**DESIGN A/E NOTE - GUIDE SPECIFICATION CONVENTIONS**

**Color-highlighted text**

**Yellow: Editor’s Notes. Comments inserted into the text are addressed to the A/E, not the Contractor. Editor’s Notes are formatted as hidden text. Editor’s Notes are not identified with an update. Do not print Editor’s Notes in issue for distribution to Bidders/Contractors.**

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**Red: Text updated in 1st quarter. April – June.**

**Strikethrough text and highlighting (not text) in previously issued quarters are deleted. Only 1st quarter highlighted updated text is indicated.**

**Turquoise: Text updated in 2nd quarter. July – September.**

**1st quarter updated text remains highlighted.**

**Pink: Text updated in 3rd quarter. October – December.**

**1st and 2nd quarter updated text remain highlighted.**

**Bright Green: Text updated in 4th quarter. January – March.**

**1st, 2nd and 3rd quarter updated text remains highlighted.**

**Text Editing**

**Select options [in brackets] and edit <notes> before issuing specifications for distribution to Bidders/Contractors.**

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 **Click Replace tab, Replace All, OK, Close. Save.**

**Delete all highlighting of text from issue to be distributed to Bidders/Contractors.**

**Tip: To delete highlighting, locate cursor at beginning of Section and block all text in Section, press Shift + Control + End, click No Highlight icon on Formatting toolbar. Save.**

**IMPORTANT: Retain month and year under section title on first page indicating updated Guide Specification Section issue used.**

**Note: This** page **will not print when Hidden text is unchecked as indicated in Editor’s Notes Tip.**

IF THE HIDDEN GUIDE SPECIFICATION CONVENTIONS DO NOT APPEAR PRECEEDING THIS

NOTE, TURN THEM ON AS FOLLOWS.

**FOR MICROSOFT WORD 2000 and 2003**, CLICK ON SHOW/HIDE ICON IN MENU BAR OR CHOOSE

TOOLS IN MENU BAR. THEN CLICK OPTIONS, VIEW TAB, UNDER FORMATTING MARKS, CHECK

HIDDEN TEXT.

**FOR MICROSOFT WORD 2007,** CLICK ON MICROSOFT OFFICE ICON LOCATED IN UPPER LEFT

CORNER OF MENU BAR. CLICK ON WORD OPTIONS AT BOTTOM OF DROP DOWN. THEN CLICK

ON DISPLAY. CHECK THE HIDDEN TEXT BOX.

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MENU BAR. IN THE DROP DOWN, CLICK ON OPTIONS, AND A WORD OPTIONS BOX WILL

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THE GUIDE SPECIFICATION CONVENTIONS SHOULD NOW BE VISIBLE IN THE DOCUMENT.

(Delete this note before printing.)

NOTES TO A-E

General:

If site is to be overseas, A-E shall revise electrical requirements throughout this spec as applicable.

SECTION **23 90 00**

PRODUCT REFRIGERATION SYSTEMS

(Edited from DeCA June 2022 Design Criteria)

1. GENERAL
	* + 1. SUMMARY
				1. Related Sections:

\*\*\* A-E to edit to indicate appropriate sections.

Division 01 Section Mechanical, Refrigeration, Food Service Equipment and Electrical Coordination.

Division 01 Section Quality Control.

Division 01 Section Environmental Procedures for Refrigerants.

Division 01 Section Environmental Management.

Division 01 Section Closeout Procedures.

Division 01 General Commissioning.

Division 05 Equipment Closure Panels

Stainless Steel Closure Panels.

Perforated Sheet Metal Closure Panels.

Division 21 Section Hangers and Supports for Fire-Suppression Piping and Equipment.

Division 22 Section Hangers and Supports for Plumbing Piping and Equipment.

Division 22 Section Vibration and Seismic Controls for Plumbing Piping and Equipment.

Division 22 Section Plumbing Piping.

Division 22 Section Common Work Results for Plumbing.

Division 23 Section Hangers and Supports for HVAC Piping and Equipment.

Division 23 Section Vibration and Seismic Controls for HVAC Piping and Equipment.

Division 23 Section Refrigeration Monitoring and Control System (RMCS).

Division 23 Section Product Refrigeration Systems contractor shall be responsible for Division 23 Section Refrigeration Monitoring and Control System (RMCS).

Division 23 Section Maintenance and Repair for HVAC and Refrigeration.

Division 23 Section Product Refrigeration Systems Contractor shall be responsible for Division 23 Section Maintenance and Repair for HVAC and Refrigeration.

Division 26 Electrical.

Division 23 Section Product Refrigeration Systems Contractor shall be responsible for refrigeration electrical, see this Section and Contract Drawings.

* + - * 1. Total System Responsibility:

Division 23 Section Product Refrigeration Systems Contractor shall be either the installer of the refrigeration equipment or the manufacturer of the compressor systems or the manufacturer of the display cases. Division 23 Section Product Refrigeration Systems Contractor shall have total system responsibility for all material and work indicated in Division 23 Section Product Refrigeration Systems and Division 23 Section Refrigeration Monitoring and Control System (RMCS). This includes, refrigeration piping, refrigeration electrical and wiring, refrigeration equipment, RMCS equipment, RMCS wiring. Subcontracts for portions of Division 23 Section Product Refrigeration Systems or Division 23 Section Refrigeration Monitoring and Control System (RMCS), shall be made directly with, and shall be directly under the control of the Division 23 Section Product Refrigeration Systems Contractor.

* + - 1. SCOPE OF WORK
				1. The product refrigeration includes the design, procurement, installation, and testing of all products, equipment, and materials required for a complete, functional and usable system. This includes, but is not limited to display cases, compressors, condensers, heat recovery coils, evaporators, unit coolers, refrigerant piping, pipe insulation, Refrigeration Monitoring and Control System (RMCS), associated controls, and electrical panels and electrical wiring that is not indicated on Drawings.
			2. SUBMITTAL
				1. Provide submittal of equipment and material to be used per submittal requirements indicated below:

Submit within 45 days after receipt of Notice to Proceed, and before starting construction or installation of materials.

Distribution: Two sets of drawings (one full size and one half size) shall be provided to the PMAC Technical Inspector on site. Provide one set of manufacturer’s product and technical data (other than drawings) in a three ring binder with a hard cover. Upload an electronic copy of all submittal data to the FACTS Documents website for the Project.

Contract Variances: If departures from the contract Drawings are deemed necessary, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the drawings. Where such departures require piping or equipment to be supported otherwise than as shown, the details submitted shall include loading and type and kind of frames, brackets, stanchions, or other supports necessary. Approved departures shall be made at no additional cost to the government.

Refrigeration Capacity Calculations: For each refrigeration system, capacity data (charts or tabulated information) for evaporator-compressor and compressor-condenser arrangements shall be submitted to assure properly balanced refrigeration equipment at the design conditions.

Provide calculations on refrigeration piping pressure drops and drawings for complete detailed pipe routing. (See Part 3 of this Section for piping installation and manufacturer design requirements).

Provide completed refrigeration schedules in same format as indicated on Contract Drawings.

Installation Drawings: The layout drawings shall include a plan of the proposed piping, wiring, and equipment to establish that the equipment will fit the allocated spaces with clearances for installation and maintenance, and that components of the total product refrigeration system are fully coordinated. Interconnecting piping and wiring between evaporators, unit coolers, heat recovery coils, and refrigerated display cases shall be clearly shown and sizes indicated. The drawings shall include proposed details for attachment, anchoring, and hanging to structural framing of the building; vibration isolation units; and foundation and supports.

Electrical: (See Part 3 of this Section for electrical installation and manufacturer design requirements).

Letter Acknowledging Submitted Design: The Contractor shall provide with the refrigeration submittal a letter from the display case manufacturer stating that the engineering department of the display case manufacturer has performed the design for the refrigeration electrical power wiring.

Installation Drawings: Provide power layout drawings showing electrical runs with wire sizes, conduit sizes, and connection points. Wiring diagrams shall identify each component, and one diagram shall show interconnected or interlocked components. Electrical drawings shall be sealed by a Registered Professional Engineer.

Breaker Cut Sheets: Provide cut sheets on all circuit breakers showing device termination temperature ratings, interrupting ratings on equipment, and interrupting ratings of breakers.

Transformer Cut Sheets: Provide cut sheets on all transformers for refrigeration.

Subcontract Plan: Provide flow chart indicating General Contractor, Section Product Refrigeration Systems contractor, and each and every subcontract related to work in Division 23 Section Product Refrigeration Systems and Division 23 Section Refrigeration Monitoring and Control System (RMCS). All subcontracts for work in Division 23 Section Product Refrigeration Systems or Section Refrigeration Monitoring and Control System (RMCS) shall be made with and report to Division 23 Section Product Refrigeration Systems Contractor.

Manufacturer Data Sheets: The list of materials and equipment shall be supported by sufficient descriptive materials, such as catalog cuts, diagrams, and other data published by the manufacturer, to demonstrate conformance to the Specification requirements. Model numbers alone will not be acceptable. Submit data concerning the following items for approval. Manufacturers catalog not acceptable, specific cut sheets or equipment data shall be provided for each piece of equipment:

|  |  |  |
| --- | --- | --- |
| Compressors-condensersHeat recovery coilsUnit coolersSolenoid valvesFilter-driersOil separatorOil pressure safety switchHeat recovery diverting valvesDisplay cases & accessoriesResume of proposed installer**Refrigerant piping****Case controllers and stepper valves****Liquid sub-cooler heat exchangers****Liquid pressure outlet regulator** |  | Silver braze materialsFiberglass and unicellular insulationHeat exchangers at unit coolersEvaporator pressure regulator (EPR)Reclaim hot water heatersThermostatsLow pressure controlHigh pressure control (conventional & solid state) with manual reset buttonColors for display cases Receiver capacityRefrigerant oils |

Manufacturer Approval of Installer: As part of the submittal, the display case manufacturer shall submit a letter acknowledging their responsibility to inspect and certify the system installation with an employee of the manufacturing company and their approval of the contractor or subcontractor installing the equipment (see paragraph 1.3). No installation work on refrigeration systems shall start until this information is provided to the contracting officer.

Installer Resume: As part of the submittal, the installing contractor shall furnish resumes and EPA certification of the key refrigeration mechanics and field superintendent responsible for installation of the refrigeration piping and components (see paragraph 1.3). No installation work on refrigeration systems shall start until this information is provided to the contracting officer.

1. PRODUCTS
	* + 1. COMPRESSOR SYSTEMS
				1. Compressor Quantity/Capacity Selection: Compressor systems shall have the number of compressors as indicated on Drawings. On multiplex compressor systems, the minimum capacities shall be as required by the refrigerated display case loads determined by the display case manufacturers and by the refrigerated room loads indicated on the Drawings plus 5% for low temperature cases and 0% for medium temperature cases. Do not credit the low temperature system capacity for subcooling in selecting compressors. The capacities of unit coolers shall be as indicated on Drawings. Capacity for display cases shall be as approved by the display case manufacturer. On multiplex compressor systems, the approximate horsepower of compressors is indicated on the Drawings only as a method of indicating the steps of capacity reduction that is required. The capacity difference between steps shall be between 8 and 12 percent. Compressors shall be selected for maximum energy efficiency and operating reliability. The largest compressor on each suction group shall have variable capacity control. Each compressor unit shall conform to and consist of the equipment and accessories as listed in ANSI/AHRI Standard 540-2004. The compressor unit shall be tested and rated in accordance with ASHRAE Standard 23-2005.
				2. Type Compressors: Compressors 2 KW (2 hp) and less may be welded hermetic type. Compressors above 2 KW (2 hp) shall be the accessible, semi-hermetic. Compressors shall be integrally cast housings of close-grained iron with oil- level bull's eye, cast cylinder heads, cast-aluminum or forged steel connecting rods, and cast iron or forged-steel crankshafts. The lubrication system on compressors 5 KW (5 hp) or larger shall be the forced-feed, positive-displacement type with oil strainer. The oil pump shall be reversible. Suction and discharge valves shall be flange connected, wrench-operated, rising stem with cap. Rotating parts shall be statically and dynamically balanced at the factory to eliminate vibration.
				3. Compressor Accessories:

Refrigerant: Systems shall use refrigerant R-407A **[ R-448A ]** **[ R-449A ]** **[ R-744 (CO2) ]** unless otherwise indicated on Drawings.

Provide permanent labels indicating the refrigerant type on the compressor systems.

Motors: Motors shall be of the constant-speed, induction, hermetically sealed, low-starting-current, high-torque type.

Oil Safety: Each compressor 5 KW (5 hp) or larger shall have a solid state oil pressure safety switch with a manual reset with auxiliary alarm contacts. Time delay duration shall be as recommended by compressor manufacturer.

Crankcase Heater: In cold climates where the compressor is located where ambient temperatures can be expected to be below 50 degrees F each compressor shall have a crankcase oil heater that is fused and wired through auxiliary contacts. Control of the heaters shall be as recommended by the compressor manufacturer.

Filters: Each compressor shall have a suction filter, replaceable core type, with felt element, brass housing and Schrader valve.

Phase loss protection.

Overload: Compressors shall have electrical over current protection and inherent thermal protection.

Variable time delay for restarting compressors after power outage.

In lieu of mechanical safety devices, electronic (intelligent controls) may be provided on all compressors to provide remote diagnostic capability.

**[ All components selected must comply with MOP ratings consistent with R-744 use ]**

* + - * 1. Compressor System Fabrication/Configuration:

Mounting: Compressor systems shall be factory-mounted, pre-piped with vibration isolation, controls, and accessories. Base frame may be constructed with either welded, painted steel or G90 galvanized steel and mechanically fastened with BobTail® HuckBolts.

Electrical: Electrical panels containing breakers and contactors for compressors, unit cooler fans, defrost, and controls shall also be mounted on the compressor system.

Lights: Pilot lights shall be provided to indicate status of heat reclaim valves, compressors, and to indicate when each refrigeration circuit is in defrost or in the refrigeration mode.

Switches: Provide double pull, double throw toggle switches for each refrigeration circuit RMCS shutdown feature. Single point 208 volt and 460 volt electrical connections shall be provided on compressor units.

Liquid line filter driers: Filter-driers shall be installed in main liquid lines leaving the receiver. Filter-driers Sizes 1/2 inch and larger shall be the full flow, replaceable core type. Sizes smaller than 1/2 inch shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down. The desiccant shall remove water, acid, and foreign material from the refrigerant. The filter-drier shall be constructed so that none of the desiccant will pass into the refrigerant lines. The minimum bursting pressure shall be 1,500 psi. Filter-driers shall be provided where recommended by manufacturer of display cases. Liquid line filter-driers shall be wax removal desiccant or approved equivalent.

Sight Glass: A moisture indicator sight-glass shall be provided in the liquid line preceding the liquid manifold. The moisture indicating elements shall be removable. Moisture indicators shall have a reversible color indicator which has an easily distinguished color change. Sight glasses shall be provided with a protective cover and shall have solder-type connections.

Oil Separator: A 99 percent or higher efficiency discharge line oil separator, shall be provided in the discharge line from each multiplex compressor system. Oil separator shall have removable flanged head for ease in removing float assembly and removable screen cartridge assembly. Provide a line size shutoff valve and sight glass in the oil return line leaving the oil separator. Insure that oil separator is installed such that float removal is easily accomplished. Pipe oil return to oil reservoir.

Oil Reservoir: An oil reservoir adequately sized for the system with two sight glass ports shall be installed above the compressor system. Provide 3/8 inch angle service valves on top and bottom of reservoir. Install Reservoir Pressure Valve on top of reservoir and pipe to suction header. Provide manufacturer's standard filter on oil return line to oil level regulators.

Separator/Reservoir: As an alternate to paragraphs above, an oil separator-reservoir assembly is acceptable. This type of system shall consist of a combination separator-reservoir assembly and oil pressure regulation valve.

Oil Regulators: On each compressor, provide an electronic oil level float with shut-off valve on each inlet. This will allow removal of individual compressors without shutting down the whole system.

