API Spec 5L, 44th Edition
Specification for Line Pipe
Effective: October 1, 2008

ISO 3183:2007 (Modified) Steel Pipe for Pipeline Transportation Systems

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API Pipeline Conference
Orlando, Florida

April 2008
API Spec 5L, 44th Edition
Specification for Line Pipe

An Overview
Background and History of Spec 5L

- API 5L initially issued in the 1920s
- Maintained by Subcommittee 5 / Task Group on Line Pipe
- Current 5L 44th edition is an adopted back ISO 3183 specification that contains both API and ISO requirements melded together to result in a single international standard.
Other API Pipeline Documents
(Upstream Subcommittee 5)

RP 5L7 – Unprimed Internal Fusion Bonded Epoxy Coating of Line Pipe, 2nd Ed (Reaffirmed 2004)
RP 5L8 – Field Inspection of New Line Pipe, 2nd Ed (Reaffirmed 2003)
RP 5L9 – Recommended Practice for External Fusion Bonded Epoxy Coating of Line Pipe, 1st Ed (Reaffirmed 2004)
Spec 5LC – Specification for CRA Line Pipe, 3rd Ed (Reaffirmed 2006)
Spec 5LD – Specification for CRA Clad or Lined Steel Pipe, 2nd Ed (1998)
API / ISO Adopt Back Process

• API and ISO Work Groups worked jointly to develop this harmonized 5L / ISO 3183 standard
• The best requirements of both standards were adopted.
• First, a revised ISO 3183 was balloted and published.
• API then adopted back the ISO 3183 standard with a few national adoption requirements listed in Annex N and Annex O.
• Therefore, the API spec 5L consists of 3183 plus (+) the requirements of Annex N and O.
Spec 5 L Format

Spec 5 L format includes:

1. API 5L cover and forward placed on top of the ISO 3183 “Steel pipe for pipeline transportation systems -2nd edition”
   • ISO 3183 is the basis or body of the 5L standard.

2. Notations in the margins of the 3183 standard showing where requirements in Annex N either supplement or replace those in the body
Manufacturing to the Requirements of Spec 5L – Monogram Program

1. Manufacturer applies for Licensing under the Monogram Program
2. Manufacturer operates a quality management system to the requirements of API Spec Q1
3. Manufacturer is audited initially (and then once every 3 years thereafter) to the requirements of Spec Q1 and Spec 5L
4. License is granted once all requirements have been demonstrated
Scope of Spec 5L

- Seamless and welded pipe for pipeline transportation systems
  - Liquid and gas
  - Onshore and offshore
  - Transmission, distribution and utility systems
- 2 PSL (Product Specification Levels)
  - PSL 1 - Basic requirements
  - PSL 2 - Enhanced requirements including mandatory notch toughness, restricted strength ranges, carbon equivalents for improving weldability
- Plain or threaded pipe ends
- Suitable for welding
Products and Product Lines (cont’d)

API Spec 5L, Clause 9.12

Types of pipe ends included in 5L are:

- Plain end pipe
- Belled end pipe
- Plain end pipe for special coupling
- Threaded end pipe
Products and Product Lines

API Spec 5L, Table 2

Seamless pipe
Welded pipe

- Continuous Weld (COWL)
  - A single gas metal Arc pass
  - At least one SAW pass on inside and one on the outside

- Submerged Arc Welded
  - Longitudinal Seam (SAWL)
  - Helical (spiral) Seam (SAWH)

- Electric Welded (EW)
  - Low frequency (LFW, PSL 1 only)
  - High frequency (HFW)

- Laser Welded (LW)
SAWL Process

ID Welding

O-Press Exit

Photos Courtesy of OSM Tubular Camrose
EW Process

Hot Weld

Active Welder

Photos Courtesy of OSM Tubular Camrose
Cutoff and Grinding Pipe Ends

Photos Courtesy of OSM Tubular Camrose
Major Changes to the Current 44\textsuperscript{th} from the 43\textsuperscript{rd} Edition of API Spec 5L

- Current 44\textsuperscript{th} edition includes:
  - Harmonized API 5L and ISO 3183 technical requirements
  - \textbf{Major} changes in format vs the 43\textsuperscript{rd} 5L edition
  - Addition of high strength X90-X120 pipe grades
  - Annexes which include requirements for sour and offshore service and for avoidance of ductile running shear fractures in gas transmission lines
Major Changes to the Current 44th from the 43rd Edition of API Spec 5L

