UNIVERSITY OF SOUTH CAROLINA

AMENDMENT NO. 1

TO: ALL VENDORS

FROM: Lana Widener

SUBJECT: USC-IFB-2494-LW
MECHANICAL EQUIPMENT FOR USC COKER LIFE SCIENCE BUILDING

DATE: August 21, 2013

This Amendment No. 1 modifies the Invitation for Bids only in the manner and to the extent as stated herein.

ITEM ONE: **EXTENDED DEADLINE FOR RECEIPT OF BIDS TO SEPTEMBER 5, 2013, 11:00 AM**

ITEM TWO: **EXTENDED DEADLINE FOR RECEIPT OF QUESTIONS TO AUGUST 28, 2013, 10:00 AM**

ITEM THREE: **REPLACE THE ORIGINAL SECTION 15840 – AIR TERMINAL UNITS WITH ATTACHED DOCUMENT SECTION 15840 – AIR TERMINAL UNITS**

ITEM FOUR: **REPLACE THE ORIGINAL DRAWINGS M2.7 AND M7.1 WITH THE ATTACHED DRAWINGS M2.7 AND M7.1**

BIDDER SHALL ACKNOWLEDGE RECEIPT OF AMENDMENT NO. 1 IN THE SPACE PROVIDED BELOW AND RETURN IT **WITH THEIR BID RESPONSE**. FAILURE TO DO SO MAY SUBJECT BID TO REJECTION.

_____ _____

Authorized Signature Firm

_____

Date

SECTION 15840 - AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Terminal units.

B. Electronic Airflow Control Valves

1.02 RELATED REQUIREMENTS

A. Section 15065 - Motors for Mechanical Equipment.

B. Section 15182 - Hydronic Piping: Connections to heating coils.

C. Section 15183 - Hydronic Specialties: Connections to heating coils.

D. Section 15810 - Ducts.

E. Section 15820 - Duct Accessories.

F. Section 15850 - Air Outlets and Inlets.

G. Section 15928 - Instruments and Control Elements: Thermostats and Actuators.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

D. Project Record Documents: Record actual locations of units.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
   1. Spare parts lists
   2. Operating instructions
   3. Maintenance instructions, including preventative and corrective maintenance.
   4. Copies of warranties
   5. Wiring diagrams
   6. Shop drawings and product data

1.04 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 AIR TERMINAL UNITS

A. MANUFACTURERS
1. Carrier
2. Enviro-Tec
3. JCI
4. Trane
5. Price
6. Titus
7. Metal Aire
8. Nailor

B. Refer to schedules for model and type terminal unit specified.

C. Hot Water Heating Coil:
1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.

D. Automatic Damper Operator:
1. Electric Actuator: 24 volt with high limit.

2.02 ELECTRONIC AIRFLOW CONTROL VALVE

A. Manufacturers
1. Phoenix Controls
2. Other acceptable manufacturer's that meet specification

B. General
1. The airflow control device shall be a venturi valve.
2. The valve assembly manufacturer's Quality Management System shall be registered to ISO 9001:2008.
3. The airflow control device shall be pressure independent over its specified differential static pressure operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifolded system.
4. The airflow control device shall maintain accuracy within ±5% of signal over an airflow turndown range of no less than:
   a. Standard Valve Body Type
      1) Up to 1000 CFM - 20 to 1
      2) Up to 1500 CFM - 16 to 1
      3) Up to 2500 CFM - 12 to 1
   b. Shut-off Valve Body Type
      1) Up to 850 CFM - 17 to 1
      2) Up to 1300 CFM - 14 to 1
      3) Up to 1600 CFM - 8 to 1
5. No minimum entrance or exit straight length of duct shall be required to ensure

accuracy and/or pressure independence.

6. The airflow control device shall maintain pressure independence regardless of loss of power.
7. The airflow control device shall be constructed of one of the following four types:
   a. Class A-The airflow control device for non-corrosive airstreams, such as supply and general exhaust, shall be constructed of 16-gauge aluminum. The device's shaft and internal "S" link shall be made of 316 stainless steel. The shaft support brackets shall be made of galvaneal (non shutoff valves) or 316 stainless steel (shutoff valves). The pivot arm shall be made of aluminum (for non shutoff valves) and 303/304 stainless (for shut off valves). The pressure independent springs shall be a spring-grade stainless steel. All shaft bearing surfaces shall be made of a PP (polypropylene) or PPS (polyphenylene sulfide) composite. Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction. No sound absorptive materials of any kind shall be used.
   b. Class B-The airflow control device for corrosive airstreams, such as fume hoods and biosafety cabinets, shall have a baked-on, corrosion-resistant phenolic coating. The device's shaft shall be made of 316 stainless steel with a Teflon coating. The shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal "S" link shall be made of 316 or 303 stainless steel. The pressure independent springs shall be a spring-grade stainless steel. The internal nuts, bolts and rivets shall be stainless steel. All shaft bearing surfaces shall be made of PP (polypropylene) or PPS (polyphenylene sulfide) composite.
8. Actuation
   a. A standard-speed electric actuator shall be used to modulate the airflow over the range of the specific valve size. The maximum time to modulate from minimum to maximum flow shall be less than 60 seconds for standard valves and 90 seconds for shut-off valves. A UL or CSA listed electronic actuator shall be factory mounted to the valve. The actuator shall have sufficient torque to modulate the airflow against the maximum duct static pressure (within product specifications).
9. The control valves shall integrate with the BMS.
10. Certification
    a. Each airflow control device shall be factory characterized to the job specific airflows as detailed on the plans and specifications using NIST accredited air stations and instrumentation having a combined accuracy of no more than ±1% of signal (5,000 to 250cfm), ±2% of signal (249 to 100cfm) and ±3% of signal (199 to 35cfm). Electronic airflow control devices shall be further characterized and their accuracy verified to ±5% of signal at a minimum of 48 different airflows across the full operating range of the device.
    b. Each airflow control device shall be marked with device-specific factory characterization data. At a minimum, it should include the room number, tag number, serial number, model number, eight-point characterization information (for electronic devices), date of manufacture and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation. Characterization data shall be stored indefinitely by the manufacturer and backed up off site for catastrophic event recovery.
11. Airflow control devices that are not venturi valves and are airflow measuring devices (e.g., pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) shall only be

acceptable, provided these meet all the performance and construction characteristics as stated throughout this specification and:

a. The airflow control device employs transducers manufactured by Rosemount, Bailey, Bristol, or Foxboro. Accuracy shall be no less than ±0.15% of span (to equal ±5% of signal with a 15 to 1 turndown) over the appropriate full-scale range, including the combined effects of nonlinearity, hysteresis, repeatability, drift over a one-year period, and temperature effect. 316L stainless steel materials shall be provided for all exhaust applications. The use of 304 stainless steel or aluminum materials shall be provided for all supply air applications.
b. Airflow sensors shall be of a multi-point averaging type, 304 stainless steel for all supply and general exhaust applications, 316L stainless steel for all fume hood, canopy, snorkel, and biosafety cabinet applications. Single point sensors are not acceptable.
c. Suppliers of airflow control devices or airflow measuring devices requiring minimum duct diameters shall provide revised duct layouts showing the required straight duct runs upstream and downstream of these devices. Coordination drawings reflecting these changes shall be submitted by the supplier of the LACS. In addition, suppliers shall include static pressure loss calculations as part of their submittals. All costs to modify the ductwork, increase fan sizes and horsepower and all associated electrical changes shall be borne by the control system supplier.

