

SECTION 16900CONTROLSPART 1 - GENERAL1.1 DESCRIPTION

- A. Work Included: Provide and install all panel and enclosure components and appurtenances as shown on the Drawings and as specified herein.
- B. Related Work Specified Elsewhere (When Applicable):
  - 1. Process equipment is specified in Division 11.
  - 2. Instrumentation is specified in Section 13440.
  - 3. Heating and ventilating is specified in Division 15.
  - 4. "Electrical - General" is specified in Section 16050.
  - 5. Panels, cabinets and enclosures are specified in Section 16160.

1.2 SUBMITTALS TO THE ENGINEER

- A. Shop drawings are required for all items provided under this Section. Submittals shall be in accordance with Sections 01340 and 16010.

1.3 QUALITY ASSURANCE

- A. Items provided shall be in accordance with the following:
  - 1. Underwriter's Laboratory, Inc. listed.
  - 2. National Electrical Manufacturers Association Standard 250-1991.
  - 3. American National Standards Institute.
  - 4. National Electrical Code.
- B. Items supplied under this Section shall conform to the requirements of Specification Section 16010 Paragraph 1.2, "Quality Assurance".
- C. Where equipment specified herein is based upon a manufacturer's standard model, other equivalent items will be considered. Equipment of other acceptable manufacturer's shall be equivalent in every way to that of the equipment specified.
- D. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of items with the project schedule.
- B. Exercise care during loading, transporting, unloading, and handling to prevent damage. Check for defects or damage upon arrival at construction site.
- C. Store in areas which will afford protection from the weather, as well as excessive condensation and construction dust and debris.
- D. Replace or repair, to the satisfaction of the Engineer, any items which are defective or have been damaged during installation, at no additional cost to the Owner.

## PART 2 - PRODUCT

### 2.1 MATERIALS

#### A. Control Stations:

1. Control stations shall be heavy duty oil-tight/watertight type unless noted otherwise on the Drawings and shall consist of operators with contact blocks and indicator lights, when indicated, mounted in either a cast or sheet steel enclosure, as specified. Although only one manufacturer has been noted, acceptable manufacturers are Allen Bradley, General Electric, Square D, or approved equal.
2. All operators used in heavy duty oil-tight/water tight control stations shall be Square D type K and shall be suitable for cover mounting in a 1-7/32 inch diameter notch type cover hole and shall be held in place by the locking thrust washer. Push buttons and selector-push buttons shall have removable inserts in eight different colors for function color coding. Push-button inserts and selector switch knobs shall be removable from the front of the control station without disturbing the wiring or mounting of the control units. Selector switches shall have removable knobs in eight different colors for function color coding. Operators for selector switches shall be bat wing type.
3. Contact blocks used in heavy duty oil-tight control stations shall be Square D Type K single-pole, single-throw (SPST) or single-pole, double-throw (SPDT) and shall be suitable for mounting side by side and/or in tandem to the base of the operator. Contact block mounting screws shall be captive with a drilled and tapped head to permit easy tandem mounting of contact blocks. Terminals shall be pressure wire type with a self-lifting pressure clamp that will compensate for wire of different size ranging from #12-#18 solid or stranded. Contacts shall be double break. Contact tips shall be silver.
4. Enclosures used in heavy duty oil-tight control stations shall be sheet steel NEMA 13 construction unless noted otherwise on the Drawings. When the Drawings indicate a NEMA 4 enclosure use cast aluminum type. Six unit and larger enclosures shall have hinged covers. All enclosures shall have sufficient depth to accommodate mounting four Class 9001 KA-1 contact blocks side-by-side and in tandem behind a single operator for a maximum of eight circuits, four normally open and four normally closed.

#### B. Control Circuit Fuses

1. Fuses shall be 3AB ceramic body fuses rated for at least 125 volts at the current ratings shown on the Drawings. Fuse size shall be 1/4" x 1 1/4".
2. Blow time shall be: 110%, 4 hours minimum; 135%, 1 hour maximum; 200%, 15 seconds maximum for 1/8-12 amp fuses and 60 seconds maximum for 15-30 amp fuses.
3. Fuses shall be Littlefuse or equal.

