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USACE / NAVFAC / AFCESA **IGS-15192 (MAY 2002)**

Preparing Activity: LANTNAVFACENGCOM **Based on UFGS-15192N**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

Use for ITALIAN projects only

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SECTION 15192

FUEL OIL PIPING
05/02

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NOTE: This guide specification is issued by the Atlantic Division, Naval Facilities Engineering Command for regional use in Italy.

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NOTE: This guide specification covers new systems for diesel fuel and for No. 2, 4, 5, and 6 heating fuel systems for buildings and central heating systems . It shall not be used for AVGAS, jet fuel, and other volatile fuel systems. Use Section 13210, "Aboveground Vault Type Tanks" for aboveground fuel oil storage tanks.Use Section 13216, "Underground Petroleum Tanks" for underground fuel oil storage tanks.

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

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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NOTE: The following information shall be shown on the project drawings:

1. Fuel oil heating and pumping equipment design and details

2. Associated piping and accessory equipment layout and details.

3. Locate piping leak detection control panel on drawings.

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PART 1 GENERAL

1.1 REFERENCES

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

ITALIAN LAWS AND NORMS (D.M.)(LAW)(CIRC.)

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NOTE: Italian laws and normatives are the legislative regulations and decrees issued by the Italian government in the form of laws, norms, decrees, circulars, and letters. These Laws and Decrees concur together with Norms and Standards in forming the governing directives for construction.

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Circ. Min. n. 40	(1968) Safety Norms to Apply in the Design, the Installation and Function of Thermal Systems with Fuel Oil or Gasoil.
Circ. 25069/4134	(8 October 1982) Safety Devices and Equipment for Technical Systems Tests Specification for Oil Intercepted Mechanical Valves
DPR n. 1288	(1967) Regulation for the Implementation of the Law 13/07/1966, Regarding Provision for Pollution of the Environment Limited to Thermal Plant Installation.

ITALIAN NATIONAL ASSOCIATION FOR UNIFICATION OF STANDARDS (UNI)

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NOTE: A UNI Norm is a technical normative recognized as Italian Law, submitted by a private organization "Ente Nazionale Italiano di Unificazione" for Italy and is available only in the Italian language. It is the National Standard.

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UNI 663	(1968) Unalloyed steel seamless tubes - Plain and tubes for general purposes - Qualities, requirements and tests
UNI 2227	(1967) Metallic pipe flanges - Dimensions of tongued and groove facings for round section gaskets - Nominal pressures 10 to 40
UNI 5634	(1997) Identification systems for pipelines and canalizations conveying fluids
UNI 5742	(1966) Metallic protective coatings of ferrous materials - Test for the zinc layer weight determination on hot galvanized materials - Double weighting test
UNI 6884	(1987) Shutting and regolation valves for fluids - Supply and test conditions
UNI 7125	(1972) Flanged gate valves for water pipelines - Technical conditions of delivery
UNI 8858	(1985) Copper alloy ball valves for heating plants - Requirements and tests

ITALIAN/EUROPEAN HARMONIZATION STANDARDS (UNI EN)(UNI ENV)(CEI EN) (UNI EN ISO)(UNI ISO)

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NOTE: A UNI EN, UNI ENV, CEI EN, UNI EN ISO or UNI ISO is a European Standard with a coincident Italian National Standard or International Standard. The two standards are identical, with most (but not all) EN's available in the English language and the UNI available only in the Italian language.

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UNI EN 226	(1987;AC1) Atomizing oil burners; Connecting dimensions between burners and heat generators
UNI EN 288-1	(1992) Specification and qualification of welding procedures for metallic materials - Part 1: General rules for fusion welding
UNI EN 733	(1997) End-suction centrifugal pumps, rating with 10 bar with bearing bracket - Nominal duty point, main dimensions,

