PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Design, manufacturing and testing of the CNG gas control, storage and dispensing equipment for the compressed natural gas station. .

2. The Work includes mechanical and electrical fabrication work and programming required in the shop fabrication of the CNG gas control equipment.

B. Related Sections:

1. Section 18000 - All

1.02 QUALITY ASSURANCE

A. Manufacturer Qualifications: Equipment manufacturers shall have at least ten years of experience in manufacturing products and accessories similar to those specified for this Project, with a record of successful in-service performance.

1.03 SUBMITTALS

A. Submit in accordance with:

1. Product Data: for products and materials in this Section.

2. Test Certificates: Dispenser hoses.

3. Qualifications: Manufacturer's list of projects.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with the following:

1. Dispensing and gas storage equipment shall be shipped to site only once the Contractor has completed the foundation pad and is ready for permanent installation.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION AND PERFORMANCE OF GAS CONTROL SYSTEM

A. CNG Priority Fill, and ESD System: **(One panel in scope)**

1. Panel to be supplied loose with supporting framework for mounting at the storage. Panel to be stainless steel.

2. Panel shall be controlled by the MCP PLC. All flow control valves to be 1" actuated ball valves.

3. Panel to be configured to connect two compressors, three banks of storage and three dispenser lines.

4. Provide one explosion proof or intrinsically safe pressure transducer for each of the three banks of storage. The pressure transducers must be tied directly into, and monitored by, the compressor MCP PLC.

5. One stainless steel, glycerin filled, 2-1/2 inch pressure gage shall be installed in the panel for each of the three banks of storage and for each of two compressors feeding the panel. The pressure gages will be flush mounted so they can be viewed from the outside of the panel without opening the panel doors.

6. Explosion proof, three way pilot air solenoid valves. These solenoids shall be controlled by the MCP PLC.

7. Automatic fail safe, normally closed, 1 inch stainless steel valves with stainless steel trim. The tubing to/from each valve shall be installed so the valve can easily be removed without removing any additional tubing or components. Each valve shall be controlled by a three-way solenoid valve with control logic from the station Master PLC. The valves shall provide the following function:

    a. Direct the flow of gas from the compressor(s), first to any vehicle that is filling at a dispenser.

    b. If no vehicles are fueling, direct the gas flow to the third or high pressure bank to keep it at maximum pressure (4500 psig or as set on site), when the third bank reaches maximum pressure, fill the second bank to maximum pressure, when the second bank reaches maximum pressure fill the first or low bank to maximum pressure, then signal the compressor(s) to shut down.

    c. If at any time an ESD is pressed, the storage banks must be isolated by removing power from the spring return, fail safe, actuated ball valves. The master PLC will use a signal from the dispenser to open the storage ESD valves only when a hose is active.

8. The panel shall be equipped with service bleed valves to properly and safely bleed down fittings required to service all components and instrumentation within the panel. This bleed down is to be tubed to the bleed down vent line that is directed to above the fueling canopy.

9. Lines to and from the panel shall be equipped with manual, stainless steel ball valves with stainless steel trim and a locking kit. The inlet and outlet of each valve shall be a compression fitting.

10. Minimum tubing and valve size within the panel and in the flow path from the compressor to the storage and from the storage to the dispenser manifolds is 1-inch.

11. Pilot tubing from the actuators to the solenoid valves and from the solenoid valves to the pilot air supply including one manual ball valve with locking kit for the pilot air supply to the priority/ESD panel. The inlet to this valve shall be 1/4-inch FNPT (for pipe connections) or 3/8-inch stainless steel compression fitting (for tubing connections).

12. Junction boxes and conduits required for installation of the solenoids and pressure transducer including explosion proof seals on each conduit entering the priority/ESD panel.

B. CNG Cascade Storage System: One included with site provision for a second future unit.

1. One storage vessel assembly each with 35,000 scf of CNG storage (nominal) capacity at 4,500 psig shall be provided.

2. Vessels shall be 5,500 psig (or greater) design pressure to ASME Section VIII, Div. 1, (3:1 safety factor is allowed on seamless cylindrical vessels).

3. Vessels shall be either cylindrical tubes or spheres supported by a structural steel frame. Spheres must be equipped with brackets to allow them to be stacked 2 high.

4. Vessels shall meet ASME Sect VIII Div 1 requirements for CNG application, and be registered with the National Board.

5. 1-inch lockable isolation ball valves shall be provided on the process connection of each vessel.

6. A "UV" stamped safety relief valve is to be provided on each vessel with an isolation ball valve locked in the open position.