Manifolds: Liquid and suction manifolds shall be provided on each multiplex system. Each manifold shall have the required number of service valves to permit servicing unit coolers and display cases. Each manifold shall have one spare 5/8 inch liquid stub and 1-3/8 inch suction stub. Each service valve shall have a full ported gauge port which can be closed by back-seating the valve and a front seat which can close-off the line connected to the manifold. Service valves shall have a removable cap over the valve stem. Insulate suction header-manifolds with one-inch thick unicellular plastic insulation.

Subcoolers: One subcooler will be provided on each low temperature compressor system. They will be piped on site to the medium temperature suction group with the highest design suction temperature. Subcoolers shall be plate type heat exchangers.

Sizing: Subcooler to be sized to provide 50 deg F liquid refrigerant temperature, as monitored by one temperature sensor on the subcooled liquid outlet.

TEV Valves: Two thermostatic expansion valves (TEV) are to be piped in parallel before the liquid inlet of the medium temperature system on the subcooler. One is to be sized for 25 percent of the subcooling load and the other for 75 percent. Prior to each TEV will be a liquid line solenoid. All will be connected to the RMCS. See Division 23 Section Refrigeration Monitoring and Control System (RMCS).

EPR Valves: One Evaporator Pressure Regulator (EPR) valves of the adjustable type shall be installed on the medium temperature multiplex compressor system when indicated on refrigeration schedules for subcooling. Unless otherwise noted on the Drawings, the EPR valve shall be an internally piloted valve. Provide on each EPR valve a schrader type valve so upstream pressure can be measured with a pressure gauge.

Insulation: Both the subcooler and all refrigerant lines connected to it shall be insulated. (See paragraph 2.12)

Electronic Expansion Valves (EEV): Provide pulse width modulated type electronic expansion valves to meter refrigerant. Valves shall have a variable refrigerant volume in response to input from the case controllers. One case controller shall be factory installed at each case for temperature control. One EEV shall be factory installed at each case evaporator coil and unit cooler. Install based on Section 23 09 16 (RMCS), Part 3, Controlled Equipment and Strategies Section 3 Case Control Strategy. Each Case Controller shall receive a remote display, mounted on the facia of the case, so service personnel and customers can see the temperature of the discharge air. Provide a Schrader type valve at the outlet of the evaporator coil so upstream pressure can be measured with a gauge. Wiring from the EEV shall be factory installed by the case or unit cooler manufacturer and connected to the case controller. All loose shipped case controllers for unit coolers shall be mounted no less than 60” A.F.F. and no more than 70” A.F.F. see Division 23 Section Refrigeration Monitoring and Control System (RMCS).

\*\*\*Use horizontal receiver where it is desirable to reduce the height of the condensers as when mechanical centers are roof mounted\*\*\*

Receiver: Liquid receivers shall be **[vertical or]** horizontal-type, designed, and rated in accordance with the recommendations of ANSI/AHRI Standard 495-2005, except as modified herein. The receiver shall be constructed and tested in accordance with requirements of Section VIII of the ASME Boiler and Pressure Vessel Code. Each receiver shall be equipped with inlet, outlet drop pipe, service ports on inlet and outlet, purging valve, relief valves of capacity and setting required by ANSI/ASHRAE Standard 15-2010. Provide calculations on receiver capacity sizing. On multiplex systems, provide liquid level gauge or liquid level indicators on receivers. Each receiver should have a storage capacity not less than 500 lbs at 80 percent capacity. Each receiver shall have an analog liquid level sensor connected to the RMCS. See Division 23 Section Refrigeration Monitoring and Control System (RMCS).

Liquid Pressure Outlet Regulator. Furnish a regulator to provide stable pressure in the liquid lines.

Suction Accumulator: On multiplex systems, suction accumulators shall be installed and shall be designed within the suction header to provide a positive trap for liquid carry-over and to assure oil return to compressor. The accumulator internal liquid holding volume shall be at least 0.4 cubic feet. Design shall insure that oil is not trapped in the accumulator.

Pressure Tap: Provide on discharge line, receiver inlet, and suction manifolds a 1/8 inch FPT with shut-off valve for installation of pressure transducers.

* + - 1. PARALLEL RACK COMPRESSOR SYSTEMS
				1. Location:

Indoor applications shall have vertical frame and housing to maximize floor space and be located per Drawing.

For remodel / renewal / upgrade projects with existing mechanical mezzanine or indoor mechanical rooms, the new refrigeration systems shall be installed in the existing space to the maximum extent possible.

Outdoor and warehouse applications shall have either vertical or horizontal frame and housing and be located per Drawing.

Outdoor housing protections shall be rain tight.

Compressor Quantity/Capacity Selection: Compressor systems shall have the number of compressors as indicated on Drawings, with a maximum of 6 hp. System capacity shall range from 95 percent loaded. Satellites may be utilized however satellite compressors that are loaded less than 75 percent shall incorporate manufacturer approved load matching technology. Digital unloader technology is acceptable.

* + - * 1. Compressor Type: Compressors to be scroll or semi-hermetic.
				2. Compressor Accessories:

Refrigerant: Systems shall use refrigerant R-407A unless otherwise indicated on Drawings.

Provide permanent labels indicating the refrigerant type on the compressor systems.

Motors: Motors shall be of the constant-speed, induction, hermetically sealed, low-starting-current, high-torque type.

Oil Safety: low pressure safety control is required for each scroll compressor to protect the compressor from operating in deep vacuum.

Filters: Each suction group shall have a suction filter, replaceable core type, with felt element, brass housing and Schrader valve.

Overload: Compressors shall have electrical over current protection and inherent thermal protection.

Sound attenuating housing.

* + - * 1. Compressor System Fabrication/Configuration:

Mounting: Compressor systems shall be factory-mounted and piped on a welded steel base mounted on vibration isolators and complete with controls and accessories.

Electrical: Electrical panels containing breakers and contactors for compressors, unit cooler fans, defrost, case lights, and fans, and controls shall also be mounted on the compressor system.

Liquid Line Filter Driers: Filter-driers shall be field installed in main liquid lines leaving the receiver. Filter-driers Sizes 1/2 inch and larger shall be the full flow, replaceable core type. Sizes smaller than 1/2 inch shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down. The desiccant shall remove water, acid, and foreign material from the refrigerant. The filter-drier shall be constructed so that none of the desiccant will pass into the refrigerant lines. The minimum bursting pressure shall be 1,500 psi. Filter-driers shall be provided where recommended by manufacturer of display cases. Liquid line filter-driers shall be wax removal desiccant or approved equivalent.

Sight Glass: A moisture indicator sight-glass shall be field installed in the liquid line. The moisture indicating elements shall be removable. Moisture indicators shall have a reversible color indicator which has an easily distinguished color change. Sight glasses shall be provided with a protective cover and shall have solder-type connections.

Separator/Reservoir: An oil separator-reservoir assembly is acceptable. This type of system shall consist of a combination separator-reservoir assembly and oil pressure regulation valve.

Oil Regulators: On each compressor, provide an adjustable oil level regulator with shut-off valve on each inlet. This will allow removal of individual compressors without shutting down the whole system.

Manifolds: Distributed parallel systems shall be loop piped and do not require a manifold. Each system shall have a suction and liquid line connection piped to the exterior of the unit for field connection. Control valves and solenoids shall be field mounted at the display case.

Electronic Evaporator Pressure Regulators (EEPR): EEPR valves shall be installed when indicated on refrigeration schedules. The EEPR valves shall be field installed at the location shown on the contract drawings. Provide on each EEPR valve a Schrader type valve so upstream pressure can be measured with a gauge. Wiring from the EEPR shall be run to the RMCS for control. See Division 23 Section Refrigeration Monitoring and Control System (RMCS).

Receiver shall be mounted on the air cooled condenser. (see paragraph 2.5.K).

* + - 1. OUTDOOR DISTRIBUTED PACKAGED REFRIGERATION SYSTEM
				1. The refrigeration equipment manufacturer shall furnish the compressor system, electrical power, distribution and control systems, fully factory installed in a portable type weatherproof enclosure, which will be located on building roof as indicated on the refrigeration drawings (refer to the fixture plan and detail drawings).
				2. The Manufacturer shall furnish and install all compressors, manifolds, valves, piping, panels, breakers, contactors, transformers, wiring and controls, etc. as required to provide complete, operating mechanical and electrical systems as specified for the unit. Refer to the Refrigeration and Electrical Drawings and these specifications for further unit equipment requirements.
				3. The system utilizes R-407A as the primary refrigerant, POE refrigerant oil. All the equipment shall be manufactured and pre-installed to operate as such.
				4. Unit layout shall conform with the enclosed layout schematics and for the compressors as specified.

The Unit Manufacturer must carefully review the layout with the piping plans and specifications, to ensure that the final configuration will optimally accommodate the external piping systems.

Approved refrigeration pre-fabricated house manufacturers:

Hill Phoenix

Hussmann

* + - * 1. The unit shall be mounted on roof steel support. Refer to the Architectural and Structural documents for more information, prior to fabrication.
				2. The unit structure shall incorporate the following:

Structural steel base.

Lift hooks.

Wall panels to be pre-coated aluminum with stainless steel removable fasteners.

Fully insulated roof and wall panels.

One (1) 120V receptacle.

* + - * 1. Furnish and install variable output current transducers for each compressor system. All of the refrigeration systems shall be controlled and monitored by a DeCA approved RMCS (Refrigeration Control and Monitoring System) system, which must incorporate the necessary interface and software to monitor and record the power consumed by these systems (furnished and installed by the Refrigeration Equipment Manufacturer.
				2. Single electrical **[460]** volt, **[3]** phase service with main service fused disconnect switch. Supply transformers as required for all circuits, confirm with electrical drawings prior to fabrication.
				3. The unit shall include factory installed and pre-wired electrical panels, circuit breakers, wiring, etc. for the compressor system and condenser. Confirm final requirements with Electrical drawings prior to fabrication.
				4. Each compressor system must be seated on anti-vibration pads and be contained within a galvanized drain pan piped to the outside. The mounts shall be of the optimum vibration absorption value, based on equipment weight and operating/vibrational characteristics.
				5. The unit shall incorporate all of the compressor and ancillary systems as indicated, and shall be completely pre-piped and pre-wired to the maximum possible extent. Piping and wiring provided by Refrigeration Equipment Manufacturer shall include, but not limited to, all refrigerant lines emanating from compressor rack to a floor or wall chase as well as controller network and communication wiring, leak detector sensor wiring.
				6. The compressor systems incorporated within the unit shall be parallel compressor refrigeration racks, with manifolds including, but not limited to, ball valves and liquid & suction distribution piping to accommodate conventional and loop piping arrangement as detailed in the refrigeration piping drawings.
				7. All suction lines and manifolds must be fully insulated in accordance with the enclosed insulation specification section.
				8. Supply and install a complete RMCS control system in accordance with the enclosed plans and specifications in unit control panel.
				9. The unit layout must be configured in such a manner, that all systems including compressors, valves, filters, motors, electrical panels and systems and all other components which may require maintenance, are located in such a manner, to provide optimum unobstructed access.
				10. All pressure relief piping shall be piped (by the Unit Manufacturer) and vented externally to the unit enclosure.
				11. Refrigeration piping shall penetrate the unit floor. Refer to Refrigeration drawings for piping stub locations.
				12. The Refrigeration Equipment Manufacturer shall be responsible for furnishing and factory installing all panels, breakers, meters, contactors, transformers, distribution panels, outdoor electrical disconnect, wiring and wiring trough as required.

\*\*\*Delete this section if no condensing units\*\*\*.

* + - 1. CONDENSING UNITS
				1. Performance Standard: Condensing units shall be as described herein and in the schedule. Each unit shall conform to and shall consist of the equipment and accessories as listed in ANSI/AHRI Standard 520-2004, Performance Rating of Positive Displacement Condensing Units. The units shall be tested and rated in accordance with ANSI/ASHRAE Standard 23-2005 (Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units).
				2. Capacity Selection: Air-cooled condensing unit shall be sized for a maximum condensing temperature of 15 deg F above ambient temperature. Condensers shall have a maximum of 12 fins per inch.

\*\*\*Select fin material\*\*\*

* + - * 1. Compressors: Compressors shall be as specified in paragraph Compressor Systems, this Section.
				2. Condenser Coil: Copper tubes shall be mechanically expanded into corrugated full-collared aluminum fins. Coils shall be helium leak and pressure tested with 400 psig. Dry air and shipped with pressurized dry nitrogen. Micro channel style coils are not permitted.
				3. Head Pressure Control: Provide head pressure controls. Condensing pressure controls shall enable condensing temperature to drop from that indicated on Drawings to 75 deg F and shall maintain proper condensing temperatures at outdoor temperatures down to 0 deg F, and shall be automatic in operation without daily or seasonal adjustment. To maintain desired condensing temperatures, variable speed or standard condenser fan controls shall be provided along with a receiver heater Suction Accumulator: Suction accumulator shall be installed on condensing units serving unit coolers with electric defrost.
				4. Receivers: Receivers shall have a storage capacity not less than 20 percent in excess of the following: refrigerant (liquid) in liquid line(s); refrigerant (vapor) in evaporator and discharge line; refrigerant (liquid) in condenser drain line; refrigerant (liquid) in condenser circuit (100 percent flooded); and sufficient liquid seal of at least 20 percent in receiver with the above conditions.
				5. Fabrication:

Mounting: Compressors shall be factory mounted with condensers, and piped on a welded steel base mounted on vibration isolators and complete with controls and accessories.

Electrical: Panels on condensing units shall contain breakers and contactors for compressors and electric defrost. The defrost time clock(s) shall be factory mounted. Single point 208 Volt, 3 Phase, 60 HZ electrical connections shall be provided on condensing units. Also, electrical connection for defrost shall be provided on condensing units, where applicable.

Liquid line solenoid valves shall be factory mounted and wired to defrost time clocks.

Covers: Outdoor condensing units shall be provided with weather hoods.

* + - 1. COMPRESSOR SYSTEM CONDENSERS
				1. Service: Air-cooled condensers shall be suitable for remote installation.
				2. Fabrication: The air-cooled condensers shall be a complete factory-fabricated and assembled units consisting of coils, fans, and electric-motor drive.

\*\*\*A-E shall edit to provide copper finned coil with stainless steel end plates within 30 miles of saltwater

* + - * 1. Coils: Copper tubes shall be mechanically expanded into corrugated full collared **[aluminum] [copper]** fins spaced at 8, 10, or 12 fins per inch. The coil shall be dried to remove free moisture and capped to prevent entrance of foreign matter. A purging valve shall be installed on top of the inverted trap of the refrigerant inlet to condenser.
				2. Fans: Fans shall be the propeller-type, directly connected to the motor shaft and statically and dynamically balanced.
				3. Fan Motors: Provide premium efficiency 850 rpm electric motors not to exceed 1.0 hp per 30 inch diameter fan. Motors shall be totally enclosed or open drip-proof type, so located within an enclosure as to be fully protected from the weather. Motor starters shall be magnetic, across-the-line type with a general purpose enclosure. Motors shall have built-in overload protection and breaker protection. Control circuit on 480 VAC condenser motors shall be 208 VAC maximum. Provide transformer at condenser for 208 VAC control. Provide variable speed drive for condenser fans and all associated controls.
				4. Fan Control: On multiplex compressor systems, condenser fans shall be located so that each refrigerant circuit of a compressor system is under a set of fans which, when cycled, shall not affect another compressor system. All fans shall be controlled by the variable speed fan controller.

\*\*\*Use following paragraph unless near salt water\*\*\*\*

* + - * 1. Cabinets and Structures: **[Aluminum or galvanized steel panels with baked enamel finish and rigid internal channel frame fully gasketed joints. Structural members shall be minimum 18 gage]**.

\*\*\*Use the following within 30 miles of salt water\*\*\*\*

* + - * 1. Cabinets and Structures: **[Aluminum or stainless steel panels with rigid internal stainless steel or aluminum channel frame, fully gasketed joints. All internal and external surfaces, structural elements, and fasteners shall be aluminum or stainless steel. Fans shall be aluminum or epoxy coated steel]**.
				2. Capacity: Sizing of the condensers for full capacity at design conditions shall be based on the following:

Temperature difference (TD), condensing temperature minus entering air temperature, shall be as indicated on the condenser schedule.