	designation system
UNI ISO 888	(1976) Bolts, screws and studs - Nominal lengths and thread lengths for general purpose bolts
UNI EN 1057	(1996) Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications
UNI EN 1092-2	(1997) Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 2: Cast iron flanges
UNI EN 1254-1	(1998) Copper and copper alloys - Plumbing fittings - Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes
UNI EN 1254-2	(1998) Copper and copper alloys - Plumbing fittings - Part 2: Fittings with compression ends for use with copper tubes
UNI EN 1254-3	(1998) Copper and copper alloys - Plumbing fittings - Part 3: Fittings with compression ends for use with plastic pipes
UNI EN 1254-4	(1998/AC) Copper and copper alloys - Plumbing fittings - Part 4: Fittings combining other end connections with capillary or compression ends
UNI EN 1254-5	(1998) Copper and copper alloys - Plumbing fittings - Part 5: Fittings with short ends for capillary brazing to copper tubes
UNI EN 10016-3	(1994) Non-alloy steel rod for drawing and/or cold rolling - Part 3: Specific requirements for rimmed and rimmed substitute low carbon steel rod
UNI EN 10208-1	(1997) Steel pipes for piprlines for combustible fluids - Technical delivery conditions - Part 1: Pipes of requirement class A
UNI EN 10242	(1994) Threaded Pipe Fitting in malleable cast iron
UNI EN 28839	(1991) Mechanical properties of fasteners - Bolts, screws, studs and nuts made of non-ferrous metals

1.2 RELATED REQUIREMENTS

Section 15050, "Basic Mechanical Material and Methods" applies to this section with additions and modifications specified herein.

1.3 DEFINITIONS

1.3.1 Carrier Piping

Piping which contains fuel oil, exclusively.

1.3.2 Secondary Containment System

System which contains carrier piping and prevents fuel leakage from carrier piping into surrounding soil and/or water. System may be either boxed-in trench or double-walled piping.

1.4 SUBMITTALS

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NOTE:

Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item is required.

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. Recommended codes for Army projects are "RE" for Resident Engineer approval, "ED" for Engineering approval, and "AE" for Architect-Engineer approval. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-03 Product Data

Pipe and fittings

Valves

Flexible hose

Dielectric unions

Strainers

Meters

Instruments

Gages

Heaters

Oil Pumps

Secondary containment system for piping

Buried piping leak detection system

Coating materials

[SD-06 Test Reports]

[Prefabricated joints for double-walled piping secondary containment.]

SD-07 Certificates

Employer's Record Documents

Welding Procedures and Qualifications

Piping welds NDE report

Qualification of Solderers

SD-08 Manufacturer's Instructions

Secondary containment system for piping

Buried piping leak detection system

Coating application procedure

SD-10 Operation and Maintenance Data

Heaters, Data Package 3

Oil Pumps, Data Package 3

Buried piping leak detection system, Data Package 5

Valves, Data Package 2

Strainers, Data Package 3

Meters, Data Package 5

Instruments, Data Package 5

Gages, Data Package 3

Oil Pumps, Data Package 3

Secondary containment system for piping, Data Package 2

Submit operation and maintenance data in accordance with Section 01781, "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

1.5.1 Welding Requirements

Provide all welding work specified this section for piping systems shall be in conformance with UNI EN 288-1, as modified and supplemented by this specification section and the accompanying drawings. The welding work includes: qualification of welding procedures, brazing procedures, welders, brazers, welding operators, brazing operators, inspection personnel, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

1.5.1.1 Employer's Record Documents

Submit to the ROICC for his review and approval the following documentation. The ROICC will review and approve for the Contracting Officer this documentation and the subject qualifications for compliance with UNI EN 288-1

a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.

b. List of qualified welders, brazers, welding operators, and brazing operators that are proposed to be used to provide the work specified in this specification section.

c. List of qualified weld inspection personnel that are proposed to be used to provide the work specified in this specification section.

1.5.1.2 Welding Procedures and Qualifications

a. Specifications and Test Results: Submit copies of the welding

procedures specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in UNI EN 288-1 or their equivalent.

b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder, and welding operator qualifications. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

1.5.1.3 Welding Examinations

Conduct non-destructive examinations (NDE) on piping welds and submit a piping welds NDE report meeting the requirements specified in UNI EN 288-1.

1.5.1.4 Welding Safety

UNI EN 288-1.

1.5.2 Soldering

1.5.2.1 Soldering Procedures

Before performing soldering, submit three copies of soldering procedure specification for copper piping included in the work, together with proof of its qualifications.

