

SECTION 13030 - CONTROLLED ENVIRONMENT ROOM

First Edition: 8.14.12 Latest Update: 8-15-12, see underlined text.

(A/E shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project.)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes, but is not limited to, the following:
 1. Provide pre-piped and pre-wired, environmental rooms as described in Paragraph 2.1 and as indicated on the drawings. Each room shall be provided ready for single point connections to each service under the mechanical and electrical specifications.

1.3 DEFINITIONS, STANDARDS AND CODES

- A. The following terms are used to describe performance characteristics of the Controlled Environment Room:
 1. Temperature Control: When used to describe chamber performance, the absolute value of the difference between the highest and lowest temperatures at a single location over the time period specified under “Test Procedures”. Temperature control requirement does not apply during defrost activity unless specifically noted herein.
 2. Temperature Uniformity: When used to describe chamber performance, the absolute value of the difference between the highest and lowest temperatures measured at numerous locations at a single point in time. Temperature uniformity requirement does not apply during defrost activity unless specifically noted herein.
 3. “Stable” or “Stabilized”: After a change in setpoint or disturbance to the room conditions, the point at which the room performance is again within the specified performance limits for control and uniformity.
- B. The following are abbreviations and standards which may be referenced herein:
 1. NRTL: Nationally Recognized Testing Laboratory
 2. UL: Underwriters Laboratory
 3. FM: Factory Mutual
 4. NFPA: National Fire Protection Association
 5. NEMA: National Electrical Manufacturers Association

6. NFPA 70: National Electric Code (latest revision)
7. NFPA 79: Electrical Standard for Industrial Machinery (latest revision)
8. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers
9. IEEE: Institute of Electrical and Electronics Engineers
10. ASTM: American Society for Testing and Materials
11. CFM: Cubic Feet per Minute
12. C: Celsius degrees

1.4 COORDINATION

- A. Provide close coordination of pre-piping and pre-wiring with the trades connecting to this work.
- B. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.5 DESCRIPTION OF WORK

- A. Extent of Controlled Environment Rooms is shown on drawings and provisions of this section.
- B. See Case Work Specification for stainless steel counters and sinks installed in controlled environment room.
- C. See Mechanical Specification for Plumbing Fixtures for sink hardware.
- D. See Mechanical Specification for Building Automation System (BAS) for interface with the BAS to monitor the room temperature.

1.6 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide all Controlled Environment Rooms as complete units manufactured by one Controlled Environment Room company for single source responsibility.
- B. Manufacturer's Qualifications: Submit printed literature and evidence of previous compliance with the documentation and performance requirements herein on at least five (5) similar projects. Provide evidence of a minimum of five (5) years of successful company operation as a manufacturer of this equipment with over two hundred (200) rooms designed, manufactured and installed by this company.
 1. Submit copies of shop drawings, manuals and other printed materials from 5 previous projects as evidence of previous performance of documentation requirements.
 2. Submit field test data from five (5) previous projects as evidence of previous experience with environmental performance requirements of this project.

3. Submit list of two hundred (200) room installations with location, project name and contact, and date of completion.

1.7 SUBMITTALS

- A. General: Submittals shall be in accordance with the Conditions of the Contract and Division 1 Specification Sections.
- B. Manufacturer's Data: Submit manufacturer's data, electronically as a "pdf" file, for each Controlled Environment Room.
 1. Performance parameters for each room, and internal and external load conditions upon which performance is predicated.
 2. Schedules of major equipment items indicating mechanical and electrical requirements and capacity or performance.
- C. Shop Drawings: Submit shop drawings, electronically as a "pdf" file, on D size paper, minimum scale 3/8 inch = 1 foot – 0 inches, which includes dimensioned architectural plans and elevations, mechanical and electrical plans as described below, and other information and details required for proper evaluation and coordinated installation with related work.
 1. Mechanical plan shall include the following:
 - a. Calculations indicating the design heating and cooling loads which support the equipment selections.
 - b. Refrigeration piping schematic showing all components and their respective size or capacity.
 2. Electrical plan shall show all power connections to the equipment, the voltage, amperage, and kW load for each circuit. Indicate location of all electrical fixtures.
 - a. Control panel wiring schematic and component layout.
 - b. Field installed conduit locations and arrangement.
 - c. Written sequence of operation for the functions listed below. If the function is not provided, no description is required.
 - 1) Cooling
 - 2) Heating
 - 3) Defrost
 - 4) All alarms
- D. Manuals: Operating procedures manual detailing step-by-step instructions to follow for useful operation of the room. Include safety precautions, troubleshooting and start-up and shut down procedures. Approval of manuals is required before fabrication of equipment.

