

DESIGN CRITERIA – PRODUCT REFRIGERATION MICRO-DISTRIBUTED SYSTEMS

GENERAL

1.01 Related Sections

- A. See Division 13 Section Cold Storage Rooms and Division 23 Section Refrigeration Monitoring and Control Systems (RMCS) for additional information.
- B. See Division 23 Product Refrigeration Systems for projects not utilizing micro-distributed system criteria.

1.02 Summary

- A. Product refrigeration includes all display cases, associated condensing units, fluid coolers, circulation pumps, evaporators (unit coolers for insulated cold storage rooms), condensing medium water piping, refrigerant piping, refrigerant controls, monitoring systems or Refrigeration Monitoring and Control System (RMCS), associated controls, and all wiring including that not indicated on Drawings required for a complete, functional and usable system. Refrigeration condensing units with all controls, fluid coolers and associated controls, circulation pumps and associated controls, unit coolers, display cases and RMCS shall be furnished by a single display case or compressor system manufacturer. The only exception to this is that the self-contained display cases can be a different manufacturer than the other cases.

1.03 Design, Furnishing and Installation

- A. The Product System Refrigeration System Provider (Provider) shall be either the primary refrigeration equipment manufacturer or the primary display case manufacturer. The entire refrigeration system shall be furnished by the Provider who shall be singly responsible for the design, furnishing, installation, testing, and satisfactory operation of the total system, including both high and low side components. The installation shall be supervised by a field engineer employed by the refrigeration equipment manufacturer or display case manufacturer. The design shall use the most energy efficient combination and arrangement of condensing units for the self-contained cases, consistent with operational reliability. Prior to acceptance, the manufacturer shall submit a letter stating that the total refrigeration system has been inspected and approved by the manufacturer and that it meets the manufacturer's installation requirements. Provide registered engineering seal and signature on each Drawing. All contractor design and installation not specifically addressed in this RFP shall meet or exceed ASHRAE recommendations/guidelines and recommendations of the equipment manufacturer(s).

1.04 Coordination

- A. The Provider shall coordinate the installation of the total refrigeration systems as delineated, and shall prepare complete shop Drawings, submittals, and design analysis of the entire refrigeration system.

PRODUCTS

2.01 Self-Contained Refrigeration Cases (Water Cooled)

- A. The designer shall evaluate between both air-cooled self-contained refrigeration cases and water-cooled self-contained refrigeration cases. A life cycle cost analysis (LCCA) shall be done to justify the system selection.
- B. The designer shall evaluate the use of adiabatic fluid coolers in desert or hot climates versus drycoolers. A life cycle cost analysis (LCCA) shall be done to justify the system selection.

2.02 Unit Coolers

- A. General: Size unit coolers in the preparation areas to meet or exceed the load upon the room at suction temperatures no greater than 20 deg F below room temperatures. Size unit coolers in all other storage rooms to meet or exceed the load upon the room at suction temperatures no greater than 10 deg F below room temperatures. Size unit coolers in frozen food storage rooms to meet or exceed the load upon the room at a suction temperature no greater than 8 deg F below room temperatures. Unit coolers operating in rooms at or below 28 deg F shall have maximum fin spacings of 4 fins per inch. Unit coolers operating in rooms above 28 deg F shall have maximum fin spacings of 6-8 fins per inch. Condensate drain lines in rooms operating at or below 32 deg F shall have 1" unicellular insulation and heat tape. Run refrigerant piping to condensing units located above respective rooms.
- B. Suspension: Suspend unit coolers located in insulated cold storage rooms. Do not use ceiling support columns within the cooler panels. Suspension system shall consist of all members, including fasteners and attachments, required to support unit coolers. Suspension system shall be of steel materials. Design of suspension system shall be in accordance with AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
- C. Provide unit cooler fans with motors.
- D. Required product temperatures to be maintained in walk in boxes and freezers is:

Unit	Temperature Range
Dairy Storage	34 to 37 deg F
Ice Cream Storage	-10 deg F or below
Freezer Vestibule	46 to 50 deg F
Frozen Food Storage	-6 to 0 deg F
Meat Storage	28 to 32 deg F
Meat Holding	28 to 32 deg F
Meat Processing/Wrapping	46 to 50 deg F
Deli Storage	34 to 37 deg F
Ambient Produce Storage	60 to 65 deg F
Produce Storage	38 to 42 deg F
Produce Processing	60 to 65 deg F
Fish Storage	28 to 32 deg F
Poultry Storage	28 to 32 deg F
Frozen Bakery	-6 to 0 deg F
Bakery Storage	34 to 37 deg F
Pre Pak Meat Storage	34 to 37 deg F

