Direct Assessment Data Gathering

Period 2

Pipeline Integrity
2017
DOT 192.459

External corrosion control: Examination of buried pipeline when exposed.

• Requires that the exposed surface of pipe must be examined for external corrosion
PHMSA Advisory Bulletin (Jan. 4, 2011)

1. Establishing MAOP (or MOP) Using Record Evidence

As PHMSA and NTSB “recommended”, operators relying on the review of design, construction, inspection, testing and other related data to calculate MAOP or MOP must assure that the records used are reliable. An operator must diligently search, review and scrutinize documents and records, including but not limited to, all as-built drawings, alignment sheets, and specifications, and all design, construction, inspection, testing, maintenance, manufacturer, and other related records. These records shall be traceable, verifiable, and complete. If such a document and records search, review, and verification cannot be satisfactorily completed, the operator cannot rely on this method for calculating MAOP or MOP.
Direct Assessment Data Gathering – Period 2

February 21-23, 2017

Mark Anderson M T S
MAOP Design Pressure

DOT 192.105 (a)

\[ P = \left( \frac{2 S t}{D} \right) \times F \times E \times T \]

- \( P \) = design pressure psi
- \( S \) = yield strength psi
- \( t \) = wall thickness in
- \( D \) = outside diameter in
- \( F \) = Design factor determined in accordance with §192.111
- \( E \) = Longitudinal joint factor determined in accordance with §192.113
- \( T \) = Temperature derating factor determined in accordance with §192.115
Definitions of terms

O’clock

• A measurement to identify the location of a area of concern on the pipe.

• The measurement is to document the location around the circumference of the pipe.
Definitions of terms

O’clock (continued)

12:00

9:00

6:00

3:00
Definitions of terms

O’clock (continued)
Pipeline Outside Diameter

- **Equipment needed**
  - Hammer, scraper and wire brush
  - Flexible tape measurer

- **Method**
  - Clean coating from pipe 360 deg.
  - Measure around the pipe in inches
  - Take measurement and divided by pi (3.142)
  - Record
  - If coating is not removed, measure coating thickness. Take answer and subtract twice the coating thickness.

**IS READING REASONABLE?**
Pipeline Outside Diameter

Clean and measure the pipe
Pipeline Outside Diameter

Record the measurement

Calculate the outside diameter
## Pipeline Outside Diameter

**IS READING REASONABLE?**

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Outside Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”</td>
<td>4.500”</td>
</tr>
<tr>
<td>6”</td>
<td>6.625”</td>
</tr>
<tr>
<td>8”</td>
<td>8.625”</td>
</tr>
<tr>
<td>10”</td>
<td>10.750”</td>
</tr>
<tr>
<td>12”</td>
<td>12.750”</td>
</tr>
<tr>
<td>16”</td>
<td>16.000”</td>
</tr>
</tbody>
</table>
Wall Thickness
Wall Thickness
Wall Thickness
Wall Thickness
Wall Thickness
# Seam Types

<table>
<thead>
<tr>
<th>Specification</th>
<th>Longitudinal Joint Factor</th>
<th>Pipe Class</th>
<th>Pipe Class Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM A53/A53M</td>
<td>Seamless</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Electric resistance welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Furnace butt welded</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>ASTM A106</td>
<td>Seamless</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ASTM A333/A333M</td>
<td>Seamless</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Electric resistance welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ASTM A381</td>
<td>Double submerged arc welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ASTM A671</td>
<td>Electric-fusion welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ASTM A672</td>
<td>Electric-fusion welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ASTM A691</td>
<td>Electric-fusion welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>API 5L</td>
<td>Seamless</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Electric resistance welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Electric flash welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Submerged arc welded</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Furnace butt welded</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>Other</td>
<td>Pipe over 4 inches (102 millimeters)</td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>Other</td>
<td>Pipe 4 inches (102 millimeters) or less</td>
<td></td>
<td>0.6</td>
</tr>
</tbody>
</table>

If the type of longitudinal joint cannot be determined, the joint factor to be used must not exceed that designated for "Other."
# Seam Types

