

SECTION 11 41 46 - EMS CONTROLS INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. General:

1. This Section specifies installation of the controls for the refrigeration and building systems furnished by the Kroger Company referred to as the Owner.
2. This Section includes various store type installations. Some of the items specified in this Section will not be used on the Project. Refer to Drawings for items included in the Project.
3. The Installer is responsible for supervising their own work and meet dates shown on the installation schedule.

B. Section includes:

1. All labor, material and equipment specified in this Section and on the Drawings necessary for a complete and working installation of the controls for the Owner's refrigeration and building systems.
2. Installation of the Owner furnished items shown on the Drawings including, but not limited to the following:
 - a. Refrigeration Controls:
 - a) VFDs.
 - b) VFD bypass assemblies.
 - c) VFD filters/reactors, chokes.
 - d) Sensors and transducers.
 - e) IO boards, transformers and enclosures.
 - f) Necessary refrigeration controllers. Whole store refrigerant leak detection systems if required.
 - b. EMS/Building Controls:
 - a) HVAC controllers.
 - b) Building controller.
 - c) Building I/O board panel.
 - d) Lighting I/O panel.
 - e) Anti-Sweat panels.
 - f) I/O boards, transformers and enclosures.
 - g) Temperature sensors, sun shield, humidistats, photocells and tamper sensors.
3. Installation of Installer supplied items including, but not limited to the following:
 - 1) Installer supplied Refrigeration and EMS/Building equipment.
 - 2) Wiring from I/O boards to sensors.
 - 3) Wiring from I/O boards to VFDs, contactors and valves.
 - 4) Networking of I/O boards to refrigeration and HVAC controllers.

- 5) Networking Refrigeration and HVAC controllers to Kroger WAN.
- 6) Programming all controllers per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.
- 7) Termination of wires to and from I/O boards and sensors.
- 8) Verification of sensor, relay and alarm function.
- 9) Sensor Calibration.
- 10) Controls installer supplied refrigeration controls items:
 - a) Wire.
 - b) Conduit / connectors.
 - c) Extension box for timer switches (if necessary).
 - d) Mounting hardware.
 - e) Miscellaneous parts (wire nuts, electrical tape, conduit fittings, labels).

- C. Modifications and additions to this Section, if required, are indicated in Section 11 41 46 - "Supplementary Refrigeration Controls Installation." If Section 11 41 46 - "Supplementary Refrigeration Controls Installation" is not included in this Project Manual, no modifications and additions to this Section are indicated. Where any portion of this Section is modified or deleted by Section 11 41 46 - "Supplementary Refrigeration Controls Installation," the unaltered portions shall remain in effect.

1.2 REFERENCES

A. Definitions

1. Certain terms and words used throughout Section shall be defined as follows:
 - a. **Owner:** The person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Owner" means the Owner or the Owner's Representative.
 - b. **Contractor:** The General Contractor with overall responsibility to build a complete store, on schedule, ready for operation as a complete food store.
 - c. **Installer:** The entity identified in this Section responsible for but not limited to material and installation of the controls for the refrigeration system, as identified in this Section.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Report to Owner any defaults in work furnished and installed by others that causes conditions unsuitable for Installer's Work. Failure to inspect and report unsuitable conditions shall constitute acceptance of work furnished and installed by others as fit and proper for coordination with the Installer's work.
- B. Cooperation with Other Trades: Cooperate with other installers doing work on the Project to prevent any conflict that would require moving or changing any refrigerant lines, devices, or other equipment, or require other installers to relocate devices and piping when installed according to plans and specifications.
 1. Where interference exists, notify Owner before proceeding with installation.
- C. Work Schedules

1. Typical work schedule shall consist of five 8-hour workdays ending no earlier than 3:00 p.m. local time at the store or in shifts as required in the Phase Plan or Project Schedule.
 - a. For non-local Installers, as approved by the Owner, work may be conducted in four 10-hour days provided the work day does not end prior to 3:00 p.m. local time.
2. Work Restrictions: For remodels, pre-piping of systems that require blocking a shopping pattern must be done between the hours of 10 P.M. and 7 A.M., unless receiving prior approval of the Owner.

1.4 SUBMITTALS

- A. The Owner will provide the following submittals for Owner supplied items for the refrigeration controls installer's information upon request:
 1. Product Data: For each item and accessory supplied by Owner.
 2. Shop Drawings: For special components and installations not detailed in manufacturer's product data.
- B. Closeout Submittals
 1. Operation and Maintenance Data: For equipment furnished and installed by Installer and equipment furnished by Owner to include installation, service, and operations manuals and instructions.
 - a. Collect manuals for equipment installed in this Section and place in a three ring binder. Deliver to the Owner's store manager upon completion of the Work. Refer to General Conditions for additional requirements.
 - b. The Owner will supply the Installer with receiver copies of all equipment and fixture purchase orders to include in Operation and Maintenance Manual.
 2. Record Drawings: As-built drawings showing the location of refrigeration controls.

1.5 QUALITY ASSURANCE

- A. Work, materials, and equipment shall comply with rules and regulations of authorities having jurisdiction. Continually monitor field installation for code compliance and workmanship quality. Installation shall comply with all manufacturers' recommendations.
- B. Maintain a set of Contract Documents easily accessible within the building for Owner to review and verify any discrepancies.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of other construction by field measurements before beginning Work.
- B. Inspect all equipment with respect to controls circuitry and report at once and confirm in writing any discrepancies, variances, or defects to the Contractor and Owner.\

1.7 DELIVERY, STORAGE, AND HANDLING

- A. For remodels, do not store material in the sales area. Material stored in the back room must be out of the way of the Owner's operations.

1.8 WARRANTY

- A. Installer's Warranty: Standard form in which Installer agrees to repair or replace any component that does not comply with requirements or that deteriorates or malfunctions as a result of improper installation by the Installer within specified warranty period.
 - 1. Warranty Period: 90 days from date of store Grand Opening provided installation is accepted and approved as completed in compliance with the Contract Documents by the Owner.
 - 2. Warranty Retainage: Until the end of the warranty period, 5 percent of the contract amount due the Installer will be held as a retainage unless a different retainage percentage is required by the Authority Having Jurisdiction.
 - 3. Warranty Service: During the warranty period, regardless if the service call is due to failure of equipment or failure of the installation, the Installer shall enter the service call with Service Hub, the Owner's electronic service call system. Submit service reports to the Owner at the end of the warranty period.
 - a. As part of the Installer's warranty service, the Installer shall make arrangements to have a service technician present at the store for the Grand Opening day to correct problems or make adjustments designated by the Owner, working a minimum of four hours, commencing two hours before store opening.
- B. Refer Division 00 Section "General Conditions" for general warranty information.

PART 2 - PRODUCTS

2.1 OWNER FURNISHED PRODUCTS

- A. Receive, handle, store, and protect materials, equipment, fixtures or supplies delivered to the site by the Owner for installation under this Contract. Schedule and coordinate deliveries.

