



SECTION 13020

LABORATORY ENVIRONMENTAL ROOMS

**** NOTE TO SPECIFIER **** Thermmax LLC; Walk-in environmental rooms for scientific and industrial applications.

This section based on products made by Thermmax LLC, which is located at:

315 West Street Road
Warminster, PA 18974
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Thermmax Scientific Products designs, manufacturers, installs, and services Walk-In Environmental Rooms for scientific and industrial applications. We offer a complete line of modular sizes, with standard and custom specifications for the precise control of Temperature and Humidity Environments.

PART 1 GENERAL

1.1 SECTION INCLUDES [Specify as required]

**** NOTE TO SPECIFIER **** Delete types of environmental rooms not required for project.

- A. Cold Rooms
- B. Freezer rooms.
- C. Incubator rooms.
- D. Stability rooms.
- E. Ultra-low freezer rooms.
- F. Special Environmental Rooms.

1.2 SYSTEM DESCRIPTION

**** NOTE TO SPECIFIER **** The environmentally-conditioned incubators, warm rooms, cold rooms, and freezers covered by this specification shall be the manufactured products of Thermmax Scientific.

- A. Performance Requirements:



1. Environmental rooms constructed of pre-molded, modular panels. Each panel shall have dimensions to allow passage through normal doorways. Construction of panels shall allow for future expansion and easy disassembly for relocation. Rooms shall be complete with necessary controls, circulation systems, and mechanical and electrical equipment to meet these Specifications.
2. Where environmental rooms are designed with common connecting walls, provide each room with independent control, airflow, and mechanical systems.
3. Maintain noise levels in special purpose room enclosures during steady state control conditions below NC-65 curve over audible frequency range as measured by standard ASA methods when external ambient is 85 decibels or less.

B. Control and Performance:

**** NOTE TO SPECIFIER ** Delete room types and temperate ranges not required.**

1. Temperature Range:
 - a. Cold Room: 2 degrees C to 10 degrees C.
 - b. Freezer Room: Minus 10 degrees C to minus 30 degrees C.
 - c. Incubator Room: 20 degrees C to 50 degrees C.
 - d. Stability Rooms: 0 degrees C to 50 degrees C.
 - e. Ultra-Low Freezer Room: 0 degrees C to minus 40 degrees C.
 - f. Special Environmental Rooms: ___ degrees C to ___ degrees C.
2. Temperature Control Stability: Plus or minus 0.3 degrees C.
3. Temperature Range: Plus or minus 1.0 degrees C.

**** NOTE TO SPECIFIER ** Delete humidity control entirely if not required; optional with manufacturer. Delete humidity ranges not required.**

4. Relative Humidity Range: [optional: specify as needed]
 - a. Range: Not controlled
 - b. Range Ambient to 95 percent relative humidity as limited by 50 degrees C dew point.
 - c. Range: 20 percent to 95 percent relative humidity as limited by 3 degrees C to 40 degrees C dew points.
 - d. Special Desiccant: Chemical desiccant drier system for applications requiring a dew point below 4 degrees C.
5. Humidity accuracy: Plus or minus 1 percent R.H. humidity control plus or minus 3 percent RH.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's Product Data indicating compliance with Contract Documents. Include manufacturer's installation instructions.
- C. Shop Drawings: Submit Shop Drawings for all components.
 1. Include rough-in, clearance and maintenance requirements.
 2. Include plans, elevations, and details.
 3. Indicate utility requirements and connections.



- D. Operation and Maintenance Manual: Submit complete instruction and maintenance manual for each environmental room that includes sequential operating instructions, routine preventative maintenance instructions, and complete schematic drawings of rooms.
- E. Warranty: Submit warranty certificate with operation and maintenance manuals for each environmental room.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firm that has produced environmental rooms for not less than 10 years, with not less than 50 similar projects that have been in successful use for not less than 5 years.
 - 1. Performance and Payment Bond: Provide products from a manufacturer which has the capability to provide a Performance and Payment Bond for this Project.
- B. Installer Qualifications: Minimum 10 years of experience in successful installation of systems of type specified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store in a weather tight location and protect from corrosive environments, distortion and other damage during delivery storage and handling.