Condenser capacity, watts at TD (BTUH at TD), shall meet or exceed the heat of rejection for the compressor system(s). The heat of rejection shall be calculated by using the compressor system operating conditions and capacity at design conditions and the appropriate heat of rejection factor for the compressors on the system.

\*\*\*Edit for Distributed Parallel Compressor Systems\*\*\*

* + - * 1. Receiver for Distributed Parallel Systems: Liquid receivers shall be horizontal-type, designed, and rated in accordance with the recommendations of ANSI/AHRI Standard 495-2005, except as modified herein. The receiver shall be constructed and tested in accordance with requirements of Section VIII of the ASME Boiler and Pressure Vessel Code. Each receiver shall be equipped with inlet, outlet drop pipe, service ports on inlet and outlet, purging valve, relief valves of capacity and setting required by ANSI/ASHRAE 15-2010, provide liquid level gauge or liquid level indicators on receivers. All receivers shall be insulated and shall have white Armaflex paint, or equivalent, to protect from UV rays.
			1. ADIABATIC HYBRID REFRIGERATION CONDENSER
				1. Type: Vertical airflow – remote hybrid condenser.
				2. Fans: Direct drive multiple fans with EC motors (integrated variable speed technology). Fans shall be factory wired to modulate speed at unison. Motors shall be programmed for 0 volts = 100% RPM and 10 volts = 0% RPM. Fan Blades / Covers: EC optimized (swept fan blade) with Optimized Venturi Cover.
				3. Voltage: 460/3/60 (to be confirmed by reference to the refrigeration/ electrical plans and the PROJECT DETAILS summary).
				4. Coil Type: Fin and tube (conventional) coil.
				5. Corrosion Protection: Required on all projects located within 50-miles of coastline of a major body of salt water.
				6. Coils: Two equal and independent condenser circuits shall be utilized, each to reject 50% of the total heat of the rejection.
				7. Fan Control: The condenser fans shall be controlled via EC motors with integrated variable speed technology (drive and control electronics). All fans shall be controlled in unison, all operating at the same speed, controlled via the RMCS control system 0-10V signal. Emergency back-up control will be FULL “ON”, all fans. Condensers shall be factory pre-wired to control the fans as specified, including necessary back-up and transformers. Where EC fan motors may fail, all remaining fans shall adjust speed to compensate for the failed motor.
				8. Control Type: The condenser control shall include dedicated on-board controller which will control the On-Demand Adiabatic Pre-Cooler functions.
				9. Fusing: Each condenser fan shall be separately fused.
				10. Disconnect: Each condenser shall be furnished with a non-fused disconnect switch.
				11. Condenser Selection Parameters – Provide condensers as indicated on the refrigeration legends.
				12. For Penthouse installations the condensers shall be field mounted on top of the unit (Confirm with PROJECT DETAILS Summary). The Unit Manufacturer shall design the enclosure to provide adequate structural strength as required to support the roof mounted condensers as specified. The Unit Manufacturer shall provide a catwalk and safety rails for field installation by the RIC. Access ladder to condensers shall be provided by the Unit Manufacturer.
				13. Spare Parts: The condenser(s) shall each be provided with a spare set of adiabatic media pads, furnished by the Unit Manufacturer, as part of the original contract.
				14. Basis of Design: BAC Trillium.
			2. **[ COMPRESSOR SYSTEM GAS COOLERS (CO2)**
				1. **Service: Air-cooled gas coolers shall be suitable for remote installation.**
				2. **Fabrication: The air-cooled gas coolers shall be a complete factory-fabricated and assembled units consisting of coils, fans, and electric-motor drive.**
				3. **Coils: The condenser shall be fin and tube style. The coil shall have copper fins with stainless steel end plates to prevent corrosion. The coil shall be dried to remove free moisture and capped to prevent entrance of foreign matter. A purging valve shall be installed on top of the inverted trap of the refrigerant inlet to condenser.**
				4. **Fans: Fans shall be the propeller-type, directly connected to the motor shaft and statically and dynamically balanced.**
				5. **Fan Motors: Provide premium efficiency variable speed electrically commutated (ECM) 850 rpm electric motors not to exceed 1.0 hp per 30 inch diameter fan. Motors shall be totally enclosed or open drip-proof type, so located within an enclosure as to be fully protected from the weather. Motor starters shall be magnetic, across-the-line type with a general purpose enclosure. Motors shall have built-in overload protection and breaker protection. Control circuit on 480 VAC condenser motors shall be 208 VAC maximum. Provide transformer at condenser for 208 VAC control. Provide variable speed drive for condenser fans and all associated controls.**
				6. **Fan Control: On multiplex compressor systems, condenser fans shall be located so that each refrigerant circuit of a compressor system is under a set of fans which, when cycled, shall not affect another compressor system. All fans shall be controlled by the variable speed fan signal.**
				7. **Spare Parts: The condenser(s) shall each be provided with a spare set of adiabatic media pads, furnished by the Unit Manufacturer, as part of the original contract.**
				8. **Cabinets and Structures: Aluminum or stainless steel panels with rigid internal stainless steel or aluminum channel frame, fully gasketed joints. All internal and external surfaces, structural elements, and fasteners shall be aluminum or stainless steel. Fans shall be aluminum or epoxy coated steel.**
				9. **Capacity: Sizing of the gas coolers for full capacity at design conditions shall be based on the following:**

**Temperature difference (TD), condensing temperature minus entering air temperature, shall be as indicated on the condenser schedule.**

* + - * 1. **Condenser capacity, watts at TD (BTUH at TD), shall meet or exceed the heat of rejection for the compressor system(s). The heat of rejection shall be calculated by using the compressor system operating conditions and capacity at design conditions and the appropriate heat of rejection factor for the compressors on the system. ]**
			1. CONTROLS
				1. Scope: Controls shall include those required for automatic operation of each compressor, air-cooled condenser, and defrost cycle as specified herein, as indicated under Division 23 Section Refrigeration Monitoring and Control System (RMCS), as indicated on the Drawings, and as recommended by the manufacturer of the insulated cold storage room unit coolers and refrigerated display cases.
				2. Factory Controls Installation: The compressor system manufacturer shall factory mount, install, and test each ICU installed on each compressor system. See Division 23 Section Refrigeration Monitoring and Control System (RMCS).
				3. Voltage/Interface: Control voltage for compressor control circuits, condenser control circuits, heat reclaim control valves, and liquid line solenoid valves shall be 208 volts 60 Hz. The RMCS shall be interfaced to these control circuits using relays.
				4. Back-up Controls: Each compressor on the system shall have a conventional low pressure control wired in series with controls provided under the Refrigeration Monitor and Control System. Low-pressure control shall have automatic reset and micro adjustable cut-in and cut-out range. Use ultra cap super hose or approved equal.
				5. High Pressure Control: Each compressor shall have a single high-pressure control with manual reset, adjustable set-point, and auxiliary alarm contact. Use ultra cap super hose or approved equal.
				6. Heat Reclaim: Heat recovery coil circuits shall be "pumped out" when circuit is not in heat reclaim. RMCS controls on compressor system shall have adjustable lockout set points.
				7. Head Pressure Control. Automatic condensing pressure controls shall be provided to enable the condensing temperature to drop to 70 deg F as ambient temperature conditions drop. They will maintain proper condensing temperatures at outdoor temperatures down to 0 deg F and shall be automatic in operation without daily or seasonal adjustment. Head pressure controls, consisting of modulating valves and bypass check valves, shall be provided to control head pressure to maintain desired condensing temperatures. On upstream pressure regulating valves, provide a Schrader type of valve to measure upstream pressure on regulating valve.
				8. Defrost: The defrost shall be initiated by the RMCS.
				9. Subcoolers: Liquid line solenoids on subcooler inlet lines shall be controlled via temp sensor on the subcooled liquid outlet.
				10. Display Case and Unit Cooler Superheat Control: Superheat control shall be by the RMCS case controller (factory installed at cases, shipped loose for field installation for evaporator coils) via an EEV valve for each evaporator coil. EEV valves are factory installed at each evaporator coil and wired through a case controller connected to the RMCS.

\*\*\*Do not use this type of heat reclaim water heater where there is limited space available.

* + - 1. HEAT RECLAIM WATER HEATER/STORAGE
				1. As indicated on Contract Drawings, provide heat reclaim water heater(s). The units shall be integrated into the product refrigeration system for maximum utilization. The refrigerant circuit shall be rated for 400 psi. Basis of Design: "Therma-Stor" II-1.
				2. Heat exchanger shall be glass lined 119 gallon storage tanks with heat exchanger wrapped around the tank with double wall construction. Insulate tank with 2 inch foam insulation.
				3. Controls as necessary to maintain water temperature in storage tank and heat pressure, shall be provided by display case manufacturer.
				4. The heat reclaim water heaters shall be furnished as an integral part of the product refrigeration system and approved by the display case manufacturer.
			2. UNIT COOLERS
				1. Fabrication: Unit coolers shall be the suspended type. Each unit cooler shall be self-contained, enclosed in a suitable metallic casing which is the manufacturer's standard. Unit coolers shall be quiet in operation. Fans shall be of the propeller type directly connected to the motor shaft. Evaporator coils shall have copper tubes and aluminum fins.
				2. Heat Exchangers: Heat exchangers shall be provided on medium temperature unit coolers to sub-cool liquid refrigerant and shall be sized for each unit cooler at the operating conditions.
				3. Capacity: Capacities of unit coolers after de-rating for motor heat shall be not less than required to meet or exceed the refrigerated room loads indicated on the Drawings and based on the operating conditions specified. The quantity of unit cooler(s) required, temperature difference, fins per inch, capacities and the type of airflow (Type I or II), and type of defrost shall be as indicated on Drawings.
				4. Valves: Unit coolers shall have a liquid line shut-off valve (soldered type). Provide Schrader type valve with cap on suction outlet of unit cooler. Provide “stepper” type electronic expansion valve (sweat fitting) with removable screen for each unit cooler, properly sized and designed for use with the type of refrigerant indicated. Provide a loose shipped case controller per evaporator coil for field installation.
				5. Motors: Provide 208/230V ECM (electrically commutated motors) fan motors. Shaded pole or split capacitance motors are not acceptable.
				6. Filter Drier: Provide a (sweat type) filter drier at inlet of each expansion valve. Filter drier shall filter contaminants down to 20 microns. Flow capacity shall meet coil requirements.
				7. Factory install RMCS discharge air temperature probe in discharge air stream. Factory install RMCS return air temperature sensor in return air stream. Factory install defrost termination temperature sensor on refrigeration evaporator coil (where required – electric defrost).
			3. MECHANICAL CENTERS
				1. Install all compressor systems, supporting electrical panels and transformers as well as other supporting equipment, heat recovery water heaters, **[gas fired water heaters]** and related equipment in **[grade]** **[roof]** mounted mechanical center**[s]**. These mechanical centers shall be factory prefabricated, pre-piped and prewired ready to set in place, and requiring only single point electrical and piping connection. All RMCS wiring is to be installed in electrical metallic tubing (EMT) conduit.
				2. The mechanical centers shall be a regularly furnished assembly supplied by the refrigeration system provider and shall be a minimum of 11 feet-0 inch in width, 8 feet-8 inch in height, and length as required to accommodate the equipment with proper clearances. Construction shall be in accord with IBC and adequate for seismic and wind loadings as required by Division 01 Section Summary of Work and the Structural Drawings. Structural Drawing submittal shall be signed and sealed by a registered structural engineer.
				3. Provide the following features:

\*\*\*Select roof or grade mounting.

**[Roof curb]** **[Grade mounting frame]** and structural attachment points coordinated with the building structure to assure adequate wind and seismic resistance. See Division 01 Section Summary of Work.

Adequate service lighting (30 foot candles at the compressors) and battery backed emergency lighting.

Ventilation designed for 100 cfm per compressor horsepower. Inlet louvers (rain proof) **[with motorized dampers]** shall be located on one side of the center with sidewall exhaust fans with motorized dampers on the opposite side and offset lengthwise to draw air over the compressor racks, all in accord with Division 23.

**[Structural steel for locating air cooled condensers [ gas coolers ] on the roof of the center and OSHA compliant catwalks a minimum of 24 inch wide, 12 gauge, grip strut, diamond plank with ladders and 1-1/2 inch diameter hand rails and intermediate rails**.**]**

All necessary electrical panels, transformers, wiring, etc. required to support the Product Refrigeration system.

Heat recovery water heaters, **[gas fired water heaters, circulating pumps,]** piped to the point of connection to the building. All plumbing equipment, piping, insulation, etc. shall be in accord with Division 22.

Doors sized and located to facilitate replacement of equipment.

Trolley and track the length of the center with hoist to handle compressors.

R-6 insulated corrugated galvanized steel wall and roof panels with factory baked enamel finish in color as selected by the contracting officer. Flame spread/smoke developed shall not exceed 25/50 by ASTM E84.

3/16 inch steel plate floor **[with the curb below the floor filled with 6 pound density board insulation for noise control]**.

\*\*\*Roof mounted units only.

**[Floors of Roof Mounted Units shall have water tight floors which drain to the outside of the curb and have 4 inch high water tight sleeves at all penetrations.]**

Electric unit heater in cold climates, selected to maintain 55 degrees F. with thermostat, all factory installed and wired, in accordance with Division 23.

All non-galvanized steel shall be factory painted.

Lifting eyes as required to install the unit.

Cantilevered steps at door, maximum 7 inch riser.

Provide **[space for domestic water heaters]** and **[space for]** building electrical service equipment as detailed and specified in Division 26. Coordinate with manufacture of the mechanical center for space and structural requirements.

* + - 1. DISPLAY CASES
				1. General:

Scope: The Work includes the furnishing, installing, and adjusting of the display cases and accessories indicated, specified, or necessary for operation. The material, equipment, and appurtenances specified herein shall be the standard products of an established manufacturer and shall have a history of satisfactory commercial operating service.

Basis-of-Design Products: To establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers, a specific manufacturer’s product is named and accompanied by the words "basis-of-design", including make or model number or other designation. Subject to compliance with requirements, provide either the named products or equal products.

NOTE: The Contract Documents reflect dimensions based on a single manufacturer’s fixture sizes and required clearances as “Basis-of-Design”. If display cases from another manufacturer are provided, it will be necessary to adjust contract document dimensions accordingly. This will include, but is not limited to length, width, and height of display case openings and adjacent spaces/fixtures. Shop drawings shall accurately reflect all required changes for coordination with affected construction trades (i.e., architectural, plumbing, electrical, HVAC, etc.).

Standards: Case ratings shall be based on ANSI/AHRI 1200-2010, "Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets" or ANSI/ASHRAE Standard 72-2005, "Method of Testing Commercial Refrigerators and Freezers." The ratings which shall be employed are for a store environment of 75 deg F dry bulb and 55 percent relative humidity. Where high performance coils are specified, suction temperature shall be at the scheduled temperature to obtain rated capacity. Refrigerated display cases must meet the latest DOE energy efficiency regulation, 10 CFR Part 43, Subpart C.

Temperature performance shall be based on the product temperatures maintained by the display cases. The intended result is preservation of the foods in such a fashion as is generally considered acceptable for displayed retail foods.

Color: Color of all refrigerated and non-refrigerated display case exterior and end panels except frozen food shall be equivalent to Hussmann #747 “Chocolate Brown” or Benjamin Moore BM # 2106-10 “Java”. Frozen food case exteriors and end panels shall be equivalent to Benjamin Moore BM # 840 “Kensington Blue”. Exposed (top mounted) case controllers shall match case exterior. Toe panels (kick plates) shall be black. Interior of all display cases shall be white except for produce cases which shall be black. Glass doors on display cases shall have black frames, black trim and black handles.

Accessibility: Cooling coils, electronic expansion valves, case controllers, air circulators, and drains shall be accessible for ease of maintenance, removal, and replacement.

Insulation: Spaces between inner and outer walls of basic case shall be completely filled with not less than 1-1/2 inch of polyurethane insulation foamed in place throughout, including end panels. Insulation "K" factor shall be equivalent to 0.13 BTU deg F, per inch of thickness. Insulation shall be enclosed and waterproofed to prevent moisture penetration, and allow high pressure spray cleaning without damage to insulation.

