
USACE / NAVFAC / AFCEA / NASA UFGS-23 12 16.00 20 (April 2006)

Preparing Activity: NAVFAC

Replacing without change

UFGS-15193N (September 1999)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2008

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 12 16.00 20

GASOLINE/DIESEL DISPENSING SYSTEMS

04/06

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SECTION 23 12 16.00 20

GASOLINE/DIESEL DISPENSING SYSTEMS 04/06

NOTE: This guide specification covers the requirements for gasoline/diesel dispensing systems as used at service stations.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically
be deleted from this section of the project
specification when you choose to reconcile
references in the publish print process.

The publications listed below form a part of this specification to the
extent referenced. The publications are referred to within the text by the
basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L (2007) Specification for Line Pipe

ASME INTERNATIONAL (ASME)

ASME B16.11 (2005) Forged Fittings, Socket-Welding and
Threaded

ASME B16.15 (2006) Cast Bronze Threaded Fittings
Classes 125 and 250

ASME B16.21 (2005) Nonmetallic Flat Gaskets for Pipe
Flanges

ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M (2007) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM D 4814 (2007a) Automotive Spark-Ignition Engine
Fuel

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check
Valves

NACE INTERNATIONAL (NACE)

NACE RP0274 (2004) High Voltage Electrical Inspection
of Pipeline Coatings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (2007) Flammable and Combustible Liquids
Code

NFPA 30A (2007) Code for Motor Fuel Dispensing
Facilities and Repair Garages

NFPA 70 (2007) National Electrical Code

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-52557 (Rev A)) Fuel Oil, Diesel; for Posts,

Camps and Stations

FS L-C-530

(Rev C) Coating, Pipe, Thermoplastic Resin

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1200

Hazard Communication

UNDERWRITERS LABORATORIES (UL)

UL 330

(1996; Rev thru Jan 2007) Hose and Hose Assemblies for Dispensing Flammable Liquids

UL 567

(2003; Rev thru Oct 2004) Emergency Breakaway Fittings, Swivel Connectors and Pipe-Connection Fittings for Petroleum Products and LP-Gas

UL 674

(2003; Rev thru Apr 2006) Standard for Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations

UL 698

(2006) Industrial Control Equipment for Hazardous (Classified) Locations

UL 886

(1994; Rev thru Nov 2005) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

1.2 DEFINITION

- a. Year 2000 compliant - means computer controlled facility components that accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations.

1.3 VAPOR RECOVERY SYSTEM DESCRIPTION

Contractor shall provide a complete and operational Stage II vapor recovery system which meets the air quality laws of the State of [_____] and local regulations. System shall be certified by the California Air Resources Board (CARB), and shall be tested to be 95 percent efficient in controlling VOC emissions during refueling of motor vehicles. Vapor recovery system shall be of the [balance] [aspirator assist] [vacuum assist] design.

1.4 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not

complex and can be reviewed through the Contractor's
Quality Control system. Only add a "G" if the
submittal is sufficiently important or complex in
context of the project.

For submittals requiring Government approval on Army
projects, a code of up to three characters within
the submittal tags may be used following the "G"
designation to indicate the approving authority.
Codes for Army projects using the Resident
Management System (RMS) are: "AE" for
Architect-Engineer; "DO" for District Office
(Engineering Division or other organization in the
District Office); "AO" for Area Office; "RO" for
Resident Office; and "PO" for Project Office. Codes
following the "G" typically are not used for Navy,
Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force
and NASA projects, or choose the second bracketed
item for Army projects.

Government approval is required for submittals with a "G" designation;
submittals not having a "G" designation are [for Contractor Quality Control
approval.] [for information only. When used, a designation following the
"G" designation identifies the office that will review the submittal for
the Government.] The following shall be submitted in accordance with
Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Dispensing system

Vapor recovery system

SD-03 Product Data

Pipe and fittings

Valves

Pumps

Dispensing system

Leak detection monitoring system

Filters

Receipt/totals printer

SD-06 Test Reports

Pneumatic test

Leak detection monitoring system test

Operational test

SD-07 Certificates

Permits

Personnel [license/certification](#)

Year 2000 (Y2K) Compliance Warranty[; G][; G, [____]]

Vapor recovery system and system components

SD-10 Operation and Maintenance Data

[Pumps](#), Data Package 2

[Dispensing system](#), Data Package 2

[Leak detection monitoring system](#), Data Package 1

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.5 QUALITY ASSURANCE

1.5.1 Standard Products

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of the products. Materials shall be resistant to diesel fuel conforming to requirements of [FS A-A-52557](#); and gasoline conforming to [ASTM D 4814](#). Completed installation shall conform to applicable requirements of [NFPA 30](#) and [NFPA 30A](#).

1.5.2 Permitting

Contractor shall obtain necessary [permits](#) in conjunction with installation of underground petroleum piping as may be required by federal, state, or local authority. Submit copy of permits to the Contracting Officer.

1.5.3 Licensed Personnel

Personnel required to install underground petroleum piping shall be licensed/certified by the state when the state requires licensed installers. Submit copy of [license/certification](#) to the Contracting Officer.

1.5.4 Safety

Ensure employees are trained in requirements of [29 CFR 1910.1200](#) and understand information contained in material safety data sheets for their protection against toxic and hazardous chemical effects.

1.5.5 Vapor Recovery System and System Components

Submit copies of CARB Executive Order verifying CARB certification.

1.6 WARRANTY

1.6.1 Year 2000 (Y2K) Compliance Warranty

For each product, component and system specified in this section as a "computer controlled facility component" provide a statement of Y2K compliance warranty for the specific equipment. The contractor warrants that each hardware, software, and firmware product delivered under this contract and listed below shall be able to accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations to the extent that other computer controlled components, used in combination with the computer controlled component being acquired, properly exchange data and time data with it. If the contract requires that specific listed products must perform as a system in accordance with the foregoing warranty, then that warranty shall apply to those listed products as a system. The duration of this warranty and the remedies available to the Government for breach of this warranty shall be defined in, and subject to, the terms and limitations of the contractor's standard commercial warranty or warranties contained in this contract, provided that, notwithstanding any provisions to the contrary, in such commercial warranty or warranties, the remedies available to the Government under this warranty shall include repair or replacement of any listed product whose non-compliance is discovered and made known to the contractor in writing within one year (365 days) after acceptance. Nothing in this warranty shall be construed to limit any rights or remedies the Government may otherwise have under this contract, with respect to defects other than Year 2000 performance.

PART 2 PRODUCTS

2.1 Y2K Compliant Products

NOTE: To ensure that buildings' systems continue to function beyond Year 2000, the following paragraph must be included when this section is part of a construction contract. For more information on Y2K, see these web sites on the Internet.

<http://www.doncio.navy.mil/y2k/year2000.htm>, the Year 2000 homepage of the Department of the Navy Chief Information Officer (DONCIO);
<http://www.itpolicy.gsa.gov/mks/yr2000.legal.htm>, the General Services Administration (GSA) Chief Information Officer (CIO) homepage for Y2K procurement, contracting, and legal issues;
<http://y2k.lmi.org/gsa/y2kproducts> contains information on vendor product compliance

Provide computer controlled facility components, specified in this section, that are Year 2000 compliant (Y2K). Computer controlled facility components refers to software driven technology and embedded microchip technology. This includes, but is not limited to, utility monitoring and control systems, fire detection and suppression systems, alarms, and other facilities control systems utilizing microcomputer, minicomputer, or programmable logic controllers.

2.2 PRODUCT CARRIER PIPE AND FITTINGS

2.2.1 Steel Pipe

Black carbon steel, [ASTM A 53/A 53M](#), Type E or S, Grade A or B, or [API Spec 5L](#), seamless or electric-weld, Grade A or B, Schedule 40.

2.2.2 Fiberglass and Flexible Pipe

Products shall be listed by Underwriters Laboratories for service intended. Limit fiberglass or flexible piping to buried service only and at pressures not exceeding that marked on pipe.

2.2.3 Fiberglass Pipe Fittings

Provide fiberglass pipe fittings supplied by pipe manufacturer with adhesives compatible with product. Threading of fiberglass pipe or mechanical pipe couplings will not be permitted.