- E. See Design Standard Plates for Division 23 Product Refrigeration Systems.
- F. Walk-in Coil Control Requirement: All walk-in coils will require a field installed control panel which will house the case controller (controlling an EEV for temperature control) and all electrical distribution blocks. All temperature sensors required for operation (discharge air, return air, suction temperature) will be field installed and wired. Each refrigeration 'circuit' will get a single electrical feed each for fans/lights/anti-sweats and a single electrical feed for defrost (as required). Specify case controller location on plans and include mounting height requirement of no less than 60" and no more than 70".
- G. Each unit cooler shall have a dedicated condensing unit, installed on the top of the respective walk-in space. Coordination with structural engineer for support from the roof level joists. Each unit cooler condensing unit will have fully engineering controls included.

2.03 Refrigerated Display Cases

- A. Locate refrigerated display cases in sales area per the [**Concept**] Floor Plan.
- B. Commissary Refrigerated Display Case Equipment Descriptions for the types of equipment currently used in DeCA commissaries will be provided in the DeCA Guide Spec.
- C. Required product temperatures, corresponding suction temperatures, coil types and defrost method for all types of display cases shall be as follows: [**NOTE TO SPECIFIER: Check against Commissary Equipment List in Appendix A and edit out any inapplicable pieces of equipment:**]
- D. Air-cooled self-contained cases require excessive maintenance and energy. The advantage of air-cooled self-contained cases is flexibility of movement, no need to tear up floor slabs to install piping or to have condensing medium pipe risers at the case visible on the sales floor, and requirement for drains. Avoid use of air-cooled self-contained cases when it is reasonable to select a water-cooled self-contained case. Placing piping under floor is as long as it is not cost prohibitive to do so. If there is any question of water-cooled or air-cooled self-contained cases, the designer should seek guidance from the DeCA project manager.
- E. Display case item descriptions: Refer to Equipment Descriptions for specific requirements.
- F. Condenser medium and refrigerant piping layout:
 - 1. Consolidate condenser medium and refrigerant line risers into shafts at column where they can be run overhead, above the sales area ceiling, to the circulation pumps / fluid coolers (condensing medium piping) or unit coolers (refrigerant piping).
 - 2. Condenser medium and refrigerant piping must be routed above sales area, where possible, route above shopping aisles, and not above soffits. This will allow for easier access for maintenance of the piping, electrical and condensate pans.
 - 3. Consider placement of chases to avoid obtrusive views or interference with overall sales area decor and appearance.
 - 4. Condensate pans under refrigerant piping:
 - a. Condensing medium piping does not require condensate pans.
 - b. For piping routed: Provide condensate pans under piping operation at 0 deg SST and lower if store is located where 2.5% design wet bulb exceeds 74 deg F.
 - c. For piping routed above Walk-in Storage or Processing Rooms and overhead in Warehouse: Provide condensate pans under piping operation at 0 deg SST and lower if store is located where 2.5% design wet bulb exceeds 78 deg F.
 - d. Slope drain pans to drain fitting. Pipe drain fitting to floor drain.
 - 5. Under floor tunnels shall not be used without express direction from DeCA/END.
- G. Refrigerated Case / Walk-in Coil Control Requirement: All refrigerated cases will be provided with factory installed case controllers (one per case), which will control an EEV (electronic expansion valve) for temperature control. All temperature sensors required for operation (discharge air, return air, suction temperature) will be factory installed and wired. Each refrigeration 'circuit' will get a single electrical feed each for fans/lights/anti-sweats and a single electrical feed for defrost (as required).

2.04 Product Refrigeration System

- A. Comply with requirements of refrigeration system Design Standards Plates.
- B. The product refrigeration system includes self-contained refrigerated cases, circulation pumps, fluid coolers, evaporators (unit coolers for insulated cold storage rooms), refrigerant

pipng, refrigerant controls, head pressure controls, defrost systems, and a refrigeration monitoring and control system (RMCS). When water-cooled self-contained systems are utilized provide two completely redundant pumps and either a multi-cell fluid cooler or multiple fan adiabatic fluid coolers. Summer design ambient temperature shall be the 0.4% ASHRAE dry or wet bulb design temperature for the area. Fluid cooler capacity shall meet or exceed condenser water loop heat of rejection. Use refrigerant R-448A on all self-contained condensing unit systems.

