

# Environmental Chamber Specifications

## PART 1 GENERAL

### 1.01 SUMMARY

#### A. Section Includes

1. Furnishing all labor, materials, equipment and services necessary to complete the controlled environmental room work.
2. Factory assembly and testing of major components prior to delivery, including air handler / evaporator, compressor / condensing unit, humidification / dehumidification equipment and control panels.
3. Delivery of room components to their final location and complete assembly of rooms in place by factory trained technician.
4. Refrigeration piping, electrical power wiring, control wiring and connections to devices which are an integral part of the rooms.
5. Startup and field testing of rooms by factory trained technical personnel.

#### B. Related Sections

1. Section 11602: Laboratory Casework and Furnishings.
2. Division 15: Furnishing and installation of plumbing utilities and final connections to service fittings.
3. Division 15: Furnishing and installation of ventilation ductwork and final connection to environmental rooms.
4. Division 16: Furnishing and installation of electrical utilities and final connections to control panels.

### 1.02 REFERENCES

#### A. Standards

1. ARI: American Refrigeration Institute, 420-77 and 520-78.
2. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers, Standard 15-1994 – Refrigeration Components, Safety and Use of Refrigerants.

3. ASTM: American Society for Testing and Materials, A204 – Aluminum Alloy, Sheet and Plate.
4. ASTM: American Society for Testing and Materials, A240 – Stainless Chromium-Nickel-Steel, Sheet and Strip.
5. ASTM: American Society for Testing and Materials, A-525 – Steel Sheet, Zinc-Coated, Physical Structural Quality.
6. UL: Underwriters Laboratories Inc., 723 – Room Panel Flame Spread Ratings.
7. NSF: National Sanitary Foundation Seal of Approval – Room Panels.
8. FM: Factory Mutual, E84 Burn Test, Class 1 Rating, Aluminum Panels.
9. CSA: Canadian Standards Association, C22.2.

#### B. Codes

1. NEC: National Electrical Code Article 310 and 410 – Electric Motors.
2. NFPA: National Fire Code, 79 – Electrical Standard for Industrial Machinery.

### 1.03 SYSTEM DESCRIPTION

#### A. Design Requirements

1. Environmental rooms shall be designed, manufactured and installed by one supplier for single source responsibility.
2. If a supplier or manufacturer provides an item which causes changes to other portions of the plans or specifications in order to incorporate their product, the cost to make the change shall be included in the supplier or manufacturer's cost.
3. Rooms shall be self contained units with all essential systems and equipment necessary for a complete and functional room.
4. Design systems with sufficient capacity to simultaneously and continuously meet all loads; including heat transmission from external sources, ventilation load and internal heat gain from equipment, lighting and people; as scheduled under Part 3 of this Section. Scheduled power supply represents the amount of power allocated by the building electrical system design for each environmental room.

Provide any additional power in excess of the amount scheduled that is required to maintain specified environmental conditions.

5. The environmental room design and installation shall conform to applicable codes, ordinances and regulations.

#### B. Performance Requirements

1. Achieve the environmental room conditions scheduled in Part 3 of this Section and maintain the conditions within the specified tolerances.
2. Those values not established in the Part 3 schedule shall be determined by the Environmental Room manufacturer.

### 1.04 SUBMITTALS

- A. Manufacturer's Data: Submit, for approval, manufacturer's data for all environmental room components including panels, air handler / evaporator, compressor / condensing units, humidification / dehumidification equipment and control panels.
- B. Shop Drawings: Submit shop drawings, minimum scale (1/4 inch = 1'-0") (1:50), which include dimensioned plans, elevations and sections. Provide utility data, details and other information required for proper evaluation of work and for coordination with other related work.
- C. Submittal shall include, as a minimum, cooling, heating and humidification / dehumidification requirements and capacities. Provide refrigeration piping schematic showing all components and their respective size or capacity, airflow schematic and written sequence of operation.
- D. Electrical plan shall show all power connections to lighting and equipment; the voltage, amperage and kW load for each circuit; and control and power wiring schematics.
- E. Provide roughing in requirements for mechanical and electrical services.
- F. Test Reports: Submit reports of all specified factory and field performance tests.
- G. Operating and Maintenance Manuals: Before request for final payment, provide Operating and Maintenance Manuals that reflect installed conditions and provide detailed operating and maintenance procedures.

### 1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Environmental rooms and associated equipment shall be provided by a single laboratory environmental room manufacturer.

