SOUTHWEST GAS CORPORATION
ENGINEERING STAFF
*MATERIAL SPECIFICATION*

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**PIPE AND TUBING**
Pipe, Line, API Specification 5L

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**PIPE AND TUBING**
Pipe, Line, API Specification 5L

## 1. SCOPE

This specification covers API Specification 5L, Grades B, X42, X46, X52, X56, X60, X65, X70, and X80 line pipe in outside diameters of 2-inch nominal through 60-inches nominal. All pipe covered by this specification must be tested in accordance with the Company's Operations Manual, Pipe and Component Testing Design.

## 2. APPLICABLE DOCUMENTS

2.1 American Petroleum Institute (API) "Recommended Practice 5L", "Specification for Line Pipe."

2.2 American Petroleum Institute (API) "Recommended Practice 5L1", "Recommended Practice for Railroad Transportation of Line Pipe."

2.3 American Petroleum Institute (API) "Recommended Practice 5LT", "Recommended Practice for Truck Transportation of Line Pipe."

2.4 American Petroleum Institute (API) "Recommended Practice 5LW", "Transportation of Line Pipe on Barges and Marine Vessels."

2.5 Title 49, Code of Federal Regulations, Part 192, "Transportation of Natural and Other Gas by Pipeline; Minimum Safety Standards" (49 CFR 192).

2.6 American Petroleum Institute (API) "Recommended Practice 5MT", "Pipeline Material Traceability and electronic MTR Inspection Documents".

**NOTE:** Unless otherwise specified, the editions of the document incorporated in whole or part by 49 CFR 192 are applicable. The above documents, and parts of documents (including annexes), not incorporated by 49 CFR 192 are incorporated by this Material Specification and will be the most recent edition. If a conflict exists between the applicable documents and/or this Material Specification, the requirements of 49 CFR 192 shall govern, and in the event of all other conflicts, the more stringent requirement shall govern. The application of earlier editions of those documents not incorporated by reference in 49 CFR 192 can be applied with Engineering staff approval.

**PIPE AND TUBING**
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## 3. TERMINOLOGY

3.1 General

3.1.1 "Southwest Gas," "Southwest" or "SWG" wherever used in this specification and other related documents will refer exclusively to Southwest Gas Corporation.

3.1.2 The terms "approve," "as approved," "satisfactory," "as directed," "or equal," or other similar terms wherever used in this specification and other related documents, will mean "as determined by Southwest Gas," unless specifically stated otherwise.

3.1.3 “Product Information Package” or “PIP” wherever used in this specification and other related documents will mean the required information that a manufacturer must submit to SWG to determine if the product is suitable for use by SWG, unless specifically stated otherwise.

3.1.4 “As-Agreed” - requirement to be as agreed upon by the manufacturer and the purchaser and specified in the purchase order.

## 4. MATERIAL AND MANUFACTURING

4.1 Pipe purchased under this specification will be manufactured, as a minimum, in accordance with API Specification 5L Performance Service Level (PSL) 1 or (PSL) 2 and additional requirements as defined in this qualification.

4.2 PSL 1 shall require staff approval.

4.3 Jointers are not permitted.

4.4 All pipe will be beveled to an angle of 30° with a tolerance of +5°, -0°. The bevel will be measured from a line drawn perpendicular to the axis of the pipe with a root face of 1/16 inch, ± 1/32 inch.

4.5 The pipe will be visually examined and will be free of defects as defined in API Specification 5L in the finished condition. This includes, but not limited to, cracks, dents, inclusions, or electric-weld flash, both internal and external. The pipe surface will be free from scale and injurious defects and shall be suitable for coating.

## 4. MATERIAL AND MANUFACTURING (Cont'd)

4.6 Pipe shall have a carbon content of no less than 0.040% and a PCM carbon equivalent of no less than 0.140%, for pipe with carbon content values less than or equal to 0.12%.

For carbon content values greater than 0.12%, the maximum carbon equivalency (CE) value will be 0.43%. The International Institute of Welding (IIW) formula found in API 5L will be used to determine the CE.

For grades X60 and higher, coil/plate chemistry shall be provided for review and acceptance prior to the start of production. Below grade X60, as-agreed, coil/plate chemistry shall be provided for review and acceptance prior to the start of production.

4.7 The weld seam of HFW pipe, not subjected to a quench and temper process, shall be fully normalized to include the HAZ at a minimum temperature of 1600 °F.

4.8 Allowable seam types are seamless or high-frequency electrically resistance welded (abbreviated as HFW or EW).

## 5. PERFORMANCE REQUIREMENTS

5.1 The minimum testing and inspection frequency required by API Specification 5L for the Grade and Delivery Condition shall be performed and successfully completed.

5.2 CVN impact tests shall be conducted for the pipe body and pipe weld for pipe over 4.5" OD in accordance with API 5L section 9.8 and Table 22. The test temperature shall be 32°F or an as-agreed lower temperature. This information shall be communicated to Purchasing prior to purchase orders being executed. Contact the chair of the Steel Group Committee for additional information and assistance.