2.2 EMS CONTROLS INSTALLER FURNISHED PRODUCTS

- A. Provide items required for installation that are not supplied by the Owner, including but not limited to:
 - 1. Wire.
 - 2. Conduit / connectors.
 - 3. Extension boxes.
 - 4. Mounting hardware.
 - 5. Control voltage transformers for contactor control.
 - 6. Miscellaneous parts (wire nuts, electrical tape, conduit fittings, labels, etc.).
 - 7. Any additional parts or materials required for a complete system to Owner's specifications.

- B. Unless otherwise specified, all materials and equipment items shall be new. All materials used in the Project shall be equal to approved samples in every respect. When required by the Owner, the refrigeration controls installer shall provide certificates of conformance for materials specified.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of refrigeration controls.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: For stores remaining open during construction, perform work in a manner as to provide a minimum of annoyance and interference to Owner's operations, its customers and vendors.
 - 1. No work shall be done by the Installer that will void a manufacturer's warranty.
 - 2. If during the course of the Work any piece of equipment under the scope of this Work is damaged (the damage occurring after arrival), the Installer shall notify the Owner immediately, listing the model number, serial number and the extent of the damage. The Installer will ensure the damage is corrected.

3.3 EMS CONTROLS INSTALLATION

- A. General
 - 1. Refer to the appropriate EMS Templates wiring schedule for wire specifications.
 - 2. Thoroughly examine Drawings for control device and equipment locations. Report discrepancies, conflicts, or omissions to Owner for resolution before starting rough-in work.
 - 3. The information in this Section is intended to be a guide for installing, wiring, programming, and setting up the EMS Controls System. Refer to the Owner's standard Drawings and manufacturer's installation manuals for the most current and more detailed instructions on controllers.
 - 4. Refrigeration Manufacturer Responsibilities:
 - a. Factory installation of rack, distributed case and singles system controls.
 - b. Mounting of refrigeration controllers and associated I/O boards,
 - c. Mounting and terminating rack inputs such as but not limited to suction and discharge pressures, liquid temperatures, liquid level and rack alarm.
 - d. Initial Programming: Includes programming each rack controller and case controller with general set-points only. Also includes input and output assignments, pressure control settings, and defrost and sensor control settings.
 - 5. HVAC Manufacturer Responsibilities:
 - a. Factory installation of I/O boards.
 - b. Factory installation of supply fan VFDs.

- c. Mounting and terminating inputs such as but not limited to mixed air temperature sensors and air flow switches.
- 6. The Owner will supply:
 - a. EMS building controller
 - b. EMS building panel
 - c. EMS lighting control panel
 - d. Anti-sweat control panels (Not required for case control stores).
 - e. Outdoor relative humidity sensors, temperature sensors and light level sensors.
 - f. Indoor relative humidity sensors, temperature sensors and light level sensors.
 - g. Reclaim Water temperature sensors.
 - h. Whole store refrigerant leak detection system.

B. Installation, General

- 1. Installer is responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.
- 2. Install low voltage wiring in metal conduit where subject to mechanical damage and at levels below 10 feet (3 m).
 - a. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 6 inches (152 mm) between raceway and high-temperature equipment such as flues.
 - b. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions.
 - c. Join raceway sections with couplings and according to authorities having jurisdictions.
 - d. Install insulated bushings on raceway ends and enclosure openings.
 - e. Seal top ends of vertical raceways.
- 3. Install flexible metal raceways and liquid-tight flexible metal raceways in lengths not exceeding 3 feet (1 m). Support at each end. Do not install flexible metal raceway less than 1/2 inch (13 mm) electrical trade size. Install liquid-tight flexible metal raceways in areas exposed to moisture.
- 4. Install low-voltage wiring meeting NEC Class 2 requirements.
 - a. Install sub-fuse low-voltage power circuits as required to meet Class 2 current limits.
 - a) NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.
- 5. Install Class 1 and Class 2 wiring in separate raceways. Do not install low voltage wiring in boxes and panels containing high-voltage wiring and equipment except for the purpose of interfacing the two through relays and transformers.
- 6. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 10 foot (3 m) intervals. Support/anchor plenum cables from structural members. Do not

support or anchor plenum cables from ductwork, electrical raceways, piping or ceiling suspension systems.

7. Secure raceways, and conduits, with clamps fastened to structure and spaced according to authorities having jurisdiction. Do not hang or attach raceways and pull boxes to ductwork, electrical raceways, piping, or ceiling suspension systems.
8. Include one pull string in each raceway **1 inch (25 mm)** or larger.
9. Install color-coded conductors throughout.
10. Terminate control and interlock wiring related to the work of this Section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

C. Communication Wiring

1. Install low-voltage Class 2 wiring per Kroger IS&S standards.
2. Install communication wiring in separate raceways and enclosures from other Class 2 wiring. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.
3. Verify entire network's integrity following cable installation using appropriate tests for each cable. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.
4. Install a continuous length of communication wiring without splices for each run when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible.
5. Label communication wiring to indicate origination and destination.
6. Ground co-axial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

D. Warning Labels

1. Affix permanent warning labels to equipment that can be automatically started by the control system. Provide labels with white lettering (12-point type or larger) on a red background. Warning labels shall read as follows:

CAUTION! This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

2. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects. Provide labels with white lettering (12-point type or larger) on a red background. Warning labels shall read as follows:

CAUTION! This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

E. Identification of Hardware and Wiring

1. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within **2 inches (50 mm)** of termination.
2. Permanently label or code each point of field terminal strips to show instrument or item served. Label control panels with minimum **1/2 inch (13 mm)** letters on laminated plastic nameplates.

3. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.
4. Label room sensors related to terminal boxes or valves with nameplates.
5. Manufacturers' name plates and UL or CSA labels shall be visible and legible after equipment is installed. Label identifiers shall match record documents.

F. Network Wiring

1. The controllers communicate to I/O boards via a RS232 / RS485 network.
2. The controllers communicate to case controls via a Modbus network.
3. Wire type and sizes per manufacturer specifications.
4. Install network wiring from the controllers to the connector plugs of any associated I/O boards.
5. Install one network loop for each refrigeration controllers I/O communication.
6. Install one Modbus network loop for each refrigeration controllers case control communication.
7. Install one network loop for all RTU's and HVAC equipment.
8. Install one network loop for all other Building and Lighting control I/O boards.
9. The network cable must be "daisy chained". "T-splicing" or a Star configuration is not allowed.
10. Check the installation carefully, then plug in the connectors.

G. I/O Board Network Addresses

1. When the controls system allows I/O addresses to be skipped, address all I/O boards and Modules per the following. This allows the use of point sharing between controllers.
 - a. Associated with Refrigeration System 'A', 1 – 5.
 - b. Associated with Refrigeration System 'B', 6 – 10.
 - c. Associated with Refrigeration System 'C', 11 – 15.
 - d. Associated with Refrigeration System 'D', 16 – 20.
 - e. Associated with Refrigeration System 'E', 21 – 25.
 - f. Associated with Refrigeration System 'F', 26 – 30.
 - g. Associated with Refrigeration System 'G', 31 – 35.
 - h. Associated with Refrigeration System 'H', 36 – 40.
 - i. Associated with Miscellaneous Refrigeration & HVAC, 41 – 49.
 - j. Associated with Miscellaneous Calculations, 50 - 59.
 - k. Associated with Lighting Control, 60 – 69.
 - l. Associated with Building Control, 70 – 99.
2. When addresses cannot be skipped, address I/O boards starting with module one first in line from the controller.

