SECTION 136020

MOTOR FUEL ELECTRICAL SYSTEMS

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**NOTE TO SPECIFIER**

*Use this Specification Section for Mail Processing Facilities.*

***This is a Type 1 Specification with completely editable text; therefore, any portion of the text can be modified by the A/E preparing the Solicitation Package to suit the project.***

*For Design/Build projects, do not delete the Notes to Specifier in this Section so that they may be available to Design/Build entity when preparing the Construction Documents.*

*For the Design/Build entity, this specification is intended as a guide for the Architect/Engineer preparing the Construction Documents.*

*The MPF specifications may also be used for Design/Bid/Build projects. In either case, it is the responsibility of the design professional to edit the Specifications Sections as appropriate for the project.*

*Text shown in brackets must be modified as needed for project specific requirements.* *See the “Using the USPS Guide Specifications” document in Folder C for more information.*

*The last date that USPS revised this standard specification section occurs in two places, at the end of this section and in the Table of Contents. If the date in this section matches the date in the Table of Contents, then you are using the latest version. Do not delete or revise the “last revised” date at the end of the section during the development of the Project Manual.*

*The footer in this section should be edited to replace the text, “USPS MPF SPECIFICATION” with the project name, and the blank date in the center should be replaced with the submission date, for interim design reviews, or the issue date of the completed Project Manual.*

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1. GENERAL
   1. SUMMARY
      1. Related Documents: The work of this Section is governed by [Division 1].
      2. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.
      3. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with the contract documents.
      4. In general, the work of this Section includes furnishing labor, equipment and materials necessary to perform the excavation, trenching, de-watering, bedding, backfilling, compaction, shoring and off-site disposal of excess and unsuitable materials during installation of fuel piping, underground storage tanks, transition sump pits, fuel related electrical conduit, and all other related utilities specified or indicated in the Contract Documents.
      5. Related work specified in other Sections includes, but is not necessarily limited to:
         1. [Section 136000 Motor Fuel Underground Storage Tanks]
         2. [Section 136015 Motor Fuel Aboveground Storage Tanks]
         3. Section 260500 Common Work Results for Electrical
         4. Section [ ]
   2. REFERENCES
      1. American Petroleum Institute:
         1. API 1615 - Installation of Underground Petroleum Storage Systems.
      2. ASTM International:
         1. ASTM D4021: Glass Fiber Reinforced Polyester Underground Petroleum Storage Tanks.
         2. ASTM C136: Standard Test Method for Sieve Analyses of Fine and Coarse Aggregates.
         3. ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics Using Modified Effort
      3. NACE International:
         1. NACE RP-02-85 - Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.
      4. National Electrical Manufacturers Association:
         1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
         2. NEMA WD 1 - General Requirements for Wiring Devices.
         3. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
         4. NEMA FG 1 - Nonmetallic Cable Tray Systems.
         5. NEMA VE 1 - Metal Cable Tray Systems.
         6. NEMA VE 2 - Metal Cable Tray Installation Guidelines.
      5. National Fire Protection Association:
         1. NFPA 30 - Flammable and Combustible Liquids Code.
         2. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages.
         3. NFPA 70 – National Electric Code
      6. International Code Council
         1. International Fire Code
      7. Petroleum Equipment Institute:
         1. PEI RP100 - Recommended Practices for Installation of Underground Liquid Storage Systems.
      8. Underwriters Laboratories Inc.:
         1. UL 913 - Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous Locations.
   3. SUBMITTALS
      1. Comply with [ ] General Requirements.
      2. Shop Drawings: Submit original copies of product data submittals for materials and equipment in Part 2 of this section including, but not limited to:
         1. Conduits.
         2. Conductors.
         3. Cable.
         4. Circuit Boards.
         5. Panels.
         6. Monitoring Consoles.
         7. Fuel Management Systems.
         8. Sensors.
         9. Probes.
         10. Underground Warning Tape.
         11. Emergency Stop Actuators.
         12. Emergency Stop Disconnects.
         13. Dispenser Hook Isolation Devices.
      3. Test Reports: Submit written test results for all tests as outlined in this specification.
      4. Manufacturer’s Field Reports: Submit report of each visit of manufacturer’s representative to provide technical assistance during installation.
      5. State Installer Certification: Certify tank installers employed on the Work, verifying that all workers meet State installer requirements.
      6. Record Drawings: Submit record drawings in accordance with [ ].
      7. Operation and Maintenance Manuals: Submit copies of the Operation and Maintenance Manual in compliance with Closeout Submittals.
      8. Manufacturer certifications: Submit manufacturer certifications for underground piping and environmental monitoring system installers.
   4. CLOSEOUT SUBMITTALS

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**NOTE TO SPECIFIER**

Closeout documents are critical for the successful fueling system project, because a complete set of closeout documents is necessary for the facility to meet life-cycle compliance requirements. This specification section is intended to be highly detailed, as experience has shown that contractors are much better able to comply with a detailed list including specific state and other regulatory forms and reports, and manufacturer checklists. As such, this section should be made as specific as possible. The state or other governing UST regulatory program will have most of the information needed for the appropriate level of specificity. Also, consult manufacturers for their installation checklists and test reports. The final closeout list should be coordinated with the “field quality control section” such that all test forms identified there as required, are included in the closeout list.

Coordinate this section with the corresponding section in 136000 and 136015.

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* + 1. Comply with pertinent provisions of the appropriate Division I regarding - Contract Closeout. In addition, comply with the specifics and additional provisions of this chapter. For the purposes of this section, the terms “Manuals and Instructions” and Closeout Documents” are used interchangeably.
    2. Coordinate closeout submittals with sections [136000] and [136015] to provide a single package for the project.
    3. Format of Closeout Documents, including Operation and Maintenance Manuals and Record Document
       1. Provide Electronic (pdf format for documents and jpeg format for photos) of all closeout documents, record documents, drawings, manuals, operating instructions, warranties, and all other documents referenced in this and related sections. Submission shall be on CD-ROM discs readable by Windows operating system. Files should be organized in logical folders and subfolders.
       2. In addition, provide bound manuals with all closeout documents, including record documents and drawings. Provide two (2) bound manuals/sets of documents. Bind Manuals in hardcover, three-ring binders, and provide identified dividers with tabs. Use multiple volumes as needed. Do not use three ring binders larger than 3 inches. Copies of faxed pages are unacceptable.
       3. Obtain at time of purchase of equipment, 2 copies of operation, lubrication and maintenance manuals for all items. Assemble these manuals in the three ring binders above, and provide electronic versions.
       4. Furnish hard copy and electronic manuals for the fuel system to Engineer for approval and distribution to Owner within 30 days of completion of the fuel system. Included shall be 8 hours of training and review at which time the contractor shall review the contents of closeout documents with fuel system operating personnel.
    4. Manuals, Instructions, and Closeout Documents shall include the following items. Items shall be for the new fuel system facility:
       1. A minimum of 96 high resolution (no less than 4 mega-pixels) digital (.jpeg format) photographs depicting the installation at each critical construction phase. Particular attention should be paid to underground, buried, and normally inaccessible components.
       2. Environmental monitoring system warranty registration and checkout form/Intrinsic Safety Checklist with proof of delivery to manufacturer.
       3. Laminated 11 x 17 inch diagram showing all sensor, probe locations throughout system with corresponding labels to match environmental monitoring system.
       4. Environmental Monitoring System final setup printout.
       5. Records of all other inspections and tests to include:
          1. [ ]; and
          2. [ ].
       6. Warranties for all equipment and apparatus. In general, any product / manufacturer documentation that was provided with the equipment shall be provided as part of the closeout documents. Any warranty requiring forms or checklists shall be completed and fully executed.
       7. Training certification for instruction seminars signed by the individuals trained on these systems.
       8. All instruction bulletins, preventive maintenance schedules, operational instructions, and parts lists provided with the tanks, dispensers, monitoring system, and all other systems.
       9. Copies of receipts for any keys, locks, or other equipment turned over to the Owner.
       10. Operating and installation manuals and instructions for each piece of equipment that was provided with manuals or instructions, including but not limited to the tank installation instructions.
  1. QUALITY ASSURANCE
     1. Qualifications: Use adequate numbers of skilled, licensed individuals who are thoroughly trained and experienced in the installation and testing of the specified systems and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.
     2. Substitutions: Where permitted, comply with Section 016000.
     3. Materials and Equipment shall be manufactured, installed, and tested as specified in latest editions of applicable publications, standards and ruling of:
        1. Local and State building, plumbing, mechanical, electrical, fire and health department codes.
        2. National Fire Protection Association (NFPA).
        3. Occupational Safety and Health Act (OSHA).
        4. Factory Mutual Association (FM).
        5. Underwriter’s Laboratories (UL).
        6. American Petroleum Institute (API).
     4. The most recent editions of applicable specifications and publications of the following organizations form part of the Contract Documents:
        1. American National Standards Institute (ANSI).
        2. American Society of Mechanical Engineers (ASME).
        3. National Electric Manufacturers Association (NEMA).
        4. American Society for Testing of Materials (ASTM).
        5. American Welding Society (AWS).
        6. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).
     5. Tests of all Contractor secured materials and products being submitted for approval to determine conformance with all requirements of the Contract Documents, including borrow materials proposed for use, shall be performed by an independent testing laboratory retained and compensated by this Contractor.
     6. As materials are incorporated into the project, on-site and off-site quality control tests shall be performed during construction to determine conformance with the Contract Documents by an independent testing laboratory retained and compensated by this Contractor.
     7. Quality assurance testing to validate results of quality control tests performed by the Contractor’s testing laboratory shall be performed by an independent testing laboratory retained and compensated by the Owner.
     8. All fuel system equipment shall be compatible with oxygenated fuel blends including up to 15% Ethanol and 20% biodiesel blends.
     9. Complete the system installation in accordance with the requirements of the State of [ ] electrical code and the National Electrical Code.
     10. Comply with the testing and field quality control requirements elsewhere in this section.
  2. PERMITS AND SUBMISSIONS
     1. The Contractor shall be responsible for all permits and notifications required by State and Local codes and regulations.
     2. Specifically at a minimum, the Contractor shall make the following submissions to the State of [ ] Department of [ ]:
        1. [ ].
        2. [ ].
        3. [ ].
        4. [ ].
     3. Copies of all submissions and permits/registrations received shall be provided as part of the closeout documentation.
  3. QUALIFICATIONS
     1. Manufacturer: Utilize companies specializing in manufacturing products specified in this section with minimum five years documented experience.
     2. Leak Detection Systems: The installing contractor of the Environmental Monitoring System shall the highest level manufacturer installer certification.
     3. The motor fuel electrical system shall be installed by a State of [ ] Licensed Master Electrician with at least 5 years of demonstrated experience with petroleum fuel systems.
  4. GENERAL CONDITIONS
     1. Lines and grades shall be as indicated. Establish and maintain temporary benchmarks on the site for reference. All vertical dimensions shall be verified from these benchmarks.
     2. All permanent benchmarks shall be protected from disturbance or destruction. Any point disturbed or destructed shall be immediately replaced by a qualified surveyor at this Contractor’s expense. Documentation of any such relocation or replacement shall be given to the Engineer.
     3. Disposition of Utilities
        1. Adequately protect from damage all active utilities and remove or relocate only as indicated, specified or directed.
        2. Report inactive and abandoned utilities encountered in excavating and grading operations to the Engineer. Remove, plug or cap as directed by the Engineer.
        3. Provide a minimum of a 48 hour notice to the Engineer and receive written notice to proceed before interrupting any utility.
     4. Stockpiling of topsoil and other excavated materials will be permitted on-site within the project limits on a case by case basis provided the stockpiles are constructed and maintained in a manner that does not create a foreign object damage risk or adversely affect any other ongoing construction or operation at the site.
     5. During windy or wet conditions and at the conclusion of each day’s work period, cover all excavated material to prevent it from becoming saturated or being displaced by wind or rain. Anchor all sides of covering as required to hold the covering firmly in place. In all cases, provide additional measures as necessary to prevent erosion, sedimentation and wind-borne displacement of excavated materials from their stockpiled location.
     6. Before beginning any work specified in this Section, the Contractor shall make certain that all applicable soil erosion and sediment control requirements are compiled with and the proper authorities have been informed of the construction schedule.
     7. Provide the services of a registered land surveyor to lay out all fuel related work perform under this Contract.
  5. DELIVERY, STORAGE, AND HANDLING
     1. Comply with [ ].
     2. Protect equipment, materials and specialties from elements and other damages caused during shipment, storage and erection until final acceptance from the Owner.
  6. ENVIRONMENTAL REQUIREMENTS
     1. Comply with [ ].
     2. Do not install underground piping when bedding is wet or frozen.
  7. FIELD MEASUREMENTS
     1. Verify field measurements prior to fabrication.
  8. COORDINATION
     1. Comply with [ ].

1. PRODUCTS
   1. TANK TOP EQUIPMENT: All tank top equipment shall meet the Phase I EVR standard as defined by the California Air Resources Board.
   2. ELECTRICAL SYSTEM CONDUITS
      1. Electrical conduits shall comply with the following:
         1. Rigid Conduit: Conduits shall be new rigid galvanized steel sized in accordance with NFPA 70, but no smaller than 3/4" diameter. Rigid non-metallic conduit shall be allowed in accordance with the requirements of Article 514 of the NEC.
         2. Flexible Conduit: Flexible conduit in NEC, Class I, Division 1 Classified Areas shall be Crouse-Hinds, flexible couplings type "ED" series or equal. Flexible conduit in NEC, Class I, Division 2 or Non-Classified Areas shall be liquid-tight metallic-core galvanized steel, grounding type with extruded PVC cover. Adapters and connectors shall be liquid-tight Crouse-Hinds "LT" type connectors or equal.
         3. Magnetic safety tape shall be used above all underground conduit.
   3. ELECTRICAL SYSTEM GROUNDING
      1. Grounding Conductors
         1. All grounding conductors shall be 2/0 AWG, stranded copper.
         2. Grounding ring conductors shall be 2/0.
      2. Grounding Rods
         1. All Grounding Rods shall be 3/4" diameter copper clad and 10 feet minimum in length.
         2. All electrical wire and cable for circuits shall be properly sized to conform to NFPA 70.
         3. Ground wires and bonds shall be #2 AWG stranded copper cable with approved type solderless connectors and lugs.
      3. Connectors
         1. Make connections in accordance with NFPA 70.
   4. ELECTRICAL SYSTEM CONDUCTORS WIRE AND CABLE
      1. General
         1. Provide wire with a minimum insulating rating of 600 volts, except for wire, used in 50 volts or below applications for control of signal systems use 300 volt minimum or 600 volt where permitted to be incorporated with other wiring systems.
         2. All wire and cable installed within conduits that exit, enter, or go through a hazardous area must conform to NEC, Article 501-13 for conductor insulation.
      2. Conductor
         1. Electrical grade annealed copper, tinned if rubber insulated, and fabricated in accordance with ASTM standards. Minimum size AWG # 12 for branch circuits.
         2. The conductors illustrated on the drawings are copper except as otherwise noted.
         3. All conductors shall be THHN or THWN except as noted.
         4. All conductors shall be petroleum resistant and nylon jacketed.
      3. Stranding.
         1. Conductors #10 AWG and smaller shall be solid. Conductors #8 AWG and larger shall be stranded in accordance with ASTM Class B stranding designations.
         2. Control wires stranded in accordance with ASTM Class B stranding designations.
      4. Insulated Single Conductors
         1. Type THHN/THWN - Frame retardant: Heat-resistant thermoplastic insulation, nylon jacket rated for 90 C dry/75C wet operation. Use for branch circuit wiring.
         2. Use type THHN/THWN or XHHW-2 for feeder circuits.
      5. Multi-Conductor Data Cable
         1. Supply data cable as required and appropriate by dispenser, fuel management, and environmental monitoring system manufacturers.
      6. Multi-Conductor Power Cable
         1. Not authorized on this project.
      7. Color Coding
         1. Provide consistent color coding of all circuits as follows:
            1. 120/208 volts code

Phase A - Black.

Phase B - Red.

Phase C - Blue.

Neutral - White.

Ground - Green.

* + - * 1. 277/480 Volt Code

Phase A - Brown.

Phase B - Orange.

Phase C - Yellow.

Neutral - Gray.

Ground - Green.

* + - 1. Color-code wiring for control systems installed in conjunction with mechanical and/or miscellaneous equipment in accordance with the wiring diagrams furnished with the equipment. Factory color code wire number 6 and smaller. Wire number 4 and larger may be color coded by color taping of the entire length of the exposed ends.
      2. Multi-Conductor Control, Signal, and Communication (100 conductors or fewer per cable): In accordance with Table 5-1, Part 5 of ICEA Pub. S-61-402 (NEMA WC 5).
      3. Substitutions for Color-Coded Wire: with approval of Owner's Representative and where color coding cannot be readily provided because of limited quantities involved, either of the following:
         1. Plastic tape applied spirally and half-lapped over exposed portions of conductors within manholes, boxes, and similar enclosures.
         2. Colored tubing cut and inserted over ends of wire prior to installing terminals.
      4. Substitutions for Color Coding for Multi-Conductor Control Cable: Printed conductor identification instead of color-coding is acceptable.
  1. ELECTRICAL SYSTEM CONNECTORS
     1. Make connections, splices, and taps and joints with solderless devices, mechanically and electrically secure. Protect exposed wires and connecting devices with electrical tape or insulation to provide protection not less than that of the conductor.
  2. OUTLET, JUNCTION, AND PULL BOXES
     1. All exterior, sump, and fuel component outlet boxes not in a designated electrical room, shall carry a NEMA 4 or NEMA 4X rating unless otherwise indicated elsewhere in these specifications or construction drawings. All outlet boxes in the Hazard areas shall be rated in accordance with Chapter 5 of NFPA 70.
     2. Cast Type Conduit Boxes, Outlet Bodies and Fittings
        1. Provide surface mounted outlet and junction boxes, in indoor locations, where exposed to moisture and in outdoor locations.
        2. Use Ferrous Alloy boxes and conduit bodies with Rigid Steel or IMC.
        3. Use Ferrous Alloy or cast aluminum boxes and conduit bodies with Electrical Metallic Tubing.
        4. Covers: Cast or sheet metal unless otherwise required.
        5. Tapered threads for hubs.
     3. Galvanized Pressed Steel Outlet Boxes
        1. General
           1. Pressed steel, galvanized or cadmium-plated, minimum of four (4") inches, octagonal or square, with galvanized cover or extension ring as required.
        2. Plug any open knockouts not utilized.
     4. Sheet Steel Boxes Indoors
        1. No. 12 USS gauge sheet steel for boxes with maximum side less than forty (40") inches, and maximum area not exceeding 1,000 square inches; riveted or welded 3/4 inch flanges at exterior corners.
        2. No. 10 USS gauge sheet steel for boxes with maximum side 40 to 60 inches, and maximum area 1,000 to 1,500 square inches; riveted or welded 3/4 inch flanges at exterior corners.
        3. No. 10 USS gauge sheet steel riveted or welded to 1-1/2 by 1-1/2 inch by 1/4-inch welded angle iron framework for boxes with a maximum side exceeding 60 inches and more than 1,500 square inches in area.
        4. Covers
           1. Same gauge steel as box.
           2. Subdivided single covers so no section of cover exceeds fifty (50) pounds.
           3. Machine bolts, machine screws threaded into tapped holes, or sheet metal screws as required; maximum spacing 12 inches.
        5. Paint
           1. Rust inhibiting primer; ANSI No. 61 light gray finish coat.
        6. Where size of box is not indicated, size to permit pulling, racking and splicing of cables.
        7. For Boxes over 600 Volts
           1. Provide insulated cable supports and removable steel barriers to isolate each feeder. Stencil cable voltage class in red letters on the front cover of the box.
           2. Braze a ground connector suitable for copper cables to the inside of the box.
     5. Pull and Splice Boxes, Outdoors
        1. Aluminum reinforced, with removable covers secured by brass machine screws.
        2. Where size of box is not indicated, size to permit pulling, racking, and splicing of the cables.
        3. Braze a ground connector suitable for copper cables to the inside of the box.
     6. Junction Box, Sidewalk Type
        1. Cast iron, hot-dipped galvanized with threaded conduit entrance hubs, flanged, reinforced checkered cover, gasketed with pry bar slots and countersunk stainless steel screws.
  3. ELECTRICAL SYSTEM FIRESTOPPING
     1. Manufacturers:
        1. Dow Corning Corp.
        2. Fire Trak Corp.
        3. Hilti Corp.
        4. International Protective Coating Corp.
        5. 3M fire Protection Products.
        6. Specified Technology, Inc.
     2. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
        1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
        2. Foam Firestopping Compounds: Multiple component foam compound.
        3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
        4. Fiber Stuffing and Sealant Firestopping: Composite of fiber stuffing insulation with silicone elastomer for smoke stopping.
        5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
        6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
        7. Firestop Pillows: Formed mineral fiber pillows.
  4. ELECTRICAL SYSTEM NAMEPLATES
     1. Unless otherwise noted, nameplates shall be black lamacoid plates with white engraved upper case letters enclosed by white border on beveled edge.
     2. Nameplates for equipment, supplied by the emergency system (if installed) shall be red lamacoid with white lettering.
     3. All nameplates shall be engraved and must be secured with rivets, brass or cadmium plate screws. The use of Dymo tape or the like is unacceptable.
     4. Nameplate inscriptions shall bear the name and number of equipment to which they are attached as indicated on the Drawings. The engineer reserves the right to make modifications in the inscriptions as necessary.
  5. ELECTRICAL SYSTEM CABLE TAGS AND WIRE IDENTIFICATION LABELS
     1. Cable tags shall be flameproof secured with nylon ties.
     2. Wire markers shall be preprinted cloth tape type or approved equivalent.
  6. ELECTRICAL SYSTEM IDENTIFICATION LABELS
     1. Acceptable Manufacturers
        1. W.H. Brady Company (Style A)
        2. Thomas & Betts Company (T&B), Style A.
        3. Approved Equal
     2. Plasticized Cloth
        1. Non-conductive.
        2. Waterproof.
        3. Capable of withstanding continuous temperatures of 235 degrees F and intermittent temperatures to 300 degrees F.
        4. Overcoating for protection against oil, solvents, chemicals, moisture, abrasion and dirt.
     3. Heavy, thermo-resistant industrial grade adhesive, for adhesion of label to any surface without curling, peeling or falling off.
     4. Label Designations: Nominal System Voltages Applied to the covers of all medium and low voltage pull, splice and junction boxes.
     5. Machine printed.
  7. ELECTRICAL SYSTEM UNDERGROUND WARNING TAPE
     1. Manufacturers:
        1. TEK ID
        2. PRESCO
        3. Approved equal.
     2. Description: 3 inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines. The warning tape shall list the utility covered, e.g., “CAUTION BURIED ELECTRIC LINE BELOW”, TEK ID MODEL # DULT-1-3.
  8. SEAL-OFF FITTINGS
     1. Cable seals shall be listed for Class I Division 1 and 2 areas and shall be installed in accordance with the NEC.
  9. EMERGENCY STOP ACTUATOR
     1. The emergency stop actuator shall be a flush momentary switch.
     2. Provide manufacturer/OEM cover for push button to prevent inadvertent actuation.
  10. DISPENSER ISOLATION DEVICES
      1. Provide dispenser isolation devices as shown on the construction drawings to provide disconnecting means for all power and data inputs/outputs to/from the dispensers.
      2. In addition, provide Dispenser Hook Isolation (DHI) boxes in the electrical panel to provide optical isolation of the dispenser circuits.
  11. ENVIRONMENTAL MONITORING SYSTEM

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**NOTE TO SPECIFIER**

Update monitoring system specifications to be consistent with the USPS technical requirements of the national centralized bulk storage tank and notification system.

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* + 1. Manufacturers:
       1. Veeder Root
       2. [Approved Equal. Note – All monitoring systems shall be compatible with the USPS Technical Requirements of the National Centralized Bulk Storage Tank and Notification System]
    2. The Contractor shall connect new sensors, probes, and alarms to the monitoring consoles.
    3. The monitoring equipment must be compatible with the tank installed, and include all wiring, sensors and components for a complete operational system.
    4. The interstitial space sensor shall be capable of detecting a change of liquid level in the tank interstitial space.
    5. The internal tank sensor shall be capable of measuring water level, fuel level, phase separation, and product high and low levels.
    6. The leak monitor shall be capable of sensing any liquid that has entered the piping containment sump. The sensor is to be connected to the same unit used for the tank monitor.
    7. The overfill alarm visible indicators and horn shall be the same manufacturer as the tank monitor.
    8. The overfill alarm horn sign shall be constructed in accordance with the construction drawings with the words "OVERFILL ALARM WHEN ALARM SOUNDS TANK IS FULL" and with other language as specified on the construction drawings. Size the sign and lettering in accordance with the construction drawings for easy reading from ground level.
    9. The monitoring system shall be capable of remote monitoring through an IP addressable direct internet connection and telephone modem.
  1. FUEL MANAGEMENT SYSTEM

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**NOTE TO SPECIFIER**

The fuel management system may or may not be desired based on the individual site needs. If a fuel management system is not installed with the project, then a surface mounted, watertight manhole should be installed in the dispensing area, such that a fuel management system can be installed in the future. The system capabilities may need to be adjusted for site specific conditions. Coordinate with site specific needs and infrastructure to specify a network if desired or required.

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* + 1. Manufacturers:
       1. Gasboy/Orpak
       2. Petrovend
       3. Fuelmaster
       4. Approved Equal
    2. Provide a pedestal based fuel management system to authorize and record fuel transactions.
    3. The system shall have the following capabilities:
       1. Authorizing a fuel dispensing transaction after an authorized card is read by the HID proximity card reader or entered into a keypad.
       2. Associating each issued HID card with a person and department.
       3. Be capable of having at least [1000] persons in the system working for up to [25] departments, in any combination thereof.
       4. Be capable of specifically authorizing certain cards. For example, only authorizing cards that have been issued to persons. Additionally, the capability of de-authorizing cards at any time by the manager, for example, in the case of employee termination.
       5. Be capable of recording and reporting each transaction, including person, company, time, date, fueling position number, and gallons dispensed, accurate to 0.1 gallon.
       6. Setting a pre-authorized, system-wide dispensing limit (per authorization) if required by the Fire Department.
       7. Generating individual invoices on a periodic basis (weekly, monthly, etc.) for each customer/tenant company. Each invoice shall have the ability to list total gallons dispensed, price per gallon, total invoice value, and a listing of each transaction in detail (time/date/person/amount dispensed).
       8. The ability to centrally control fueling at the entire facility, collectively or on an individual dispenser basis. That is, the manager, from the control computer, shall be able to “turn-on” or “turn-off” any fueling position at the facility at any time by allowing or dis-allowing the system to authorize any particular position.
       9. Be managed from a remote computer at the facility (within the facility LAN) or be managed remotely from a computer over the internet.
    4. Provide remote desktop computer with sufficient system resources to operate the fuel management system.
    5. Supply all network equipment and software, including but not limited to routers, switches, cables, fiber optic cables, fiber converters, connectors, software, and power supplies sufficient to create an internal virtual private network to which all fuel system control equipment (including Fuel Management and Environmental Monitoring, System consoles) will be connected. The network shall have the capability for the fuel control desktop computers to see and control all fuel system equipment, and have the ability for an outside user, monitoring company, or manufacturer service person to access each system software or web-based interfaces.]

1. EXECUTION
   1. GENERAL
      1. The installation of underground storage tanks and all fuel system equipment electrical and monitoring components shall be conducted in strict accordance with the manufacturer’s installation instructions. Nothing in this specification is intended to supersede or contradict those instructions.
      2. Install underground tanks and all fuel system equipment in accordance with the requirements of all State and Local codes and regulations including, but not limited to, the State [ ], the State/City of [ ] Electrical Code as adopted and amended by the State of [ ], The International Fire Code and NFPA 30A, and the NFPA 70
   2. ELECTRICAL SYSTEM – EXAMINATION
      1. Prior to device installation, verify outlet boxes are installed at proper height.
      2. Prior to device installation, verify wall openings are neatly cut and completely covered by wall plates.
      3. Prior to device installation, verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
      4. Prior to making equipment connections, verify equipment is ready for electrical connection, for wiring, and to be energized.
   3. ELECTRICAL SYSTEM INSTALLATION – CONDUIT
      1. All exposed canopy area conduits shall be finished to match the canopy structure.
   4. ELECTRICAL SYSTEM INSTALLATION – EQUIPMENT CONNECTIONS
      1. Make electrical connections.
      2. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations, including in all sumps and fueling equipment areas.
      3. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
      4. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
      5. Install terminal block jumpers to complete equipment wiring requirements.
      6. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
   5. HAZARDOUS LOCATIONS
      1. Install electrical wiring and components in strict accordance with Chapter 5 and Articles 514 and 515 of the NEC.
   6. ELECTRICAL SYSTEM - WIRE AND CABLE
      1. Provide a complete system of conductors in raceway system. All conductors of all systems shall be installed in a raceway system.
      2. Use No. 12 AWG, minimum.
      3. Do not install wire in incomplete conduit runs or until after the concrete work and plastering is completed and moisture is swabbed from conduits. Eliminate splices wherever possible. Where necessary, splice in readily accessible pull, junction, or outlet box.
      4. Flashover or insulation value of joints shall be equal to that of the conductor. Provide Underwriters' Laboratories listed connectors rated to 600 volts for general use and 1,000 volts for use between ballasts and lamps or gaseous discharge fixtures.
      5. Use terminating fittings, connectors, etc., of a type suitable for the specified cable furnished. Make bends in cable at termination prior to installing compression device. Make fittings tight.
      6. Extend wire sizing for the entire length of a circuit, feeder, etc. unless specifically noted otherwise.
   7. ELECTRICAL SYSTEM WIRE INSTALLATION
      1. General
         1. Provide tools, equipment, and materials to pull all wire and cable into place and to make required splices and termination.
      2. Wire and Cable in Conduit, Duct or Wireway
         1. Utilize roller bearing swivel to prevent twisting of cable entering conduit or duct.
         2. Take precautions to avoid entrance of dirt and water into conduit and ducts.
         3. Clean existing conduits and ducts to remove any pulling compound prior to pulling new cables.
         4. Do not damage conductor insulation, braid jacket or sheath.
         5. Do not bend conductors to less than manufacturer's recommended radius.
         6. Make splices only in pull boxes, junction boxes and outlet boxes.
         7. Utilize cable reels on jacks for pulling through pull boxes, ducts and conduits so bends will not be excessive, and conductors will not touch sharp edges; use feeding tube where required.
         8. For large diameter cables, utilize properly sized pulling grips (endless woven basket two to four feet long of ductile steel).
         9. Do not exceed maximum recommended pulling tension of wire and cable.
      3. Splices, Terminations, and Connections
         1. General: Except where lugs are furnished with equipment, provide terminals and connectors suitable for quantity, conductor size and direction of entry (top or bottom).
         2. Insulated Flanged Terminals: Install for connection of conductors No. 12 AWG and smaller to device terminals; do not exceed three terminals at single connections.
         3. Circumferential Compression Type Connectors: Install for splices and connections No. 4 AWG and larger.
            1. Use for incoming and outgoing cable connections at enclosures and for ground connections.
            2. Use manufacturer's approved tool and correct hex head that embosses die number on connector lug.
            3. Make crimped indentations parallel with conductor.
            4. Fill voids and irregularities with insulation putty.
            5. Cover neatly with four (4) layers of vinyl plastic tape except where insulated covers are permitted; half-lap tape in two directions.
            6. Use spring-held bakelite covers over splices or taps only with approval of Owner's Representative.
         4. Conductor Arcproofing
            1. Cover two or more power feeder cables occurring in the same switchboard section, junction box or pull box (including pull boxes over switchboards) with arcproof and flameproof tape.
            2. Provide tape "Scotch" Irvington Tape No. 7700 or Plymouth Rubber Co. Slipknot No. 30 to provide an insulation capable of withstanding a 200-amp arc for not less than 30 seconds.
            3. Apply tape in a single layer, half lapped, or as recommended by the manufacturer to conform to the above requirements. Apply with a random wrap of 1/2 inch wide pressure-sensitive, plastic film tape color coded as specified in the "conductor identification" paragraph.
   8. FIELD QUALITY CONTROL – WIRE
      1. Testing
         1. Test system wiring for continuity, grounds and short circuits prior to connection of any equipment.
         2. Test final equipment connections for continuity of grounds and short circuits.
         3. Insulation Resistance of Feeders and Subfeeders
            1. Test with megger for insulation resistance.
            2. Correct faults and replace sections with faulty insulation.
            3. Demonstrate installation is free of grounds and short circuits and that insulation resistance complies with ICEA values.
         4. Test direct burial cables after completion of backfilling.
   9. ELECTRICAL SYSTEM INSTALLATION – DEVICES
      1. Locations
         1. Comply with layout drawings for general location; contact Owner's Representative for questions about locations and mounting methods.
         2. Relocate outlets obviously placed in a location or manner not suitable to the room finish.
         3. Avoid placing outlets behind open doors.
      2. Align devices vertically and horizontally. Device plates shall be aligned vertically with a tolerance of 1/16". All four edges of device plates shall be in contact with the wall surface.
      3. Mounting Heights as indicated on the Drawings and according to ADA requirements.
      4. Fastening - securely fasten devices into boxes and attach appropriate cover plates.
      5. Install device plates on all outlet boxes. Provide blank plates for all empty, spare and boxes for future devices.
      6. Caulk around edges of outdoor device plates and boxes when rough wall surfaces prevent a rain tight seal. Use caulking material as approved by the Architect/Engineer.
   10. ELECTRICAL SYSTEM FIELD QUALITY CONTROL – DEVICES
       1. Inspect each wiring device for defects.
       2. Operate and test each device.
       3. Make electrical connections.
       4. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
       5. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
       6. Install terminal block jumpers to complete equipment wiring requirements.
       7. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
       8. Install all connections within the Classified Areas in accordance with Chapter 5 of the NEC.
   11. EMERGENCY STOP SYSTEM TESTING
       1. The emergency stop system shall be tested in the presence of the Engineer.
       2. A report of emergency stop system testing shall be provided in closeout documents.
   12. DISCONNECT
       1. The Contractor shall install disconnecting means for each individual dispenser. Install dispenser area disconnecting devices as shown on the construction drawings, which provide both power and data disconnects.
       2. In addition, install DHI boxes in the electrical room to provide optical isolation of the dispensing circuits, as shown on the construction drawings.
   13. DISPENSER TESTING
       1. The Contractor shall perform the following electrical circuit test for the [ ] (#) facility dispensers:
          1. Turn off all circuit breakers controlling the pumps and check to assure that all pumps are not running.
          2. Confirm that all nozzles are in the dispenser boot with the boot electrical switch off.
          3. Turn on circuit breaker controlling one pump and on each dispensing pump:
             1. Remove nozzle, turn operating handle on, and dispense product to confirm hose is pressurized.
             2. Assure that only the correct pump turns on.
          4. If circuit disconnection or other problems are detected using the above procedure, more correction and repeat entire system checkout.
   14. INSTALLATION - ENVIRONMENTAL MONITORING SYSTEM
       1. The Contractor’s monitoring system installer shall be a certified environmental monitoring system technician and installer.
       2. The environmental monitoring system shall be configured in strict accordance with the construction drawings.
       3. The Contractor shall install all monitoring equipment, including monitor console and communications module, magnetostrictive probes, leak sensors, and hydrostatic sensors, in strict accordance with the environmental monitoring system installation instructions.
       4. The Contractor shall verify the overall accuracy of the Automatic Tank Gauging (ATG) system in accordance with API’s Manual of Petroleum Measurement Standards, Chapter 3, Section 1B.
       5. The Contractor shall supply, install, and program a red warning light and sign outside of the maintenance building at 84 inches AFF, at the location shown on the construction drawing. The light shall be actuated by an output signal from the monitoring system, and shall be programed to actuate upon any UST or AST leak sensor alarm (sump or interstitial). The light shall not actuate due to any level probe conditions, i.e., the light should not actuate on high or low level alarms.
       6. The environmental monitoring system must be programmed with, at a minimum, the following parameters:
          1. Proper tank size, product, and gallonage.
          2. Water level warning at 1.5 inches.
          3. High water level limit at 2.0 inches.
          4. High product level – 90%.
          5. Delivery limit – 30%.
          6. Low Product level – 25%.
          7. Leak test - Annually for double-wall tanks (4-hour test).
          8. The audible timer shutoff on the monitoring system overfill alarms shall be set at 60 seconds.
          9. The system shall be programmed for single shift with a start time at midnight.
          10. All liquid sensors shall be identified as to their location. If multiple sensors are used, Contractor will post a laminated drawing adjacent to the monitor to indicate the location of the sensors by name and number. In addition, the Contractor shall fabricate and mount a sign stating “Tank Monitoring System” adjacent to the monitoring system panel.
          11. The Contractor shall be responsible for confirming the above parameters with each system operator and programming the environmental monitoring system to meet each operator’s specific needs.
       7. The Contractor shall provide, as part of the closeout documentation, the monitoring system final setup print-out.
       8. The Contractor shall locate all monitoring equipment, including the monitoring system console and all sensors, in accordance with the construction drawings for each location.
       9. The Contractor shall complete and submit to the manufacturer the environmental monitoring system Warranty Registration and Checkout form as well as the Intrinsic Safety Checklist. A copy of the completed checklist as well as confirmation of delivery of the checklist to the manufacturer shall be submitted as part of the closeout documentation.
          1. Manufacturer's written certification of a complete and functional installation for the leak detection and inventory control system shall be provided by the contractor.
       10. The Contractor shall connect the monitoring system to the internet and the fuel management system. The Contractor shall configure the monitoring system to send automatic e-mails and/or text messages based on owner direction.
       11. The Contractor shall supply, as part of the closeout documentation, any instruction bulletins, preventative maintenance schedules, operational instructions and parts lists associated with the environmental monitoring system.
   15. INSTALLATION – FUEL MANAGEMENT SYSTEM