2.2.4 Flexible Pipe Fittings

Provide bronze mechanical couplings supplied by pipe manufacturer.

2.2.5 Joint Compound

Joint compound for piping system shall be resistant to water and be suitable for use with fuel containing 40 percent aromatics.

2.2.6 Flange Gaskets

Provide non-asbestos compressed material in accordance with [ASME B16.21](#), 1.60 mm 1/16 inch thickness, full face or self-centering flat ring type. Gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). NBR binder shall be used for hydrocarbon service.

2.2.7 Flexible Connectors

NOTE: Listed flexible connectors may be used when
allowed by NFPA 30 and when approved by local codes
as an alternative for swing joints.

Flexible metal hose, corrugated type with braided wire sheath covering, close-pitch annular corrugations, rated for working pressure of at least 862 kPa (gage) 125 psig, 305 mm 12 inch minimum live length, threaded end connections and shall conform to requirements of [UL 567](#). Metal for hose and braided wire sheath shall be ANSI 300 series stainless steel.

2.3 DOUBLE-WALL SECONDARY CONTAINMENT PIPING

NOTE: Underground piping which carries petroleum
shall be double-wall constructed. Vent lines may be
of single-wall construction. A leak monitoring
system shall also be included to monitor the annular
space between the pipe walls.

Provide double-wall containment piping system. Exterior containment pipe shall be compatible with transported fluid and sized to contain 110 percent of the total volume of the primary inner pipe or pipes and additional equipment required, such as leak detection cables. Containment pipe containing multiple product carrying pipes shall have adequate spacing and supports for the product carrying piping to ensure unhindered performance of the leak detection system. Steel secondary containment piping shall be factory coated. Coating shall consist of thermoplastic resin conforming to FS L-C-530.

2.4 VALVES

Valves shall be Class 150. Gate valves shall be wedge disc type, union bonnet, inside screw, rising stem, and shall have threaded ends with an "O"-ring seal. Check valves shall be synthetic disc, swing check type with screwed ends. Valve body shall be bronze. Gate and check valves shall conform to MSS SP-80. Provide UL listed emergency shut-off valve in accordance with NFPA 30 with stainless steel main spring, fusible link, and test port.

2.5 LEAK DETECTION MONITORING SYSTEM

NOTE: Indicate panel location on drawings.

Provide continuous surveillance leak detection system suitable for operation in an NFPA 70, Class I, Division I, Group D environment and located in the leak containment space between interior and exterior walls of double-wall piping. System shall detect leakage into containment space by monitoring interstitial pressure, vacuum variations, or sense hydrocarbon vapors electronically. Sensor output and transmission shall be electronic. Sensors shall be compatible with and detect leakage of materials stored in pipe at a rate of 0.105 milliliter per second 0.1 gallons per hour with 95 percent probability of detecting this size leak and five percent probability of declaring pipe leaking at this rate when, in fact, it may be leaking less as well as ground water which may leak through secondary containment. [System shall be capable of monitoring [] zones through use of one central remote panel.] Panel shall be in a NEMA enclosure suitable for the environment and have an audible and visual alarm for each zone and include acknowledgement switch and rechargeable battery backup capable of operating the system continuously for a minimum of 48 hours. Panel shall incorporate self-test system which permits operator verification of proper operation of leak detection equipment. Mount panel as indicated. Enclose underground cable in PVC coated conduit. Provide instructions and equipment required for calibration of leak detection system and manufacturer's recommend calibration maintenance schedule.

2.6 DISPENSING SYSTEM

Computer controlled dispensing system shall consist of product dispensing units, management control systems, printers, necessary computers, microprocessors, wiring, cabling, and accessory equipment.

