ISOLATION ROOM CONTROL SYSTEMS
GUIDE SPECIFICATION

Part I - General

A. Provide a complete system for the variable air volume or constant air volume control of isolation and ante rooms.

B. System shall include, but not be limited to, control panels, supply variable air volume boxes, general room exhaust valves, fume hood exhaust valves, air flow sensing stations, room pressure sensors and alarm modules.

C. Total system shall be installed and commissioned by, or under the direct supervision of, factory trained and authorized field engineers.

1.2 Related Work

A. Section :General Provisions
B. Section :Variable Frequency Drives

C. Section :Factory Assembled Air Handling Units
D. Section :Factory Built-up Air Handling Units
E. Section :Centrifugal Fans
F. Section :Axial Fans
G. Section :Power Ventilators
H. Section :Ductwork
I. Section :Ductwork Accessories
J. Section :Air Distribution Devices
K. Section :Air Flow Control Systems
L. Section :Building Control Systems
M. Section :Building Automation Systems
N. Section :Control Sequences of Operation
O. Section :Testing, Adjusting and Balancing

1.3 Job Conditions

A. Coordinate exact sizes and locations of components with the contractor installing the ductwork, temperature controls, and Division 16 work.

1.4 Submittals

A. Furnish shop drawings on all equipment provided under this Section, including but not limited to:

1. Hardware and Devices
2. Installation Control Drawings
3. Sequence of Operation
4. Operating and Maintenance Manuals

1.5 Quality Assurance

A. Supplier of this section's systems shall be regularly engaged in the production, assembly, and installation of isolation room hood control systems and have a proven track record of a minimum of 5 years.

B. Supplier of this section's systems shall assume single source responsibility for the complete installation, calibration, and startup of the isolation room tracking systems. Systems shall be left in a completely automated, fully functioning mode of operation.

Part II - Products

2.1 Acceptable Manufacturers

A. Base Bid: Laboratory Control Systems Inc. TLC-90 System

2.2 General

A. Isolation Room Control system shall use closed loop control to continually monitor and adjust the supply, and exhaust volumes. Open loop control systems that merely feed back an analog signal that measures a position of a mechanical device, or systems that can control by pressure only, are unacceptable and will not be considered. Open loop and closed loop are as defined by 1991 ASHRAE Application Manuals Chapter 41, page 41.1 .

2.3 System Design

A. In all cases, systems shall fail-safe to a mode which achieves the maximum safety to personnel in the spaces served by the systems.

B. Room pressurization control will be accomplished by flow synchronization (airflow tracking) or by direct space pressure control, or by a combination of both. Unless specifically identified elsewhere, all systems on this project shall utilize flow synchronization as the mode of control. Air flows from the supply air and exhaust air will be measured and controlled to maintain a safe, comfortable, and energy efficient environment.

C. All actuators will be pneumatic to ensure quick response time and fail-safe operation.

2.4 Equipment

A. Isolation Room Control Panels: Equal to Laboratory Control Systems Inc.Envirotrak III control panels and shall include all control components for the system logic, input signal conditioning, output signal conditions, power supplies and operator interface. Control panels shall be located to facilitate maintenance and troubleshooting. Panels shall be of standalone design with the ability to operate the entire space it serves upon loss of communications from the network. Each panel shall be fully field programmable.

B. Central Processing Unit (CPU): Industrial quality with the following minimum performance parameters:

1. Scan Rate: The time used by the control system to read a sensor value, calculate a control response, and output a signal to the controlled element shall not exceed 50

milliseconds. Control systems that utilize the communication network to pass primary control information are not acceptable.

2. Input Accuracy: The input section of the electronics (A/D converter) shall be minimum 12 bits (0.024%) resolution.

C. Control Modes: The control system shall incorporate proportional, integral and derivative modes of control. Each mode shall be indefinitely adjustable.

D. Alarm Processing: The pressurization and fume hood control system shall provide fully field programmable alarm processing capabilities. The system shall have the capability of high and low alarms. These alarms shall be transmitted over this network to the supervisory system and/or annunciated locally as required.