1.8 SPECIAL DOCUMENTATION REQUIREMENTS

- A. Closeout Documentation: The following documentation is required at project completion. It shall be provided in addition to any requirements of the project general conditions. All documentation shall illustrate or describe the as-built condition of the completed work.

Provide two (2) complete sets of documentation for each room installed. Each set shall be delivered in a three ring binder with the project name and room identifier on the cover.

1. Drawings of the completed installation showing locations of all equipment and fixtures.
2. Refrigeration piping schematic.
3. Complete parts list with all control and refrigeration system parts and the original manufacturer's name and part numbers.
4. Control panel wiring diagram indicating the terminal connections for all ungrounded conductors. Conform to the control system documentation requirements of this section.
5. Control panel interior component layout drawing indicating the wiring and terminal connection locations for each component. Conform to the control system documentation requirements of this section.
6. Approved copy of operating procedures manual.

1.9 WARRANTY

- A. Manufacturer shall warrant Controlled Environment Rooms to be free from defects in materials and workmanship for two (2) year after date of Substantial Completion. Components found to be defective under normal operation shall be replaced at no cost to the Owner. Normally expendable items shall be exempt from the warranty, as well as items subject to abuse or misuse.
- B. Manufacturer shall provide an additional three (3) year warranty on the condenser and compressor, and shall be part of entire system warranty by controlled environmental room manufacturer. Manufacturer shall furnish a replacement for condenser or compressor that fails due to defects in material or workmanship. Items subject to abuse or misuse shall be exempt from the warranty.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturer: Subject to compliance with requirements, manufacturers offering controlled environmental rooms that may be incorporated in the Work include the following:
 1. Harris-Environmental Systems, Inc.
 2. Environmental Specialties Inc.
 3. Stability Environments Inc.
- B. Major components of each room shall be pre wired, prefabricated and tested at manufacturer's facility prior to delivery.
- C. Controlled Environment Room operation shall be fully automatic, requiring only a change in a single operating setpoint at the controller to effect the proper change in sequential operation, system capacity, and chamber conditions.

- D. Operating Parameters: operating parameters shall be as follows:
1. Room Designation: Cold Room
 2. Highest Temperature: 6°C (42.8°F)
 3. Lowest Temperature: 4°C (39.2°F)
 4. Temperature Control: +/- 0.5°C (32.9°F / 31.1°F)
 5. Horizontal Temperature Uniformity: +/- 0.5°C (32.9°F / 31.1°F)
 6. Vertical Temperature Uniformity: +/- 0.5°C (32.9°F / 31.1°F)
 7. Ventilation Air Supply Connection: 50 CFM
 8. Ventilation Air Exhaust Connection: 50 CFM
 9. Electrical Power Requirements: Connection to the building emergency power system as indicated below:
 - a. Control Panel: 120V/208V, 3Ph, 4 wire, 20 amps.
 - b. Compressors: 203V, 3Ph, 3 wire, 15 amps.