B. Manufacturer's Qualifications:

1. 10 years or more experience in manufacture of laboratory environmental rooms and equipment of type specified.
2. 10 installations of equal or larger size and with similar requirements.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Schedule delivery of environmental room components and equipment when building spaces are sufficiently complete so that material can be installed immediately following delivery.
- B. Protect finished surfaces from soiling or damage during handling and installation. Keep covered with polyethylene film or other protective coating.

1.07 PROJECT CONDITIONS

- A. Do not deliver or install equipment until windows and doors are installed and the building is secure and weather tight.
- B. Examine project conditions at the site with regard to access, dimensions and the general areas of work. Installation work shall be performed in close coordination with other trades.
- C. Provide for any mechanical or electrical service different than that shown on the construction Drawings or indicated in these Specifications, but necessary to accommodate the manufacturer's product requirements.

1.08 WARRANTY

- A. Provide a written warranty stating the product is free from defects in material or workmanship under normal use and service. Warranty shall become effective following the acceptance date and cover the following items for the noted duration:
  1. Ten year insulated panel warranty
  2. Five year compressor warranty
  3. One year parts warranty
  4. One year labor warranty

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, provide products by one of the following:

1. Scientific Climate Systems Ltd.; 8208 Westpark Drive; Houston, Texas 77063, Phone: 713-781-6447

### 2.02 ROOM CONSTRUCTION

A. Wall and Ceiling Panels:

1. Modular panel sections, (4 inches) (100 mm) thick, consisting of foamed in place urethane insulation with interior and exterior metal surfaces. Provide panels in standard size increments, fully interchangeable, and in a configuration that meets the specified dimensions. Structural metal, wood or fiberglass material shall not be used between interior and exterior surfaces.
2. Interior and Exterior Surfaces; Stucco embossed aluminum, minimum (0.04 inches) (1 mm) thick, with baked enamel finish. Color selected by Owner's Representative.
3. Insulation: Foamed-in-place urethane having a thermal conductivity ("K" Factor) not exceeding (0.118 BTU/hour/square foot/degree Fahrenheit/inch) shall not exceed 0.029 (R-34) for (4 inch) (100 mm) thick walls. Foam shall be 97 percent closed cell, impervious to moisture. Insulation shall bond the panel and have a minimum compressive strength of (28 pounds per square inch) (193 kPa).
4. Panel sections shall lock together from inside the room with cam type fasteners, providing accurate, tight joining. A minimum of 3 locking devices shall be used on each vertical joint. Distance between locking devices shall not exceed (48 inches) (1220 mm). Edge of panels shall be foamed in place, tongue and groove construction with every tongue including an interior and exterior foamed in place flexible vinyl gasket to ensure a tight fit. Batten strips or pressure clips as a means of covering seams or joining panel sections shall not be utilized.
5. Each panel shall meet UL fire test rating with a flame spread rating of 25 or less and display the UL label for this rating. Panels shall be tested and approved by Factory Mutual, Standard Number 4880, for Class I building type, insulated wall and ceiling construction in combination.

6. Reinforce ceiling panels to support equipment loads without violating the insulation value of the panels. Reinforce wall panels to support wall mounted shelving shown on the Drawings.

#### B. Floor Panels:

1. Floor Panels: Minimum of (4 inches) (100 mm) of foamed in place urethane insulation with interior and exterior metal surfaces of (14 gage) (1.99 mm) galvanized steel capable of withstanding a minimum of (600 pounds per square foot) (23.5 kPa). Provide ramps at all doors, extending inside, as shown on the Drawings.

#### C. Doors

1. In fitting, semi flush, with a minimum clear opening of (36 inches wide by 78 inches) (915 mm by 1980 mm) high. Doors shall have a thermal resistance within 10 percent of that for wall panels.
2. Observation Window: Minimum of (18 inches by 12 inches) (45 mm by 300 mm), 3 pane with (1/4 inch) (6 mm) air space between panes. Windows shall be removable for replacement.
3. Gaskets: Extruded vinyl, resistant to oils and sunlight and easily replaceable. Provide antisweat heaters to control condensation as a standard item on all door jambs at rooms designed for operation below degrees Celsius.
4. Hardware: Polished aluminum, cam action type, self closing, self lubricating and edge or strap mounted with stainless steel. A minimum of 2 hinges per door, adjustable for proper gasket seal.
5. Lock: Provide with keyed cylinder lock capable of release from the room interior whether or not the door is locked.