<table>
<thead>
<tr>
<th>Process</th>
<th>Process Dates</th>
<th>Common Diameters (inch)</th>
<th>Max Length (feet)</th>
<th>Unique Identifying Characteristic(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnace Butt Weld (FBW)</td>
<td>1832 - 1954</td>
<td>1/8 – 3</td>
<td>20</td>
<td>No visible weld; relatively short joint length</td>
</tr>
<tr>
<td>Continuous Butt Weld (CBW)</td>
<td>1923 - Current</td>
<td>1/8 – 4-1/2</td>
<td>40</td>
<td>Uniform wall thickness with no visible weld</td>
</tr>
<tr>
<td>Lap Weld</td>
<td>1887 - 1962</td>
<td>1-1/4 – 30</td>
<td>22-26</td>
<td>Waffle-like pattern over the weld seam</td>
</tr>
<tr>
<td>Hammer Weld</td>
<td>1917-1921 (or later)</td>
<td>20-96</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Electric Resistance Welded (ERW)</td>
<td>1928 - Current</td>
<td>1-1/2 – 24</td>
<td>80</td>
<td>Occasional “trim tool marks” near the weld zone</td>
</tr>
<tr>
<td>Flash weld (EFW)</td>
<td>1930 - 1972</td>
<td>8-5/8 – 36</td>
<td>40</td>
<td>Square weld bead shape on the ID and OD</td>
</tr>
<tr>
<td>Single Sided Arc Weld</td>
<td>1925 - 1952 (or later)</td>
<td>To 96</td>
<td>30</td>
<td>Elliptical weld bead on the outside diameter</td>
</tr>
<tr>
<td>Double Submerged-Arc Weld (DSAW)</td>
<td>1946 - Current</td>
<td>16 - 48</td>
<td>40</td>
<td>Elliptical weld bead on the inside and outside diameters</td>
</tr>
<tr>
<td>Seamless</td>
<td>1890 - 1938</td>
<td>To 6 - To 16 - To 26</td>
<td>40</td>
<td>Surface roughness, and helical variation in wall thickness</td>
</tr>
<tr>
<td>Spiral Weld</td>
<td>1948 - Current</td>
<td>To 56</td>
<td>40</td>
<td>Helical weld seam</td>
</tr>
</tbody>
</table>
Seam Types

Historic
- Furnace Butt Weld Pipe
- Continuous Butt Weld Pipe
- Lap Weld
- Hammer Weld
- ERW Low Frequency

Modern
- ERW High Frequency
- Flash Weld
- Single Sub Arc
- Double Submerged Arc
- Seamless
- Spiral Weld

Measurement / Equipment

Coating type

Shrink Sleeve and FBE
Seam Types
Seam Types
Seam Types
Seam Types
Seam Types
Pipe Identification
Pipe Identification

5L-0303  07-2012
API SPEC 5L PSL2 L415MB SAWL

Φ914×28×11910mm

TESTED: 24.2MPa

HEAT No. S214268

PIPE No. 21217721
Fittings

\[ P = (2 \frac{St}{D}) \times F \times E \times T \]
Fittings
Fittings
ANSI Pressure Rating
# Pressure Rating

<table>
<thead>
<tr>
<th>ANSI Rating</th>
<th>Pre 1980</th>
<th>Post 1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>275</td>
<td>285</td>
</tr>
<tr>
<td>300</td>
<td>720</td>
<td>740</td>
</tr>
<tr>
<td>400</td>
<td>960</td>
<td>990</td>
</tr>
<tr>
<td>600</td>
<td>1440</td>
<td>1480</td>
</tr>
<tr>
<td>900</td>
<td>2160</td>
<td>2220</td>
</tr>
</tbody>
</table>

Assuming Under 100 Deg. F
Internal Corrosion

Figure 2 -- Radiograph Setup (Cont.)

NOTE: Do NOT Radiograph any girth weld.

With "Shallow" Slope Change Due to Pipe Bend -- Inclusive Angle > 120 deg

End Point of Half Ponding

Single Film Centered @ 6:00

Minimum of the Least of Half Ponding Point or 10'-0"

Minimum of the Least of Projected

End Point of Ponding

End Point of Half Ponding

FLOW
Internal Corrosion
Internal Corrosion
Internal Corrosion
Internal Corrosion
Internal Corrosion
Missing Data

OD = 36 in
wt = 0.500 in
SMYS = 52,000 psi
Class 1
ERW
T = 65 F
Missing Data

\[ P = (2 \, \text{St/D}) \times F \times E \times T \]

\[ P = \left(\frac{2 \times 52,000 \times .5}{36}\right) \times .72 \times 1 \times 1 \]

\[ P = 1,444 \, \text{psi} \times .72 \times 1 \times 1 \]

\[ P = 1,040 \, \text{psi} \]
Missing Data

Missing Seam

\[ P = (2 \text{ St/D}) \times F \times E \times T \]

\[ P = \left(\frac{(2 \times 52,000 \times 0.5)}{36}\right) \times 0.72 \times 0.8 \times 1 \]

\[ P = 1,444 \text{ psi} \times 0.72 \times 0.8 \times 1 \]

\[ P = 1,040 \text{ psi} \quad \text{New} \ P = 823 \text{ psi} \]
Missing Data

Missing Grade

\[ P = (2 \times \text{St/D}) \times F \times E \times T \]

\[ P = ((2 \times 24,000 \times .5) / 36) \times .72 \times 1 \times 1 \]

\[ P = 667 \text{ psi} \times .72 \times 1 \times 1 \]

\[ P = 1,040 \text{ psi} \quad \text{New P} = 473 \text{ psi} \]
Thank You!

Questions?