C. EXHAUST AND SUPPLY AIRFLOW DEVICE CONTROLLER

1. One controller shall be provided for both the supply airflow control device and the corresponding exhaust airflow control device. The controller shall be a microprocessor-based design and use closed-loop control to linearly regulate airflow based on a digital control signal. The device shall generate a digital feedback signal that represents its airflow.
2. In flow tracking applications where an exhaust device and or a return device is tracking a supply device, flow data for each device (up to 3 valves total) shall be downloaded to the controller in the factory.
3. The airflow control device shall store its control algorithms in non-volatile, rewritable memory. The device shall be able to stand alone or to be networked with other room-level digital airflow control devices through an industry standard protocol.
4. Room-level flow tracking control functions shall be embedded in and executed by one controller mounted on one of the airflow devices.
5. The room-level control network shall communicate by using BACnet® MS/TP protocol. The control device must meet the requirements of a BACnet Application Specific Controller (B-ASC Level Device), and be a BACnet Testing Laboratories (BTL) certified device.
6. The airflow control device shall use industry standard 24 VAC power.
7. The airflow control device shall have provisions to connect a notebook PC commissioning tool and every node on the network shall be accessible from any point in the system.
8. The airflow control device shall include inputs with 10-bit resolution that accept 10K thermistors, 0-10 VDC, 0-5 VDC, 0-20 mA and dry contact signals. Controller shall include binary and analog outputs on board. Analog outputs shall be 5 VDC, 0-10 VDC, 2-10 VDC, or 0-20mA. Software shall include scaling features for analog outputs. Controller shall include a 24 Vdc voltage supply for use as power supply to external sensors.

9. Controller shall also include support for interface with digital display which allows display and modification of controller set point variables.

D. Temperature Controller
1. For zones with constant volume (CV) venturi valves that require hydronic reheat control, provide a low-voltage and microprocessor-based zoning thermostat-controller capable of (Select: three point floating or 0-10Vdc analog control). The thermostat-controller shall operate in a stand-alone mode and be capable of BACnet MSTP communications.
   a. Thermostat-controller shall be pre-programmed, containing all required I/O to accomplish local HVAC temperature control for heating with reheat.
   b. Thermostat-controller shall be provided with two (2) floating or two (2) analog proportional-integral control outputs. Thermostat-controller shall have integrated changeover function, which will allow seamless switching between cooling and heating mode based upon temperature or a network value input.
   c. Thermostat-controller shall achieve accurate temperature control using a PI proportional-integral algorithm. Differential-based thermostat-controllers are not acceptable. Thermostat-controller shall have an adjustable deadband.
   d. Thermostat-controller shall have an on-board 10K NTC thermistor and the capability for a remote temperature sensor that will replace the on-board temperature sensor.
   e. Thermostat-controller shall be capable of local or remote override during unoccupied mode. The thermostat-controller shall resume occupied setpoints and will revert back to unoccupied setpoints after a set time adjustable from 0 to 24 hours. Thermostat-controller shall also have configurable temporary or permanent local override setpoints. When the “temporary setpoints” mode is enabled, once the temporary occupancy timer expires, the setpoints will revert back to their default values. Thermostat-controller shall have adjustable local unoccupied heating and cooling setpoint limits as well as maximum heating and minimum cooling limits.
   f. Thermostat-controller shall also provide; (2) additional configurable inputs for remote night setback, occupancy sensing, door contact, remote override, or filter alarm as required. (1) additional configurable input for dry contact or analog sensor changeover, or for other temperature sensor monitoring as required. (1) configurable auxiliary output to be used for heating or local digital output.
   g. Thermostat-controller shall be equipped with 2-line, 16-character LCD dual intensity backlit display with two status LEDs for heating or cooling mode, and be capable of displaying temperatures in Celsius or Fahrenheit.
   h. Thermostat-controller shall utilize EEPROM memory to back up local configuration parameters in the event of power failure. Thermostat-controllers requiring batteries, or have no provisions for retention during loss of power shall not be acceptable.
   i. Thermostat-controller shall have (4) adjustable keypad lockout levels limiting access to changes of occupied and unoccupied setpoints.

E. OPERATION SEQUENCES
1. Room Volumetric Offset Control
   a. The airflow control system shall control supply and exhaust airflow devices in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. The offset

represents the air volume that enters or exits the room from the corridor or adjacent spaces.

b. The airflow control system shall maintain the fixed volumetric offset as the supply and exhaust venturi valves increase or decrease flow to meet temperature, occupancy, or ACH demands.

c. The offset control algorithm shall sum the flow values of all supply and exhaust airflow devices and command appropriate controlled devices to new set points to maintain the desired offset. This offset shall be adjustable from the BMS or locally through commissioning software installed on a laptop computer.

d. The offset control algorithm shall consider non-networked airflow control devices that consist of supply and exhaust flow devices that provide an analog signal scaled to reflect actual flow and any number of constant volume devices where the total of the supply and exhaust devices or may be included in the offset control algorithm.

2. Space Temperature Control

a. The airflow control system shall regulate the space temperature through a simultaneous combination of programmable volumetric thermal override and control of reheat coils and/or staged or simultaneous auxiliary temperature control devices. The controller shall calculate separate cooling and heating set points based on a single writable set point from the BMS, with the option of a local set point offset adjustment.

b. Temperature control shall be implemented through the use of independent primary cooling and heating control functions, as well as an auxiliary temperature control function, which may be used for either supplemental cooling or heating. Cooling shall be provided as a function of thermal override of conditioned air with the supply and exhaust airflow devices responding simultaneously to maintain the desired offset. Heating shall be provided through either modulating or floating point control actuator of a properly sized control valve connected to the selected reheat coil.

