is at full speed (100%) while return fan is at zero speed (0%). Outside air dampers are at 100% command, Mix air temp is warm at 65°F, chw valve is at 24%, to maintain 64°F. REC: Further review of all temperature and flow components and controls. Verify if heating valve is leaking or OAD is working at all.
AHU Scheduling	All Air handlers are operating 24/7 with the exception of Dental Unit. Not all areas need constant operation, and some, even if unit was kept on, could probably benefit from temperature or pressure setbacks. REC: Put non-critical units on a time schedule to either shut down or reduce airflows and possibly reset temperatures.
4th floor West corr.	Offices have steam radiator heat on pneumatic local thermostat, and window A/C on its own thermostat. Comfort control is difficult and problematic. Replace valve tops with electronic controls as a minimum. Upgrade the HVAC in that area.
A-1	BAS control: Mixed air control is not consistent at all temperatures and not working properly. OA damper is open above 75°F OAT. REC Close OAD when OAT GT 75°F.
A-2	BAS control: Discharge air control is erratic above 45°F OAT. AHU control valves open fully very often, indicating poor efficiency and performance.

<b>VA VISN 19 Retro-Cx - Grand Junction VA Medical Center</b>	
A-2	BAS Control: Preheat valve only opens after heat recovery valve is full stroke, causing supply temperature to drop to 44°F with a 60°F set point. ON another occasion, 3/3/12, heating valve went from 30-100% 4 times in 2 hours. Valves appear to travel quickly from open to closed.
AHUs generally	BAS control: Economizer damper (OA) is open at times when OAT is greater than Return temperature, and reportedly even when OAT is 80°F. Needs correction
AHUs generally	BAS control: Economizer damper (OAD) is not fully open when the chilled water valve begins to open/is open. This generally occurs when OAT is less than 50°F, and appears to limit the OAD to about 60-80% maximum opening. More air side free cooling could be possible.
AHUs generally	Several units can't maintain supply air temperature when the OAT goes above about 74°F. CHW valves go full open and over-flow the coils, which is inefficient. Related to plugged coils. Significant issue is A-12, which drives the operation of mechanical cooling and quantities of chillers.
BAS Server	BAS Server is having difficulty storing and receiving trends and performing front end tasks. A larger and newer server is recommended.
Pneumatic system	Water in pneumatic system damages components on 1st floor especially. Some parts of 1st, 2nd, 3rd and 4th floor still have pneumatic local controls. Upgrade system
VAV terminals	In verifying the VAV terminals in Building 1, our TAB contractor reset many of the mins/max air flow values back to design settings. The values had previously been reduced significantly. REC: The remainder of VAV terminals be checked for correct settings.
A-12 VAV terminals	This area has older VAVs, not JCI VMA model. Area could use rebalancing airflow to actual heat load in area, review of (proper) temperature sensor location, and possibly upgrade VAV controllers
A-6	OA Dampers are limited below 55 OAT closes from 100 to 40%, and go full open above 55 as needed. CHW valve open above 41 deg OAT, closed below 37 OAT. REC: Reprogram control logic
A-7	OA Dampers are limited below 55 OAT and go full open above 55 as needed. REC: Reprogram control logic
A-7	OA Dampers go fully closed for long periods of time in winter season, ventilation to occupants is diminished. REC: Reprogram Control Sequence for min Vent.
A-10	OA Dampers go fully closed for a period when unit appears to keep running. Ventilation to occupants is diminished - Dining room. REC: Reprogram Control Sequence for minimum Ventilation
A-11	OA Dampers go fully closed for a period in winter when OAT goes above 69, which appears to be room temperature set point. CHW valve is still open as needed. Appears OAD is leaking air through. (Morgue) REC: Reprogram Control Sequence for Ventilation

<b>VA VISN 19 Retro-Cx - Grand Junction VA Medical Center</b>	
A-12	Lab. (100% OA unit) Chw valve open fully above 70 OAT, May 2012 on, overflowing, not making setpoint. (Expect valve to be open, but not full) DAS of 52, DAT up to 62, unit drives need for chiller at plant. Coil flushing began in April. REC: Continue to flush coils, check for leakage of heating system.
A-14	Steam heating valve and its face and bypass open and close at the same time. REC: Programming change to optimize coil valve versus face and bypass damper strategy.
A-14	100% OA unit. Steam valve was opening when OAT was between 55-60°F OAT to control to 68°F set point; space temp rose accordingly from 75 to 78°F. REC: use of deadband to avoid heating supply air above 55°F OAT.
A-28	Locker unit. Seems to have wipe (steam heat coil gain) across steam coil. REC: Verify valve closure and modify software to accommodate different sequence.
CHW Flow	There are 3 chilled water flow meters reporting to the BAS associated with our study, plant, Building 1 and Building 20. The building 1 meter is failed. REC: replace or repair meter to operating status to be able to analyze chilled water operation. REC put flow meter points prominently on graphics to monitor their status, not only the BTU Tonnage calculation.
Lower RH set point	RH set point is 25% return air, generally for the hospital. A reduction to 20% is recommended for non-critical areas. MRI and Cath labs are particular areas that need some RH in a dry climate.
AHUs running continuous	Combines 38 and 117, and adds several units. Turn off units on a schedule, and allow units to come back on during the unoccupied hours based on temperature requirements. Can included A-15 SPD, and A-3 Pharmacy, in spite of critical nature of Pharmacy.
A-3 Pharmacy	A-3 operates 24/7 and has a critical area - the pharmacy.
AHU fan speed control	AHUs now operate on a fixed supply duct static pressure setting. Over time field changes are made, airflows may have been decreased, and static pressure setpoint is not reviewed, and fan maintains a higher static pressure than needed. Recommend resetting the setpoint based on VAV terminal damper worst case.
Heating hot water pump speed	The Graphic for pumps and heat exchanger control of Pumps do not show differential set point and pump speed. It is not clear how well pump speed is being varied to maintain the lowest speed while still maintaining flow. If flow decreases significantly from heating to cooling season, lowering the setpoint can assist in energy savings. REC: BAS programming modification to review AHU valve position and reset DP setpoint for worst case.
Operating Room Occupancy Set back	As we walked through Building 1 and observed in springtime the operating room upgrades that were not a part of this study, we observed that the rooms were without occupancy sensors that would decrease airflow changes during unoccupied periods. This effort combined with lower airflow rates as a result of new VAMC ventilation standards will result in lower energy use and costs. Recommend occupancy sensors be installed provide feedback to the BAS to control HVAC levels in the ORs, if not done so already