All sheet metal and framing to be galvanized steel, stainless steel or anodized aluminum.

Floor Air Gap: Where return air for HVAC is drawn from under a refrigerated display case, that case shall be equipped for return air with a 1 inch opening the full length of the case.

End Panels: Cases located adjacent to solid walls shall have boxed end panels. Cases with exposed ends shall have contour end panels coordinated with case profile.

Mirrored Panels: End panels on produce cases and grab-n-go cases as specified shall have a mirror on panel side towards the product.

Local Thermometers: Provide.

Descriptive dimensions of display cases are only approximate. Some variation is permissible. However, minimum product capacity requirements shall be met or exceeded.

Controls: Provide case controllers in accordance to Section 23 09 16 (RMCS) Part 3, Controlled Equipment and Strategies, section 3, case control strategy and electronic expansion valves (EEV) to meter the refrigerant and control the superheat value of the case. Case controllers to control case lighting, defrost schedule and temperature/superheat control. Case controllers must be part of and communicate with the overall refrigeration and HVAC monitor and control system. Case controllers shall be factory installed.

Exterior Material: The exterior of the display case shall not be less than 20 gauge steel finished in baked porcelain enamel, baked refrigerator synthetic enamel, baked acrylic enamel, or a combination of these as standard with the manufacturer and as indicated in manufacturer's current catalogs and sales literature.

Interior Material: The interior area of the case shall be baked enamel on steel, stainless steel, or acid-resistant porcelain on steel, or bare aluminum with natural drainage outlets. When required by display case manufacturer, drain heaters shall be provided. Joints in lower compartments shall be waterproof.

Bumpers: Front of cases shall have a bumper rail of high impact rubber, PVC, or vinyl. Provide matching bumper rail on exposed end panels. All bumpers shall be black in color unless otherwise specified in Architectural finish drawings.

Lights: Display case lights shall be LED controlled by the RMCS to be on only during store sales hours. LED lighting shall be 4000 degrees K for all cases, except meat cases. LED lighting for meat cases shall be 3500 degrees K. LED shall be rated for minimum 50,000 hour life at 70 % output. Minimum 60 lumens per watt efficiency.

Motors: Display case fan motors shall be the highest efficiency type available. Provide electronically commuted motors (ECM).

Filter Drier: Provide a factory installed (sweat type) filter drier at inlet of each expansion valve. Filter drier shall filter contaminants down to 20 microns. Flow capacity shall meet fixture requirements.

Factory install RMCS discharge air temperature probe in discharge air stream. Factory install RMCS return air temperature sensor in return air stream. Factory install defrost termination temperature sensor on refrigeration evaporator coil (where required – electric defrost).

Defrost shall be off cycle or electric as scheduled on the Drawings.

All Multi-Deck and Reach-In Glass cases piping connections will be located on the top of the cases. Piping shall be tested at the factory to the standards outlined in the testing section of this specification.

Evaporator coils shall have aluminum fins on copper or aluminum tubes with seamless, non-corrosive drain pan. Each liquid line connection shall have a hand valve.

All refrigerated cases shall have a 1 inch to 2 inch drain at the low point of the drain pan.

Electrical requirements shall be:

120 V for fans and lights and anti-sweat heaters.

208V, 1 phase defrost heaters and self-contained cases except as noted.

Transparent reach-in doors for frozen food / ice cream cases shall be of triple-pane glass with either heat-reflective treated glass or gas fill having limited anti-sweat heaters to prevent external condensation in stores with less than 60 percent relative humidity. The door frames shall be constructed of non-conductive composite material (Hussmann Innovator III) or insulated aluminum with thermal break (Anthony Eliminator II) or similar construction requiring heat only to prevent freezing of the door gasket seal. All medium temperature doors are to be designed with no heat in doors and low volume heat in frames.

Night curtains shall be provided on all open multideck cases except produce cases. Standard is Super Market Energy Technologies "Night Shield Night Covers" magnetically mounted, manually operated, spring loaded, retractable, anti-bacterial treated, aluminized fabric screen. The screens shall be integrated into the design of the case so that they are concealed form view when retracted.

* + - * 1. 1B02 Bakery Display Case, Non-Refrigerated, Clerk, Service:

Salient Characteristics:

Nominal Dimensions:

Length:

1B02-4: 48 inches (1-1/2 inch end panels).

1B02-5: 57-1/2 inches (1-1/2 inch end panels).

1B02-6: 75-1/2 inches (1-1/2 inch end panels).

Height: 49 inches.

Depth: 39-1/2 inches.

Lights: One row of lights at top of case and at each shelf level.

Shelves: Three 3/8 inch glass shelves. One 20 inch and two 26 inch deep shelves full length of case.

Glass Front: Curved glass, lift-up design with key locks and keys.

Sliding rear glass doors with continuous finger pulls keyed locks and keys, easily removed for cleaning.

Mirrored Ends/Panels: Manufacturer’s standard.

Basis-of-Design Product: Hussmann, Model SHVS N/R.

* + - * 1. 1B06 Bakery Display Case, Refrigerated, Clerk, Service:

Salient Characteristics:

Nominal Dimensions:

Length:

1B06-4: 48 inches (1-1/2 inch end panels).

1B06-5: 57-1/2 inches (1-1/2 inch end panels).

1B06-6: 75-1/2 inches (1-1/2 inch end panels).

1B06-8: 96 inches (1-1/2 inch end panels).

Height: 48-3/4 inches.

Depth: 39-3/4 inches.

Lights: One row of lights at top of case and at each shelf level.

Shelves: Three 3/8 inch glass or epoxy coated wire shelves. One 20 inch and two 26 inch deep shelves full length of case.

Base shelf: 30 inch deep.

Glass Front: Curved glass, lift up design with key locks and keys.

Sliding aluminum or PVC framed rear glass doors or mirrored doors with continuous finger pulls, keyed locks and keys, easily removed for cleaning.

Mirrored Ends/Panels: Manufacturer’s standard.

Designed to maintain a product temperature of 41 deg F.

Basis-of-Design Product: Hussmann, Model SHVS.

* + - * 1. 1B07 Bakery Display Case, Refrigerated, Self-Service:

Salient Characteristics:

Nominal Dimensions:

Length:

1B07-4: 48 inches (1-1/2 inch end panels).

1B07-5: 57-1/2 inches (1-1/2 inch end panels).

1B07-6: 75-1/2 inches (1-1/2 inch end panels).

1B07-8: 96 inches (1-1/2 inch end panels).

1B07-12: 144 inches (1-1/2 inch end panels).

Height: 48-3/4 inches.

Depth: 39-1/4 inches.

Lights: One row of lights at top of case and at each shelf level.

Shelves: Three 3/8-inch glass or epoxy coated wire shelves. One 22-inch, one 20-inch, and one 16-inch deep shelves full length of case.

Base shelf: 30 inch deep.

Solid back panel.

Mirrored Ends/Panels: Manufacturer’s standard.

Designed to maintain a product temperature of 41 deg F.

Basis-of-Design Product: Hussmann, Model SHVSS

* + - * 1. 1B08 Case, Ice-Cream, Frozen Food, Glass Doors, Low Temperature, Upright:

Salient Characteristics: Case, frozen food, reach-in, 2, 3, 4 or 5 glass doors (as specified), five upper solid shelves per door section, low temperature, remote refrigeration.

Nominal Dimensions:

Length:

1B08-2: 2 Dr, 62 inches 2 inch end panel.

1B08-3: 3 Dr, 92-1/2 inches 2 inch end panel.

Height: 83-1/2 inches.

Depth: 39-3/4 inches.

Door Width: 30 inches.

Upper shelves: 22 inches deep.

Sill Height: 13-3/8 inches (max).

Designed to maintain a product temperature of 0 to -10 deg F.

Lights: Vertical LED lighting assembly, one at each end and one between all doors.

Shelves: Five solid adjustable upper shelves per door section with price tag molding. One bottom epoxy coated wire rack per door section with price tag molding.

Doors: constructed per paragraph 2.10.A.26, 67 inches high with magnetic gaskets, automatic door closures, doors hinged on left side.

Basis-of-Design Product: Hussmann, Model RLN.

* + - * 1. 1B30-A Self-Service Refrigerated Bakery Display Case:

Salient Characteristics:

Self-service refrigerated bakery merchandiser.

Remote refrigeration with leads designed to operate in ambient conditions of 75 deg F and 55 percent relative humidity.

Integrated Product Temperature (IPT): 41 deg F.

Digital thermometer (Fahrenheit).

Plastic laminate premium color indicated on Drawings on all exposed exterior surfaces, with black trim.

Flat front panel with 1 inch bumper on front and exposed ends.

White case interior with solid back panel.

Full end panels with mirror facing interior of case.

One 24-inch deep clear glass display shelf, one 20-inch deep clear glass display shelf, and one 16-inch deep clear glass display shelf, removable and adjustable vertically on 1 inch centers at zero-degree, 5-degree, and 10-degree angles.

LED lighting with protective coating at top of case and beneath each glass shelf.

Adjustable levelers.

Nominal Dimensions:

50 inches wide.

42 inches deep.

51-1/4 inches high.

Electrical:

120 volts, 60 hertz, single phase.

2.27 amps.

Basis-of-Design Product: Structural Concepts. (231) 798-8888 or [www.structuralconcepts.com](http://www.structuralconcepts.com).

Model HV48RSS.

* + - * 1. 1B30-B Self-Service Refrigerated Bakery Display:

Salient Characteristics:

Self-service refrigerated bakery merchandiser.

Remote refrigeration system designed to operate in ambient conditions of 75 deg F and 55 percent relative humidity.

Integrated Product Temperature (IPT): 41 deg F.

Digital thermometer (Fahrenheit).

Plastic laminate premium color indicated on Drawings on all exposed exterior surfaces, with black trim.

Flat front panel with 1 inch bumper on front and exposed ends.

White case interior with solid back panel.

Full end panels with mirror facing interior of case.

One 24-inch deep clear glass display shelf, one 20-inch deep clear glass display shelf, and one 16-inch deep clear glass display shelf, removable and adjustable vertically on 1 inch centers at zero-degree, 5-degree, and 10-degree angles.

LED lighting with protective coating at top of case and beneath each glass shelf.

Adjustable levelers.

Nominal Dimensions:

58 inches wide.

42 inches deep.

51-1/4 inches high.

Electrical:

120 volts, 60 hertz, single phase~~.~~

2.55 amps.

Basis-of-Design Product: Structural Concepts. (231) 798-8888 or [www.structuralconcepts.com](http://www.structuralconcepts.com).

Model HV56RSS.

* + - * 1. 1B30-C Self-Service Refrigerated Bakery Display:

Salient Characteristics:

Self-service refrigerated bakery merchandiser.

Remote refrigeration system designed to operate in ambient conditions of 75 deg F and 55 percent relative humidity.

Integrated Product Temperature (IPT): 41 deg F.

Digital thermometer (Fahrenheit).

Plastic laminate premium color indicated on Drawings on all exposed exterior surfaces, with black trim.

Flat front panel with 1 inch bumper on front and exposed ends.

White case interior with solid back panel.

Full end panels with mirror facing interior of case.

One 24-inch deep clear glass display shelf, one 20-inch deep clear glass display shelf, and one 16-inch deep clear glass display shelf, removable and adjustable vertically on 1 inch centers at zero-degree, 5-degree, and 10-degree angles.

LED lighting with protective coating at top of case and beneath each glass shelf.

Adjustable levelers.

Nominal Dimensions:

76 inches wide.

42 inches deep.

51-1/4 inches high.

Electrical:

120 volts, 60 hertz, single phase.

3.28 amps.

Basis-of-Design Product: Structural Concepts. (231) 798-8888 or [www.structuralconcepts.com](http://www.structuralconcepts.com).

Model HV74RSS.

* + - * 1. 1D00 Case, Deli, Refrigerated, Clerk Service:

Salient Characteristics:

Nominal Dimensions:

Length:

1D00-8: 96-3/8 inches (1-1/2 inch end panels).

1D00-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 52 inches.

Depth: 44-5/8 inches.

Lights: Lights in top of case and one row beneath each shelf the length of case.

Shelving: Two 12 inch or one 12 inch and one 10 inch stainless steel or epoxy coated mezzanine shelves full length of case.

Wire Racks: Provide stainless steel wire display racks.

Glass Front: Curved, lift up design, lockable, with fully gasketed perimeter.

Sliding glass rear doors, lockable.

Wrapping Board: Full length at rear of case.

Mirrored inside end panels.

Convenience Outlet: 120V duplex receptacle for scales.

Designed to maintain average product temperature of 36 deg F.

Basis-of-Design Product: Hussmann, Model SMB.

* + - * 1. 1D01 Case, Meat, Multi-Deck, Deli, Prepackaged:

Salient Characteristics:

Nominal Dimensions:

Length:

1D01-8: 96-3/8 inches (1-1/2 inch end panels).

1D01-12: 144-1/2 inches (1-1/2 inch end panels).

Height 81-3/4 inches.

Depth: 42 inches.

Height of front shall be 27-1/4 inches.

Lights: One row of lamps in canopy.

Shelves: Five 22-inch deep upper shelves shall be metal bar with baked enamel finish or perforated aluminum, acid-resistant finish, sectional, removable, adjustable to no less than three positions.

Designed to maintain a product temperature of 33 deg F.

The front edges of shelving to be equipped with price tag molding to hold standard size price tags/labels.

High performance coil.

Provide night curtains (2.10.A.27).

Basis-of-Design Product: Hussmann, Model D5X-HEP.

* + - * 1. 1D02GD Case, Medium Temperature, Glass Door, Upright, Deli:

Salient Characteristics:

Nominal Dimensions:

Length:

1D02GD-8: 96-3/8 inches (1-1/2 inch end panels).

1D02GD-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 81-3/4 inches.

Depth: 42 inches.

Door Width: 24 inches

Upper Shelves: 22 inches deep.

Sill Height: 19-5/8 inches (max).

Canopy Lights: Horizontal lighting fixtures, with LED lighting,

Shelves: Six levels of display composed of bottom deck and 5 rows of removable upper cantilevered adjustable shelves.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

French door style glass doors, 24 inches wide.

Designed to maintain a product temperature of 30 - 36 deg F.

Basis-of-Design Product: Hussmann, Model DD5X-LP.

* + - * 1. 1D07 Sushi Preparation Table & Display (Mobile Island, Refrigerated, Self-Contained):

Salient Characteristics:

Self-contained refrigeration system with R-407A or R-134A refrigerant, and bottom mounted air-cooled condensing unit designed to maintain a product temperature of 33 - 38 deg. F. Designed for operation at maximum of 75 deg. F DB and 55 percent RH. Condensing unit shall be designed to slide out for ease of maintenance.

Compressor unit with minimum 1/3 horsepower.

Electrical: 220 volt, 60 hertz, 1 phase, 14.846 amps. with NEMA 14-20P0 plug. Additional power as necessary for rear refrigerated storage.

Condensate dissipater pan.

Electronic thermostat temperature controls.

Electronic temperature sensors.

One solar digital thermometer.

Energy efficient fans.

Off-cycle defrost.

On/Off light switch for LED case lighting with magnetic light fixture mounting.

Four casters, 5 inches diameter (NSF). Position locks shall be provided on the two rear casters as a minimum.

CFC free foamed-in-place insulation.

Seamless, non-corrosive tub.

Copper tube aluminum finned coils.

Case exterior color as indicated on Drawings, with stainless steel interior.

Welded steel chassis.

Preparation Table Work Surface:

Solid surfacing, white.

Two step work surface consisting of upper surface for food storage pans and 16 inches deep (f to b) lower surface that steps down approximately 5 inches.

Upper work surface equipped with refrigerated insert areas for food ingredient pans. Three insert areas, each approximately 21 inches wide by 13 inches length by 4 inches deep. Insert areas shall accommodate at least six each (total) smaller standard food ingredient pans.

Stainless steel pans with clear lids: Provide two 1/3 size pans, six 1/6 size pans, and two 2/3 size pans per insert area.

