

**SECTION 23 13 13**  
**UNDERGROUND STORAGE TANKS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This Section includes fuel storage tanks, piping system and equipment, including:

1. Piping, fittings, and specialties.
2. Fuel storage tanks and accessories.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 31 20 00, EARTHWORK: Excavation and backfill.
- D. Section 03 30 00, CAST-IN-PLACE CONCRETE.
- E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for piping.
- G. Section 26 32 13 ENGINE GENERATORS.

**1.3 QUALITY ASSURANCE**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.
- B. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than one year old.
- C. UL Compliance: Provide fuel piping components and storage tanks which are listed and labeled by UL.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
1. Pipe and equipment supports. Submit calculations for variable spring and constant support hangers.
  2. Pipe and tubing, with specification, class or type, and schedule.
  3. Pipe fittings, including miscellaneous adapters and special fittings.
  4. Flanges, gaskets and bolting.
  5. Valves of all types.
  6. Strainers.
  7. Flexible connectors for water service.
  8. Expansion joints.
  9. Expansion compensators.
  10. All specified hydronic system components.
  11. Water flow measuring devices.



- B16.3-2006.....Malleable Iron Threaded Fittings: Class 150 and 300
- B16.4-2006.....Gray Iron Threaded Fittings: (Class 125 and 250)
- B16.5-2003.....Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard
- B16.9-07.....Factory Made Wrought Butt Welding Fittings
- B16.11-05.....Forged Fittings, Socket Welding and Threaded
- B16.18-01.....Cast Copper Alloy Solder Joint Pressure Fittings
- B16.22-01.....Wrought Copper and Bronze Solder Joint Pressure Fittings.
- B16.24-06.....Cast Copper Alloy Pipe Flanges and Flanged Fittings
- B16.39-06.....Malleable Iron Threaded Pipe Unions
- B16.42-06.....Ductile Iron Pipe Flanges and Flanged Fittings
- B31.1-08.....Power Piping
- E. American Society for Testing and Materials (ASTM):
  - A47/A47M-99 (2004).....Ferritic Malleable Iron Castings
  - A53/A53M-07.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - A106/A106M-08.....Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
  - A126-04.....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
  - A183-03 ..... Standard Specification for Carbon Steel Track Bolts and Nuts
  - A216/A216M-08 ..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
  - A234/A234M-07 ..... Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
  - A307-07 ..... Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
  - A536-84 (2004) ..... Standard Specification for Ductile Iron Castings

- A615/A615M-08 ..... Deformed and Plain Carbon Steel Bars for  
Concrete Reinforcement
- A653/A 653M-08 ..... Steel Sheet, Zinc-Coated (Galvanized) or Zinc-  
Iron Alloy Coated (Galvannealed) By the Hot-Dip  
Process
- B32-08 ..... Standard Specification for Solder Metal
- B62-02 ..... Standard Specification for Composition Bronze or  
Ounce Metal Castings
- B88-03 ..... Standard Specification for Seamless Copper Water  
Tube
- B209-07 ..... Aluminum and Aluminum Alloy Sheet and Plate
- C177-04 ..... Standard Test Method for Steady State Heat Flux  
Measurements and Thermal Transmission Properties  
by Means of the Guarded Hot Plate Apparatus
- C478-09 ..... Precast Reinforced Concrete Manhole Sections
- C533-07 ..... Calcium Silicate Block and Pipe Thermal  
Insulation
  
- F. American Water Works Association (AWWA):
  - C110-08.....Ductile Iron and Grey Iron Fittings for Water
  - C203-02.....Coal Tar Protective Coatings and Linings for  
Steel Water Pipe Lines Enamel and Tape Hot  
Applied
  
- G. American Welding Society (AWS):
  - B2.1-02.....Standard Welding Procedure Specification
  
- H. Copper Development Association, Inc. (CDA):
  - CDA A4015-06.....Copper Tube Handbook
  
- I. Expansion Joint Manufacturer's Association, Inc. (EJMA):
  - EMJA-2003.....Expansion Joint Manufacturer's Association  
Standards, Ninth Edition
  
- J. Manufacturers Standardization Society (MSS) of the Valve and Fitting  
Industry, Inc.:
  - SP-67-02a.....Butterfly Valves
  - SP-70-06.....Gray Iron Gate Valves, Flanged and Threaded  
Ends
  - SP-71-05.....Gray Iron Swing Check Valves, Flanged and  
Threaded Ends
  - SP-80-08.....Bronze Gate, Globe, Angle and Check Valves