2.6.1 Product Dispensing Units

Provide computer controlled, lighted, [single] [double] sided, remote type,

with [one] [two] [three] [four] [_____] hose outlets [each] suitable for single product delivery flow rate of 0.76 liter per second 12 gallons per minute from each nozzle. Steel frame shall be capable of resisting normal vertical and lateral loads and secured to dispensing island with at least two 15 mm 1/2 inch anchor bolts. Exterior panels shall be either stainless steel or steel with baked enamel finish, or combination of the two. Provide manufacturer's standard microprocessor which has the following functions:

- a. Displays: Solid state liquid crystal displays (LCD'S), five-digit cash display to \$999.99, with automatic shutdown, and four-digit volume display to 999.9 liters 999.9 gallons.
- b. Totalizer: Eight-digit (999,999.99) electronic totalization with identification for each product volume in liters gallons.
- c. Price setting: Price-jog keyswitch on each computer housing to enable remote price setting from management control system.
- d. Filters: Replaceable filter element on each product line with a nominal filtration efficiency of 0.025 mm 25 microns with a flow rating equal to the rate of the dispensing unit.
- e. Backup: Battery backup with automatic charging circuits to hold data for a minimum of three months without recharging. Sales display shall remain visible for 15 minutes after power failure.
- f. Accessories: Equip each assembly with accessories such as built-in air eliminators, line check valves, and emergency shut-off valve. Install centering ring or stabilizer bar to ensure proper shearing action for emergency shut-off valve if the dispensing unit is knocked from it's supports.
- g. Interlocks: Units shall include nozzle supports interlocked to pump motor control switch to start and stop the pump by nozzle removal and replacement. Provide each unit with interlock switch and valve arrangement that prevents flow of product until meter is reset after dispensing nozzle is returned to holder.
- h. Hose: Provide dispensing hose [conforming to UL 330] [of the coaxial vapor recovery type certified by CARB], gasoline and oil resistant, statically grounded, flexible in sub-zero temperatures. Provide a minimum of 3.70 meters 12 feet of hose for each product line on the dispenser. Provide each hose with spring loaded cable to return device attached near mid-length of hose.

NOTE: Select nozzle features based on product(s) dispensed, customer requirements, and compatibility with vapor recovery system. Bellowless nozzles may only be used with vacuum assist vapor recovery systems.

- i. Nozzles: Dispensing nozzles shall be automatic shutoff type, without latch-open device, aluminum body, and full hand insulator to prevent splash-back. [Nozzles shall be CARB certified for Stage II vapor recovery, contain an integral vapor valve [and

evacuator], and be of the [bellows] [bellowless] design.] [Vapor recovery nozzles are not required for diesel dispensing systems.]

- j. Breakaway device: Provide each product hose with UL listed [and CARB certified] emergency breakaway device designed to retain liquid on both sides of breakaway point. Breakaway device shall have pressure balancing chamber to override line pressure to prevent nuisance breaks caused by a restriction in delivery hose diameter.

NOTE: Select type of pump; either submersible or suction type.

- k. **Pumps:** [Provide submersible pumps to be located in product storage tanks. Pump and motor combination shall operate efficiently totally submerged in product of storage tank. When pump only is submerged, pump shall be driven by explosion-proof motor for Class I, Division 1, Group D hazardous locations as defined in **NFPA 70**. Each pump shall have delivery capacity of [_____] **liter per second** **gpm** at a total discharge head of [_____] **kPa** **feet** Maximum delivery rate at each dispensing unit shall be **0.76 liter per second** **12 gpm** with one nozzle flowing. Minimum delivery rate at each dispensing unit shall be **1.50 liter per second** **24 gpm** with two nozzles flowing. Multiple outlet single pump fuel discharge pipeline shall hold pressure of **21 to 34 kPa** **3 to 5 psi** utilizing back pressure and check relief valves. Install on discharge side of each pump, an approved leak detection device which will provide indication when piping between tank-mounted pump and dispensers are not liquid-tight. Pump inlet shall be horizontal. Provide clearance of not less than **127 mm** **5 inches** nor more than **178 mm** **7 inches** between bottom of tank and end of pump.]

[Provide internal gear-type rotary suction pumps with adjustable bypass valves and suction strainers.]

- l. **Motors:** Each motor shall be sized to start and drive equipment at specified capacity and duty cycle without exceeding nameplate rating of motor when operating at proper electrical system voltage. Installation of electrical equipment at dispensers, motors, and pump starter controllers shall be in compliance with Class 1, Group D hazardous location.

2.6.2 Management Control System

Provide management control system which furnish computerized control of station fuel dispensing system including operational, control, and management functions from a central control console with displays and separately mounted electronics and data cabinets. Provide functions to provide receipt and report printout types. Each system shall provide the following:

2.6.2.1 Operating Functions

Operate up to [_____] fueling positions with up to [_____] different products. Operate prepay on preset volume or dollar operation with cash or credit pricing. Include two tier pricing with two levels in each tier.

Display grade, dispenser number, volume, and sales amount in one sequence. Provide audible signals and flashing indicators to alert operator to customer needs and dispenser status. Provide functions to calculate change if tank is too full to accept prepaid amount.

2.6.2.2 Control and Management Functions

Accumulate, store, and deliver full range of management information including pricing by grades and types of service. Provide totals for up to four shifts by product volume, cash and credit sales, and declining balance inventory.

2.6.2.3 Control Console

Provide the following:

- a. Indicators: Call, ready, in-use, used, stopped, unpaid
- b. Manager's keyswitch: Key protection for setting operating modes
- c. Keyboard: Standard international 11-pad numerical
- d. Clock: Real-time operating, showing year, month, day, hour, minute, second
- e. Function keys: Pump stop, pump start, mode, unit price, refund, recall, cash/credit, volume, print/enter, clear, credit paid, cash paid, authorize
- f. Operating temperature range: 0 to 40 degrees C 32 to 104 degrees F

2.6.2.4 Display

Provide the following with light emitting diodes (LED'S):

- a. Operating: Grade, pump number, volume, cash
- b. Mode or memory: Mode number, sub-mode, memory data
- c. Display indicators: Water, low inventory, new data, mode, prepay/preset, volume, cash, credit, return, price

2.6.2.5 Power

115 volts, 60 Hz.

2.7 RECEIPT/TOTALS PRINTER

Provide printer with the following characteristics:

- a. Print speed: 1.25 lines per second
- b. Line length: 40 column, 12 characters per 25.40 mm inch
- c. Paper: Roll, one- or two-ply, 86 mm 3 3/8 inches wide
- d. Spacing: 6 lines per vertical 25.40 mm inch
- e. Character types: Upper and lower case, 96-character

alpha-numeric, normal and double-width

f. Printing mechanism life: 10 million cycles

g. Power: 115 volts, 60 Hz

2.7.1 Receipt and Report Printout Types

Provide printer and system functions to provide the following receipts and reports.

2.7.1.1 Customer Receipt

- a. Time, date, and day of week
- b. Name and grade of fuel product
- c. Pump number and unit price
- d. Total sale by payment method (cash or credit)
- e. Total sales volume in gallons or liters
- f. Prepaid deposit
- g. Discount amount where applicable
- h. Transaction number
- i. Three line customizable heading
- j. Customer receipt available only after dispensing

2.7.1.2 Shift Change Totals

Dollar and volume totals and totalizer readings for current, first, second, and third shift totals.

2.7.1.3 Unit Price Summary

Unit prices for cash and credit, night, day

2.7.1.4 Station Programming Data

List parameters which determine station dispensing system will operate.

- a. Prepay or post pay
- b. Cash or credit pricing
- c. Sales and volume ration limits

2.7.1.5 Diagnostic Messages

Include printer test, last mode entries, system power ON/OFF records, and other information for diagnosing problems by station personnel.

2.8 ABOVE GROUND PIPING

Provide ASTM A 53/A 53M, Schedule 40, hot-dip galvanized, threaded end connections; with ASME B16.11 hot-dip galvanized or ASME B16.15 bronze threaded fittings above grade at dispensers.

2.9 BURIED WARNING AND IDENTIFICATION TAPE

Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by electronic detection instrument. Provide tape in rolls, 80 mm 3 inches minimum width, color coded for utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read "CAUTION BURIED FUEL PIPING BELOW" or similar wording. Provide permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with printed side up at a depth 300 mm 12 inches below top surface of earth or top surface of subgrade under pavements.

2.10 PETROLEUM STORAGE TANKS

NOTE: Select the applicable section used in the
project specifications.

See Section [33 56 10 FACTORY-FABRICATED FUEL STORAGE TANKS] [23 11 13.00 20 FUEL OIL PIPING].

