THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE
PROCUREMENT SERVICES
301 SPARKMAN DRIVE
HUNTSVILLE, ALABAMA 35899
PHONE (256) 824-6484

DATE	BID NUMBER
9/22/14	**B002315**

RESPONSE DUE BY:
10/06/14
1:30 PM

ALL BIDS WILL BE PUBLICLY OPENED ON THE OPENING DATE DESIGNATED AT THE UNIVERSITY OF ALABAMA IN HUNTSVILLE, PROCUREMENT SERVICES, BUSINESS SERVICES BLDG., HUNTSVILLE, ALABAMA 35899. BIDS RECEIVED AFTER THE SPECIFIED TIME ON THE OPENING DATE WILL NOT BE CONSIDERED.

WHEN USING FEDEX, UPS, OR ANY EXPRESS PACKAGING/SHIPPING, THE BID NUMBER MUST BE CLEARLY PRINTED ON THE AIR BILL.

REQUEST FOR FORMAL BID

CONTACT	EMAIL	VENDOR NO.
JUDY CURTIS	CURTISJ@UAH.EDU	

VENDOR

ALL BIDS MUST BE SIGNED, SEALED, AND RETURNED IN AN ENVELOPE WITH THE BID NUMBER AND OPENING DATE NOTED ON FRONT. FORWARD ALL BIDS TO THE ADDRESS INDICATED ABOVE. FAILURE TO COMPLY WILL RESULT IN A "NO BID" RESPONSE IN ACCORDANCE WITH ALABAMA COMPETITIVE BID LAW 41-16-24 sub-part b.

THE ABOVE BID NUMBER MUST APPEAR ON ALL BIDS AND RELATED CORRESPONDENCE

OR EQUAL, REFER TO GENERAL CONDITIONS ON ATTACHED SHEET

NO	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	EXTENSION
01			THE UNIVERSITY OF ALABAMA IN HUNTSVILLE REQUESTS BIDS FOR A **RENOVATION OF FUME HOOD CONTROLS IN LABS AT MSB** AS PER THE ATTACHED SPECIFICATIONS. **THERE WILL BE A MANDATORY PRE-BID MEETING ON SEPTEMBER 30, 2014 AT 10:30 AM IN THE PHYSICAL PLANT BUILDING ROOM-108.**		
02			VENDORS MUST HAVE A REPRESENTATIVE FROM THEIR COMPANY AT THIS MEETING OR UAH WILL NOT ACCEPT THEIR BID. **AWARD:** NO AWARD INFORMATION WILL BE MADE AVAILABLE BY TELEPHONE, FAX, MAIL, OR EMAIL. ONCE THE BID IS AWARDED, THE AWARD INFORMATION AND TABULATION WILL BE POSTED TO OUR WEBSITE: WWW.UAH.EDU/BUSINESS-SERVICES CLICK ON "VENDORS", THEN "BID AWARDS".		

TOTAL ➡

SHOULD A PURCHASE ORDER BE ISSUED, THE FOREGOING AND THE TERMS AND CONDITIONS ON THE ATTACHED SHEET SHALL BE APPLICABLE AND BINDING UPON THE VENDOR.
I ACKNOWLEDGE THAT I HAVE SIGNATURE AUTHORITY TO SIGN ON BEHALF OF THE COMPANY AND HEREBY AGREE TO ALL GENERAL CONDITIONS OF THIS BID REQUEST.

SIGNATURE _____ DATE _____

COMPANY REPRESENTATIVE

LABORATORY CONTROL SYSTEM
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Note that there are no design drawings which have been developed for this project. However, existing drawings of the original Materials Science Building Science Labs are available in Room 121 of the UAH Physical Plant Building, but they only depict the current or existing state of electrical and mechanical systems.

1.2 SUMMARY

A. This project will entail renovation of Laboratory Control Systems (LCS) for Rooms 216, 218, and 224 of the University of Alabama in Huntsville (UAH) Materials Science Building (MSB), and associated fume hood components as described in this technical specification. Competing contractors will submit a base bid to renovate Laboratory (Fume Hood) control systems for those three rooms, with an alternate bid to renovate Laboratory Control Systems in Room 330 of MSB. Note that the successful bidder must plan and schedule to perform the job during a period from December 11, 2014 through January 6, 2015, thus minimizing impact on classes and Lab operations. That schedule must be coordinated through Tom Estes (256-824-2787), the UAH Director of Mechanical and Electrical Maintenance, in cooperation with respective Lab owner/occupants.
B. Remove all existing supply air valves, water valves, fume hood monitors, sash sensors, temperature sensors, and associated wiring and pneumatic tubing.
C. Provide engineering, documentation, materials, equipment, components, installation, supervision, calibration, software programming, and checkout for a completely renovated and fully operational LCS. This includes, but is not limited to, making any necessary repairs to fume hood sashes to insure safety and proper operation of sash sensors.
D. Provide a LCS to control the airflow into and out of laboratory rooms, control laboratory fume hood exhaust airflow to maintain a constant average face velocity into the fume hood. The LCS shall vary the amount of supply and exhaust airflow into the rooms to operate the laboratories at the lowest possible airflow rates necessary to maintain temperature control, achieve minimum ventilation rates, and maintain laboratory pressurization in relation to adjacent spaces (positive or negative). The LCS shall be capable of operating as a stand-alone system, and as a system integrated with the Digital Control System (DDC).
E. NOTE THAT A MANDATORY PRE-BID MEETING IS SCHEDULED TO TAKE PLACE IN ROOM 108 OF THE UAH PHYSICAL PLANT BUILDING AT 10:30 ON SEPTEMBER 30, 2014. A VISIT TO THE PROJECT SITE WILL FOLLOW THE MEETING AND ATTENDEES WILL BE ABLE TO EVALUATE CONDITIONS IN RESPECTIVE LABS IN ORDER TO DEVELOP BID PROPOSALS. LABS WILL BE AVAILABLE TO THOSE MEETING ATTENDEES FOR THE REMAINDER OF THAT DAY. PROCUREMENT RELATED QUESTIONS WILL BE REFERRED TO JUDY CURTIS AT (256-824-2552) AND TECHNICAL ISSUES WILL BE ADDRESSED BY TOM ESTES AT (256-824-2787). NOTE THAT ALL TECHNICAL SUBMITTALS FOR THIS PROJECT WILL BE FORWARDED TO MR. ESTES FOR APPROVAL.

1.3 REFERENCE

A. ANSI: American National Standards Institute, 1430 Broadway, New York, New York 10018.
   1. ANSI 70-2 - Control Valve Seat Leakage.
B. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, Georgia 30329.
   1. 90.1 –Energy Standard for Buildings Except Low-Rise Residential Buildings.
   2. 130 – Method of Testing for Rating Ducted Air Terminal Units.

3. 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks.

C. ASTM: American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.
1. ASTM B 61 - Steam or Valve Bronze Castings.
2. ASTM B 62 - Composition Bronze or Ounce Metal Castings.
3. ASTM B 584 - Copper Alloy Sand Castings for General Applications.

D. ARI: Air Conditioning and Refrigerating Institute, 1501 Wilson Boulevard, Arlington, Virginia 22209.
1. 880 - Air Terminals.

E. IEEE: Institute of Electrical and Electronics Engineers, 445 Hose Lane, P.O. Box 1331, Piscataway, New Jersey 08855-1331.
1. C62.41 - Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits.

F. ISA: Instrument Society of America, P.O. Box 12277, Research Triangle Park, North Carolina 27709.
1. S75.01 - Flow Equations for Sizing Valves.
2. S75.11 - Inherent Flow Characteristics and Rangeability of Control Valves.

G. NEMA: National Electrical Manufacturers Association, 2101 L. Street N.W., Washington, D.C. 20037.
1. 250 - Enclosures for Electrical Equipment, 1000 Volts Maximum.

H. NFPA: National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.
1. NFPA 70 - National Electrical Code (NEC).

I. UL: Underwriters Laboratories, 333 Pfingsten Road, Northbrook, Illinois 60062.

J. Local building codes.

1.4 DEFINITIONS

A. DDC: Direct Digital Control

B. I/O: Input and output points.

C. LAN: Local Area Network.

D. Power wiring: Wire or cable carrying nominal 120 volts and higher.

E. Instrumentation cable: Wire or cable carrying less than nominal 120 volts.

F. Control wiring: Wire or cable carrying nominal 120 volts or less.

G. Where the word "furnish" or "provide" appears in the specifications, it shall be construed to mean furnish and install complete and ready for safe and regular use. Each exception to this definition shall be specifically defined. For example, access doors required in ceilings or walls are to be furnished to another trade for installation.

H. The term "analog output" means true proportional signaling consisting of 0-20 VDC, 0-10 VDC, 0-5 VDC or 0-20 ma electrical signals. Tri-state/pulse width signaling methods are not considered analog.

I. The term "analog input" means true proportional signaling consisting of resistance vs. temperature devices (RTD's, thermistors) and 0-20 VDC, 0-10 VDC, 0-5 VDC or 0-20 ma electrical signals.

J. The term "binary or digital" when referencing outputs and inputs means a device providing open or closed and on or off indication.

1.5 GENERAL REQUIREMENTS

A. Codes, Rules and Regulations:
1. Comply with the current versions of rules, regulations, and ordinances of the local authority, whether so indicated or not. Where alterations to and/or deviations from the contract documents are required by the authority, report the requirements to the Owner and secure approval before proceeding with work.
2. Comply with rules and regulations of the State Fire Insurance Regulatory Code, and Underwriters' Laboratories, whether so indicated on the contract documents or not. Comply with all Federal, State and municipal building and safety laws, ordinances, and regulations relating to buildings and public safety. Comply with the Owner's insurance underwriters requirements.
3. Documents referenced are the most recent issue as of the time of award, unless noted otherwise.

B. Specifications:
1. Specifications and referenced standards indicate minimum requirements.
2. Where specifications are different or contradict the reference

standards, the more stringent shall apply. Satisfy the more stringent of either the specifications or reference standards at no additional cost to Owner. When conflicts occur, request for direction, before proceeding. Submission of bid constitutes ratification of this requirement.

3. In addressing the arrangements of the principal equipment, ductwork and piping, the overall concept of system operation must be planned and preserved. Where headroom and space conditions appear inadequate, propose solutions to the Owner for review before proceeding with the work.
4. Those bidding this project are required to survey the site to inspect all required offsets, fittings, expansion joints, anchors and accessories which may be required. Carefully investigate the structural and finish conditions affecting the work and the work of other trades and arrange work accordingly. Provide the best possible arrangement so as to provide the maximum headroom and access.