#### D. Closure Panels

1. Furnish and install the necessary vertical and horizontal closure panels, strips and shrouds to enclose opening between environmental rooms and adjacent corridor, building partitions and ceiling. Finish to match adjoining environmental room wall panels.

### 2.03 ROOM INTERIORS

- A. Lay in Ceiling: Provide a (24 inch by 48 inch) (610 mm by 1220 mm) acrylic, egg crate type lay in ceiling grid supported by (1 ½ inch by 1 ½ inch) (38 mm by 38mm) anodized aluminum members.

B. Ceiling Plenum:

1. Plenum to contain evaporator coils, drain pans, fans, heating elements, control valves and other equipment necessary to condition the room air to maintain specified conditions.
2. Conditioned air shall pass into a positive pressure plenum extending across the room ceiling. Plenum to provide the correct percentage of total opening to ensure uniform air distribution throughout the room.

C. Flooring

1. Provide resilient flooring in each room, 4 degrees Celsius and above, to match that specified under Division 9. Final selection of color and style by the Owner's Representative. Prefinish floor with a substrate that will accept the resilient flooring. Flooring is to be secured to the substrate with adhesive that will withstand the temperatures listed in the Environmental Room Schedule. Provide grooved base.

D. Conditioning Module

1. Room air shall be temperature conditioned by a conditioning module consisting of an evaporator with drain pan, air circulating fans and controls.
2. Locate conditioning module in ceiling plenum above lay in ceiling. Conditioning module shall be low profile type to maximize the clear height inside the room.
3. Electrical power feed to conditioning module shall be through the environmental control panel.

E. Lighting

1. Design: Lighting shall be sufficient to provide (70 foot-candles) (753 lx) of uniform illumination when measured at (36 inches) (910 mm) above the floor.
2. Mount fixtures above the false ceiling panels.
3. Fixtures: Vapor proof fluorescent type with low temperature ballast suitable for the temperature listed in the Environmental Room Schedule. Underwriters Laboratories approved 120/60/1.
4. Lamps: Provide type specified under Division 16. For rooms at 0 degrees Celsius and below, provide low temperature lamps.

5. Switch: Provide with pilot light and locate outside of the room next to the door.

#### F. Freestanding Shelving Units

1. Open wire shelves (where indicated), adjustable on (1 inch) (25 mm) centers, constructed of 9 gage wire ribs and side reinforcing members all around. Provide (1 inch) (25 mm) diameter vertical support posts with ringed grooves (1 inch) (25 mm) apart.
2. Materials: Shelves and posts of epoxy coated nickel-chrome steel
3. Materials: Shelves and posts of Type 304 stainless steel.
4. Size: (74 inches) (1800 mm) high, (72 inches) (1830 mm) maximum width, and depth as indicated on the Drawings. Provide with 5 tiers of shelves unless otherwise indicated on the Drawings.

### 2.04 REFRIGERATION SYSTEM

#### A. Design

1. Complete integrated system consisting of a conditioning module, compressor / condenser unit, interconnecting piping, interconnecting wiring and controls designed for continuous system operation. The refrigeration system shall be a fully modulating type which continuously proportions the mixture of liquid and hot gas phases of the refrigerant entering the evaporator, utilizing a modulating control valve. On/off solenoid valve type of control will not be acceptable. The system shall also include high/low pressure controls, receiver, expansion valve and all necessary components for a complete system to achieve the specified performance.
2. System Capacity shall be sufficient to simultaneously and continuously meet all loads, from 0 to 100 percent, including heat transmission from external sources, ventilation load and internal heat gain from equipment, lighting and people.
3. Refrigeration: R-134A for rooms 4 degrees Celsius and above. R-404A for minus 20 degree freezers.
4. Ventilation will be continuously provided from building supply air system. Rooms must maintain temperature control and uniformity with ventilation load continuously present.

## B. Conditioning Module

1. Evaporator Coil: Copper tube, copper fin with aluminum housing. Minimum 8 fins per (inch) (24 mm), minimum 4 rows deep. Air velocity shall be less than (500 fpm) (2.5 m/s).
2. Coil Blower/Motor: Permanently lubricated, ball bearing design, rubber mounted and thermally protected.
3. Drain Pans: Provide an insulated, stainless steel, condensate drain pan large enough to collect all condensate during normal operating and defrost cycles.