2.2 CONSTRUCTION

- A. Wall, ceiling, and floor panels shall be a combination of manufacturer's standard and custom sizes used to construct room enclosure in accordance with the exact sizes noted above or on the contract drawings. Where sizes are not provided, controlled environment room shall fit the available space to within two (2) inches of all surrounding structures.
- B. Wall and ceiling panels shall have a minimum of 4 inch foamed in place urethane insulation. No wood, metal or other structural framing shall be permitted in panel construction. Panel sections shall lock together from inside the room with cam type fasteners, providing accurate, tight joining. A minimum of three (3) locking devices shall be used on each vertical joint. Horizontal and vertical distance between locking devices shall not exceed 46 inches. Provide snap-in cover for each locking device access hole.
- C. Edge of panels shall be foamed in place, tongue and groove construction with every tongue side including an interior and exterior foamed-in-place flexible vinyl gasket to assure a tight fit. The panels shall be formed using exterior and interior metal skins with 100% of the interior volume, exclusive of locking devices, being foamed-in-place insulation.
- D. Floor panels shall be similar to other panels, but must be able to support uniformly distributed loads of six hundred (600) pounds per square foot. Floor panel thickness shall be two (2) inches with internal ADA ramp.

2.3 INSULATION

- A. Insulation: Foamed-in-place urethane having a thermal conductivity ("K" Factor) not exceeding 0.135 BTU/Hr./Sq. Ft./°F/inch of thickness. The overall coefficient of heat transfer ("U" Factor) shall not exceed .034 (R-30.1) for 4 inch thick walls.
- B. Panels shall be UL Classified Building Unit, with a flame spread rating of 25 or less and each panel shall display the UL label for this rating. Panels shall be tested and approved

by Factory Mutual (Standard #4880) for Class I building type, insulated wall and ceiling construction in combination, with each panel displaying the agency approval label for this rating.

2.4 FINISHES

- A. All rooms shall have interior and exterior insulated panel finishes as described below.
 - 1. Exposed exterior: Smooth 24 Gage galvanized steel, painted with white baked on enamel.
 - 2. Unexposed exterior: Smooth 24 Gage galvanized steel, unpainted.
 - 3. Interior walls and ceiling: Smooth 24 Gage galvanized steel, painted with white baked on enamel.
 - 4. Interior floor: 14 Gage galvanized steel.

2.5 DOOR CONSTRUCTION

- A. Swing type door openings shall be 34 inches x 78 inches. Construction and finish shall be same as that of adjacent wall panels. Door shall be in fitting and flush mounted. Door and jamb assembly shall remain free of condensation under the specified room operating conditions.
- B. Door Gasket shall be of thermoplastic material mounted along both sides and the top of the door. An adjustable rubber double wiper gasket will be mounted along the door's bottom edge.
- C. All door hardware shall have a brushed chrome finish. The hinges shall be of self closing type with pin and cam design. The door handle and catch assembly shall be self-closing type. Door handle mechanism shall permit easy and convenient opening without the necessity of manipulating strike release mechanisms. Door shall have provision for padlocking.
- D. Doors shall include an interior safety release to permit the opening of the door from within the room even if the door is padlocked.
- E. Provide a view port in each door. Multi pane window consists of panes of glass with sealed air spaces between each one. The window must be removable for easy replacement. Provide frame and glass heating system where necessary to prevent condensation on exterior surfaces. Minimum window dimensions shall be 12 inches x 12 inches.

2.6 CONTROLS AND INSTRUMENTS

- A. General: Instruments, controls, and major electrical components shall be installed in a painted steel control center next to the door at eye level. Enclosure shall be UL listed and carry a NEMA 12 rating. The control center shall have a lockable hinged service door for front access to control and electrical components. A clear polycarbonate cover and lock to prevent unauthorized controller access shall be provided. The control panel shall

house the temperature and alarm controls, defrost controls, related switches, relays, and pilot lights. Wire control panel for single point power connection with separate branch circuit protection, utilizing circuit breakers, for all circuits necessary for the operation of the room, except compressor circuit. Provide panel with main circuit breaker. The panel shall be clearly labeled in a permanent fashion showing functions of all switches, name of manufacturer, and party to contact for service.

B. Safety and Quality Assurance:

1. Complete control panel assembly shall be tested and certified by a NRTL to be in accordance with NFPA 70 and NFPA 79. A certifying label from the testing agency shall be applied to the exterior of each control panel.
2. Provide as-built documentation for every control panel and completed system which details the following:
 - a. Scaled illustration of the physical component layout of the control panel face and interior with designations for each component which are common to all other documentation. Terminals on each component shall be indicated and the conductors connected to each terminal documented on the drawing.
 - b. Schematic of control system in ladder-type format, utilizing IEEE Standard 315-1975 (reaffirmed 1993) symbols and abbreviations, and textual information indicating basic function of each logical portion of the schematic.