- Grade designations for PSL 2 contain a delivery condition, e.g., heat treatment of the pipe
- Chemical composition limits are more specific and tighter for many grades
- Maximum limits on yield and tensile strength
- Strength levels in US Customary units are converted from metric equivalents and are not rounded to the nearest thousand
  - Conversion results in a slightly different value than in the past
- Tighter pipe end diameter tolerances
Major Changes to the Current 44th from the 43rd Edition of API Spec 5L

Annexes with specific manufacturing or service requirements have been added

- **Annex B:** (Normative) Qualified Manufacturing Procedures for PSL 2
- **Annex G:** (Normative) Requirements of Ductile Running Fracture Propagation for PSL 2
- **Annex H:** (Normative) Sour Service PSL 2 Pipe
- **Annex J:** (Normative) Offshore Service PSL 2 Pipe
- **Annex N:** (Normative) Identification of Deviations (National Adoption Annex)
- **Annex O:** (Informative) API Monogram Program (National Adoption Annex)
(Regional) Annex N – Deviations from ISO 3183 and API Spec 5L

1. Definition for “Sample” and “Test Piece” added
2. 6.2.1, Table 1 on Pipe/steel grades and delivery conditions – added restrictions for intermediate grades
3. 7.2 c) 34) – Alternate pipe length marking allowances, if agreed to by manufacturer and purchaser
4. 7.2 c) 56) - Changes in hardness testing as permitted in Annex H – PSL 2 pipe ordered for sour service
5. 7.2 c) 57) – Changes in hardness testing as permitted in Annex J – PSL 2 pipe ordered for offshore service
6. 10.2.11 - Reprocessing – allowances for failure to meet mechanical properties, manufacturer can heat treat entire lot and treat as new lot.
7. 10.2.12 - New retesting requirements - allowances for failure to meet testing, manufacturer can heat treat entire lot and treat as new lot
8. Section 11 - Fifteen marking changes to accommodate the API Monogram program or reference to API Spec 5L
9. D.2.1.2 – Some allowable qualification test substitutions based on the 5L, 43rd Edition
10. D.3.1.1 – Only specific (cited) codes are acceptable for welder qualification
11. H.7.3.3.3 & J.8.3.2.3 c) Hardness test location changes
Ordering 5L Line Pipe (API Spec Q1, Section 7.4)

API Spec 5L, Section 7
1. Purchase order must first include general information, Clause 7.1
   - Attributes such as pipe diameter, wall thickness, quantity, grade, PSL and applicability of individual annex requirements

2. Purchase order must indicate which provisions of Clause 7.2 sub clauses actually apply
   - Items subjected to mandatory agreements
     • References provided in Clause 7.2.a
   - Items that apply as prescribed unless otherwise agreed
     • References provided in Clause 7.2.b
Ordering 5L Line Pipe (API Spec Q1, Section 7.4) cont’d

3. Purchase order should identify the applicability of all subclauses of Clause 7.2
   - 55 agreement clauses
   - These requirements can be project specific
   - Failure to specify will result in requirement not being met or default to the specific clause in the body
   - Many of these requirements are addressed in the Data Sheet attached to the Tender or Invitation to Bid documents
Chemical Composition Requirements

API Spec 5L, Tables 4 (PSL 1) & 5 (PSL 2)

- More extensive requirements for PSL 2 than for PSL 1
- Tighter requirements on chemical alloying elements for PSL 2
- Mandatory CE (carbon equivalent) requirements for PSL 2 promotes better weldability
Pipe Grades

• Designation of grade is related to minimum yield strength
  – SI / USC units
• Yield strength ranges from:
  – L175/A25 (25.4ksi) to L830/X120 (120.4ksi)
• Requirements include minimum and maximum strengths
• Minimum strength requirement on weld seams
• Specification permits intermediate grades
Examples of Pipe Grades, PSL 2

API Spec 5L, Table 7 (abbreviated)