3. Occupancy Override Control

a. The airflow control system shall have the ability to change the minimum ventilation and/or temperature control set points, based on the occupied state, to reduce energy consumption when the space is not occupied. Two occupancy modes shall be available: occupied and unoccupied. The occupancy state may be set by either the BMS as a scheduled event or a local override button that allows a user to set the space to occupied for a predetermined interval. The local timed bypass button (located on the wall mounted temp sensor) or the override contact shall be given priority over the BMS command.

4. Emergency Mode Control (Alternate Flow Control)

a. The airflow control system shall provide a means in conjunction with a BMS supervisory controller of overriding temperature and pressurization control in response to a command indicating an emergency condition exists, and airflow control devices are to be driven to a specific flow set point. The system shall support up to four emergency control modes. The emergency control modes may be initiated either by a local contact input or BMS command. Once an emergency mode is invoked, pressurization (offset) and temperature control are overridden for the period that the mode is active. Emergency modes shall have a priority scheme allowing a more critical mode to override a previously set condition.

5. Humidity Control

a. The airflow control system shall have an optional embedded humidity control function, which allows the monitoring and control of the relative humidity level in the pressurized zone. The airflow devices shall have the ability to monitor the relative humidity level of the space and, based on a BMS writeable set point, develop a control signal to drive a humidification control circuit.

6. Shut-off Control
   a. The air flow control venturi valves shown on the drawings and schedules as type SOV shall be capable of shut off function. Each device shall be capable of accepting a digital input to switch the air valves from the set point flow to shut-off position using either Pandemic or Emergency modes. These valves shall also be capable of network operation and being commanded to shut-off position from the BMS. Feedback shall be available to indicate flow and shut-off.
7. 3-State Control
   a. The airflow control system shall provide a means of controlling a 2 or 3-state local exhaust device (e.g. hood, canopy, snorkel). 2-state control can be set for either min flow (unoccupied) and max flow (occupied), or off and max flow (normal). 3-state control can be off, min (unoccupied) and max (normal) flow.
8. LED Control / Alarming
   a. The airflow control system shall provide LED notification for 2 or 3-state hoods, 2-state snorkels or capture hoods (LED provided by others). Alternatively, when not used for LED notification, the LED control can be used for room-level alarm indication for spaces such as Operating Rooms (alarm provided by others).
9. Indoor Air Quality (IAQ) Control
   a. The airflow control system shall provide a means of dynamically controlling the air change per hour (ACH) rate to the space, based on the input from an air quality signal (i.e. monitoring system or a maximum of two local sensors). A minimum and maximum ACH shall be programmed into the controller and the airflow control system shall linearly ramp within these values in response to the air quality signal. Proper offset and directional airflow will be maintained at all times.
10. Pandemic Mode Control
    a. The airflow control system shall provide a means of receiving a local or network command to switch to 100% outside exhaust by closing the return air valve and opening the exhaust air valve, change the pressurization (i.e. volumetric offset) of the space from neutral to negative or positive and increase the ACH set point.
11. BACnet Multi-Use Inputs
    a. In addition to the dedicated inputs for standard control functions, each BACnet venturi valve controller shall provide multi-use inputs for the following local monitoring or control functions (per the capabilities and limitations shown in Section 2.05.A):
       1) Discharge Air Sensor
       2) Volumetric Cooling Override
       3) Occupancy Sensor
       4) Humidity Sensor
       5) Pressure Monitoring
       6) IAQ Sensor
       7) Pandemic Switch
       8) Emergency Switch
       9) Additional Flow Inputs (Supply and Exhaust)
       10) Local Offset Selection Switch

F. BACnet INTERFACE TO BUILDING MANAGEMENT SYSTEMS
1. The airflow control system network shall interface digitally with the BMS via BACnet MS/TP. All room-level points shall be available to the BMS for monitoring or trending. At a minimum, the airflow controller shall be BACnet Testing Lab (BTL) certified as an Application Specific Controller (B-ASC).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Support units individually from structure. Do not support from adjacent ductwork.

C. Connect to ductwork in accordance with Section 15810.

3.02 ELECTRONIC AIRFLOW CONTROL VALVES

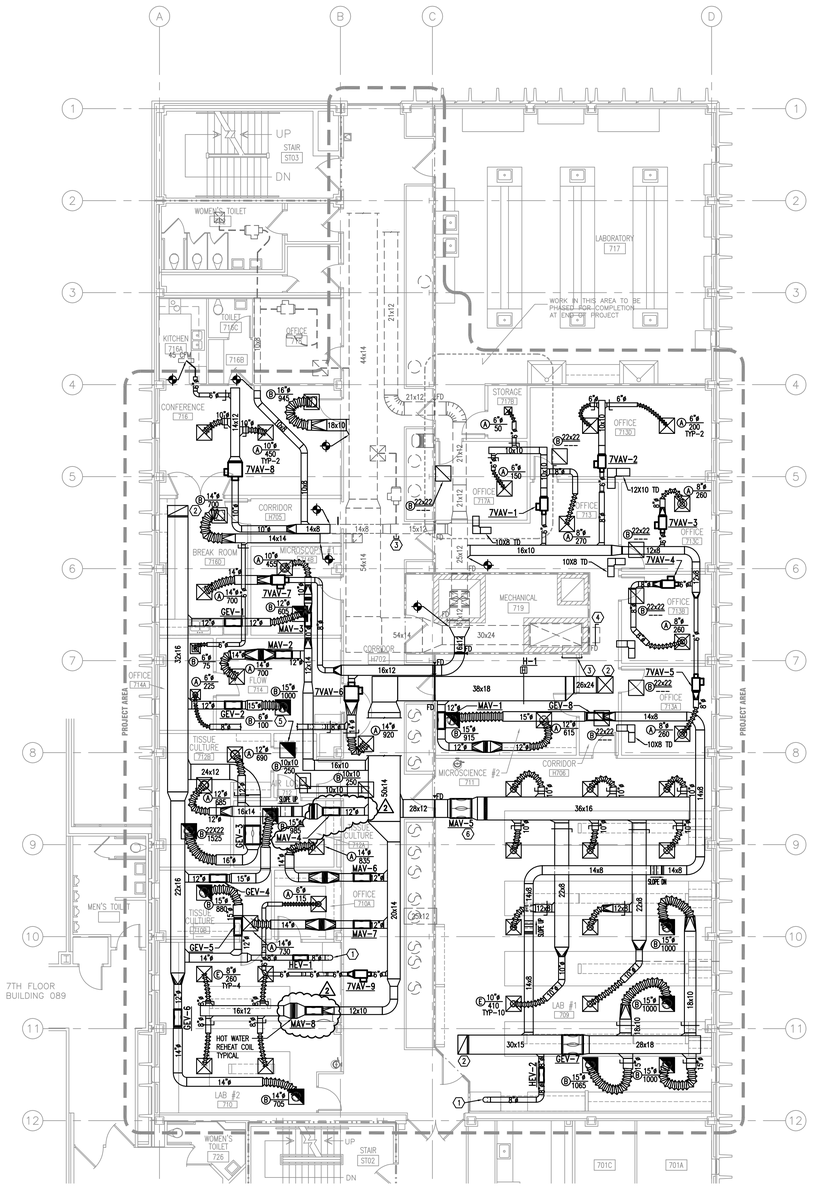
A. Installation
1. The BMS contractor shall install any required routers and repeaters or supervisory controllers in an accessible location in or around the designated critical or non critical room.
2. The BMS shall install an appropriately sized and fused 24 Vac transformer suitable for NEC Class II wiring.
3. The BMS contractor shall provide all required reheat coil and radiation control valves. Actuators shall be proportional or floating point control.
4. All cable and conduit shall be furnished and installed by the BMS contractor. The BMS contractor shall terminate and connect all cables as required. The BMS shall utilize cables specifically recommended by the airflow controls supplier.
5. The mechanical contractor shall install all airflow control devices in the ductwork and connect all airflow control valve linkages.
6. The mechanical contractor shall install any sound attenuating devices provided by the airflow controls supplier.
7. The mechanical contractor shall provide and install all reheat coils and duct transitions.
8. The mechanical contractor shall install all reheat and radiation control valves.
9. The mechanical contractor shall provide and install insulation as required.
10. Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.