C. Basis of Design:
1. The manufacturer, whose products serve as the basis of design for this project, is identified in Part 2 Products/ 2.1 Manufacturers of this specification.

D. Supervision:
1. Supervise work in accordance with the Conditions of the Contract.

E. Space Limitations:
1. Since space requirements and equipment arrangements vary according to manufacturer, the responsibility for space requirements, initial access and proper fit rests with the Contractor.
2. Provide clearance space in accordance with code requirements, the requirements of the local inspection department, and the recommendations of the equipment manufacturers.

F. Manufacturer's Recommendations:
1. With exceptions as noted in the specifications, apply, install, connect, erect, use, clean and condition manufactured articles, materials, and equipment per manufacturer's current printed recommendations and instructions. Keep copies of such printed recommendations and instructions at the job site and make them available when requested.

1.6 SYSTEM DESCRIPTION AND DESIGN CRITERIA

A. Objectives:
1. The LCS is a major element in providing effective management of the facility and its activities in areas controlled by the LCS.
2. The LCS is required to strike a balanced function between initial cost, operating costs, energy, safety, and comfort. Safety is the top priority, followed by, comfort, then operating cost, and energy.
3. Design the LCS for availability under equipment and power failures and adverse and emergency conditions possible within the building.
4. The DDC system shall provide transaction histories of LCS key events and produce hard copies of information from the available data.
5. Items and details that are specified indicate the minimum elements and characteristics that shall be supplied. Furnish and install other products that are not mentioned, but are required to accomplish the objectives.

B. General:
1. The LCS is a software-based system providing both overall and local supervision.
2. The LCS shall use DDC for control of equipment and devices.
3. The LCS shall be fully integrated and installed as a single complete package.
4. The LCS shall utilize products kept in inventory.

C. System Speed:
1. System communication speed and response time at the time of LCS acceptance:
   a. Values of analog and digital points connected to the LCS shall be updated at least every 2 seconds. Points used globally shall comply with this requirement.
   b. Values of analog and digital points connected to the LCS shall be updated and displayed at least every 10 seconds.
   c. Alarms of analog and digital points connected to the LCS shall be displayed within 2 seconds of activation or change of state.
   d. Performance indicated shall be through a notebook computer connected to the LCS network and through the DDC workstation(s).

D. Control Accuracy:

1. Accuracy shall meet the following end-to-end overall system accuracy, including errors associated with the sensor, transmitter, lead wire, and analog to digital converter.
   2. Temperature:
   a. Air system: Within 0.5 degree F.
   b. Space: Within 1.0 degree F.
3. Relative Humidity: Within 2 percent RH.
4. Airflow: Within 5 percent of design flow rate.
5. Space Pressure: Within 0.5 percent of design setpoint.

E. Reliability:
1. Design, install and configure the LCS to yield a mean time between failure (MTBF) of at least 40,000 hours based on a confidence level of at least 90 percent. The MTBF value shall include any failure for any reason to any part of the LCS.
2. Provide control system redundancy to maintain the system and equipment that is being controlled operational and under automatic control in the event of a failure.

F. Ambient Temperature and Humidity:
1. LCS shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions encountered for the installed location.
2. Provide electrical and electronic products that are not installed in a control panel with a NEMA 250 Type 1 enclosure unless a more stringent enclosure is indicated.

G. Software:
1. Provide software to support the functions specified that is fully supported. No special "patches" or first-time software will be accepted. Provide the latest version of software available at the time of final acceptance.
2. The LCS shall be programmable by the Owner.
3. Execute control functions within the LCS controller. Loop control shall be executed using direct digital control algorithms.
4. Create database and display I/O values with at least the following precision:
   a. Airflow: x.x CFM up to 100 CFM, x CFM between 100 and 1000 CFM, 10x between 1000 and 10,000 CFM and 100x above 10,000 CFM.
   b. Relative Humidity: x percent RH.
   c. Space Pressure: x.xxx in. WC.
   d. Temperature:
      1) Air Systems: x.x deg. F.
      2) Space: x.x deg. F.
   e. Fume hood face velocity: x fpm.
   f. Position:
      1) Air Valve: x percent open.
      2) Fume hood sash position: x percent open.
   g. Voltage:
      1) All: x.x volts up to 100 volts, x for 100 volts and above.
   h. Amps:
      1) All: x .xx milliamps.
      2) All: x.x amps up to 100 amps, x for 100 amps and above.
5. The following points, as a minimum, shall be monitored;
   a. Room Temperature: Analog Input.
   b. Room Temperature Setpoint: Analog Output.
   c. Room Temperature Local Override: Analog Input.
   d. Supply Air Temperature: Analog Input.
   e. Room Air Flow Offset: Analog Input.
   f. Room Air Flow Offset Setpoint: Analog Input.
   g. Cooling Demand: Analog Input.
   h. Cooling Setpoint: Analog Output.
   i. Heating Demand: Analog Input.
   j. Heating Setpoint: Analog Output.
   k. Heating Control Valve Control: Analog Output.
   l. Heating Control Valve Position: Analog Input.
   m. Occupancy Status: Digital Input.
   n. Total Exhaust Flow: Analog Input.
   o. Total Supply Flow: Analog Input.

p. SAV Air Flow: Analog Input.
q. SAV Jam Alarm: Digital Input.
r. SAV Static Pressure Alarm: Digital Input.
s. General (Room) Exhaust Flow: Analog Input.
t. General (Room) Exhaust Jam Alarm: Digital Input.
u. Point Exhaust Flow: Analog Input.
v. Point Exhaust Jam Alarm: Digital Input.
w. Hood Exhaust Flow: Analog Input.
x. Hood Emergency Override: Digital Input.
y. Hood Face Velocity: Analog Input.
z. Hood Sash Opening: Analog Input.
aa. Hood Jam Alarm: Digital Input.
bb. EAV Static Pressure Alarm: Digital Input.
cc. Door Open Status: Digital Input.
dd. LCS UPS Low Battery Alarm: Digital Input.
ee. LCS UPS Battery On Status: Digital Input.
ff. The above point list is a general example of the minimum point requirements.

H. Operator Interfaces:
1. Access:
a. Access to the LCS network, through a DDC computer workstation, notebook computer or dial-up communications shall not limit the availability of data.
b. The hardware configuration of the network shall be transparent to the operator when accessing data.
2. Notebook Computers:
a. Connect notebook computers to the LCS LAN through a communications port directly on the space temperature sensor or through a communication port on a room level controller.
b. Notebook computers shall be able to communicate with any device connected to the LCS regardless of the location of the physical connection to the LCS.
c. The notebook computer shall provide monitoring, programming, setpoint adjustments and reporting capabilities of I/O connected anywhere in the LCS.
d. If communication port is not integral to room sensor or room level controller, provide a separate communication port in each room that is connected to LCS and achieves functionality indicated.

I. Failures:
1. In the event of failure(s), provide automatic reconfiguration of the network to allow all operational equipment to perform their designated functions. The automatic reconfiguration shall maximize the availability of data for global purposes.
2. Provide message and alarm buffering to prevent data from being lost. Use error detection, correction and retransmission to guarantee data integrity.
3. Ensure alarms, including no-signal response, are reported within 2 seconds of failure.
4. Failure of a LCS room level controller that connects the LAN shall not impair the operation of the LAN.
5. In the event of LAN communications loss, LCS room level control shall continue to monitor and control points reporting to it.

1.10 SUBMITTALS

A. General:
1. Submit product data and samples as required.
2. Submit first a coordinated schedule for review and approval:
a. List each proposed submittal. Designate by item, name and specification.
b. Date of submission.
c. Dates that reviewed submittal will be needed.
d. Schedule of coordination meetings. Schedule shall include for each meeting: topics, date, time, duration, and location.
e. Submission shall not begin until coordination schedule has been approved.
3. Before data sheets are submitted for approval, confirm that each separate item or piece of equipment complies with the specifications.
4. Submit brochures that contain only information relative to the particular equipment or

materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless irrelevant information is marked out and relevant material is clearly marked.

5. Obtain written approval for each sequence, schematic, and input/output summary before proceeding with implementation.
6. Submittals shall include software descriptions, calculations, and details required to demonstrate that the system has been coordinated and will function as a system.
7. Submittals shall show sufficient data to indicate compliance with the contract documents.
    a. Proper sizes and capacities.
    b. The item will fit the available space and provide proper service.
    c. Construction methods, materials and finishes.
    d. Manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions for each product in the system.
8. Responsibility for errors and omissions in submittals is not relieved by the review and approval of submittals.
9. Responsibility for deviations from the requirements of the contract documents is not relieved unless written acceptance for each specific deviation is provided.
10. Submittal sheets shall be sequentially numbered with the format sheet number of number. For example, 1 of 3.

C. Response to Specifications:

1. The manufacturer shall submit a point by point statement of compliance with this specification Section.
2. Where the proposed system complies fully, such shall be indicated by placing the word "comply" opposite the paragraph number.
3. Where the proposed system does not comply, or accomplishes the stated function in a manner different from that described, a full description of the deviation shall be provided.
4. Submissions which do not include a point by point statement of compliance as specified shall be rejected.

D. Documentation Requirements:

1. Provide technical specification data sheets for proposed products. Data sheets shall be referenced to products by specification Section, page number, paragraph, subparagraph.
2. The submittal shall contain a complete functional work statement which addresses aspects of the implementation of the LCS including, but not be limited to, the following:
    a. LCS configuration complete with peripheral devices, batteries, power supplies, diagrams, with interconnection diagrams.
    b. Complete detail on hard copy reports, summaries, and logs with respect to format and timing of events which cause their generation.
    c. Complete definition of system operation under failure conditions. Define other failure conditions not covered in this specification which are unique to the proposed system.
    d. Complete bibliography of documentation and media to be delivered to the Owner.
    e. Definition of factory, installation and acceptance test and plans and procedures to be generated in support of the test.
    f. Definition of training of operating personnel.
3. The application software submittal shall consist of a flow diagram and an outline of the subroutines that indicate each program variable name and the units of the variable.
    a. This document shall indicate the origin of constants that are used in the engineering equations and a reference source for the equations.
    b. The software submittal shall include but not be limited to the following:
        1) Complete and detailed operator interface definition for operator alphanumeric and graphic devices.
        2) Complete network communications description for message handling, diagnostic and handshaking protocols.
        3) Complete operation system description, including architectural aspects which affect the implementation of this particular system.
        4) Complete definition of system data base file architecture, including Capacities and limitations thereto.
        5) Complete detail on hard copy reports, summaries, and alarm logs, both with respect to format and to timing of events which cause their generation.
        6) Complete definition of system operation under failure conditions. Also, define any other failure conditions which are peculiar to the proposed

system.