## C. Compressor/Condenser Unit

1. Air cooled, semi hermetic, serviceable unit sized to maintain temperature / humidity conditions scheduled for each room under Part 3 of this Section.
2. All components of the unit shall be designed for 125 psig working pressure or 150 percent of maximum operating pressure, whichever is greater.
3. Unit shall have a minimum of a high/low pressure safety control, receiver with fusible plug, liquid line drier with sight glass, crankcase pressure regulator, accumulator, vibration absorbers and thermal protection.
4. Unit shall be designed for continuous operation for maximum compressor life and to eliminate on-and-off cycling.
5. The compressor / condenser unit shall be linked to an evaporator of matching capacity.
6. Provide a fully accessible sheet metal sound enclosure internally lined with (2 inch, 6 pound) (48 mm, 2.7 kg) density glass fiberboard tightly fitted to the cold room. The enclosure shall be provided with acoustically lined air transfer ducts as required to dissipate any heat buildup within the enclosure.

## D. Automatic Defrost System

1. For rooms with setpoint temperature between 0 degrees Celsius and 6 degrees Celsius, provide hot gas bypass defrost with timer and fan delay switch. Set defrost initiation time and duration so that room temperature increase is minimized while achieving complete removal of accumulated frost. Electric heat trace and insulate drain pipe.

#### E. Piping:

1. ACR type, hard drawn, cleaned and capped Type L copper tubing soldered with silver solder. Hot gas piping shall be silver brazed. All piping shall be installed to allow for linear expansion of copper after startup.
2. Suction Piping: Size for velocity of (500-700 fpm) (2.5 – 3.5 m/s) on horizontal runs with a slight pitch toward condensing unit. When condensing unit is located below evaporator and there is no possibility of trapping oil; size vertical runs same as horizontal runs. When condensing unit is located above evaporator; size vertical runs for velocity of (1,000 – 1,500 fpm) (5-7.5 m/s) and install proper traps spaced not more than over (10 feet) (3 m) apart on all tubing risers.
3. Hot gas Piping: When hot gas piping is field installed remote from compressor, size at same velocities and with same trap requirements as specified above for suction lines.
4. Liquid Piping: Size all liquid piping for maximum (2 psig) (13.8 kPa) pressure drop.
5. Hangers: Provide with appropriate tubing clamps to support liquid, suction and discharge lines individually. Space hangers or clamps (8 feet) (2.4 m) on center maximum.
6. Condensate Drain Piping: Provide (7/8 inch) (20 mm) or greater, Type L copper tubing from evaporator drain pan to the building waste system. In rooms with sinks, drain piping shall be connected to the sink drain on the house side of the trap. In rooms without sinks, drain piping shall terminate (2 inches) (48 mm) above the floor sink or floor drain outside the room. Horizontal piping between drain pan and environmental room wall shall be located above the lay in the ceiling and pitched in the direction of flow. Rigidly support piping at walls, (3 feet) (1 m) on center with a (1 inch) (24 mm) clear space between the wall and the drain line. Provide cleanout tee near drain pan. Where piping passes through wall of room, provide chrome plated escutcheons on both faces of the wall and a trap seal at the outside surface of the wall. Insulate and electric heat trace drain piping.
7. Refrigerant Testing: Pressurize and leak test entire system at not less than (100 psig) (690 kPa). Clean and dehydrate by maintaining a vacuum of 500 microns, or lower, for a 5 hour period. Add required charge of refrigerant and oil if necessary and test entire system for performance. The type of refrigerant used shall be in accordance with State and Local Codes. Mark each system clearly as to refrigerant type used.

8. Service line penetrations shall be properly sealed with silicone caulking.

F. Insulation:

1. Suction and hot gas refrigeration lines shall be insulated with a closed cell foam plastic insulation. The material shall be tubular in form and sized according to the pipe size. Joints shall be thoroughly bonded by the adhesive recommended by the manufacturer of the insulation. Insulation shall meet local and state fire and smoke requirements. Penetrations of the insulation must be thoroughly sealed to form a complete vapor barrier. Wherever the insulation terminates the edges shall be sealed to the pipe with sealant.

