UNIVERSITY OF MICHIGAN
ARCHITECTURE, ENGINEERING AND CONSTRUCTION

ARCHITECTURE & ENGINEERING
326 East Hoover, Mail Stop B
Ann Arbor, MI 48109-1002
Phone: 734-764-3414
Fax: 734-936-3334

BuildingName
The Description of the Project
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SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 231113 - FUEL OIL SYSTEMS

END OF CONTENTS TABLE

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 231113 - FUEL OIL SYSTEMS

REVISIONS:

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

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

1. Piping, fittings, and specialties.
2. Oil transfer equipment.
3. Oil storage tanks and accessories.

SPEC EDITOR: LIST ONLY MATERIALS IN THIS PROJECT WHICH THE READER MAY EXPECT TO FIND IN THIS SECTION. VERIFY THAT LISTED SECTIONS ARE INCLUDED IN THIS PROJECT SPECIFICATION AND THAT THEIR TITLES ARE CORRECTLY INDICATED HERE.

1.3 DEFINITIONS

A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

1.4 QUALITY ASSURANCE

A. Qualify welding processes and welding operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

B. Regulatory Requirements: Comply with provisions of the following codes:

1. NFPA 31 - Standard for the Installation of Oil Burning Equipment, for oil piping materials and components, oil piping installations, and inspection, and testing of fuel oil piping systems.

SPEC EDITOR: MODIFY BELOW BY SUBSTITUTING PLUMBING CODE ENFORCED BY THE AUTHORITY HAVING JURISDICTION. INSERT THE EDITION IN FORCE.

2. BOCA Basic National Mechanical Code.

C. UL Compliance: Provide fuel oil piping components and storage tanks which are listed and labeled by UL.

1.5 SEQUENCING AND SCHEDULING

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.

1.6 WARRANTY

SPEC EDITOR: BE CAUTIOUS NOT TO REDUCE THE PROTECTION THE OWNER MIGHT OTHERWISE BE ENTITLED TO, BY INCLUDING UNINFORMED REQUIREMENTS FOR WARRANTIES. SEE EVALUATIONS AND DIVISION 1 SECTION "WARRANTIES AND BONDS."

SPEC EDITOR: RETAIN THIS ARTICLE WHEN SPECIFYING STEEL TANKS WITH STI-P3 CATHODICALLY PROTECTED TANKS.

A. Special Product Warranty: Submit a written warranty for the underground fuel oil storage tanks, executed by the manufacturer, agreeing, at the manufacturer's option, to repair the failure, replace the failed tanks limited to delivery of new tank to the site of original installation, or refund the original purchase price of the tanks, provided the tanks are installed in accordance with the manufacturer's instructions. Warranty shall protect the Owner for a period of 30 years from the date of original purchase, against structural failures of the tanks, including cracking, breakup, or collapse; and failure of the tanks due to external corrosion, and internal corrosion when the tanks are used for storage of fuel oils at temperatures not exceeding 150 deg. F. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

SPEC EDITOR: USE THE ARTICLE BELOW WHEN SPECIFYING GLASS-FIBER REINFORCED PLASTIC TANKS.

B. Special Project Warranty: Submit a written warranty for the underground fuel oil storage tanks, executed by the manufacturer, agreeing, at the manufacturer's option, to repair the failure, replace the failed tanks limited to delivery of new tank to the site of original installation, or refund the original purchase price of the tanks, provided the tanks are installed in accordance with the manufacturer's instructions. Warranty shall protect the Owner for a period of 30 years from the date of original purchase, against failure of the tanks due to external corrosion, and internal corrosion when the tanks are used for storage of fuel oils at temperatures not exceeding 150 deg. F. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vertical Ball Check Valves:

1. Keystone
2. Milwaukee
3. Grinnell
4. APCO
5. Crane
6. Stockham

B. Strainers:

1. Armstrong Machine Works.
2. Hoffman Specialty ITT; Fluid Handling Div.
3. Metraflex Co.
4. R-P&C Valve; Div. White Consolidated Industries, Inc.
5. Spirax Sarco.
6. Trane Co.
7. Victaulic Co. of America. (low pressure applications only)
8. Watts Regulator Co.

C. Oil Transfer Pumps:

1. ITT Marlow.
2. Roper Pump Co.
3. Viking Pump Div.; Houdaille Industries, Inc.
4. Webster Electric Co; Sub. of Sta-Rite Industries, Inc.

D. Oil Piping Specialties:

1. McDonald Mfg. Co., A.Y.
2. OPW Division; Dover Corp.

E. Steel Underground Oil Storage Tanks:

1. Adamson Co., Inc.
2. Buffalo Tank, Div. Bethlehem Steel Corp.
3. Highland Tank & Mfg. Co.
4. Modern Welding Co., Inc.

F. Glass Fiber Reinforced Plastic Underground Oil Storage Tanks:

1. Lifetime Fiberglass Tank Co.
2. Owens-Corning Fiberglas Corp.
3. Xerxes Fiberglass Inc.

2.2 PIPE AND TUBE MATERIALS

SPEC EDITOR: SELECT ONE – ANNEALLED COPPER IS NOT TO BE USED INDOORS.