7) Complete definition of application programs and device drivers to be generated. Specific information on data acquisition and control strategies shall be included, showing their relationship to system timing, processing burden and system throughout.

1.11 QUALITY ASSURANCE

A. Requirements Included:
   1. Quality control of products and workmanship.
   2. Manufacturer's instruction.
   3. Manufacturer's certificates and field services.

B. Description:
   1. Maintain quality control over:
      a. Supervision.
      b. Subcontractors.
      c. Suppliers.
      d. Manufacturers.
      e. Products.
      f. Services.
      g. Workmanship.
      h. Site conditions.
   2. Produce work in accordance with contract documents.

C. Quality Control Program:
   1. Provide and maintain an effective quality control program and inspection system to ensure that supplies and services required under the contract conform to the specifications. Maintain and make available to the Owner adequate records of the inspections.

D. Workmanship:
   1. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
   2. Provide qualified personnel to produce work of specified quality.
   3. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and cracking.
   4. Provide finishes to match approved samples.

1.12 COORDINATION MEETINGS

A. Demonstrate and review the progress of the LCS installation with the Owner.

B. Meeting schedule shall be determined following the awarding of the contract. Refer to submittal paragraph for coordination meeting schedule submittal procedure.

C. Exact locations, dates and times will be determined following the awarding of the contract. Location of meetings shall be at project site unless otherwise approved by Owner.

D. Design meetings to involve the Owner with the design and implementation of the LCS.

E. Meeting topics: System architecture, LCS hardware, software, interfaces to other systems, installation schedule, coordination with other trades, system documentation, color graphics, alarms, and other topics.

1.13 WARRANTY

A. General:
   1. Begin the warranty period at the successful completion of the endurances test specified under LCS acceptance. In addition, a warranty shall commence upon the date of shipment and extend for a period of thirty-six months whereupon any defects in materials or LCS performance shall be repaired by the supplier at no cost to the Owner.
   2. The Owner will notify the LCS trade of failure and observed defects.
   3. Corrections to the work shall be at no cost to the Owner.
      a. Guarantee response time to the site shall be no longer than 12 hours following the call from the Owner.
   4. Emergency service shall be available to the Owner on a 24-hour a day basis during this

period. No overtime premium shall be charged during the warranty period. 5. Furnish new and install or repair and replace products to specified quality.

B. Procedures:
   1. Before starting corrections during the warranty period, conform to the Owner's established policy for work on premises.
   2. Before service arrives at the project site to perform the corrective work, notify the Owner.
   3. Upon completion of the corrective work, file a signed copy of the service report with the Owner. Acceptance of corrective work must be acknowledged by the Owner.
   4. If the corrective work requires more than 24 hours to complete, notify the Owner and give an estimate of the completion date.
   5. Modification, alteration, addition or removal of hardware or software from the LCS shall be performed off-line.
   6. Maintain at the site a written maintenance, modification, and repair log:
      a. Record in the Log:
         1) Each incident of equipment malfunction.
         2) Date, time and duration of all maintenance and repair work performed on the equipment.
         3) A description of the cause for the work.
         4) Diagnostic report of corrections or adjustments.
         5) Parts repaired and parts replaced.
         6) A narrative of all special events.
      b. The information in the log shall be aggregated into a management report, delivered on an annual basis to the Owner.

C. Maintenance During the Warranty Period:
   1. During the warranty period, provide normal maintenance service as recommended by the manufacturer.
   2. Maintenance shall include but is not limited to:
      a. Equipment, hardware and materials.
      b. Software maintenance and updates.

D. Scheduled Maintenance:
   1. During the inspection of each element in the LCS, make instrumented tests and adjustments. Repair faulty equipment and replace worn parts.
   2. Schedule at least two inspections during the warranty period.
   3. Inspections shall include the following tasks:
      a. Visual checks.
      b. Adjustments.
      c. Exercise scan and command functions.
      d. Verify displays, printouts and logs.
      e. Demand each point in system and check display.
      f. Test start, stop and auto functions.
      g. Cause alarms and check displays.
      h. Verify alarm return-to-normal.
      i. Clean equipment if required for proper performance.
      j. Field check and calibrate equipment, components and accessories.
      k. System software diagnostics and correction. l. Resolution of Owner's problems.
   4. Schedule each maintenance visit with Owner in advance.
   5. Submit a written report of each visit to the Owner within 5 days of the visit.

E. Damages:
   1. Repair damages resulting from repair work.

1.14 OPERATION AND MAINTENANCE MANUAL

A. General: Provide 2 copies of an operation and maintenance manual bound in a hardback, loose-leaf binder, to the Owner after LCS acceptance. In addition, provide a CD or DVD with contents of entire manual in electronic format (PDF). The manual shall include the names, addresses and telephone numbers of each trade installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include as a minimum the Sections described in the following paragraphs.

B. Functional design section: The functional design section shall identify the operational

requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for all system operating modes.

C. Hardware section: The hardware section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and pictorial layouts, alignment and calibration procedures, manufacturer's repair parts list indicating sources supply, interface definition, signal identification and timing diagrams.

D. Software section: The software section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, instruct the user on programming or reprogramming any portion of the LCS and other information necessary to enable proper integration, loading, testing, and program execution.
   1. Complete electronic schematic wiring diagrams for printed circuit boards, and all peripheral devices included in these specifications.
   2. Complete software program flow charts for system indicating interactions of all software.
   3. Complete software listing including parameter listing in the computer language being provided.
   4. An operator's reference table listing the addresses of all connected input points, output points and unguarded software parameters. Settings shall be shown where applicable.

E. Operation section: The operation section shall provide instructions for operation of the system including as a minimum; operator instruction on man-machine interface, system startup procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventative maintenance schedule, parameter schedules and sequence definition, and system access requirements. Include computer programs and data files into the related computers including all control programs, initial approved parameters and settings, English descriptors, and color graphics complete with dynamic dispersed data. In addition, the following, to be user implemented, shall have samples installed for training and validation:
   1. Bar chart (four different bars on one chart).
   2. Curve plot (five curves on one plot).
   3. Trend log.
   4. Alarm message (action taking message).
   5. Run time maintenance message.
   6. Trouble action message.

F. Maintenance section: The maintenance section shall provide descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair of replacement of defective components.

G. Maintain CD or DVD electronic copies of data files and application software for reload use in the event of a system crash or memory failure, including controller programs. Deliver one copy with each manual to the Owner during training session, and archive one copy in the LCS trades local software vault.

1.15 DELIVERY, STORAGE AND HANDLING

A. Handle products carefully to prevent damage, breaking, denting and scoring. Do not install damaged products.

B. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, water, construction debris and physical damage.

C. Comply with the manufacturer’s rigging and installation instructions for unloading and moving to the final installed location.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Phoenix Controls Corporation is the basis of design. Other manufacturers’ listed are acceptable contingent upon strict compliance with the specification and are acceptable only if they can provide an LCS that is equal in every respect to the operational characteristics, capacities, and intent indicated by the contract documents.. Manufacturers’ shall provide products and installation through a local office.

1. Phoenix Controls Corporation.

B. The LCS shall be supplied and installed by a trade specializing in such work for at least 10 years.
C. The LCS trade shall have a local office (within 200 miles of the project site) staffed with factory trained engineers and system technicians fully capable of providing instruction, routine maintenance, and emergency service on all system components.
D. The LCS manufacturer shall have documented proof, for review, that the LCS trade has resident factory trained personnel who have been trained in all areas and scope of the LCS.
E. Listed manufacturers that do not have a LCS trade with factory trained staff in a local office, and are able to provide the service indicated, are not acceptable.
F. The Owner shall be the sole judge of quality and equivalence of equipment, materials, methods, and life cycle cost.

2.2 MATERIALS

A. General:
1. Use materials in the system that are:
a. In compliance with applicable codes.
b. Selected to prevent corrosion and galvanic action.
c. New, never used.

2.3 WIRE, CABLE, CONDUIT

A. Wire:
1. Single Conductor Control Wiring above 24 volts:
a. Wire size shall be at least No. 16 AWG.
b. Conductor shall be 7/24 soft annealed copper stranding with a 2 inch to 2-1/2 inch lay.
c. Conductor insulation shall be 600 volt, type THWN or THHN, 90 degrees Celsius per UL 83.
d. Conductor colors shall be black (hot), white (neutral), green (ground).
e. Furnish wire on spools.
f. Basis of design: Okonite Okoseal N-Type.

B. Cable:
1. Single Twisted Shielded Instrumentation Cable above 24 volts:
a. Wire size shall be minimum No. 18 AWG.
b. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2 inch to 2-1/2 inch lay.
c. Conductor insulation shall have a type THHN/THWN or TFN rating.
d. Shielding shall be 100 percent type .35/.5 mil aluminum/mylar tape, helically applied with 25 percent overlap, aluminum side in with a No. 18 AWG-7/26 tinned copper drain wire.
e. Outer jacket insulation shall have a 600 volt, 90 degrees Celsius rating and shall be type "TC" cable.
f. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
g. Furnish wire on spools. h. Basis of design: Dekoron IC52-67000.
2. Single Twisted Shielded Instrumentation Cable 24 volts and lower:
a. Wire size shall be minimum No. 18 AWG.
b. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2 inch to 2-1/2 inch lay.
c. Conductor insulation shall have a nominal 15 mil thickness, constructed from flame retardant PVC..
d. Shielding shall be 100 percent type 1.35 mil aluminum/polymer tape, helically applied with 25 percent overlap, aluminum side in with a No. 20-22 AWG tinned copper drain wire.
e. Outer jacket insulation shall have a 300 volt, 105 degrees Celsius rating and shall be type PLTC cable.
f. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
g. Furnish wire on spools.
h. Basis of design: Okonite Type P-OS.

3. LAN Cable:
    a. Comply with the requirements dictated by the LCS manufacturer, contingent upon compliance with the following:
        1) The cable complies with NFPA 70.
        2) Provide a unique cable color not used by other building trades.

C. Power Wiring:
1. Power wiring shall be in accordance with all applicable standards..

D. Conduit:
1. Conduit shall be in accordance with all applicable standards.

2.4 GENERAL REQUIREMENTS

A. Each individual laboratory shall have a dedicated or networked LCS room control that connects all LCS devices in the room together. The room control shall have spare points in place for the addition of devices in the future without the need or replacing or expanding existing controls. Provide 20 percent spare points.

B. The LCS shall maintain specific airflow (within 5 percent of signal within one second of a change in duct static pressure) regardless of the magnitude of the pressure change (within 0.6 to 3.0 inches w.c.), airflow change, or quantity of airflow control devices connected to the duct distribution system.