## 2.05 VENTILATION SYSTEM

- A. Ventilation supply and exhaust will be provided on a continuous basis from the building ventilation system. Provide a pressure independent constant volume air valve on the supply and exhaust to each environmental room. Environmental rooms must maintain specified uniform temperature and humidity control with ventilation load continuously present.
- B. Provide a (4 inch) (100 mm) diameter exhaust duct collar through the roof of the environmental room for connection to the building laboratory exhaust system. Exhaust ducts shall be insulated for a minimum of (6 feet) (1 m) beyond the duct collar.
- C. Provide a (4 inch) (100 mm) diameter supply duct collar through the roof of the environmental room for connection to the building laboratory supply air system. Termination of the supply air duct in the ceiling plenum shall be at warm side of the evaporator.

## 2.06 DEHUMIDIFIERS

- A. Provide a dehumidification system with equipment sized to maintain temperature / humidity conditions scheduled for each room under Part 3 of this Section.
- B. General Description: Automatic, continuous duty, dry desiccant type. Rotary non-cycling for continuous, unattended operation. The dehumidifier shall be completely factory assembled, wired and tested. It shall be self contained and include a rotary cylinder type desiccant drum assembly filled with granular chemical desiccant. The dehumidifier shall be complete with a process air fan and motor, reactivation air heating system, access panels, filters and controls for complete automatic operation.

- C. Construction: The dehumidifier shall be constructed of (16 gage) (1.613 mm) zinc grip type steel and provided with access panels which shall be designed to allow complete internal inspection and servicing of the desiccant drum and drive assembly. The dehumidifier shall be primed and painted consistent with corrosion prevention standards. The casing shall be constructed air and vapor tight throughout.
- D. The unit shall be divided internally into two separate sections, process and reactivation. Division of the separate sections shall be accomplished with long life silicone seals, ensuring minimum cross leakage.
- E. The drum drive assembly shall have a positive drive arrangement for slip free rotation of the desiccant cylinder. An electronic control shall allow drum rotation adjustment. Filters shall be factory mounted in the process and reactivation air inlet openings. Filters shall be of the cleanable type.
- F. Desiccant: The desiccant drum shall be fully charged with a granular, chemically inert, non-corrosive, nonflammable, nontoxic desiccant. The desiccant shall be high absorption capacity silica gel.
- G. Provide all interconnecting wiring, controls and ductwork to the rooms.

## 2.07 CONTROLS

- A. Locate all instruments and controls in a control panel on the outside of the room. Controls shall be mounted at ADA compliance. Provide panel with a clear acrylic cover and a lock with two keys.
- B. Main Temperature Control: Microprocessor based PID controller designed for environmental room applications with the following features:
  - 1. Resistance Temperature Detector (RTD) 100 ohm platinum sensor for rapid response to temperature fluctuation, open tip for environmental rooms. Sensitivity shall be greater than or equal to plus or minus 0.1 degree Celsius.
  - 2. The microprocessor PID controller shall continuously monitor room condition versus setpoint, providing an output which will modify the conditioning system capacity in response to any deviation.
  - 3. Controller range shall be established to cover the required range of the room as scheduled.
  - 4. Accuracy: Plus or minus 0.25 percent of reading plus 1 digit over advertised span at 25 degrees Celsius.
  - 5. Ambient Temperature Error: 0.01 percent of span per degree Celsius deviation from 25 degrees Celsius.

6. Resolution: 1 degree/unit.
  7. Calibration Drift: Self compensating for ambient temperature. All calibration values shall be stored in memory. No field calibration shall be required.
  8. Noise Rejection: Normal mode, 85 dB minimum at 60 Hertz or greater. Common mode, 90 dB minimum.
- C. High Temperature Safety Control: A separate and independent safety control circuit and devices shall be installed in the control panel. This control shall be a sensitive electronic controller with setpoint dial calibrated in degrees Celsius. In the event of a high temperature alarm condition, the safety control will de-energize the heaters and lights in the room and activate an audible and visual alarm. A panel mounted momentary contact push button shall be provided to deactivate only the audible portion of the alarm. When temperature returns to the normal range the heaters, lights and alarm system shall automatically reset. Provide dry contact for connection to external alarm.
- D. Low Temperature Safety Control: A separate and independent safety control circuit and devices shall be installed in the control panel. Its sole function shall be to deactivate the refrigeration system and activate audible and visual alarms in the event of a low temperature alarm condition. This control shall be a sensitive electronic controller with setpoint dial calibrated in degrees Celsius. A panel mounted momentary contact push button shall be provided to deactivate only the audible portion of the alarm. When temperature returns to the normal range the alarm system shall automatically reset. Provide dry contact for connection to external alarm.
- E. Temperature Recorder: House in main control panel case and provided with a (10 inch) (250 mm) circular chart capable of recording 7 days of operation with minus 50 degrees Celsius to plus 75 degrees Celsius recording range. Ambient temperature error shall be no more than 0.02 percent of span per degree Celsius deviation from 25 degrees Celsius. Chart making shall be by means of a disposable felt tip pen. Input to the recorder shall be from a 100 ohm RTD sensor. The sensor shall be immersed in a glycerin solution and the container secured to the interior wall of the room.