B. System Start-up and Training
1. System start-up shall be provided by a factory-authorized representative of the airflow control system manufacturer. Start-up shall also provide electronic verification of airflow, supply, make-up, general exhaust, system programming and integration to BMS (when applicable).
2. The balancing contractor shall be responsible for final verification and reporting of all airflows.
3. The airflow control system supplier shall furnish a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves and general troubleshooting procedures.
4. Operation and maintenance manuals, including as-built wiring diagrams and

component lists, shall be provided for each training attendee.

C. CLOSEOUT ACTIVITIES
1. Training
   a. The ACS supplier shall furnish a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, general procedures for verifying airflows of air valves and general troubleshooting procedures.
   b. Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each training attendee.
2. Maintenance
   a. The airflow control valve utilizing flow metering and volumetric offset shall require no scheduled maintenance.
   b. Systems using airflow management sensors/transducers (e.g., pitot tube, flow cross, orifice ring, air bar, hot wire, vortex shedder, side wall sensors, etc.) shall provide at no additional cost to the owner during and after the warranty period five years of required preventive maintenance on all airflow sensors.
      1) Airflow sensors shall be removed, inspected, and cleaned semi annually during the five-year period to prevent inaccuracies due to long-term buildup of dust, lint corrosion, wet or sticky particles, or other materials that foul the sensors.
      2) If impractical to remove the airflow sensors, the critical airflow control system supplier shall include in the proposal the cost of supplying and installing duct access doors, one for each sensor, so that they may be cleaned in place.
      3) The transducer shall be checked and recalibrated every 6 months to ensure long-term accuracy.
      4) Note that auto-zero recalibration of transducers is not acceptable as a substitute for semi-annual recalibration.

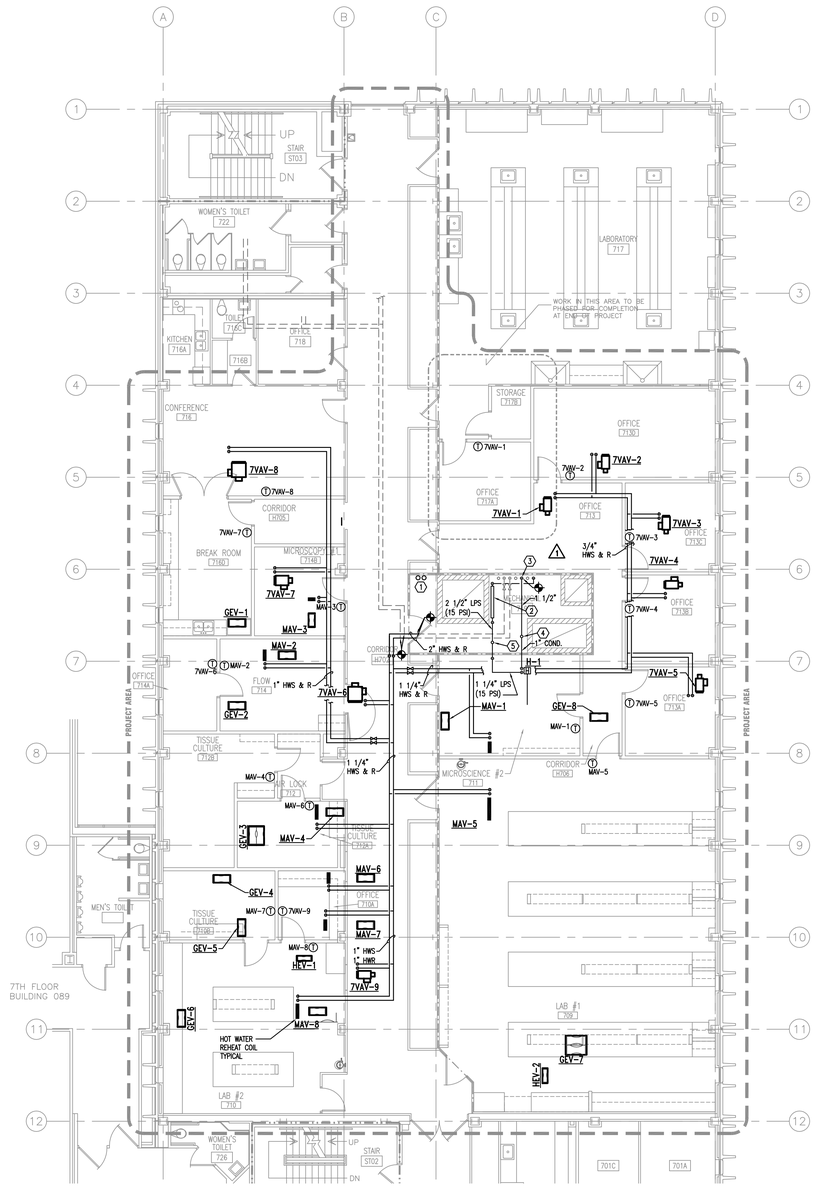
END OF SECTION



NOTES:

1. ROUTE DUCT DOWN AND CONNECT TO FUME HOOD. TRANSITION DUCT AS REQUIRED TO FUME HOOD CONNECTION SIZE. COORDINATE SIZE AND LOCATION WITH FUME HOOD MANUFACTURER.
2. DUCT UP THROUGH ROOF. SEE SHEET M2.8 FOR CONTINUATION.
3. CAP AND REINSULATE EXISTING DUCT.
4. ADD NEW BALANCING DAMPER IN EXISTING RETURN DUCT AND BALANCE TO 1400 CFM.
5. 6"ø UP TO EF-1 ON ROOF AND DOWN TO (B) 6"ø 100°. PROVIDE TRANSITION FROM 6"ø EXHAUST DUCT TO CONNECTION OF EF-1.
6. SEE VENTURI TYPE VALVE WITH REHEAT DETAIL FOR ADDITIONAL INFORMATION.