<table>
<thead>
<tr>
<th>Pipe Grade</th>
<th>Yield Strength, ksi</th>
<th>Tensile Strength, ksi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USC / SI</td>
<td></td>
</tr>
<tr>
<td>L245 / A25</td>
<td>35.5</td>
<td>65.3</td>
</tr>
<tr>
<td>L360 / X52</td>
<td>52.2</td>
<td>76.9</td>
</tr>
<tr>
<td>L415 / X60</td>
<td>60.2</td>
<td>81.9</td>
</tr>
<tr>
<td>L555 / X80</td>
<td>80.5</td>
<td>102.3</td>
</tr>
<tr>
<td>L690 / X100</td>
<td>100.1</td>
<td>121.8</td>
</tr>
<tr>
<td>L830 / X120</td>
<td>120.4</td>
<td>152.3</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>L245 / A25</td>
<td>60.2</td>
<td>110.2</td>
</tr>
<tr>
<td>L360 / X52</td>
<td>66.7</td>
<td>110.2</td>
</tr>
<tr>
<td>L415 / X60</td>
<td>75.4</td>
<td>110.2</td>
</tr>
<tr>
<td>L555 / X80</td>
<td>60.6</td>
<td>119.7</td>
</tr>
<tr>
<td>L690 / X100</td>
<td>110.2</td>
<td>143.6</td>
</tr>
<tr>
<td>L830 / X120</td>
<td>132.7</td>
<td>166.1</td>
</tr>
</tbody>
</table>
## Product Specification Levels (PSL) Comparison

### Some differences between PSL 1 and PSL 2

<table>
<thead>
<tr>
<th>Attribute</th>
<th>PSL 1</th>
<th>PSL 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Range</td>
<td>A25 (L175) thru X70 (L485)</td>
<td>B (L245) thru X120 (L830)</td>
</tr>
<tr>
<td>Chemistry</td>
<td>C/Mn/P/S</td>
<td>C/Si/Mn/P/S/V/Nb/Ti/CE</td>
</tr>
<tr>
<td>End Condition</td>
<td>Plain, threaded or belled</td>
<td>Plain End</td>
</tr>
<tr>
<td>Seam Welding</td>
<td>All methods</td>
<td>Not COW or LW</td>
</tr>
<tr>
<td>EW Frequency</td>
<td>No minimum</td>
<td>70 KHz minimum</td>
</tr>
<tr>
<td>Yield Strength, min/max</td>
<td>Specified/None</td>
<td>Specified/Specified</td>
</tr>
<tr>
<td>Fracture toughness</td>
<td>If stipulated by customer</td>
<td>Mandatory minimums</td>
</tr>
</tbody>
</table>
Testing and Inspection Requirements  
(API Spec Q1, Section 8.2.4)

API Spec 5L, Tables 17 (PSL1) & 18 (PSL2)