C. Refrigeration Defrost Methods

1. On display cases with operating discharge air temperature (DAT) at greater than 32 deg F, the defrost shall be off cycle, or as required in the Equipment Descriptions.
2. On walk-in boxes with operating discharge air temperature (DAT) greater than 32 deg F, the defrost shall be off cycle.
3. Off cycle defrost shall be time-initiated and time-terminated.
4. All other refrigeration defrost shall be electric. Electric defrost shall be time-initiated and temperature-terminated with time fail safe.
5. Defrost shall be controlled through the RMCS.

D. Pumping Systems:

1. Locate parallel pumping systems **[in mezzanine] [or] [in mechanical centers [or] distributed package units]** with a condensing water loop system to the condensing units for cases, unit cooler condensing units, and remote fluid coolers. For each pump, provide a VFD for varying the speed of the pump in response to load demand reduction. For each condensing unit on each case or unit cooler, provide replaceable core suction filter/drier, crankcase heater, high pressure safety switch with manual reset and low pressure cut in/out with automatic reset, braided steel lines to controls, electronic oil pressure safety control, and compressor isolation valves. All condensing unit compressors shall be high efficiency, semi-hermetic, fractional DC variable capacity compressors or approved equal. Each condensing unit shall have a replaceable core liquid line filter drier and liquid receiver with visual and RMCS level indication. Compressors shall be staged on and off through the case provided RMCS system.

E. Fluid Coolers

1. Roof or Grade mounted Condensers shall be water cooled type with ECM fan motors and all motors shall be direct drive type. Control shall be through the RMCS and shall provide for staging of each fan set to control condenser medium temperature. **[SITE SPECIFIC: Include following sentence if condensers will be installed within 30 miles of salt water:]**
[Provide VFD control VFD panel in [mezzanine] [mechanical center].

2.05 Prefabricated Walk-in Refrigerators and Freezers

- A. Refer to Division 13 Section Cold Storage Rooms.

2.06 Electrical

- A. Provide grounding conductors in all refrigeration electrical conduit runs.
- B. Provide duplex receptacles in the kick plates, 3' from the end of each side of each island case lineup. See Design Standard Plate Product Refrigeration Systems-50.
- C. Provide electrical panel schedules and refrigeration electrical drawings showing wiring requirements for refrigeration circuits.
- D. Show location of all walk-in cooler / freezer case controller enclosures. Add a keyed note on plan to indicate mounting height of no less than 60" and no more than 70" A.F.F.

EXECUTION

3.01 Refrigerant Handling and Recovery

- A. Division 01 Section Environmental Procedures for Refrigerants applies.

3.02 Display Cases

- A. Seal as required to floor, walls and to each other with sheet metal parts and caulking per Design Standards Division 23 Sections Common Work Results for HVAC and Product Refrigeration Systems.
- B. Include details of case sealing on construction Drawings.

3.03 Electrical

- A. Show on the Refrigeration Drawings:
 - 1. Provide a weatherproof disconnect and enclosure for a permanent plug-in receptacle for power to a temporary refrigeration trailer. The trailer provider will provide a receptacle to match the NEMA configuration of the trailer plug. Provide conductors and circuit breaker for 208V/3Ø/7060 ampere **lead receptacle**.
 - 2. Provide a duplex outlet at each end and each side of the island case runs. Locate the receptacle in the toe/space of the cases 5' ± from each end of each case run except that it shall not be below doors at glass door cases.
 - 3. Provide electrical panel schedules and refrigeration electrical drawings showing wiring requirements for refrigeration circuits.

3.04 Pumping Systems and Fluid Coolers Locations

- A. Mechanical mezzanines shall only be used if existing for pumping systems.
- B. In smaller stores, pumping systems and fluid coolers may be located on Grade. If line lengths exceed practical limits (300'), locate pumping systems and fluid coolers on the roof.
- C. Locate Roof mounted pumping systems and fluid coolers above walk-in coolers to minimize noise in the Sales Area.

3.05 Contract Documents Check List

- A. Layout unit cooler drain lines on Drawings, such that lines do not cross door openings.
- B. In add / alter projects ensure continuous availability of refrigerated cases and walk-ins by providing a location for new equipment separated from the old equipment location so that new and existing refrigerated cases and walk-ins can be operated simultaneously.
- C. Verify that space and structural support are adequate for replacement equipment.
- D. Show location of condensate piping and floor drains for all condensate producing equipment.
- E. Gas fired equipment located in refrigeration equipment rooms, occupied spaces, or in equipment spaces other than properly ventilated and protected boiler rooms shall be of the separated combustion type with combustion air ducted from out of doors.
- F. Work with the Structural Engineer to determine whether seismic restraint or wind restraint is needed for items of mechanical equipment based on ASCE 7-02.
- G. All unit heaters in machinery rooms shall be sealed combustion type.

END OF SECTION