1 PARTIAL SEVENTH FLOOR PLAN – HVAC DUCTWORK
1/8"=1'-0"



PIPING NOTES:

1. 4" CHWS & R UP TO ROOF. SEE ROOF PLAN FOR CONTINUATION.
2. NEW STEAM PRESSURE REDUCING STATION. SEE STEAM PRESSURE REDUCING STATION DETAIL ON SHEET M0.3 FOR ADDITIONAL INFORMATION.
3. 1 1/2" CONDENSATE DOWN. SEE PARTIAL MECHANICAL ROOM PLANS FOR CONTINUATION.
4. 1 1/2" CONDENSATE UP TO ROOF. SEE SHEET M2.8 FOR CONTINUATION.
5. 2" LPS (15 PSI) UP TO ROOF. SEE SHEET M2.8 FOR CONTINUATION.

2 PARTIAL SEVENTH FLOOR PLAN – HVAC PIPING
1/8"=1'-0"

GMK ASSOCIATES, INC.
Design/Planning/Construction
1201 Main Street, Suite 2100
Columbia, S.C. 29201
tel. 803-256-0000
fax 803-255-7243

consultants

owner

UNIVERSITY OF SOUTH CAROLINA

project name
COKER - 7th FLOOR PHARMACY RENOVATION

State project number
H27- 6101

project number
12023.01

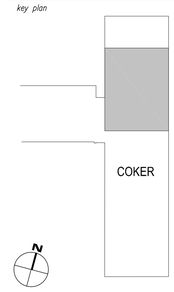
seals/signature

issued for
CONSTRUCTION

date
APRIL 23, 2013

number	item	date
1	ADDENDUM NO. 2	05/28/13
2	VALUE ENGINEERING	07/25/13

key plan



sheet title
PARTIAL SEVENTH FLOOR PLAN HVAC DUCTWORK AND PIPING

sheet number
M2.7

drawn by JDR
checked by JDR

ABBREVIATIONS

ABV	Above	MBH	Thousand BTU/Hr (thousands)
AFF	Above Finished Floor	MIN	Minimum
BHP	Brake Horsepower	MPS	Medium Pressure Steam
BR	Barometric Relief Damper	N/A	Not Applicable
CFM	Cubic Feet Per Minute	NIC	Not in Contract
CC-1	Cooling Coil No. 1	NTS	Not To Scale
CHWS	Chilled Water Supply	OA	Outside Air
CHWR	Chilled Water Return	OBD	Opposed Blade Damper
DD	Duct Smoke Detector	OD	Outside Diameter
DB	Dry Bulb Temperature	PD	Pressure Drop
EAT	Entering Air Temperature	RH-1	Re-Heat Coil No. 1
ELEC	Electric or Electrical	RA	Return Air
EWB	Entering Air Wet Bulb	RET	Return
EWT	Entering Water Temperature	RH	Relative Humidity
ERW-1	Energy Recovery Wheel No. 1	SA	Supply Air
F-#	Filter Type No.	SEER	Seasonal Energy Efficiency Ratio
FL	Floor	SHT	Sheet
H-1	Humidifier No. 1	SP	Static Pressure
HWS	Hot Water Supply	SPEC	Specifications
HWR	Hot Water Return	SPL	Supply
HP	Horsepower	T	Thermostat
LAT	Leaving Air Temperature	T-1	Tank No. 1
LWB	Leaving Air Wet Bulb	TEMP	Temperature
LWT	Leaving Water Temperature	TSTAT	Thermostat
MAX	Maximum	TYP	Typical
		VFD	Variable Frequency Drive
		WB	Wet Bulb Temperature
		WPD	Water Pressure Drop (in. w.g)

MECHANICAL GENERAL NOTES

1. DO NOT SCALE DRAWINGS; SEE ARCHITECTURAL DRAWINGS AND REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF DOORS, WINDOWS, CEILING, DIFFUSERS, ETC.
2. EXTEND ALL DRAIN LINES TO EXTERIOR AND SPILL ON GRADE. ROUTE TO AVOID INTERFERENCE WITH PASSAGEWAYS. CONDENSATE DRAINS SHALL BE TRAPPED. SLOPE DRAIN LINES 1/8" PER FOOT.
3. ALL PIPING AND DUCTWORK INSULATION SHALL BE RUN CONTINUOUSLY THROUGH FLOORS, ROOFS AND PARTITIONS EXCEPT WHERE PROHIBITED BY FIRE CODES.
4. ALL PIPING SHALL BE SUPPORTED IN ACCORDANCE WITH THE SPECIFICATIONS AND FURTHER SUPPORTS OR HANGERS SHALL BE ADJACENT TO ELBOWS, TO PREVENT WEIGHT OF PIPING BEING PLACED ON THE EQUIPMENT. SUPPORT DETAILS SHALL BE SUBMITTED TO THE MECHANICAL ENGINEER.
5. ALL PIPING AND DUCTWORK LOCATIONS SHALL BE COORDINATED WITH THE WORK UNDER OTHER DIVISIONS OF THE SPECIFICATIONS TO AVOID INTERFERENCE.
6. ALL PIPING, DUCTS, VENTS, ETC. EXTENDING THRU EXTERIOR WALLS AND ROOFS SHALL BE FLASHED AND COUNTERFLASHED.
7. PROVIDE ALL TRANSITIONS REQUIRED FOR INSTALLATION OF DUCT, EXHAUST FANS, AND ALL OTHER EQUIPMENT AND APPURTENANCES.
8. ALL DUCT IS GALVANIZED SHEET METAL EXCEPT AS NOTED.
9. DUCT SIZES ARE CLEAR INSIDE DIMENSIONS.