Fixed-mount front sneeze guard panel; clear tempered glass; straight profile.

Two tempered glass end panels mounted on top of insulated end panels.

Self Service (Front):

One adjustable (height and angle) 15 3/4-inch deep shelf with undershelf light, full length of case, stainless steel.

Base deck (adjustable angle) lighted with continuous ledge light, full length of case, stainless steel.

Canopy light (same profile as ledge light), full length of case, stainless steel.

Air dam: Clear tempered glass at front of base deck.

Case front nosepiece: Painted body panel to match exterior case color.

Molded bumper (1 inch wide) across front of display case, centered on nosepiece. Color: Black.

Kickplate color: Black.

Two insulated end panels: Laminated exterior to match case color with stainless steel interior and vinyl edge molding with brushed stainless looking finish; fabricate top to receive glass end panel.

Rear refrigerated storage, medium temperature, with see-through glass, NSF-7 certified sliding doors, base and adjustable storage shelves, and lighted interior storage area.

Basis-of-Design Product: Structural Concepts (231) 798-8888 or www.structural concepts.com.

Model GP641RR, Sushi Preparation Table (Mobile Island, Refrigerated, Self-Contained).

Approximate Dimensions:

1D07-4: 51 inches long, 51-3/4 inches deep, 43 inches high (55 inches with sneeze guard).

1D07-6: 75-3/8 inches long, 51-3/4 inches deep, 43 inches high (55 inches with sneeze guard).

1D07-8: 99-3/4 inches long, 51-3/4 inches deep, 43 inches high (55 inches with sneeze guard).

* + - * 1. 1D17 Preparation and Display Case for Pizza and Sandwiches:

Salient Characteristics:

Remote refrigerated display case, designed to maintain a product temperature of 33 - 38 deg. F.

Case exterior color as indicated on Drawings, with stainless steel interior.

Preparation Table Work Surface:

Solid surfacing, white.

Two step work surface consisting of upper surface for food storage pans and 16 inches deep (f to b) lower surface that steps down approximately 5 6 inches.

Upper work surface equipped with refrigerated insert areas for food ingredient pans. Three insert areas, each approximately 21 inches wide by 13 inches length by 4 inches deep. Insert areas shall accommodate at least six each (total) smaller standard food ingredient pans.

Stainless steel pans with clear lids: Provide two 1/3 size pans, six 1/6 size pans, and two 2/3 size pans per insert area.

Fixed-mount front sneeze guard panel; clear tempered glass; straight profile.

Two tempered glass end panels mounted on top of insulated end panels.

Self Service (Front):

One adjustable (height and angle) 15 3/4-inch deep shelf with undershelf light, full length of case, stainless steel.

Base deck (adjustable angle) lighted with continuous ledge light, full length of case, stainless steel.

Canopy light (same profile as ledge light), full length of case, stainless steel.

Air dam: Clear tempered glass at front of base deck.

Case front nosepiece: Painted body panel to match exterior case color.

Molded bumper (1 inch wide) across front of display case, centered on nosepiece. Color: Black.

Kickplate color: Black.

Two insulated end panels: Laminated exterior to match case color with stainless steel interior and vinyl edge molding with brushed stainless looking finish; fabricate top to receive glass end panel.

Rear refrigerated storage, medium temperature, with see-through glass, NSF-7 certified sliding doors, base and adjustable storage shelves, and lighted interior storage area.

Basis-of-Design Product: Structural Concepts (231) 798-8888 or www.structural concepts.com.

Model GP641RR, Preparation and Display Case for Pizza and Sandwiches (remote refrigeration).

Approximate Dimensions:

1D17-4: 51 inches long, 51-3/4 inches deep, 43 inches high (55 inches with sneeze guard).

1D17-6: 75-3/8 inches long, 51-3/4 inches deep, 43 inches high (55 inches with sneeze guard).

1D17-8: 99-3/4 inches long, 51-3/4 inches deep, 43 inches high (55 inches with sneeze guard).

* + - * 1. 1D22 Case, Island Display, Low Profile, Multi-Deck Medium Temperature, Dairy or Deli, Remote Refrigeration:

Salient Characteristics:

Nominal Dimensions:

Center Case Length:

1D22-8: 96-3/8 inches

1D22-12: 144-1/2 inches

End Case Length:

1D22-E: 40-3/4 inches

Height: 48 inches.

Depth: 81-1/2 inches.

Height to Bumper: 8-1/4 inches.

Product display depth to be a minimum of 12 inches.

Case to be provided with multi-positional bottom rack, one (1) adjustable 16 inch shelf, one (1) adjustable 12 inch shelf, and one (1) non-refrigerated top display area.

Clear 5 inch high Plexiglas perimeter.

Remote refrigeration designed to maintain a product temperature of 36 to 38 degrees.

Basis-of-Design Product: Hussmann, Model CW2GE and CW2EGE, End Cases.

* + - * 1. 1D24 Case, Low Profile, Prepackaged Deli, Multi-Deck Medium Temperature, Open Type:

Salient Characteristics:

Nominal Dimensions:

Length:

1D24-8: 96-3/8 inches (1-1/2 inch end panels).

1D24-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 55-3/4 inches.

Depth: 42 inches.

Sill height: 19-5/8 inches.

Shelves: Three, 18 inch deep, sectional shelves of display with 3 rows of removable upper-cantilevered adjustable shelves extending full length of case.

Full-length row of lighting.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

Designed to maintain a product temperature of 30 to 35 deg F.

Provide night curtains (2.10.A.27).

Basis-of-Design Product: Hussmann, Model C2X-XLEP.

* + - * 1. 1F00 Case, Fresh Fish, Refrigerated, Medium Temperature, Clerk Service:

Salient Characteristics:

Nominal Dimensions:

Length:

1F00-4: 48-1/4 inches (1-1/2 inch end panels).

1F00-6: 72-1/4 inches (1-1/2 inch end panels).

1F00-8: 96-3/8 inches (1-1/2 inch end panels).

1F00-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 52 inches.

Depth: 45-3/8 inches.

Sill height: 23 inches.

LED Lights on top of case for the length of the case.

LED ledge lights.

Lift up, curved tempered front glass. Glass must be lockable.

Rear service removable glass sliding doors. Lockable doors must be furnished.

Gravity coil, ice pans with stops.

A 7 inch to 10 inch deep high density polyethylene food wrapping shelf that is the full length rear of the case, duplex receptacles (120 volts) required on rear mullions for display scales and printer.

Stainless steel case top cover.

Stainless steel interior, stainless steel adjustable ice trays, bottom rack and drain pan; bottom flushing system with a timer clock; perimeter heater and ice guard for front glass.

Designed to maintain a product temperature of 28 to 32 deg F. Top gravity coil and bottom serpentine coil.

Black vinyl cart bumper entire length of case on customer side.

Scale Stand: Adjustable stand, 22 inches by 18 inches with 120V duplex receptacle and Cat 5 scale connections.

Basis-of-Design Product: Hussmann, Model Q3-FC Service Fish.

* + - * 1. 1F01 Case, Fresh Fish, Single Deck:

Salient Characteristics:

Nominal Dimensions:

Length:

1F01-8: 96-3/8 inches (1-1/2 inch end panels).

1F01-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 43-1/8 inches.

Depth: 42 inches.

Shelving to be stainless steel, sectional, and adjustable to no less than three positions.

Front edges of deck equipped with permanently attached price tag molding to hold standard size price and UPC identification tags/labels.

Full stainless steel interior for use with fish.

Designed to maintain a product temperature of 28 to 32 deg F.

Basis-of-Design Product: Hussmann, Model M1X-E.

\*\*\*This case for Cheese only, No Meat\*\*\*

* + - * 1. 1G02 Case, Dairy, Multi-Deck, Front Load, Medium Temperature, Open Type:

Salient Characteristics:

Nominal Dimensions:

Length:

1G02-8: 96-3/8 inches (1-1/2 inch end panels).

1G02-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 81-3/4 inches.

Depth: 42 inches.

Height of front shall be 27-1/4 inches.

Lighting at the canopy.

Shelves: Six levels of display with 5 rows of removable upper cantilevered adjustable 22 inch shelves extending full length of case and one row in lower display area.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

Designed to maintain a product temperature of 34 to 38 deg F.

Provide night curtains (2.10.A.27)

Basis-of-Design Product: Hussmann, Model D5X-HEP.

* + - * 1. 1G02GD Case, Medium Temperature, Glass Door, Upright, Dairy:

Salient Characteristics:

Nominal Dimensions:

Length:

1G02GD-6: 72-3/8 inches (1-1/2 inch end panels).

1G02GD-8: 96-3/8 inches (1-1/2 inch end panels).

1G02GD-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 81-3/4 inches.

Depth: 42 inches.

Door Width: 24 inches

Upper Shelves: 22 inches deep.

Sill Height: 19-5/8 inches (max).

Canopy Lights: Horizontal lighting fixtures, with LED lighting,

Shelves: Six levels of display composed of bottom deck and 5 rows of removable upper cantilevered adjustable shelves.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

French door style glass doors, 24 inches wide.

Designed to maintain a product temperature of 34 - 38 deg F.

Basis-of-Design Product: Hussmann, Model DD5X-LP.

* + - * 1. 1G06 Case, Frozen Food, End Cap for Wide Island, Low Temperature, with Solid Walls and Lids:

Salient Characteristics:

Nominal Dimensions:

Length:

Match width of 1G07.

Height: 35-7/8 inches.

Depth: 42 inches.

End caps shall be designed for compatibility and for wraparound appearance when joined to the wide island frozen island food case. Dimensions, materials, accessories, trim and finish shall match adjoining cases.

Shelves: Epoxy coated bottom wire shelves: adjustable to at least three positions.

Designed to maintain a product temperature of -10 to 0 deg F.

Each case shall be furnished with curved modular sliding glass covers as follows:

Self-supporting curved modular glass covers that slide open and close, front to back.

Clear 4mm-thick tempered flat safety glass.

Aluminum frames positioned on the top of the hand rail of solid front display cases, matched to the specific dimensions required per case model. Frames are provided with modular sliding sections for each four feet of case length, with two sliding covers per four foot section. End cases shall have three sliding covers for the entire length of the case. Case-to-case connections for 8-foot and 12-foot cases include a joint cap over the edge of the frame. Frames are secured to the display case with double stick tape. The modular sliding glass covers slide on tracks incorporated in each frame.

LED lighting at the top of the center divider on double wide island cases (1G07) and at the top of the back divider on the wrap-around end cap (1G06). Provide one Eclipse EFDS Series LED linear fixture (nominal length 45-inches) on each side and for every four lineal feet of double wide island cases (1G07) and one fixture centered on every wrap-around end cap (1G06). Lumen output: 1,260 at 4000K. LED lighting shall be controlled by RMCS.

Aluminum double price bar, complete with perforated center cover and clamps for affixing advertising panels (HL display). Provide above center divider at double wide island cases (1G07) and above back divider at wrap-around end cap (1G06).

Color: All components other than safety glass shall be manufacturer’s standard black color.

Basis-of-Design Product: Hussmann, Model FWE-L with Glass Lids.

* + - * 1. 1G07 Case, Frozen Food, Wide Island, Low Temperature, Open Type, with Solid Walls and Lids:

Salient Characteristics:

Nominal Dimensions:

Length:

1G07-8: 96-3/8 inches.

1G07-12: 144-1/2 inches.

Height: 35-7/8 inches.

Depth: 80-1/2 inches.

Shelves: Epoxy coated bottom wire shelves; adjustable to at least three positions.

Designed to maintain a product temperature of -10 to 0 deg F.

Each case shall be furnished with curved modular sliding glass covers as follows:

Self-supporting curved modular glass covers that slide left to right, front-to-back.

Clear 4mm-thick tempered flat safety glass.

Aluminum frames positioned on the top of the hand rail of solid front display cases, matched to the specific dimensions required per case model. Frames are provided with modular sliding sections for each four feet of case length, with two sliding covers per four foot section. End cases shall have three sliding covers for the entire length of the case. Case-to-case connections for 8-foot and 12-foot cases include a joint cap over the edge of the frame. Frames are secured to the display case with double stick tape. The modular sliding glass covers slide on tracks incorporated in each frame.

LED lighting at the top of the center divider on double wide island cases (1G07) and at the top of the back divider on the wrap-around end cap (1G06). Provide one Eclipse EFDS Series LED linear fixture (nominal length 45-inches) on each side and for every four lineal feet of double wide island cases (1G07) and one fixture centered on every wrap-around end cap (1G06). Lumen output: 1,260 at 4000K. LED lighting shall be controlled by RMCS.

Aluminum double price bar, complete with perforated center cover and clamps for affixing advertising panels (HL display). Provide above center divider at double wide island cases (1G07) and above back divider at wrap-around end cap (1G06).

Color: All components other than safety glass shall be manufacturer’s standard black color.

Basis-of-Design Product: Hussmann, Model FW-L with Glass Lids.

* + - * 1. 1G10 Case, Frozen Food, Glass Doors, Low Temperature, Upright:

Salient Characteristics:

Nominal Dimensions:

Length:

1G10-2: 2 Dr, 62 inches (2 inch end panels).

1G10-3: 3 Dr, 92-1/2 inches (2 inch end panels).

1G10-4: 4 Dr, 122-7/8 inches (2 inch end panels).

1G10-5: 5 Dr, 153-3/8 inches (2 inch end panels).

Height: 83-1/2 inches.

Depth: 39-3/4 inches.

Door Width: 30 inches.

Upper Shelves: 22 inches deep.

Sill Height: 13-3/8 inches.

Lights: Vertical lighting assembly, one at each end and one between all doors.

Shelves: Five solid adjustable upper shelves per door section with price tag molding. One bottom epoxy coated wire rack per door section with price tag molding.

Doors: constructed per paragraph 2.10.A.26, 67 inches high with magnetic gaskets, automatic door closures, doors hinged on left side.

Designed to maintain a product temperature of -10 to 0 deg F.

Basis-of-Design Product: Hussmann, Model RLN.

* + - * 1. 1G12 Case, Ice-Cream, Frozen Foods, Frozen Juice, Glass Doors, Low Temperature, Upright:

Salient Characteristics:

Nominal Dimensions:

Length:

1G12-2: 2 Dr, 62 inches (2 inch end panels).

1G12-3: 3 Dr, 92-1/2 inches (2 inch end panels).

1G12-4: 4 Dr, 122-7/8 inches (2 inch end panels).

1G12-5: 5 Dr, 153-3/8 inches (2 inch end panels).

Height: 83-1/2 inches.

Depth: 39-3/4 inches.

Door Width: 30 inches.

Upper shelves: 22 inches deep.

Sill Height: 13-3/8 inches.

Lights: Vertical lighting assembly, one at each end and one between all doors.

Shelves: Five solid adjustable upper shelves per door section with price tag molding. One bottom epoxy coated wire rack per door section with price tag molding.

Doors: constructed per paragraph 2.10.A.26, 67 inches high with magnetic gaskets, automatic door closures, doors hinged on left side.

Designed to maintain a product temperature of -10 to 0 deg F.

Basis-of-Design Product: Hussmann, Model RLN.

* + - * 1. 1G13 Case, Frozen Juice, Glass Doors, Low Temperature, Upright:

The 1G13 case is the same as the 1G12case respectively, except that the adjustable shelves shall be five tiers of solid shelves with 3 inch product lip designed to display frozen juice.

* + - * 1. 1G24 Merchandiser, Grab-N-Go, Self-Contained, Medium Temperature, Multi-Deck, Upright:

Salient Characteristics:

Upright refrigerated merchandiser case, multi-deck, open type, medium temperature. Shall be customer self-service, grab-n-go type for home meal replacement. Case for use as an end cap or wall merchandiser.

Nominal Dimensions:

Length:

1G24-4: 48 inches (1-1/8 inch end panels).

1G24-5: 60 inches (1-1/8 inch end panels).

1G24-6: 72 inches (1-1/8 inch end panels).

1G24-8: 96 inches (1-1/8 inch end panels).

Width: 32-5/8 inches.

Height:

86-1/2 inches on 48 inch and 96 inch case lengths.