H. Controller Communications

1. Installation per Kroger IS&S standards.
2. Install a Cat. 5 cable from the computer room to the EMS Building Controller.
3. Install/pull two CAT5 communication cables and a pull string between the controller and the store computer room or IDF cabinet.
4. Leave a **50 foot (15.25 m)** loop of free cable at each end.
5. Do not plug the wire into the controller until the wire has been tested.

6. The computer room end of the cat. 5 cable to be terminated by the Owner in the store's computer room.
7. Install a Cat. 5 jumper cable from the patch panel to the first available port in the switch (hub).
8. Terminate both ends of the Cat. 5 jumper cable with RJ45 connectors.
9. Do not plug the jumper wire into the store's hub until it has been tested.
10. Use a Cat. 5 wire tester to verify proper wiring and termination of the Cat. 5 cable and jumper wire.
11. Do not plug the Cat. 5 jumper wire into the store's switch (hub) until programming is complete. When not in conduit, maintain the Cat. 5 cable at least **12 inches (305 mm)** from any high voltage (110+ VAC) wiring.

I. Programming

1. Point Naming: Name points as shown on the equipment points list provided with each sequence of operation or in a manner consistent with the mechanical drawing nomenclature..
2. Software Programming: Provide system programming per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.
3. Operator Interface: Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation).

J. Control System Checkout and Testing

1. Startup Testing: Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any or all startup testing.
2. Calibrate and prepare for service each instrument, control, and accessory according to the manufacturers guidelines.
3. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
4. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
5. Verify that binary output devices such as relays, solenoid valves, actuators and control valves, and starters, operate properly and that normal positions are correct.
6. Verify that analog output devices such as actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves to ensure proper action and closure. Make necessary adjustments.
7. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
8. Verify that system operates according to sequences of operation or per Owners specifications. Simulate and observe each operational mode by overriding and varying inputs and schedules.
9. Alarms and Fail Safes: Check each alarm with an appropriate signal at a value that will trip the alarm. Trip field contacts to check logic and to ensure that components fail in the proper direction. Test actions by simulating alarm conditions to check initiating value of variable action.

K. Control System Demonstration and Acceptance

1. Test to demonstrate system operation and compliance with specification. Provide Owner with log documenting completion of startup tests. Owner will be present to observe and review system demonstration. Notify Owner at least 10 days before system demonstration begins.
2. Demonstrate actual field operation of each sequence of operation as specified. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Owner. Provide and operate test equipment required to prove proper system operation.
3. Demonstrate compliance with sequences of operation through each operational mode.
4. Demonstrate complete operation of system interface. Trend logs for each system. Trend data shall indicate set-points, operating points, valve positions, and other data as specified.
5. Demonstrate the building fire alarm system interface.
6. Tests that fail to demonstrate proper system operation shall be repeated after installer makes necessary repairs or revisions to hardware or software to successfully complete each test.
7. Acceptance: After tests described in this Section are performed to the satisfaction of Owner, Owner will accept control system as meeting completion requirements. Owner may exempt tests from completion requirements that cannot be performed due to circumstances beyond Installer's control. Owner will provide written statement of each exempted test.

3.4 EMS REFRIGERATION CONTROLS INSTALLATION

A. Case Controls

1. Case OEM to supply installed case controls, one per evaporator.
2. Controls installer to verify installation and factory terminations of OEM case controls.
3. Controls installer to verify programming of case controllers per Owner's specifications.
4. Walk-in box OEM to supply case control enclosure and required sensors, one kit per coil.
5. Controls installer to mount walk-in box case controller, mount and wire sensors and terminate sensors at case controller. Install walk-in box case controller enclosure on top of box.
6. Controls installer to install and terminate communication loop daisy chained from the refrigeration controller to the case controllers.
7. Electrical installer to land 120 volt and/or 208 volt power at each controllers terminal blocks per the Electrical Drawings.

B. Temperature Sensors

1. Refrigeration manufacturer to provide detailed board and point sheet located in the I/O panel.
2. Label cables with system number and type (temp or term).
3. From I/O panel, pull a single pair cable for each temperature sensor to cases and walk-ins. (Per EMS and R drawings)
4. Most case sensors will be installed by the case manufacturer. All others to be installed by Controls Installer. Mount field installed sensors in the discharge air honeycomb and attached horizontally with two wire ties. For cases without honeycomb, mount a sensor in the discharge air. Ensure rack controller points match the circuit functions they are connected to.
5. Install cables in a continuous run with no splices.

6. Underground conduit is supplied and installed by the electrical installer. Conceal sales floor cable in conduit or columns.
7. Bundle together cable that is “free-wired” above the sales floor and strap every 3 feet (1 m). Strap the cable bundle to the ceiling truss or girders, not to the refrigeration line sets.
8. Maintain cable at fixtures off the floor under cases using clamps every 4 feet (1.2 m). Maintain cable away from high voltage wire installed by the electrical installer.
9. Mount walk-in box sensors in the return air of the evaporator coils.
 - a. Locate sensor at height of bottom of the evaporator, centered between the evaporator and the wall, no more than 1 foot (305 mm) from the evaporator.
 - b. Use a 12 inch (305 mm) piece of 1/2 inch (13 mm) PVC EMT with 1/2 inch (13 mm) threaded fitting and a 2 inch by 3 inch (handy box) or 4 inch (100 mm) J box with cover plate.
 - c. Drill a 1/4 inch (6 mm) hole down the top of the walk-in.
 - d. Feed cable through hole and “make up” connection inside the J box. Pull sensor through PVC and secure with plastic wire tie.
 - e. Fill hole inside and out with silicone sealant.
10. Mount outdoor air temperature sensors on roof, facing north. Where applicable, install a sun shield over the temperature sensor.
11. Install sensors according to manufacturer's recommendations. Mount sensors rigidly and adequately for operating environment.
12. Install liquid temperature sensors in heat reclaim water tank.

C. Refrigeration Valve Control

1. Install / pull 2 wire cable from each refrigeration valve to the corresponding rack controller output point.
2. Wire to be sized per NEC.

D. Defrost Terminations

1. Install defrost terminations for systems as specified on the refrigeration drawings and point sheets. Pull a single pair for each system and walk-in, from fixtures I/O panel.
2. Terminate Bi-Metal, thermostat, or pipe mounted temp from case to I/O panel. Wire thermostats in series (no voltage) and install thermostats and temperature sensors with DG clamps as recommended by the manufacturer.
3. Install a strap on Bi-Metal sensor on walk-in freezers (one per coil). If coils are individually circuited connect to individual inputs in the I/O panel. If coils are on the same refrigeration circuit, daisy chain the Bi-Metal sensors to one input in the I/O panel.