PART 3 EXECUTION

3.1 EARTHWORK

Excavation and backfilling for tanks and piping shall be as specified in Section 31 00 00 EARTHWORK.

3.2 PIPING

NOTE: Piping must maintain the specified minimum pitch and must not be encased in concrete. Most types of pumps normally installed at automotive service stations cannot deliver fuel past a vapor lock. Vapor locks can occur where a portion of the pipe run is installed higher than the pipe elbow below the pump pedestal, especially if the pipe is encased in concrete and absorbs enough heat on warm sunny days to vaporize the fuel.

Piping system shall be steel or nonmetallic. Nonmetallic pipe shall be used for buried lines only. Buried lines which carry product shall have double-walled containment system. Each section of underground pipe shall rest solidly on pipe bed. Piping connections to equipment shall be as required by equipment manufacturer. Make tank connections with two elbow swing joints or flexible connectors to allow for differential settlement. Threaded or mechanical joints shall be allowed at termination points of product carrying lines only. Test plug connections of secondary

containment piping may be threaded. Clean pipe interior of foreign matter before lowering into trench and keep clean during installation. Pipe shall not be laid in water or when trench or weather conditions are unsuitable. When work is not in progress, close open ends of pipe and fittings so that water, earth, or other substances cannot enter. Replace pipe, fittings, or appurtenances found defective after installation. Make threaded joints with tapered threads and make tight with joint compound; compatible with intended petroleum products, applied to male threads only. This requirement shall not apply for gauging hatch or similar connections directly over the tank where line terminates in a fitting within a manhole designed to allow for differential settling. Flanges shall not be permitted on buried lines.

3.2.1 Installing Piping

Handle pipe and accessories to ensure sound, undamaged condition. Take care not to damage coating when lowering pipe into trench and when backfilling. Install nonmetallic pipe in accordance with pipe manufacturer's instructions. Lay underground pipelines with a minimum pitch of 25 mm per 15 meters one inch per 50 feet. Horizontal sections shall have a minimum coverage of 457 mm 18 inches. Piping shall be free of traps and shall drain toward tank. Where steel piping is to be anchored, weld pipe to structural steel member of anchor and patch abraded areas with protective coating or covering as specified. Fit piping passing through concrete or masonry construction with sleeves. Each sleeve shall be of sufficient length to pass through entire thickness of associated structural member and large enough to provide a minimum clear distance of 15 mm 1/2 inch between pipe and sleeve, except where otherwise indicated. Sleeves through concrete may be 20-gage metal, fiber, or other approved material. Sleeves shall be located on center with piping and fastened in place. Space between sleeves and pipe shall be calked and filled with bituminous plastic cement or mechanical calking units designed for such use.

3.2.2 Installing Dispenser

Install on raised concrete foundation and protect against collision damage. Provide opening in island for product and electrical risers for each dispenser. Fill island riser holes with clean sand. Install dispensers in accordance with manufacturers' instructions and with emergency shut-off valve breaking point level with island surface.

3.3 PROTECTIVE COATING FOR UNDERGROUND STEEL PIPE

Apply protective coating to valves, fittings, and joints not factory coated. Piping installed in valve boxes or manholes shall also receive specified protective coating. Coatings shall consist of thermoplastic resin conforming to FS L-C-530. Apply pipe joint coatings, valve coatings, and field repair material as recommended by manufacturer. Finished thickness of pipe coating system shall be as indicated in TABLE I with a five percent allowable tolerance.

TABLE I (Thickness of Coating)

Outside diameter of pipe (mm)	Thickness in mm (minimum)
15 to 40	0.5842
40 to 73.15	0.6858
7316.114.30	0.8128

TABLE I (Thickness of Coating)

Outside diameter of pipe (mm)	Thickness in mm (minimum)
over 114.30	0.9144

TABLE I (Thickness of Coating)

Outside diameter of pipe (inches)	Thickness in mils (minimum)
0.50 to 1.50	23
1.50 to 2.88	27
2.89 to 4.50	32
over 4.50	36

3.3.1 Inspection of Pipe Coatings

Repair damage to protective covering during transit and handling before installation. After applying field coating and wrapping inspect entire pipe by an electric holiday detector with impressed current in accordance with NACE RP0274 using full-ring, spring-type coil electrode. Equip holiday detector with a bell, buzzer, or other type of audible signal which sounds when holiday is detected. Repair holidays in protective covering immediately upon detection. Occasional checks of holiday detector potential will be made by the Contracting Officer to determine suitability of detector. Holiday test and repair holidays prior to introducing fuel into system. Labor materials and equipment necessary for conducting inspection shall be furnished by the Contractor.