MECHANICAL DEMOLITION NOTES

1. DRAWINGS SHOW GENERAL INTENT OF DEMOLITION. QUANTITIES, LOCATIONS, SIZES AND EQUIPMENT ARE SHOWN TO INDICATE TYPE OF SYSTEM INSTALLED AND DOES NOT NECESSARILY REPRESENT EXACT CONDITIONS. CONTRACTOR SHALL FIELD VERIFY BEFORE BIDDING.
2. DEMOLITION OF EQUIPMENT, SYSTEMS, AND COMPONENTS SHALL INCLUDE ALL SUPPORTS, PADS, HANGERS, INSULATION, CONTROLS, STARTERS, ACCESSORIES, AND APPURTENANCES NOT REQUIRED FOR THE INSTALLATION OF THE NEW SYSTEM.
3. WHEN PARTIAL DEMOLITION OF A SYSTEM IS INDICATED, THE PART OF THE SYSTEM SHOWN TO REMAINED SHALL BE REMOVED TO THE ACTIVE MAIN OR BRANCH IF NOT REQUIRED FOR THE INSTALLATION OF THE NEW SYSTEM. THE ACTIVE MAIN OR BRANCH SHALL BE REPAIRED TO MATCH NEW INSTALLATION AS MUCH AS PRACTICAL. IF SYSTEM IS INSULATED, INSULATION SHALL BE PATCHED AND FINISHED REPAIR (IE: VAPOR BARRIER, COATING, ETC.)
4. REMOVAL OF SYSTEMS SHALL INCLUDE COMPLETE SYSTEM WHENEVER PRACTICAL. IF NOT, SYSTEM (IE: PIPE, CONDUIT, ETC.) SHALL BE REMOVED TO 1 INCH BELOW SURFACE.

HVAC LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
T	TEMPERATURE SENSOR OR THERMOSTAT		CEILING SUPPLY DIFFUSER, RETURN GRILLE W/ FLEX DUCT CONN. FOR RETURN OR EXHAUST AIR; SEE "DIFFUSER & GRILLE SCHEDULE"	18x12 12x12	TRANSITION, FLAT ON BOTTOM (FOB) FLAT ON TOP (FOT, IF APPLICABLE)
S	WALL SWITCH		EXISTING DUCT WORK TO REMAIN		TURNING VANES
H	WALL HUMIDISTAT		EXISTING DUCT WORK TO BE REMOVED		DUCT SMOKE DETECTORS
	CONNECT TO EXISTING		DUCT TURNING DOWN	CR	CONCEALED REGULATOR
18x12	RECTANGULAR DUCT SIZE, FIRST FIGURE IS SIDE SHOWN		DUCT TURNING UP		MANUAL VOLUME DAMPER
18"ø	ROUND DUCT SIZE		UNION	A 6"ø 100	A – DIFFUSER TAG 6"ø – NECK SIZE 100 – CFM
R	CHANGE OF ELEVATION, RISER (R), DROP (D)		STRAINER		GATE VALVE
	ACOUSTICAL LINING INSULATION		STRAINER WITH BLOW OFF		CONTROL VALVE, TWO WAY
	FLEXIBLE DUCT		ECCENTRIC REDUCER FLAT ON TOP		END CAP
CHWS	CHILLED WATER SUPPLY		TEE OUTLET UP		ELBOW TURNED DOWN
CHWR	CHILLED WATER RETURN		TEE OUTLET DOWN		ELBOW TURNED UP
	CONCENTRIC REDUCER				ECCENTRIC REDUCER FLAT ON BOTTOM

AIR DISTRIBUTION SCHEDULE

TAG	DESCRIPTION	NECK	MODULE SIZE	MOUNT	CONSTR.	MFGR	MODEL	NOTES
A	SQUARE PLAQUE CEILING SUPPLY	AS SHOWN	24x24	LAY-IN	ALUMINUM	PRICE	SERIES ASPD	2,3
B	PERFORATED CEILING RETURN/EXHAUST	AS SHOWN	24x24	LAY-IN	ALUMINUM	PRICE	SERIES APDDR	3
C	SQUARE PLAQUE CEILING SUPPLY	AS SHOWN	16x16	SURFACE	ALUMINUM	PRICE	SERIES ASPD	2,3
D	PERFORATED CEILING RETURN/EXHAUST	AS SHOWN	16x16 1	SURFACE	ALUMINUM	PRICE	SERIES APDDR 1	3 1
E	LABORATORY SUPPLY DIFFUSER	AS SHOWN	24x24	LAY-IN	ALUMINUM	PRICE	SERIES AFRFD	3,4

1. FURNISH WITH OPPOSED BLADE DAMPER 1
2. 4-WAY DEFLECTION UNLESS NOTED OTHERWISE
3. BAKED ENAMEL OFF-WHITE FINISH
4. 2-WAY RADIAL PATTERN
5. FURNISH WITH 2 SETS OF REPLACEMENT FILTERS

FAN SCHEDULE

TAG	TYPE	CAPACITY CFM	E.S.P. (IN. WG.)	MOTOR HP	MOTOR RPM	ELECTRICAL (VOLTS/PHASE)	EMERGENCY POWER	MANUFACTURER	MODEL NO.	NOTES
LEF-1	VENT SET	6535	2.2	15	1725	460/3/60	NO	GREENHECK	VEXTOR-CD-15-1-B-MV	3,6,9,10,11,12,13
LEF-2	VENT SET	5465	2.2	15	1725	460/3/60	NO	GREENHECK	VEXTOR-CD-15-1-B-MV	3,6,9,10,11,12,13
EF-1	DOWNBLAST	100	0.375	1/6	1725	115/1/60	NO	GREENHECK	G-060-VG	2,3,4,5,8

1. MOTORIZED BACKDRAFT DAMPER
2. GRAVITY BACKDRAFT DAMPER
3. DISCONNECT SWITCH
4. BIRDSCREEN
5. SEISMIC ROOF CURB
6. BELT GUARD
7. FILTER
8. ECM MOTOR W/VFD
9. BYPASS DAMPER
10. PLENUM
11. CHEMICAL RESIST FLEX CONNECTION
12. VFD IN NEMA 3R ENCLOSURE
13. SPRING ISOLATORS

STEAM HUMIDIFIER SCHEDULE

TAG	LOCATION	TYPE	DUCT SIZE	CFM	CAPACITY (LBS/HR)	STEAM PRESS. (PSIG)	MAXIMUM ABSORPTION DISTANCE	AIR PD (IN W.C.)	MANUFACTURER	MODEL	NOTES 1
H-1	RM 711	DUCT MOUNTED	38X18	11000	215	15	24"	0.051	DRI-STEEM	ULTRA-SORB LV	1,2,3,4,5,6,7