5.3 For information only, if as agreed, full curve pipe body Charpy V-notch for shear area and absorbed energy shall be provided for 10% of the heats produced. Data shall include upper and lower plateaus and the transition temperature. Charpy V-notch full curve tests shall be provided for the SAW weld metal and HFW weld metal for 10% of the heats, except that weld fracture appearance is not required.

## 5. PERFORMANCE REQUIREMENTS (Cont'd)

5.4 If as agreed, for pipe wall thicknesses standard wall and greater, drop weight tear tests shall be performed for all pipe 16" OD and larger. Two transverse drop-weight tear tests from one length of pipe shall be tested at 32°F or the minimum design temperature, whichever is lower, for each heat. If more than 100 lengths of pipe are included in a heat, an additional pipe will be tested. The fracture appearance shear area shall be reported for each individual specimen. The minimum average shear area of two specimens from any heat shall be 85%. Full curve DWTT tests shall be provided for 10% of heats.

5.5 Southwest Gas reserves the right to require any supplementary requirements listed in the API Specification 5L when specified on the purchase order.

5.6 In addition to the requirements of API 5L, X52, X56, X60, X65, X70, and X80 shall also receive longitudinal testing and documentation for informational purposes.

The maximum allowable yield and tensile strength tested in the longitudinal direction must not be greater than 17 ksi (117 MPa), respectively, over the specified minimum values of API 5L Grades X52, X56, X60, X65, X70, and X80 line pipe.

Exceptions to longitudinal testing are allowed for grades X65 and greater upon staff approval.

5.7 If as agreed, the hydrostatic test dwell time shall be increased to 10 seconds.

5.8 If as agreed, the minimum hydrostatic test pressure shall be 95% of material SMYS

5.9 If as agreed, the residual magnetism shall not exceed 20 gauss.

5.10 The full-length pipe straightness should aim to be 0.15% of the measured length.

## 6. METALLOGRAPHIC EXAMINATION

6.1 For submerged arc welded pipe, one full wall thickness transverse section of the weld zone shall be removed from on pipe for each 100 lengths welded at each welding station and prepared for metallographic examination. The sample shall exhibit proper penetration, alignment and fusion.

## 6. METALLOGRAPHIC EXAMINATION (Cont'd)

6.2 For high frequency welded pipe, one full wall thickness transverse section of the weld zone shall be removed from one pipe from each heat. If more than 100 lengths of pipe are included in a heat, an additional pipe shall be tested.

6.3 HV 10kg hardness testing shall be conducted on each weld cross section on the outer diameter, mid wall, and inner diameter. The base metal, heat-affected zone, and weld metal/weld line shall be indented for a total of 15 indentations. The hardness measurements taken within the heat affected zone shall be located as close as possible to the fusion boundary between the weld metal and heat affected zone. The hardness shall not exceed 260 HV 10kg or HRC 22.

## 7. DIMENSIONS AND TOLERANCES

Pipe diameter, wall thickness, dimensions and tolerances will be held to API Specification 5L values.

Unless a minimum or maximum length is specified on the materials requisition and purchase order, the following tolerances in length shall apply:

**TABLE 1**

| Nominal Length (Feet) | Minimum Length (Feet) | Minimum Average Lengths Of Each Order Item (Feet) | Maximum Length (Feet) |
|---|---|---|---|
| 20 (SRL) | 9.0 | 17.5 | 22.5 |
| 40 (DRL) | 14.0 | 35.0 | 45.0 |
| 60 (TRL) | 21.0 | 52.5 | 65.0 |
| 80 (QRL) | 28.0 | 70.0 | 85.0 |

## 8. WORKMANSHIP AND DEFECTS

8.1 Scabs, slivers and deep scratches shall be ground to vanishing. If scratches, dents, deep or rough grinds, gouges, and other surface imperfections are not scattered, but appear over a large area in excess of what is considered a workmanlike finish, the surface imperfections shall be cause for rejection of the pipe, even if the individual imperfections would be permissible. Repair of defects by welding shall be made before final mill hydrostatic testing.

**8. WORKMANSHIP AND DEFECTS** (Cont'd)

8.2 Cold-formed dents 1/8 inch or deeper with a sharp bottom gouge, groove or scratch and dents extending into the weld or weld heat -affected zone shall be removed as a cylinder. Jacking to remove dents is unacceptable.

8.3 The welds shall not be peaked. If as agreed, peaks shall not exceed 1/16 inch (0.0625 inch). Localized off-seam welds are limited to 1/8 inch (0.125 inch) maximum deviation from weld toe linearity. The deviation from linearity is determined by placing a straight edge of suitable length against the weld cap toe so as to straddle the area in question and measuring the perpendicular distance from the side of the straight edge to the weld toe. Off-seam welds exceeding 1/8 inch shall be nondestructively tested an exhibit no evidence of lack of penetration.

8.4 If as agreed, hard spots larger than 2 inches in diameter, of any size separated by less than 12 inches on either the inside or outside surface of the pipe and having a Brinell hardness of 280 HBW of more shall be removed as a cylinder.

