SECTION 33 52 43.13 – AVIATION FUEL PIPE, FITTINGS, AND INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section of the specifications describes and provides for the furnishing, installing and testing of pipe and piping components for the aviation fueling system.

1.2 RELATED SECTIONS:

A. Section 09 97 13.00 - Fuel System Coatings

B. Section 33 52 43.00 - Fuel System General Provisions

C. Section 33 52 43.11 - Fuel System Piping Specialties

D. Section 33 52 43.15 - Fuel System General Valves

E. Section 33 52 43.24 - Fuel System Inspection, Testing, and Flushing

F. Section 33 52 43.25 - Fuel System Service Pits and Access Covers

1.3 REFERENCES:

A. American Society for Testing and Materials (ASTM):

1. A53 - Pipe, Steel, Black, and Hot Dipped, Zinc Coated Welded and Seamless.
2. A105 - Forging, Carbon Steel, for Piping Components.
3. A193 – Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
4. A194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.
5. A234 - Piping Fitting of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
6. A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
7. D1655 - Standard Specification for Aviation Turbine Fuels

B. American Society of Mechanical Engineers (ASME)

1. B1.20.1 – Pipe Threads, General Purpose (inch)
2. B16.5 - Pipe Flanges and Flanged Fittings.
3. B16.9 – Factory Made Wrought Steel Butt Welding Fittings.
4. B16.11 - Forged Steel Fittings, Socket Welding and Threaded.
5. B16.20 – Metallic Gaskets for Pipe Flanges – Ring – Joint, Spiral Wound, and Jacketed.
6. B16.25 - Buttwelding Ends.
7. B31.3 - Process Piping.
8. BPVC Section IX - Welding, Brazing, and Fusing Qualifications

C. American Petroleum Institute (API):

1. Spec 5L - Line Pipe.
2. API RP 1110 – Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide.
3. Std. 601.21 - Metallic Gaskets for Piping, Double-Jacketed Corrugated and Spiral Wound.
4. Std. 2015, Safe Entry and Cleaning of Petroleum Storage Tanks.

D. American Welding Society

E. Federal Specifications (FS) QQ-P-416 - Plating, Cadmium.

F. National Electrical Manufacturer's Association (NEMA)

G. ASTM D 3359-95 - Standard Test Methods for Measuring Adhesion by Tape

1.4 DEFINITIONS:

A. Unless otherwise specified, the working pressure ratings as used in these specifications for valves, fittings, unions, and other piping specialties refer to pressure ratings in pounds per square inch above atmosphere (PSIG) in accordance with applicable ASME Standards.

B. The use of the word "piping" shall be interpreted to include all pipe, valves, fittings, flanges, supports, or accessories for any particular portion of the work, or system to which the word "piping" is applied.

1.5 SUBMITTALS:

A. Product Data: Submit manufacturer’s data sheets identifying equipment size, materials, pressure ratings, etc.

1. Carrier Pipe
2. Flanges
3. Fittings
4. Bolts
5. Nuts
6. Gaskets
7. Branch Connections
8. Anchor Bolts
9. Pipe Supports

B. Shop Drawings

1. Pipe Supports

C. Instructions

1. Pipe Supports

D. Quality Assurance

1. Design Data

a. Calculations

2. Test Reports

    a. Radiographic
    b. Pipe Supports

3. Manufacturer's Instructions
4. Qualification Statements

    a. Welder Performance Qualifications (WPQ)
    b. Welding Procedure Specifications (WPS)
    c. Welder Performance Qualification Test Certificates
    d. Internal and External Pipe Coating Procedures and Results
    e. Hot Tapping Operations

5. Certifications

    a. Carrier Pipe
    b. Flanges
    c. Fittings
    d. Bolts
    e. Nuts
    f. Piping System Installation

E. Records:

1. Procedure Qualification Records (PQR)

1.6 QUALITY ASSURANCE:

A. All pipe and piping materials shall be provided by a manufacturer and fabricator approved by the Engineer.

B. Welding operations, qualification of welders and welding procedures shall comply with ASME B31.3 and the ASME Boiler and Pressure Vessel Code, Section I and Section IX. Certified copies of the welding procedure, the procedure qualification, and the welder qualification certification must be submitted prior to beginning any welding operations.