1.6 WARRANTY

- A. Provide manufacturer's written one-year warranty against defects. Manufacturer shall agree to repair or replace items proven to be defective.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Thermmax LLC. 315 West Street Road, Warminster, PA 18974
Tel. (267) 308-1680. Toll Free Tel. (800) 899-3774.
Fax: (267) 308-1687. Web: <http://www.thermmax.com>.
- B. Substitutions: Not permitted
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MANUFACTURED UNITS

- A. General: Pre-fabricated walk-in rooms, metal clad, sectionals constructed and designed for accurate field assembly with provisions to facilitate disassembly for relocation and to add extra panels to increase size.



- B. Panel Construction:
1. Interchangeable panels, UL approved, designed for quick assembly, consisting of interior and exterior metal pans accurately formed with metal dies and checked with gauges for uniformity.
 2. Panel Edges: Tongue and groove interfaces to assure a tight joint. Provide flexible vinyl gasket on interior and exterior of each panel along each tongue edge to provide sealing at each joint.
 - a. Do not use batten strips, pressure clips, or other fastening hardware for covering joints or joining panel sections.
- C. Panel Locking Devices: Self-contained, interior cam-lock fasteners locked and released with single hex wrench tool.

**** NOTE TO SPECIFIER ** The process of foaming provides the most positive adhesion of insulation to metal pans available on the market. The process of applying metal to board urethane under pressure with glue is not satisfactory and can result in eventual delamination of metal from insulation under high temperature and humidity. Foamed-in-place urethane construction results in a lightweight room, when completed, and decreases erection costs and final building weight load.**

- D. Insulation: 4 inch (102 mm) foamed-in-place urethane insulation, using EPA Montreal Protocol accepted non-toxic, non-flammable fluorocarbon blowing agents, adhered to interior and exterior faces of panels. The resulting cured foam shall be an odorless closed-cell product and shall not emit or outgas the fluorocarbon blowing agent.
1. Thermal Conductivity Factor K: No more than 0.14 BTU per hour per square foot between wall faces.

**** NOTE TO SPECIFIER ** “U” factor determined by dividing “K” value by nominal wall thickness.**

2. Rated U-Factor: 0.035.
 3. R-Value: Not less than 29.
 4. Flame Spread Rating: 25.
- E. Closure Panels: Provide closure panels, matching materials, colors, and finishes of adjacent panel material, to fill in between building and environmental room.

F. Doors:

1. General: In-fitting, flush mounted, constructed similar to wall panels.

**** NOTE TO SPECIFIER ** Delete door swing not required for project.**

- a. Door Swing: Right-hand.
- b. Door Swing: Left-hand.
- c. Door Swing: As required for installation convenience.
- d. Door Opening: 36 inches by 78 inches (914 mm 1981 by mm).
- e. Door Opening: 48 inches by 84 inches (1292 mm by 2134 mm).
- f. Door Opening: Special: _____

- G. Gasket: Vinyl type with magnetic steel core. Provide gaskets on both sides and top of door. Provide adjustable rubber wiper gasket on bottom of door. Provide gasket with enough magnetic force to form positive airtight seal.

- H. Hardware: Heavy-duty door hardware with high luster finish. Incorporate keyed lock cylinders and padlock latches into door latch and handle assemblies.



1. Hinges: Self-closing type with durable stainless steel pins and self-closing nylon cams. Provide three hinges.
2. Door Handle and Latch Assembly: Automatic closing type. Provide safety release mechanism on inside of room preventing personnel from being locked from outside.

**** NOTE TO SPECIFIER ** Delete heated gasket if no low temperature rooms required for project.**

I. Heated Gasket: Low voltage heater built into perimeter of jamb to prevent door from accumulating ice and freezing temperatures.

J. Window: Multi-layer, heated thermal pane window mounted in door with the following minimum viewing area:

**** NOTE TO SPECIFIER ** Delete window sizes not required for project.**

1. Window Size: 14 inches by 14 inches (356 mm by 356 mm).
2. Window Size: 14 inches by 23 inches (356 mm by 584 mm).
3. Window Size: Special size of ___ inches by ___ inches (___ mm by ___ mm).

