

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes: Electrical work required in the manufacturing, testing and commissioning of the compressed natural gas station. Work Includes:
1. Provision of electrical and controls equipment and materials specifically listed herein and as required to accomplish a complete and functioning system consistent with Owner's bus maintenance, operations and specification requirements.
 2. Complete fabrication of the natural gas fueling equipment and control systems and necessary connections.
 3. Provide wire, conduit, fixtures, appurtenances and equipment for power, control and communications as indicated.
 4. All switchgear shall be equipped with adequate anchoring and bracing for the seismic conditions at the project site.
 5. Contractor shall supply accurate drawings detailing the interconnecting conduit and wiring between the CNG station components and equipment, including power and control panels.
 6. Provide equipment lugs on all pieces of equipment for a #3/0 copper ground loop.
 7. Provide ready access and connection points in conduit or boxes to facilitate field installation and connection.
 8. On site verification of site terminations and testing of circuits.
 9. Fabricator shall leave all seals unpoured but supply approved sealing material (such as "chico") for the field Installation Contractor.
 10. Supply six explosion proof ESD buttons crated loose, as well as buttons on each skid mounted piece of equipment, and on each dispenser.
 11. Signs and labeling.
 12. Provide related work not included in this section, which is required through applicable codes and for complete installations.
 13. Delegated Design:
 - a. Provision of Arc Flash study and implementation of all recommendations and labeling.

B. Related Sections:

1. Section 18000 - All

1.02 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Equipment manufacturers (panel fabricators and skid assemblers) shall have at least 10 years of experience in manufacturing products and accessories similar to those specified for this Project, with a record of successful in-service performance. Provide list of projects.

1.03 SUBMITTALS

A. Submit :

1. Product Data: All specified products and materials.
2. Qualifications: Manufacturer's list of products.
3. Deferred Submittals: See Section 18000, General.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Contactors, Panel Pilot Lights and Push Buttons: NEMA rated "heavy duty, industrial," as manufactured by GE, Square D, Cutler Hammer or Allen-Bradley or approved equal.
- B. SCR motor control equipment to be GE, Allen Bradley, Square D or approved equal.
- C. Circuit Breakers: Square D, Cutler Hammer or approved equal.
1. Circuit breakers shall be interchangeable with equipment supplied in the Maintenance buildings.
- D. Programmable Logic Controllers (PLCs): Allen Bradley Compact Logix or approved equal for the MCP and UCPs and Allen Bradley MicroLogix on the CNG dryer. PLCs must be networked together.
- E. Operator Interfaces (OI): Allen Bradley Panel View or approved equal.
- F. Motors: Reliance, Siemens, Toshiba, Marathon, or approved equal.
- G. Shielded Cable: Belden, Carol or approved equal.
- H. Combustible Gas Detectors: Det-tronics or SEC Infrared Hydrocarbon Gas Detector with addressable communications, digital display of LEL and relay and 4-20mA outputs; or approved equal.

2.02 MATERIALS

- A. Electrical components and assemblies shall be new and shall bear CSA/NRTL or UL or FM approval for this application.
- B. All cabling and buss bar shall be copper—aluminum is not acceptable.
- C. All breakers are to be rated with KAIC ratings as dictated by utility and short circuit protection study—assume 65 KAIC for bid purposes.
- D. Controls, displays, switches, IS barriers, relays and contactors, instrumentation and other electrical components that are not specifically called out in this Section shall be non-proprietary, third party supplied.
- E. Main compressor drive motors, cooler fan motors and exhaust fan motors shall be 480 VAC with a service factor of 1.15. Compressor main drive motors shall be Class 1, Division 2 rated. Fan motors shall be Class 1, Division 2 rated. Motors over 25 horsepower shall be equipped with thermocouples in each winding to allow monitoring of winding temperatures through the PLCs. Motors shall be rated high or premium efficiency.
- F. Motor starters shall be NEMA rated and equipped with overload relays to protect the motor from excessive current. Overloads shall be wired to provide an overload fault signal to the PLC controls. Contactors shall be equipped with an auxiliary contact which will be wired to the PLC controls to indicate a contact closure failure. Motors over 50 horsepower shall be controlled with an SCR electronic soft start.
- G. Motors greater than 300 Hp are to be equipped with Variable Frequency Drives (VFDs).
- H. The Motor Control Center (MCC) that houses all power distribution and motor control shall be sized for the current base bid equipment and the future simplex compressor. Each compressor shall have its own section or backplate in the MCC.
- I. Electrical panels mounted outdoors shall be NEMA 4 or NEMA 3R rated. Electrical panels shall be designed to avoid the need for air purging by using Class 1, Division 2 rated components, or by mounting outside of a hazardous area. The Master PLC Control Panel (MCP) and the Unit Control Panels (UCPs) shall be sized such that at least 25 percent of the panel backplate area is available for future installation of additional equipment, including room for an additional 25 percent of terminal blocks of each voltage.
 - 1. In the MCP, this additional space shall be measured after accounting for the future compressor.
- J. Intrinsically protected circuits, pressure transducer circuits and communications cable shall be shielded cable of 18 gauge or larger. Individual pairs shall be shielded. The shield shall be grounded at one end only to the common frame ground.