C. Welders must be qualified to position 6G of ASME BPVC Section IX, tested on the type of pipe used in this project, and must have been qualified within the six months preceding this project or the welder shall be re-qualified.

D. Contractor is responsible for all costs associated with procedure and welder qualifications.

E. Certified copies of the quality control procedures and results of the internal and external pipe coating application shall be submitted.

F. No foreign materials or components, supplied as part of this Section, shall be utilized. The use of the words “domestic materials” or “no foreign materials” shall mean all materials shall be of U.S. origin. The Contractor shall certify this condition in the compliance submittals. If at any time, the Owner or Engineer determines that any flanges, fittings, bolts or nuts are not of U.S. origin, the Owner shall be entitled to replace the components without need for individual testing for conformance to technical specifications. Contractor shall be responsible for all costs, including labor, materials and consequential costs, associated with such replacement.

G. Pipe flanges and fittings shall bear a stamp indicating country of origin.

H. The installation shall include all necessary materials, coating, supports, controls, valves and fittings, hereinafter described or called for on the Contract Drawings accompanying these specifications, or as necessary to make the installation complete.

I. The drawings and specifications shall be considered complementary, one to the other, so that materials and labor indicated, or called for, or implied by the one and not the other, shall be supplied and installed as though specifically called for by both.

J. All materials and equipment provided under these specifications shall be new, unused products of manufacturers regularly engaged in production of such equipment for a minimum of 5 years. All products shall conform to the applicable code or standard for its manufacturing, fabricating and installation.

K. All testing shall be in accordance with ASME B31.3 for abovegrade and belowground piping. The third-party testing agency shall be qualified to perform testing and meet the requirements of ASME.

PART 2 - MATERIALS

2.1 PIPING MATERIALS:

A. The piping system is a combination of above ground and below ground piping. All above ground piping shall be of single wall construction. All below ground piping shall be of single wall construction.

B. All direct buried piping connections shall be welded. Welded joints shall conform to the standards set forth in the ASME B31.3 Code for Petroleum Refinery Piping.

C. Threaded joints are only allowed for small bore piping that has no internal pressure such as vent or atmospheric drain piping. Threaded joints shall be American Standard for Pipe Threads, ASME B1.20.1. All burrs shall be removed. Pipe ends shall be reamed out to size of bore and all chips shall be removed. Teflon pipe thread sealant shall be used on the male threads only and shall not extend past the end of the pipe.

D. Furnish and install flanges where shown and at connections to all equipment. Flanged connections are only allowed above ground or within pits/vaults. Flanges shall not be direct buried.

E. Unless otherwise specified herein or stipulated on the Contract Drawings, all flanges shall be matched on piping, valve or equipment as to size, and shall be constructed from materials equivalent to the piping. Flanges shall be raised face.

F. Pipe fittings shall be of standard manufacture of materials, weight, and quality corresponding to the pipe with which they are used.

G. Fittings such as elbows, tees, reducers and caps shall be used for all changes in piping direction, intersections, size changes and end closures unless otherwise stipulated on the Drawings or specified herein.

H. The manufacturer or supplier of the piping materials shall provide a certificate of the inspection, stating origin of manufacture and that all material has been manufactured, sampled, tested and

inspected in accordance with the specified ASTM, API and other identified specifications and has been found to meet those requirements.

I. All pipe shall be stamped with specification, grade, and heat number. Shop coated pipe shall have specification, grade, and heat number stenciled on the coating.

J. All portions of equipment coming in contact with Jet A shall be free of copper, brass, bronze or zinc material. Aluminum is not allowed unless specified otherwise. All trim shall be stainless steel. Galvanized piping is not allowed in the aircraft system.

2.2 PIPING SPECIFICATIONS:

A. The following table is provided to indicate the basic design conditions of the components within this section of the specification:

SERVICE	SYMBOL	PRESSURE	TEMPERATURE	SPECIFIC GRAVITY
Jet Fuel (ASME CLASS 150)	JF	285 psig	-20 to 110°F	0.81+/-0.05

B. The following is provided to indicate the various materials of construction for the design service required by this specification

1. Carrier Pipe
    a. Pipe Size 2" and Smaller: ASTM A53 Grade B, Schedule 80, Seamless, low frequency welding process less than 1kHz shall not be used
    b. Pipe Size 2-1/2" to 10": ASTM A53 Grade B or API 5L Grade B, ERW or Seamless, low frequency welding process less than 1kHz shall not be used, Schedule 40
    c. Pipe Size 12" and Larger: ASTM A53 Grade B or API 5L Grade B, ERW or Seamless, low frequency welding process less than 1kHz shall not be used, wall thickness: 0.375-inch.
    d. Where applicable, use double random lengths to minimize the number of welds required.
2. Joints
    a. Pipe Size 2" and Smaller: Socket Weld unless otherwise indicated in details.
    b. Pipe Size 2-1/2" and Larger: Butt - Weld, End preparation to ASME B16.2.
3. Flanges
    a. Pipe Size 2" and Smaller: ASME Class150 ASME B16.5, Carbon Steel ASTM A105, Socket Weld Raised-Face.
    b. Pipe Size 2-1/2" and Larger: ASME Class 150 ASME B16.5, Carbon Steel ASTM A105, Weld Neck Raised-Face.
    c. Flange face and ASME 150 rating to be compatible with corresponding component. Flanges shall be standard 1/16th inch raised face.
4. Fittings
    a. Pipe Size 2" and Smaller: Socket Weld, Carbon Steel ASTM A105, Grade 2 - 3,000 lb.
    b. Pipe Size 2-1/2" and Larger: Buttweld, ASME B16.9, Carbon Steel per ASTM A234 Grade B, wall thickness to match pipe.
    c. Notes: Bushings shall not be used except as noted.
5. Bolts

a. Pipe Size 2" and Smaller: Alloy steel, teflon coated machine bolts, ASTM A193, Grade B7.
b. Pipe Size 2-1/2" and Larger: Alloy steel, teflon coated machine bolts, ASTM A193, Grade B7.
c. Notes: Studs may be used for corresponding equipment. Cadmium plated bolts may be substituted in lieu of teflon where approved by Owner or Engineer.

6. Nuts

a. 2" and Smaller: Nuts to be heavy hexagon carbon steel ASTM A194, Grade 2H, teflon coated.
b. 2-1/2" and Larger: Nuts to be heavy hexagon ASTM A194 Grade 2H teflon coated.
c. If cadmium plated bolts are used, cadmium plated nuts shall be used. If teflon coated bolts are used, teflon coated nuts shall be used. Teflon is the preferred coating, cadmium plating shall be approved by Owner or Engineer.

7. Gaskets

a. 2" and Smaller: Flexitallic Type CGI 304 Stainless Steel Windings with Thermiculite 835 filler Conform to ASME B16.20.
b. 2-1/2" and Larger: Flexitallic Type CGI 304 Stainless Steel Windings with Thermiculite 835 filler Conform to ASME B16.20.
c. Inner ring shall be 304 stainless steel and outer ring shall be carbon steel.
d. Gaskets shall be color coded on outside circumference to facilitate inspection of installed product.
e. Gaskets are to be torqued per manufacturer's recommendations.

C. The interior and exterior coating for all carbon steel pipe and piping materials shall be as specified in Section 09 97 13.00 - Fuel System Coatings.

D. Welded elbows shall be long radius unless otherwise shown.

E. Changes in direction of pipe of other than 45 degrees or 90 degrees shall be made as follows:

1. With long radius welds cut to proper angle and shop beveled.
2. Or, at the option of the Contractor, with long radius pipe bends. Pipe roundness shall be maintained to factory tolerance for straight pipe lengths. Submit shop drawings of all bends and bending procedures for approval.
3. Bends of 3 degrees or less shall be miter joints.

F. Tee Connections:

1. Branch connections may be used in lieu of butt welding tees for sizes below 3" only, and only above ground or within pits/vaults. Branch connections shall not be used in direct buried piping except for hot tap operations on an active line.
2. Branch connections for aboveground or within vaults, shall be weldolets, sockolets, socket-welded nipolets, or socket-welded elbolets, as manufactured by Bonney Forge or equal.
3. Material shall be ASTM A105, Grade 2, standard weight steel, and shall conform to ASME B16.11.
4. Use for all vent and instrument connections.

G. Fittings for Threaded Fuel Pipe:

1. 3,000 pound forged steel conforming to ASME B16.11.
2. Threads of threaded jointed piping shall be full, clean, sharp, and true.
3. Bushings shall not be used except as noted on the drawings.

PART 3 - EXECUTION

3.1 CLEAN PIPING REQUIREMENTS:

A. **The importance of keeping the interior of all piping systems clean during construction is critical.** The Contractor is required to keep the interior of the carrier piping clean from all visible dirt or foreign matter at all times and under all conditions. If for any reason the inside of the piping contains dirt or foreign matter, the Contractor shall correct this condition to the Owner's satisfaction with all necessary material, labor and equipment for cleaning being furnished at the Contractor's expense. The following measures shall be taken to assure cleanliness of the system:

1. The pipe and fittings shall be delivered to the job site sealed. The seals are not to be removed until the pipe is installed. After each day's work, the open ends of all pipe being installed shall be sealed closed with an expansion type weatherproof and watertight seal manufactured for this purpose. At the Contractor’s option, weld caps or plate steel may be welded into place on the end of the pipe.
2. All fittings and valves shall be kept in a covered dry storage area until installation.
3. Pipe shall not be installed or stored in areas or ditches containing water or mud.
4. At openings for branches in piping, all material that falls into the pipe must be removed before welding in the branch fittings.

B. Contractor shall install weld caps or plate steel on the end of the pipe between phases of work.

C. Should the Contractor fail to keep the pipe sealed in the trench and it floods with water and mud, he shall flush the pipe clean with water and dry the piping by blowing -20 deg dried air through the pipe. Air drying shall continue until the dew point of the air exiting the pipe is equal to the dew point of the air entering the pipe. Upon completion of drying operations, the pipe shall have a camera operated down the entire length of the pipe with the results recorded and forwarded to the Owner for review. The flushing/drying will continue until the pipe cleanliness is accepted by the Owner. Water shall not be used if the piping is connected in any fashion (including closed double block and bleed plug valves) to active jet fuel piping.

3.2 HANDLING PIPE:

A. The shipment, delivery, and installation of all pipe and accessories shall be handled in such manner as to ensure a sound undamaged condition. Particular care shall be taken not to damage pipe coating when storing pipe. No other pipe or materials of any kind shall be placed inside a pipe or fitting after the coating has been applied.

B. Perform the hauling of pipe and other materials in such a manner as to prevent damage to pipe and material. If damage is sustained, Contractor shall be responsible for repair or replacement cost.

C. In order to protect the exterior coating from damage, all piping shall be unloaded with padded forks or slings and shall be stored on padded cribbing or supports. All pipe fabrication shall take place on padded supports or cribbing.

D. Transporting and installation of pipe and other equipment shall be performed such that stainless steel surfaces do not contact carbon steel surfaces. Welding and grinding of carbon steel shall take place adequate distance from all stainless steel such that sparks or particulate will not contaminate stainless steel surfaces. Should the Contractor handle stainless steel pipe or

equipment in a manner that causes surface contamination, Contractor shall be responsible for repair or replacement at no cost to Owner.