K. Floors: Provide insulated floors with similar construction as wall and ceiling panels. Design floors for 600 pounds per square foot distributed load weight.

1. Interior Floor Surface: Heavy gauge galvanized steel.

**** NOTE TO SPECIFIER ** Delete non-skid coating paragraph if not required for project.**

- a. Where scheduled, apply non-skid coating to cover floor surface.
2. Sealing Strips: At exterior of environmental room walls and floor, provide sealing strips between environmental room walls and floor and adjacent building walls and floor to prevent air infiltration and environmental losses.

**** NOTE TO SPECIFIER ** Delete floor thickness not required for project. Freezer Rooms must have a minimum of 4 inch thick floor insulation or be built on a properly insulated concrete slab. Cold Rooms without insulated floors can only be built on ground level concrete slabs. Consult Thermmax whenever prefabricated insulated floors are not used.**

3. Floor Thickness: 2 inches (51 mm).
4. Floor Thickness: 4 inches (102 mm).

**** NOTE TO SPECIFIER ** Delete floor covering not required for project.**

5. Floor Covering: Removable, open tread floor covering in each environmental room complying with the following:

Thickness: 1/8 inch (3 mm).

Material: PVC rubber matting.

Pattern: Open diamond design for easy cleaning.

Color: As selected.

6. Floor Covering: Seamless inlaid sheet vinyl in each environmental room complying with the following:

Manufacturer: Altro Walkway Type 20 or equal.

Coving: Seamless corner coving, extending into the sidewalls a minimum height of 4 inches (102 mm). Coving shall be vinyl capped.

Color: As selected.

2.3 ROOM SURFACE FINISH:

**** NOTE TO SPECIFIER ** Delete finishes not required for project.**



- A. Standard Finishes: Where scheduled, provide panel sections with the following surface finishes:
 - 1. Interior Walls and Ceilings: 26 gauge galvalume steel faced with hard, durable, factory-applied painted finish.
Color: White acrylic enamel.
 - 2. Exterior Walls (exposed surfaces only): 26 gauge galvanized steel faced with hard, durable factory applied painted finish.
Color: White acrylic enamel.
- B. Special Aluminum Finishes: Provide panel sections with the following surface finishes:
 - 1. Interior and Exterior Walls: 0.040 inch (1 mm) thick embossed aluminum surfaces with natural finish.
 - 2. Interior Floor Surface: 14 gauge galvanized steel, unfinished.
- C. Special Stainless Steel Finishes: Provide interior and exterior wall surfaces fabricated from stainless steel with No. 2B finish.

2.4 LIGHTING

- A. Lighting Systems: Cool white fluorescent lamps, with lamps and ballasts.
 - 1. Provide UL-approved fixtures.
 - 2. Mount light fixtures mounted and provide in sufficient quantity for minimum intensities of 70 foot-candles measured 40 inches (1016 mm) above floor.
 - 3. Install lights to provide uniform distribution of light.

**** NOTE TO SPECIFIER ** Delete the following light fixture type if no rooms operating at design temperatures indicated in paragraph.**

- B. Low Temperature Electronic Ballasts: Provide low temperature for cold rooms operating below 10 degrees C (50 degrees F).

**** NOTE TO SPECIFIER ** Delete the following light fixture type if no rooms operating at design temperatures indicated in paragraph.**

- C. Incandescent Lights: Vapor proof lights provide for freezers operating below 0 degrees C (32 degrees F).

**** NOTE TO SPECIFIER ** Delete the following paragraph if optional light cycle timer is not required.**

- D. Light Cycle Timer: A 24 hour on/off cycle timer shall be provided on control panel for cycling interior lighting.

2.5 INSTRUMENTS AND CONTROL SYSTEMS

- A. CONTROL PANEL SYSTEM: **Touch Screen Control System:**
A surface Mounted Control Console will be provided using an **Allen Bradley MicroLogix 1400 PLC and Fuji MoniTouch, touch screen (HMI).**

The **full color, six inch (6") Touch Screen** will provide all On/Off equipment controls, Temperature set point and display, High/Low temperature Alarms, data logging and interface **for remote computer recording and monitoring via**



Ethernet connection. Temperature is measured with a 100 Ohm Platinum RTD sensor.