7. Each vessel shall be equipped with a multi-turn “gage valve style” drain valve at the relief valve end. Storage assemblies must be approximately 2 inches higher at the process end to facilitate draining at the relief valve end. Vessel drain valves shall be arranged and tubed to a height of approximately 24 inches to 36 inches from grade. Note that for 3 tube assemblies, drains for one 3 tube assembly will be operated from the one side of the assembly (in place) while drains for the other assembly will be drained for the other side (in place).

8. The maximum footprint available for each storage vessel assembly is 3 feet wide x 25 feet long.

9. Vessels shall be configured to allow the future addition of an identical assembly.

C. Common Requirements for Light Duty Vehicle Dispensers:

1. Meters and dispensers must be approved for retail sale of fuel with all regulatory agencies with authority at this site. This shall include but not be limited to NIST approval.

2. Dispenser display heads must be compatible with the Owner's selected fuel management system. This display head must provide scalable volume and penny pulse outputs and authorization in and out signals.

3. Dispensers are to communicate with the MCP PLC via Ethernet, RS 485, ModBus or approved equal.

4. Dispensers shall include electronic temperature compensation as follows:

   a. Electronic temperature compensation controlled by the main PLC or the dispenser, to regulate to 3,600 psig at 70°F.

   b. The system shall be reprogrammable to regulate to 3,000 psig at 70°F.

   c. For fast fill, this system shall compensate for ambient temperature and heat of compression effects to fill to 95 to100 percent of tank rated capacity under initial pressure and ambient conditions where code pressure limits do not restrict filling to higher pressures.

5. One explosion proof or intrinsic pressure transducer shall be installed on tubing immediately upstream of each fast fill hose. The pressure transducers shall be tied directly into and monitored by, the main PLC.

6. One stainless steel, glycerin filled, 2-1/2-inch pressure gage shall be connected to the tubing upstream of each hose. The pressure gage shall be tied into the dispenser panel downstream of the automatic valve and flush mounted so it can be viewed from the front of the dispenser panel.

7. Each fast fill hose shall have an ASME "UV" Stamped SRV set and sealed at 4,500 psig to protect the hose from over pressurization. This will include an SRV inlet connection to the process tubing and an adequately sized SRV outlet connection to the vent piping.

8. Components shall be rated to 5,000 psig with safety factor as required by ASME B31.3.

9. Each line within the dispenser shall be equipped with service bleed valves to properly and safely bleed down fittings required to reconnect the hose after breakaway or to service any components or instrumentation in the dispenser.

10. Hoses shall be mounted to be sufficiently anchored and reinforced that it can withstand, without damage, a hose tension 4 times that imposed by a breakaway event. (This may require the installation of outside 4-inch HSS support posts to suspend the fueling hose on fast fill dispensers.)

11. Hoses shall be a maximum of 18 feet in length. The Owner will advise the actual required length prior to shipment of the equipment.

12. Hose retractors shall be provided to prevent the hose from touching the ground when in use or in storage position.

13. Cabinets and cabinet frames to be stainless steel.

14. Cabinets shall not include any manufacturer logos, other than on the serial number plate.

15. Cabinets shall include hose number labelling in 4" high letters—numbers to be advised by Owner.

D. CNG Light Duty Fast Fill Vehicle Dispensers Requirements **(One Dual Hose in scope):**

1. Minimum tubing and valve size within the dispenser flow path is 1/2-inch. Standard port ball valves are acceptable.

2. Micromotion CNG 50 meter on each hose (approved by local weights and measures authorities).

3. Each dispenser hose assembly shall be 3/8-inch for flow and 3/8-inch for vent and shall be equipped with a stainless steel OPW CT1000 (or approved equal) fueling nozzle (vented away from the dispenser), an OPW ILB-1 (or approved equal) in-line stainless steel breakaway connection to limit longitudinal hose tension (to the level currently stipulated by NFPA 52) on each of the flow and vent hose.

4. Three explosion proof, three-way, pilot gas solenoid valves per hose to control the actuated valves that provide sequencing. These solenoid valves shall be controlled by the main PLC or the dispenser mounted sequencing controller. Sequencing system is to provide cascaded fill to maximize fill speed and storage utilization. In the event of an ESD, all actuated ball valves must close automatically. Pilot gas shall be tubed to vent to the vent connection.

5. Three automatic fail safe, normally closed, stainless steel ball valves with stainless steel trim, per hose. **High pressure solenoid valves are not acceptable.** The inlet/outlet of this valve shall be a 1/2-inch compression (or zero clearance) fitting. If compression fittings are used, the tubing to/from the valve must be installed so the valve can easily be removed without removing any additional tubing or components. These valves shall be controlled by the three-way solenoid valves.