C. The LCS shall use volumetric airflow offset control to maintain room pressurization. The system shall maintain proper room pressurization polarity (negative or positive) regardless of any change in room/system conditions such as the raising and lowering of any or all fume hood sashes or rapid changes in duct static pressure.

D. The LCS shall be segregated into individual sub networks to isolate network communications to ensure room-level control functions can be executed reliably while also providing LCS system wide communications and communications with the DDC. Each room shall be its own sub network. Commercially available routers or other approved means shall be used to provide the isolation.

E. All LCS I/O points shall be available through the interface to the building automation system (DDC) for trending, archiving, graphics, alarm notification, and status reports. LCS performance. (speed, stability, and accuracy) shall be unaffected by the quantity of points being monitored, processed, or controlled.

2.5 FUME HOOD CONTROLS

A. Provide individual average face velocity controllers to proportionally control the hood's exhaust airflow to maintain a constant face velocity

B. The fume hood exhaust air valve shall respond to the fume hood sash opening by achieving 90 percent of its commanded value within one second of the sash reaching 90 percent of its final position (with no more than 5 percent overshoot/ undershoot) of required airflow with a sash movement between 1.0 to 1.5 feet per second.

C. Use either sash position sensing or through the wall velocity sensing technology to achieve constant face velocity control. Use the same method (sash position sensing or through the wall sensing) on all hoods.

D. The airflow at the fume hood shall vary in a linear manner between two adjustable minimum and maximum flow set points to maintain a constant fume hood face velocity throughout the range. A minimum volume flow shall be set to assure flow through the fume hood even with the sash Totally closed.

E. Provide a fume hood monitoring mounted on the hood for indication of audible and separate visual alarms of both flow and emergency exhaust conditions.

F. If providing fume hood control functions in a separate device(s) from fume hood monitoring functions, provide the necessary interface between the devices to provide the following at the hood:
1. Ability to regulate the face velocity setpoint of the hood and make this command value available to the DDC.
2. If using sash position technology, provide a signal indicating sash position.
3. Provide a face velocity signal or a flow feedback signal to the fume hood monitor, which may be used for calculating face velocity, or to confirm the airflow device has achieved the proper flow rate and make this value available to the DDC.
4. Provide an alarm in the event the exhaust air valve is unable to achieve the proper flow

rate, or there is a loss of static pressure indicating improper fan operation, or that there is a loss of power to the airflow control device.

2.6 AIR VALVE

A. The air valve shall consist of a round venturi shaped body housing an aerodynamic shaped cone, cone guide shaft, connecting linkage and spring. The principle of operation for airflow control is to vary the free passage for airflow within the valve by moving the cone axially along the cone guide shaft.

B. The air valve shall be pressure independent over the differential static pressure operating range indicated. 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 air valves connected to the duct distribution system.

C. The air valve shall maintain accuracy and a specific airflow within 5 percent of signal over an airflow turndown range indicated as stated by the venturi's original manufacturer's sizing chart n the "Ideal Selection Range" without exceeding 2000 FPM velocity and have no deviation or loss of accuracy through the entire airflow and pressure range.

D. Construction:
   1. Class A: The valve body for non-corrosive airstreams including supply air and general room exhaust shall be constructed of minimum 16 gauge aluminum. The cone shaft and shaft support brackets shall be made of stainless steel. The pivot arm and internal mounting linkage shall be made of aluminum. The pressure independent springs shall be a spring-grade stainless steel. The cone shaft bearing surfaces shall be made of Teflon, polyester, or PPS (polyphenylene sulfide) composite.
   2. Class B: The valve body for corrosive airstreams including: fume hoods, canopy hoods, snorkels, vented storage cabinets, vacuum pump exhaust vents and other such devices shall be constructed of minimum 16 gauge aluminum and coated with a baked-on corrosion resistant phenolic coating, or constructed of 304 or 316 stainless steel. The cone shaft shall be made of 316 stainless steel and coated with Teflon. The shaft support brackets shall be made of 316 stainless steel. The pivot arm and internal mounting linkage shall be made of 303, 304 or 316 stainless steel. The pressure independent springs shall be a spring-grade stainless steel. The internal nuts, bolts and rivets shall be stainless steel. The cone shaft bearing surfaces shall be made of Teflon or PPS (polyphenylene sulfide) composite.
   3. Class C: Highly corrosive airstreams shall be constructed as defined for Class B and, in addition, shall have no exposed aluminum or stainless steel components. Shaft support brackets, pivot arm, internal mounting link, and pressure independent springs shall have a baked on corrosion resistant phenolic coating. The internal nuts, bolts, and rivets shall be titanium or phenolic coated stainless steel. Only devices clearly defined as "C" will require this construction.

E. Duct Connections:
   1. Single Valve: Circular
   2. Multiple Valves Ganged in a Single Assembly: Rectangular flanged.
   3. The air valve shall not require straight duct on the inlet or outlet to achieve the accuracy and pressure independence indicated.

F. Supply air valve (SAV) Insulation:
   1. Externally insulate the entire valve body with closed cell insulation, such as, flexible elastomeric or polyolefin for energy efficiency and to prevent sweating.
   2. Insulation thickness shall achieve a R-valve that complies with the more stringent of the following requirements:
      a. R-value of at least 6.
      b. R-value required by governing energy code and ASHRAE 90.1.
      c. R-value sufficient to prevent sweating while operating under design conditions.
   3. Field insulate valves if factory insulation can not comply with requirements.

G. Over Pressure Requirements:
   1. Valve shall be suitable for regular operation at a pressure that is 150 percent higher than the normal or average operating range of the valve without damage or need for maintenance of any kind.
   2. Valves shall be capable of withstanding an abnormal overpressure of up to 6 inches w.c. that is sustained for a period of 24 hours without damage or maintenance of any kind.

H. Air Valve Leakage:
   1. Valves shall comply with the following leakage requirements unless a more stringent requirement is indicated.
      a. Casing leakage: When operating at a static pressure of 4 inches w.c. the maximum leakage through casing penetrations shall not exceed one cubic foot per minute (CFM).
      b. Shut-off leakage: When operating at a static pressure of 4 inches w.c. the maximum leakage across the valve (inlet/discharge) for sizes through 12 inches shall not exceed 5 CFM.

I. Sound Performance:
   1. The air valve shall not exceed the radiated sound power levels (decibels) as indicated below when tested in accordance with ARI-880 or ASHRAE 130 while operating at maximum scheduled airflow with a static pressure drop across the valve of 2 inches w.c.
      a. 125 Hz: 58
      b. 250 Hz: 61
      c. 500 Hz: 59
      d. 1000 Hz: 57
      e. 2000 Hz: 56
      f. 4000 Hz: 50
   2. The air valve shall not exceed the discharge sound power levels (decibels) indicated below when tested in accordance with ARI-880 or ASHRAE 130 while operating at maximum scheduled airflow with a static pressure drop across the valve of 2 inches w.c.
      a. 125 Hz: 75
      b. 250 Hz: 74
      c. 500 Hz: 70
      d. 1000 Hz: 75
      e. 2000 Hz: 69
      f. 4000 Hz: 65
   3. If the air valve cannot meet the sound performance, retrofit the air valve and/or duct distribution with sound attenuation to achieve the sound levels indicated. Provide independent laboratory sound testing and report to validate the performance.

J. Electric Actuator:
   1. Factory install a high speed electric/electronic actuator to the valve assembly. The same actuator shall be used throughout the project regardless of the valve application. The design intent is to provide an actuator that can accommodate future changes in application.
   2. Failsafe Operation:
      a. Upon loss of signal;
         1) Software configurable in field for fail safe operation without external influence while maintaining pressure independent operation.
         2) Each valve shall able to fail in anyone of three positions (closed, open, or last) and easily changeable through software if application changes.
         3) Fail open valves shall fail to maximum airflow position.
         4) Fail closed valves shall fail to minimum airflow position.
         5) Fail last position valves as required.
      b. Upon loss of power:
         1) Valve to position itself in an appropriate failsafe state.
         2) Fail open valves shall fail to maximum airflow position.
         3) Fail closed valves shall fail to minimum airflow position.
         4) Pressure independent airflow control shall be maintained during power fail.
         5) Position shall be maintained constantly without external influence, regardless of external conditions on the valve (within product specifications).
      c. Override control schemes which place the valves to an uncontrolled, wide open or completely closed state, during an emergency or any loss of power are not acceptable.
      d. Electric actuators that fail in only one position (closed, open, or last) position exclusively are not acceptable.
      e. Provide as part of LCS battery back-up or other means required to comply with the fail safe operation requirements.
   3. Size actuators to operate the related air valve with sufficient reserve power to provide smooth modulating action and the proper speed of response at the velocity and pressure conditions to which the air valve is subject. As a minimum,

the actuator shall have a minimum of 50 ft. lbs of torque and operate the valve throughout its full operating range while achieving the speed or response indicated.

4. Actuators for valves indicated to have complete shut off capability shall produce sufficient torque to close off against the maximum system pressures encountered. Size the actuators to close off against 6 inches w.c., as a minimum.
5. Provide one actuator for each single and dual air valve assembly. Provide two actuators on three and more ganged assemblies. Ganged valve assemblies shall be synchronized to operate in unison.
6. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the air valve has reached either its full open or closed position.
7. Provide mounting hardware and linkages for connecting the actuator to the air valve. Attach the actuator in a way that ensures maximum transfer of torque without slippage.
8. Actuators shall be capable of stopping at all points in the cycle and starting in either direction from any point.
9. Design actuators to accept an analog voltage or milliamp control input signal.
10. Provide the actuator with integral protection against overload throughout the entire operating range in both directions. Electronic overload, digital rotation sensing circuitry, mechanical end switches or magnetic clutches are acceptable methods of protection.

K. Certification

1. Factory calibrate each air valve to the job specific airflows using NIST traceable air stations and instrumentation having a combined accuracy within one percent of signal over the entire range of measurement. Electronic airflow control devices shall be further calibrated and their accuracy verified to within 5 percent of signal at a minimum of forty-eight different airflows across the full operating range of the device.

2. Air valves shall be individually marked with device specific, factory calibration data. At a minimum, it should include: tag number, serial number, model number, eight point characterization information (for electronic devices), and quality control inspection numbers. All information shall be stored by the manufacturer for use with as-built documentation.

2.7 CONTROLLERS

A. Controller be a microprocessor-based design and, shall use closed loop control to linearly regulate airflow based on a digital control signal. Provide a digital feedback signal that represents its airflow.

B. Store control algorithms in non-volatile, re-writable memory. The controller shall be able to stand-alone or to be networked with other room level controllers using an industry standard protocol. The room-level LCS control network shall utilize LonTalk, BACnet or MODBUS communications protocol. The building level control network shall utilize either LonTalk or BACnet.

C. Room-level control functions shall be embedded in and carried out by controllers located within the room using a distributed control architecture.

D. Controllers shall use industry standard 24 Vac power.

E. Controllers 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. If an integral communication port is not available with the controller, provide a separate communication port connected to the LCS for each room served by the LCS.

F. Controllers shall have built-integral Input/Output connections address fume hood control, temperature control, humidity control occupancy control, emergency control and non-network sensors switches and control devices. As a minimum, the controller shall have:

1. Three Universal Inputs, capable of accepting 0 to 10Vdc, 4 to 20mA, 0 to 65k ohms, or Type 2 or Type 3 10k ohm @ 25 degree C thermistor temperature sensors.
2. One Digital Input capable of accepting a dry contact or logic level signal input.
3. Two Analog Outputs capable of developing either a 0 to 10Vdc, or 4 to 20mA linear control signal.

4. One Form C (SPDT) relay output capable of driving up to 1A @ 24Vac/Vdc.

G. Controllers shall meet FCC Part 15 Subpart J Class A.

H. Control Functions:

1. Utilize a peer-to-peer, distributed control architecture to perform room-level control

functions. The room-level controls shall function as a stand-alone network. There shall be no reliance on external or building-level control devices to perform room-level control functions. Master/Slave control schemes shall not be acceptable. Room control functions shall at a minimum include, pressurization, temperature, humidity control and respond to occupancy and emergency control commands.

2. Room Pressurization Control:
   a. The LCS shall control supply and exhaust valves in order to maintain a volumetric offset (either positive or negative). Offset shall be maintained regardless of any change in flow or static pressure. This offset shall be field adjustable and represents the volume of air, which will enter (or exit) the room from the corridor or adjacent spaces.
   b. The pressurization control algorithm shall sum the flow values of all supply and exhaust valves and command appropriate controlled devices to new set points to maintain the desired offset. The offset shall be adjustable.
   c. The pressurization control algorithm shall consider both networked devices, as well as:
      1) Up to three non-networked devices providing a linear analog flow signal.
      2) Any number of Constant Volume devices where the total of supply devices and the total of exhaust devices may be factored into the pressurization control algorithm.
   d. Volumetric offset shall be the only acceptable means of controlling room pressurization.
   e. The pressurization control algorithm shall support the ability to regulate the distribution of total supply flow across multiple supply air valves in order to optimize air distribution in the space.
3. Room Temperature Control
   a. The LCS shall regulate the space temperature through a combination of volumetric thermal override and control of hot water reheat coils. The LCS shall support up to four separate temperature zones for each room. Each room shall have provisions for monitoring up to five temperature inputs and calculating a straight-line average to be used for control purposes. Separate cooling and heating set points shall adjustable from the DDC, LCS network tool, and locally at the temperature sensor..
   b. Temperature control shall be implemented through the use of independent primary cooling and heating control functions. Cooling shall be provided as a function of thermal override of conditioned air with both supply and exhaust air valves responding simultaneously so as to maintain the desired offset. Heating shall be provided through modulating control of hot water flow through a reheat coil.

2.8 SERVER

A. Servers shall provide integration to the DDC and provide access through world wide web.
B. Server hardware and operating system software shall, at a minimum, consist of:
   1. PC processor with minimum 64-bit structure.
   2. Minimum 1 GHz processor speed.
   3. Minimum 1024 MB on board RAM.
   4. Hard drive, minimum 80 gigabytes.
   5. Network Interface Card, (10/100).
      a. For each LCS server provided, install additional network card with 10/100 Ethernet connectivity (2 network cards per server). DDC system administrators will provide network security configuration settings.
   6. DVD/CD-ROM Drive.
   7. Internal DVD-R Drive.
   8. Basis of design: Dell PowerEdge.
E. Software licenses required for use of system by Owner.
F. Provide password protection for access to LCS server from WEB server.

2.9 TEMPERATURE INSTRUMENTS

A. Air temperature sensors:
   1. Resistance temperature sensors:
      a. General:

1) Resistance temperature sensors shall conform to the International Practical Temperature Scale of 1968 and to DIN 43760 and BS1904.

b. Resistance temperature detector (RTD):

1) Platinum with a value of 1000 ohms at 32 degrees F and a temperature coefficient of 0.00214 ohms/ohm/degree F.

2) Provide 2 teflon insulated, at least 24 gauge, stranded copper lead wires.

3) Performance characteristics:

a) Range: Minus 49 to plus 500 degrees F.

b) Interchangeable accuracy: At 32 degrees F plus or minus 0.5 degrees F.

c) Repeatability: Plus or minus 0.45 degrees F.

d) Response time: 62.8 percent of change in 5 seconds with 170 degrees F water flowing across sensor at 3 feet per second.

e) Self heating: Negligible.

2. Thermistors:

a. Thermistors shall be pre-aged and burned in and shall be coated with glass, inserted in a metal sleeve and the entire unit encased in epoxy.

b. Accuracy: With 0.2 degrees C.

c. Range: Minus 55 to plus 150 degrees C.

d. Reference Resistance: 10Kohm at 25 degrees C.

e. Stability: 0.02 degrees C per year.

f. Drift less than 0.5 degrees F over 10 years.

3. Room (space) temperature sensors:

a. Sensor assembly shall include a temperature sensing element mounted under a bright white, non-yellowing, plastic cover.

b. Provide a mounting plate that is compatible with the surface shape that it is mounted to and the electrical box used.

c. Temperature sensors shall be either 1000 ohm platinum RTD or a thermistor.

d. Provide an LED or LCD digital display of sensed temperature with local adjustment of temperature setpoint.

4. Duct temperature sensors:

a. Provide a mounting plate that is compatible with the surface shape that it is mounted to and the electrical box used. Seal the duct penetration airtight.

b. Temperature sensors shall be either 1000 ohm platinum RTD or a thermistor.

c. Sensor probe length to extend approximately to midpoint of duct cross section.

5. Provide temperature sensors inputs directly connected to controller (not through a transmitter) with 12 bit resolution.

2.10 CONTROL VALVES AND ACTUATORS

A. Control Valves:

1. General:

a. Determine the control valve sizes and flow coefficients by ISA S75.01.

b. Control valve characteristics and rangeability shall conform to ISA S75.11.

2. Design criteria:

a. Unless otherwise specified, rate control valves in water systems for 200 psig at 200 degrees.

b. Control valve shut-off classifications are not less than Class IV based upon ANSI 70-2.

c. Valves used in water systems shall be modulating type with a straight through pattern and equal percentage flow throttling characteristics.

d. Valves shall fail in last position unless otherwise indicated.

e. Size control valves to pass the design flow required with not more than 95 percent of stem lift, unless otherwise noted within specifications. Consider viscosity, flashing, and cavitation corrections.

f. In water systems, size modulating control valves at terminal equipment for a pressure drop of 7 psid at design flow, unless otherwise noted within specifiations.

3. Ball Valves through 2 inches:

a. Nominal 600 WOG rating with 200 psi closeoff pressure.

b. Cast bronze ASTM B 61, ASTM B 62, ASTM B 584 body and tail piece.

c. Threaded (NPT) ends.

d. Reinforced Teflon packing ring stem seal. Provide a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means such as EPDM O-rings are acceptable if an equivalent cycle endurance can be demonstrated by testing.
e. Equal percentage flow characteristic by using a characterizing disk or other approved means.

4. Basis of design: Belimo B2 series.

B. Valve Actuators:

1. General:
   a. Size actuators to shut-off against pump shut-off head. Size hot water valve actuators for at least 100 feet of water.
   b. Provide a position indicator and graduated scale on each actuator. Indicate the word "OPEN" and "CLOSED", or similar notation, at the stem travel limits.
   c. Select the valve actuator operating speed to be compatible with the HVAC system operation. Lab applications are capable of rapid changes in airflow. The valve actuator speed of response shall be determined by the LCS trade to ensure the temperature control criteria can be achieved. Sub-cooling and overheating for sustained periods of time (greater than 15 seconds) are not acceptable.
2. Electric and Electronic Actuators:
   a. Provide hydraulic or gear type electric or electronic actuators.
   b. When operated at rated voltage each actuator shall deliver the torque required for continuous uniform movement of the control device from limit to limit.
   c. Actuators shall function properly within a range of 85 to 120 percent of line voltage.
   d. Actuators with input power less than 100 watts may use fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings and pressed steel enclosures.
   e. For actuators with input power greater than 100 watts the gears shall be ground steel, oil immersed, the shaft shall be hardened steel running in bronze, copper alloy or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast iron, cast steel or cast aluminum housing.
   f. For an actuator greater than 400 watts input, provide totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
   g. Two position actuators shall be of the single direction, spring return or reversing type.
   h. Proportioning actuators shall be capable of stopping at all points in the cycle and starting in either direction from any point.
   i. Design proportioning actuators to accept both a 0 to 10 volt DC and 0 to 20 milliamp control input signal. Floating point and pulse width modulating control input signals are not acceptable.
   j. For fail safe applications, actuators shall be easily switchable from fail open to fail closed in the field without having to replace the actuator or valve.
   k. Provide actuators with an external manual adjustment mechanism to allow manual positioning when the actuator is not powered.
   l. Provide the actuator with integral protection against overload throughout the entire operating range in both directions. Electronic overload, digital rotation sensing circuitry, mechanical end switches or magnetic clutches are acceptable methods of protection.
   m. Unless otherwise required for valve interface, provide an actuator designed to be directly coupled to the valve shaft without the need for connecting linkages.
   n. Attach the actuator to the valve drive shaft in a way that ensures maximum transfer of torque without slippage.
   o. Basis of design: Belimo.