A minimum of 90 days of data will be stored in the data logger.

The Operator Interface will be recessed in a Control Console with a clear acrylic lockable door to protect tampering. All touch screen access including set points, Alarm settings, and system operation is password protected.

In the event of an Alarm condition, a local audible buzzer will activate until reset. All alarms are logged and the last ten (10) Alarm conditions can be displayed on the Touch Screen. Isolated dry relay contacts are provided for connection to the BAS.

The Environmental Cold Room is furnished with a High Temperature Failsafe. This Over-temperature safety cutout device (Honeywell UDC700) is designed to protect the environmental room from thermal damage. This is an adjustable device but always set for maximum value of 55 degrees C (131 degrees F). When actuated, all heat producing components including circulation fans, lights, receptacles and heaters become electrically deactivated.

Sensors will be precision, platinum, resistance temperature devices (RTD). The controller output is a true proportional 4-20 mA signal from the PLC which drives a **Sporlan CDS** proportional valve in the suction line of each refrigeration system.

High and Low Temperature Alarms will be provided with dual set points, one for HIGH and one for Low.

Analog signals are also provided for remote monitoring of Temperature and Humidity at the Building System.

Separate independent C-contact sets are provided for connections to the building alarm system (BAS) to activating a remote alarm in the event of over/under temperature condition.

- B. The following items will be readily operated:
1. Control function to adjust temperature set point (° C)
 2. Control function to adjust Relative Humidity set point (%RH) (when specified).
 3. Alarm Set points for high and low temperature and/or Relative Humidity.
 4. Data recording mode to indicate in chart recorder format temperature and humidity history over the 8 hours or 24 hour period.
 5. Data download connector to interface with operator's standard windows based PC. Data can be archived and printed using Thermmax provided software package. Alarm events shall also be logged.
 6. Touch Screen buttons to perform the functions:
 - a. Refrigeration on/off
 - b. Heat on/off
 - c. Ventilation on/off
 - d. Humidification on/off
 - e. Dehumidification on/off



- f. Defrost on/off
 - 7. The panel shall clearly indicate when the above operating functions are on.
- C. Room control parameter adjustments such as PID values, defrost times and frequencies shall be adjustable only by using password security access. Set Points and other basic operator functions are also only available by password access. Three levels of access security are provided. These adjustments once accessed shall not require special computer equipment or factory personnel to change.
- D. All settings will be stored in non-volatile memory so that all information, adjustable parameters, and control programs are not lost on power failure.

**** NOTE TO SPECIFIER ** Delete the following paragraph if optional chart recorder is not required.**

- B. Recorder: Synchronous motor driven circular chart recorder provided to continuously indicate control conditions within room.
1. Microprocessor-type, analog, programmable to achieve proper parameter ranges and time bases.
 2. Chart Recorder, Model DR4300 10 inch Circular Chart Recorder by Honeywell, Inc.

**** NOTE TO SPECIFIER ** Delete optional Data Logger if not required for project**

3. Data Logger (optional): Two Channel data logger to store one week of temperature and relative humidity measurements. Data can be downloaded into customers PC computer and analyzed using standard windows based software.

**** NOTE TO SPECIFIER ** Delete optional Profile Programmer if not required for project.**

Profile Programmer: Control system that includes microprocessor based set point instead of time profile programmer.

**** NOTE TO SPECIFIER ** Delete optional Computer Interface if not required for project.**

Computer Interface: Digital computer communication interfaces designed to enable user to monitor and record process variables.

Format: RS485 formats.

2.6 CONDITIONING PLENUMS

- A. Ceiling Conditioning Plenum:
1. Design environmental room air to be completely conditioned in ceiling plenum, with motor-driven blowers designed to recirculate air continuously to ensure temperature uniformity.
 2. Plenum Housing shall be fabricated with metal finishes to match the Room Interior Color.
 3. Provide ceiling plenums containing heaters, copper tube with aluminum finned evaporator coil, humidification apparatus, and condensate drain pan.