SP-85-02.....Cast Iron Globe and Angle Valves, Flanged and  
Threaded Ends

SP-110-96.....Ball Valves Threaded, Socket-Welding, Solder  
Joint and Flared Ends

SP-125-00.....Gray Iron and Ductile Iron In-line, Spring  
Loaded, Center-Guided Check Valves

K. National Sanitation Foundation/American National Standards Institute,  
Inc. (NSF/ANSI):

61-2008.....Drinking Water System Components - Health  
Effects

L. Tubular Exchanger Manufacturers Association: TEMA 9th Edition, 2007

### 1.5 APPLICABLE PUBLICATIONS

- A. Coordinate the size and location of concrete ballast pads and fill and sounding boxes for underground storage tanks, and housekeeping equipment pads for oil transfer pumps. Cast anchor bolt inserts into pad. Concrete reinforcement and formwork requirements are specified in Division 3.

## PART 2 - PRODUCTS

### 2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

- A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

### 2.2 PIPE AND TUBING

- A. Fuel Piping:

1. Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40, seamless, black steel pipe, with beveled ends, with threaded joints and fittings for 2 inch and smaller, and with welded joints for 2-1/2 inch and larger.

- B. Pipe supports, including insulation shields, for above ground piping: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

### 2.3 FITTINGS FOR STEEL PIPE

- A. 50 mm (2 inches) and Smaller: Screwed or welded joints.

1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.
2. Forged steel, socket welding or threaded: ASME B16.11.
3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
4. Unions: ASME B16.39.

- B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.

1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
2. Welding flanges and bolting: ASME B16.5:
  - a. Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
    - 1) Contractor's option: Convuluted, cold formed 150 pound steel flanges, with teflon gaskets, may be used for water service.
  - b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.
- C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.

#### **2.4 SCREWED JOINTS**

- A. Pipe Thread: ANSI B1.20.
- B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

#### **2.5 VALVES**

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer.
- C. General duty valves (i.e., gate valves) are specified in Division 23 Section " Valves". Special duty valves are specified in this Article by their generic name. Refer to Part 3 below, Article "VALVE APPLICATION" for specific uses and applications for each valve specified.
- D. Fuel Safety Valves: 250 psig maximum working pressure, 550 deg. F. maximum operation temperature; ASTM B 61 bronze body and bronze bases and discs, and field adjustable cadmium-plated carbon steel springs factory-set at 20 percent above operating pressure. End connections shall be inside threaded with threads conforming to ANSI B1.20.1. Valve shall be UL-listed for flammable or volatile liquids.
- E. Vertical Ball Check Valves: Class 200, 400 psig maximum operating pressure, 2-piece bronze construction with threaded end connections; integral bronze seats and replaceable stainless steel ball.

#### **2.6 STRAINERS**

- A. Basket or Y Type.
  1. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 1.1

mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.

B. Suction Diffusers: Specified in Section 23 21 23, HYDRONIC PUMPS.

## 2.7 STEEL UNDERGROUND STORAGE TANKS AND ACCESSORIES

- A. General Description: Double-wall, factory-fabricated and tested, cathodically-protected, and bearing UL and sti-P3 labels. Fabricate inner and outer walls and headers using hot-rolled carbon steel sheets or plates, as specified in UL 58. Size and capacity as indicated.
- B. Fabrication: Tanks shall be fabricated for operation at atmospheric pressure; to store liquids with specific gravities up to 1.1, and with maintained temperatures of up to 150 deg. F. Fabricate shell and head joints, lifting lugs, manholes, masonry supports, and pipe connections in accordance with UL 58. Fabricate tanks for the following internal and external loads:
1. External Hydrostatic Pressure: 3'-0" depth of bury from top of tank and hole fully flooded; withstand general buckling with safety factor of 2:1.
  2. Surface Loads: H-20 axle loads when installed in accordance with manufacturer's installation instructions.
- C. Tank Fittings and Accessories: Provide storage tank with the following factory-installed fittings and accessories:
1. Tank Manhole: 24 inch diameter, bolted, flanged, and gasketed manhole, with extension collar, for access to inside of tank.
  2. Threaded pipe connection fittings on top of tanks, for fill, supply, return, vent, gages, heating coils, and hot-well in locations and of sizes as indicated. Provide cast-iron plugs for shipping.
  3. Anchor Straps: Provide manufacturer's standard anchoring system (straps, cables, turnbuckles, etc.) with the strength of at least 1-1/2 times the maximum uplift force of the empty tank without backfill in place.
  4. Lifting Lugs: Provide lifting lugs to facilitate handling and installation.
  5. Ladders: Provide carbon steel ladder inside tank, anchored to top and bottom, and located as indicated.
  6. Masonry Supports: (2) 6" x 6" x 3/8" steel angles 6' - 0" long located longitudinally on each side of the manhole and continuously welded in place.
  7. Supply Tube: Provide extension of transfer pump suction line fitting into tank, terminating 6 inch above tank bottom and cut at 45 degree angle.
  8. Vent Cap: cast iron threaded tee inlet; 40 mesh brass wire cloth screen.
  9. Fill Box: Flush heavy duty, waterproof, cast iron body and top cap, and brass inner cap with lock with key wrench.
  10. Remote Oil Gages: Balanced hydraulic type providing a true volumetric indication. Gage volume range to suit capacity storage; UL-listed and labeled.