E. Gateway: Equal to Laboratory Control Systems Inc.TLC-90 Network Controller. Provides a network function for data retrieval and communication with Envirotrak controllers through the keyboard and line display or provide for communication exchange with the system supervisory workstation. Features shall include:

1. The OptiView is an advanced operator interface that provides building owners and operators with a quick and efficient means to access the day-to-day functions required to operate, monitor, and control their Laboratory Control System. Using only three keys, the operator can access all information available within OptiView. Display capabilities include real-time data database information, alarms, and schedules. In addition, OptiView's display screens can be customized to provide the building owner/operator with a set of screens that organizes and presents information in a logical, intuitive manner
2. Multiple Password Protected Operator Interface with Multiple Levels of Security
3. Auto Restart Following Power Failure
4. Rechargeable 72 Hour Memory Battery Backup
5. Time of Day Scheduling Including Night Setback, Holidays and Weekends
6. Alarm Actions and Messages
7. Trend Log and Data Logging Capabilities
8. Existing Menu Programs and User Defined Programs
9. IBM Personal System/2 Interface for Program Uploading and Downloading (RS-232 Port, 9600 Baud)
10. Two RS-485 Ports for Communication with Envirotrak Controllers (51.2K Baud)
11. Internal Modem through Standard RJ-11 Jack (1200 Baud or Greater)
12. Operating Environment: 30 - 122F, 0-90% RH (non-condensing)
13. Power Requirements: 120VAC, 0.25a

F. Provide an Envirotrak System Supervisory Workstation for central supervisory operations interface. Workstation shall be Pentium III computer with 3.5 inch diskette drive, CD-ROM, 10 GB fixed disk, display adapter, 17 inch color display, keyboard and IBM PC DOS 3.3 or higher and OS/2 operating system.

1. In addition to the above, the system shall include the following:

   a. Alarm Printer

2. The functions of the System Supervisory Workstation shall include:

   a. Envirotrak System Access
   b. System Monitoring
   c. Database Management

d. Management Reports
e. System Programming. If the contractor provides only 0 - 10 volt analog signals, the system must be able to be reprogrammed and calibrated from the P.C. workstation. Simple monitoring of such output is not acceptable.
f. User Program Development
g. Facilities Management
h. Dynamic Graphics Display Generator
i. Data Collection and Recording
j. Report Generation
k. Maintenance Management

G. Controller: Equal to Laboratory Control Systems Inc. Envirotrak III microprocessor-based distributed control system. Able to control a variety of control sequences through standard configurations of interface hardware and software. Analog inputs shall be capable of being software filtered to eliminate hysteresis effects and unwanted signals. Controller database stored in non-volatile EEPROM memory for complete standalone operation. Features include:

1. 2 Wire RS-485 Serial Communications, 51.2K Baud
2. Contact Inputs: 2 Total Used for Status Monitoring of Dry Contacts
3. Digital Outputs: 2 Total, 24VAC, 12VA (.05 amp max)
4. Analog Inputs: 5 Total Universal Inputs Individually Configurable for Any of the Following:
   1000 Ohm Platinum Temperature Sensor
   -40F to +240F at 0.1F Resolution
   1000 Ohm Balco Sensor
   -28.6F to +240F at 0.1F Resolution
   0-10VDC at 0.005V Resolution
   4-20mA at 0.01mA Resolution
5. Analog Outputs: 3 Total, Configurable for the Following:
   0-10VDC at .005 V Resolution
   4-20mA at .005mA Resolution
   Accuracy: +/-% F.S.
6. Alarm Inhibiting: User programmable, S/S points up to 255 seconds; analog and loop points up to 255 minutes following start command.
7. Power Requirements: 24V, +/-2%, 50-60Hz, 40VA Maximum
8. User-defined programming - 100 lines of UDP CODE available. 10 User-defined programs maximum.
9. Local Interface Port - Supports IAM alarm/Interface module, ENV-IS temperature sensor and/or hand-held operator interface tool.
10. Time-of-Day and Back-Up Schedule - Assignable to Any Schedulable Point. Two Schedules: 10 Days; 6 Events per Day.
11. Operating Environment: 32 to 122F (0-50C) 0-90% RH (non-condensing)
12. The control unit shall generate real time information reflecting actual air flow measurement. Systems that provide only a 0-10 volt analog signal, must be programmable as mentioned in Section F.2.e, and must provide an actual air flow measurement to complete a closed loop system. Systems that merely sense a 15-20% reduction in air flow are not acceptable. As a minimum the following information shall be available:
    a. Room Pressure (ΔP)
    b. Supply/Make-Up Ar Flow (CFM)
    c. General Exhaust Flow (CFM)
    d. Room Offset (CFM)
    e. Room Temperature
    f. Room Pressure Setpoint

g. Air Change Rate
h. Occupied/Unoccupied

H. Room Alarm Module: Equal to Laboratory Control Systems Inc. IAM. The local interface module shall incorporate the following functions and features as a minimum:

1. Microprocessor-Based with Programmable Function Section
2. Membrane Push-Button Function Keys
3. Red, Yellow, and Green L.E.D. Indicators
4. Communication Ports
5. Digital Liquid Crystal Display (LCD) Capable of Displaying the Following:

a. Environmental Control

1. Air Flow: CFM or L/S

2. Pressurization: Differential Flow - CFM or FL/S
Differential Pressure - H20 or Pa

3. Time of Day: a.m. or p.m.
Clock

b. Fume Hood Control: Face Velocity - FPM or M/S
Air Flow - CFM or L/S
Open Area - Sq ft or M2
Sash Alarm

c. Additional Alpha Display Points:

1. Alarm HI
2. Alarm Lo
3. Normal
4. Caution
5. Emergency Override
6. Setpoint
7. Service
8. Clock
9. On/Off/Auto
10. Fan - LO/HI
11. Day/Night
12. Deviation

6. Alarm module shall incorporate a hidden password push-button and feature a programmable "monitor only" mode to restrict tampering.

7. Mounting: The IAM shall be surface-mounted to the wall with mounting plate furnished.

I. Optional Auxiliary Emergency Override Switch: Each space connected to the isolation room control system shall include a hall mounted emergency override switch, located near the exit door from the space.

J. Room Temperature Sensor: Equal to Laboratory Control Systems Inc. Model ENV-IS.

The ENV-IS Series Intelligent Sensors are programmable room temperature thermostats designed to operate as a standalone interface to the Envirotrak controller. Each sensor features a microprocessor, communications ports, membrane push-button keys and a digital liquid crystal display (LCD).

Temperatures and times may be programmed for display in domestic or international formats. Selected versions of the sensors feature a hidden password push-button and a programmable 'monitor only' mode to restrict tampering. Also, to facilitate a modular approach to environmental controls, the networking capability for he ENV-IS, using an optional signal splitter, provides for as many as three ENV-IS connected to one Envirotrak controller.

The Intelligent Sensor Cable Splitter (IS-SPL) provides the means for one Envirotrak controller to control the temperatures in one, two, or three zones. It also means that one Envirotrak controller can control as many as three pieces of equipment.

Specifications

Type: Resistance-temperature detector (RTD)

RTD Material: Thin-film platinum

Nominal Resistance: 1000 ohms +0.1% @ 0C
ALPHA: .00385/ohm/ohm/C

Temperature Range:

Operating Range: 32F to 120F

Measuring Range: 55F to 90F

Setpoint Range: Software controlled

Resolution: 1F

Recommended Wire: Modular cable: Six-position, six-conductor

Cover: Color: Shadow white plastic case

Mounting: Directly to wall surface with mounting plate

Dimensions: 4 13/16"H x 3-1/4"W x 1 31/64"D

K. RTD Duct Temperature Sensor: Equal to Laboratory Control Systems Inc. DTS RTD sensor for installation in air ducts. Two-wire interface with Envirotrak controller. Features include:

1. Type: Resistance temperature detector (RTD)
2. RTD material: Thin Film Platinum
3. Nominal resistance: 1000 ohms +/- .1% @ 0°c
   Alpha .00385/ohm/ohm/°C
4. Temperature range: -40 to 250°F (-40to 121°C)
5. Maximum Error: 1.6°F (1.0°C) Over 290°F (161°C) Spa
6. Recommended current: 1.0 mA
7. Maximum current: 3.0 mA

L. Low Differential Pressure Transmitter: Furnish for each air flow or differential pressure measurement point a low differential pressure transmitter incorporating the following functions and features:

Pressure Range: 0-0.1 through 0-5.0"W.C. - Selected according to required operating range.
Accuracy: 1% F.S.O.
Stability: +/-0.5% F.S.O.
Thermal Effects: +/-1% F.S.O.
Overpressure Rating: 15 PSI

Power Supply: 24VAC
Supply Current: 25mA (peak draw 70mA when auto zeroing)
Output Signal: 4-20mA

The transmitter shall be temperature compensated and feature an auto zero function to eliminate zero drift and the need for periodic calibration.

M. E/P Transducers: Furnish and install for each actuator an E/P transducer which converts a proportional electric output signal from the Envirotrak controller to a direct-acting proportional pneumatic signal to operate a pneumatic actuator. The transducer shall be powered by the control signal and require no extra power supply.