C. Control Panel Components and Functions:

1. Devices:
 - a. Pilot Lights: Pilot lights shall be red, minimum one quarter (1/4) inches in diameter. Lamps shall be replaceable from the front of the control panel.
 - b. Audio Annunciator: Primary audio annunciator shall be solid state piezo-electric device providing a warble tone when activated. Provide volume control allowing adjustment of audio signal sound pressure level from 75 to 95 dBa measured at a distance of two (2) feet. Any additional audio annunciators employed shall have same characteristics, but noticeably different frequency or tone.
2. Main Temperature Control: Temperature control shall be accomplished by a microprocessor based controller with simultaneous LED digital display, in 0.1° increments, of setpoint and actual air temperature within the room. All cooling and heating functions of the chamber shall be controlled by this device with all necessary operating data entered by the manufacturer. Controller shall have nonvolatile memory, retaining all operating data during a power failure. Unit shall be standard DIN plug in package for easy replacement.
 - a. Temperature sensor shall be mounted in stainless steel sheath for protection against damage.
 - b. Adjustable alarms for high and low temperature shall be provided. Setpoints for alarms shall be entered digitally and shall have a setpoint resolution of 0.1°C (32.18°F). Alarm shall activate when temperature

reaches the alarm setpoint. When conditions are re-established within the operator selected acceptable range, the alarm shall automatically reset. Provide alarm devices and function as follows:

- 1) Visual Indication by pilot light. Light shall illuminate whenever an alarm condition occurs, and remain illuminated until alarm condition is corrected. High and low alarms shall be separately identified.
 - 2) Audio indication of alarm condition shall be by audio annunciator specified in this section.
 - 3) A silence feature activated by a push button on the control panel face shall be provided for the audio alarm. Pressing the push button shall silence the audio portion of the alarm until the alarm condition has been corrected.
 - 4) Activation of alarm shall transfer dry alarm contacts suitable for connection to remote alarm monitors. The alarm shall be provided with one normally open and one normally closed contact.
3. Heater Limit Safety: On all rooms provided with electric air heating, provide a separate, independent solid state limit control which is UL listed (UL991) as a temperature limit device. This limit control shall monitor air temperature in the conditioning unit, opening the heater power contactor and enabling the audio alarm and a red pilot light if temperature exceeds a preset limit. The preset, non-adjustable limit setpoint shall not exceed +65°C (149°F), but shall be high enough to prevent false alarming under normal system operation. The tripped limit control shall require manual reset.
4. Recorders: Furnish and install an electronic recording device with ten (10) inch diameter circular chart. Provide one hundred (100) preprinted charts and fiber tipped pen with each instrument. Chart rotation time shall be seven (7) days. Input devices shall be of the same type and arrangement as device utilized for input to main temperature control. Instrument shall have a chart range of -40°C (-40°F) to +60°C (149°F). Chart calibration and divisions shall be Celsius degrees.

2.7 MECHANICAL DESIGN

- A. Refrigeration System: All rooms shall be provided with mechanical cooling systems as specified herein. The refrigeration system shall be an integral part of the control and conditioning system and shall include two (2) condensing units, a primary unit and a standby unit. The primary unit shall be a water cooled condensing unit and the standby unit shall be air cooled unit. Both units shall be located on top of the environmental room. All piping and wiring between remote components and rooms shall be installed by the manufacturer. Final connections to building services shall be made by others.
1. System shall incorporate industrial type hermetic compressor, operating continuously. Include all components necessary to accomplish effective, efficient, serviceable installation. System shall consist of, but not be limited to, compressor, receiver, liquid/water cooled condenser, evaporator, moisture indicating sight glass, liquid filter drier, high and low pressure controls, crankcase pressure