3.3 FABRICATION AND INSTALLATION:

A. All piping materials, fabrication, installation and application shall be in compliance with the latest requirements of the code for Petroleum Refinery Piping ASME B31.3, and all state and local regulations when applicable.

B. All temporary piping required for construction, testing, flushing and start-up shall be furnished by the Contractor. Such piping shall remain the property of the Contractor; and it shall be his responsibility to dismantle and remove it from the premises when no longer required.

C. End Preparation: The base metals for all butt-welding pipe joints shall be prepared to provide for proper "fit-up" in accordance with ASME B16.25. Ends shall be prepared by machining or flame cutting. Hand flame cutting is only allowed subject to approval by the Engineer and only where the use of machine or automatic machine flame cutting is impractical. Hand flame cuttings shall be ground smooth. No welded joint shall be made where either flame cut or machine cut ends provide a spacing between the pipe so large that more than one stringer bead is required to completely close the pipe. Where flame cutting by hand is employed, the included angle or bevel at the end of the pipe shall be not less than plus or minus 5 degrees from that which is required elsewhere in these specifications for machine cut beveled ends. Pipe end for socket welding shall be reamed for the full inside diameter to remove all burrs and obstructions.

D. All pipe shall follow the routes shown on the drawings and shall be placed accurately to measurements indicated or established from the work. Pipe shall be placed clear of equipment, and other work. Changes in direction shall be made by use of fittings for standard angles and by trimmed fittings for angles other than standard. Reference earlier paragraphs in this section.

E. Any damage to the internal or external pipe coatings by bending or handling, including lineup of pipe joints, shall be the responsibility of the Contractor and shall be repaired to equal the original coating per Section 09 97 13.00 - Fuel System Coatings. Repair of the internal coating damaged by field welding of pipe joints is not required.

F. Proper pipe joint alignment and separation shall be accomplished without the use of backing rings.

G. Weld spatter shall be removed around welds leaving a smooth clean surface.

H. Pipe shall be fabricated to measurements established on the job and shall be carefully worked into place without springing or forcing.

I. Flanges and unions shall not be placed in a location that will be inaccessible after completion of the work.

J. All piping and equipment shall be properly supported and guided. Anchors shall be provided where shown and where required to absorb or transmit thrust and eliminate vibration or pulsation.

K. Changes in pipe size shall be made with reducing fittings. The Contractor shall pay special attention to the type of reducer, and its orientation, shown on the Contract Drawings. Bushings shall not be used unless otherwise shown.

L. Flanged joints shall be accurately centered and aligned prior to installation of bolts so as to prevent mechanical pre-stressing of the flanges, pipe and equipment.

M. For belowground piping, install pipe so as to be clear of contacts with other pipes, pipe sleeves, casings, reinforcing steel, conduits, cables, or other metallic structures. Minimum separation from non-metallic utilities is 12” and from metallic utilities is 24”. Should uncovered field conditions result in clearances less than this, bring to the attention of the Engineer for resolution prior to installing the new piping.

N. Verify all measurements before commencing work. Submit discrepancies for clarification before proceeding.

O. Arrange all piping with proper slopes, without sags, traps, or pockets.

P. Provide high point vents, pump outs, and low point drains as required and indicated on the drawings.

Q. Do not remove stenciling on stainless steel piping.

3.4 WELDING:

A. Qualifications of welders shall be done by Contractor in accordance with ASME B31.3, Process Piping and the qualification submitted to the Engineer before welder is allowed to make construction welds. Certified test results for each welder employed by the Contractor shall be kept in the contractor's field office for inspection by the Engineer. Performance test records of welders issued by a previous employer, in lieu of qualification tests conducted by the Contractor, will not be acceptable. The welder must have been qualified within the previous six months of the NTP on the project. The Contractor shall assume the costs for all tests.

