

Pipe Specifications

The following summarizes pipeline specifications for the Keystone XL Pipeline project.

1.0 DESIGN FORMULA

The design parameters for steel pipe will be determined in accordance with the following equation: (See 49 CFR 195.106-Internal Design Pressure)

$$P = 2St/D \times F \times E$$

where:

P = Internal Design Pressure, psig

S = Specified minimum yield strength, psi

D = Nominal outside diameter of the pipe, inches

t = Specified wall thickness of the pipe, inches

F = Design Factor

E = Seam joint factor

2.0 DESIGN FACTOR DETERMINATION

The design factor (F) will be determined as a result of conditions or a combination of conditions such as crossings, fabrications, station yards, and special areas.

2.1 Mainline and Station

An application for a special permit, to allow the use of a design factor of 0.80, will be made to the Pipeline Hazardous Materials Safety Administration. The 0.80 design factor would be used for the mainline in all areas where normal installation methods and cross country conditions prevail.

2.2 Crossings and Fabrication

Though a de-rated design factor is not specified by Part 195 for crossings and fabricated assemblies, a conservative design practice is considered prudent, therefore pipe installed at all highway, road and open cut waterway crossings will be of sufficient wall thickness and grade to effectively equate to a design factor 0.60. Directionally drilled waterway crossings, railroad crossings and all fabricated assemblies shall be designed using a design factor of 0.50.

2.3 Special Areas

In addition to the correct application of the design equation, the designer shall ensure that the pipeline is designed with the public's safety in mind and in accordance with the principles of engineering science. The pipeline design shall provide adequate structural capacity to accommodate unusual site specific loading conditions in any areas of natural hazard encountered, particularly in areas of limited access.

3.0 LINE PIPE REQUIREMENTS

Pipe for the U.S. portion of the Keystone XL pipeline line shall be double submerged arc welded in accordance with API 5L Steel Pipe, latest edition.

New steel pipe for the mainline shall be mill inspected by an authorized TCPL inspector and mill tested to API/ASTM specification requirements, as a minimum.

If shipped by rail, the shipment shall be made in accordance with API Recommended Practice 5L1 specification latest edition, if shipped by barge or marine transport, the shipment must be in accordance with API Recommended Practice 5LW.

4.0 MINIMUM WALL THICKNESS AND YIELD STRENGTH

Mainline pipe minimum wall thickness for the Keystone XL pipeline will be determined by the design formula, included in Section 1.0 and consideration of pipe structural integrity for shipping, handling, bending, welding, and installation/back-fill in rugged terrain. The mainline pipe will be:

- 36" O.D. x 0.465" w.t., API 5LX-70 (0.80 design factor)
- 36" O.D. x 0.618" w.t., API 5LX-70 (0.72 design factor)
- 36" O.D. x 0.740" w.t., API 5LX-70 (0.60 design factor)
- 36" O.D. x 0.515" w.t., API 5LX-70 (0.50 design factor)

5.0 PIPE WALL THICKNESS TRANSITIONS

End preparation will be done in accordance with API 1104 latest edition.

6.0 MINIMUM PIPE LENGTH

Minimum pipe length to be installed on pipeline construction will be five (5) feet. This does not apply to fabricated assemblies or transition pieces.

7.0 PIPE BENDING

The U.S. portion of the Keystone XL pipeline will utilize both field bending and 3D fittings in the construction of the pipeline.

8.0 COATING CONSIDERATIONS

A. Below Ground Piping

The primary coating for the exterior surface of below ground line pipe shall be fusion bonded epoxy (FBE) with a nominal 16 mil thickness and with a five inch (5") coating cutback at each end of the pipe joint. Welded field joints shall be protected with liquid epoxy or field applied FBE. Internal coating is not required for this project. Line pipe installed in a bored or directional drill crossing coated with FBE and an over coat of abrasion resistant coating. .

Line pipe installed in marshes and wetlands subject to flooding for extended periods of time and beneath uncased drainage canals and ditches, and rivers and streams installed by the open-cut method will be externally coated over FBE coating with reinforced concrete or concrete weights installed to provide the pipe with a minimum specific gravity of 1.10 in fresh water.

B. Above Ground Piping

All above grade, uncoated piping and appurtenances shall be sandblasted clean, primed and painted in accordance with Keystone XL painting specifications. Colors shall be specified by Keystone XL.