E. Door Alarms

1. DAC-55 Door alarm. Reference EISD-4.

F. Variable Frequency Drives - General

1. The Owner will provide all VFDs, VFD enclosures and bypass assemblies, VFD filters/reactors chokes, sensors, IO boards, transformers, and necessary refrigeration controllers.

2. Installer provides conduits, unistrut, fasteners, line voltage conductors and connections, control wiring and CAT5 network communication cable.
3. Provide crane for the purpose of lifting VFD enclosures to roof when applicable.
4. Mount VFDs and bypass panel assemblies in a location approved by the Owner.
 - a. Indoor Installations: Typically install adjacent to refrigeration system, mounted in a serviceable location no higher than **66 inches (1675 mm)** from the finished floor to the top of the bypass assembly. Allow proper clearances per NEC from structures and other equipment for both installations.
 - b. Mechanical Room Installations: Typically install in the refrigeration mechanical enclosure, mounted in a serviceable location no higher than **66 inches (1675 mm)** from the finished floor to the top of the bypass assembly. Allow proper clearances per NEC from structures and other equipment.
 - c. Outdoor Installations Mount the assembly on the condenser as close to the electrical disconnect as possible. A location on the north or west side of the condenser is preferred. Allow proper clearances per NEC from structures and other equipment.
5. The capacitive loading of the drive by the motor conductors imposes limits on the distance between any motor and the associated VFD. Contact the VFD manufacturer if the distances between the VFDs being installed and the motors served exceed **330 feet (100 m)** for any size drive specified.
6. Where controls and control system elements are permanently installed or mounted on outdoor condensers, machine room equipment or structures, install in a manner that does not obstruct refrigeration maintenance and service activities. Mount VFDs and bypass panels so that access doors can be opened at least 90 degrees.
7. Route communications, control, and power wiring between control system elements in such a way as to prevent obstruction of or damage during refrigeration maintenance and service activities.
8. Install line and load voltage conductors in metallic conduit.
9. Line and load conductors MUST be in separate conduits.
10. Do not install low voltage cable in the same conduit as line voltage wiring.
11. Bundle together low voltage cable that is "free wired" above sales area floor and strap every **5 feet (1.5 m)**. Strap the cable bundle to ceiling truss or girders.
12. Install low voltage communication wiring from board to board with no breaks or splices.
13. Install all control wiring between refrigeration system mounted I/O boards and VFD/VFD bypass panel terminal blocks.
14. Install low voltage sensor cable from the I/O board to the sensor with no breaks or splices.

G. Air-Cooled Condenser Fan VFDTD Controls Installation

1. Configuration:
 - a. Air-cooled Rooftop Condensers 2 Fans Wide by 2 Fans Long or Longer:
 - a) Condenser fan #1 shall always be the fan closest to the refrigeration manifold, on the side not being split during low ambient modes.
 - b) Condenser Fan #2 shall be the fan immediately adjacent to fan #1 on the split condenser side.
 - c) Continue to label fans on the non-split side by odd numbers, 3, 5, 7, etc.

- d) Continue to label fans on the split side by even numbers, 4, 6, 8, etc.
- e) If no split condenser exists:
 - 1) Identify Condenser Fan #1 as the first fan on the left manifold side.
 - 2) Identify Condenser Fan #2 as the first fan on the right manifold side.
 - 3) Identify Fans continuing this odd/even pattern.
- b. Air-Cooled Rooftop Condensers 1 Fan Wide by 4 Fans Long or Longer:
 - a) Condenser fan #1 shall always be the fan closest to the refrigeration manifold.
 - b) Fans shall be identified 2, 3, 4, etc. moving away from the manifold.
- 2. Install wire connections at VFD so that the incoming line feeds from the load side of the condenser disconnect provides incoming line power to the VFD, and VFD line output power conductors are connected to the air cooled condenser fan motor distribution block. Route wiring inside watertight conduits or watertight metal wireways rated specifically for the purpose of enclosing up to 480V power circuit wiring. Motor disconnect to be on the line side of the drive.
- 3. Provide line voltage wiring and connections between the VFDs and the condenser enclosures as required by the NEC and VFD manufacturer's guidelines. Refer to NEC and local electrical codes and regulations for the correct size of the conductors. In some cases a larger conductor size may be required to avoid excessive voltage drop. Use **221 degrees F (105 degrees C)** PVC-insulated cables with copper conductors having a suitable voltage rating for power connections. Connect the VFDs to the building electrical system ground. The ground wiring must conform to local regulations and codes.
- 4. Route the control wiring from the refrigeration controller I/O boards to the VFDs bypass enclosure.
- 5. Route the communication wiring from the refrigeration controller to the I/O boards located in the condenser electrical panels and the VFD bypass panel (if applicable).
- 6. Label the conductors at both ends of each cable **12 inches (305 mm)** from end of cable. Run wiring separately from the power wiring, either neatly and securely wire-tied to appropriate elements of the building structure, or in conduit or other suitable enclosure where it may be exposed to weather or damage.
- 7. Refrigeration equipment must be shut down prior to turning off condenser. If shut down is longer than 15 minutes, refrigeration system must be pumped down by qualified refrigeration technician. Complete wiring for each condenser and VFD one at a time so only one air-cooled condenser is disabled or shut off at any point.
- 8. Air-cooled condenser control circuit to be fed from the load side of disconnect.
- 9. Install one outside temperature sensor on each air cooled condenser being fitted with a VFD. Sensor will be located under fan #1 per the details located in the EMS drawings.

H. Evaporative Condenser Fan VFDTD Controls Installation

- 1. In dry climates, the evaporative condenser is shared by both refrigeration and air handler racks. A refrigeration controller, typically shared with another refrigeration rack, operates all functions on the AC rack, including cycling compressors to maintain pressure in the suction header.
- 2. Install wire connections at VFD so that the incoming line feeds from the load side of the disconnect provides incoming line power to the VFD, and VFD line output power conductors are connected to the fan motor contactor. Route wiring inside conduit or

metal wireway rated specifically for the purpose of enclosing up to 480V power circuit wiring. Motor disconnect to be on the line side of the drive.

