

PART 1 -- GENERAL

1.1 SUMMARY

- A. THIS SECTION INCLUDES FUEL-OIL AND DIESEL-FUEL-OIL DISTRIBUTION SYSTEMS SECTION AND THE FOLLOWING:
  1. PIPES, TUBES, AND FITTINGS.
  2. PIPING AND TUBING JOINING MATERIALS.
  3. PIPING SPECIALTIES.
  4. VALVES.
  5. FRP FUEL-OIL USTS.
  6. FUEL-OIL UST ACCESSORIES.
  7. FUEL-OIL STORAGE TANK PIPING SPECIALTIES.
  8. FUEL-TRANSFER PUMPS.
  9. LEAK-DETECTION AND MONITORING SYSTEM.
  10. CONCRETE BASES.

1.2 PERFORMANCE REQUIREMENTS

- A. MAXIMUM OPERATING-PRESSURE RATINGS: 3-PSIG FUEL-OIL SUPPLY PRESSURE AT OIL-FIRED APPLIANCES.
  - 1. PRODUCT DATA: FOR EACH TYPE OF PRODUCT INDICATED.
- B. SHOP DRAWINGS: FOR FACILITY FUEL-OIL PIPING LAYOUT, INCLUDE PLANS, PIPING LAYOUT AND ELEVATIONS, SECTIONS, AND DETAILS FOR FABRICATION OF PIPE ANCHORS, HANGERS, SUPPORTS FOR MULTIPLE PIPES, ALIGNMENT GUIDES, EXPANSION JOINTS AND LOOPS, AND ATTACHMENTS OF THE SAME TO BUILDING STRUCTURE. DETAIL LOCATION OF ANCHORS, ALIGNMENT GUIDES, AND EXPANSION JOINTS AND LOOPS.

1.3 ACTION SUBMITTALS

- A. WELDING CERTIFICATES.
- B. FIELD QUALITY-CONTROL REPORTS.
- C. WARRANTY: SAMPLE OF SPECIAL WARRANTY.

1.5 CLOSEOUT SUBMITTALS

- A. OPERATION AND MAINTENANCE DATA.
- 1.6 QUALITY ASSURANCE
  - A. STEEL SUPPORT WELDING QUALIFICATIONS: QUALIFY PROCEDURES AND PERSONNEL ACCORDING TO AWS D1.1/D1.1M, "STRUCTURAL WELDING CODE -- STEEL."
  - B. PIPE WELDING QUALIFICATIONS: QUALIFY PROCEDURES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE.
  - C. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, BY A QUALIFIED TESTING AGENCY, AND MARKED FOR INTENDED LOCATION AND APPLICATION.
  - D. COMPLY WITH ASME B31.9, "BUILDING SERVICES PIPING," FOR FUEL-OIL PIPING MATERIALS, INSTALLATION, TESTING, AND INSPECTING.
  - E. COMPLY WITH REQUIREMENTS OF THE EPA AND OF STATE AND LOCAL AUTHORITIES HAVING JURISDICTION. INCLUDE RECORDING OF FUEL-OIL STORAGE TANKS AND MONITORING OF TANKS AND PIPING.

1.7 WARRANTY

- A. SPECIAL WARRANTY: MANUFACTURER'S STANDARD FORM IN WHICH MANUFACTURER AGREES TO REPAIR OR REPLACE COMPONENTS OF FUEL-OIL STORAGE TANKS AND FLEXIBLE, DOUBLE-CONTAINMENT PIPING AND RELATED EQUIPMENT THAT FAIL IN MATERIALS OR WORKMANSHIP WITHIN SPECIFIED WARRANTY PERIOD.
  1. STORAGE TANKS:
    - a. FAILURES INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING WHEN USED FOR STORAGE OF FUEL OIL AT TEMPERATURES NOT EXCEEDING 150 DEG F:
      - 1) STRUCTURAL FAILURES INCLUDING CRACKING, BREAKUP, AND COLLAPSE.
      - 2) WARRANTY PERIOD: 30 YEARS FROM DATE OF SUBSTANTIAL COMPLETION.
    - b. FLEXIBLE, DOUBLE-CONTAINMENT PIPING AND RELATED EQUIPMENT:
      - a. FAILURES DUE TO DEFECTIVE MATERIALS OR WORKMANSHIP FOR MATERIALS INSTALLED TOGETHER, INCLUDING PIPING, DISPENSER SUMPS, ENTRY BOOTS, AND SUMP MOUNTING ADAPTERS.
      - b. WARRANTY PERIOD: 10 YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

PART 2 -- PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. SEE PART 3 PIPING SCHEDULE ARTICLES FOR WHERE PIPES, TUBES, FITTINGS, AND JOINING MATERIALS ARE APPLIED IN VARIOUS SERVICES.
- B. STEEL PIPE: ASTM A 53/A 53M, BLACK STEEL, SCHEDULE 40, TYPE E OR S, GRADE B.
  1. MALLEABLE-IRON THREADED FITTINGS: ASME B16.3, CLASS 150, STANDARD PATTERN.
  2. WROUGHT-STEEL WELDING FITTINGS: ASTM A 234/A 234M, FOR BUTT AND SOCKET WELDING.
  3. UNIONS: ASME B16.39, CLASS 150, MALLEABLE IRON WITH BRASS-TO-IRON SEAT, GROUND JOINT, AND THREADED ENDS.