4. Ceiling plenums shall be low profile and have dual horizontal air flow to evenly distribute recirculation air through the working space of the room. Air flow velocities from the plenum shall not exceed 450 feet per minute.
5. Plenum shall be easily accessible from inside the room to service fan motors, heaters, control valves and sensor components.
6. Ceiling Material: Easily removable and constructed of high grade, non-corrosive acrylic egg crate material.
7. Motors: Fractional horsepower, high-efficiency PSC type, serviceable from inside environmental room.

B. Electric Heater: Non-corrosive, low-watt density, finned elements that operate in black region of optical spectrum.

**** NOTE TO SPECIFIER ** Delete optional steam humidifier if not required for project.**

- C. Steam Humidifier: Steam-generating-type humidifier designed to add water vapor into conditioning plenum and not directly into room area. Provide steam generator complying with the following requirements:
1. Built in safety protection, and automatic water level control valve, and a safety overflow.
 2. Self-cleaning, with microprocessor control.
 3. Manufactured from corrosion free materials.
 4. Replaceable tank liner.
 5. Uses demineralized, distilled or reverse osmosis water supply furnished by Owner.

**** NOTE TO SPECIFIER ** Delete Dehumidification below if humidity control is not required for project.**

- D. Dehumidification:
1. Moisture removal accomplished by means of specially designed, direct expansion refrigeration coil located in conditioning plenum.
 2. Design coil for effective latent heat removal with minimum removal of sensible heat.
 3. Provide non-freezing dehumidification system that produces low humidity condition limited by dew point of 6 degrees C.

**** NOTE TO SPECIFIER ** Delete Chemical Drier if ultra-low humidity and sub-freezing conditions are not required for project.**

- E. Chemical Drier (Sub-Freezing Dew Point Capability):
1. Chemical dehumidifier system for ultra low humidity range designed to provide sub-freezing dew point conditions.
 2. Continuous, dry desiccant, fully automatic absorption, capacity of refrigeration system shall be increased to adequately neutralize sensible heat load imposed by chemical dryer over entire environmental range.

F. Sealants: Silicone silastic sealing compound, flexible when cured to allow for thermal contraction and expansion over its entire environmental range.

**** NOTE TO SPECIFIER ** Delete Forced Air Ventilation System if not required for project.**

2.7 FORCED AIR VENTILATION SYSTEM



- A. Provide forced air exchange ventilation system for applications consisting of an independent exhaust blower and adjustable intake filter port.
 - 1. Intake Filter Port: Easily replaceable.

**** NOTE TO SPECIFIER ** Delete CFM volumes not required for project.**

- B. Amount of Air Exchange:
 - 1. 15 CFM.
 - 2. 25 CFM.
 - 3. 50 CFM.
 - 4. Other _____ of indoor ambient air-conditioned air.

2.8 REFRIGERATION SYSTEMS

- A. Design Requirements:
 - 1. The environmental room design and installation shall conform to applicable codes, ordinances and regulations governing the use and safety of refrigerants including, but not be limited to, ASHRAE/ANSI standard 15-1992, ARI 420-77, ARI 520-78.
 - 2. Condensing Unit: Semi-hermetic serviceable compressor and spring mounted. System shall be designed to operate continuously using a hot gas bypass system control. Cycling compressor systems and electric reheat systems are not acceptable.
 - 3. Equip each condensing unit as follows:
 - a. High/low pressure control with automatic reset.
 - b. Vibration eliminating devices on suction and discharge lines.
 - c. Fusible plug.
 - d. Liquid line dryer.
 - e. Moisture indicating sight glass.
 - f. Suction line filter.
 - g. Magnetic contactor on all three phase units.
 - h. Accessories including isolation mountings and racks, expansion valve, interconnecting piping, piping insulation, solenoid valves, fused disconnect switch or circuit breaker, motor starter and all necessary equipment to achieve the specified performance for each room.
 - i. All other safety mechanical devices required.
 - j. Weatherproof exterior case, full weather shrouding, low ambient protection.
 - k. Select refrigerant to give optimum operation considering evaporating and condensing temperatures. Refrigerant shall conform to latest protocol concerning its use based on ozone depletion potential.
 - l. Air cooled condensers shall be manufactured and be properly matched to compressors determined by condensing unit manufacturer.
 - m. Condensing units shall be designed, engineered, manufactured and of adequate capacity to fulfill operating temperature requirements and performance, and shall be balanced with the air handling system in operation.
 - n. Electrical Requirements: 208V/3 phase/3 wire power for each condensing unit.
 - 4. Refrigeration Piping: ACR type, hard drawn, cleaned and capped Type L copper tubing soldered with silver solder (minimum of 45% Silver), except hot gas lines which shall be silver brazed. All lines shall be installed to allow for linear expansion of copper after start-up.