Specifications:

Ambient Operating Limit:
Temperature: 41F to 131F (5C to 55C)
Humidity: 5 to 95% RH
Storage: -22F to 158F (-30C to 70C)
Power Supply: None, powered by control signal
Power consumption: 16mA at 11.5VDC
Input Signal: 2 to 10VDC
Main Air Pressure: 18psi (125kPa)
Maximum Safe Air Pressure: 29psi (200kPa)
Air Consumption: 0.025SCFM (11/17ml/s)
Air Capacity: 0.45SCFM (211ml/s)
Air Connections: Dual barb-fittings for: 1/4" (6mm) O.D. or 5/32" (4mm) O.D. tubing
Electrical Connections: Screw terminals for 14 to 22 gage wire
Calibration: Factory calibrated Note: Must be mounted vertically within 5 degrees to maintain factory calibration.

N. Air flow sensors shall be furnished as an integral part of the supply and exhaust boxes. Sensor shall measure velocity pressure and produce an output that is an amplified velocity pressure signal equal to 1.8 x actual velocity pressure. The sensor shall be averaging type employing no fewer than 12 total pressure and 3 static pressure measurement points.

Sensor material shall be aluminum, heresite-coated aluminum, or stainless steel to correspond with duct material. Sensors, or their associated terminal box assemblies, shall be installed with a minimum of three straight duct diameters upstream and a minimum of 2 diameters downstream when used as a duct mounted air flow measuring device. Air flow measurement accuracy shall be +/-0.5%. Flow curves shall be furnished with the air flow sensor.

O. Duct Velocity Transmitter Specifications:

A DVT as manufactured by Laboratory Control Systems Inc.Products Division shall sense a flow dependent pressure signal that has been averaged on an incremental basis over the full duct. This air flow sensor shall amplify the velocity pressure signal so that the transmitted pressure is a true linear function of velocity pressure, approximately 1.6 times the average velocity pressure in the standard configuration. Higher amplification factors may be achieved if furnished with a calibrated orifice so the measured signal is optimized for duct size and flow.

The DVT shall be built from heavy gauge coated sheet steel. Calibration charts showing signal pressure vs. capacity shall be provided. This transmitter shall be installed in the supply or extract ductwork.

Air flow sensing tubes shall have a minimum of 12 total pressure measuring points and 3 static pressure measuring points.

The DVT shall be furnished with an integral differential pressure transmitter suitable for output to a building automation system for control or monitoring purposes. The transmitter shall incorporate the following features and functions:

Pressure Range: 0-0.1" to 0-5.0" W.C.-Selected according to required operating range.

Accuracy: 1% F.S.O.

Stability: +/-0.5% F.S.O.

Thermal Effects: +/-1% F.S.O.

Overpressure Rating: 15PSI

Power Supply: 24VAC

Supply Current: 25mA (peak draw 70mA when auto zeroing)

Output Signal : 4-20mA

The transmitter shall be temperature compensated and feature an auto zero function to eliminate zero drift and the need for periodic calibration.

A schematic drawing shall be provided with each DVT indicating proper hookups for transmitter and controls.

It shall be the responsibility of the installing contractor to install the DVT as required by the DVT manufacturer.

P. Room Static Pressure Sensor: Provide, where required, a shielded static pressure sensor suitable for flush mounting in either the wall or the ceiling. The sensor shall incorporate multiple sensing ports, pressure impulse suppression attenuator, airflow shielding and barbed or compression sitting. Casing shall be capable of measuring static pressure to within 1% of actual.

The Room Static Transmitter shall be furnished with a differential pressure transmitter suitable for output to a building automation system for control or monitoring purposes. The transmitter shall incorporate the following features and functions.

Pressure Range : +/- 0.15"W.C. -selected according to required operating range.

Accuracy: 1% F.S.O.

Stability: +/-0.5% F.S.O.

Thermal Effects: +/-1% F.S.O.

Overpressure Rating: 15PSI

Power Supply: 24VAC

Supply Current: 25mA (peak draw 70mA when auto zeroing)

Output Signal: 4-20mA

The transmitter shall be temperature compensated and feature an auto zero function to eliminate zero drift and the need for periodic calibration.

Q. Supply Variable Air Volume (VAV) Boxes: Furnish VAV boxes as on the drawings and specified under Section, Air Distribution Devices. Controls for the VAV box shall be located in the laboratory control panel for ease of adjustment, calibration, and troubleshooting. This shall apply to all supply VAV boxes serving laboratory and support areas. Each device must be field calibrated to accurately reflect construction and last minute design changes.

R. Supply Box Reheat Coils: Furnish reheat coils as shown on the drawings and specified under Section, Air Distribution Devices.

S. General Room Exhaust Valves: Furnish general room exhaust valves as shown on the drawings and specified under Section, Air Distribution Devices. Controls for the exhaust valves shall be located in the laboratory control panel for ease of adjustment, calibration, and troubleshooting. This shall apply to all general exhaust boxes serving laboratory and support areas. Each device must be field calibrated to accurately reflect construction and last minute design changes.