2.2 DOUBLE-CONTAINMENT PIPE AND FITTINGS

- A. FLEXIBLE, DOUBLE-CONTAINMENT PIPING: COMPLY WITH UL 971.
  1. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, AVAILABLE MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:
    - a. EMVIRON PRODUCTS, INC.
    - b. QEW.
    - c. DUALOY 3000/LCX.
  2. PIPE MATERIALS: PVDF COMPLYING WITH ASTM D 3222 FOR CARRIER PIPE WITH MECHANICAL COUPLINGS TO SEAL CARRIER, AND PE PIPE COMPLYING WITH ASTM D 4976 FOR CONTAINMENT PIPING.
  3. FIBERGLASS OR PE SUMPS.
  4. WATERIGHT SUMP ENTRY BOOTS, PIPE ADAPTERS WITH TEST PORTS AND TUBES, COAXIAL FITTINGS, AND COUPLINGS.
  5. MINIMUM OPERATING PRESSURE RATING: 10 PSIG.
  6. PLASTIC TO STEEL PIPE TRANSITION FITTINGS: FACTORY-FABRICATED FITTINGS WITH PLASTIC END MATCHING OR COMPATIBLE WITH CARRIER PIPING, AND STEEL PIPE END COMPLYING WITH ASTM A 53/A 53M, BLACK STEEL, SCHEDULE 40, TYPE E OR S, GRADE B.

2.3 PIPING SPECIALTIES

- A. Y-PATTERN STRAINERS:
  1. BODY: ASTM A 126, CLASS B, CAST IRON WITH BOLTED COVER AND BOTTOM DRAIN CONNECTION.
  2. END CONNECTIONS: THREADED ENDS FOR NPS 2 AND SMALLER.
  3. STRAINER SCREEN: 60-MESH STARTUP STRAINER, AND PERFORATED STAINLESS-STEEL BASKET WITH 50 PERCENT FREE AREA.
  4. CWP RATING: 125 PSIG.
- B. MANUAL AIR VENTS:
  1. BODY: BRONZE.
  2. INTERNAL PARTS: NONFERROUS.
  3. OPERATOR: SCREWDRIVER OR THUMBSCREW.
  4. INLET CONNECTION: NPS 1/2.
  5. DISCHARGE CONNECTION: NPS 1/8.
  6. CWP RATING: 150 PSIG.
  7. MAXIMUM OPERATING TEMPERATURE: 225 DEG F.

2.4 JOINING MATERIALS

- A. JOINT COMPOUND AND TAPE: SUITABLE FOR FUEL OIL.
- B. WELDING FILLER METALS: COMPLY WITH AWS D10.12/D10.12M FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND CHEMICAL ANALYSIS OF STEEL PIPE BEING WELDED.
- C. BRAZING FILLER METALS: ALLOY WITH MELTING POINT GREATER THAN 1000 DEG F COMPLYING WITH AWS A5.8/A5.8M. BRAZING ALLOYS CONTAINING MORE THAN 0.05 PERCENT PHOSPHORUS ARE PROHIBITED.

2.5 MANUAL FUEL-OIL SHUTOFF VALVES

- A. SEE VALVE SCHEDULE IN PART 3 FOR WHERE EACH VALVE TYPE IS APPLIED IN VARIOUS SERVICES.
- B. GENERAL REQUIREMENTS FOR METALLIC VALVES: COMPLY WITH UL 842.
  1. CWP RATING: 125 PSIG.
  2. THREADED ENDS: COMPLY WITH ASME B1.20.1.
  3. DRYSEAL THREADS ON FLARE ENDS: COMPLY WITH ASME B1.20.3.
  4. TAMPERPROOF FEATURE: LOCKING FEATURE FOR VALVES INDICATED IN THE VALVE SCHEDULE.
  5. SERVICE MARK: INITIALS "WOG" SHALL BE PERMANENTLY MARKED ON VALVE BODY.
- C. TWO-PIECE, FULL-PORT, BRONZE BALL VALVES WITH BRONZE TRIM: MSS SP-110.
  1. BODY: BRONZE, COMPLYING WITH ASTM B 584.
  2. BALL: CHROME-PLATED BRONZE.
  3. STEM: BRONZE, BLOWOUT PROOF.
  4. SEATS: REINFORCED TFE; BLOWOUT PROOF.