- a. Suction Lines: Size for velocity of 500-700 FPM on horizontal runs and show 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 and install proper (shallow) "P" traps spaced not over 10 feet apart on all tubing risers.
 - b. Hot Gas Lines: When hot gas lines are field installed remote from compressor, size tubing at same velocities as specified above for suction lines.
 - c. Liquid Lines: Size all liquid lines for maximum 2 PSIG pressure drop.
 - d. Hangers: F & M ring type or Unistrut assemblies with appropriate tubing Hydrosorb clamps to support liquid, suction, and discharge lines individually. Space hangers or clamps 8 feet o.c. maximum.
 - e. Condensate Drain Piping: 7/8 inch O.D., or greater, Type L copper tubing piped from evaporators to open floor drain or nearest sink, rigidly supported at walls 3 feet o.c. maximum, installed in such a manner that leaves 1 inch clearance space between wall and drain, and equipped with cleanout tee near evaporator. Adequately pitch piping toward floor drain or sink, carry through wall of refrigerated areas properly trapped and discharged within 2 feet of floor drain.
 - f. Refrigerant Testing: Pressurize and leak test entire system at not less than 100 PSIG, clean and dehydrate by maintaining a vacuum of 500 microns or lower for a five hour period.
 - g. Add required charge of refrigerant, and oil if necessary, and test entire system for performance using an electronic lead detector for presence of refrigeration leaks. Mark each system clearly as to refrigerant type used.
5. Refrigerant: Do not use refrigerants containing CFC or HCFC. Use R-404A refrigerant for rooms operating above 0 deg C. R404A shall be used for Freezers.
 6. Insulation: Fire retardant Armstrong "Armaflex Insulation" or equal for insulating refrigeration suction lines. Use minimum 1/2 inch thick wall; apply during tubing assembly wherever possible.
- B. Provide refrigeration system specifically designed, engineered, and manufactured of adequate capacities to achieve and maintain individual room temperature and performance requirements noted in Part 1. Provide system balanced in operation with conditioning system. In addition, allow a customer live load in the Room of 10 watts per square foot.
1. Provide factory-assembled and tested system by manufacturer. Include high/ low-pressure controls, receiver, sight glass, moisture indicator, replaceable dryer, thermal expansion valve, and necessary equipment to achieve specified performance.
- C. Compressor: Semi-hermetic or Scroll, heavy-duty, industrial unit with solid-state motor protection and oil pressure safety control. Provide compressor with oil sight glass, lubrication protection cutout, and integral suction and discharge service valves.
- ** NOTE TO SPECIFIER ** Delete if air-cooled condensing unit is not required.**
- D. Air-Cooled Condensing Unit: Provide system with air cooled condenser, low speed fans, and low noise with metal guard protection.
- ** NOTE TO SPECIFIER ** Delete if water-cooled condensing unit is not required.**
- E. Water-Cooled Condenser: Provide system with water-cooled condenser. Include water saving pressure regulation valve for constant compressor head pressure regulation.