8.5 Laminations shall be considered injurious and shall be cause for rejection. A lamination is defined as a linear discontinuity in the end face ¼ inch or greater in length. Such laminations shall be removed as a cylinder. If the lamination extends to a distance equal to 1/3 of the pipe length, or if laminations are found on both ends of the pipe, the entire length shall be rejected. Nonmetallic inclusion or separation less than ¼ inch are acceptable if separated by at least 4 inches of sound metal. A maximum of six such indications in the full pipe circumference is allowed. Provided the combined length of these defects is less than 1 inch.

8.6 Imperfections with depths greater than 12-1/2 percent of the nominal wall thickness measured from the surface of the pipe shall be considered injurious defects. Such defects may be ground to vanishing provided a smooth, curved surface is maintained and the remaining wall thickness is not less than the minimum wall thickness.

## 9. INSPECTION

9.1 Successful review of the Product Information Package (PIP), as well as any future reference by SWG to the Seller's part number or internal code number in any future contract or purchase, will mean only that no conflict with the specification was found and will not relieve the Seller from meeting all the requirements of this specification.

9.2 Southwest retains the option to inspect the manufacture and testing of all materials, products or systems referenced in this specification that are sold to Southwest.

9.3 Southwest will make appropriate inspections and tests of all materials, products or systems supplied to this specification. SWG will have the right, at their option, to reject any material which fails to conform to this specification. Any such rejection may take place at the manufacturer's facility; the supplier's warehouse or any subsequent delivery location, before or after SWG assumes possession. Notice of rejection will be made promptly thereafter by SWG. The defective product will be replaced or returned for credit at the manufacturer's expense.

9.4 Any changes in the manufacturing of previously approved materials, products or systems described in this material specification for sale to SWG, must be approved by SWG's Engineering Staff. Failure to obtain SWG's approval may be cause for rejection and disqualification as an approved supplier.

## 10. PRODUCT MARKING

Pipe manufactured to this specification will be marked with the following, according to API 5L:

- Manufacturer's name or mark
- "API Spec 5L", products in compliance with multiple standards shall be marked with the name of each
- Specified OD
- Specified wall thickness
- Pipe steel grade (steel name), to include delivery condition (e.g. M – Thermomechanical rolled or formed)
- PSL designation followed by the letter G if Annex G of API 5L is applicable
- Type of pipe
- Mark of SWG inspection representative
- Heat number or Z-number, if applicable
- If the specified hydrostatic test pressure is higher than the test pressure specified by API 5L Tables 24, 25, or 26 the word TESTED shall be marked at the end of the marking followed by the specified test pressure in psi

SWG requires additional marking beyond the expectations of API 5L to include:

- Weight per foot
- Southwest purchase order number
- Process of manufacture as defined by API 5L: (SMLS, HFW, SAW)

## 11. CERTIFICATION

The manufacturers or supplier's material test report (MTR) will be furnished to Southwest. The MTR shall conform to the requirements of API 5L as well as any additional as-agreed requirements or tests specified in this specification. Per 49 CFR 192.67, the MTRs must include the following physical characteristics:

- Yield strength
- Ultimate tensile strength
- Diameter
- Wall thickness
- Seam type
- Chemical composition

Upon the request of Southwest, Electronic Material Test Reports (MTR's) shall also be provided in accordance with the API RP 5MT. Data Interchange method and Data Model shall be agreed to by Southwest prior to purchase. If special software or access is required to view and copy the electronic MTR, the manufacturer shall provide free of charge to Southwest and our Distributor.

## 12. SAFETY DATA SHEETS

In accordance with law, the Seller will supply Safety Data Sheets for all applicable items supplied under this specification to the following:

1) The Receiving Location

2) Engineering Staff

3) Southwest Gas Corporation
Corporate Safety
Mail Station LVA-530
P.O. Box 98510
Las Vegas, NV 89193-8510

## 13. PACKAGING AND PACKAGE MARKING

Packaging and package marking shall conform to ASTM A-700, otherwise the distributor will provide the Company with all relevant packaging specifications for approval. The manufacturer/distributor shall follow their company's packaging and loading specification and requirements.

## 14. STOCK CLASSIFICATION DESCRIPTION

PIPE, API 5L GRADE _____; _____ (SEAMLESS, HFW, SAW)); _____ INCH OD X WT; _____ (SRL, DRL, TRL, QRL); ENDS BEVELED FOR WELDING 30°, +5, -0; MAX LENGTH _____ FT, MIN LENGTH _____ FT. (OPTIONAL).

## 15. LOADING AND TRANSPORTATION

Loaded and Transported pipe shall meet the current applicable specification in CFR 192; Truck; API Recommended Practice 5LT, Recommended Practice for Truck Transportation of Line Pipe.

Rail: API Recommended Practice 5L1, Recommended Practice for Railroad Transportation of Line Pipe.

Barge: API Recommended Practice 5LW, Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels.