

## SECTION 15980

### INSTRUMENTATION AND CONTROL

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, tools, and equipment, and install all instrumentation and controls associated with all new or upgraded Petroleum systems as required by the Contract Drawings.

##### 1.02 APPLICABLE STANDARDS

All instrumentation and control equipment shall comply with the following standards and all other applicable federal, state, and Building Official and Code Administrators (BOCA) Building Codes including revisions to the date of Contract.

NFPA	National Fire Protection Association
ANSI	American National Standards Institute
ASTM	American Society of Testing Materials
ASME	American Society of Mechanical Engineers
NEC	National Electric Code
ISA	Instrumentation Society of America
NEMA	National Electrical Manufacturers Association
IEEE	Institute of Electrical and Electronic Engineers
	The Board of Standards and Appeals of the City of New York
	The Building Code of the City of New York
	New York City Fire Law Handbook
API	American Petroleum Institute

Year-2000 Compliant: All electrical components including but not limited to computers, controllers, readouts, motors, transmitters, relays, displays, recorders, and associated software, etc. shall be capable of accurately processing, receiving, and sending data to and from their intended inputs and outputs, into and between the twentieth and twenty-first centuries (and extending throughout the twenty-first century), including leap-years, without any date-related malfunction.

##### 1.03 SUBMITTALS

###### A. Shop Drawings:

1. Wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function properly as a unit. Site specific, sealed electrical drawings will be furnished by the Veeder Root Engineering Consultant.

2. Equipment and instrument list, including size, input/output types, expected range of operation, utility requirements, and materials of construction. A Bill of Materials also shall be included and keyed to the drawings. The Bill of Materials shall provide sufficient information to determine compliance with the Contract Drawings and Specifications.
3. Drawings showing the proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of work, including clearances for maintenance and operation.
4. Manufacturers' descriptive and technical literature, including catalog cuts.
5. Legends for name plates.
6. Equipment certifications and test reports.

- B. Spare Parts Data: Within 30 days of Shop Drawing approval, the Contractor shall furnish spare parts data for each different item of material and equipment specified. Data shall include a complete list of parts and supplies, with current unit prices and a source of supply. A list of all special tools required for installation, maintenance or repair of equipment shall be provided.

At a minimum the contractor will supply the following spare parts and tools:

#0330020-067 cable seal kit	#0330020-90 cable kit
#0331028-001 cord grip	576010-780 red plastic lens
#312020-928 sensor mounting kit,	#330020-012 universal mounting kit
#312020-952 probe cap kit for UST or	#312020-984 probe cap kit for AST
#330020-282 probe riser cap	#331137-001 probe riser cap tool
#790095-001 emergency alarm	#790095-001 emergency switch
#0514100-304 sealing pack	0510901-337 tie wraps

where direct burial cable is allowed by code:

#848100-805 sealant	#848100-903 sealant gun	# 848100-904 tool
#848100-502 kit	#848100-501splice kit	#848100-500 prep kit
#848100-101 filler	#848100-301 cable	#848100-501 cable kit

The Contractor shall furnish those spare parts and special tools which are recommended by the manufacturers. The Contractor also shall provide a 12-month supply of any expendable items and frequently replaced parts as identified by the manufacturer. These items shall include but not be limited to: one (1) printer ribbon, 24 rolls of paper.

- C. Operating and maintenance instructions shall be provided for each different type of control, instrument, and system.

1. The Contractor shall furnish to the Construction Manager six (6) complete copies of the operating instructions outlining the procedures required for equipment and system start-up, operation, and shut-down. The instructions shall include the manufacturer's name, model number, service manual, parts list, and a brief description of all equipment and their basic operating features.
  2. The Contractor shall furnish to the Construction Manager six (6) complete copies of maintenance instructions listing routine maintenance procedures, possible breakdown and repairs, and troubleshooting guide.
- D. Performance Test Reports: Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing that all field tests are performed to adjust each component and that all field tests are performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of the controls.

### 1.03 QUALITY ASSURANCE

- A. Installation of all systems shall be performed by a Contractor who possesses a Installers License. The Contractor shall be certified by the tank manufacturer as a Veeder Root Level 2 service provider. The Contractor shall have a minimum of 5 years of experience.
- B. The Contractor shall purchase the systems from a manufacturer approved by the Construction Manager. The manufacturer shall maintain a service depot within 25 miles of each facility. That service depot must contain an active inventory of at least \$100,000 at all times. This will ensure the timely delivery with parts and service personnel available for servicing of parts at any time. The manufacturer shall furnish required supervision, as required by the owner's representative for the installation of the systems, and shall furnish an experienced installation and maintenance worker for the supervision of personnel in the initial operation and maintenance of the systems.
- C. Approved Vendors:
 

Veeder Root	1-860-651-2700
Yeager Engineered Systems	1-973-543-0202
- D. The Contractor shall install compatible components and shall perform all modifications necessary for the proper operation and guarantee of the equipment. The Construction Manager reserves the right to require the Contractor to make such tests, during the installation and upon the completion thereof, as may be necessary to demonstrate that the work and equipment, as installed, complies with the Contract Specifications and requirements provided herein. The Contractor shall provide all labor, instruments, and apparatus required for such tests. If any of the work or equipment fails to meet the Contract Requirements or to function properly, the defects shall be rectified at the Contractor's own expense by readjusting, or by removing and replacing the faulty work or equipment until,

under test, the requirements are met. The Construction Manager reserves the right to check the Contractor's instruments or to furnish his own instruments.

- E. The Contractor awarded this contract shall have on staff as a full time employee:
1. Professional Engineer, licensed in the state of installation
  2. Master Plumber
  3. Licensed Installer
  4. Emergency Spill Response Team
  5. Shurelock Testing System for Sumps and Spill Contianers
  6. NACE Certified Technician

#### 1.05 MANUFACTURER'S SERVICES

- A. The Contractor shall provide the services of a manufacturer's engineering consultant who is experienced in the installation, adjustment, and operation of the instruments and controls specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.
- B. The leak detection/inventory control system shall include a minimum five-year warranty and fuel management services contract for the entire system that includes on-site replacement of parts, programming, testing of system features, and a minimum of the following:
1. Consolidated monthly reports on all tanks, lines and sensors
  2. Remote monitoring for all sites installed or upgraded.
  3. A tank test performance guarantee for all USTS
  4. Alarm response 24 hours a day 7 days a week
    - a. Notifies detailed personnel according to alarm condition and type
    - b. Archives alarm reports continuously
    - c. Allow instant access to consolidated alarm history
    - d. Allows protocol for each individual alarm
- C. The Fuel management services contract shall be provided by the systems manufacturer, have providing these services for a minimum of 5 years, provide services 24 hours a day all 7 days per week, have a minimum of 25 full time employees assigned to administer and service this program and be located within 250 miles of each site.

#### 1.05 FIELD TRAINING

The Contractor shall provide a field training course for the Project Manager and his designated operating staff. Training shall be provided for a total of 24 hours of normal working time, and shall be completed prior to the system's final acceptance by the Project Manager. Field training shall cover all of the items contained in the operating and maintenance manuals.

## PART 2 - PRODUCTS

### 2.01 GENERAL

The general instrumentation requirements are identified on the Contract Drawings. All instruments and control equipment shall conform with the following general provisions.