- D. Corrosion Protection System: Tanks and their piping shall be protected by a properly engineered, installed, and maintained corrosion protection system in accordance with the Steel Tank Institute of Standard No. sti-P3 "System for External Corrosion Protection of Underground Steel Storage Tanks." Provide means monitoring cathodic protection by either "Protection Prover 1" or "Protection Prover 2" monitoring system.

## **2.8 GAGES, PRESSURE AND COMPOUND**

- A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.
- B. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.
- C. Range of Gages: Provide range equal to at least 130 percent of normal operating range.
1. For condenser water suction (compound): Minus 100 kPa (30 inches Hg) to plus 700 kPa (100 psig).

## **2.9 GRADE MANHOLE**

- A. Precast Concrete Manhole Sections: ASTM C478, base and concentric cone sections with integral ladder.
- B. Cast-Iron Ring and Cover: heavy-duty, water-resistant, cast-iron manhole frame, gasket, and bolted lid; 24 inch diameter inside opening dimension; 8 inches overall height.

## **2.10 FIRESTOPPING MATERIAL**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of Generator equipment. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- C. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- D. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves.
- E. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.
- F. Connect piping to equipment as shown on the drawings.

### **3.2 PIPE JOINTS**

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.
- C. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.

### **3.3 UNDERGROUND TANK INSTALLATION**

- A. Perform air pressure test on tanks prior to placing into excavations. Test pressure shall not exceed 5 psi. Apply a soap solution to joints.
- B. Excavate to a sufficient depth for a minimum of 3 foot earth cover from top at tank to grade; allowing for cast-in-place, reinforced concrete ballast pad, plus 6 inches of sand or pea gravel between ballast pad and tank. Excavation shall extend one foot around the perimeter of the tank.
- C. Place reinforcing and concrete as specified in Division 03. Excavation floor and walls may serve as forms. Use ASTM C150 Portland Cement concrete, Type I, with normal weight aggregate conforming with ASTM C33, and having a 28 day compressive strength at 3,000 psi.
- D. Set tiedown eyelets for hold-down straps in concrete ballast pad and tie to reinforcing steel.
- E. Place 6 inches of clean sand or pea gravel on top of ballast pad.
- F.** Set tank on fill materials.

- G. Protect anodes during tank placement and backfilling operations.
- H. Install holddown straps.
- I. Make piping connections.
  
- J. Backfill excavation with clean sand or pea gravel. Tamp backfill to consolidate.

**3.4 SEISMIC BRACING ABOVEGROUND PIPING**

Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**A.5 OPERATING AND PERFORMANCE TEST AND INSTRUCTION**

- A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- C. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance.
- D. Review data in Operating and Maintenance Manuals. Refer to Division 01 section "Project Closeout."
  - 1. Schedule training with Owner through the Architect, with at least 7 days advance notice.
- E. Before activating system perform these steps:
  - 1. Open valves to full open position. Close bypass valves.
  - 2. Remove and clean strainer screens.
  - 3. Check pump for proper direction of rotation.
  - 4. Fill oil storage tank with proper fuel type.
  - 5. Check operating controls of fuel burner units.
  - 6. Check operation at automatic bypass valves.
  - 7. Check and set operating temperature controls on oil heaters.
  - 8. Check corrosion monitoring systems for proper operation.

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