1. Design unit to operate on city water of approximately 24 degrees C (75 degrees F) inlet temperature.
 2. Design condenser for tower cooled building water operating with inlet temperatures of between 16 degrees C (60 degrees F) and 29 degrees C (85 degrees F) and temperature rise of minus 12 degrees C (10 degrees F) or less.
 3. Design condenser for building chilled water system operating at inlet temperature of 45 to 55 degrees F.
- F. Control: Design refrigeration system to contain full capacity control to operate continuously regardless of control system demand.
1. Incorporate bypass to maintain specified temperature ranges. Proportionally control cooling by means of electronic temperature controller modulating liquid refrigerant feed to conditioning coil.
- ** NOTE TO SPECIFIER ** Delete redundant refrigeration system if not required.**
- G. Redundant Refrigeration System: 100 percent backup redundant refrigeration system designed to work in conjunction with passive system. These two (2) systems will periodically rotate operation on an adjustable cycle timer to assure that both systems are given equal running time and are periodically tested to be functional. On failure, passive system will automatically come on line to maintain room temperature. Failure mode alarm will be activated and backup system will then run continuously until fault is cleared.
- H. Defrost System: When room temperatures operate continuously below 4 degrees C (39 degrees F), automatic hot gas defrost system will be employed.
1. Defrost Cycles: Controlled by 24 hour timer adjustable to determine number of defrosts per day, and duration of each defrost.
 2. Electric Defrost System: On freezer rooms operating at minus 20 degrees C (minus 4 degrees F) or below and on rooms with remote condensers an electric defrost system will be used in lieu of hot gas system.
- I. Outside Condensing Unit: When limited space or other requirements dictate, place condensing unit outside building. Protect unit from weather with easy access hinged enclosure, properly vented for adequate air movement.
1. Provide system with head pressure control and crankcase heaters for proper winterized operation.
 2. Provide system in NEMA 4 electrical enclosure with disconnect and internal contactor box located on housing.

2.9 SHELVING

**** NOTE TO SPECIFIER ** Delete types of shelving below which are not required. Indicate shelving width, length, and number of tiers on the Drawings or in a schedule.**

- A. Freestanding Shelving: Chrome-plated wire rod shelving units manufactured free of burrs, sharp edges, and protrusions.
1. Manufacturer: Metro Super Erecta, Eagle Group or equal.
 2. Shelves: Adjustable in freestanding rack.
- B. Freestanding Shelving: Stainless steel wire rod shelving units manufactured free of burrs, sharp edges, and protrusions.
1. Manufacturer: Metro Super Erecta, Eagle Group or equal.



- 2. Shelves: Adjustable in freestanding rack.
- C. Wall-Mounted Shelving: Chrome-plated or stainless steel, wire rod shelving units manufactured free of burrs, sharp edges, and protrusions.
 - 1. Manufacturer: Metro Super Erecta, Eagle Group or equal.

**** NOTE TO SPECIFIER ** Delete below if optional antimicrobial finish not required.**
Protective Finish: Manufacturer's recommended MetroSeal or Eagle antimicrobial protective finish.

2.10 ACCESS PORTS

- A. Provide access ports for water, drain line, air line, or gas lines in size specified:

**** NOTE TO SPECIFIER ** Delete sizes not required for project.**

- 1. Size: 1 inch (25 mm).
- 2. Size: 2 inch (51 mm).
- 3. Size: 3 inch (76 mm).
- 4. Size: 4 inch (102 mm).
- 5. Size: _____.

2.11 ELECTRICAL OUTLETS

Vapor-proof, duplex, 115 volt, 20 amp GFI receptacles installed on inside wall 45 inches (1143 mm) above floor. Wire each receptacle to terminal box on top of room for connection by others.

Other special: _____

2.12 SOURCE QUALITY CONTROL

- A. Manufacturer shall perform factory test and inspection on major components to assure basic quality, conformance of design, and functional operation.
- B. Each control console shall be bench tested using simulator panel to test logic functions, control systems function, and alarm operations.
- C. Each condensing unit and air unit shall be pressure tested for leaks and checked for design conformance.
- D. Notify Owner of testing time a minimum of 72 hours in advance.

