

**Oakhurst Dairy – New Milk Cooler****SECTION 16900 - STARTER ENCLOSURE PANELS****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. This Section describes the general requirements of panels. The supplier shall be responsible for all interface with the associated equipment manufacturers.
- B. The following control panel(s) shall be furnished and installed:
  - 1. SEP-A

**1.2 SUBMITTALS**

- A. The panel submittal shall show all interconnections. Include the following information in the submittal for this section:
  - 1. Scale drawings showing the location of face-of-panel mounted devices. Include a legend listing and identifying face-of-panel devices by their assigned tag numbers and nameplate inscriptions.
  - 2. A listing of devices mounted within the panel. Include the tag number, description, manufacturer and complete model number for each device.
  - 3. Panel elementary diagrams including panel power distribution and ancillary devices such as relays, alarms, fuses, lights, fans, heaters, etc.
    - a) Show circuits and components individually.
    - b) Show panel terminal and wire identification numbers.
    - c) Do not submit typical diagrams for multiple circuits.
  - 4. Power requirement and heat dissipation summary for each panel. State required voltages, currents, and phase(s). State maximum heat dissipation in Btu/hr.
  - 5. Cut sheets and catalog information of enclosures. Indicate options to be supplied.
  - 6. Component manufacturing data sheet indicating ratings, performance, size, weight, and energy requirements. Clearly identify each component by item number and nomenclature consistent with project requirements.

**1.3 MAINTENANCE**

- A. Provide the following spare parts:
  - 1. One light bulb for every 10 light bulbs or fraction thereof for each type of bulb.
  - 2. One relay of each type and size utilized.
  - 3. Four fuses for each type and size utilized.
- B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.

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- A. Provide one-year manufacturer's warranty on system components. Warranty period shall start after substantial completion has been issued. Guarantee that components will be free from defects in materials and workmanship. Guarantee that, during the one-year warranty period, there will be no cost to Owner for service and repair calls. Guarantee that repairs and service shall be accomplished within forty-eight hours of notification by the Owner.

**PART 2 - MATERIALS****2.1 FABRICATION**

- A. Use numbered terminal blocks for external connections.
- B. Use panel fabrication techniques that allow for removal and maintenance of all equipment after installation.
- C. Provide UL approved panels.

**2.2 ENCLOSURES**

- A. Provide structural reinforcements within enclosures to insure a plane surface, to limit vibration and to provide rigidity during shipment, installation and operation without distortion or damage to the panel or to any instrument.
- B. Place knockouts for the wiring of freestanding panels either at top or bottom of the panel. Cover holes for future devices with a plastic plate.
- C. Bonderize steel enclosures. Prime and finish with two coats of factory finished ANSI baked enamel. Paint the panel interior white. The exterior color will be selected by the Owner.
- D. Cut, punch, or drill cutouts for face-of-panel mounted instruments and smoothly finish with rounded edges.
- E. Provide steel stiffeners on the back of the panel face as may be required to prevent deflection due to instruments, operation of equipment, or opening/closing of doors. Use 0.25 inch high by 1 inch wide by 0.5 inch deep minimum stiffeners and tack welded to the panel.
- F. Use enclosures which conform to the requirements of the NEMA type specified as follows:
  - 1. Wall-Mounted Enclosures:
    - a) Type NEMA 1
    - b) Minimum 12 gauge steel construction with continuously welded seams.
    - c) Heavy gauge continuous hinge with stainless steel hinge pins.
    - d) Latches: Stainless steel, cam actuated link lock latches. Consist of stationary panel clips engaged with easy access door mounted cam actuated latch. No tools shall be required to open and properly secure the enclosure.