A. Steel Pipe: ASTM A 120, 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. Copper Tubing: ASTM B 88, Type L, hard drawn copper tubing with wrought copper fittings and brazed joints for 2 inch and smaller, above ground, within building. Use Type K, annealed copper tubing for 2 inch and smaller without joints, for underground installations.

2.3 FITTINGS

SPEC EDITOR: FITTINGS BELOW ARE ALSO AVAILABLE IN CLASS 250.

A. Cast-Iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

SPEC EDITOR: FITTINGS BELOW ARE ALSO AVAILABLE IN CLASS 300.

B. Malleable Iron Threaded Fittings: ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

C. Steel Fittings: ASTM A 234, seamless or welded, for welded joints.

D. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

SPEC EDITOR: FLANGES BELOW ARE ALSO AVAILABLE IN CLASS 250.

E. Cast-Iron Threaded Flanges: ANSI B16.1, Class 125; raised ground face, bolt holes spot faced. Threads shall conform to ANSI B1.20.1.

SPEC EDITOR: BELOW FLANGES AND FITTINGS ARE AVAILABLE IN SEVERAL CLASSES, MATERIALS, FACINGS, AND END CONNECTIONS. VERIFY WITH PROJECT REQUIREMENTS.

F. Steel Flanges and Flanged Fittings: ANSI B16.5, including bolts, nuts, and gaskets of the following material group, end connection and facing:

1. Material Group: 1.1.
2. End Connections: Butt Welding.
3. Facings: Raised face.

2.4 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, Classification BAg1 (silver).

B. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.5 PIPING SPECIALTIES

A. Y-Pattern Strainers: 125 psig working pressure; cast-iron body conforming to ASTM A 126, Class B; flanged ends for 2-1/2 inch and larger, threaded connections for 2 inch and smaller, bolted cover, perforated stainless steel screen, and plugged blow-down drain.

SPEC EDITOR: THE FOLLOWING ARE FOR 1-1/2 INCH PIPE AND SMALLER.

B. Flexible Connectors: minimum 150 psig working pressure, maximum 250 deg F operating temperature; stainless steel bellows with woven flexible bronze wire reinforcing protective jacket. Connectors shall have flanged or threaded end connections to match equipment connected; and shall be capable of 3/4 inch misalignment.

2.6 GENERAL DUTY VALVES

A. General duty valves (i.e., gate, globe, ball, and butterfly valves) are specified in Division 22 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.

2.7 SPECIAL DUTY VALVES

SPEC EDITOR: INTEGRAL RELIEF VALVE ON OIL TRANSFER PUMP MAY BE SUFFICIENT TO ELIMINATE INLINE SAFETY RELIEF VALVES.

A. Oil 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.

B. 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.

2.8 FUEL OIL TRANSFER PUMPS AND ACCESSORIES

SPEC EDITOR: CAPACITY IN GPM MAY BE PRESENTED IN A SCHEDULE IF THERE ARE SEVERAL PUMPS WITH VARIOUS CAPACITIES, OR MAY BE SPECIFIED HERE. ALSO AVAILABLE WITH FLANGE MOUNTING MANY OPTIONAL FEATURES AVAILABLE TO SUIT UNIQUE PROJECT REQMTS, CONSULT MFR LITERATURE.

A. General Description: single-stage, positive displacement rotary type, with the following features and accessories; foot-mounted, cast-iron housing, steel gears, bronze bearings, steel shaft, standard mechanical seals; built-in pressure relief bypass; steel base; and drive coupling. Provide pumps with capacities and electrical characteristics as scheduled for number 2 or 3 fuel oil. Pumps shall be constructed in accordance with UL 343, and be UL-listed and bear the UL label.

SPEC EDITOR: SELECT FROM THE FOLLOWING 2 DRIVE OPTIONS.

B. Drive: V-belt drive, with belt guard.

C. Drive: direct drive, close coupled.

D. Motor: Split phase for single-phase motors; capacitor-start, induction-run, totally enclosed for 3-phase motors.

2.9 STEEL UNDERGROUND STORAGE TANKS AND ACCESSORIES

SPEC EDITOR: SELECT ONE OF 2 OPTIONS BELOW. INDICATE SIZE AND CAPACITY ON THE DRAWINGS.

A. General Description: single-wall factory-fabricated and tested, cathodically-protected, and bearing UL and sti-P3 labels. Fabricate wall and headers using hot-rolled carbon steel plates or sheets, as specified in UL 58. Size and capacity as indicated.

B. 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.

C. 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.

D. Tank Fittings and Accessories: Provide storage tank with the following factory-installed fittings and accessories:

SPEC EDITOR: INCLUDE TANK DETAILS ON DRAWINGS INDICATING LOCATION OF FITTINGS. FLANGED FITTINGS ARE ALSO AVAILABLE.

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.

SPEC EDITOR: IF PARAGRAPH BELOW IS RETAINED, INDICATE LADDER LOCATION ON TANK DETAIL ON DRAWINGS.

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.