**** NOTE TO SPECIFIER ** Delete below if schedule with the following information is clearly indicated on the Drawings. Call Thermmax for assistance.**

2.13 SCHEDULE OF ROOMS

- A. Equipment Designation: ER-1.
 - 1. Exterior Dimensions: _____ width x _____ length x _____ height.
 - 2. Interior Dimensions: _____ width x _____ length x _____ height.
 - 3. Temperature Range: _____ degrees C.
 - 4. Humidity Range: _____ percent RH.
 - 5. Ventilation: _____ CFM.



6. Electrical Utilities: _____ voltages.

**** NOTE TO SPECIFIER ** Delete type not required for project.**

7. Condensing Unit: Water.

8. Condensing Unit: Air.

**** NOTE TO SPECIFIER ** Delete unit location not required for project.**

9. Condensing Unit Location: Local indoors.

10. Condensing Unit Location: Remote indoors.

11. Condensing Unit Location: Remote outdoors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are acceptable to tolerances.
- B. Verify construction of substrates, building walls, and floors are in place and ready to receive Work of this Section.
- C. Start of installation indicates installer's acceptance of substrate and conditions.

**** NOTE TO SPECIFIER ** Coordinate preparation with work of General Contractor.**

3.2 PREPARATION

- A. Verify the following is in place prior to installation:
 - 1. Area is completely ready for proper and efficient installation of environmental rooms, floor is flat and level, area is clear of partitions, piping, obstructions, and loose articles preventing erection and assembly of environmental rooms and support equipment.
 - 2. Electrical service to area of Work of this Section, including fused disconnect is in place.
 - 3. Floor drains, condensate removal pump system, or both are installed to remove room drainage.
 - 4. Water supply and return line, if required, are installed and final connections made.
 - 5. Other special utilities and service connections are in place.
 - 6. Building wall, roof, or floor penetrations are completed.

3.3 INSTALLATION

- A. Install environment rooms per manufacturer's recommendations and final approved Shop Drawings.
 - 1. Install components straight, plumb, level and true. Install service lines at right angles to walls and floors, except where required to pitch to drains.
 - 2. Seal or otherwise insure that fastenings to rooms do not compromise vapor barriers or insulation. Seal between piping and sleeves.
 - 3. Do not install damaged units. Replace components damaged during shipping, handling, or installation with new identical factory-supplied components.
- B. Pressurize and leak test entire system at not less than 100 psig. Clean and dehydrate by maintaining a vacuum of 500 microns, or lower, for a 5 hour period. Add required charge or



refrigerant, and oil if necessary, and test entire system for performance. Mark each system clearly as to refrigerant type used and amount of charge.

- C. Install filler panels to enclose spaces between top of walk-in room and finished ceiling and sides of unit and construction of surrounding area.
- D. Install shelving per manufacturer's instructions, with adjustable shelf heights as indicated on Drawings.

3.4 FIELD QUALITY CONTROL

- A. Measure temperature accuracy and uniformity inside completed room using 15 Temperature Escort (or equal) Data Loggers. Place pods throughout internal workspace at strategic locations no closer than 12 inches (305 mm) from surfaces.
 - 1. The data loggers will remain in the test space for 24 hours. When test is complete the temperature data loggers are downloaded into a PC computer. Data is formatted in an Excel Format to provide tabular and graphical results of uniformity and stability. Test Reports will be turned over to owner.
- B. Owner's representatives shall be given option of witnessing and confirming test results. Notify Owner's representative in writing, 72 hours prior to test.

3.5 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to completion of performance tests, provide manufacturer's representative to conduct demonstration for designated Owner's personnel with respect to room's controls and related systems. Manufacturer's representative will inform Owner's personnel of proper room operation and maintenance. Notify Owner at least 72 hours in advance to permit Owner's authorized representative to schedule such an instruction period.

3.6 CLEANING AND PROTECTION

- A. Repair or remove and replace defective Work, equipment, and accessories as directed upon completion of installation. Remove and refinish damaged or soiled areas. Clean exposed and semi-exposed surfaces, touch-up finish as required. Remove cartons and debris from the Work site and legally dispose of the same. Leave Work area in a clean condition. Protection: Adequately protect the Work from damage until final acceptance by the Owner.

END OF SECTION