1.5.2.2 Qualification of Solderers

Before solderer performs soldering, submit to the Contracting Officer for review and approval, copies of the Performance Qualification Record showing that the solderer was tested under the approved procedure specification submitted by the Contractor.

1.5.2.3 Defective Soldering

Solderers making defective soldering after passing a qualification test shall be required to take a re-qualification test. Solderers failing the re-qualification tests will not be permitted to work under this contract.

PART 2 PRODUCTS

2.1 SOURCE MANUFACTURERS

2.1.1 Fuel Oil Piping Systems

The following manufacturers provide materials and components for fuel oil

piping systems that generally comply with these specifications:

DALMINE S.p.A
Piazza Caduti 6 Luglio '44, 1
24022 Dalmine (BG)
Tel: 035/560111
Fax: 035/563381

SICAM S.p.A
Via Settembrini, 26
20124 Milano
Tel: 02/2940103
Fax: 02/29404356

2.2 SYSTEM PRESSURE/TEMPERATURE RATING

System components, including piping, equipment, valves, and accessories shall be suitable for working pressure of 1896 kPa (gage) at 38 degrees C 275 psig at 100 degrees F.

2.3 MATERIALS AND EQUIPMENT

2.3.1 Steel Pipe and Fittings

Provide the following pipe and fittings in fuel oil supply, return, vent, and fill piping. Provide dielectric fittings, unions or flanges between steel piping and copper tubing for all piping sizes; except that copper alloy valves and strainers may be used without dielectric fittings, unions or flanges.

2.3.1.1 Pipe

Provide UNI 663 electric-resistance welded or seamless 4 inches 100 psig. Provide Weight Class STD or Schedule No. 40 black steel pipe for welding end connections. Provide Weight Class XS or Schedule No. 80 black steel pipe for all piping with threaded end connections.

2.3.1.2 Threaded and Socket-Welding Fittings

UNI EN 1254-1, UNI EN 1254-2, UNI EN 1254-3, UNI EN 1254-4, UNI EN 1254-5, and UNI EN 10242, forged steel.

2.3.1.3 Threaded Fittings

UNI EN 10242, black malleable iron.

2.3.1.4 Butt-Welding Fittings

UNI EN 288-1. Provide butt-welding fittings of the same material and weight as the piping on which fittings are installed; provide backing rings compatible with piping materials being butt welded.

2.3.1.5 Flanges and Flange Fittings

UNI EN 1092-2, steel welding neck flanges. Flange faces shall have integral grooves of rectangular cross section which afford containment for self-energizing gasket material. Extend bolts no less than two full threads beyond the nut with the bolts tightened to the required torque.

2.3.2 Copper Piping

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NOTE: Copper alloy piping materials shall not be used where subject to physical damage, such as within a boiler plant.

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2.3.2.1 Pipe and Tubing

UNI EN 1057, [hard-drawn for underground] [hard-drawn or annealed for aboveground].

2.3.2.2 Flanges and Flanged Fittings

UNI EN 1092-2.

2.3.2.3 Solder Joint Fittings

UNI EN 1254-1, UNI EN 1254-2, UNI EN 1254-3, UNI EN 1254-4, and UNI EN 1254-5 wrought copper. Provide 95-5 tin-antimony solder, or provide a lead-free solder.

2.3.3 Valves

Provide unions with threaded end connections on one side of threaded valves in steel piping systems.

2.3.3.1 Bronze Gate Valves

UNI 7125, 50 mm and smaller, wedge disk, nonrising stem.

2.3.3.2 Steel Gate Valves

UNI 7125, oil service.

2.3.3.3 Ball Valves

Full port design. Copper alloy body UNI 8858 for flanged or butt-welding ends and for threaded, socket-welding, solder joint, grooved and flared ends. Full port design, copper alloy body, except sizes 65 mm 2.5 inches and larger shall be cast-iron body. Valves shall have two-position lever handles. Ball valves may be provided in lieu of gate valves.

2.3.3.4 Relief Valves

Circ. 25069/4134, steel or bronze bodies, corrosion-resistant valve seats, and positive closing to prevent leakage.

2.3.3.5 Check Valves

UNI 7125.