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**NOTE TO SPECIFIER**

The fuel management system may or may not be desired based on the individual site needs. If a fuel management system is not installed with the project, then a surface mounted, watertight manhole should be installed in the dispensing area, such that a fuel management system can be installed in the future. The system capabilities may need to be adjusted for site specific conditions. Coordinate with site specific needs and infrastructure to specify a network if desired or required.

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* + 1. Install Fuel Management System in accordance with manufacturer requirements and instructions, and in accordance with NFPA 30A and 70.
    2. Run wires, cables, conduits, and raceways as necessary to complete all system connections, including fiber optic pathways and converters where necessary.
    3. Make all connections to system to function as described above.
    4. Engage the services of a manufacturer field representative to program, start up, calibrate, and test the system and provide training to fuel management personnel on all system functionality. Complete sample transactions and generate sample invoices from those transactions, prior to turn-over to the owner.
    5. Install all required network equipment required to provide a fully functioning system.
  1. SENSOR AND LEVEL PROBE TESTING
     1. Complete functionality of the environmental monitoring system shall be tested. In the presence of the engineer, put each sensor into an alarm condition and manually raise the probe float to simulate an overfill condition.
     2. All sensors and probes shall be tested in the presence of the Engineer.
     3. Provide the monitoring system printout of each alarm from the test sequence (depicting each sensor alarming) to the owner prior to operating the system.
     4. Complete State electronic release detection form reporting test results to the owner. Coordinate testing with other Gasoline System sections.
  2. COMMISSIONING
     1. Coordinate commissioning activities with the commissioning activities required in sections [ ] and [ ]. A single commission program, combining the requirements of the sections shall be coordinated.
     2. The Contractor shall commission the motor fuel systems. Commissioning shall include all testing, start-up, calibration, programming, and documentation. At the conclusion of the commissioning, the facility shall be ready for the owner and tenants to conduct unrestricted operations and use all systems to their full intended and designed capacity.
     3. The Contractor shall submit a system commissioning plan to the owner and engineer for approval at least 30 days prior to commissioning the system. The plan, at a minimum shall include health and safety, testing, calibration, startup, and operational testing procedures for all operation and safety equipment. The plan shall also include all testing and commissioning procedures specifically outlined in this section. The Contractor shall be responsible for supplying all fluids and commodities required to startup and calibrate systems. The plan may be combined with commission plans for other vehicle service equipment systems.
     4. Commissioning of the fuel system shall commence no less than 21 days prior to date of beneficial occupancy, and be completed prior to beneficial occupancy.
     5. Fuel or flammable liquids shall not be introduced into the underground tanks until the environmental monitoring and leak detection system is fully programmed, operational, and tested. Fuel shall not be introduced into the dispensing system until all safety (including emergency stop, crash valves, etc.) and leak detection devices have been tested and fire extinguishers are installed.
     6. Notify the engineer no less than 14 days prior to the completion of Commissioning. When Commissioning is completed, the Contractor shall facilitate a final inspection by the engineer. The Contractor shall have all necessary trade personnel on-site to operate equipment, open containment areas, and open electrical enclosures and equipment during the engineer’s final Commissioning inspection. That final inspection shall include, but not be limited to:
        1. Operational test of all systems.
        2. Operational test of all safety devices (e-stop switches, crash valves, overfill alarms);
        3. General review of the installation against plans, specs, and manufacturer requirements;
        4. Review of all test reports and manufacturer start-up reports;
        5. Test of all leak detection sensors;
        6. Closeout document requirements review;
        7. Tank registration form review, to include all outstanding regulatory reports;
        8. Inspection of all tank level probes to verify 90% setting;
        9. Inspect of mechanical overfill protection devices to verify/measure 95% setting;
        10. Inspect of all sumps and containment areas;
        11. Review and validation of monitoring system programming;
        12. Operational test of the fuel management system and verification that the system is recording transactions and that the operator is able to generate fuel invoices.
        13. Confirmation that system training has been completed; and
        14. Verification that remote monitoring for the Environmental Monitoring System is programmed and functioning properly.
  3. MANUFACTURER'S FIELD SERVICES
     1. The Contractor’s field superintendent supervising the installation of all underground petroleum carrying components shall be factory or manufacturer certified to perform such installation. Additionally, the field supervisor shall carry any State or Local certifications to install underground tanks and petroleum components.
     2. Furnish factory training representatives to provide up to 8 hours of training on each major piece of equipment or system.

END OF SECTION

USPS MPF Specification Last Revised: 10/1/2022