2.11 ACCESSORIES

A. Control transformers:

1. Size each transformer for the total connected load, plus an additional 25 percent of the connected load.
2. Each transformer shall be at least 100 volt amps.
3. Provide the transformer with both primary and secondary fuses.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine conditions under which the LCS will be installed.
B. Notify the Owner in writing of unsatisfactory conditions.
C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Furnish and install products required to satisfy the requirements of the contract documents.
   2. Install plumb, parallel, and perpendicular with building lines.
   3. Install properly supported.
   4. Install in compliance with applicable codes.
   5. Provide proper operation of the system.
   6. Provide roof, floor, and wall opening and sleeves required that are not provided by other trades. Before proceeding with drilling, punching or cutting of the structure, inform the Owner of intentions, check locations of concealed parts or services and receive the approval of the Owner. Patch, flash, grout and refinish openings made.
   7. Welding requirements:
      a. Restrict welding and burning to supports and bracing. No equipment shall be cut or welded without permission of the Owner. No welding or cutting is permitted which might damage adjacent mechanical equipment.
      b. Welding, where required, shall be by inert-gas electric arc process and shall be performed by qualified welders in accordance with the applicable welding code. If requested, submit satisfactory evidence of welder's ability before being allowed to perform welding work.
      c. Comply with the Owner's requirements for fire protection and follow such procedures strictly while performing welding or cutting.
   8. Fastening hardware:
      a. Do not use Stillson wrenches, pliers or other tools likely to cause injury to or mar the surfaces of rods, nuts or other parts, for work of assembling or tightening nuts.
      b. Tighten the bolts and nuts firmly and uniformly, and take care not to overstress the threads by excessive force, or by wrenches of excessive lengths.
      c. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.
   9. Install products in accordance with manufacturer's written instructions and in a location that is accessible that will permit calibration and maintenance from the floor, equipment platforms, or catwalks.
   10. Identify wiring and tubing with an identification system. Each piece of wire and tubing shall have the same designation at each end. The identification system shall be approved by the Owner.

B. Electrical power distribution:
   1. Furnish and install an electrical power distribution system to implement the work under this Section, Electrical power distribution shall include
      power for items such as, but not limited to:
      a. Transmitters.
      b. Control panels.
      c. Controllers.
      d. Actuators.
   2. Power shall be available in the form of 120/208 volts, 3 phase, 4 wire from electrical panels throughout the facility. Space shall be available at each panel for work under this Section.
   3. Furnish and install circuit breakers that match the existing, power wiring and conduit.
   4. Electrical power distribution shall meet applicable code requirements..
   5. Install an appropriately sized and fused 24 Vac transformer suitable for NEC Class II wiring. Transformers shall meet the VA requirements of the high speed electric actuators.

C. LCS network installation:

1. Coordinate the routing of the LCS with DDC networks to assure that a preplanned routing is used.
2. Install LCS network routers and repeaters, as required, in an accessible location approved by the Owner.

D. Wiring and conduit:
1. Exposed low voltage cable and Line voltage wiring shall be installed in conduit.
2. Install conduit as specified below.
   a. Cables serving a common system may be grouped in a common conduit. Do not group conductors from different systems, or different voltages.
   b. Install the LCS in accordance with the manufacturer's recommendations and with NFPA 70.
   c. Conduits 1/2 inch in diameter shall be the smallest size.
   d. Install conduit expansion joints where conduit runs exceed 200 feet, and runs across building expansion joints.
   e. Install conduit to avoid pipes. Maintain a separation of at least one inch where conduits run parallel to, or across pipes.
   f. Continuous above grade conduit runs shall not exceed 100 feet in length without pull or junction boxes installed.
   g. Do not install raceways or electrical items on any "explosion relief" walls, or rotating equipment.
   h. Use flexible conduit only where flexibility is required. Runs of flexible conduit shall not exceed 3 feet in length, unless detailed otherwise.
   i. Conduit shall be continuous from outlet to outlet, from outlet to cabinets, pull and junction boxes, and shall be secured to boxes in such manner that each system shall be electrically continuous throughout.
   j. Secure threaded conduit entering a cabinet, box, and trough, with a locknut on the outside and on the inside, such that the conduit system is electrically continuous throughout. Provide a bushing on the inside. Bushings shall be metal with insulated throats. Locknuts shall be the type designed to bite into the metal, or on the inside of the enclosure shall have a grounding wedge lug under the locknut.
   k. Conduit box type connectors for conduit entering enclosures shall be the insulated throat type.
   l. Connect conduit entering enclosures in wet locations with approved box type connectors, or with watertight sealing locknuts or other approved fittings.
   m. Offset conduits where they enter surface mounted equipment. Wiring installed in panels and other enclosures shall be neatly looped and laced.
3. Provide cables with protective sheathings that are waterproof and capable of withstanding continuous temperatures of 194 degrees F with no measurable effect on the physical or electrical properties of the cable.
   a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.
4. Do not install cable closer than one foot from transformers and electrical power cables. Provide a system free of electro-magnetic interference (EMI).
5. Identify each wire on each end and at each terminal with a number coded identification tag. Each wire shall have a unique tag.
6. Provide strain relief.
7. Terminate wiring in a junction box.
   a. Clamp the cable over the jacket, in the junction box. Individual conductors in the stripped section of the cable shall be slack between the clamping point and terminal block.
8. Terminate wire work with terminal blocks.
9. Install signal transmission components in accordance with ANSI C2, REA Form 511a, NFPA 70, and as shown.
10. Keep runs short. Allow extra length for connecting to terminal boards. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
11. Grounding shall be in accordance with ANSI C2. Ground wire shall be copper. Demonstrate ground resistance.
12. Install control wiring in a separate conduit from power wiring.
13. Wiring shall be continuous from terminal to terminal without splices.

14. Use insulated spade lugs for wiring connection to screw terminals.
15. Use shielded wiring to transmitters.
16. Use shielded wiring to temperature sensors.
17. Perform continuity and meager testing on wiring.

E. Product installation:

1. General:
   a. Check and verify the location of temperature sensors and other exposed control instruments with the Owner.
   b. Identify mounting height for all products exposed to view.
      Do not install products without Owner approval of mounting height and location.
   c. Seal airtight penetrations to ductwork, plenums and air handling equipment with rubber gaskets or grommets.
2. Fume hood sash sensors:
   a. Install the sash sensors, interface boxes, presence and motion sensor, and fume hood monitor on the fume hood.
   b. Reel-type sash sensors and their stainless steel cables shall be hidden from view.
   c. Bar-type sash sensors shall be affixed to the individual sash panels.
   d. Sash interface boxes with interface cards shall be mounted in an accessible location.
   e. Perform any repairs necessary to insure safety and proper operation of sash sensors.
3. Temperature sensor installation:
   a. Space mounted analog temperature sensor:
      1) Unless otherwise indicated, mount space temperature sensors at a height that complies with code, state and federal accessibility requirements.
      2) Mount the assembly in an electrical box. Provide an electrical box of sufficient size. Provide the electrical box with a face plate to match the sensor cover.
      3) Conceal the sensor assembly inside a cover.
      4) Recess the electrical box within the wall so only the electrical box face plate and sensor cover are exposed to view.
      5) Mount space temperature sensors located on exterior walls on a 1 inch thick insulating block. Provide a finished appearance consistent with adjacent materials in the space. An acceptable installation is contingent upon Owner approval.
      6) Align the sensor and sensor/transmitter assembly with other electrical devices, such as visual alarms and light switches which are located in the vicinity to provide a neat and well thought out arrangement. Where possible, align in both the horizontal and vertical axis.
   b. Single point duct mounted temperature sensor:
      1) Provide single point type duct mounted supply air temperature sensors. Locate the sensors in the ducts with the sensitive portion of the element installed in the center of the duct cross section and located to sense the average temperature. Do not exceed 24 inches in sensor length.
      2) Rigidly support the sensor to duct using a threaded pipe flange.
      3) Locate the sensor in the duct downstream of the reheat coil.
4. Controller and system control panel installation:
   a. Install at viable locations approved by the Owner.
   b. Mount to walls.
5. Actuator installation:
   a. Furnish and install actuators required to implement the LCS system sequences of operation.
   b. Provide the mounting hardware and linkages for the installation of the actuators to the air valves.
   c. Locate the actuators to provide ease of maintenance and repair.

3.3 CLEANING

A. General:

1. Execute cleaning, during progress of the work, and at completion of the work, as required by the General Conditions.

2. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

B. Materials:
1. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

C. During construction:
1. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from the construction of LCS.
2. Provide on-site containers for the collection of waste materials, debris and rubbish.
3. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

D. Final cleaning:
1. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surface.
2. Wash and shine glazing.
3. Polish glossy surfaces to a clean shine.

3.4 LCS START-UP PROCEDURES

A. Check-out:
1. Before calibration, testing and check-out of the instruments installed in the field. Use this procedure before any continuity, loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instruments for proper installation with respect to direction of flow, elevation, orientation, insertion depth, or any other applicable considerations.
4. Temperature instrument check-out:
   a. Verify the sensing element for proper material and length.
   b. Verify that the wire is correct.
5. Airflow control device check-out:
   a. Verify that proper alignment has been provided.
6. LCS check-out:
   a. Verify that power supply is from the emergency power supply, if applicable.
   b. Verify that wires at the control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that LCS is protected from power supply surges.

B. Calibrating and adjusting:
1. Calibrate every instrument in the system.
2. For each analog instrument, make a three point test of calibration for both linearity and accuracy.
3. Equipment and procedures used for calibration shall meet the requirements of the instrument manufacturer's recommendations. Test equipment used in the calibration of instruments shall have an accuracy at least double that of the instrument being calibrated.
4. Calibrate each instrument according to the accuracy outlined in the instruction manual supplied for the instrument by the manufacturer.
5. Control system inputs and outputs:
   a. Check analog inputs using a precision voltage or current source at 0 percent, 50 percent and 100 percent of span.
   b. Check analog outputs using a milliampere meter at 0 percent, 50 percent and 100 percent output.
   c. Check digital inputs using a jumper wire.
   d. Check digital outputs using an ohmmeter to test for contact making or breaking.
   e. Check resistance temperature inputs at 0 percent, 50 percent and 100 percent of span using a precision resistant source.
6. Flow:
   a. Set differential pressure flow transmitters for 0 percent and 100 percent values with three point calibration accomplished at 100 percent, 50 percent and 90

percent of span.

7. Pressure:
   a. Calibrate pressure transmitters at 0 percent, 50 percent, and 100 percent of span.
8. Temperature:
   a. Calibrate resistance temperature transmitters at 0 percent, 50 percent and 100 percent of span using a precision resistance source.
9. Fume Hood:
   a. Calibrate the fume hood motion sensor, sash sensors and fume hood monitor.
10. Stroke and adjust airflow control devices following the recommended procedure from the manufacturer, such that the damper is 100 percent open and closed at the specified signal.
11. Replace out of tolerance instruments failing the test.
12. Provide diagnostic and test instruments for calibration and adjustment of system.
13. Provide a written description of the procedures and equipment for calibrating each type of instrument. Submit the procedures for review and approval before initiating start-up procedures.

C. Testing:
1. Test every point in every system to verify safety and operating control setpoints are as specified and as required to operate the system safely while obtaining optimum performance from the equipment controlled. Test every point throughout its full operating range.
2. Test every control loop of every system to verify the system functions in a stable accurate mode of operation and is in accordance with specified sequences of operation. Adjust proportional, integral and derivative actions to meet end to end accuracies specified.
3. Test every system for proper operation under the sequence of operation.
4. Test software and hardware interlocks.