2.3.3.6 Plug Valves

[Bronze] [Cast-Steel] [UNI 6884], PTFE seat, non-lubricated full port, [taper plug] [square head].

2.3.4 Secondary Containment System for Piping

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NOTE: Specify secondary containment for piping when required by provincial, regional, or local laws, regulations, statutes, etc.

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Provide double-walled piping secondary containment system for underground piping to completely contain the carrier piping including swing joints. Secondary containment shall allow for complete inspection of carrier pipe connections, during carrier pipe hydrostatic testing, before the secondary containment system is sealed. When steel pipe is provided as the secondary containment, provide protection as specified in paragraph entitled "Protective Coating Systems for Underground Steel Piping." The secondary containment system for underground piping shall be:

a. Compatible with No. [_____] fuel oil.

b. Non-corrosive, di-electric, non-degradable and resistant to attack from microbial growth.

c. Designed and made of materials which have sufficient strength to withstand the maximum underground burial loads. [Double-walled outer piping shall be able to withstand H2O loading and a minimum 105.4 kPa air pressure test. Prefabricated joints shall be 100 percent air tested at factory.] All piping sections and joints shall be factory prefabricated and tested.

d. The carrier pipe shall be welded and tested in accordance with UNI EN 10208-1 Code for Pressure Pipe.

e. All carrier piping shall be spaced, guided, and supported within the secondary containment piping. Pipe supports shall maintain the orientation of the carrier pipes throughout the system and shall permit axial movement or lateral movement due to expansion. The supports shall be designed to permit spilled fluid to drain through the containment piping towards the low points. Supports shall be made of materials compatible with all piping.

f. Any expansion of the carrier pipes shall be accommodated by the natural flexibility of the pipe utilizing elbows or expansion loops within the containment system.

2.3.5 Piping Accessories

2.3.5.1 Flexible Hose

Flexible metal hose, corrugated type with braided wire sheath covering, close-pitch annular corrugations, rated for a working pressure of at least 862 kPa (gage), 200 mm minimum live length, [flanged] [screwed] end connections, UL listed for flammable liquid service. Metal for hose and braided wire sheath shall be stainless steel.

2.3.5.2 Dielectric Unions

UNI EN 10242. Union comprised of steel female pipe thread end and copper solder-joint end conforming to dimensional, strength, and pressure requirements of UNI EN 10242. Steel parts shall be galvanized or plated. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, it shall be able to withstand a 600-volt breakdown test.

2.3.5.3 Welding Filler Metal

DPR n. 1288, Circ. Min. n. 40, and compatible with the materials to be welded.

2.3.5.4 Brazing Filler Metal

UNI EN 1254-1, UNI EN 1254-2, UNI EN 1254-3, UNI EN 1254-4, and UNI EN 1254-5, silver base alloy, with melting point not less than 593 degrees C.

2.3.5.5 Hangers, Supports, and Shields

Hangers, supports, rods, anchors, and washers shall be hot-dip galvanized after final fabrication. Hangers and supports shall be of the adjustable type.

2.3.5.6 Strainers

[Screwed] [Flanged] connections, gage pressure rating, [single] [duplex] basket type, with inlet and outlet on the same center line. Cast steel or fabricated steel body, [1000 by 1000] [[_____] by [_____]] mesh stainless steel baskets. Open area of one basket shall be 2.5 times inlet or outlet piping area. Furnish one spare basket for each location.

2.3.5.7 Gaskets

Provide one piece, factory cut, 1.60 mm thick, gaskets intended for fuel oil ervice and manufactured of fire-resistant materials. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints. Dimensions for gaskets shall be in accordance with UNI 2227.

2.3.5.8 Bolting

Material and dimensions for bolts, studs, and nuts shall conform to UNI ISO

888. Threads for bolts, studs, and nuts shall conform to UNI EN 28839. Provide steel flat circular washers under bolt heads and nuts..

2.3.5.9 Identification for Piping Aboveground

Labels for pipes 20 mm diameter and larger shall bear printed legends to identify contents of pipes and arrows to show direction of flow. Labels shall have color coded background to signify levels of hazard in accordance with UNI 5634. Legends and type and size of characters shall also conform to UNI 5634. Make labels of plastic sheet with pressure sensitivity suitable for intended applications, or they may be premolded of plastic to fit over pipe. For pipes smaller than 20 mm diameter, provide brass identification tags 40 mm in diameter with legends in depressed black filled characters.