3. Supply and install line voltage wiring and connections between the VFD and condenser enclosure as required by the NEC and VFD manufacturer's guidelines. Refer to NEC and local electrical codes and regulations for the correct size of the conductors. In some cases, a larger conductor size may be required to avoid excessive voltage drop. Use 221 degrees F (105 degrees C) PVC-insulated cables with copper conductors having a suitable voltage rating for power connections. Connect the VFDs to the building electrical system ground. The ground wiring must conform to local regulations and codes of authorities having jurisdiction.
4. Route control wiring from the refrigeration controller I/O boards to the VFD bypass enclosure. Run wiring separately from any power wiring, either neatly and securely wire-tied to appropriate elements of the building structure, or in conduit or other suitable enclosure where it may be exposed to weather or damage.
5. If refrigeration equipment is running, shut down refrigeration equipment prior to turning off condenser. If shut down is longer than 15 minutes, the refrigeration system must be pumped down by qualified refrigeration technicians.
6. Install one humidity sensor on building, away from condenser exhaust. Run shielded cable from sensor to designated input on the I/O board located at the refrigeration system. Terminate per the control schematic drawing.
7. Install one ambient temperature sensor on building, away from condenser exhaust. Run shielded cable from sensor to designated input on the I/O board located at the refrigeration system. Terminate per the control schematic drawing. Shield sensor from the sun, in free air circulation and away from any potential source of warm air, so that it accurately senses outdoor air temperature. Locations near machine room air makeup or exhaust openings, vent stacks for heating appliances, and HVAC exhaust duct openings are not permitted.
8. Install one sump temperature sensor in sump of evaporative condenser. Run shielded cable from sensor to designated input on the I/O board located at the refrigeration system.
9. Install one drop leg temperature sensor per discharge group. Run shielded cable from sensor to designated input on the I/O board located at the refrigeration system.

I. Condenser Fan VFDTD Control Installation Completion - All

1. Program the parameters in each VFD according to the Kroger Controller's Standards Document.
2. Program the controller for VFD operation per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.
3. Check all details of installation.
4. Check temperature sensor readings at controller. Calibrate as necessary.
5. Check speed control input terminals at all VFDs for presence of 0 - 10 V speed control signal.
6. Place VFDs in automatic operation position. Confirm they are running at full speed (60 Hz).
7. Fan motor and circuit wiring protection will be provided by fused motor disconnects, not the VFD amperage limiting feature. Set the VFD amperage limit feature to its uppermost amperage setting.
8. Start and run each VFD in manual mode as completed and verify correct fan blade rotation.
9. Start and run each VFD in bypass mode as completed and verify correct fan blade rotation.

10. When VFD installation and testing is completed, leave the VFD under control of the refrigeration controller.
11. The Fixture And Equipment Electrical Installer shall complete the Condenser Fan VFDTD Control Installation Completion Report at the end of this Section and place in the controller cabinet. Indicate the load connected to every point on each I/O board.

J. Suction Stop Solenoids in Loop Piping (when applicable).

1. In stores with loop piping, locate suction stop solenoids on refrigeration circuits near cases.
2. Provide control voltage signal from refrigeration rack controller.

3.5 EMS BUILDING CONTROLS INSTALLATION

A. Sensors

1. General

- a. Sensor cables per manufacturers specifications.
- b. Do not install the temperature and humidity sensors in the direct airflow of ventilation systems or case exhausts.
- c. Label the end of all cables with the sensor type and location, for example, "RH Sensor at Frozen Food."

2. Indoor Temperature Sensors

- a. Install one temperature sensor for each zone for HVAC control.
 - a. Mount 7 feet 6 inches (2285 mm) AFF on sales floor.
 - b. Mount 5 feet (1526 mm) AFF in office areas.
- b. Install one temperature sensor for each unit heater.
- c. Mount temperature sensors away from, or below humidity sensors (humidity sensors create heat).
- d. Install dedicated temperature sensor in Frozen Food for Anti-Sweat Control.
- e. Install one temperature sensor in each HVAC unit supply air.

3. Indoor Humidity Sensors

- a. Install one humidity sensor for HVAC control on sales floor per EM Drawings.
- b. Install dedicated humidity sensor in Frozen Food for anti-sweat control.
- c. Install dedicated humidity sensor in the Pharmacy for Pharmacy RTU control.
- d. Mount humidity sensors above temperature sensors (humidity sensors create heat).

4. Indoor Light Level Sensor.

- a. Install one Indoor light level sensor for sales floor lighting control when skylights are present.
- b. Sensor to be mounted in skylight per the details on the EMS drawings.

5. Outdoor Sensors

- a. Install one outdoor temperature sensor, relative humidity sensor and light level sensor.
- b. Mount sensors on roof away from equipment such as RTU's, exhausters, condensers and vents.
- c. Install one outdoor light level sensor for parking lot light control. Position the sensor facing north, away from direct sunlight. Avoid aiming at other bright light sources that may be on at night.

B. EMS Building Control Panel, Lighting Control Panel Installation, and Alarm Logger

1. Installation and supervision of low voltage field wiring.
2. Complete the following prior to arrival of perishable product:
 - a. Termination of all field wiring to the appropriate boards and points as provided.
 - b. Start-up of all controllers. Upon start-up of individual systems, troubleshooting any problem wiring (i.e. open or shorted sensors, blown fuses, etc.).
3. Final connections and check-out of the alarm system.
4. Training store personnel for alarm situations.
5. Remote communications checkout.
6. Testing of fail-safe modes by simulating power fail on the boards and loss of communications from the controller.
7. Pull low voltage sensor and communications wiring to the respective panels, according to the electrical prints, utilizing manufacturers approved cable.
8. Mount alarm logger (if required by Owner) in a location easily viewed and accessed by store personnel per Owners direction.
9. Mounting, EMS Panels
 - a. Mount with center of display **5 feet (1.5 m)** above finished floor.
 - b. Mount in the mechanical enclosure or adjacent to the electrical switchgear as directed by the Owner.
 - c. Mount panels so that access doors can be opened at least 90 degrees.
 - d. Securely mount **1/2 inch (13 mm)** plywood to wall surface for mounting of controller. Mount panels using bolts and nuts, rather than screws, to reduce the chance of wire damage from sharp fastener edges.
 - e. Do not allow debris or filings of any kind from collecting on any of the electronic components.
 - f. Locate a reliable non switched source of line voltage power for the controller.
 - g. Power connector at the controller and power up.
10. Power
 - a. EMS Controller's 120 volt power to be supplied from a dedicated circuit, from the emergency panel (generator backup).
 - b. Do not use the transformer powering the controller to power relays. A separate transformer must be installed for this purpose.
 - c. Do not apply power to the controller or any I/O cards until all wiring is complete.

C. Lighting Controls

1. General:

- a. Sales floor lights, track lights, décor, up lighting (on top of cases), case lights, parking lot lights, canopy, signage and security/wall pack lights shall be controlled with the EMS
 - b. Program and wire control points per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.
 - c. Owner to verify operation and schedules.
2. Wiring
- a. See Owner's standard drawings for typical relay board wiring.
 - b. Install 2-wire cable from each contactor to the EMS Lighting Control Panel.
 - c. Wire contactors to the normally closed contacts of the controller relays.
3. Dimming
- a. Install Owner furnished lighting dimming panel.
 - b. Mount adjacent to the electrical switchgear or adjacent to contactors controlling the fixtures to be dimmed as directed by the Owner.
 - c. Mount panels so that access doors can be opened at least 90 degrees.
 - d. Securely mount **1/2 inch (13 mm)** plywood to wall surface for mounting of controller. Mount panels using bolts and nuts, rather than screws, to reduce the chance of wire damage from sharp fastener edges.
 - e. Do not allow debris or filings of any kind from collecting on any of the electronic components.
 - f. Locate a reliable non switched source of line voltage power for the controller.
 - g. Power connector at the controller and power up.
 - h. Install 2 wire cable from lighting dimming panel, daisy chained to controlled fixtures.