SPEC EDITOR: SELECT FROM 2 OPTIONS BELOW, BUT ONLY FOR HEAVY OIL STORAGE TANKS. HOT-WELLS ARE USED IN SOME AREAS IN LIEU OF HEATING COILS FOR HEAVY OIL. EDIT AS DESIRED. SCHEDULE HEATING CAPACITY OR INDICATE ON DRAWINGS.

7. Heating Coils: Provide heating capacity as scheduled. Coils shall be continuous spiral having a 3 inch slope, made of Type K soft annealed copper with no joints within the tank.
8. Hot-Wells: Provide 8 inch diameter hot-well extending from 4 inch above tank top to 4 inch above tank bottom. Provide tappings above tank for connection of oil suction and return piping. Provide 2 inch hole in well, just below top of tank, for venting.
9. Supply Tube: Provide extension of transfer pump suction line fitting into tank, terminating 6 inch above tank bottom and cut at 45 degree angle.
10. Vent Cap: cast iron threaded tee inlet; 40 mesh brass wire cloth screen.
11. Fill Box: Flush heavy duty, waterproof, cast iron body and top cap, and brass inner cap with lock with key wrench.
12. Remote Oil Gages: Balanced hydraulic type providing a true volumetric indication. Gage volume range to suit capacity storage; UL-listed and labeled.

SPEC EDITOR: RETAIN ONLY ONE OF THE 3 PARAGRAPHS BELOW, DEPENDING UPON REQUIREMENTS WITHIN YOUR LOCAL AREA. AUTHORITY HAVING JURISDICTION MAY WAIVE THE REQUIREMENTS FOR CORROSION PROTECTION WHERE EVIDENCE IS PROVIDED THAT SUCH PROTECTION IS NOT NECESSARY.

E. 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.

2.10 SOURCE QUALITY CONTROL

A. Perform tests at the factory after fabricating and prior to shipment in accordance with sti-P3.

2.11 GLASS-FIBER-REINFORCED POLYESTER UNDERGROUND STORAGE TANKS

A. General Description: double-wall factory-fabricated and tested, in conformance with ASTM D 4021; bearing UL label. Tanks shall be designed to be vented and operated at atmospheric pressure; designed to store liquids with specific gravities up to 1.1, and with maintained temperatures of up to 150 deg F; and shall be chemically inert to petroleum being stored, plus their additives.

SPEC EDITOR: COORDINATE ELECTRICAL CONNECTIONS.

B. Hydrostatic Monitoring System: Include a brine antifreeze solution, UL listed reservoir sensor, and UL listed electronic control panel to monitor leaks in inner and outer tank walls. Controls shall operate with 120 volts A.C.

C. Tank Fittings and Accessories: Provide storage tank with the following factory-installed fittings and accessories:

SPEC EDITOR: INCLUDE TANK DETAILS ON DRAWINGS INDICATING LOCATION OF FITTINGS. FLANGED FITTINGS ARE ALSO AVAILABLE.

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.

SPEC EDITOR: IF BELOW IS RETAINED, INDICATE LADDER LOCATION ON TANK DETAIL ON DRAWINGS.

5. Ladders: Provide carbon steel ladder inside tank, anchored to top and bottom, and located as indicated.

SSPEC EDITOR: ELECT FROM 2 OPTIONS BELOW, BUT ONLY FOR HEAVY OIL STORAGE TANKS. HOT-WELLS ARE USED IN SOME AREAS IN LIEU OF HEATING COILS FOR HEAVY OIL. EDIT AS DESIRED.

6. Heating Coils: Provide spiral type heating coil of capacity as scheduled, installed in tank manhole.
7. Hot-Wells: Provide 8 inch hot-well extending from 4 inch above tank top to 4 inch above tank bottom. Provide tappings above tank for connection of oil suction and return piping. Provide 2 inch hole in well, just below top of tank, for venting.
8. Supply Tube: Provide extension of transfer pump suction line fitting into tank, terminating 6 inch above tank bottom and cut at 45 degree angle.
9. Vent Cap: cast iron threaded tee inlet; 40 mesh brass wire cloth screen.
10. Fill Box: Flush heavy duty, waterproof, cast iron body and top cap, and brass inner cap with lock with key wrench.

11. Remote Oil Gages: Balanced hydraulic type providing a true volumetric indication. Gage volume range to suit capacity storage; UL-listed and labeled.

2.12 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.

PART 3 - EXECUTION

3.1 PIPE INSTALLATIONS

A. General: Refer to Section 221113 - Piping Materials and Methods" for basic piping installation instructions.

B. Install supply, return, fill, and vent piping at a uniform grade of 1/4 inch in ten feet downward in the direction of the storage tank.

3.2 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.

SPEC EDITOR: BALLAST PAD SIZE AND REINFORCING SHOULD BE SUFFICIENT TO HOLD DOWN EMPTY TANK COMPLETELY SUBMERGED IN WATER.

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.

SPEC EDITOR: RETAIN BELOW FOR STEEL TANKS.

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.

3.3 FIELD QUALITY CONTROL

A. Test oil piping in accordance with NFPA 31.

B. Remake leaking joints and connections using new materials.

3.4 COMMISSIONING

A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance.

C. 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.

D. 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.

END OF SECTION 231113