2.3.5.10 Buried Utility Warning and Identification Tape

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 an electronic detection instrument. Provide tape in rolls, 80 mm minimum width, yellow in color with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall read "CAUTION BURIED FUEL OIL 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 of 300 mm below top surface of earth or top surface of subgrade under pavements.

2.3.5.11 Miscellaneous Metal

UNI EN 10016-3, standard mill finished structural shapes, hot-dip galvanized after final fabrication.

2.3.6 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Except as indicated otherwise, provide pipe sleeves as specified in this section. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide 25 mm one inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.3.6.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or Schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry

and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.3.6.2 Sleeves not in Masonry and Concrete

Provide 0.55 mm 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.3.7 Meters

Piston [or] [disk], size as indicated, for [_____] liter per second maximum flow of Grade No. [_____] fuel oil at [_____] to [_____] degrees C and [_____] kPa (gage) maximum pressure. Meter shall be arranged for mounting [in pipe line] [on pedestal] [and shall have overrange protection]. Casing shall be [aluminum] [bronze] [cast-iron]. Pressure drop through meter shall not exceed [_____] kPa. Provide [combination register-totalizer] [and] [water escape hole].

2.3.8 Instruments

2.3.8.1 Thermometers

Thermometers shall be bi-metal dial type with stainless steel case, stem, and fixed thread connection; 125 mm diameter dial with glass face gasketed within the case; accuracy within one percent of scale range. Provide scale range suitable for the intended service.

2.3.8.2 Pressure Gages

Single style with 115 mm diameter dial for fuel, brass or aluminum case, bronze tube; accuracy within [2] [_____] percent of scale range. Provide scale range suitable for the intended service.

2.3.9 Protective Coating Systems for Underground Steel Piping

2.3.9.1 Underground Piping and Fittings

Provide protective coating system on both steel carrier piping when direct buried, in secondary containment or in a trench and on steel secondary containment piping.

a. Piping: New steel pipe shall receive protective coating system of factory-applied adhesive undercoat and continuously extruded polyethylene coating with minimum thickness of plastic resin 0.91 mm for pipe sizes 150 mm and larger, and 0.58 mm for pipe sizes under 150 mm.

b. Fittings and Other Surfaces: Fittings, couplings, regular surfaces, damaged areas of extruded polyethylene coating and existing piping affected by the Contractor's operations shall be protected by the application of tape. Surfaces to be tape wrapped shall be clean, dry and grease free. Tape type specified below shall be applied over a primer compatible with the tape and the extruded polyethylene coating.

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NOTE: Polyethylene heat shrink sleeves can be used for welded joints and pipe with factory applied polyethylene coating in lieu of protective tape; however not recommended for systems with numerous bends.

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(1) Fittings, Couplings, and Regular Surfaces: Tape shall be initially stretched sufficiently to conform to the surface to which it is applied, using one layer lapped at least 25 mm. Tape shall overlap the extruded polyethylene coated piping 80 mm at all joints. A second layer, lapped at least 25 mm, with a tension as it comes off the roll shall be applied and pressed to conform to the shape of the component. Tape shall be 0.51 mm nominal thickness. Do not wrap joints until completion of pressure testing.

(2) Damaged Areas of Extruded Polyethylene Coating: Residual material from coating shall be pressed into the break or trimmed off. Tape shall be applied spirally and one-half lapped as it is applied. Tape shall extend 80 mm beyond the damaged area. A double wrap of one full width of tape shall be applied at right angles to the pipe axis in a manner to seal each end of the spiral wrapping. Tape shall be 0.51 mm nominal thickness.

(3) Existing Piping Affected by the Contractor's Operation: Wrap to 80 mm beyond the point of connection.

c. Flanges, Valves, and Irregular Surfaces: These items shall receive coal tar base coating applied to a minimum dry film thickness of 0.76 mm.

2.3.9.2 Cathodic Protection

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NOTE: Cathodic protection is required for all parts of an underground piping system that are made of steel and are in contact with the ground.