- K. Conduit for Intrinsically Safe (IS) circuits shall be rigid galvanized or “Liquid Tite” sealed and installed in accordance with the NEC requirements for Class 1 (Hazardous Locations).
- L. Devices isolated from the main skid, such as compressor enclosure door panels, shall be grounded with copper ground cables.
- M. Conduit seals shall be EYS or EZS. Sealing cement (chico) shall be packaged and shipped with the equipment to site. Seals shall not be poured until equipment has received final Owner and regulatory approval.
- N. MCC Power Distribution and Control Panel and MCP Master PLC Panel (as applicable):
 - 1. Panel shall meet seismic requirements of the site location.
 - 2. MCC Panel bus rating for new site service entrance equipment and main site breaker panel shall be minimum 1000 A, 480 V, 3 phase, 4 wire.
 - 3. MCC and MCP main panel breaker shall be equipped with an appropriately rated surge suppressor on the load side. Leads from the surge suppressor to the breaker shall not exceed 18”.
 - 4. Breakers shall be lockable in the off position and all 480 VAC breakers to include 120 V shunt trip coil.
 - 5. SCR starters for the CNG main compressor motors. SCRs shall be heavy duty rating with integral bypass contactor to engage once motors reach full operating speed.
 - 6. Disconnects and cross-line starters for fans, air compressors, and pumps shall be provided.
 - 7. MCP shall include Uninterruptible Power Supply (UPS) sized to maintain control power for a minimum of two hours on all PLCs, Operator Interfaces, dispenser heads and dispensing system solenoids.
- O. All electrical panels shall include a thermostatically controlled panel heater if required for equipment to operate reliably in all climatic conditions on site.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify installation by others as satisfactory prior to commissioning station. Beginning commissioning work constitutes acceptance of conditions as satisfactory.

3.02 INSTALLATION

- A. Supplemental Installation Requirements:

1. Terminations: The Equipment Supplier shall verify all electrical terminations to the CNG station equipment.
2. Conduit for intrinsically safe circuits shall be galvanized rigid metal conduit or “Liquid Tite” sealed and installed in accordance with the NEC requirements for Class 1 (Hazardous Locations).
3. Conduit runs shall be cleaned to remove debris and water which may have collected during installation, prior to conductors being drawn in.
4. Flexible Conduit: Flexible connections made in a hazardous area shall be approved for NEC Class 1 (Hazardous Locations) requirements. In general purpose and Division 2 areas, only “Liquid Tite” flex with approved seal-tight connectors shall be used. The interior of the dispenser, defueling and buffer panels and other panels containing gas componentry shall be considered as Class I, Division 1, Group D environments which require braided metal flexible connectors rated for this area.
5. Grounding:
 - a. General: Grounding shall be done in accordance with the regulations of the NEC and the applicable inspection authority. The use of conduit in place of a ground conductor is prohibited.
6. Sealing: The cross-sectional area of the conductors permitted in a conduit seal shall not exceed 25 percent of the cross-sectional area of a conduit of the same trade size. Pour seals after Owner’s approval. Seals shall be packed within approved packing compound and sealed using UL approved sealing compound. Seals shall not be poured at a temperature lower than that approved by the inspection authority (generally 40 degree F).
7. Labeling and Identification:
 - a. Intrinsic conduits shall be labeled as indicated in the NEC (NFPA 70).
 - b. Conduits shall be labeled immediately outside of every box or panel as they enter or leave with stainless steel or brass labels. The conduit number and maximum voltage shall be clearly indicated in 1/2 inch high letters and permanently affixed to the conduit with stainless steel wire or chain.
 - c. At distribution centers, pullboxes, wireways, and the like, feeder conductors of each feeder group shall be neatly labeled, then laced or clipped into a feeder group.
 - d. Label conductors at each end of every wire and at each junction box where splicing is required with permanent, fade resistant wire numbers as listed on the equipment supplier’s drawings. The numbering system shall be in strict accordance with the equipment drawings. Site numbering which does not match the drawings shall not be acceptable. Where no

numbers are shown on the drawings, the wires shall be identified according to the panelboard and circuit number of device terminal block number from which they originate. Hand written labels shall not be used.

- e. Spare PLC I/O shall be wired to the terminal strip and labeled. External terminations to the electrical panels shall be made at the terminal strip and labeled.
 - f. Supply revised installation drawings as well as equipment drawings which indicate wire numbers for all wires including spare conductors.
8. Miscellaneous:
- a. Wires and cables shall be bundled neatly and tied using T & B TY-RAPS, or approved equal. Wiring shall represent a neat appearance upon completion.
 - b. Conduits except 480 VAC shall be provided with a minimum of 30 percent spares, unless specified otherwise in the Conduit Schedule. Spares shall be numbered on the record drawings.
 - c. Emergency shutdown (ESD) buttons shall be factory installed on the equipment including one at each dispenser, compressor, dryer, and six others to be installed remotely (remote button stations to be shipped loose). Buttons shall terminate dryer, compressor, and dispenser operations immediately and shall require key reset from the master control panel. The ESD circuit shall be hardwired (not PLC input) and shall be failsafe (de-energized condition requiring manual restart).

PART 4 - MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. No separate measurement or payment will be made for the work required by this section. The cost for this portion of the Work will be considered incidental to, and included in the Lump Sum price bid for the Project.

End of Section