D. Inspection:
1. When complete, submit a written certification that:
   a. Contract documents have been reviewed.
   b. Work has been inspected for compliance with the contract documents.
   c. Work has been completed in accordance with the contract documents.
   d. Equipment and systems have been tested and meet the requirements of operational stability, accuracy, performance and function in accordance with the sequences of operation.
   e. Work is completed and ready for inspection.
2. Should work be considered incomplete or defective:
   a. The Owner will promptly notify the LCS trade in writing, listing the incomplete or defective work.
   b. Take immediate steps to remedy the stated deficiencies, and send a second written certification to the Owner that the work is complete.
3. When the Owner finds that the work is acceptable in accordance with the contract documents, make close out submittals and begin LCS acceptance procedures.

3.5 LCS ACCEPTANCE

A. General
1. After completion of installation and start-up procedures, commence the specified 3-phase LCS acceptance procedures:
   a. Follow with the order specified.
   b. Each testing phase shall be satisfactorily completed before entering the next phase.
2. Before entering each phase of the sequence, submit a written agenda to the Owner describing in detail the procedure to be followed to meet the requirements.
3. Submit a sample of the test report proposed.
   a. Identify project.
   b. Provide a list of all points, arranged in numerical order of point addresses.
      1) Show point descriptor and location of each.
      2) Indicate system panel and or controller which processes each point.
      3) Use the list as a basis for the specified report form.
   c. Signatures of participants and observers.
   d. Results.

e. Description of adjustment or corrections of points in error.
f. Date.

4. Provide schedule of tests. Estimate dates of significant events.
5. Provide results.
6. Acceptance procedures may be witnessed by the Owner if deemed appropriate by said parties.
7. Provide personnel and diagnostic instruments.
8. Provide testing stimulants.
9. Use digital meters of double the accuracy of the instruments being calibrated.

B. **Phase 1**:

1. Submit an agenda describing the procedures to be followed in adjusting and verifying operation of each point.
2. Operate each analog point in the LCS:
   a. At a point in the upper quarter of its range.
   b. At a point in the lower quarter of its range.
   c. At the mid point of its range.
3. Exercise each digital point in the LCS.
4. Read and record each value at the DDC workstation and LCS controller and observe the actual function at the field instrument for every point in the LCS. The value displayed at the DDC workstation shall match the value observed at the field instrument.
5. Submit an operation report for each point in the LCS, in an approved format, and describe any corrective and adjusting action taken.

C. **Phase 2**:

1. Furnish, install and debug software to implement the software functions specified.
2. Submit an agenda and report format for the software demonstrations.
3. Demonstrate the software operates the systems according to the sequences of operations and performs software programs and functions specified and intended.
4. Provide written documentation of the demonstration, signed by representatives of the LCS trade and Owner.

D. **Phase 3**:

1. Verify calibration and function of each point in the LCS.
   a. Verify analog points at the operating value.
   b. Record on an approved form.
   c. Make approved adjustments to out of tolerance points.
      1) Identify these points for reference.
      2) Simulate abnormal conditions to demonstrate proper function of safety devices.
2. Simulate cooling and heating requirements and demonstrate proper sequence of control.
3. Readjust settings to design values and observe the ability of the controls to establish the desired conditions.
4. After the verification procedure is completed, record on an approved form all corrected points and all points requiring correction. Replace instruments that measurements indicate are out of specified tolerances. Identify on the form any points (instruments) that have been replaced.
5. At least 24 hours after the verification procedure is completed:
   a. Reverify corrected points and points that required additional correction.
   b. Record on an approved form.
   c. Identify points requiring correction.
6. After 24 hours, reverify and correct.
   a. Continue reverification testing until the point is normal on two consecutive reverifications.
   b. Record tests and corrections.
   c. Total down time during the 30 day test period shall not exceed 1 percent of the total operating time.
      1) Power outages shall not count as down time, but shall suspend the test.
      2) Hardware or software failures caused by power outages shall count as down time.
   d. During the 30 day test period, man the control room at least eight hours per day, five days per week.
   e. Failure to meet the specified operating level requires that the test be continued until the system qualifies. Testing of a failed system (system which exceeded 1

percent down time over a 30 day test period) shall continue until down time is less than 1 percent of total test time.

f. Evaluation of down time will be as follows: as specified, the maximum allowed down time is 1 percent. The time will be counted on a point-hour basis; that is, the total number of point hours in the test is equal to the number of points multiplied by the number of test hours. The following is an example of the calculation for maximum allowable down time:

1) Maximum allowable down time for 30 day endurance test when the system contains 1000 individual points (combined analog and digital) is computed by 30 days x 24 hours per day x 1000 points x 1 percent equals 7,200 point hours maximum allowable down time.

2) A point hour of down time is one point down for one hour. Three points down for 5 hours is a total of 15 point hours. Four points down for one-half hour is 2 point hours.

3.6 CLASSROOM INSTRUCTION TO OWNER

A. At a mutually agreed upon time, either during or after LCS acceptance give 8 hours of instruction to the Owner on the operation of LCS. Describe its intended use with respect to the programmed functions specified. Operator orientation of the LCS shall include, but shall not be limited to, the operational program, equipment functions (both individually and as part of the total integrated system), commands system generation, advisories, and appropriate operator intervention required in responding to the system's operation. Use the Owner's operation and maintenance manual prepared for this project in addition to the instruction. A classroom will be provided on the Owner's premises for instruction.

B. As a minimum, instruct the Owner on the following during the instruction specified above. Additional instruction time as deemed necessary by the Owner may be obtained on the basis negotiated.

1. Sequence of operation review.
2. Sign on; sign off.
3. Selection of each display and report.
4. Commanding of points, English and graphic mode.
5. Modifying English text.
6. Modifying alarm limits and start-stop times.
7. System initialization.
8. Download and initialization of LCS controllers.
9. Purge and/or dump of historical data.
10. General troubleshooting procedures.
11. Fume hood monitor calibration.
12. Procedures for verifying airflow of air valves.
13. Creating and modifying color graphics.
14. Password assignment/modification (supervisor only).
15. Operator assignment/modification (supervisor only).
16. Operator authority assignment/modification (supervisor only).
17. Point disable/enable (supervisor only).
18. Station data segregation/modification (supervisor only).
19. Software review of sequence of operation programs.
20. Modification of control programs.
21. Add/delete/modify data points.
22. Use of diagnostics.
23. System maintenance procedures.
24. Upload/download and off-line archiving of all system software.

C. Base training and instruction defined in this paragraph upon 4 persons.

PRICE FOR ROOMS - 216, 218, and 224 $_____

PRICE FOR ROOM 330 = $_____

GENERAL CONDITIONS

1. **Award:** The University of Alabama in Huntsville reserves the right to accept or to reject any or all bids and is not necessarily bound to accept the lowest bid if that bid is contrary to the best interest of the University. In making an award, intangible factors such as bidder's service, integrity, facilities, equipment, reputation, and past performance will be weighed along with the quality displayed in the samples submitted. Bids may be awarded either item by item, in products groups, or all or none, whichever appears to be in the best interest of the University. The University reserves the right to waive any or all formalities.

2. **Bid Withdrawal:** No bids may be withdrawn without approval from The University of Alabama in Huntsville Procurement Services. Any requests for withdrawal must be in writing to Procurement Services within five (5) days after opening date with justification for reason of withdrawal. More than two (2) such requests could result in removal from our bid list. No bid may be withdrawn after the issuance of purchase order. If a withdrawal is made after the purchase order is issued, the vendor will be considered in default. Refer to "Default of Contractor".

3. **Prices and Payment Terms:** Bidders should quote applicable cash discounts. The University will not take into consideration in bid evaluation any cash discount of less than thirty (30) days duration. However, we will take advantage of all discounts for which we are eligible. Identify these discounts in your bid response. Bids containing "payment in advance" or "COD" requirements may be rejected.

4. **Applicable Law:** It is agreed this quotation is valid to the extent that it does not violate the constitution or the laws of the State of Alabama.

   Bidder represents and warrants that all article and services covered by this bid meet or exceed the safety standards established and promulgated under the Federal Occupational Safety and Health Act of 1970, No. 2006, and its regulations in effect or proposed as of the date of this bid.

   The furnishing of materials, supplies, equipment or service to The University of Alabama in Huntsville under this purchase order, contract, solicitation for bids, or construction specification constitutes assurance by the vendor or contractor of his compliance with applicable provisions of and pertinent regulations promulgated under Executive Order 11246, date September 28, 1965 issued by the President of the United States of America, and Public Law 88-352, 88th Congress, the "Civil Rights Act of 1964".

5. **Non-Collusion:** Any agreement or collusion among bidders or prospective bidders in restraint of freedom of competition, by agreement to bid at a fixed price or to refrain from bidding, or otherwise, shall render the bids of such bidders void. Each bidder certifies that he has not been a party to such an agreement by signing this bid.

6. **New Products:** Unless specifically called for in the bid, all products for purchase must be new, never previously used, and the current model and/or packaging. No remanufactured, demonstrator, used, or irregular product will be considered for purchase unless otherwise specified in the bid. The manufacturer's standard warranty will apply unless otherwise specified in the bid. All requests should be supplied complete, ready to be installed, including all cabling and connectors where applicable.

7. **Bonds:** Bid and performance security bond, when required will be indicated.

8. **Bid Submission:** Failure to submit a bid on the official UAHuntsville form provided for that purpose shall be a cause for rejection of the bid. Return of the complete document is required. Modification of or additions to any portion of the solicitation may be cause for rejection of the bid; however, UAHuntsville reserves the right to decide, on a case by case basis, in its sole discretion, whether or not to reject such a bid as non-responsive.

   All information shall be entered in ink or typewritten in the appropriate space on the form. Mistakes may be crossed out and corrections inserted before submission of your bid. Corrections shall be initialed in ink by the person signing the bid.

   All bids must be signed. Failure to do so will result in rejection of bid.

9. **Delivery:** Time of delivery shall be stated as the number of calendar days following receipt of the order by the vendor, to receipt of the goods by The University of Alabama in Huntsville.

   Delivery time may be a criterion in awarding bids. Specify earliest possible delivery after receipt of order.

   Failure to deliver within the time vendor specified in the bid will constitute a default and may cause cancellation of the contract. Refer to "Default of Contractor".