6. Each supply line to the dispenser shall be equipped with a manual, stainless steel ball valve with stainless steel trim and a locking kit mounted upstream of the filters. The inlet to each valve must be a 1/2-inch compression fitting.

7. Each line to the dispenser shall be equipped with a check valve internal to the sequencing system to prevent back feed from higher banks. The inlet/outlet of each valve shall be a 1/2-inch compression fitting.

8. A manual, 1/2-inch stainless steel ball valve with stainless steel trim and a locking kit shall be provided in an easily accessible location on the outside of the dispenser cabinet just upstream of the fueling hose.

9. Dispenser manufacturer shall provide prefabricated dispenser installation "pits" which shall be cast into the concrete island. A total of two light vehicle dispenser pits will be required (one for the in scope dispenser and one for a future dispenser). Pits shall be a minimum of 18 inches deep with an open bottom, or deeper if required to house and provide adequate service access for all components including filters. The size of the pits shall be the minimum of the projected area under the dispenser, or as required to provide sufficient room for all equipment. Dispenser pits shall be stainless steel and shall include a diamond plate lid on the future dispenser pit.

10. The dispenser shall be shutdown automatically by the master PLC or dispenser controller if preset flow rates or fill volumes are exceeded, or if a sudden loss of pressure occurs. These values shall be determined by the Equipment Supplier at time of commissioning. These values must be easily recalibrated in the field. The Equipment Supplier shall perform tests for the Owner, the Engineer and the local regulatory agency to prove its reliable operation.

11. Dispensers shall be field calibrated to +/-1 percent accuracy with a vehicle fill from 1,000 psig, 2,000 psig and 2,500 psig initial pressures.

12. Dispensers shall include an electronic digital display showing quantity in Therms, GGE or GDE as determined by the Owner at time of commissioning. This unit must be compatible with a fuel management system selected by the Owner. Pulse output from this display head shall be connected to a customer supplied fuel management system and to the station MCP PLC.

13. Dispenser shall be equipped with a green "dispenser active" light (or approved equal) mounted at the dispenser. This light will energize when the controller activates the dispensing cycle and will de-energize only after this cycle is fully completed or has been terminated manually. A digital display indicating fill status is acceptable.

14. The dispenser will provide signals to the Master PLC to indicate that a hose is active, the current hose pressure and the flow rate using a high speed pulse counter on the PLC. These signals will be used to open the ESD valves to allow dispensing, and by the future SCADA system to log fills.

15. An explosion proof, momentary contact, ESD button shall be installed on each dispenser and clearly labeled. Each ESD button shall be equipped with two Normally Closed (NC) contacts. One NC contact shall be hardwired in series with the other station ESDs and the master start pushbutton located on the

face of the MCP. The second NC contact shall be hardwired as an independent input to the MCP PLC.

16. One explosion proof or intrinsically safe vibration switch shall be installed in each dispenser enclosure. This switch shall initiate an ESD.

17. Junction boxes, conduits and explosion proof seals required for installation of the display head, micro motion, lights, solenoid and pressure transducers including explosion proof seals on each conduit entering the dispenser.

E. Filter Panels: **one required**.

1. Panels to be generously sized and constructed of Aluminum or Stainless Steel. Panels to include a lockable full face door on at least one side or on both sides if required to allow safe and convenient maintenance.

2. Each panel to include:

   a. One high capacity, pre-coalescing (Grade 10) filter on each of the three storage bank manifolds (3 filters per panel). These filters shall have a minimum 5,000 psig rating as well as filter size and capacity meeting or exceeding the specifications of Parker J-6 filters. The filter shall be serviceable without removal of adjacent tubing or equipment. The filter shall be equipped with a multi-turn “gage style” manual drain valve.

   b. Upstream and downstream isolation valves and flow tubing as indicated on the drawings. All flow tubing to be 1 inch.

3. Panels to be sized to allow the site installation of the insulating flanges from the underground lines within the panel.

F. Vehicle Defueling System: **One Manual Defuel Post Required.**

1. There will be a need at the facility to periodically defuel the vehicles partially or completely, to facilitate repairs to the high pressure tubing and vessels on the bus. This defueling process shall be accomplished under controlled and safe conditions.