B. Welding and fabrication shall be accomplished in accordance with ASME B31.3 latest edition. Before welding, the piping or other equipment shall be carefully lined up so that no part is offset; flanges and branches shall be set square and true. This alignment must be preserved during the welding operation. If tack welds are used, they must be of the same quality and made by the said procedure as the completed weld. No weld metal shall project within the pipe so as to restrict its area or cause danger of its loosening and falling into the pipe. The piping shall not be split, bent, flattened or otherwise injured before, during or after installation. During erection, care shall be taken to remove all dirt, scale and other foreign matter from inside the piping before tying in sections, valves, equipment or fittings.

C. Backing rings shall not be used.

D. All welded joints shall be made as recommended by the standards of the American Welding Society and B31.3. The welding shall ensure complete penetration of the deposited metal with the base metal. The filler shall be suitable for use with the base metal. Mitered joints shall not be used except where specifically allowed in this specification or on the Contract Drawings.

E. All manual welds shall be made using downhill welding procedure. Shop welds utilizing machine-welding procedures do not have to qualify to the downhill requirement. Machine-welding procedures must be qualified and submitted to the Engineer.

F. Qualifications and Approval:

1. Welding procedures that are intended to be used on the job shall be submitted for approval. The Contractor shall be responsible to assure that all welding procedures,

welders, and welding operators have been qualified in accordance with applicable code requirements before work is started. Shop and field procedures shall be submitted to the Engineer for approval. The procedure specifications shall be as follows:

a. Include copies of the qualification test records as evidence that the procedures have been qualified in accordance with the latest revisions of the following code:

1) ASME B31.3 - Process Piping.

b. Developed for the conditions of this Contract and be complete and specific, and if necessary, differentiate between shop and field welding.

c. Welder Performance Qualification Test Certificates:

1) Furnish welder performance qualification test certificates prior to starting work for position 6G for the pipe being installed as part of this project made in strict compliance with the above code.

2) Submit qualification test records for each welder on the project and keep record files.

2. Costs: Costs incident to procedure and welders qualification tests shall be the responsibility of the Contractor.

G. Each welder shall identify each of his welds with a specific code or identifier. The Contractor shall keep an as-built fabrication drawing on the site that identifies the location of each weld made and also indicates the welder who made the weld. The marking shall be made with a “low stress” steel stamp or permanent ink marking.

H. The Owner reserves the right to place welding inspectors (at the Owner’s cost) in the shop where off site welding is taking place.

I. Any welder failing more than 5% of his welds is subject to removal from the project.

3.5 CONNECTION TO ACTIVE PIPING:

A. Active piping shall not be cut, tapped or disturbed until the Contractor has obtained the necessary written approvals from the Owner, Fuel System Operator and the Engineer.

B. Each active fuel line shall be substantially drained prior to cutting into the line. Fuel shall not remain in the piping as it is cut. The contractor shall exercise extreme caution during the cutting of existing piping and shall not use cutting torches and spark producing cutting tools and methods.

C. The Contractor shall have the necessary number of drip pans and vacuum trucks on site during cutting operations. Any and all fuel spilled during the cutting procedure shall be immediately cleaned up and removed from the site by the Contractor at no additional cost to the Contract and in accordance with Section 01 33 29.06.01.

D. The Contractor shall take adequate measures for fire protection during modifications to existing piping and equipment. Such measures shall include, as a minimum but not limited to, the following precautions:

1. Do not cut, bevel, weld, grind or otherwise generate sparks near open sources or spills of jet fuel.
2. Provide a fire extinguisher, 2.5 gallons Class AB Foam Type, at each welding operation.
3. Protect adjacent services from weld splatter and sparks by use of welding blankets.
4. Obtain necessary hot work permits from the Airport.

5. Notify the Airport Fire Department at least 48 hours in advance of the intended operation. In the event the Fire Department elects to have equipment present during the operation, the Contractor shall coordinate the construction area with the Fire Chief to allow proper positioning of equipment.

E. Welding to existing piping:

1. Flow nitrogen through piping, or use dry ice plugs, and weld area to eliminate all measurable oxygen.
2. Weld piping in accordance with API, NFPA and OSHA requirements.
3. Use Plidco fittings to eliminate welding directly within the vapor space of existing piping.

F. Plidco Fittings:

1. Plidco fittings (“weld+ends”) shall be employed at each saw cut into existing underground piping. Each fuel line shall be substantially drained prior to cutting into the line.
2. Follow the manufacturer’s printed installation procedure. Flow fuel prior to weld-out.
3. Installing Plidco “weld +ends”:

   a. The existing piping shall be cleaned of all old coating in the area where the Plidco is to be installed. The pipe shall be cleaned of burrs and other surface irregularities that might damage the Plidco seals during operation.
   b. Slide Plidco “weld+ends” completely over one end of pipe. Mark off one-half of Plidco “weld+ends” coupling length from middle of gap in pipe joints. Slide fitting back to mark to divide coupling equally over joint.
   c. After coupling is positioned, torque clamping and thrust screws tight, following the manufacturers installation instructions for torque values and sequence.
   d. Pipeline shall be put in operation. Thrust screws shall be burned off flush. Ends of coupling shall be fillet-welded around circumference, including seal welding of thrust screws. Clamping screws shall be cut or burned off and seal-welded also.
   e. For critical, limited schedule, tie-in operations the Contractor shall have an extra pair of seals on hand for each size of Plidco coupling.

G. Hot Tapping Operations

1. In the event the work scope requires tapping or temporary line plugging operations, the Contractor shall hire a specialty subcontractor to provide the equipment and personnel required to perform the task. The specialty subcontractor shall have a minimum of 10 years experience in similar type of work. The Contractor shall submit on the procedure and the subcontractor he intends to use. The subcontractor shall be T.D. Williamson, Inc., or approved equal.
2. Contractor shall note that the wall thickness of the existing system piping has not been confirmed. Previous smart-pigging inspections indicate that the wall thickness of the 14-inch and 20-inch pipes may be 0.250-inch or 0.375-inch. Contractor shall field-verify existing wall thickness prior to commencement of any tapping operations.

3.6 PIPE SUPPORTS:

A. Pipe supports shall meet the design and location requirements of ASME B31.3 and shall be types as detailed.

B. Support locations are indicated on the drawings for piping 3” and larger only based on the pipe routing shown. Should the Contractor change the pipe routing, the Contractor shall revise the pipe support locations accordingly and submit for review prior to beginning fabrication.

C. Pipe supports for piping 2-1/2 inches and smaller shall be field located. Spacing shall be in accordance with ASME 31.3 from which the following table is derived:

D.

Pipe Diameter (nominal inches)	Maximum Support Spacing (feet)
3/4"	6'
1"	7'
1-1/2"	9'
2"	10'
2-1/2"	11'
3"	12'

E. Where changes in direction occur, reduce the spacing allowed in ASME B31.3 by three-quarters.

F. Furnish and install all rigid supports, whether or not they are shown and detailed, but are required to adequately support the piping systems. Include all necessary structural steel, brackets, anchor bolts, etc., which are required to properly support the piping systems.

G. Large bore (3” and larger) pipe supports shall be complete factory fabricated and hot dip galvanized assemblies.

1. Pipe support shall have adjustable height flat plate support with two U-bolts and an integral baseplate with slotted anchor rod holes.
2. U-bolts and nuts shall be galvanized. U-bolts shall also be coated with heat shrink liner to prevent metal to metal contact between U-bolt and piping being supported.
3. Each U-bolt shall be spanned above flat plate, with an I-Rod liner of standard temperature rating.
4. Pipe support assemblies shall be as manufactured by EZ Line Figure FIR or approved equal.
5. Elbow pipe support assembles shall have cradle support with two galvanized and heat shrink coated U-bolts. The cradle assembly shall have I-Clip Liners.
6. Pipe shoes with hold down clamps shall have I-Clip lining of the clamps and a slide plate of PTFE permanently bonded to the bottom of the WT flange. PTFE slide plate shall extend to within ½” of edge of WT bottom surface.
7. Pipe shoes welded to the pipe shall be of the same material as the pipe. A slide plate of PTFE shall be permanently bonded to the bottom of the WT flange. PTFE slide plate shall extend to within ½” of edge of WT bottom surface.

H. Pipe supports shall be anchored as detailed, using ASTM F1554 Gr 36, hot dip galvanized threaded rod. Nuts shall be ASTM A563, Grade DH heavy hex carbon-steel nuts, hot dip galvanized. Washers shall be ASTM F436, Type 1, hardened carbon steel washers, hot dip galvanized. Anchor rod sizes and embedment shall be as detailed.

1. Install the anchor rods using the Hilti RE 500 V3 system. The embedment hole MUST BE cleaned prior to installing the epoxy and anchor rod per the manufacturer’s installation instructions, utilizing a compressed air gun at 90 psi, with tip that extends to bottom of hole, and steel wire “bottle” brushes. Follow manufacturers data for temperature based full cure times before loading the anchor rods.
2. Clean the concrete surface immediately below baseplate of any loose material or bond breaking material and roughen the surface. Confirm that the bottom of the base plate is clean. Install the pipe support and level the base plate using the leveling nuts so that the vertical member of the pipe support is level in both planes. Install the washer and anchoring nut and snug tighten.

3. Install minimum 4,000 psi non-shrink grout between the baseplate and the concrete slab. Pack the material tightly into place, assuring that no voids are present. Finish the edges of the grout as detailed and tool to a smooth finish.
4. After the grout is fully cured, torque the anchoring nut per the manufacturer's data provided for each diameter of anchor rod.

I. Small bore (2-1/2" and smaller) pipe supports shall be field assembled, utilizing a metal framing system by Unistrut, B-Line, or Grinnell.

1. Channel sections shall be 1-5/8" pre-galvanized carbon steel, model P1000T with slotted holes to accommodate anchoring to the concrete slab. Vertical members shall be capped with Model P1180 electrogalvanized caps.
2. Bases for vertical channel sections shall be electrogalvanized Model P2072ASQ, with a 4-hole base plate and a vertical member with two holes to install a galvanized bolt through the vertical channel section is two locations.
3. Pipe clamps shall be Cush-A-Clamps with electrogalvanized straps and a UV-resistant elastomer cushion. Tighten the shoulder bolt sufficiently to compress the cushion around the pipe.
4. Vertical channel section bases, and horizontal channel sections shown mounted directly to the concrete slab, shall be installed using ¼" threaded rod and hardware conforming to the materials specified herein.

J. Observe the flushing system in operation and make adjustments as necessary to support the system under dynamic loads.

3.7 SAFETY PRECAUTIONS AND FUEL SYSTEM MODIFICATIONS:

A. Safety procedures are the responsibility of the Contractor. All operations in the construction area that involve open flames or the possibility of arcing or sparking shall be conducted in a "Gas-Free" condition.

B. It shall be the responsibility of the Contractor to monitor the use and suitability of the equipment and procedures on the job and maintain a safe "Gas-free" condition when necessary during construction.

C. Prior to commencing any phase of the work requiring a gas-free condition, the Contractor shall make the following minimum provisions:

1. Empty pipes containing fuel and purge all vapors.
2. Isolate, blank off, and adequately ventilate open piping sections so that no part of the pipe containing fuel or vapors is exposed.
3. Inspect for, and confirm that there are no open pools of fuel, or soil contaminated to a combustible limit, in the area of the work.
4. Drain and ventilate storage tanks prior to working on the tanks or tank connections.

D. Utilize a combustible gas analyzer or similar device to make certain that concentrations of combustible gas do not exist in the construction area when performing these operations.

E. Perform all safety precautions as required to assure that the work is conducted in a safe manner and to conform to applicable codes.

END OF SECTION