D. Anti-Sweat Controls

1. General: Keep anti-sweat heaters on until the EMS system is programmed.
2. Anti-Sweat Panels
 - a. Locate the Anti-sweat panels as close to the anti-sweat circuit breaker panel as possible.
 - b. The middle of the Anti-sweat panels shall be located **5 feet 5 inches (1.65 m)** above finished floor.
 - c. Install the control or communication wire from the EMS Building Panel to the Anti-sweat control Panels per the EMS drawings.
 - d. Do not exceed the maximum amp rating to each channel of the Anti-Sweat Panel.
 - e. Wire anti-sweat circuits "through" the Anti-Sweat Panels to the cases.
 - f. Program controller per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.
 - g. Do not wire channels "HOT".
 - a) CAUTION: Connecting or disconnecting a circuit while current is flowing may destroy the Anti-Sweat Panel Channel.

E. Unit Heater Control

1. Install one temperature sensor per unit heater.
2. Install/pull 2-wire shielded cable (per EMS drawings) from temperature probe to the EMS controller building panel.
3. Install/pull 2-wire shielded cable (per EMS drawings) from unit heater to output in the EMS controller building panel.
4. Supply and install relay in unit heater to control the run signal via the EMS building controller.
5. Program controller per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.

F. Water Reclaim Control

1. Install Owner furnished temperature probe at water reclaim tanks per details.
2. Install refrigeration OEM furnished reclaim valve at reclaim tanks.
3. Install/pull 2-wire shielded cable (per EMS drawings) from temperature probe to the EMS controller building panel or the refrigeration control panel of the refrigeration system providing water reclaim.
4. Install/pull control voltage cable (per EMS drawings) from heat reclaim solenoid to the EMS controller building panel or the refrigeration control panel of the refrigeration system providing water reclaim.
5. Reclaim initiated by EMS building controller using global or transmitted inputs and outputs.
6. Program per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.

G. HVAC Reclaim Control

1. Verify refrigeration OEM supplied and installed reclaim solenoid is properly wired, powered and operational. Reclaim solenoid wired to condenser mounted I/O board. Correct any wiring issues.
2. Reclaim initiated by EMS building controller using global or transmitted inputs and outputs.
3. Program per the Kroger Co. Controller Set Points and Standards Document available on Owners electronic website.

H. Life Safety (Duct, Smoke Detectors)

1. Install a 2 conductor, 18 AWG) cable from the fire alarm panel to the EMS Building Control Panel. Terminate the wire to the normally open contacts on the HVAC relay in the fire alarm panel.

I. Irrigation Controllers

1. Install/pull 2 wire cable from the irrigation controller to the building controller I/O panel. Wire is from the auxiliary alarm contacts in the irrigation controller. Terminate on a controller input point. Controller to be programmed per divisions preferences on alerting of a leak.
2. Wire to be sized per NEC.

J. Exhaust Hood Control

1. Install/pull 4 wire cable from each exhaust hood to the building controller I/O panel.
2. Wire one pair from the auxiliary proof contacts in the exhaust hood control panel. Terminate on building control panel controller input point for hood proof.
3. Wire one pair from the control relay in exhaust hood control panel. Terminate on building control panel relay output for hood on/off control.
4. Wire to be sized per NEC.
5. Program RTUs and hood schedules per the setpoint documents.

K. Refrigerant Leak Detection Unit.

1. Install refrigerant leak detection unit in accordance with the manufacturers cut sheets and manuals.
2. Mounting, Refrigerant Leak Detection Unit (LDU):
 - a. Mount with center of display 5 feet (1.5 m) above finished floor.
 - b. Mount adjacent to the building environmental control panel as directed by the Owner.
 - c. Mount panels so that access doors can be opened at least 90 degrees.
 - d. Securely mount 1/2 inch (13 mm) plywood to wall surface for mounting of controller. Mount panels using bolts and nuts, rather than screws, to reduce the chance of wire damage from sharp fastener edges.
 - e. Do not allow debris or filings of any kind from collecting on any of the electronic components.
 - f. Locate a reliable non switched source of line voltage power for the unit.
 - g. Power connector at the unit and power up.
3. Mounting, Refrigerant Leak Detection Control Panel:
 - a. Mount adjacent to the refrigerant leak detection unit as directed by the Owner.
 - b. Mount panels so that access doors can be opened at least 90 degrees.
 - c. Securely mount 1/2 inch (13 mm) plywood to wall surface for mounting of controller. Mount panels using bolts and nuts, rather than screws, to reduce the chance of wire damage from sharp fastener edges.
 - d. Do not allow debris or filings of any kind from collecting on any of the electronic components.
 - e. Locate a reliable non switched source of line voltage power for the unit.
 - f. Power connector at the unit and power up.
4. Power
 - a. Supply leak detection and controller's 120 volt power from a dedicated circuit.
 - b. Do not use the transformer powering the controller to power relays. A separate transformer must be installed for this purpose.
 - c. Do not apply power to the controller or any I/O cards until all wiring is complete.
5. Programming
 - a. Program the LDU per manufacturer guidelines.
 - b. Document each zones location, temperature and length of tubing. These are needed in the LDU.

- c. Program the EMS system per the controller setpoint document located on Owners electronic website.
- 6. Refrigerant Leak Detection Monitoring Points
 - a. All 16 available zones of the LDU will be utilized. Do not utilize more than 16 zones.
 - b. Priority for monitoring zones:
 - a) Coolers, Freezers and Prep Rooms.
 - b) Refrigeration Compressor systems located in an enclosed space.
 - c) The return duct from an RTU drawing air from undercase returns or the largest RTU. Mounted in ductwork.
 - d) Near other grouped refrigeration compressor systems located in back rooms, mezzanines or machine rooms.
 - e) On a column, 16 inches (406 mm) above finished floor, in a j-box near the deli area refrigerated cases on the sales floor.
 - f) On a column, 16 inches (406 mm) above finished floor, in a j-box near the frozen glass door cases on the sales floor.
 - c. As priority above dictates, these locations will have tubing run from the LDU and will be terminated with the designated filter.
 - d. An additional port on the LDU is dedicated as a purge zone and must have tubing run outside the building and terminated with the designated filter end. Located this zone as to protect the sampled air from contaminants. Keep away from dock areas and exhaust.
 - e. Zones located in the dairy cooler, prep rooms and the outdoor purge zone will be mounted in a special washdown rated j-box furnished by the Owner.
 - f. Where damage may be a concern for the filter end, remove the j-box knockouts and install a cover plate.
- 7. Refrigerant Leak Detection Horn and Strobe
 - a. All individual zones will have a horn and strobe mounted near the monitored area. Where case return air is monitored, a horn and strobe will not be required.
 - b. Mounting Location: As indicated in EMS Drawing details.
 - c. Install one additional strobe only in the customer service area or managers offices as directed by Owner. This unit shall alarm any time a leak is detected by any zone.
 - d. Install one additional horn and strobe near the LDU as directed by Owner. This unit shall alarm any time a leak is detected by any zone.
 - e. Install/pull control voltage cable (per EMS Drawings) from the leak detection control panel relays OR refrigeration controller relays to each zone horn and strobe. Horn and strobe for each zone will be activated by one relay.
 - f. Horn and Strobes will operate independent of each other and will only alarm when that particular zone has been identified with a leak greater than 1000 PPM.
 - g. Program the controller to accomplish the above alarm sequence.
- 8. Refrigerant Leak Detection Tubing
 - a. Install tubing per the manufacturers guidelines.