1. FULL MODULATING CONTROL
2. HI-LIMIT SENSOR
3. DUCT MOUNTED HUMIDITY SENSOR
4. HUMIDIFIER ON EMERGENCY POWER
5. PRESSURE AIRFLOW PROVING SWITCH
6. STEAM TRAP
7. ELECTRONIC ACTUATOR 1

ROOFTOP UNIT SCHEDULE

TAG	SERVICE	CAPACITY CFM	MINIMUM O.A.	FAN TYPE	STATIC PRESS. IN. W.G. TOTAL	STATIC PRESS. IN. W.G. EXT	FAN RPM	FAN BHP	MOTOR RPM	MOTOR HP	LAT. UNIT (°F)	ELECTRICAL VOLTS/PHASE	EMERGENCY POWER	AIR VOLUME CONTROL	PREHEAT COIL EQ. NO.	HEATING COIL EQ. NO.	COOLING COIL EQ. NO.	PRE-FILTER (%)	FINAL FILTER	HUMIDIFIER EQ. NO.	MANUFACTURER	MODEL	REMARKS
RTU-1	SUPPLY	11000	11000	AIRFOIL	7.58	3.5	2017	20.21	1800	25	55.0	480/3	YES	VFD	HC-1	---	CC-1	30	F-1A & F-1B	---	TRANE	PERFORMANCE CLIMATE CHANGER-25	1,2

1. FACTORY MOUNTED VFD
2. SINGLE POINT POWER CONNECTION

FILTER SCHEDULE

TAG	SYSTEM	TYPE MEDIA	CAPACITY (CFM)	FILTER DEPTH (INCHES)	MAXIMUM AIR VELOCITY (FPM)	INITIAL PRESS. DROP (IN. WG.)	FINAL PRESS. DROP (IN. WG.)	EFFICIENCY PERCENT	MERV RATING	MANUFACTURER	MODEL	NOTES
F-1A	RTU-1	PRE-FILTER	11000	4"	500	0.31	1.0	30	8	FARR	30/30	1
F-1B	RTU-1	FINAL FILTER	11000	12"	500	0.6	1.5	95	14	FARR	RIGA-FLO	1

1. TEST METHOD: ASHRAE 52.1-92 STANDARD

MAKEUP AIR VALVE SCHEDULE

TAG NO.	MAXIMUM BOX CFM	MINIMUM BOX CFM	MIN. INLET S.P. (W.C.)	PIPE RUNOUT SIZE (INCHES)	REHEAT COIL GPM	REHEAT COIL MBH	REHEAT COIL EWT (°F)	REHEAT COIL LWT (°F)	REHEAT COIL MAX. AIR VEL.	REHEAT COIL MAX COIL HT.	REHEAT COIL MAX. WPD	PRIMARY NC @ 1.5" SP DISCH/RAD.	INLET SIZE (INCHES)	ELECTRICAL (VOLTS/PHASE)	TRACKING VALVE 1	MANUFACTURER	MODEL NO.	NOTE 1
MAV-1	615	300	1.25	3/4"	1.2	11.7	160	140	900	12"	5	---	12	120/1	GEV-8	PHOENIX CONTROLS	HSWF10M-ALN4Z	1,2,3,4
MAV-2	700	300	1.25	3/4"	1.2	11.7	160	140	900	12"	5	---	12	120/1	GEV-2	PHOENIX CONTROLS	HSWF12M-ALN4Z	1,2,3,4
MAV-3	455	150	1.25	3/4"	0.6	5.9	160	140	900	10"	5	---	10 2	120/1	GEV-1	PHOENIX CONTROLS	HSWF10M-ALN4Z	1,2,3,4
MAV-4	1375	195	1.25	3/4"	0.8	7.6	160	140	900	12"	5	---	12 28X14	120/1	GEV-3	PHOENIX CONTROLS	HSWF12M-ALN4Z	1,2,3,4 2
MAV-5	4100	1495	1.25	1"	5.8	58.4	160	140	900	14"	5	---		120/1	GEV-7	PHOENIX CONTROLS	HSWX214M-ALN4Z	1,2,3,4
MAV-6	835	150	1.25	3/4"	0.6	5.9	160	140	900	12"	5	---	12	120/1	GEV-4	PHOENIX CONTROLS	HSWF12M-ALN4Z	1,2,3,4
MAV-7	730	150	1.25	3/4"	0.6	5.9	160	140	900	12"	5	---	12	120/1	GEV-5	PHOENIX CONTROLS	HSWF12M-ALN4Z	1,2,3,4
MAV-8	1040	480	1.25	3/4"	1.9	18.7	160	140	900	12"	5	---	12	120/1	GEV-6	PHOENIX CONTROLS	HSWF12M-ALN4Z	1,2,3,4

2
1. LOW SPEED ELECTRIC ACTUATOR
2. CONTROL POWER TRANSFORMER
3. REHEAT COIL MOUNTED IN DUCT
4. FLANGED CONNECTION 1

GENERAL EXHAUST VALVE SCHEDULE

TAG NO.	AREA SERVED	MAXIMUM BOX CFM	MINIMUM BOX CFM	MIN. INLET S.P. (W.C.)	PRIMARY NC @ 1.5" SP DISCH/RAD.	INLET SIZE (INCHES)	ELECTRICAL (VOLTS/PHASE)	MANUFACTURER	MODEL NO.	NOTE 1
GEV-1	---	605 1	300	1.25	---	12	120/1	PHOENIX CONTROLS	HSWF12M-ALN4Z	2,3,6,7
GEV-2	---	1000	600	1.25	---	12	120/1	PHOENIX CONTROLS	HSWF12M-ALN4Z	2,3,6,7
GEV-3	---	1525	345	1.25	---	24X12	120/1	PHOENIX CONTROLS	HSWX212M-ALN4Z	2,3,6,7
GEV-4	---	985	300	1.25	---	12	120/1	PHOENIX CONTROLS	HSWF12M-ALN4Z	2,3,6,7
GEV-5	---	880 1	300	1.25	---	12	120/1	PHOENIX CONTROLS	HSWF12M-ALN4Z	2,3,6,7
GEV-6	---	670	110	1.25	---	12	120/1	PHOENIX CONTROLS	HSWF12M-ALN4Z	2,3,6,7
GEV-7	---	4065	1460	1.25	---	28X14	120/1	PHOENIX CONTROLS	HSWX214M-ALN4Z	2,3,6,7
GEV-8	---	915	600	1.25	---	12	120/1	PHOENIX CONTROLS	HSWF12M-ALN4Z	2,3,6,7

1. HIGH SPEED ELECTRIC ACTUATOR
2. LOW SPEED ELECTRIC ACTUATOR
3. CONTROL POWER TRANSFORMER
4. CORROSION-RESISTANT COATING ON VALVE
5. CONNECT TO TWO POSITION WALL SWITCH
6. SEE LAB CONTROL DIAGRAMS FOR MORE INFORMATION
7. FLANGED CONNECTION 1