- 5. PACKING: THREADED-BODY PACKNUT DESIGN WITH ADJUSTABLE-STEM PACKING.
- 6. ENDS: THREADED, FLARED, OR SOCKET AS INDICATED IN THE VALVE SCHEDULE.
- 7. CWP RATINGS: 600 PSIG.
- 8. SERVICE MARK: INITIALS "WOG" SHALL BE PERMANENTLY MARKED ON VALVE BODY.

2.6 SPECIALTY VALVES

- A. PRESSURE RELIEF VALVES: COMPLY WITH UL 842.
  1. LISTED AND LABELED FOR FUEL-OIL SERVICE BY AN NRTL ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.
  2. BODY: BRASS, BRONZE, OR CAST STEEL.
  3. SPRINGS: STAINLESS STEEL, INTERCHANGEABLE.
  4. SEAT AND SEAL: NITRILE RUBBER.
  5. ORIFICE: STAINLESS STEEL, INTERCHANGEABLE.
  6. FACTORY-APPLIED FINISH: BAKED ENAMEL.
  7. MAXIMUM INLET PRESSURE: 150 PSIG.
  8. RELIEF PRESSURE SETTING: 60 PSIG.
- B. OIL SAFETY VALVES: COMPLY WITH UL 842.
  1. LISTED AND LABELED FOR FUEL-OIL SERVICE BY AN NRTL ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.
  2. BODY: BRASS, BRONZE, OR CAST STEEL.
  3. SPRINGS: STAINLESS STEEL.
  4. SEAT AND DIAPHRAGM: NITRILE RUBBER.
  5. ORIFICE: STAINLESS STEEL, INTERCHANGEABLE.
  6. FACTORY-APPLIED FINISH: BAKED ENAMEL.
  7. MANUAL OVERRIDE PORT.
  8. MAXIMUM INLET PRESSURE: 60 PSIG.
  9. MAXIMUM OUTLET PRESSURE: 3 PSIG.

2.7 FRP FUEL-OIL UST

- A. BASIS-OF-DESIGN PRODUCT: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCT INDICATED ON DRAWINGS OR COMPARABLE PRODUCT BY ONE OF THE FOLLOWING:
  1. CONTAINMENT SOLUTIONS, INC.
  2. XEVEX CORPORATION.
- B. DESCRIPTION: HORIZONTAL, FRP UST, UL 1316, DOUBLE WALL, WITH INTERSTITIAL SPACE.
- C. CONSTRUCTION: FABRICATED WITH FIBERGLASS-REINFORCED POLYESTER RESINS; SUITABLE FOR OPERATION AT ATMOSPHERIC PRESSURE; FABRICATED FOR THE FOLLOWING LOADS:
  1. DEPTH OF BURY: 3 FEET FROM TOP OF TANK TO FINISHED SURFACE.
  2. EXTERNAL HYDROSTATIC PRESSURE: TO WITHSTAND GENERAL BUCKLING WITH SAFETY FACTOR OF 2:1 IF HOLE IS FULLY FLOODED.
  3. SURFACE LOADS: ASHTO'S "SPECIFICATIONS FOR HIGHWAY BRIDGES," H-20 AXLE LOADS OF 32,000 LB.

2.8 FUEL-OIL UST ACCESSORIES

- A. TANK MANHOLES: 22-INCH-- MINIMUM DIAMETER; BOLTED, FLANGED, AND GASKETED, WITH EXTENSION COLLAR FOR ACCESS TO INSIDE OF TANK.
- B. THREADED PIPE CONNECTION FITTINGS ON TOP OF TANK FOR FILL, SUPPLY, RETURN, VENT, SOUNDING, AND GAGING, IN LOCATIONS AND OF SIZES INDICATED. INCLUDE CAST-IRON PLUGS FOR SHIPPING.
- C. STRIKER PLATES: INSIDE TANK, ON BOTTOM BELOW FILL, VENT, SOUNDING, GAGE, AND OTHER TUBE OPENINGS.
- D. LIFTING LIGGS: FOR HANDLING AND INSTALLATION.
- E. LADDERS: CARBON-STEEL LADDER INSIDE TANK, ANCHORED TO TOP AND BOTTOM. INCLUDE REINFORCEMENT OF TANK AT BOTTOM OF LADDER.
- F. SUPPLY TUBE: EXTENSION OF SUPPLY PIPING FITTING INTO TANK, TERMINATING 6 INCHES ABOVE TANK BOTTOM AND CUT AT A 45-DEGREE ANGLE.
- G. SOUNDING AND GAGE TUBES: EXTENSION OF FITTING INTO TANK, TERMINATING 6 INCHES ABOVE TANK BOTTOM AND CUT AT A 45-DEGREE ANGLE.
- H. CONTAINMENT SUMPS: FIBERGLASS OR PE WITH SUMP BASE, ADD-ON EXTENSION PIECES AS REQUIRED, SUMP TOP, LID, AND GASKET-SEAL JOINTS. INCLUDE SUMP ENTRY BOOTS FOR PIPE PENETRATIONS THROUGH SIDEWALLS.
- I. SUMP ENTRY BOOTS: TWO-PART PIPE FITTING FOR FIELD ASSEMBLY AND OF SIZE REQUIRED TO FIT OVER PIPE. INCLUDE GASKETS SHAPED TO FIT SUMP SIDEWALL, SLEEVES, SEALS, AND CLAMPS AS REQUIRED FOR LIQUID-TIGHT PIPE PENETRATIONS.
- J. ANCHOR STRAP STORAGE TANK MANUFACTURER'S STANDARD ANCHORING SYSTEM, WITH STRAPS, ANCHORING MATERIALS, CABLES AND TURNBUCKLES, OF STRENGTH AT LEAST ONE AND ONE-HALF TIMES MAXIMUM UPLIFT FORCE OF EMPTY TANK WITHOUT BACKFILL IN PLACE.
- K. FILTER MAT: GEOTEXTILE WOVEN OR SPUN FILTER FABRIC, IN 1 OR MORE LAYERS, FOR MINIMUM TOTAL WEIGHT OF 3.02 SQ. YD.
- L. OVERFILL PREVENTION VALVES: FACTORY FABRICATED OR SHOP OR FIELD ASSEMBLED FROM MANUFACTURER'S STANDARD COMPONENTS. INCLUDE DROP TUBE, CAP, FILL NOZZLE ADAPTOR, CHECK VALVE MECHANISM OR OTHER DEVICES, AND VENT IF REQUIRED TO RESTRICT FLOW AT 95 PERCENT OF TANK CAPACITY AND TO PROVIDE COMPLETE SHUTOFF OF FILLING AT 98 PERCENT OF TANK CAPACITY.