- b. Clearly label the ends of the tubing as to which zone it serves.
 - c. Run tubing rectilinear, making only 90 degree turns.
 - d. Tubing shall follow the refrigerant line and/or the low voltage control cable for that zone.
 - e. Hang and support tubing utilizing vinyl cushion clamps designed to not crush the tubing. Use KMC Stampings Part# COV-0509Z1 or Owner approved equal. The molded clips to be supported by zip ties no less than every 8 feet (2.438 m) to avoid sagging of the tubing.
 - f. If necessary, make splices with a “high flow” fitting.
 - g. Verify in the LDU the airflows are sufficient for accurate readings.
 - h. High traffic areas, areas where the tubing may get damaged and below 8 feet (2.438 m) above finished floor, run tubing in 3/4 inch (19 mm) EMT conduit for protection.
9. Provide plastic signage to be mounted next to the horn & strobe devices.
- a. Refer to EM template drawings for example sign.
 - b. Text: Blue front and white engraved letters that read “REFRIGERANT LEAK ALARM”, “EVACUATE THIS SPACE”, “CONTACT FACILITY MAINTENANCE”.
 - c. Size: 10 inches (254 mm) wide by 8 inches (203 mm) tall with four mounting locations, one in each corner.
 - d. Mount the sign as close as possible to the horn and strobe device.

3.6 ATTACHMENTS

- A. The following pages contain:
- 1. Installer Responsibility Matrix.
 - 2. Controller Input Point Completion Report.

| Installer Responsibility Matrix The Kroger Co. | | | | | | | | | | | |
|--|----------------|-------|-------|--------|--------|-----------|-------|-------|-----|-----|----------------------|
| DESCRIPTION | RESPONSIBILITY | | | | | | | | | | COMMENTS |
| | REM | RI | BEI | HVAC-M | HVAC-I | EMS-1 | OWNER | FEI | RCI | ISI | |
| Refrigeration Control Equipment | | | | | | | | | | | |
| CONTROLLER COMMUNICATION WIRING | | | | | | F / I / T | | | | | |
| I/O NETWORK WIRING | | | | | | F / I / T | | | | | |
| I/O MODULES & TRANSFORMERS IN REF SYSTEMS | F / I | | | | | | | | | | |
| REFRIGERATION CONTROLLER UNITS | F / I | | | | | | | | | | |
| REF SYSTEM SENSORS AND TRANSDUCERS | F / I | | | | | T | | | | | |
| REFRIGERATION SOLENOID VALVES | | F / I | | | | | | | | | AS APPLICABLE |
| WALK-IN COOLER / FREEZER ANALOG TEMPERATURE SENSORS | | | | | | T | F | | I | | RI-SEAL PENETRATIONS |
| REFRIGERATED FIXTURE ANALOG TEMPERATURE SENSORS | F / I | | | | | T | | | | | RI-SEAL PENETRATIONS |
| CONDENSER I/O MODULES & TRANSFORMERS | F / I | | | | | T | | | | | |
| WIRING TO REFRIGERATION FIELD SENSORS | | | | | | F / I / T | | | | | |
| WIRING TO REFRIGERATION SOLENOID VALVES | | | | | | F / I / T | | | | | AS APPLICABLE |
| WIRING TO REFRIGERATION SUCTION STOP SOLENOID VALVES | | | | | | F / I / T | | | | | |
| DEFROST TERMINATION WIRING | | | | | | F / I / T | | | | | |
| DEFROST WIRING CONDUIT | | | | | | | | F / I | | | |
| NETWORK WIRING TO CONDENSERS | | | | | | F / I / T | | | | | |
| SPORT II EPR VALVES | F / I | | | | | | | | | | |
| UNDERGROUND EMS CONDUIT | | | F / I | | | | | | | | |

| Installer Responsibility Matrix The Kroger Co. | | | | | | | | | | | |
|---|----------------|----|-----------|--------|--------|-----------|-------|-----------|-----------|-----------|----------------------------|
| DESCRIPTION | RESPONSIBILITY | | | | | | | | | | COMMENTS |
| | REM | RI | BEI | HVAC-M | HVAC-I | EMS-1 | OWNER | FEI | RCI | IS-I | |
| PROVIDE POWER FOR ALL CONTROLS | | | F / I / T | | | | | | | | SEE ARCHITECTURAL DRAWINGS |
| WIRING FOR HOT WATER RECLAIM CONTROL | | | | | | F / I / T | | | | | |
| WALK-IN DOOR SWITCHES | | | | | | | | F / I | | | SEE EMS DRAWINGS |
| LINE VOLTAGE FOR WALK-IN DOOR SWITCHES | | | | | | | | F / I / T | | | |
| CONTROL WIRING FOR WALK-IN DOOR SWITCHES | | | | | | F / I / T | | | | | |
| CONTROL WIRING FROM REFRIG SYSTEM TO CONDENSER VFD BYPASS PANEL | | | | | | F / I / T | | | | | SEE EMS DRAWINGS |
| CATEGORY-5 NETWORK CABLE | | | | | | | | | | F / I / T | |
| | | | | | | | | | | | |
| CASE CONTROLLERS | F / I | | | | | | | | | | |
| WALK-IN BOX COIL CASE CONTROLLERS | F | | | | | | | | I | | |
| CASE CONTROL LOW VOLTAGE AND COMM WIRE | | | | | | F / I / T | | | | | |
| WALK-IN BOX SENSOR & VALVE MOUNTING AND WIRING | | | | | | | | | F / I / T | | RI-SEAL PENETRATIONS |
| CASE CONTROL 120V AND 208V POWER | | | | | | | | F / I / T | | | |
| CASE CONTROLLER PROGRAMMING VERIFICATION | | | | | | F | | | | | |
| | | | | | | | | | | | |
| MOUNT LEAK DETECTION UNIT (LDU) | | | | | | | F | | I | | |
| FURNISH & INSTALL 120V POWER TO LDU | | | F / I / T | | | | | | | | |
| INSTALL & TERMINATE TUBING AND FILTERS TO ALL ZONES | | | | | | | F | | I / T | | |