- A. All equipment in a system shall be compatible in function and appearance. Provisions shall be made, where necessary, for signal dampening to suppress noise and spurious electrical signals in order to provide the desired degree of performance.
- B. All instrument supports and interconnecting wiring and conduit shall be as recommended by the manufacturer and approved by the Construction Manager.
- C. Identifying tag number for each instrument shall be permanently etched or embossed onto a durable tag which shall be fastened to the device housing with stainless steel rivets or self-tapping, stainless-steel screws of appropriate size. Where neither of the above fastening can be accomplished, tag number nameplates shall be permanently attached to the device by a circling of stainless-steel wire.
- D. All instruments and devices furnished under this Section requiring electrical power shall be suitable for operation on a 120 Volt  $\pm 10\%$ , 60 Hertz  $\pm 2$  Hertz supply.
- E. All instruments shall return to accurate measurement upon restoration of power after a power failure.
- F. Unless otherwise noted, all instruments in contact with a process stream shall be furnished with diaphragm seals.
- G. Instruments shall be guaranteed to maintain the characteristics listed herein and under conditions listed and shall meet the following specifications, except where otherwise noted:
  - 1. Accuracy:  $\pm 1\%$  of span
  - 2. Repeatability:  $\pm 0.1\%$  of span
  - 3. Dead Band:  $\pm 1\%$  of span (where applicable) in accordance with ISA Standard S50.1
  - 4. All signal generators and transmitters shall be capable of operating at a load of 600 ohm in accordance with ISA Standard S50.1, higher when specified. Signals shall be output isolated.

5. All electronic instruments shall be solid-state and shall be capable of operating throughout the temperature range of 10 degrees Fahrenheit to 110 degrees Fahrenheit, unless otherwise specified.
  6. Temperature effect on calibration shall be equal to or less than 1% over a temperature change of 100 degrees Fahrenheit.
- H. The ranges and scales shall be as per specified, shown on the Contract Drawings, or approved by the Construction Manager.
- I. Where separate measuring elements and transmitters are required, they shall be fully matched and any special cables or equipment required must be supplied for installation.
- J. The Contractor shall be responsible for the matching of electrical characteristics of instruments and shall supply transmitters with ample signal output capacity. Additional signal generators or repeaters shall be avoided if possible, but must be supplied if necessary.
- K. All equipment, unless otherwise specified, shall be furnished in the manufacturer's standard enclosure for the service indicated by the equipment location.
- L. All miscellaneous necessary work required to complete installation shall be included. This work includes, but is not limited to, bolts, nuts, studs, gaskets, pipe tapping, holes through walls, and repair.
- M. Electrical control conductors shall be No. 14 AWG or larger. Conductors larger than No. 14 shall be used where herein specified, or where indicated on the Contract Drawings.
- N. The size of the conductors and other current-carrying parts of switches and control equipment shall be ample for the rating of the devices to which they are to be connected for service, without undue heating. In no case shall the current density exceed 1,000 amperes per square inch of cross-section. At contacts, the current density shall not exceed 150 amperes per square inch.

## 2.02 LEAK DETECTION/INVENTORY CONTROL SYSTEM

- A. The leak detection/inventory control system shall include all parts, equipment, and software necessary for a complete system. All software, firmware, and hardware shall be of the latest revisions at the time of contract signing and/or requisition placement. The leak detection/inventory control system shall include, but not be limited to the following:
1. One (1) monitoring head/system controller capable of controlling 12 tank probes and associated sensors