## 2.08 PERSONNEL EMERGENCY ALARM

- A. Provide room with a reset type, electrically powered personnel emergency alarm system. Power shall be from the room electrical input. The system shall consist of an actuator within the room and audible and visual alarms affixed to the front exterior of the room. Provide an additional alarm for the building automation system utilizing two dry contacts.

- B. The alarm system actuator shall be a heavy duty, oil tight switch, equipped with a red button marked, "EMERGENCY ALARM – PULL TO RESET." The actuator shall be mounted on the interior wall of the room adjacent to the door jamb and (12 inches) (300 mm) above the finish floor.
- C. The audible alarm shall be of a type that provides a high decibel level of sound output at a frequency distinct from room parameter alarms. The visual alarm shall be mounted in an area providing no vision interference and shall be prominently labeled "PERSONNEL EMERGENCY."

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Deliver to job site, uncrate and assemble all equipment herein. All debris and crafting materials shall be removed. Components shall not be exposed to weather.
- B. Sections shall match without distortion. Door shall close and seal without binding.
- C. Electrical:
  - 1. Furnishing, installation and connection of control panel, complete with disconnects for incoming service and branch circuits.
  - 2. Incoming service to control panel mounted disconnects from junction box located above the environmental room.
  - 3. Interlocking control wiring between control panel and remote compressors or heaters, between fan/coil unit and remote compressors or heaters, where required.
  - 4. Provide a dry contact, for use by building automation system, that will close when any of the operating controls fail or when any of the safety devices prevent operation of conditioning equipment.
  - 5. Provide sealing fitting to seal conduit at all penetrations of environmental room wall or roof panels.
- D. Mechanical:
  - 1. Service line penetrations into rooms shall be properly sealed with silicone caulking.
  - 2. Insulate the exhaust duct for a minimum of (6 feet) (1.8 m) beyond the collar.

- E. Manufacturer of laboratory controlled temperature rooms shall provide carpentry supervisor and mechanical supervisor on job site whenever cold room installation in that area of work on rooms is taking place.
- F. Manufacturer's Representative shall instruct Owner's staff in the operation of room including controls, after completion of room startup. The operating and maintenance manual shall indicate sequential operation, startup and shutdown, with all pertinent control data and schematics.

### 3.02 TESTING

- A. Provide all equipment and instrumentation for testing and perform the specified tests.
- B. Control Setpoint: Verify temperature control of plus or minus 0.5 degrees Celsius at the room sensor.
- C. Temperature Uniformity: Measure the temperature on a horizontal plane (40 inches) (1000 mm) above the floor within (12 inches) (300 mm) of walls throughout the entire room. Temperature uniformity shall be plus or minus 0.5 degrees Celsius. Measure and record uniformity using a multipoint strip chart recorder utilizing a minimum of twelve thermocouples during a continuous 24 hour test period.
- D. Temperature Gradient: Verify that maximum temperature gradient from floor to ceiling does not exceed 1.0 degrees Celsius.
- E. Recovery Test: All rooms, except freezers, shall recover preset operating temperature within 5 minutes after door has been fully opened to (75 degrees Fahrenheit) (24 degrees Celsius) ambient for a period of 1 full minute.
- F. Internal Load Test: Each room shall maintain plus or minus 1.0 degree Celsius control when operating with the number of people, amount of ventilation and internal heat gain of lighting and equipment as shown on the Environmental Room Schedule.
- G. Provide written reports, in duplicate, of all tests. Reports shall indicate procedures followed, instruments used and tabulation of results.
- H. Witnessing of Tests: Owner's Representative shall be given the option of witnessing and confirming test results. Notify Owner's Representative, in writing, 10 days prior to tests.
- I. Supplier shall provide all equipment for testing and perform all tests for IQ and OQ validation. Test shall confirm that the room meets the temperature stability specifications.