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- e) Provide enclosures with louvers, forced ventilation, or air conditioners as required to prevent temperature build-up. Except for enclosures mounted with their backs directly adjacent to a wall, place louvers in the rear of the enclosure, top and bottom. For enclosures mounted with their backs directly adjacent to a wall, place louvers on the sides.
  - f) ANSI 61 gray polyester powder coating inside and out over phosphatized surface.
2. Free Standing Control Panels:
- a) Type NEMA 12
  - b) Provide removable lifting rings, interior lights, and receptacles as for steel enclosures.
  - c) Minimum 12 gauge steel construction with continuously welded seams.
  - d) Heavy gauge continuous hinge with stainless steel hinge pins.
  - e) Gasketed overlapping doors with no center post.
  - f) Provide doors with three-point latches. Provide key locking latching mechanism.
  - g) Provide enclosures with louvers, forced ventilation, or air conditioners as required to prevent temperature build-up. Except for enclosures mounted with their backs directly adjacent to a wall, place louvers in the rear of the enclosure, top and bottom. For enclosures mounted with their backs directly adjacent to a wall, place louvers on the sides.
  - h) ANSI 61 gray polyester powder coating inside and out over phosphatized surface.
3. Acceptable Manufacturers:
- a) Hoffman Engineering Company.
  - b) Stahlin Enclosures (Robroy Industries):
  - c) McKinstry Incorporated.
  - d) Hammond Manufacturing.

**2.3 POWER DISTRIBUTION**

- A. Each SEP control panel shall include a main disconnect switch rated in accordance with the overcurrent protection provided to the panel.
  - 1. The operator handle shall be lockable and accessible from the front of the panel.
- B. The incoming service of the control system shall be 480 volt, 60 hertz, three-phase
- C. Distribution from panel main disconnect to starters shall be performed via Power Distribution Blocks as manufactured by Marathon, Bussman, or Ferraz-Shawmut and terminal blocks as described above.
- D. Provide for feeder circuit conduit entry as appropriate to physical layout.

**2.4 PANEL WIRING AND TERMINATIONS**

- A. Wire and terminate equipment in accordance with the latest standards of the National Electrical Code as well as state and local electrical codes.

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- B. Wiring:
1. Use flexible stranded copper wiring.
    - a) Run wires in continuous lengths from terminal to terminal. Do not splice wires.
    - b) Provide and install wire markers on all wires. Wire markers numbers shall match terminal numbers.
  2. Use type MTW, THHN or THWN wiring with insulation rated at 600 V.
    - a) Use 14 AWG or larger wiring.
  3. Segregate signal wiring from control power wiring, group functionally and arrange neatly to facilitate tracing or circuits.
  4. Use plastic wiring wraps to bundle wires, outside of wiring ducts. Securely fasten the bundles to the steel structure at intervals not exceeding 12 inches. Use Panduit wiring ducts and size to provide a minimum of 20 percent spare space.
  5. Do not intermix signals within the same bundle or duct.
  6. All wires entering or leaving the control panel shall be wired through an interfacing terminal block.
  7. All wiring shall be clearly labeled at each termination end with permanent labeling sleeves or adhesive labels.
    - a) Points of electrical equivalence shall bear the same unique identifying number.
    - b) All wire numbers shall be clearly identified on the control panel drawings.
    - c) All field changes shall be incorporated into the As Built wiring diagrams.
- C. Color code wiring as follows:
1. All low voltage (less than 300 VAC) wiring that obtains overcurrent protection from within the control panel shall be red in color.
  2. All three-phase wiring is to be color coded in accordance with Section 16050, Article "Identification Materials and Devices."
  3. All control wiring whose originating control power is from a source outside of the control panel shall be orange or yellow in color. (e.g. Interfacing between SEP and equipment control panel)
  4. All D.C. wiring is to be blue in color. Positive leads are to be dark blue. Negative Leads are to be a lighter shade of blue or white traced with a blue stripe.
  5. All neutrals for control wiring are to be white in color.
  6. All grounds will be green in color.
  7. All two (2) conductor shielded cables used for analog inputs shall contain a red or white (clear) conductor to be identified as positive and a black conductor to be identified as negative.
- D. Terminal Blocks
1. Provide factory assembled terminal blocks on a mounting channel and bolt the channel to the inside of the panel. Space terminal block strips no closer than six inches center to center.

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2. Provide screw type 600 V terminals with pressure plate to accept wire size #14 AWG and larger. Do not use miniature terminal blocks.
  3. Provide a continuous marking strip with the terminals.
  4. Reserve one side of each terminal strip for field incoming conductors. Do not make common connections and jumpers required for internal wiring on the field side of the terminal.
  5. Terminate no more than two wires at any one terminal.
  6. Provide a minimum of 25 percent spare terminals.
- E. Grounding
1. Provide ground buses in each cabinet or panel
  2. Provide grounding lugs for connection to the external grounding system.