2.9 FUEL-OIL STORAGE TANK PIPING SPECIALTIES

- A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, AVAILABLE MANUFACTURERS OFFERING PRODUCTS THAT MAY BE INCORPORATED INTO THE WORK INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:
  1. QEW.
- B. FITTING MATERIALS: CAST IRON, MALLEABLE IRON, BRASS, OR CORROSION-RESISTANT METAL; SUITABLE FOR FUEL-OIL STORAGE TANK CONTAINMENT SUMPS AND AT LOW POINTS IN PIPING.
  1. SURFACE, FLUSH-MOUNTED FITTINGS: WATERPROOF AND SUITABLE FOR TRUCK TRAFFIC.
  2. ABOVEGROUND-MOUNTED FITTINGS: WEATHERPROOF.
- C. LOCKING FILL BOXES: FLUSH MOUNTING, WITH LOCKING-TYPE INNER FILL CAP FOR STANDARD PADLOCK AND THREADED FILL-PIPE CONNECTION.
- D. SUPPLY AND SOUNDING DROP TUBES: FUEL-OIL SUPPLY PIPE OR FITTING, INSIDE TANK, TERMINATING 6 INCHES ABOVE BOTTOM OF TANK, AND WITH END CUT AT A 45-DEGREE ANGLE.
- E. PIPE ADAPTERS AND EXTENSIONS: COMPATIBLE WITH PIPING AND FITTINGS.
- F. SUCTION STRAINERS AND CHECK VALVES: BRONZE OR CORROSION-RESISTANT METAL COMPONENTS.
- G. FOOT VALVES AND ANTISIPHON VALVES: POPPET-TYPE, BRONZE OR CORROSION-RESISTANT METAL COMPONENTS.
- H. WEATHERPROOF VENT CAP: CAST- OR MALLEABLE-IRON INCREASER FITTING WITH CORROSION-RESISTANT WIRE SCREEN, WITH FREE AREA AT LEAST EQUAL TO CROSS-SECTIONAL AREA OF CONNECTING PIPE AND THREADED-END CONNECTION.
- I. METAL MANHOLES: 22-INCH-- MINIMUM DIAMETER FRAME AND COVER. FURNISH MANHOLE UNITS OF ADEQUATE SIZE FOR ACCESS TO FITTINGS IF SIZE IS NOT INDICATED.
- J. MONITORING WELL CAPS: LOCKING PIPE PLUG AND MANHOLE.

2.10 LEAK-DETECTION AND MONITORING SYSTEM

- A. CABLE AND SENSOR SYSTEM: COMPLY WITH UL 1238.
  - a. CONNECT TO THE EXISTING VEEDER-ROOT: A DANAHER CORPORATION COMPANY.
- 3. CALIBRATED, LEAK-DETECTION AND MONITORING SYSTEM WITH PROBES AND OTHER SENSORS AND REMOTE ALARM PANEL FOR FUEL-OIL STORAGE TANKS AND FUEL-OIL PIPING.
  4. INCLUDE FITTINGS AND DEVICES REQUIRED FOR TESTING.
  5. CONTROLS: ELECTRICAL, OPERATING ON 120-V AC.
  6. CALIBRATED, LIQUID-LEVEL GAGE COMPLYING WITH UL 180 WITH FLOATS OR OTHER SENSORS AND REMOTE ANNUNCIATOR PANEL.
  7. REMOTE ANNUNCIATOR PANEL: WITH VISUAL AND AUDIBLE, HIGH-TANK-LEVEL AND LOW-TANK-LEVEL ALARMS, FUEL INDICATOR WITH REGISTRATION IN GALLONS, AND OVERFILL ALARM. INCLUDE GAGE VOLUME RANGE THAT COVERS FUEL-OIL STORAGE CAPACITY.
  8. CONTROLS: ELECTRICAL, OPERATING ON 120-V AC.

2.11 LABELING AND IDENTIFYING

- A. DETECTABLE WARNING TAPE: ACID- AND ALKALI-RESISTANT, PE FILM WARNING TAPE MANUFACTURED FOR MARKING AND IDENTIFYING UNDERGROUND UTILITIES, A MINIMUM OF 6 INCHES WIDE AND 4 MILS THICK, CONTINUOUSLY INSCRIBED WITH A DESCRIPTION OF UTILITY, WITH METALLIC CORE ENCASED IN A PROTECTIVE JACKET FOR CORROSION PROTECTION, DETECTABLE BY METAL DETECTOR WHEN TAPE IS BURIED UP TO 30 INCHES DEEP; COLORED YELLOW.
- 2.12 SOURCE QUALITY CONTROL
  - A. PRESSURE TEST AND INSPECT FUEL-OIL STORAGE TANKS, AFTER FABRICATION AND BEFORE SHIPMENT, ACCORDING TO ASME AND UL 1316.
  - B. AFFIX STANDARDS ORGANIZATION'S CODE STAMP.

PART 3 -- EXECUTION

3.1 EARTHWORK

- A. REFER TO DRAWINGS BY FISHER AND ARNOLD INC.
- 3.2 OUTDOOR PIPING INSTALLATION
  - A. INSTALL UNDERGROUND FUEL-OIL PIPING BURIED AT LEAST 18 INCHES BELOW FINISHED GRADE.
  - B. INSTALL DOUBLE-CONTAINMENT, FUEL-OIL PIPE AT A MINIMUM SLOPE OF 1 PERCENT DOWNWARD TOWARD FUEL-OIL STORAGE TANK SUMP.
  - C. INSTALL VENT PIPE AT A MINIMUM SLOPE OF 2 PERCENT DOWNWARD TOWARD FUEL-OIL STORAGE TANK SUMP.
  - D. ASSEMBLE AND INSTALL ENTRY BOOTS FOR PIPE PENETRATIONS THROUGH SUMP SIDEWALLS FOR

LIQUID-TIGHT JOINTS.

- E. INSTALL METAL PIPES AND TUBES, FITTINGS, AND VALVES AT PIPING CONNECTIONS TO UST.
- F. INSTALL FITTINGS FOR CHANGES IN DIRECTION IN RIGID PIPE.
- G. INSTALL SYSTEM COMPONENTS WITH PRESSURE RATING EQUAL TO OR GREATER THAN SYSTEM OPERATING PRESSURE.
- H. INSTALL PRESSURE GAGE ON SUCTION FROM EACH PUMP.
- 3.3 PIPING INSTALLATION
  - A. INSTALL PIPING FREE OF SAGS AND BENDS.
  - B. INSTALL FITTINGS FOR CHANGES IN DIRECTION AND BRANCH CONNECTIONS.
  - C. VERIFY FINAL EQUIPMENT LOCATIONS FOR ROUGHING-IN.
  - D. USE ECCENTRIC REDUCER FITTINGS TO MAKE REDUCTIONS IN PIPE SIZES. INSTALL FITTINGS WITH LEVEL SIDE DOWN.
  - E. CONNECT BRANCH PIPING FROM TOP OR SIDE OF HORIZONTAL PIPING.
  - F. INSTALL UNIONS IN PIPES NPS 2 AND SMALLER AT FINAL CONNECTION TO EACH PIECE OF EQUIPMENT AND ELSEWHERE AS INDICATED. UNIONS ARE NOT REQUIRED ON FLANGED DEVICES.
  - G. DO NOT USE FUEL-OIL PIPING AS GROUNDING ELECTRODE.

3.4 VALVE INSTALLATION

- A. INSTALL MANUAL FUEL-OIL SHUTOFF VALVES ON BRANCH CONNECTIONS TO FUEL-OIL APPLIANCE.
- B. INSTALL VALVES IN ACCESSIBLE LOCATIONS.
- C. PROTECT VALVES FROM PHYSICAL DAMAGE.
- D. INSTALL METAL TAG ATTACHED WITH METAL CHAIN INDICATING FUEL-OIL PIPING SYSTEMS.
- E. INSTALL OIL SAFETY VALVES AT INLET OF EACH OIL-FIRED APPLIANCE.
- F. INSTALL PRESSURE RELIEF VALVES IN DISTRIBUTION PIPING BETWEEN THE SUPPLY AND RETURN LINES.
- G. INSTALL ONE-PIECE, BRONZE BALL VALVE WITH HOSE END CONNECTION AT LOW POINTS IN FUEL-OIL PIPING.
- H. INSTALL MANUAL AIR VENTS AT HIGH POINTS IN FUEL-OIL PIPING.

3.5 PIPING JOINT CONSTRUCTION

- A. REAM ENDS OF PIPES AND TUBES AND REMOVE BURRS.
- B. REMOVE SCALE, SLAG, DIRT, AND DEBRIS FROM INSIDE AND OUTSIDE OF PIPE AND FITTINGS BEFORE ASSEMBLY.
- C. THREADED JOINTS: THREAD PIPE WITH TAPERED PIPE THREADS ACCORDING TO ASME B1.20.1. CUT THREADS FULL AND CLEAN USING SHARP DIES. REAM THREADED PIPE ENDS TO REMOVE BURRS AND RESTORE FULL I.D. JOIN PIPE FITTINGS AND VALVES AS FOLLOWS:
  1. APPLY APPROPRIATE TAPE OR THREAD COMPOUND TO EXTERNAL PIPE THREADS UNLESS DRY SEAL THREADING IS SPECIFIED.
  2. DAMAGED THREADS: DO NOT USE PIPE OR PIPE FITTINGS WITH THREADS THAT ARE CORRODED OR DAMAGED. DO NOT USE PIPE SECTIONS THAT HAVE CRACKED OR OPEN WELDS.
- D. WELDED JOINTS: CONSTRUCT JOINTS ACCORDING TO AWS D10.12/D10.12M, USING QUALIFIED PROCESSES AND WELDING OPERATORS ACCORDING TO "QUALITY ASSURANCE" ARTICLE.
  1. BEVEL PLAIN ENDS OF STEEL PIPE.
  2. PATCH FACTORY-APPLIED PROTECTIVE COATING AS RECOMMENDED BY MANUFACTURER AT FIELD WELDS AND WHERE DAMAGE TO COATING OCCURS DURING CONSTRUCTION.
- E. BRAZED JOINTS: CONSTRUCT JOINTS ACCORDING TO AWS'S "BRAZING HANDBOOK," "PIPE AND TUBE" CHAPTER.
- F. FLARED JOINTS: COMPLY WITH SAE J513. TIGHTEN FINGER TIGHT, THEN USE WRENCH ACCORDING TO FITTING MANUFACTURER'S WRITTEN RECOMMENDATIONS. DO NOT OVERTIGHTEN.

3.6 FUEL-OIL UST INSTALLATION

- A. EXCAVATE TO SUFFICIENT DEPTH FOR A MINIMUM OF 3 FEET OF EARTH COVER FROM TOP OF TANK TO FINISHED GRADE. ALLOW FOR CAST-IN-PLACE, CONCRETE-BALLAST BASE PLUS 6 INCHES OF SAND OR PEA GRAVEL BETWEEN BALLAST BASE AND TANK. EXTEND EXCAVATION AT LEAST 12 INCHES AROUND PERIMETER OF TANK.
- B. SET TIE-DOWN EYELETS FOR HOLD-DOWN STRAPS IN CONCRETE-BALLAST BASE AND TIE TO REINFORCING STEEL.
- C. PLACE 6 INCHES OF CLEAN SAND OR PEA GRAVEL ON TOP OF CONCRETE-BALLAST BASE.
- D. SET TANK ON FILL MATERIALS AND INSTALL HOLD-DOWN STRAPS.
- E. CONNECT PIPING.
- F. INSTALL TANK LEAK-DETECTION AND MONITORING DEVICES.
- G. INSTALL CONTAINMENT SUMPS.
- H. BACKFILL EXCAVATION WITH CLEAN SAND OR PEA GRAVEL IN 12-INCH LIFTS AND TAMP BACKFILL LIFT TO CONSOLIDATE.
- I. INSTALL FILTER MAT BETWEEN TOP OF BACKFILL MATERIAL AND EARTH FILL.
- J. INSTALL FRP USTS WITH FRP HOLD-DOWN STRAPS, MANHOLE EXTENSIONS, AND MANHOLE RISERS.

3.7 FUEL-OIL PUMP INSTALLATION

- A. TRANSFER PUMPS:
  1. INSTALL PUMPS WITH ACCESS SPACE FOR PERIODIC MAINTENANCE INCLUDING REMOVAL OF MOTORS, IMPELLERS, AND ACCESSORIES.
  2. INSTALL SUCTION PIPING WITH MINIMUM FITTINGS AND CHANGE OF DIRECTION.