89-3/8 inches on 60 inch and 72 inch case lengths.

Sill Height: 18-3/8 inches.

Self-contained refrigeration designed to maintain a product temperature of 33 to 37 deg F with top mounted air cooled condensing unit, designed to slide out for ease of maintenance, electronic temperature control, defrost controls, and anti-condensation heaters and condensate pan.

Shelves: Deck and five rows of upper adjustable/removable white powder coated sheet metal shelves with product stop extending full length of case. Shelves can be removed and adjusted to be flat or slanted (0 to 10 degrees).

LED Lighting at canopy and shelves.

Price Tag Molding: Front edge of each shelf and deck shall be equipped with price tag molding to hold standard size price tags and labels.

Electrical requirements:

Fans and Heaters: 120 volt

Condensing Unit: 208 volt single phase

Drain Evaporator Pan: 240 volt

Solid end panel with mirror bright stainless steel on interior side of panel.

Case to be provided without requirement for floor drain to allow mobility for relocation. Seamless, non-corrosive electric condensate dissipater pan shall be included.

Place a label in the bottom of the case every 3 feet behind the front sill stating "Do not flush with water. There is no direct drain connection and the floor will be flooded."

Provide power cord.

\*\*\*Note to Designer: Requires 24 inch minimum clearance above case for proper air flow for condenser. Will not fit under typical soffit.

Basis-of Design-Product: Hussmann Model RGD-SC 3072.

* + - * 1. 1G27 Case, Frozen Food, Back To Back, Glass Doors, Low Temperature, Upright:

Salient Characteristics:

Nominal Dimensions:

Length:

1G27-3: 3 Dr, 92-1/2 inches (2 inch end panels).

1G27-4: 4 Dr, 122-7/8 inches (2 inch end panels).

1G27-5: 5 Dr, 153-3/8 inches (2 inch end panels).

Height: 83 inches.

Depth: 72-3/8 inches.

Door Width: 30 inches.

Upper Shelves: 22 inches deep.

Sill Height: 13-1/8 inches.

Vertical LED lighting assembly, one at each end and one between all doors.

Shelves: Five adjustable solid shelves per door section with and price tag molding to hold standard price and UPC tags and labels. One bottom wire rack per door section with price tag molding.

Doors: Constructed per paragraph 2.10.A.26, 67 inch high frame (65-1/2 inch door) with magnetic gaskets, automatic door closures, doors hinged on left side.

Designed to maintain a product temperature of -10 to 0 deg F.

Basis-of-Design Product: Hussmann, Model RLNI.

* + - * 1. 1G28 Case, Ice-Cream, Frozen Foods, Frozen Juice, Back To Back, Glass Doors, Low Temperature, Upright:

Salient Characteristics:

Nominal Dimensions:

Length:

1G28-3: 92-1/2 inches (2 inch end panels).

1G28-4: 122-7/8 inches (2 inch end panels).

1G28-5: 153-3/8 inches (2 inch end panels).

Height: 83 inches.

Depth: 72-3/8 inches.

Door Width: 30 inches.

Upper Shelves: 22 inches deep.

Sill Height: 13-1/8 inches.

Vertical LED lighting assembly, one at each end and one between all doors.

Shelves: Five adjustable solid shelves per door section and price tag molding to hold standard price and UPC tags and labels. One bottom wire rack per door section.

Doors: Constructed per paragraph 2.10.A.26, 67 inch high frame (65-1/2 inch door) with magnetic gaskets, automatic door closures, doors hinged on left side.

Designed to maintain a product temperature of -10 deg F.

Basis-of-Design Product: Hussmann, Model RLNI.

* + - * 1. 1G30 Case, Frozen Food, Back To Back, Glass Doors, End Cap:

Same as 1G27 with 2 end doors and 3 doors each side.

\*\*\*Note: Only available from Hussmann with 3 doors per side.\*\*\*

* + - * 1. 1G31 Case, Ice Cream, Frozen Foods, Frozen Juice, Back To Back, Glass Doors, Low Temperature, Upright, End Cap:

Same as 1G28 with 2 end doors and 3doors each side.

\*\*\*Note: Only available from Hussmann with 3 doors per side.\*\*\*

* + - * 1. 1G35 Case, Frozen Food, Intermediate Island, Dual Temperature, Remote Refrigeration, Open Type with Solid Walls and Glass Lids, and Contour End Panels:

Salient Characteristics:

Nominal Dimensions:

Length:

1G35-8: 96-3/8 inches (3-1/2 inch contoured end panels).

1G35-12: 144-1/2 inches (3-1/2 inch contoured end panels).

Height: 35-7/8 inches.

Depth: 58 inches.

Shelves: Epoxy coated bottom wire shelves; adjustable to at least three positions.

Front edges of deck equipped with price tag molding to hold standard size price tags/labels.

Designed to maintain a product temperature of -10 to 0 deg F.

Each case shall be furnished with curved modular sliding glass covers as follows:

Self-supporting curved modular glass covers that slide open and close, front-to-back.

Clear 4mm-thick tempered flat safety glass.

Aluminum frames positioned on the top of the hand rail of solid front display cases, matched to the specific dimensions required per case model. Frames are provided with modular sliding sections for each four feet of case length, with two sliding covers per four foot section. Case-to-case connections for 8-foot and 12-foot cases include a joint cap over the edge of the frame. Frames are secured to the display case with double stick tape. The modular sliding glass covers slide on tracks incorporated in each frame.

LED lighting at the top of the center divider on intermediate width island cases. Provide one Eclipse EFDS Series LED linear fixture (nominal length 45-inches) on each side and for every four lineal feet of intermediate width island cases. Lumen output: 1,260 at 4000K. LED lighting shall be controlled by RMCS.

Aluminum double price bar, complete with perforated center cover and clamps for affixing advertising panels (HL display). Provide above center divider at intermediate width island cases.

Color: All components other than safety glass shall be manufacturer’s standard black color.

Basis-of-Design Product: Hussmann, Model FI-L with Glass Lids.

* + - * 1. 1G36 Case, Frozen Foods, Wide Island, Dual Temperature, Remote Refrigeration, Open Type, with End Cap Displays, and Solid Walls with Glass Lids:

Same as 1G06 / 1G07 except with dual temperature capability.

Basis-of-Design Product: Hussman, Model FW-L and FWE-L with Glass Lids.

* + - * 1. 1G38 Merchandiser, Grab-n-Go, Remote Refrigeration, Medium Temperature, Multi-Deck, Upright:

Salient Characteristics:

Upright refrigerated merchandiser case - multi-deck, open type, medium temperature. Shall be customer self-service, grab-n-go type for home meal replacement. Case for use as an end cap or wall merchandiser.

Nominal Dimensions:

Length:

1G38-4: 48 inches (1-1/8 inch end panels).

1G38-5: 60 inches (1-1/8 inch end panels).

1G38-6: 72 inches (1-1/8 inch end panels).

1G38-8: 96 inches (1-1/8 inch end panels).

1G38-10: 120 inches (1-1/8 inch end panels).

1G38-12: 144 inches (1-1/8 inch end panels).

Depth: 31 inches.

Height: 84-5/8 inches.

Sill Height: 18-3/8 inches.

Remote refrigerated, designed to maintain a product temperature of 33 to 37 deg F.

Shelves: Deck and five rows of upper adjustable/removable white powder coated sheet metal shelves with product stop extending full length of case. Shelves can be removed and adjusted to be flat or slanted (0 to 10 degrees).

LED Lighting at canopy and shelves.

Price Tag Molding: Front edge of each shelf and deck shall be equipped with price tag molding to hold standard size price tags and labels.

Solid end panel with mirror bright stainless steel on interior side of panel.

Basis-of Design-Product: Hussmann, Model RGD-30-83.

* + - * 1. 1MXX Case, Fresh Meat, Refrigerated, Medium Temperature, Clerk Service:

Salient Characteristics:

Nominal Dimensions:

Length:

1MXX-4: 48-1/4 inches (1-1/2 inch end panels).

1MXX-6: 72-1/4 inches (1-1/2 inch end panels).

1MXX-8: 96-3/8 inches (1-1/2 inch end panels).

1MXX-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 52 inches.

Depth: 45-3/8 inches.

Sill height: 23 inches.

LED Lights on top of case for the length of the case.

LED ledge lights.

Lift up, curved tempered front glass. Glass must be lockable.

Rear service removable glass sliding doors. Lockable doors must be furnished.

Gravity / conduction coil.

A 7 inch to 10 inch deep high density polyethylene food wrapping shelf that is the full length rear of the case, duplex receptacles (120 volts) required on rear mullions for display scales and printer.

Stainless steel case top cover.

Front glass air sweep.

Stainless steel interior, bottom rack and drain pan; and bottom flushing system with timer clock.

Designed to maintain a product temperature of 28 to 34 deg F.

Black vinyl cart bumper entire length of case on customer side.

Scale Stand: Adjustable stand, 22 inches by 18 inches with 120V duplex receptacle and Cat 5 scale connections.

Basis-of-Design Product: Hussmann, Model Q3-MC Service Meat.

* + - * 1. 1M02 Case, Fresh Meat, Single Deck, Medium Temperature, Open Type:

Salient Characteristics:

Nominal Dimensions:

Length:

1M02-8: 96-3/8 inches (1-1/2 inch end panels).

1M02-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 43-1/8 inches.

Depth: 42 inches.

Sill height: 31 inches.

Designed to maintain a product temperature of 28 to 34 deg F.

Front edges of deck equipped with price tag molding to hold standard size price tags/labels.

Basis-of-Design Product: Hussmann, Model M1X-EP.

* + - * 1. 1M04 Case, Meat Or Prepackaged Deli, Multi-Deck, Medium Temperature, Open Type:

Salient Characteristics:

Nominal Dimensions:

Length:

1M04-8: 96-3/8 inches (1-1/2 inch end panels).

1M04-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 81-3/4 inches.

Depth: 42 inches.

Sill height: 23-5/8 inches.

Lighting at canopy.

Shelving: Provided with five rows of 22-inch shelves, removable, and adjustable to three positions with one row of adjustable bottom screen.

Designed to maintain a product temperature of 30 to 36 deg F.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

Provide night curtains (2.10.A.27).

Basis-of-Design Product: Hussmann, Model D5X-EP.

* + - * 1. 1M04GD Case, Medium Temperature, Glass Door, Upright, Meat or Prepackaged Deli:

Salient Characteristics:

Nominal Dimensions:

Length:

1M04GD-8: 96-3/8 inches (1-1/2 inch end panels).

1M04GD-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 81-3/4 inches.

Depth: 42 inches.

Door Width: 24 inches

Upper Shelves: 22 inches deep.

Sill Height: 19-5/8 inches (max).

Canopy Lights: Horizontal lighting fixtures, with LED lighting,

Shelves: Six levels of display composed of bottom deck and 5 rows of removable upper cantilevered adjustable shelves.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

French door style glass doors, 24 inches wide.

Designed to maintain a product temperature of 30 - 36 deg F.

Basis-of-Design Product: Hussmann, Model DD5X-LP.

* + - * 1. 1M07 Case, Meat, Multi-Deck, Medium Temperature, Open Type:

Salient Characteristics:

Nominal Dimensions:

Length:

1M07-8: 96-3/8 inches (1-1/2 inch end panels).

1M07-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 78-3/8 inches.

Depth: 42 inches.

Height of front shall be 23-5/8 inches.

Lighting at canopy.

Shelves: One row of 16 inch shelves to be placed on top row of case. Four rows of 18 inch shelves to be placed below the row of 16 inch shelves.

Designed to maintain a product temperature of 28 to 34 deg F.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

Provide night curtains (2.10.A.27).

Basis-of-Design Product: Hussmann, Model M5X-EP.

* + - * 1. 1M07-F Case, Fresh Meat or Deli, Multi-Deck, Low Profile, Medium Temperature:

Salient Characteristics:

Nominal Dimensions:

Length:

1M07-F-8: 96-3/8 inches (1-1/2 inch end panels).

1M07-F-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 48-1/2 inches.

Depth: 42 inches.

Height of front shall be 23-5/8 inches.

Shelves: Two shelves, 12 inches top and 18 inches lower adjustable shelves extending full length of case.

Lighting at canopy.

Designed to maintain a product temperature of 28 to 34 deg F.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

Curved front panels.

Plexiglas shelf stops on each shelf.

Provide night curtains (2.10.A.27).

Basis-of-Design Product: Hussmann, Model C2X-EP.

* + - * 1. 1M09 Case, Fresh Meat or Deli, Multi-Deck, Low Profile, Medium Temperature:

Salient Characteristics:

Nominal Dimensions:

Length:

1M09-6: 72-3/8 inches (1-1/2 inch end panels).

1M09-8: 96-3/8 inches (1-1/2 inch end panels).

1M09-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 55-3/4 inches.

Depth: 42 inches.

Sill height: 19-5/8 inches.

Shelves: Three adjustable shelves, ~~14~~ 12 inch top, 16 inch middle shelf, and ~~16~~ 18 inch lower shelf extending full length of case.

LED lighting at canopy.

Designed to maintain a product temperature of 28 to 34 deg F.

Front edges of shelves and deck equipped with price tag molding to hold standard size price tags/labels.

Curved front panels.

Plexiglas shelf stops on each shelf.

Provide night curtains (2.10.A.27).

Basis-of-Design Product: Hussmann, Model C2X-XLEP.

* + - * 1. 1P03 Case, Produce, Single Deck, Medium Temperature:

Salient Characteristics:

Nominal Dimensions:

Length:

1P03-8: 96-3/8 inches (1-1/2 inch end panels).

1P03-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 74inches.

Depth: 42 inches.

Sill height: 30-1/2 inches.

LED Lighting at canopy.

Provide flat front on canopy that will accommodate aftermarket signage panels.

Cases to have a single deck and a superstructure with a 30 inch slanted mirror. Mirror to be full length of case.

Drain pan shall be stainless steel or fiberglass.

Designed to maintain a product temperature of 34-38 deg F.

Front edge of deck equipped with price tag molding to hold standard size price tags/labels.

Case to have minimum of 5 each, 30 inch length by 6 inch high slotted black epoxy-coated wire product dividers per case.

Case to have 4 inch high perforated acrylic front product stop, the entire length of each shelf.

Quick disconnect fitting for water hose. Furnish one 24 foot water hose with shutoff spray nozzle for each 6 cases.

Basis-of-Design Product: Hussmann, Model P2X-EP.

* + - * 1. 1P07 Case, Produce, Pre-cut Packaged Vegetables and Juices, Upright, Refrigerated:

Salient Characteristics:

Nominal Dimensions:

Length:

1P07-8: 96-3/8 inches (1-1/2 inch end panels).

1P07-12: 144-1/2 inches (1-1/2 inch end panels).

Height: 81-3/4 inches.

Sill Height: 19-1/4 inches.

Depth: 42 inches.

Top discharge air curtain.

LED Lighting at canopy.

Provide flat front on canopy that will accommodate aftermarket signage panels.

5 rows of adjustable 22-inch deep upper shelves.

Three clear or black color acrylic product dividers per four foot section of shelf.

Three inch high wire or acrylic front product stop, the entire length of each shelf.

Price Tag Molding: On front of each shelf.

Interior of case to be black finish.

Designed to maintain a product temperature of 33 - 38 deg F.

Quick disconnect fitting for water hose. Furnish one 24 foot water hose with shutoff spray nozzle for each 6 cases.

Basis-of-Design Product: Hussmann, Model D5X -LEP.

* + - 1. REFRIGERATION PIPING AND ACCESSORIES
				1. Scope: The refrigeration piping system shall consist of HVAC and product piping systems and heat reclaim piping systems handling fluorocarbon refrigerants.
				2. Copper Tubing/Piping Classification: Copper tubing shall be type "L" hard-drawn **[ “K” (CO2) ]**. Tubing shall be dehydrated, marked "ACR", capped, sealed, and delivered to the job site in that condition. **[All high side tubing shall be either welded steel or stainless steel piping, rated for 1,200 psi MOP. (CO2) ]**
				3. Quality Assurance: Tubing delivered to the job site or found on the job site without capped ends shall be tagged and rejected from installation on this project.
				4. Accessories:

Product Standards: Refrigerant piping, valves, fittings, and accessories shall conform to the requirements of ANSI/ASHRAE Standard 15-2010, and ANSI B31.5unless otherwise specified.