VARIABLE AIR VOLUME TERMINAL BOX SCHEDULE

TAG NO.	AREA SERVED	MAXIMUM BOX CFM	MINIMUM BOX CFM	MIN. INLET S.P. (W.C.)	PIPE RUNOUT SIZE (INCHES)	REHEAT COIL GPM	REHEAT COIL MBH	REHEAT COIL EWT (°F)	REHEAT COIL LWT (°F)	REHEAT COIL MAX. WPD	PRIMARY NC @ 1.5" SP DISCH/RAD.	INLET SIZE (INCHES)	ELECTRICAL (VOLTS/PHASE)	MANUFACTURER	MODEL NO.	NOTE
7VAV-1	---	470	140	1.0	3/4"	0.8	7.7	160	140	5	---	6	120/1	TRANE	VCWF-06	1,2
7VAV-2	---	400	120	1.0	3/4"	0.7	7.3	160	140	5	---	6	120/1	TRANE	VCWF-06	1,2
7VAV-3	---	260	80	1.0	3/4"	0.5	5.0	160	140	5	---	6	120/1	TRANE	VCWF-06	1,2
7VAV-4	---	260	80	1.0	3/4"	0.5	5.0	160	140	5	---	6	120/1	TRANE	VCWF-06	1,2
7VAV-5	---	260	80	1.0	3/4"	0.5	5.0	160	140	5	---	6	120/1	TRANE	VCWF-06	1,2
7VAV-6	---	1145	1145	1.0	1"	4.4	44.1	160	140	5	---	10	120/1	TRANE	VCWF-10	1,2
7VAV-7	---	700	210	1.0	3/4"	1.0	10.4	160	140	5	---	8	120/1	TRANE	VCWF-08	1,2
7VAV-8	---	900	450	1.0	3/4"	1.8	18.5	160	140	5	---	8	120/1	TRANE	VCWF-08	1,2
7VAV-9	---	115	115	1.0	3/4"	1.8	18.5	160	140	5	---	6	120/1	TRANE	VCWF-06	1,2

1. ELECTRIC ACTUATOR
2. CONTROL POWER TRANSFORMER
3. SOUND ATTENUATOR

HOOD EXHAUST VALVE SCHEDULE

TAG NO.	AREA SERVED	MAXIMUM BOX CFM	MINIMUM BOX CFM	MIN. INLET S.P. (W.C.)	PRIMARY NC @ 1.5" SP DISCH/RAD.	INLET SIZE (INCHES)	ELECTRICAL (VOLTS/PHASE)	MANUFACTURER	MODEL NO. 1	NOTE 1
HEV-1	---	485	485	1.25	---	8	120/1	PHOENIX CONTROLS	CEV8F0M-ACN4Z	3,4,6,7
HEV-2	---	485	485	1.25	---	8	120/1	PHOENIX CONTROLS	CEV8F0M-ACN4Z	3,4,6,7 2

1. HIGH SPEED ELECTRIC ACTUATOR
2. LOW SPEED ELECTRIC ACTUATOR
3. CONTROL POWER TRANSFORMER
4. CORROSION-RESISTANT COATING ON VALVE
5. CONNECT TO TWO POSITION WALL SWITCH
6. SEE LAB CONTROL DIAGRAMS FOR MORE INFORMATION
7. FLANGED CONNECTION 1

COIL SCHEDULE

TAG	LOCATION	SERVICE	CAPACITY CFM	MAX. AIR VELOCITY (FPM)	MIN. FACE AREA (SQ. FT.)	AIR PRESS DROP (IN. WG.)	CAPACITY TOTAL MBH	CAPACITY SENS. MBH	CAPACITY KW	AIR TEMPERATURE ENTERING DB °F	AIR TEMPERATURE ENTERING WB °F	AIR TEMPERATURE LEAVING DB °F	AIR TEMPERATURE LEAVING WB °F	STEAM CAPACITY (LBS/HR)	STEAM PRESS. (PSIG)	WATER ENTERING TEMP. °F	WATER LEAVING TEMP. °F	WATER GPM	MAX. PRESS. DROP (FT. WATER)	MINIMUM NO. OF ROWS	MAXIMUM NO. OF FINS/FT.	ELECTRICAL (VOLTS/PHASE)	NOTES
CC-1	RTU-1	COOLING	11000	500	23.73	1.251	1057.33	516.23	---	95.0	80.0	53.0	52.9	---	---	48.0	60.0	175.7	20	8	163	---	---
HC-1	RTU-1	HEATING	11000	500	22.67	0.069	473.7	---	---	20.0	---	59.7	---	500.7	15	---	---	---	0.1	1	42	---	---

1. MINIMUM WATER VELOCITY - 3 FEET PER SECOND
2. 2-WAY VALVE
3. 3-WAY VALVE
4. MINIMUM WATER VELOCITY - 4 FEET PER SECOND

PUMP SCHEDULE

TAG	SERVICE	TYPE	FLOW (GPM)	HEAD (FT)	EFFICIENCY (%)	MOTOR HP	MOTOR RPM	MOTOR TYPE	ELECTRICAL (VOLTS/PHASE)	EMERGENCY POWER	MANUFACTURER	MODEL	NOTES
P-1B	SECONDARY CHILLED WATER	INLINE	200	56	59.5	7.5	1750	ODP	460/3	NO	BELL AND GOSSETT	SERIES 80 2-1/2 X 9-1/2B	1,2

1. INVERTER DUTY MOTOR
2. VARIBABLE FREQUENCY DRIVE

GMK ASSOCIATES, INC.

Design/Planning/Construction
1201 Main Street, Suite 2100
Columbia, S.C. 29201
tel. 803-256-0000
fax 803-255-7243

consultants

owner

UNIVERSITY OF SOUTH CAROLINA

project name
COKER - 7th FLOOR PHARMACY RENOVATION

State project number
H27- 6101

project number
12023.01

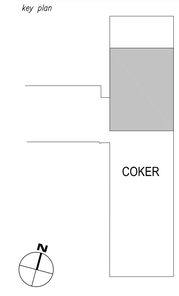
seals/signature

issued for
CONSTRUCTION

date
APRIL 23, 2013

number	item	date
1	ADDENDUM NO. 2	05/28/13
2	VALUE ENGINEERING	07/25/13

key plan



sheet title
HVAC LEGENDS, NOTES, ABBREVIATIONS & SCHEDULES

sheet number
M7.1

drawn by JDR
checked by JDR