UTILITIES & ENERGY SERVICES
TEXAS A&M UNIVERSITY

Design Standard

Laboratory Control Systems (LCS)

Detailed specifications follow.

PART 1 - GENERAL

1.01 DESCRIPTION

A. When a construction project includes Fume Hoods, the engineer will design a Variable Air Volume (VAV) laboratory airflow control system, (LCS). Constant Air Volume Systems (CAV) are not acceptable. The VAV LCS shall be furnished and installed to comply with the engineer's design of airflow into and out of laboratory rooms and fume hoods. The exhaust flow rate of a laboratory fume hood shall be precisely controlled to maintain a constant average face velocity into the fume hood when the sash is open. The laboratory control system shall vary the amount of make-up/supply air into the room 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). Air Changes per Hour (ACH) will be engineered, and balanced, to provide 8 ACH when occupied, and 4 ACH when unoccupied, (with fume hood sash closed). The laboratory will have dual technology, ceiling mounted, occupancy sensors installed that control general lighting in the room, as well as connect to the LCS, in order to manage the Air Changes per Hour during occupied and unoccupied periods.

1.02 RELATED WORK

A. The LCS shall be included within the scope and responsibilities of the projects Building Automation System (BAS) Contractor.

1.03 ACCEPTABLE BAS Contractors and Laboratory Control Systems

A. The following are acceptable BAS Contractors and Laboratory Control Systems
   1. Siemens Building Technologies with Siemens Laboratory Control Systems
   2. Johnson Controls Metasys and TSI Laboratory Control Systems

B. The above vendors will supply a LCS that will use varying LCS products, methods and technologies to meet the engineers design. The BAS contractor will be responsible for providing the LCS to meet the engineers design.

1.04 WARRANTY PERIOD

A. Warranty shall be for a period of twenty-four months (starting from the date of final acceptance) whereupon any defects in materials or laboratory airflow control system performance shall be repaired by the supplier at no cost to the Owner.

1.05 SHOP DRAWINGS:

The BAS contractor shall provide to the engineer and owner in an electronic and paper format:

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Details of control panel faces.
4. Equipment schedule.
5. Valve schedule.
6. Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
7. Control System Software: Schematic diagrams, written descriptions, and points list.
8. Sequences of operation.
9. Software and firmware operational documentation.
10. Samples of Graphic Display screen types and associated menus.
11. Operation and maintenance data.

PART 2 - SYSTEM PERFORMANCE REQUIREMENTS AND COMPONENTS

2.01 Fume Hood Monitor/Controller

1. A fume hood monitor shall be provided. This same monitor shall generate an exhaust airflow control signal for the appropriate airflow control device in order to provide a constant average face velocity.
2. Audible and visual alarms shall be provided for both flow alarm and emergency exhaust conditions.
3. The fume hood monitor shall indicate the average face velocity for the fume hood, and have indicator lights to indicate normal, warning and alarm status. The fume hood monitor shall have an audible alarm and alarm silence button

2.02 AIRFLOW CONTROL DEVICE

A. The airflow control device shall be pressure independent over its specified operating range. An integral pressure independent assembly shall respond and maintain specific airflow within one second of a change in duct static pressure irrespective of the magnitude of pressure and/or flow change or quantity of airflow controllers on a manifolded system.

B. Each fume hood exhaust terminal will have a factory mounted, removable, air flow transmitter with output of 4-20 mA proportional to velocity pressure. The air flow transmitter will have an accuracy of at least ±.5% of the transmitter range.

C. The laboratory general exhaust valve (GE) shall meet one of the following requirements:

Actuation:

1. For electrically-actuated VAV boxes the actuator shall be mounted to the VAV box. Loss of main power shall cause the actuator to position itself in an appropriate failsafe state. Options for these failsafe states include: normally open-maximum position, normally closed-minimum position, or last position. This position shall be maintained constantly without external influence, regardless of external conditions on the actuator (within product specifications).

2.03 LABORATORY CONTROL UNIT

A. Each Laboratory Control Unit (LCU) shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each LCU shall be a microprocessor-based, multi-tasking, real-time digital control processor. Provide the following types of LCUs as a minimum:

1. VAV Fume Hood, temperature general exhaust and supply controllers.
2. Laboratory Room Controllers.

B. A laboratory control unit shall control the supply and/or general exhaust and laboratory exhaust airflow control devices to maintain proper room pressurization polarity (positive or negative). Each individual laboratory shall have a dedicated laboratory control unit.

C. The control unit shall be electronic. The inputs shall accept linear feedback signals from fume hood, canopy, snorkel, biosafety cabinet, and office supply airflow control devices. The output signals shall control supply, general exhaust/return airflow control devices and/or variable frequency drives with signals that are linearly proportional to the desired supply or exhaust airflows.

D. The control unit shall maintain a constant design offset between the sum of the room's total exhaust and make-up/supply airflows. 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.

E. The control unit shall provide linear signals that are proportional to all airflow sources, sash sensors, and flow alarms. The signals shall be available for hard wired connection to the facility's direct digital control (DDC) system, or through an integrated control unit that interfaces directly into the facility's DDC system.

F. Refer to the DDC Control specification for the required input/output summary for the necessary points to be monitored and or controlled.

G. The LCU shall be equipped with a dynamic auto-zero module to automatically recalibrate the flow sensors every 24 hours without reducing flow through the boxes.

H. Each laboratory shall have a dedicated 120 Vac line connection to power the laboratory's airflow control system power supply.

2.04 INTERFACE TO BUILDING AUTOMATION SYSTEM

A. The laboratory airflow control system shall fully interface with the project Building Automation System (BAS). The LCS system shall include all necessary devices and software to monitor and control all items indicated in on the Contract Documents. All points shall be able to be monitored and adjusted thru the BAS

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Building Automation System (BAS) contractor shall install sensors, interface boxes, presence and motion sensors, and fume hood monitor on the fume hood. Sash interface boxes with interface cards shall be mounted in an accessible location.

B. The BAS contractor shall install the laboratory control unit (if panel-mounted) and wall-mounted power supply (as required) in an accessible location in the designated laboratory room.

C. The BAS contractor shall terminate and connect devices as required. In addition, integrated laboratory control unit connectors shall be furnished by the BAS.

D. The laboratory control unit or power supply shall be from a dedicated, single phase 120 vac power circuit.

PART 4 - SYSTEM START-UP AND TRAINING

A. System start-up shall be provided by a factory authorized representative of the laboratory airflow control system manufacturer. Start-up shall include calibrating the fume hood monitor and any combination flow sensing equipment as required. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, make-up, general exhaust, or return).

B. The balancing contractor shall be responsible for final verification and reporting of all airflows. All balancing shall be coordinated with the commissioning efforts of the BAS system.

C. The BAS contractor shall furnish a minimum of eight hours of owner training, by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves, and general troubleshooting procedures.

D. Operation and Maintenance manuals, including as-built wiring diagrams and component lists shall be provided.