2.5 Sequence of Operation

A. Isolation Room Control Sequence:

1. The Isolation Room Control System shall maintain the air change rate and pressurization in the space by modulating the supply and exhaust boxes.

2. The supply air flow shall be modulated to maintain a constant air change per hour (adjustable) at all times. The exhaust air shall be modulated to track the supply air in order to maintain a fixed cfm offset between supply and exhaust. Closed loop air flow tracking shall be utilized to insure fail safe operation.

3. Actual room differential pressure shall be monitored and used as an alarm point to indicate an inability of the air flow control or mechanical systems to maintain proper pressurization in the space. (As an option, room ΔP may be displayed locally at the alarm annunciation panel.)

4. Room temperature is maintained by modulating the reheat coil in response to changes in the space temperature. An anticipatory control loop, utilizing both space and duct temperature sensors is used to provide stable control in the event of a large, rapid change in cooling load. (i.e. Room switches from Unocc-Occ or the room is suddenly occupied by surgical team, etc.)

B. Optional Modes of Operation:

1. Occupied/Unoccupied operation shall be selected by a keyed switch on the annunciation panel. Unoccupied state shall be indicated by an amber light. Control sequence is as above except the supply air shall have two setpoints, Occ/Unocc.

2. Mode of Pressurization - The mode of pressurization, i.e. positive or negative shall be selectable by a keyed switch located on the Isolation Room control panel. Mode of operation shall be indicated by L.E.D. or pilot light.

Part III - Execution

3.1 Installation

A. The Isolation Room control manufacturer shall be responsible for ensuring that the control system is installed and operates properly as intended and designed. Installation of all components shall be installed by, or under the direct supervision of, factory authorized personnel.

B. The Mechanical Contractor shall be responsible for the installation of the supply VAV boxes, fume hood exhaust valves, general exhaust valves, sensing stations and any other devices to be installed in the air streams.

C. The Isolation Room control manufacturer shall provide detailed control schematics and prepare field installation drawings for the ATC Contractor to install control wiring and tubing. The temperature control contractor shall provide a source of clean, dry, control grade 20 psig air as required.

D. The electrical contractor will provide a 120VAC power receptacle (as required).

3.2 System Start-Up

A. Point to point terminations check-out, setpoint adjustments and calibration, system start-up, and final calibration shall be performed by, or under the direct supervision of, factory trained and authorized field engineers. The installed system must be able to be field calibrated on site without removing the box or valve. This will ensure an accurately calibrated finished product that will reflect changes in the construction phase or last minute design requirements.

B. All dampers, damper operators, flow sensors, etc., shall be checked for proper operation and field calibrated where required. Alarm systems and fail-safe modes shall be checked for each and every device.

C. Each tracking system shall be calibrated and tuned to provide fail-safe, efficient operation. Flow transducers shall be calibrated for zero and span, the control loop shall be for each mode of proportional, integral and derivative control. All dampers, damper operators, flow sensors, etc., shall be checked for proper operation. The flow volume control system shall be run through its entire range and calibrated as required to linearize the output. Alarm systems and fail-safe modes shall be checked for each and every device.

D. The Isolation Room control system supplier shall work closely with the balancing contractor to ensure proper air distribution in the HVAC system. The balancing contractor shall coordinate the work of the hood and tracking systems supplier with the hood certification testing and the HVAC balancing. It is imperative that the methods of testing air flow at the hoods are known and understood by all parties involved. Where there is a conflict as to proper methods to use for balancing, the Engineer shall have the final say.

E. The Balancing Contractor shall be responsible for providing CFM versus signal data to the laboratory fume hood control system supplier, who will then generate CFM versus signal

charts for each box. This data shall be provided to the Owner as a part of the Operation and Maintenance manuals.

3.4 Documentation and Training

A. The Isolation Room control supplier shall provide all the documentation and training necessary so that the Owner can be capable of operating and maintaining the control system.

B. Provide 4 hours of pre-construction systems overview for construction personnel.

C. Provide 3 days of on-site training to personnel designated by the Owner. Training is to Include: Systems operation, troubleshooting, instrument calibration, alarm handling, and system reconfiguration.

D. Follow-up Training (optional): Provide 5 working days of training for 3 people, of the Owner's choosing, at a factory training site. Transportation, room and board expenses will be the Owner's expense. The training presented shall be the same training that the factory field engineers receive.

E. Documentation shall consist of dimensional data for control panels, supply boxes, exhaust valves, flow measuring sensors, etc., control schematics, equipment sizing, instrumentation data sheets and Sequences of Operation.