3.8 LEAK-DETECTION AND MONITORING SYSTEM INSTALLATION

- A. INSTALL LEAK-DETECTION AND MONITORING SYSTEM. CONNECT TO THE EXISTING ALARM PANEL INSIDE BUILDING WHERE INDICATED.
  1. DOUBLE-WALL, FUEL-OIL STORAGE TANKS: INSTALL PROBES IN INTERSTITIAL SPACE.
  2. DOUBLE-CONTAINMENT, FUEL-OIL PIPING: INSTALL LEAK-DETECTION SENSOR PROBES IN FUEL-OIL STORAGE TANK CONTAINMENT SUMPS AND AT LOW POINTS IN PIPING.
  3. INSTALL LIQUID-LEVEL GAGE AND CONNECT TO EXISTING VEEDER ROOT SYSTEM FOR MONITORING.
  4. CONNECT TO EXISTING FUEL MANAGEMENT SYSTEM FOR OWNER CONTROL OF FUEL DISPENSING.

3.9 CONNECTIONS

- A. INSTALL PIPING ADJACENT TO EQUIPMENT TO ALLOW SERVICE AND MAINTENANCE.
- B. INSTALL UNIONS, IN PIPING NPS 2 AND SMALLER, ADJACENT TO EACH VALVE AND AT FINAL CONNECTION TO EACH PIECE OF EQUIPMENT HAVING THREADED PIPE CONNECTION.
- C. CONNECT PIPING TO EQUIPMENT WITH BALL VALVE AND UNION. INSTALL UNION BETWEEN VALVE AND EQUIPMENT.

3.10 LABELING AND IDENTIFYING

- A. INSTALL DETECTABLE WARNING TAPE DIRECTLY ABOVE FUEL-OIL PIPING, 12 INCHES BELOW FINISHED GRADE, EXCEPT 6 INCHES BELOW SUBGRADE UNDER PAVEMENTS AND SLABS. TERMINATE TRACER WIRE IN AN ACCESSIBLE AREA, AND IDENTIFY AS "TRACER WIRE" FOR FUTURE USE WITH PLASTIC-LAMINATE SIGN.
- 1. PIPING: OVER UNDERGROUND FUEL-OIL DISTRIBUTION PIPING.
- 2. FUEL-OIL STORAGE TANKS: OVER EDGES OF EACH UST.

3.11 CONCRETE BASES

- A. CONCRETE BASES: ANCHOR EQUIPMENT TO CONCRETE BASE ACCORDING TO EQUIPMENT MANUFACTURER'S WRITTEN INSTRUCTIONS AND ACCORDING TO SEISMIC CODES AT PROJECT.
  1. CONSTRUCT CONCRETE BASES OF DIMENSIONS INDICATED, BUT NOT LESS THAN 4 INCHES LARGER IN BOTH DIRECTIONS THAN SUPPORTED UNIT.
  2. INSTALL DOWEL RODS TO CONNECT CONCRETE BASE TO CONCRETE FLOOR, UNLESS OTHERWISE INDICATED, INSTALL DOWEL RODS ON 18-INCH CENTERS AROUND THE FULL PERIMETER OF THE BASE.
  3. INSTALL EPOXY-COATED ANCHOR BOLTS FOR SUPPORTED EQUIPMENT THAT EXTEND THROUGH CONCRETE BASE, AND ANCHOR INTO STRUCTURAL CONCRETE FLOOR.
  4. PLACE AND SECURE ANCHORAGE DEVICES. USE SUPPORTED EQUIPMENT MANUFACTURER'S SETTING DRAWINGS, TEMPLATES, DIAGRAMS, INSTRUCTIONS, AND DIRECTIONS FURNISHED WITH ITEMS TO BE EMBEDDED.
  5. INSTALL ANCHOR BOLTS TO ELEVATIONS REQUIRED FOR PROPER ATTACHMENT TO SUPPORTED EQUIPMENT.
  6. USE 3000-PSIG, 28-DAY, COMPRESSIVE-STRENGTH CONCRETE AND REINFORCEMENT AS SPECIFIED IN

3.12 FIELD QUALITY CONTROL

- A. TANKS: MINIMUM HYDROSTATIC OR COMPRESSED-AIR TEST PRESSURES FOR FUEL-OIL STORAGE TANKS THAT HAVE NOT BEEN FACTORY TESTED AND DO NOT BEAR THE ASME CODE STAMP OR A LISTING MARK ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION:
  1. INNER TANKS: MINIMUM 3 PSIG AND MAXIMUM 5 PSIG.
  2. INTERSTITIAL SPACE: MINIMUM 3 PSIG AND MAXIMUM 5 PSIG, OR 5.3-IN. HG VACUUM.
  3. WHERE VERTICAL HEIGHT OF FILL AND VENT PIPES IS SUCH THAT THE STATIC HEAD IMPOSED ON THE BOTTOM OF THE TANK IS GREATER THAN 10 PSIG, HYDROSTATICALLY TEST THE TANK AND FILL AND VENT PIPES TO A PRESSURE EQUAL TO THE STATIC HEAD THIS IMPOSED.
  4. MAINTAIN THE TEST PRESSURE FOR ONE HOUR.
- B. PIPING: MINIMUM HYDROSTATIC OR PNEUMATIC TEST-PRESSURES MEASURED AT HIGHEST POINT IN SYSTEM:
  1. FUEL-OIL DISTRIBUTION PIPING: MINIMUM 5 PSIG FOR MINIMUM 30 MINUTES.
  2. FUEL-OIL, DOUBLE-CONTAINMENT PIPING:
    - a. CARRIER PIPE: MINIMUM 5 PSIG FOR MINIMUM 30 MINUTES.
    - b. CONTAINMENT CONDUIT: MINIMUM 5 PSIG FOR MINIMUM 60 MINUTES.
  3. SUCTION PIPING: MINIMUM 20-IN. HG FOR MINIMUM 30 MINUTES.
  4. ISOLATE STORAGE TANKS IF TEST PRESSURE IN PIPING WILL CAUSE PRESSURE IN STORAGE TANKS TO EXCEED 10 PSIG.
- C. INSPECT AND TEST FUEL-OIL PIPING ACCORDING TO NFPA 31, "TESTS OF PIPING" PARAGRAPH; AND