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Underground coated steel piping shall have cathodic protection with test stations as specified in Section [13110 "Cathodic Protection by Galvanic Anodes"] [13111 "Cathodic Protection by Impressed Current"].

2.3.10 Protective Coating Materials for Aboveground Pipe

Coatings shall be the products of one manufacturer and coating application procedure shall be in accordance with manufacturer's instruction. Piping surface preparation shall be abrasive blast clean steel surfaces in accordance with UNI 5742 to a surface profile of 0.013 to 0.051 mm.

2.3.10.1 External Coatings

Protect aboveground piping against atmospheric corrosion with a coat of organic, lead and chromate free, zinc-rich primer conforming to UNI 5742 applied to a minimum dry film thickness of 0.102 mm and finished with two coats of epoxy polyamide topcoat. Apply a gray first topcoat applied to a minimum dry film thickness of 0.076 mm and finish with a white second topcoat applied to a minimum dry film thickness of 0.076 mm resulting in a total system minimum dry film thickness of 0.28 mm.

2.4 FUEL OIL HEATERS AND PUMPING EQUIPMENT

2.4.1 Shell and Tube Heater

The shell, containing oil, shall be steel with steel or cast iron heads and 20 mm o.d. by 1.519 thick steel tubes with removable bundles rated for 1034 kPa (gage) working pressure. Design unit for [_____] kPa (gage). Heater shall have necessary heating medium connections such as inlet and outlet, drain, vent, thermometer, and pressure gage. Heater shall have the capacity to heat [_____] liter per second of No. [_____] fuel oil from [_____] degrees C to [_____] degrees C when supplied with [[_____] kPa (gage) steam] [[_____] liter per second of [_____] degrees C hot water].

2.4.2 Oil Pumps

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NOTE: Maximum suction lift for internal gear pumps shall not exceed 34 kPa.

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UNI EN 733, suitable for No. [_____] oil at a viscosity of [_____] Pa.S. Pumps shall deliver [_____] liter per secondat a developed head of [_____] kPa and a suction lift not less than [_____] kPa. Mount pump and direct connected electric motor or steam turbine on extended base plate. Provide a drip pan with each pump. Provide all metal flexible coupling between pump and drive. Provide pressure relief valve on discharge lines, piped to return line. Provide duplex strainer on suction side. Motor starters on oil pumps shall be lockable.

2.5 BURIED PIPING LEAK DETECTION SYSTEM

[Automatic leak detection system for pressurized piping shall detect leaks of 3.20 millimeter per second at 69 kPa line pressure within one hour.]

[Interstitial monitoring system in secondary containment shall include sensor probes located in the low point sump of the secondary containment system. The collection sumps shall include the following:

a. A lid designed to prevent surface water from draining down into the sump.

b. A vent which will allow any collection of vapors to escape.

c. Sufficient strength to keep out the surrounding backfill material.

Probes shall measure at least 3 mm of oil on water.]

[Interstitial monitoring system for the secondary containment shall include sensing cables located in the annulus of double-wall pipes [or floor of trench]. Sensing cable shall detect the presence of fuel at any point along its length.]

[Panel shall be in a NEMA enclosure suitable for the environment and an audible and visual alarm for each zone and battery backup capable of operating the system continuously for a minimum of 48 hours. Panel shall incorporate a self-test system which permits operator verification of proper operation of leak detection equipment. Mount panel where shown on the drawings. Provide instructions and equipment required for calibration of the leak detection system and manufacturer's recommended calibration maintenance schedule.]

[Leak detection system shall be capable of monitoring [_____] zones through use of one central remote panel.]

2.6 ELECTRICAL

2.6.1 Electrical Motors, Controllers, Contactors, and Disconnects

Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to Section 16402N, "Interior Distribution System." Provide electrical connections under Section 16402N, "Interior Distribution System." Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

PART 3 EXECUTION

3.1 INSTALLATION

Contractor shall provide installation of fuel oil piping system in accordance with applicable provincial, regional or local regulations.

3.1.1 Fuel Oil Piping System

Install piping in out-of-the-way locations, in a manner that will minimize cutting of beams, girders, columns, or load-bearing members. Installation of oil piping and equipment in buildings shall conform to UNI EN 226, except as indicated or specified herein.