2. One (1) magnetostrictive technology type, stainless steel inventory control and in-tank leak testing probe assembly (per tank, as required)
  3. One (1) annular space liquid sensing probe for interstitial space (per double-wall tank, as required)
  4. One (1) liquid sensing probe for manway sump (per sump, as required), for underground storage tanks only.
  5. One (1) overfill alarm with acknowledgment switch (per dispenser tank, as required)
  6. One 4-20millimap communication package
  7. One (1) pulser/totalizer for dispenser (per hose assembly, as required)
  8. One (1) stick gauge calibrated in inches (per tank)
- B. The controller shall be capable of performing in-tank leak detection functions, business inventory reconciliation (BIR) functions, Continuous Statistical Inventory Reconciliation, automatic tank calibration and charting, and external leak detection functions. The controller shall be completely compatible with all probes, sensors, and dispensers. The controller shall have LCD light groups identifying inventory, system status, setup, and diagnostics. The controller shall be supplied with an integral printer. The controller shall be supplied with an internal telephone fax/modem/dialer for the dedicated use of a card reader system. The fax/modem shall be capable of dialing a pre-programmed telephone number at operator specified alarm or inventory conditions. The controller shall include all software and interface modules required for probes, sensors, dispensers, alarms, modems, and other input/output devices required for a complete system. The controller shall be a model TLS-350R (BIR) Monitoring Head/System Controller with Integral Printer, Model 848290-122, with SiteFax Fax/Modem Interface Module, Model No. 330149-001, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.
- C. The inventory control and in-tank testing probe assembly shall be of the magnetostrictive technology type. The in-tank probe shall be capable of measuring product level in the tank in inches, and detecting the presence of water in the tank. The probe shall be capable of performing the 0.1 gallon per hour volumetric tank tightness testing and 0.2 gallon per hour automatic tank gauging in the tank system. The probe shall meet NEC, NFPA, and UL requirements for hazardous locations. Probe electronics shall be capable of operating from -20 Celsius to +50 Celsius. The in-tank probe assembly shall include 4-inch floats and 4-inch sealed riser cap and ring. Each probe shall be completely compatible with the fluid to be stored in the tank. The probe shall be Series 8473 MAG1 Magnetostrictive Probe with 4-inch Float Kit, Model No. 847391, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.

To insure maximum protection against electrical interference and to provide a more reliable data stream the probe interface must be of digital technology. The probe assembly shall also include Magnetostrictive Probe Installation Kit, Model No. 849600, and Riser Cap and Ring Kit, Model No. 312020-952, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal. Controller shall be equipped with Four-Input Probe Interface Module, Model No. 329356-002, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.

- D. The annular space liquid sensing probe shall be capable of detecting and differentiating between liquid hydrocarbons and other liquids in the interstitial space between tank walls. The probe shall meet NEC, NFPA, and UL requirements for hazardous locations. Probe electronics shall be capable of operating from -20 degrees Celsius to +70 degrees Celsius. Annular space sensor shall be Series 7943 Discriminating Interstitial Sensor For Fiberglass Tanks, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal. Controller shall be equipped with Eight-Input Type A Sensor Interface Module, Model No. 329956-001, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.
- E. The manway sump sensing probe (underground storage tanks only) shall be capable of detecting and differentiating between liquid hydrocarbons and other liquids in the manway containment sump. The probe shall meet NEC, NFPA, and UL requirements for hazardous locations, and shall be capable of withstanding the harsh environment and wide temperature ranges possible in the intended location. Containment sump sensor shall be Series 7943 Solid-State Discriminating Containment Sump Sensor, Model No. 794380-208, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal. Controller shall be equipped with Six-Input Type B Sensor Interface Module, Model No. 329950-001, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.
- F. The overfill alarm shall be the audible horn and flashing light type. The overfill alarm shall be supplied with an alarm acknowledgment switch. Alarm electronics shall be capable of operating from -40 degrees Fahrenheit to +150 degrees Fahrenheit. The alarm and acknowledgment switch shall be Series 7900 Overfill Alarm and Alarm Acknowledgment Switch, Models No. 790091-001 and 790095-001, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal. Controller shall be equipped with Four-Relay Output Interface Module, Model No. 329359-001, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.
- G. The pulser/totalizer shall be capable of totalizing product flow through the hose assembly in the dispenser, and sending a signal back to the controller. The pulser/totalizer shall be capable of performing business inventory reconciliation (BIR) functions. The pulser/totalizer shall be compatible with the dispensers. The controller shall be equipped with an interface module compatible with the pulser/totalizer. The pulser/totalizer shall be Model 787491-003, Mechanical

Dispenser Pulse/Totalizer, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal. Controller shall be equipped with Mechanical Dispenser Interface Module (DIM), Model 330250-001, as manufactured by Veeder-Root, of Simsbury, Connecticut, or approved equal.