Fittings: Fittings for brazed joints shall be wrought copper or forged-brass sweat fittings. Cast sweat-type fittings shall not be allowed for brazed joints. Ells shall be of long radius type. No 45 degree elbows shall be used.

Hand Valves: Refrigerant shut-off valves shall be designed for use with the refrigerant used and shall have pressure ratings compatible with system pressures encountered. Gate valves shall not be acceptable. Valves shall be all brass, handwheel-operated, diaphragm, packless-type, globe or angle valves in sizes up to and including 5/8 inch. For valves 5/8 inch and larger, ball valves designed specifically for refrigerant service shall be used.

Check Valves: Check valves shall be steel or brass body, lift or swing type suitable for refrigerant liquid or gas service.

Solenoid Vales: Solenoid valves shall be bronze, brass or steel body, packless type, with stainless-steel trim, rated for continuous-duty service, direct or pilot operated, provided with manual lift stem and designed for or use with the type of refrigerant used. Valves shall have a safe working pressure of 400 psi **[ 800 psi (CO2) ]** and a maximum operating pressure differential of at least 200 psi **[ 600 psi (CO2) ]** at 85 percent of rated voltage. Valves shall have an operating pressure differential suitable for the refrigerant used. Valves shall have adequate capacity for the installation at a pressure drop suitable for the refrigerant used. Solenoids shall have moisture proof insulation and shall be UL approved.

Electronic expansion valves (sweat fitting) shall be designed for use with the type of refrigerant used and with a pressure rating suitable for the pressure encountered. The valves shall be of the thermostatic type, diaphragm or bellows operated, with removable screens and external super heat adjustment set at the factory for 10 deg F super heat. Power elements and valve size shall be as recommended by the manufacturer for the service intended. Multi range expansion valves are not acceptable.

Piping Pit Enclosures: Piping pit enclosures shall have an aluminum frame and cover mounted within a steel structural frame. Composite liner with steel securing rods.

Basis of Design Product: Model ADL, as manufactured by Craigg Manufacturing Corporation. http://www.craigg.com/.

* + - 1. REFRIGERATION PIPING INSULATION

\*\*\*In locations where the 1% design outdoor wet bulb temperature is less than 68 deg F, A-E shall specify: suction lines operating below – 0 degrees F shall be insulated with 1 inch elastomeric pipe insulation.

* + - * 1. Refrigerant Suction Lines:

Suction lines operating above 0 deg F saturated suction temperature (SST) shall be insulated with elastomeric pipe insulation with wall thickness of 1 inch. Where the 2.5 percent design wet bulb temperature exceeds 78 deg F insulation wall thickness shall be 1.5 inch.

Suction lines operating at a 0 deg F and lower shall be insulated with elastomeric pipe insulation of 1 inch wall thickness.

Where the 2.5 percent design wet bulb temperature exceeds 75 deg F insulation wall thickness shall be 1.5 inch.

Where the 2.5 percent design wet bulb temperature exceeds 78 deg F insulation wall thickness shall be 2 inch and may be applied in two layers with only the outer layer being of the factory split self-adhesive type.

This additional insulation shall not be required in tunnels or below cases in the sales area but will be required above ceilings, in soffits above cases, and in all non-air conditioned spaces. Wall thickness in these areas shall be 1 inch.

* + - * 1. Refrigerant Liquid Lines: Liquid lines shall be insulated with elastomeric pipe insulation with 1/2 inch wall thickness. Liquid lines in refrigerated cases, and walk-in boxes do not require insulation.
				2. Drains on Unit Coolers in Refrigerated Rooms: In refrigerated rooms that operate at less than 32 deg F, drains shall be insulated with elastomeric pipe insulation with 1/2 inch wall thickness.
				3. Elastomeric Pipe Insulation Standard: Elastomeric flexible pipe insulation. Flame-spread rating not greater than 25 and a smoke-developed rating not greater than 50. Insulation shall have a K factor of .28 or less at 75 deg F mean temperature. Insulation shall have a water vapor permeability of .10 or less and a water absorption by volume of 1 percent or less. Insulation shall be assembled with all-temperature adhesive (Armstrong 520 or equivalent). Splitting of joints of insulation is not allowed except for the outer layer of two layer pipe insulation where the total thickness exceeds 1 inch. Butt joints of insulation shall not be sealed until pressure tests and leak tests are completed. Insulation installed outdoors and subject to water damage shall be provided with an additional (0.016 inch aluminum jacket with lock seam longitudinal joint and stainless steel "Bandit" straps for butted joints as required for a water-tight installation.
				4. Refrigerant Hot Gas Lines: Hot gas lines from the compressor systems to heat recovery coils shall be insulated with 1 inch of fiberglass. Outlet lines on heat recovery coils do not require insulation. Fiberglass insulation shall be installed after pressure and leak tests are completed. Refrigerant lines leaving heat reclaim coils does not require insulation.
				5. Fiberglass Insulation Standard: Fiberglass insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire rating of 25 and smoke hazard rating of 50 as tested by procedure ASTM E-84, NFPA 225 or UL 723. Insulation material should have a maximum K factor of 0.28 or less at 75 deg F mean temperature with factory-applied fire retardant vapor barrier jacket. Jacketing materials installed in exposed locations (mechanical equipment rooms, exposed in finished areas, etc.) shall be Owens-Corning ASJ or pre-sized glass cloth, neither requiring painting but suitable or direct application of finish without surface preparation. Jackets furnished for installation in concealed locations (in chases, above ceiling, etc. may be ASJ or FRJ. ASJ and FRJ jackets shall have self-sealing joints. Insulation shall be provided with a vapor barrier having vapor permeability rating suitable for the service intended, and joints shall be properly sealed.
				6. Insulation installed outdoors shall be provided with an additional 0.016 inch aluminum jacket with lock seam longitudinal joint and stainless steel "Bandit" straps for butted joints as required for a water-tight installation.
1. EXECUTION
	* + 1. QUALITY ASSURANCE
				1. Manufacturer Responsibility: The manufacturer of the refrigerated display cases or the compressor system shall:

Furnish the refrigeration compressor units, condensers, heat recovery coils, heat reclaim hot water heaters, diverting valves for heat recovery, unit coolers, display cases and RMCS.

Coordination: Coordinate the installation of the total refrigeration system.

Submittal: Shall review the construction project Electrical Drawings and Specifications and provide electrical power and control wiring and refrigeration piping not specifically provided for in the Drawings and Specifications.

Factory Testing: Shall factory mount, install, and test the control system for each compressor system.

Interim Inspections/Reports: An Employee of the Display Case Manufacturer, not of the dealer or installing contractor, shall conduct inspections of the installation of the product refrigeration systems every 60 days beginning upon delivery of the first piece of refrigeration equipment. Within 5 days after each inspection by the manufacturer, an inspection report shall be submitted to the Contracting Officer. The inspection report shall detail whether or not the product refrigeration equipment is being installed in accordance with the Manufacturer's recommendations. All items of non-compliance shall be noted on this report. failure to provide these reports in a timely manner may result in the Contracting Officer's attainment of a manufacturer inspection visit and subsequent deduction of payment from the Contractor. The representative shall have been employed by the same manufacturer's which furnished the display cases, for a minimum of two years and shall have a minimum of 5 years journeyman refrigeration "hands on" experience.

Piping Certifications: A letter signed by the manufacturer of the display cases certifying the piping is installed in accordance with the manufacturer's requirements shall be submitted to the contracting officer prior to charging the systems with refrigerant. All items of non-compliance shall be noted in this report.

Startup: Display case manufacturer's technical representative, not of the dealer or installing contractor, shall be provided to "fine tune" and commission the system prior to conducting the five day performance test. For projects where the equipment is installed in phases, the manufacturer’s representative shall inspect each major phase of refrigeration work.

Final Certification: A letter signed by the manufacturer of the display cases certifying the systems are installed in accordance with the manufacturer's requirements shall be submitted to the contracting officer prior to final acceptance of the systems. All items of non-compliance shall be noted in this letter.

The contractor installing the equipment must be an installer who is approved by the display case manufacturer.

* + - * 1. Contractor Experience: The installer shall have successfully completed not less than three installations of equal or greater size and complexity within the past three years.
				2. Mechanic's Experience: The installing contractor or subcontractor shall employ EPA certified refrigeration mechanics to install the system. The mechanics installing the system shall have a minimum of three years of experience installing supermarket refrigeration systems. As part of the submittal, the installing contractor shall furnish resumes and EPA certification of the key refrigeration mechanics and field superintendent responsible for installation of the refrigeration piping and components.
				3. Testing: Provide water tightness test(s) and pressure test(s) and performance test(s) per paragraph 3.2, prior to stocking fixtures.
			1. INSTALLATION, GENERAL
				1. Product Delivery/Storage: The Contractor shall coordinate delivery of materials and equipment with the construction schedule. Materials and equipment stored on site must be protected from damage. Display cases, unit coolers, and compressor racks must be stored in a covered storage area and be kept clean and dry until installed in the commissary.
				2. System Identification: Compressor systems, unit coolers, condensers, **[ gas coolers (CO2) ]** heat reclaim coils, and refrigerated display cases shall have a permanent metal or laminated plastic identification tag to identify compressor system, refrigerant circuit numbers, and alarm probe. The identification scheme must be coordinated with and match the RMCS system identification scheme. Letters on tag shall be 1/4 inch to 3/8 inch in height. Mechanically fasten the tag.
				3. Supports/Penetrations: Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided and detailed. Necessary supports shall be provided for equipment, appurtenances and pipe. These include frames or supports for compressors, condensers, evaporators, and other similar items requiring supports.
				4. Filter and Oil Change: Upon completion of the performance test, the Contractor shall perform the following on each refrigeration system and show the removed filter-drier to the Government Authorized Technical Representative:

Change liquid line filter-drier cores.

Change suction filter-drier cores.

Change oil filter.

* + - * 1. Refrigerant Charge: Provide refrigerant charge to maintain not less than 30 percent receiver level with heat reclaim "ON".
				2. Hurricane strapping is required for systems installed outside at any location with 120 MPH design wind speed or higher.
			1. ELECTRICAL INSTALLATION AND DESIGN
				1. Comply with Division 26, especially Section Raceways and Boxes which limits the number of conductors per conduit.
				2. Scope: Provide all wiring for product refrigeration system including wiring necessary for operation of system which is not specifically shown on drawings. All equipment shall have disconnect switches.
				3. Design Scope: In accordance with the Drawings and this Section of the Specification, the Contractor shall have the electrical power wiring for the refrigeration system designed by a professional electrical engineer under the supervision of the display case manufacturer. A PE shall seal the electrical drawings.
				4. Material: Electric wiring shall be copper and installed in conduit.
				5. Grounding: Provide a grounding conductor in all branch circuit conduits. Do not use conduit as the only means of grounding for the refrigeration electrical system.
				6. General: Wire sizes shall be in accordance with NEC Latest Edition.
				7. Conductor Temperature Design Standard: All power wiring in the refrigeration compressor rooms shall be designed for 9 deg F higher than the 1 percent ambient summer design temperature.
				8. Transformer Temperature Design Standard: All transformers provided for the refrigeration shall have copper windings and shall be rated for 144 deg F temperature rise.
				9. Breaker Ir Standard: Minimum interrupting rating (Ir, RMS) for refrigeration electrical feeders and branch circuits circuit breakers shall be as follows:
				10. Circuit Breaker:

Voltage Interrupting Rating

\*\*\*A-E shall edit to remove Main Transformer Ir ratings as applicable to project.

480V Main Building Transformer

 500 KVA, Ir = 12,000

480V Main Building Transformer

 750 KVA, Ir = 18,000

480V Main Building Transformer

 1000 KVA, Ir = 24,000

480V Main Building Transformer

 1500 KVA, Ir = 35,000

480V Main Building Transformer

 2000 KVA, Ir = 48,000

208V Refrigeration Power Transformer

 225 KVA, Ir = 15,000

208V Refrigeration Power Transformer

 300 KVA, Ir = 20,000

* + - * 1. Defrost Feeder Design Loading: The minimum size of feeder for 208V defrost panels shall be as follows:

On multiplex compressor systems with 5 or less refrigeration circuits the feeder shall be sized for the following combined loads: largest defrost load, control circuit on compressor system, and unit cooler fan motor loads.

On multiplex compressor systems with more than 5 refrigeration circuits the feeder shall be sized for the following combined loads: largest defrost load plus one other defrost load, control circuit on compressor system, and unit cooler fan motor loads.

* + - * 1. Penetrations: Seal electrical penetrations in walk-in boxes and display cases with silicon sealant inside and outside of conduits. See Division 13 Section Cold Storage Rooms and Electrical details.
			1. REFRIGERATION PIPING INSTALLATION AND DESIGN
				1. Brazing Material: Copper joints shall be brazed with AWS BCUP5 (14.5-15.5 percent Silver) Silver Braze and copper to brass or steel shall be brazed with AWS BAG4 (40 percent Silver).
				2. Purging: During brazing operations, the tubing and fitting being brazed shall have a continuous purge of dry nitrogen at a rate which will preclude oxidation of the tubing and fitting. Tubing and fittings shall be properly cleaned prior to brazing. Copper **[ steel/stainless steel (CO2) ]** tubing joints that are assembled on the job site shall be assembled with fittings.
				3. Cutting: Joints in copper **[ steel/stainless steel (CO2) ]** tubing shall be cut square with tubing cutter, ends shall be reamed, and fillings and dust removed from interior of pipe
				4. Piping Design: Refrigeration piping shall be sized by the refrigeration equipment manufacturer and shall be based on the following:

Pressure Drop Liquid and Discharge: Pressure drop in the liquid and discharge line shall not be greater than 3 psi.

Pressure Drop Suction Line: Pressure drop in the suction line shall not be greater than 2 psi.

Velocity Suction line: Minimum gas velocity for horizontal suction line shall be 700 FPM and 1500 FPM for vertical suction line.

Maximum velocity for liquid line from condenser to receiver line shall be 100 FPM.

Traps/Risers: Every suction riser shall have an oil trap sized the same as the horizontal suction line. The oil trap shall be long radius wrought copper manufactured for use as a trap. Traps constructed of several 90 degree elbows are not permitted. For risers exceeding 16 feet a second trap shall be installed at the mid-point of the riser. Suction and discharge horizontal lines shall be continuously pitched a minimum of 1/2 inch per 10 feet in the direction of flow.

The first three support points from the compressor racks of each piping circuit shall have hydrazorb or equal clamps securing both suction and liquid lines to trapeze hangers with other circuits. See DeCA detail "clamp assembly for uninsulated refrigeration line or electrical conduit".

Condenser Piping**[ Gas Cooler (CO2): ]** : 50 percent/ 50 percent split:

Hot Gas Lines: Parallel and equivalent, hot gas lines shall be installed to accommodate condensers which are indicated for 50 percent / 50 percent condenser **[ Gas Cooler (CO2) ]** split. See this Section and or contract drawings.

Liquid Lines: Parallel and equivalent, liquid lines shall be installed to accommodate condensers which are indicated for 50 percent / 50 percent condenser **[ Gas Cooler (CO2) ]** split. See this Section and or contact drawings.

Provide risers, traps, offsets, and drops as required to coordinate with the building structure and the work of other trades.