2. A manual ball valve shall be installed immediately downstream of the defuel hose.

3. A manually-controlled multi-turn rising plug or gauge style throttling valve shall limit flow from the vehicle.

4. Each defueling post hose assembly shall be equipped with an OPW BDN defuel coupling (that mates to the NGV1 fueling receptacle coupling on the vehicle), a Swagelok 83 Series three-way manual valve (vented away from the dispenser). Other hose requirements are as per the hose requirements specified in Article 2.03, Materials.

5. The defueling post shall be equipped with two stainless steel, 0 to 5,000 psig, glycerin filled, 2.5-inch pressure gauges. One gauge shall be installed immediately downstream of the defueling hose. The second gauge shall be installed immediately downstream of the throttling valve. The pressure gauges shall be flush mounted so that they can be viewed from the outside of the defueling panel.

6. The vent stack shall be locally mounted and shall be a minimum two-inch schedule 80 pipe with a drip pocket with drain valve. The vent stack shall release vertically upward at a minimum height of 15 feet above grade. The vent stack shall be braced and supported to within 5 feet of the release point with 4 inch HSS. The vent stack shall be equipped with two earth ground lugs sized for 3/0 cable.

7. Supply one vehicle-to-vehicle defueling hose. Hose shall be conductive 3/8-inch CNG hoses meeting requirements in Article 2.03, Materials, and with an overall length of 50 feet with an in-line breakaway installed at the mid point. Hoses shall be equipped with a Swagelok 83 series three-way valve on each end. One end shall be equipped with an OPW BDN defueling connector. The other end shall be equipped with an OPW NGV1 fueling connector. The vent hose shall be split in the middle of the hose assembly to allow venting.

8. A detailed defueling and vehicle-to-vehicle defueling procedure shall be provided.

2.02 MANUFACTURERS

A. Dispensing Equipment shall be designed and manufactured by one of the following:

1. ANGI Energy

2. Atlas Copco (Greenfield Compression)

3. IMW

4. Kraus

5. TGT

2.03 MATERIALS

A. Gas control panels shall be NEMA 4X metal panels.

B. Dispenser Hoses:

1. Hose to be rated for CNG use by manufacturer and marked or tagged "For CNG Use".

2. Carbon steel braid hoses are not acceptable, even if the braid has a corrosion resistant plating.

3. If the hose is thermoplastic, it shall be factory pin pricked and pressure tested per NFPA requirements. Hose tag shall include the following:

    a. "For CNG Use"

    b. Test date

    c. Test pressure

    d. Hose serial number

    e. MAWP (maximum allowable working pressure)

    f. Burst pressure

    g. A copy of the test certificate shall be included in quality control information for the station.

4. Hoses shall be comprised of:

    a. A 2-foot electrically conductive whip hose rated for a minimum of 5000 psig operating pressure and 20,000 psig burst pressure, bonded to a 3/8-inch vent hose of the same specifications as the flow hose.

    b. An electrically conductive main hose rated for a minimum of 5000 psig operating pressure and 20,000 psig burst pressure of sufficient length to reach the fueling receptacle on the vehicles yet not touch the ground when the hose is disconnected, bonded to a 3/8-inch vent hose of the same specifications as the flow hose.

    c. Total hose length is to be maximum 20 feet or as required by code. Owner will advise preferred length prior to shipping.

5. Flow and vent hoses shall be equipped with an OPW ILB (in line breakaway), (or approved equal), in-line stainless steel breakaway connection to limit longitudinal hose tension to the level currently stipulated by NFPA 52.

6. A hose retractor and a holster are required for each hose to ensure that a 20' long hose does not touch the ground. Hose retractor cable shall be breakaway type.

7. Vent hoses shall be tubed away from the vehicle and vented above the dispenser.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Refer to Section 18000, General, for general installation requirements.

3.02 SHOP AND FIELD QUALITY CONTROL

A. Shop Testing – Dispensers:

1. Cycle valves under maximum operating pressure by actuating solenoids.

2. Test display head reset sequence and totalizers using signal generator on Micro Motion electronics.

B. Shop Testing – Storage: As required by governing codes, standards and best industry practice.

C. Field Testing During Commissioning:

1. Mechanical reliability of componentry based on a minimum of 100 fills per dispenser hose or 30 days operation, whichever occurs first.

2. Verification of controls logic and wiring.

3. Verification of safety and control device calibration, operation and program logic. The Contractor shall submit a calibration procedure for acceptance by the Consultant—this calibration will require the use of a master calibrated meter supply by the meter manufacturer.

4. Accurate and repeatable measurement based on a minimum of 500 fills per dispenser or 30 days operation, whichever occurs first. (not including defueling panel)

End of Section