- H. Direct burial cable shall be used where allowed by code and furnished by the system manufacturer. They shall include but not be limited to:
- |                                   |                               |
|-----------------------------------|-------------------------------|
| #848100-500 Direct Burial Cable   | #848100-310 3 Conductor Cable |
| #848100-110 Filler rod, 1000 ft   | #848100-501 Slice Kit         |
| #848100-805 Direct Burial Sealant | #848100-903 Sealant Gun       |

## 2.03 EMERGENCY TELEPHONE

- A. The emergency telephone shall be Model K-1900WZ Hot-Line Wall Phone as manufactured by Viking Electronics, Inc., of Hudson, Wisconsin, or approved equal.
- B. Each emergency telephone shall be installed inside a weatherproof enclosure which shall be Model 255 as manufactured by Gai-Tronics, Inc., of Mohnton, Pennsylvania, or approved equal.
- C. Each emergency telephone shall be pre-programmed to dial an approved 911 number whenever the handset is lifted.
- D.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Installation of all equipment shall be in accordance with BOCA building codes, and the NFPA, NEC, and NEMA codes. The Contractor shall furnish and install all required conduit sealing fittings, explosion-proof accessories, and NEMA Type 7 enclosures where indicated on the Contract Drawings, or where required by Code, or both.
- B. The locations shown for instrumentation and control equipment on the Contract Drawings are approximate. The Contractor shall field locate as directed by the Construction Manager. The Contractor shall field locate the new TLS-350R controller at a location which is accessible and visible from an occupied work station. All power and control wiring and connections not specifically indicated on the Contract Drawings, but required for the proper operation of equipment shall be made by the Contractor in accordance with these Specifications. All electrical control and instrumentation equipment installed in Class 1 hazardous locations shall be installed in NEMA Type 7 enclosures. Conduits and wireways leading to and from these areas shall be provided with sealing fittings. All non-conducting metal parts of switches and control, shall be rust-proofed by galvanizing, cadmium plating, baked enamel or by the use of a non-corroding metal. Springs, wherever used, shall be a phosphor bronze.

- C. Each leak detection inventory control system shall be installed, programmed and adjusted in accordance with the manufacturer's instructions so that all components function properly. Each overflow alarm and alarm acknowledgement switch shall be programmed and adjusted so that the alarm is activated at 85 percent of the tank capacity. Each waste oil overflow alarm and alarm acknowledgement switch shall be programmed and adjusted so that the alarm is activated at 80 percent of the tank capacity.

### 3.02 TESTING

- A. General: All equipment (hardware and software) shall be factory and field tested to demonstrate that it provides the specified functions.
- B. The factory and onsite test procedures shall be submitted to the Construction Manager for approval prior to starting the actual tests.
- C. The onsite testing shall include checking of cables, testing of system subassemblies and checking of connections for each component and for the entire instrumentation and control system.
- D. The Contractor shall notify the Construction Manager in writing that he is ready and desires to start the on-site system testing. The Construction Manager will authorize start of the testing at a mutually-agreed starting date.
- E. Shop Testing: All activating devices, instruments and assemblies furnished under this item shall be set up in the shop of the manufacturer and tested over the full range of the equipment. The equipment shall satisfactorily perform all the functions within the requirements of the specifications.
- F. Field Testing: All instruments and systems shall be field tested to ensure conformance with the Specifications. Control systems shall receive dynamic loop tests which shall conform to the intent of ANSI: MC4.1 (ISA-S26). The control systems and equipment shall include provisions for such testing.
- G. Input signals for equipment control shall be simulated for at least 5 signal values from 0 to 100 percent signal, with corresponding equipment response to be manually recorded, and adjustments made as required. Output signals from the equipment shall be read for at least 5 signal values from 0 to 100 percent of the meaningful process values, and adjustments shall be made as required.
- H. All instruments used for control functions shall be tested with the final elements in the circuit in addition to simulated control methods. The Contractor shall adjust instruments and/or final elements to obtain the best working conditions for a dynamic system.

END OF SECTION