3.1.2 Underground Piping

a. Piping shall be free from traps and shall drain toward low points.

[b. Install underground fuel lines in a single trench with a bed of well-compacted non-corrosive material such as cleaned, washed sand at least 150 mm deep.]

[c. Trenches shall be wide enough to permit at least 150 mm of backfill between underground fuel lines and the sides and floor of the trench. Provide cover of at least 150 mm.]

3.1.3 Pipe Sleeves and Plates

Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Extend sleeves in floor slabs 80 mm above the finished floor. Provide not less than 6 mm space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and calk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal. Secure plates to pipes at sleeves.

3.1.4 Steel Piping

Steel piping 50 mm and smaller shall be threaded or socket-welded. Steel piping 65 mm and larger shall be butt welded. Flanges may be used for valves and equipment installation. Piping joints shall conform to UNI 663. Direct buried piping connections shall be welded.

3.1.5 Threaded Joints in Piping

Provide lubricant or polytetrafluoroethylene tape on male threads of screwed joints. Red or white lead and zinc compound conforming to UNI EN 10242 may be used. Lubricate threaded pipe joints, as well as bolts and studs used on high temperature pipe joints up to 566 degrees C, with anti-seize compound. Piping shall be free from fins and burrs. Ream or file out pipe ends to size of bore and remove chips. Attach screwed flanges by screwing the pipe through the flange, and reface pipe and flange accurately.

3.1.6 Copper Tubing

Cut with square ends and remove burrs and fins. Replace tubing cut, dented, or otherwise damaged with new tubing. Clean outside surface of tubing ends and inside recess of fittings to bright metal with wire brush or abrasive, then apply flux to outside surface of tubing ends and on the recess inside of fittings. Insert tubing to the full depth of fitting, then braze. Remove stems and washers of solder-joint type valves before brazing. Brazing procedure qualification and preparation and procedures for joints shall be in accordance with UNI EN 1254-1, UNI EN 1254-2, UNI EN 1254-3, UNI EN 1254-4, and UNI EN 1254-5.

3.1.7 Welding

3.1.7.1 Welding of Piping

Welding of joints in piping, butt welds, fillet welds, bends, loops, offsets, and cleaning of pipe shall be in accordance with UNI EN 288-1. Welds shall be visually examined and meet acceptance standards.

3.1.7.2 Quality of Welds

Quality of welds, correction of defects, stress relieving, and preheating shall be in accordance with UNI EN 288-1.

3.1.7.3 Arc Welding and Gas Welding

In accordance with UNI EN 288-1.

3.1.8 Unions and Flanges

Place unions and flanges where necessary to permit easy disconnection of piping and apparatus.

3.1.9 Valves

Install valves in positions accessible for operation and repair.

3.1.10 Thermometers

Provide thermometers and thermal sensing elements of control valves with separable sockets. Install separable sockets in pipe lines in such a manner to sense the temperature of flowing fluid and minimize obstruction to flow.

3.2 FIELD QUALITY CONTROL

Prior to application of test pressure, remove or valve off piping components which may be damaged by test and install a calibrated test gage in the system. Maintain test pressure for at least one hour. In the event of leakage, locate and repair leak by rewelding and repeat test. Materials and equipment shall be subject to inspection at the installation site by the Contracting Officer.

3.2.1 Piping Test

Before backfilling of pipe trenches, perform hydrostatic test of fuel oil piping at 1.5 times system pressure or 689 kPa (gage) whichever is greater.

3.2.2 Secondary Containment Piping Test

The secondary containment piping system shall undergo a 34 kPa minimum air-pressure/soap test upon completion of installation to confirm the secondary containment integrity. This testing shall be in compliance with the manufacturer's published installation instructions.

3.2.3 Protective Coating Systems

Inspect protective coating systems, with a holiday tester just prior to placement in ground. Holidays revealed shall be promptly repaired. Steel piping coating system shall be given a holiday test with a voltage of 100 to 200 times the thickness of the coating.

3.2.4 Leak Detection

Test the buried piping leak detection monitoring system in accordance with the manufacturer's testing procedure.

-- End of Section --