* + - * 1. System Cleanliness: Pipes, strainers, and valves shall be cleaned free of scale and thoroughly flushed of foreign matter. Strainers and valves shall be thoroughly cleaned. The interior and exterior (tubes and fins) of air-cooled condensers, evaporative condensers, unit coolers, and display cases shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust. Equipment shall be wiped clean, with oil, dust, dirt, and-or paint spots removed. It shall be the responsibility of the Contractor to maintain the system in this clean condition until final acceptance.
				2. Copper Piping/Tubing **[ steel/stainless steel (CO2) ]**: Refrigeration tubing/piping delivered to the job site or found on the job site without capped ends, shall be tagged and rejected from installation on this project.
				3. Fitting: Pipes shall be cut accurately to measurements established at the job site and worked into place without springing or forcing, and properly clearing windows, doors, and other openings. Pipes shall be installed to permit free expansions and contraction without damage to joints or hangers. Changes in direction shall be made with fittings. Bent pipe showing kinks, wrinkles, flattening or other malformations will not be accepted. Open ends of pipes or equipment shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system.
				4. Isolation Valves: Hand valves shall be installed on each side of each piece of equipment such as compressors, heat recovery coils, hot water heater, heat exchangers, condensers, receivers, and other similar items, and at other points indicated or required for maintenance, isolation, charging, or sectionalizing purposes. Additional valves necessary for safe and proper operation of the refrigeration system shall be included in the installation. Valves are not required on the outlet of evaporators in cases and unit coolers.
				5. Hangers: Pipe supports and hangers shall conform to the requirements of the Specifications. Hangers shall be located within 3 feet of the ends of each run out, not over 1 foot from each change of direction, and at intervals indicated on the Drawings in the table entitled "Pipe Support Spacing for Refrigerant Piping."
				6. Piping Pit Enclosure: Install according to manufacturer’s instructions.
				7. **[ Circuit Isolation Valves: Ball valves shall be installed on the supply and return lines of each refrigeration circuit in the building. Provide a check valve bypass assembly around each ball valve to allow the CO2 to escape from the circuit back to the system, preventing a high pressure buildup during isolation. (CO2) ].**
			1. UNIT COOLER INSTALLATION
				1. Drains:

Union: Unit cooler drains shall be piped to be easily disconnected and to allow the drain pan to be easily dropped for service.

Piping material shall be type L or M hard-drawn copper.

Traps: Traps are required on unit cooler condensate drains where the drains are extended to a floor drain outside the room. Drains for unit coolers in frozen food and carcass rooms storage shall be trapped outside of the room.

Heat tape: Heat tape and 1/2 inch unicellular plastic insulation is required on condensate drains in rooms where temperature is maintained at 32 deg F or lower. Heat tape shall be the type that regulates its own heat output as its temperature changes (FreezGard or equivalent). Avoid piping drain lines above doorways. Maximum length of a drain line shall be 50 feet.

Heat Exchanger: Provide a heat exchanger for each unit cooler.

Valves: Unit coolers shall have a liquid line shutoff valve (sweat type). Provide Schrader type valve with cap on suction outlet of unit cooler. Provide EEV (sweat fitting) for each unit cooler, properly sized and designed for use with the type of refrigerant indicated.

See unit cooler mounting detail.

* + - 1. DISPLAY CASE INSTALLATION
				1. Install in accordance with the manufacturer's recommendations and supervision as specified.
				2. Valves: Each refrigerated case having a remote compressor system shall have a liquid line hand shutoff valve (solder type).
				3. Heat Exchanger: Provide a heat exchanger in each display case that is not served by a subcooled circuit.
				4. Shims: Shim cases level using galvanized steel shims.
				5. Sensors: Probes for the alarm and monitoring system shall be pre-wired at the factory. Mount probes as recommended by the manufacturer.
				6. Case Controllers: Each case shall have a case controller installed and pre-wired to the maximum extent possible at the factory. Refer to Section 23 09 16, part 3, section 3 – Case Control Strategy for the points needing to be controlled and monitored.
				7. Valves: Each case shall have a factory installed pulse width modulated EEV (electronic stepper expansion valves) control valve, pre-wired to the case controller.
				8. Provide a remote case display to be factory mounted in the facia of the display case. These are not to be provided for coffin cases. Remote displays shall:

Show the current discharge temperature of the case.

Show if the case is in defrost or not.

Allow a service technician to put the case into defrost.

* + - * 1. Close-off Panels: Provide close-off panels as necessary. Seal the top and sides of the display cases. Use stainless steel or other visually appealing material for closure panels in visible locations as described in Division 05 Metal Fabrications, and use perforated metal panels where not visible to Customer view.
				2. Condensate Piping: Case drain piping shall be sized as recommended by the case manufacturer. Drains shall be accessible for ease of maintenance. Except for seafood and rear roll-in dairy case(s), drain pipe may be schedule 40 PVC or type M hard-drawn copper. On seafood and roll-in dairy cases, use type M or L hard-drawn copper.

Accessible: Drains shall be accessible for ease of maintenance.

* + - * 1. Condensate Drain Strainer: Provide a 1/4 inch mesh stainless steel strainer inside the case at each drain. Secure strainer to drain.
				2. Stat Location: When display case thermostats are required, install so that set-point adjustments can be made without unloading or removing panels from the cases.
				3. Partitions: Provide and install a plexiglass partition between display cases with electric defrost which are connected to different refrigeration circuits. Partitions are to match interior of case. Seal the edge joints.
				4. Defrost requirements will be as indicated on Drawings.
				5. Anti-Condensate Fans: Where back to back display cases occur without floor level return air pulled from under the cases; provide ventilation fans to circulate store air through this area.
				6. Produce Water Connection: Provide quick connect domestic cold water connection: Provide and install quick connections for spraying water on the produce. Provide connection in every 1P02, 1P03 and 1P07 produce case.
			1. TESTING
				1. Entire System: Upon completion of each refrigeration system, and at a time designated by the Contracting Officer, refrigerant piping fabricated at the job site shall be pressure-tested for leaks and the entire system shall be tested as hereinafter specified. The tests shall be conducted in the presence of the Government Authorized Technical Representative. The Contractor shall furnish instruments, test equipment, and personnel who are required for the tests.
				2. Piping:

Pressure Test: After components of the refrigerant system have been installed and the piping connected, the total product refrigeration system shall be subjected to a pneumatic test. The pneumatic testing shall be done by charging system with a sufficient amount of anhydrous carbon dioxide or dry nitrogen to bring the pressure to 300 psi for high side and 150 psi for low side. The system shall be proven tight and free of leaks by testing joints with a halide or electronic leak detector and by allowing the leak test pressure to remain on the system for 12 hours with no drop in pressure. Correction of .3 psi will be allowed for each degree change in the initial and final temperature of the surrounding air, plus for an increase and minus for a decrease.

Evacuation Test: After the foregoing tests have been satisfactorily completed and the pressure relieved, the system shall be evacuated to an absolute pressure of 500 microns. During evacuation of the system the ambient temperature shall be higher than 34 deg F. No more than one system shall be evacuated at one time by one vacuum pump. When a vacuum of 500 microns is obtained, close off vacuum pump for 30 minutes and observe the magnitude and rate of pressure rise. If pressure continues to rise, check the system for leaks, repair them, and repeat the evacuation procedure. If pressure rises to a point and holds, but rises above 1000 microns, repeat the evacuation and close off procedure until the rise is small enough to indicate that the system is dry. The Contractor shall maintain records of test pressures and vacuum reading on each system and shall indicate length of time test pressures and vacuums were maintained. This record shall be submitted to the Contracting Officer at the completion of the pressure and leak tests.

Electronic Leak Test: Upon completion of the evacuation test, the vacuum shall be broken by completely charging with dry refrigerant for which the system is designed and shall be subjected to the performance tests and halide torch or electronic leak-detector tests herein specified. Upon satisfactory completion of the tests, charge the systems with adequate refrigerant to maintain a minimum of 20 percent receiver capacity reserve during all operating conditions including simultaneous heat reclaim and condenser flood back during cold weather operation. Loss of refrigerant during the warranty period shall be guaranteed and refrigerant required shall be Contractor-furnished.

* + - * 1. Case Water Tightness Test: Test the water tightness of all display cases joints and refrigeration line penetrations with a hose stream of water. Conduct this test prior to cases start up and in the presence of the Government Authorized Technical Representative. Provide written copy of test witnessed by Government Authorized Technical Representative prior to turning cases over to government.
				2. Performance Test: After the pressure tests have been completed, systems are operational, and before the total product refrigeration system is accepted, performance tests to demonstrate the capacity specified and general operating characteristics of equipment shall be conducted in the presence of the Government Authorized Technical Representative, by a competent, experienced engineer from the display case manufacturer who will attest the reliability of the results. The operational test shall cover a period of not less than 5 days for each system and shall demonstrate that the entire system is functioning in accordance with the Drawings and Specifications. Corrections and adjustments shall be made as necessary to produce specified conditions. The Contractor shall assure full responsibility for satisfactory operation of the integrated system. Typed, tabulated data taken during the performance tests that indicate that the system will produce the required capacity, shall be provided. Performance tests shall include the following specific information in the report and conclusions regarding the adequacy of the system:

Time, dates, and duration of test.

Dry-bulb temperatures maintained inside each of the refrigerated rooms and display cases during every hour of the test. The digital display on the refrigeration monitoring system shall be used to determine these temperatures.

Outside and sales area dry-bulb and wet-bulb conditions every 6 hours as determined with a sling psychrometer or with refrigeration monitoring system.

Compressor suction and discharge pressures taken every hour with the compressor in operation; compressor model and manufacturer, and type of refrigerant employed.

The Contractor shall furnish instruments, test equipment, and test personnel required for the tests. Four copies of the test report shall be submitted to the Contracting Officer.

* + - 1. PHASE COMPLETION/ACCEPTANCE
				1. Prior to phase completion and government usage of any piece of new refrigeration equipment, the following shall be accomplished:

Temperatures Maintained: Equipment shall be maintaining contract specified control.

Certification of Installation Received: Certification of proper installation of that piece of equipment shall have been received by the government, from the Display Case Manufacturer (see paragraph 1.3).

Test Report: Provide written copies of witnessed water tightness tests and pressure tests, for the equipment being turned over for government use.

Interim Inspection Reports: Inspection reports from the Display Case Manufacturer shall have been received by the government for that phase of equipment. (See Quality Assurance this Section.)

* + - 1. PREFINAL INSPECTION
				1. Prior to prefinal inspection, the following shall be accomplished:

Temperatures Maintained: All equipment shall be maintaining contract specified control.

O&M Info Received: All O&M information shall have been received by the government.

Warranty Received: Warranty letters from the RMCS and Display case manufacturers shall have been received by the government.

Test Reports: Provide written copies of witnessed water tightness tests, and pressure tests. Provide these prior to turning over cases for use.

Certification of Refrigeration System Installation Received: Certification of installation letter from the Display Case Manufacturer shall have been received by the government (see Quality Assurance this Section).

Certification of RMCS System Installation Received: Certification of installation letter from the RMCS manufacturer has been received by the government. (See Division 23 Section Refrigeration Monitoring and Control System (RMCS).)

Interim Inspection Reports: Inspection reports from the Display Case Manufacturer shall have been received by the government for that phase of equipment. (See Quality Assurance this Section.)

Pre-Functional Checklists: All equipment information must be recorded regarding start-up of equipment.

Functional Checklists: All equipment information must be recorded regarding fine tuning of operation.

Completion of Commissioning Checklists, located in specification section 23 09 16.

* + - 1. SPARE PARTS REQUIREMENTS
				1. The Contractor shall provide the following for all projects:

Spare adiabatic condenser pads (1 complete set per unit installed)

* + - 1. OPERATING AND MAINTENANCE INSTRUCTIONS
				1. Distribution:

Upload electronic O & M manuals and CAD Drawings to FACTS Document for the Project.

Provide one printed copy to the Contracting Officer Technical Representative (to be forwarded to commissary).

* + - * 1. Contents: Each set shall have the following contents.

CD Cover: The following identification shall be inscribed on the covers: "OPERATING AND MAINTENANCE INSTRUCTIONS," the location of the building, the name of the installer, and the contract number The instructions shall include, but shall not be limited to, the following:

All documentation on CD.

CAD drawings of system layout showing equipment locations on the floor plan, piping, valves, and controls. Provide one printed copy and CD-ROM for local store use.

Approved wiring and control diagrams with data to explain the detailed operation and control of each component. Include interface and connection to the refrigeration monitoring control system (RMCS).

In each set of instructions provide a copy of refrigeration system drawings. Drawings shall include refrigeration schedules, refrigeration circuit layout, and refrigeration electrical wiring.

Operating and maintenance (including lubrication) instructions for each piece of equipment.

Display case manufacturer's bulletins, catalogue cuts and descriptive data, installation and operation data.

Parts lists and recommended spare parts.

Warranty certificates for compressors, display cases, etc., including procedures for getting warranty items replaced.

Approved pressure control and temperature settings, refrigeration schedule and refrigeration circuit layout drawings of the entire system and layout drawings on RMCS, framed under laminated plastic, shall be posted, in the Refrigeration Equipment Room where directed by the Contracting Officer. Drawings shall be fixed so that they will not fade. The framed drawings shall be posted before acceptance testing of the systems. Each set shall be in bound notebooks.

* + - 1. TRAINING OF MAINTENANCE PERSONNEL
				1. Training of DeCA's contracted maintenance personnel shall be conducted by a case manufacturer’s employee, not an employee of the dealer or contractor, within 30 days and not more than 45 days after final acceptance of the system. The instruction (8 hrs) shall be conducted at the commissary by the display case manufacturer. Instruction shall be given to personnel who will be responsible for maintenance and operation of the refrigeration system after the contractor completes the contract. Coordinate this meeting in advance with DeCA/LEEF, Lackland AFB, TX to schedule attendance by contracted maintenance personnel. A written list of personnel attending instruction shall be provided by the Contractor to the Contracting Officer.
			2. FINAL ACCEPTANCE
				1. Prior to final acceptance, the following shall be accomplished:

Temperatures Maintained: All equipment shall be maintaining contract specified control.

Punch List Complete: All pre final and final punch list items shall have been corrected by the contractor and their correction approved by DeCA/LEED Lackland AFB TX.

O&M Info Received: All O&M information shall have been received by the government.

Warranty Received: Warranty letters from the RMCS and Display case manufacturers shall have been received by the government.

Certification of Installation Received: Certification of installation letters from the Display Case Manufacturers shall have been received by the government. (See paragraph 3.1.)

Test Reports: Provide written copies of witnessed water tightness tests, and pressure tests.

Training: Training of Maintenance Personnel has been completed.

* + - 1. WARRANTY GUARANTEES AND SERVICE
				1. The manufacturer shall guarantee that the equipment furnished shall operate without excessive noise or vibration; deliver the specified capacities indicated in the schedule and nameplate ratings without overloading; and shall satisfactorily operate for a period of 1 year from the date of final acceptance of the units by the Contracting Officer.
				2. Work and equipment shall be guaranteed by the installing contractor to be free from defects in the materials or workmanship for a period of one year from date of final acceptance of the total construction project by the Contracting Officer. The refrigeration systems shall be guaranteed to perform satisfactorily for 1 year from date of final acceptance of the total construction project by the Contracting Officer. Satisfactory performance shall mean that the refrigerated cases and insulated cold storage rooms shall maintain the design discharge air temperature while operating at design conditions. Design conditions and temperatures shall be based on ASHRAE Standard No. 72-83.
				3. Emergency Repair Warranty: In addition to the warranty of construction, the following repair service is a part of the specifications and shall be binding on the installing contractor:

The manufacturer of the equipment shall guarantee that the equipment shall operate without failure for the periods indicated below beginning on the date of final acceptance of the total construction contract by the contracting officer.

First 90 Days: During the first 90 days of the warranty, the Manufacturer shall provide 24 hours a day, 7 days per week (including holidays), service to the Commissary. A technician shall arrive at the Commissary within 2 hours of receipt of a telephone call for warranty service. All parts and labor shall be provided by the Manufacturer at no cost to the government during this period.

91 to 365 Day: During the 91st day through the 365 day of the warranty, the Manufacturer shall provide free exchange of parts within 24 hours of notification. Shipping costs shall be paid by the Manufacturer.

* + - 1. REFRIGERANT HANDLING AND RECOVERY
				1. General: All Work shall be accomplished in accordance with current regulatory requirements established by the Environmental Protection Agency, including final regulations to implement the Clean Air Act.
				2. Recover all refrigerant in accord with all State, Local, and Federal regulations regarding the recover, handling, and storage of refrigerants.
				3. For Contractor responsibilities, ownership requirements of refrigerant and log book and record keeping procedures see Division 01 Section Environmental Procedures for Refrigerants.

END OF SECTION