ACCORDING TO REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

- D. TEST LIQUID-LEVEL GAGE FOR ACCURACY BY MANUALLY MEASURING FUEL-OIL LEVELS AT NOT LESS THAN THREE DIFFERENT DEPTHS WHILE FILLING TANK AND CHECKING AGAINST GAGE INDICATION.
- E. TEST LEAK-DETECTION AND MONITORING SYSTEM FOR ACCURACY BY MANUALLY OPERATING SENSORS AND CHECKING AGAINST ALARM PANEL INDICATION.
- F. START FUEL-OIL TRANSFER PUMPS TO VERIFY FOR PROPER OPERATION OF PUMP AND CHECK FOR LEAKS.
- G. TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED AND MALFUNCTIONING CONTROLS AND EQUIPMENT.
- H. BLEED AIR FROM FUEL-OIL PIPING USING MANUAL AIR VENTS.
- I. FUEL-OIL PIPING AND EQUIPMENT WILL BE CONSIDERED DEFECTIVE IF IT DOES NOT PASS TESTS AND INSPECTIONS.
- J. PREPARE TEST AND INSPECTION REPORTS.
- 3.13 OUTDOOR PIPING SCHEDULE
  - A. UNDERGROUND FUEL-OIL PIPING: FLEXIBLE, DOUBLE-CONTAINMENT PIPING; SIZE INDICATED IS CARRIER-PIPE SIZE.
  - B. UNDERGROUND FUEL-OIL-TANK FILL AND VENT PIPING: STEEL PIPE, STEEL OR MALLEABLE-IRON THREADED FITTINGS, AND THREADED JOINTS. COAT PIPE AND FITTINGS WITH PROTECTIVE COATING FOR STEEL PIPING.
  - C. CONTAINMENT CONDUIT: STEEL PIPE WITH WROUGHT-STEEL FITTINGS AND WELDED JOINTS. COAT PIPE AND FITTINGS WITH PROTECTIVE COATING FOR STEEL PIPING.
  - D. ABOVEGROUND FUEL-OIL PIPING SHALL BE THE FOLLOWING:
    1. STEEL PIPE, STEEL OR MALLEABLE-IRON THREADED FITTINGS, AND THREADED JOINTS.

3.14 INDOOR PIPING SCHEDULE

- A. ABOVEGROUND FUEL-OIL PIPING:
  1. NPS 1/2 AND SMALLER: STEEL PIPE, STEEL OR MALLEABLE-IRON THREADED FITTINGS, AND THREADED JOINTS.
  2. NPS 5/8 TO NPS 2: STEEL PIPE, STEEL OR MALLEABLE-IRON THREADED FITTINGS, AND THREADED JOINTS.

3.15 ABOVEGROUND MANUAL FUEL-OIL SHUTOFF VALVE SCHEDULE

- A. DISTRIBUTION PIPING VALVES FOR PIPE NPS 2 AND SMALLER SHALL BE THE FOLLOWING:
  1. TWO-PIECE, FULL-PORT, BRONZE BALL VALVES WITH BRONZE TRIM.
- B. VALVES IN BRANCH PIPING FOR SINGLE APPLIANCE SHALL BE THE FOLLOWING:
  1. TWO-PIECE, FULL-PORT, BRONZE BALL VALVES WITH BRONZE TRIM.

END OF SECTION 231113

DISPENSERS

- 4.01 COMPATIBILITY
  - FOR DISPENSING LOW VISCOSITY PETROLEUM FUELS -- DIESEL BIODIESEL BLENDS UP TO 20%; GASOLINE, INCLUDING OXYGENATED BLENDS, KEROSENE, AVIATION, AND JET FUEL. FUEL MUST MEET THE APPLICABLE ASTM STANDARD.

4.01 LCD DISPLAYS

- A. BACKLIT 1" SIX-DIGIT VOLUME DISPLAY AND 1/2" FOUR-CHARACTER STATUS DISPLAY PER HOSE, DISPLAYS EACH SIDE OF CABINET, EXCEPT MODELS WITH