#### C. Relays

1. Industrial Control Relays - Industrial control relays shall be utilized where specifically called for on the Drawings or within the Specifications. Industrial control relays with 10 ampere contact rating shall be Square D, Class 8501

- Type X or equal. Relays with 30 ampere contact rating shall be Square D, Class 8501, Type C or equal.
2. Pilot Duty Relays - Unless specifically noted otherwise, relays shall be general purpose relays. General purpose relays shall be IDEC RH Series, 10A contact rating, 4 Form "C" contacts or equal, provided with internal indicating light. Pilot duty control isolating relays for PLC inputs and outputs shall be suitable for the application, and shall be submitted for approval by Engineer.
  3. Relays shall be electrically held, electrically operated with 120 volt coils except as noted otherwise on the Drawings. Contacts shall be rated 600 volt, 10 ampere and shall be convertible from Normally Open to Normally Closed. Where relays are used to control single-phase, fractional horsepower motors, contacts shall be rated in accordance with the N.E.C. for the motor to be controlled. Where relays are not installed within system control panels, provide a suitable enclosure as specified in Section 16160, with NEMA ratings as indicated on the Drawings.
  4. Dry contacts used for telemetry inputs or other low current inputs, shall be bifurcated cross bar gold overlay silver and rated dry circuit. These contacts will be provided through dedicated interposing relays as shown on the schematic diagrams of the Drawings. Relays shall be provided with plug-in type sockets with screw terminal wiring connections to facilitate relay change out and wiring. Relays shall be Potter and Brumfield type KHAU-17A16 - 120 or 12V as shown on Drawing, or approved equal.
- D. On-Delay & Off-Delay Timing Relays
1. Solid State - Unless specifically noted otherwise, time delay relays shall be general purpose time delay relays. General purpose time delay relays shall be IDEC RTE or equal.
  2. Delay timing relays shall be solid state type rated for use at 120 volts. Contacts shall be NO or NC as detailed on the Drawings or within the Specifications, and shall be rated 5 amperes (minimum). Minimum time range shall be adjustable from 1 second to 1 minute. Other ranges as required by function and as indicated on the Drawings or within the Specifications. Where mounted external to control panels, delay timing relays shall be provided with enclosures as specified in Section 16160, with NEMA ratings as indicated on the Drawings.
- E. Miscellaneous Indicating Lights
1. Indicator lights shall be heavy duty, oiltight and designed to operate at 120 volts, 60 Hz AC. Indicator lights shall be provided with a chrome-plated metal or anodized-aluminum mounting rings, engraved as indicated on the Drawings. Lens color shall be as indicated. Indicator lights shall be 30 mm LED lamp type, with "Push to Test" option to allow easy testing of lamp integrity. Lights shall maintain NEMA rating of panel/enclosure.
- F. Fuse Blocks
1. Fuse blocks shall be rated for at least 30 amps and 300 volts. The clips shall be high tensile spring brass, electro-tin plated. The base shall be polyester, glass reinforced with a UL-94VO flammability rating.

2. At least four spare sets of clips shall be provided on each fuse block and shall be labeled "SPARE".
  3. Fuse blocks shall be Littlefuse Omni-block or equal.
  4. Fuse block switches shall be din rail mounted.
- G. Terminal Strips
1. Terminal strips shall be supplied to make all power and control connections. All terminals shall be clearly marked for easy identification. A ground terminal strip shall also be provided. At least 20 percent of terminals supplied shall be spare. All wiring shall be terminated on field terminal blocks.
  2. Terminal blocks shall be rated at least 300 volts for NEMA general industrial control devices and 600 volts for NEMA limited power circuits. Terminal blocks shall be spring-type Wago terminals or equivalent. Terminals shall be color-coded according to the following:
    - a) Analog and Discrete I/O: Grey
    - b) Line AC Power: Blue
    - c) 24 VDC Power: Red
    - d) DC Common: Black
    - e) System Ground: Yellow-Green
    - f) Intrinsic Safe: Light Grey
    - g) Intrinsic Safe Ground: Yellow-Green
  3. All wiring terminating on Wago terminals shall be fitted with color-coded ferrules, properly sized according to the conductor gauge size.
- H. Control Power Transformers:
1. Supply all control power transformers necessary to make panel functional. All transformers shall have both primary legs and all "hot" secondary legs fused. One secondary leg shall be grounded.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All items incorporated into the work shall be installed in accordance with the Drawings and Specifications. Where detailed drawings or technical specifications are not provided, the items shall be installed in accordance with the manufacturer's preferred recommendations and conforming to the best practice of the trade involved.
- B. All installations shall be in accordance with the applicable sections of Division 11, 13, 14, 15 and 16.

### 3.2 TESTS

- A. All items shall be factory tested. Field tests shall be as specified in applicable sections of DIVISIONS 11, 13, 14, 15 and 16. In the absence of specific requirements for field tests, Contractor shall demonstrate proper functions of all items under simulated operating conditions

END OF SECTION