- regulator, suction accumulator, suction line filter, expansion valve, oil level sight glass, condenser pressure regulator, manual shut off valves and all interconnecting piping, insulation and wiring.
- a. If the primary condensing unit fails to energize, send an alarm to the control panel and energize the standby condensing unit.
 - b. Condensing units shall be provided with automatic reset high and low pressure controls.
 - c. Condensing units shall be provided with a fused disconnect switch.
2. Defrost controls shall be installed on all rooms with specified operating temperatures extending below $+6^{\circ}\text{C}$ (42.8°F). All rooms shall be defrosted with compressor discharge gas unless indicated otherwise on the schedule. Defrost cycle control is considered an essential element of room operation. Defrost controls shall perform the following functions:
- a. Defrost cycle initiation will automatically be skipped if room temperature is above a preset limit. Limit is adjustable on the front of the control panel. Initiation of the defrost cycle is accomplished with a timing device capable of providing up to six (6) defrost periods per day.
 - b. Three (3) methods of terminating the cycle shall be provided.
 - 1) Termination will occur when evaporator temperature or suction pressure reaches a preset adjustable level.
 - 2) An increase in room air temperature by a predetermined amount will cause the cycle to terminate. This maximum room temperature rise limit is adjustable on the control panel face.
 - 3) The expiration of a preset time period allowed for coil heating shall cause the heating cycle to terminate. This function shall be considered to be a secondary method. Defrost cycles shall normally terminate by the detection of a rise in evaporator temperature or suction pressure.
- B. Ceiling Conditioning Unit: The air in the room shall be conditioned by a ceiling mounted conditioning unit. It shall contain all interior cooling, heating, and air moving equipment within a housing fabricated of aluminum. Service to the internal components shall be via removable panels on the housing. The bottom of the housing shall serve as a condensate drain pan. The conditioning unit shall be completely pre assembled, and tested prior to shipment, requiring only field connection to controller and condensing units.
1. Air movers shall be aluminum bladed fans with permanently lubricated motors.
 2. Evaporator coil shall be fabricated of copper tubes and aluminum fins.
 3. Condensate drain pan shall be heated on all units with operating temperature range extending below 0°C (32°F).
 4. Heaters are required on all rooms with operating range extending above $+30^{\circ}\text{C}$ (86°F), and shall be Incoloy sheathed Nichrome wire with a maximum watt density of 23 watts per square inch. Heaters must be positioned inside the conditioning unit housing, but not in contact with the evaporator surface. Ends of heater elements and wiring terminations must be electrically insulated to disallow human contact with current carrying parts and sealed to prevent entrance of

moisture into the element. Provide electric control interlock to open heater power circuit contactor whenever air flow is inadequate.

C. Refrigerant Piping:

1. Refrigerant Piping: Refrigerant piping shall be hard drawn copper with brazed and soldered joints. Utilize only cleaned and capped pipe lengths which are specifically manufactured for refrigerant duty.
2. Insulation for refrigerant lines: Suction and hot gas lines shall be insulated with closed cell flexible foam plastic, "Armaflex" or equal. The material shall be tubular in form and sized properly for the pipe being insulated. Joints shall be thoroughly bonded using the adhesive recommended by the insulation manufacturer. Insulation shall meet all applicable fire and smoke requirements.

- D. Ventilation Connections: Provide two (2), four (4) inch diameter ventilation connections through the roof with two (2) inch high duct collars for field connection of duct work by others. Coordinate the location of these connections with the mechanical drawings and include the locations on the submittal.

2.8 LIGHTING

- A. Furnish and install quantity of lighting fixtures scheduled for each room in an arrangement approved by the Architect. All others shall be provided with cool white rapid start-type fluorescent fixtures.

B. Fixture Types:

1. Fluorescent fixtures shall have electronic ballasts rated for operation at the maximum low temperature at the location where they are installed. All fixtures shall be vapor-proof type with non-metallic housing, gasketed lens, and non metallic lens cover latches. Each fixture shall accommodate two (2) 48 inch size T-8 lamps.
2. Incandescent fixtures shall be vapor proof type with globe and guard.
3. Light fixtures to be surface mounted to ceiling and provided in sufficient quantity for minimum intensities of seventy (70) foot candles at -20°C (-4°F).