**2.5 MOTOR STARTERS**

- A. Provide Allen Bradley, Bulletin 190 starters (no substitutions) as follows:
- B. Combination Starter shall be Coordinated Protected Starter, Cat. No.190-CPS40D with 190-PXXX trip unit appropriately sized to motor full load amperage and service factor.
1. Starter coil voltage shall be 120V, 60 Hz.
  2. Coordinate with equipment vendors as required to obtain full load amperage and service factor for each motor.
- C. Starter Accessories:
1. Auxiliary Contacts, 2 NO & 2 NC, Cat. No. 190-A22C.
  2. Remote Operator Module, powered at 120 VAC, Cat. No. 190-RCX120.
    - a) Device may be signaled at either 24V or 120V. Contractor shall coordinate with the equipment vendor associated with each SEP and provide the appropriate remote operator module to match vendor control voltage.
  3. Coding Pin, coordinated with each trip unit to prevent insertion of incorrect trip unit into Cat. No. 190-N7

**2.6 SELECTOR SWITCHES, PUSHBUTTONS, AND INDICATING LIGHTS**

- A. Use NEMA Type 13 oil-tight selector switches, pushbuttons, and indicating lights. Provide units which will accommodate panel thickness from 1/16-inch to 3/16-inch. Provide units which are approximately 1½-inches square.
- B. Include operator mechanisms and contact blocks on selector switches and pushbuttons. Label contact block terminals for identification purposes and provide at least one single pole, double throw contact. Use heavy-duty type contact blocks rated 10 A at 115V AC breaking current.
- C. Where the contact blocks handle analog (4 to 20 mA) and 24V DC or less contact closure signals, provide contact material of gold or gold flashing over silver and rated 0.5 A at 115V AC.

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- D. Provide two-, three-, and four-position maintained contact selector switches as required for control interface.
- E. Provide spring return selector switches as noted.
- F. All indicating lights shall be low voltage transformer type with push-to-test feature.
- G. Acceptable Manufacturers:
  - 1. Allen Bradley
  - 2. Square D
  - 3. Cutler Hammer
  - 4. CMC

**2.7 NAMEPLATES**

- A. Front-Panel Mounted: Furnish nameplates to properly identify all systems and equipment. Submit a final list of name plates to be used and a location drawing to the Engineer for review. Provide all name plates of laminated plastic having black letters on white background, including device identification number as well as a descriptive name.
- B. Back-of-Panel Mounted: Use plastic markers with black letters on a white background in the panel interior to identify each device mounted on the panel exterior or interior. Locate the markers adjacent to, but not on, the given device and do not obstruct visibility by wire bundles or other equipment. Include device identification number as well as descriptive name on all nameplates.

**2.8 RELAYS**

- A. To assure similar appearance and uniform operating characteristics, provide all relays from the same manufacturer. All relays shall have a clear polycarbonate dust cover. Provide UL recognized relays. All relays shall have an integral LED that lights when the relay is energized.
- B. Provide all miniature-type relays with contacts rated not less than 5 amperes at 120V AC. Provide relay coils of molded construction and operation at 120V AC  $\pm$ 10 percent, 60 Hz.
- C. Provide relays rated for an operating temperature range compatible with the environment.
- D. Provide blade base plug-in type relays furnished with appropriate sockets, and Westinghouse Type MP.
- E. Acceptable Manufacturers:
  - 1. Potter & Brumfield
  - 2. Magnecraft & Struthers-Dunn
  - 3. Square D Company
  - 4. Idec

**PART 3 - INSTALLATION****3.1 INSTALLATION**

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- A. Contractor shall furnish and install all anchors, supports, mounting devices, conduits, wiring, and other items required for a complete, functioning system. Contractor shall furnish and install any required liquid tubing, piping, and pipe tags required for the system, unless specifically covered in another section of the Specifications
- B. Install system in strict accordance with approved Shop Drawings and the manufacturer's instructions. Contractor shall be responsible for making any field modifications or adjustments required to provide a complete, functioning system.

**3.2 CLEANING**

- A. Remove shipping stickers, paint splatters, dirt, grease, and other contaminants to restore the instrumentation to a clean and like-new condition prior to final acceptance.

END OF SECTION 16900