3.4 CATHODIC PROTECTION

Provide steel secondary piping systems with cathodic protection as specified in [Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT]. Cathodic protection for piping system shall be coordinated and compatible with tank corrosion control system.

3.5 ELECTRICAL WORK

Provide switches and devices required for controlling electrical equipment. Pumps shall be wired and ready for connection to power circuit. Wiring, equipment, and fittings shall be explosion-proof in conformance with applicable requirements of UL 674, UL 698, and UL 886 for Class I, Division 1, Group C and D hazardous locations. Submit proof of such conformance. Electrical installations shall conform to requirements of NFPA 70.

3.6 Pneumatic Test

Test product carrier piping under pneumatic pressure of at least 1 1/4 times designed working pressure of the particular piping system, but not less than 345 kPa (gage) 50 psig. Test secondary piping under pneumatic pressure of 34 kPa (gage) 5 psig. Joints in secondary piping shall not be made until product carrier pipe is successfully pressure tested. Take care not to exceed pressure rating of various fittings such as the dry break vapor line adapter. Maintain pressure in product carrier piping for at least 2 hours during which there shall be no drop in pressure in each line

greater than that allowed for thermal expansion and contraction. Maintain pressure in secondary piping for at least one hour. To facilitate this test, various sections of each piping system may be isolated to test each separately. Furnish tapped test adapted fittings that can be attached to each end of the section of line being tested that will permit direct connection to the piping from air compressor. No taps in line will be permitted. Furnish necessary equipment for testing. Gages shall be subject to testing and approval. In event leaks are detected, repair and repeat tests. Upon satisfactory completion of tests, relieve pressure and seal line. Make provisions to prevent displacement of piping during testing. Keep personnel clear of piping during pneumatic testing. Isolate equipment such as pumps, tanks, and meters from piping system during tests.

3.7 FLUSHING AND OPERATIONAL TEST

Do not install dispensing units during flushing and cleaning of piping. Install temporary piping or hose equipped with a strainer having not less than 40-mesh screen between supply pipe and tank fill connection on tank from which fuel is being pumped. Furnish temporary pump for flushing. Flush each dispensing system with same type of fuel intended for use in system until outflowing fuel is "clean" and "bright": clean means absence of sediment or emulsion; bright refers to fluorescent appearance of fuel that has no cloud or haze. Test each system to demonstrate performance requirements for which it was designed. [Test shall include unloading fuel trucks to demonstrate effectiveness of vapor recovery system.] Operate fuel dispensing equipment to demonstrate capability of fuel pumps to deliver desired flow and draw storage tank contents to level of pump inlet and to test dispensing nozzle's capability to recirculate vapors from receiving unit back to storage tank. When a portion of each system or a piece of equipment fails to pass tests, make repairs or adjustments and repeat test until satisfactory performance is achieved. Tests shall be witnessed by the Contracting Officer, and the Contractor shall notify the Contracting Officer [_____] days before testing. Furnish calibrated instruments and equipment, as well as the fuel, required to clean and flush each system and to conduct tests. Upon completion of tests replace filters.

3.8 LEAK DETECTION MONITORING SYSTEM TEST

Activate leak monitoring system and test in accordance with manufacturer's instructions.

3.9 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurement, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

<u>Products</u>	<u>Inch-Pound</u>	<u>Metric</u>
a. Dispensing Unit Flow Rate	= 12 gpm	= 0.76 liters/sec
b. Flange Gaskets Thickness	= 1/16 inch	= 1.60 mm
c. Buried Warning and Identification Tape Width	= 3 inches	= 80 mm

Products

Inch-Pound

Metric

-- End of Section --