| Installer Responsibility Matrix The Kroger Co. | | | | | | | | | | | |
|---|----------------|----|-------|--------|--------|-------|-------|-----|-----|------|---------------------------------------|
| DESCRIPTION | RESPONSIBILITY | | | | | | | | | | COMMENTS |
| | REM | RI | BEI | HVAC-M | HVAC-I | EMS-1 | OWNER | FEI | RCI | IS-I | |
| MOUNT CONTROL BOARDS FOR COMM TO LDU & ALARMS | | | | | | I/T | F | | | | |
| FURNISH & INSTALL 120V POWER FOR LDU CONTROL BOARDS | | | F/I/T | | | | | | | | |
| FURNISH & INSTALL CONTROL WIRE FROM LDU TO CONTROL BOARDS | | | | | | F/I/T | | | | | |
| MOUNT ZONE HORN / STROBE DEVICES | | | | | | I/T | F | | | | |
| FURNISH & INSTALL COMM WIRE FROM LD CONTROL BOARDS TO ENVIRONMENTAL CONTROL PANEL | | | | | | F/I/T | | | | | |
| FURNISH & INSTALL CONTROL WIRE FROM LD CONTROL BOARDS TO HORN / STROBE DEVICES | | | | | | F/I/T | | | | | |
| FURNISH & INSTALL CONTROL WIRE FROM REFRIGERATION CONTROL BOARDS TO HORN / STROBE DEVICES | | | | | | F/I/T | | | | | |
| PROGRAMMING TO IMPLEMENT LEAK DETECTION AND ALARMING. | | | | | | F/I/T | | | | | |
| REFRIGERANT LEAK ALARM SIGNAGE | | | | | | F/I/T | | | | | |
| | | | | | | | | | | | |
| ELECTRONIC REF LEAK DETECTOR (RULER ONLY) | | | | | | I/T | F | | | | |
| ELECTRONIC REF LEAK DETECTOR LOW VOLTAGE POWER (RULER ONLY) | | | | | | F/I/T | | | | | |
| ELECTRONIC REF LEAK DETECTOR LOW VOLTAGE CONTROL POINTS (RULER ONLY) | | | | | | F/I/T | | | | | |
| | | | | | | | | | | | |
| Lighting Control Equipment | | | | | | | | | | | |
| I/O MODULES W/ENCLOSURE AND TRANSFORMER | | | | | | I/T | F | | | | LOCATE NEAR ELECTRICAL LIGHTING PANEL |
| OUTDOOR LIGHT LEVEL SENSOR | | | | | | I/T | F | | | | ON ROOF, FACING NORTH |
| INDOOR LIGHT LEVEL SENSOR | | | | | | I/T | F | | | | |
| LIGHTING CONTROL CONTACTORS (EXCLUDING HA, HB, HC, LC) | | | I/T | | | | F | | | | |

| Installer Responsibility Matrix The Kroger Co. | | | | | | | | | | | |
|---|----------------|----|-----------|--------|--------|-----------|-------|-----------|-----|------|----------------------------------|
| DESCRIPTION | RESPONSIBILITY | | | | | | | | | | COMMENTS |
| | REM | RI | BEI | HVAC-M | HVAC-I | EMS-1 | OWNER | FEI | RCI | IS-I | |
| WIRING FROM I/O OUTPUTS TO CONTACTORS | | | | | | F / I / T | | | | | |
| WIRING FROM I/O INPUTS SENSORS | | | | | | F / I / T | | | | | |
| CLEAN POWER/ JUNCTION BOXES I/O PANELS | | | F / I | | | | | | | | |
| I/O NETWORK WIRING | | | | | | F / I / T | | | | | |
| UNDERGROUND EMS CONDUIT | | | F / I | | | | | | | | |
| DIMMING CONTROL VOLTAGE FROM I/O TO FIXTURES | | | | | | F / I / T | | | | | |
| | | | | | | | | | | | |
| HVAC Control Equipment | | | | | | | | | | | |
| ENVIRONMENTAL CONTROL PANEL | | | | | | I | F | | | | |
| RTU I/O MODULES | F / I | | | | | | | | | | |
| ANTI-SEAT CONTROL PANELS | | | | | | | F | | I | | NOT REQUIRED W/ CASE CONTROLS |
| LINE VOLTAGE TO/FROM ANTI-SWEAT CONTROL PANELS | | | | | | | | F / I / T | | | NOT REQUIRED W/ CASE CONTROLS |
| CONTROL WIRING TO/FROM ANTI-SWEAT CONTROL PANELS | | | | | | F / I / T | | | | | NOT REQUIRED W/ CASE CONTROLS |
| SALES AREA TEMPERATURE SENSORS | | | | | | I / T | F | | | | |
| RELATIVE HUMIDITY SENSORS | | | | | | I / T | F | | | | |
| OUTDOOR AMBIENT SENSORS | | | | | | I / T | F | | | | |
| WIRING TO HVAC FIELD SENSORS | | | | | | F / I / T | | | | | |
| I/O NETWORK WIRING TO RTU I/O MODULES | | | | | | F / I / T | | | | | |
| POWER TO ENVIRONMENTAL CONTROL PANEL | | | F / I / T | | | | | | | | |

| Installer Responsibility Matrix The Kroger Co. | | | | | | | | | | | |
|---|----------------|----|-----------|--------|--------|-----------|-------|-----|-----|-----------|----------|
| DESCRIPTION | RESPONSIBILITY | | | | | | | | | | COMMENTS |
| | REM | RI | BEI | HVAC-M | HVAC-I | EMS-I | OWNER | FEI | RCI | IS-I | |
| NETWORK WIRING TO ENVIRONMENTAL CONTROL PANEL | | | | | | F / I / T | | | | | |
| UNDERGROUND EMS CONDUIT | | | F / I | | | | | | | | |
| CATEGORY-5 NETWORK CABLE TO CONTROLLER AND ALARM LOGGER | | | | | | | | | | F / I / T | |
| WIRING FROM EXHAUST HOOD CONTROL PANEL TO ENVIRONMENTAL CONTROL PANEL | | | | | | F / I / T | | | | | |
| WIRING FROM IRRIGATION CONTROLLER TO ENVIRONMENTAL CONTROL PANEL | | | | | | F / I / T | | | | | |
| ALARM LOGGER | | | | | | I / T | F | | | | |
| POWER TO ALARM LOGGER | | | F / I / T | | | | | | | | |

| Legend | |
|--------|--------------------------------------|
| F | Furnish |
| I | Install |
| T | Terminate |
| F/I | Furnish And Install |
| REM | Refrigeration Equipment Manufacturer |
| RI | Refrigeration Installer |
| FEI | Fixture Electrical Installer |
| BEI | Building Electrical Installer |
| HVAC-M | HVAC Equipment Manufacturer |
| HVAC-I | HVAC Installer |
| RCI | Refrigeration Controls Installer |
| EMS-I | Controls Installer |
| IS-I | Information Systems Installer |

Controller Input Point Completion Report

The Kroger Co.

[illegible]

The Kroger Co.

11 41 46 - 28