- C. All lighting and switches are provided with cold room inclusive of associated overcurrent protection, conduit and wiring (lighting is served from circuit breaker in main control panel). The lighting is identified, but there is no reference to controls, conduit or wiring.

2.9 FREESTANDING SHELVING UNITS

A. Manufacturers:

1. Intermetro Industries Corporation, Wilkes-Barre, Pennsylvania
2. Wm. Hodges and Company, St. Louis, Missouri
3. AMCO Corporation, Chicago, Illinois

- B. Size: Refer to Drawings. Provide each shelf unit with five (5) tiers.

- C. Open wire shelves, adjustable on one (1) inch centers, constructed of 9 gage wire ribs, perpendicular support ribs, and side reinforcing members all around. Provide one (1) inch diameter vertical support posts with ringed grooves 1 inch apart.
- D. Materials: Shelves and posts of Type 304 stainless steel.

2.10 ELECTRICAL FITTINGS

- A. Electrical Receptacles: Furnish and install flush mounted electrical receptacles where indicated below. Receptacles shall be vapor-proof duplex with vapor-proof covers. The 2 inch x 4 inch junction box for each outlet shall be foamed into the insulated panel with a 1/2 inch EMT conduit from each junction box extended to the top of the room to allow electrical connection of the outlet. All conduits shall be hidden within the walls of the room. All wiring and conduit from the outlet to the box's central junction box shall be provided by the cold room vendor and comply with local codes.
- B. Junction Boxes: Provide two (2), 2 inch x 4 inch junction boxes @ eight (8) feet on center per side.
- C. Receptacle Locations: Provide receptacles @ two (2) feet on center in raceway on all walls.

2.11 ELECTRICAL LOADS

- A. Electrical loads for condenser units shall be 208V/3Ph/60Hz as standard. Room electrical loads (lights, alarms, chart recorders, etc.) shall be 120V/208V/3Ph/60Hz wire, as standard.

2.12 ACCESSORIES

- A. Closure Trim: Furnish and install sheet metal panels to close off open spaces between the room and adjacent walls or ceiling. Trim pieces shall be fabricated of same material as adjacent insulated panel surface.
- B. Fresh Air Induction Unit: If fresh air induction is required, furnish and install an enclosed, self contained, fan powered blower assembly which will provide fresh air to the rooms as scheduled. Provide a replaceable filter on the inlet of the unit.

PART 3 EXECUTION

3.1 GENERAL

- A. Rooms shall be installed, commissioned, and tested by the manufacturer.

3.2 INSTALLATION

- A. Deliver all equipment to its final destination.

- B. Assemble rooms complete with all interconnecting wiring and piping. Install all fixtures supplied by the manufacturer.
- C. Coordinate sequence of work with related trades.
- D. Final connections of services shall be by mechanical and electrical contractors. Coring and sealing of any building walls, ceilings, or floors shall be by others.
- E. Mounting base, curbs, or pad for condensing units, if required, is by others.

3.3 FIELD QUALITY CONTROL

- A. Installation shall be accomplished by the manufacturer of the rooms. The manufacturer's project manager shall coordinate the installation of the rooms, instruct Owner's personnel on proper operation and preventive maintenance, and shall field check the equipment.
- B. Start up, commissioning, and field test of each room shall be performed by manufacturer to verify proper operation of all components and system operational features.

3.4 TESTING

- A. General: Each room shall be tested in accordance with the procedure outlined below. Deficiencies in performance or operation evidenced by the tests shall be remedied by the manufacturer and the room shall be retested.
- B. Operational Function Testing
 1. Simulate and verify all alarm and limit functions.
 2. Operate and verify all defrost functions and their coordination with other room functions.
 3. Verify operation of all specified functions and switches.
 4. Prepare a detailed written report indicating the step by step procedure used to perform tests. Indicate the specific results of each step.
- C. Performance Testing
 1. Operate the room at its design setpoint for seven (7) contiguous days, documenting room temperature with chart recorder provided with control system.
 2. Turn over completed test chart to Owner's representative for approval of room performance.

END OF SECTION 13030