   All prices quoted are to be F.O.B. delivered to The University of Alabama in Huntsville, Central Receiving Building, 301 Sparkman Drive, Huntsville, Alabama, 35899 (unless another F.O.B. point is stated by the University on bid form). The successful bidder must assume all responsibility for damage in transit. When installation is required, it will be stated. If you are not quoting a delivered price, indicate your shipping point, and provide shipping cost for evaluation purposes.

10. **Bid Terms:** Show unit prices, extensions, and total price. In the event of a discrepancy between the unit price and the extension, the unit price shall govern. Bids shall remain firm for minimum thirty (30) days from date of bid opening and any exception must be clearly stated.

11. **Bid Opening:** Bidders may attend the bid opening, but no information or opinions concerning the ultimate award will be given at the bid opening or during the evaluation process. After the public opening of this bid, the results will not be available to bidders not attending the opening until after an award is made. Bid tabulations can be reviewed by accessing Procurement Services website at http://uah.edu/business-services. Click on "Vendors" then "Bid Awards".

12. **Bids are Public Record:** All bids become a matter of public record at bid award. The University accepts no responsibility for maintaining confidentiality of any information submitted with bid whether labeled confidential or not.

13. **Standards of Quality:** When a material, article or piece of equipment is identified in these specifications by reference to manufacturer's or vendor's name, trade name, catalog and stock numbers, etc., it is intended merely to establish a standard; and, any material, article or equipment of other manufacturer and vendor which will perform equally the duties imposed by the general design, provided the material, article, or equipment proposed, is in the opinion of the Purchasing Agent of equal substance and function. It shall not be purchased or installed by the contractor without the Purchasing Agents' written approval.

    The bidder is responsible to clearly and specifically indicate the product being offered and to provide sufficient descriptive literature, catalog cuts and technical detail to enable UAHuntsville to determine if the product offered meets the requirements of the invitation. Normally in competitive sealed bidding only the information furnished with the bid will be considered in the evaluation. Failure to furnish adequate data for evaluation purposes may result in declaring a bid nonresponsive. Unless the bidder clearly indicates in its bid that the product offered is an "Equal" product, such bid will be considered to offer the brand name product referenced in the invitation. The University of Alabama in Huntsville will be sole judge of EQUAL items bid.

14. **Vendor Authorization:** Vendor must be an authorized distributor/agent to sell products proposed in this bid request. When it is deemed to be in the best interest of the University, Procurement Services may request an on-site premise visit to examine the facility.

15. **Default of Contractor:** Where the University has determined the contractor to be in default, the University reserves the right to purchase any or all products or services covered by the contract on the open market and to charge the contractor with cost in excess of the contract price. Until such assessed charges have been paid, no subsequent bid from the defaulting contractor will be considered.

16. **Fiscal Funding Clause:** The continuation of this contract is contingent upon the appropriation of funds to fulfill the requirements of the contract by the legislature. If the legislature fails to appropriate sufficient monies to provide the continuation of a contract, the contract shall terminate on the date of the beginning of the first fiscal year for which funds are not appropriated.

17. **Contract Cancellation:** Procurement Services has the right to cancel any contract, in accordance with Purchasing Rules and Regulations, for cause, including, but not limited to, the following: (1) failure to deliver within the contract; (2) failure of the product or service to meet specifications, conform to sample quality, or to be delivered in good condition; (3) misrepresentation by the contractor; (4) fraud, collusion, conspiracy, or other unlawful means of obtaining any contract with the state; (5) conflict of contract provisions with constitutional or statutory provisions of state or federal law; and (6) any other breach of contract.

18. **Warranties:** Should merchandise described on this bid contain a manufacturer's warranty, bidders must state the warranty terms in the space provided on the bid. Bids offered for merchandise when no warranty applies must clearly state: "NO WARRANTY COVERAGE". Warranty information may be criteria in making this award. Failure of bidders to furnish this data may cause rejection of the complete bid as being non-responsive.

19. **Disclosure Statement:** The successful bidder will be required to file with Procurement Services a disclosure statement of relationship between contractors/grantees and employees/officials of the University. This form must be completed prior to issuance of the Purchase Order by The University of Alabama in Huntsville.

20. State of Alabama Immigration Law: Pursuant to the State of Alabama Immigration Law, by signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

21. **Restrictions On Communications with University Staff:** From the issue date of this Solicitation until a Contractor is selected and a contract award is made, Bidders are not allowed to communicate about the subject of the bid with any University administrator faculty, staff, or members of the Board of Trustees except:

- The Procurement Services representative, any University Procurement Official representing the University administration, or others authorized in writing by the Procurement Office and
- University Representatives during Bidder presentations.

If violation of this provision occurs, the University reserves the right to reject the Bidder's response to this Solicitation.

Note: In order for an alternate bid to be considered, bidders must supply current catalogs or brochures, including pictorials and specifications.

F.O.B. Point UAHUNTSVILLE DESTINATION	TERMS	WARRANTY
ESTIMATED DELIVERY	YOUR REFERENCE NO.*	QUOTATION EFFECTIVE UNTIL
BUSINESS CLASSIFICATION (see note below):	EMAIL ADDRESS:	

* Your company reference number, if applicable with this bid quotation.

NOTE: Please indicate your company classification in the appropriate box above: Small Business (**SB**), a Small Disadvantaged Business (**SD**), a Black Small Disadvantaged Business (**BD**), a Woman-Owned Small Business (**WB**), a Woman-Owned Small Disadvantaged Business (**WD**), a Black Woman-Owned Small Disadvantaged Business (**BW**), a Large Business (**LB**), an Individual (**IN**), Educational (**ED**), Non-Profit (**NP**), a Labor Surplus Area Concern (**LS**), Disabled Veteran-Owned Small Business (**DV**), Veteran-Owned Small Business (**VS**), Historically Underutilized Business Zone (**UZ**), or a Governmental Agency (**GV**).

Certification Pursuant To Act No. 2006-557
Alabama Law (Section 41-4-116, Code of Alabama 1975) provides that every bid submitted and contract executed shall contain a certification that the vendor, contractor, and all of its affiliates that make sales for delivery into Alabama or leases for use in Alabama are registered, collecting, and remitting Alabama state and local sales, use, and/or lease tax on all taxable sales and leases into Alabama. By submitting this bid, the bidder is hereby certifying that they are in full compliance with Act No. 2006-557, they are not barred from bidding or entering into a contract pursuant to 41-4-116, and acknowledges that the awarding authority may declare the contract void if the certification is false.

_____ _____
COMPANY NAME (TYPE OR PRINT) TELEPHONE NUMBER

_____ _____
SIGNER'S NAME (TYPE OR PRINT) FAX NUMBER

_____ _____
SIGNATURE DATE

The University of Alabama in Huntsville prohibits the installation of asbestos on its campus. Suppliers and contractors will not supply any equipment, material, or supplies, which contain asbestos without prior written approval.

Failure to designate Bid Number and Opening Date on the outside of your sealed envelope containing your bid and more than one bid submitted in this envelope will result in a "No Bid" response in accordance with Alabama Competitive Bid Law 41-16-24 sub-part b.

The University of Alabama in Huntsville will not accept faxed bids.

Any product that fails to meet the specifications, performance requirements or compatibility requirements will be rejected and returned to the vendor at no cost to the University.

REV. 8/12

State of Alabama Immigration Law

If the successful bidder is located in Alabama or employs an individual or individuals within the State of Alabama, the successful bidder shall provide a copy of its Employment Eligibility Verification (E-Verify) company profile. To expedite the ordering process, this document may be submitted with the bid response.

If the successful bidder is not located in the State of Alabama and does not employ an individual or individuals within the State of Alabama, the successful bidder shall complete and return the Certification of Compliance form included with this Request for Price Quotation (E-Verify company profile is not required). To expedite the ordering process, this document may be submitted with the bid response.

If you are not currently enrolled in E-Verify, follow these instructions:

- Log onto www.uscis.gov/everify
- Click “Getting Started” for information about the program, requirements, and enrollment process.
- Click “Enroll in E-Verify” and begin enrollment process.
- When enrollment process is complete, click “Edit Company Profile” and print this one-page document.
- This one-page document must be submitted prior to a contract or purchase order being issued.
- For further assistance please consult the E-Verify Quick Reference Guide.

If you have previously enrolled in E-Verify, follow these instructions:

- Log onto www.uscis.gov/everify
- Click “Edit Company Profile” and print this one-page document.
- This one-page document must be submitted prior to a contract or purchase order being issued.

REV. 6/12

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

CERTIFICATION OF COMPLIANCE WITH THE STATE OF ALABAMA IMMIGRATION LAW

The undersigned officer of _____ (Company) certifies to the Board of Trustees of the University of Alabama that the Company is not located in Alabama and that the Company does not employ an individual or individuals within the State of Alabama.

_____
SIGNATURE OF COMPANY OFFICER

_____
PRINT COMPANY NAME

_____
PRINT NAME OF COMPANY OFFICER

_____
PRINT TITLE OF COMPANY OFFICER

_____
DATE

DISCLOSURE STATEMENT OF
RELATIONSHIP BETWEEN CONTRACTORS/GRANTEES AND
EMPLOYEES/OFFICIALS OF UA/UAB/UAHuntsville/UAS
(THE "UNIVERSITY OF ALABAMA SYSTEM")

1. Contract # B002315

2. Name of Contractor/Grantee _____

   Address _____

   _____

   _____

   Phone _____

3. Nature of contract/grant

   RENOVATION OF FUME HOOD CONTROLS IN LABORATORIES AT MSB_____

   _____

4. Does the contractor/grantee have any relationship with an employee or official of the University, or a family member of such employee or official, that will enable such employee or official, or his/her family member, to benefit from this contract/grant? If so, please state the names, relationships, and nature of the benefit.

   _____

   _____

   _____

   (For employees of the University, family members include spouse and dependants. For members of the Board of Trustees (officials), family members include spouse, dependants, adult children or their spouses, parents, in-laws, siblings, and their spouses.)

Certification Pursuant To Act No. 2006-557
Alabama Law (Section 41-4-116, Code of Alabama 1975) provides that every bid submitted and contract executed shall contain a certification that the vendor, contractor, and all of its affiliates that make sales for delivery into Alabama or leases for use in Alabama are registered, collecting, and remitting Alabama state and local sales, use, and/or lease tax on all taxable sales and leases into Alabama. By submitting this bid, the bidder is hereby certifying that they are in full compliance with Act No. 2006-557, they are not barred from bidding or entering into a contract pursuant to 41-4-116, and acknowledges that the awarding authority may declare the contract void if the certification is false.

This disclosure form will be available for public inspection upon request.

The above information is true and accurate, to the best of my knowledge.

_____
Signature of Authorized Agent

_____
Date

This form must be completed and returned before any contract(s) will be issued by the University.

9-09