- Testing requirements include, type of test, lot size and frequency
- Tables include requirements for:
  - Chemical analysis
  - Mechanical testing (tensile, bending, Charpy toughness, hardness)
  - Macro- and micro-scopic testing of welds
  - Hydrostatic testing
  - Visual and non-destructive testing
<table>
<thead>
<tr>
<th>Parameter Item</th>
<th>API 5L 43rd Edition</th>
<th></th>
<th>API 5L 44th Edition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Body OD (from nom.)</td>
<td>Table 7</td>
<td>min -3.2 mm</td>
<td>max 6.4 mm</td>
<td>Table 10</td>
</tr>
<tr>
<td>2. End OD (from nom)</td>
<td>Table 8</td>
<td>min -0.8 mm</td>
<td>max 2.4 mm</td>
<td>Table 10</td>
</tr>
<tr>
<td>3. End-diameter average difference</td>
<td>Table 8</td>
<td></td>
<td>max 2.4 mm</td>
<td></td>
</tr>
<tr>
<td>4. End Diameter Out of round axis tolerance, spec OD</td>
<td>Table 8</td>
<td>min -10.7 mm</td>
<td>max 10.7 mm</td>
<td></td>
</tr>
<tr>
<td>5. Out of round - end, max differential min &amp; max OD</td>
<td>Table 8</td>
<td></td>
<td>max 12.7 mm</td>
<td></td>
</tr>
<tr>
<td>6. Out of round - body, max differential min &amp; max OD</td>
<td>Table 10</td>
<td>min -1.6 mm</td>
<td>max 1.6 mm</td>
<td></td>
</tr>
<tr>
<td>7. Local wall thickness</td>
<td>Table 9</td>
<td>min -1.0 mm</td>
<td>max +2.5 mm</td>
<td>Table 11</td>
</tr>
<tr>
<td>8. Weight, single lengths</td>
<td>Table 10</td>
<td>min -1.75 %</td>
<td>max 10 %</td>
<td></td>
</tr>
<tr>
<td>9. Weight, carload</td>
<td>Table 10</td>
<td>min -1.75 %</td>
<td>max 1.4 mm</td>
<td></td>
</tr>
<tr>
<td>10. Weight, order items</td>
<td>Table 10</td>
<td>max -1.75 %</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>Table 11</td>
<td>min 8.53 m</td>
<td>max 25.91 m</td>
<td>Table 12</td>
</tr>
<tr>
<td>11. Length</td>
<td>Table 11</td>
<td>min 21.34 m</td>
<td>max 25.91 m</td>
<td></td>
</tr>
<tr>
<td>Mill Jointers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Length avg</td>
<td>Table 11</td>
<td>max 25.91 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Finished jointer length</td>
<td>Table 11</td>
<td>max 25.91 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Sub-joint Length</td>
<td>7.7</td>
<td>min 1.52 m</td>
<td>max 8.13 m</td>
<td>min 1.5 m</td>
</tr>
<tr>
<td>15. Long seam offset</td>
<td>A.2</td>
<td>min 51 mm</td>
<td>max 203 mm</td>
<td>A.2.4</td>
</tr>
<tr>
<td>16. WPS/PQR &amp; welder qualification</td>
<td>A.1</td>
<td></td>
<td>max 58 mm</td>
<td>max 200 mm</td>
</tr>
<tr>
<td>17. Weld Height - any point</td>
<td>A.2</td>
<td>max 3.2 mm</td>
<td>A.2.3</td>
<td>max 3.5 mm</td>
</tr>
<tr>
<td>18. Weld Height - overlap</td>
<td>A.2</td>
<td>max 3.2 mm</td>
<td>A.2.3</td>
<td>max 3.5 mm</td>
</tr>
<tr>
<td>19. Radiography</td>
<td>A.4</td>
<td>min 100% Circ</td>
<td>A.4</td>
<td>min 100% circ</td>
</tr>
<tr>
<td>Defects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Dent depth in body without gouge</td>
<td>7.8.1</td>
<td>max 6.4 mm</td>
<td>9.10.5.2</td>
<td>max 6.4 mm</td>
</tr>
<tr>
<td>21. Dent depth in body with gouge</td>
<td>7.8.1</td>
<td>max 3.2 mm</td>
<td>9.10.5.2</td>
<td>max 3.2 mm</td>
</tr>
<tr>
<td>22. Dent length in body (without gouge)</td>
<td>7.8.1</td>
<td>max 50%  OD</td>
<td>9.10.5.2</td>
<td>max 0.5 OD</td>
</tr>
<tr>
<td>23. Offset plate edges</td>
<td>7.8.2</td>
<td>max 1.6 mm</td>
<td>9.13.1</td>
<td>max 1.5 mm</td>
</tr>
<tr>
<td>24. Out of line weld bead</td>
<td>7.8.2</td>
<td>max complete fusion per NDT</td>
<td>9.13.3</td>
<td>max 3.0 mm</td>
</tr>
<tr>
<td>25. ID and OD bead height</td>
<td>7.8.4</td>
<td>min 0 mm</td>
<td>9.13.3</td>
<td>max 3.5 mm</td>
</tr>
<tr>
<td>26. Hardspot hardness max</td>
<td>7.8.8</td>
<td>max 35 mm HRC</td>
<td>9.10.6</td>
<td>max 35 HRC</td>
</tr>
<tr>
<td>27. Hardspot dimensions - any direction</td>
<td>7.8.8</td>
<td>max 50.8 mm</td>
<td>9.10.6</td>
<td>max 50 mm</td>
</tr>
<tr>
<td>28. Cracks, sweats, leaks</td>
<td>7.8.9</td>
<td>max 0 mm</td>
<td>9.10.6</td>
<td>max 50 mm</td>
</tr>
<tr>
<td>29. Defects or inclusions in bevel face</td>
<td>7.8.10</td>
<td>max 6.4 mm</td>
<td>9.10.4</td>
<td>max 6.4 mm</td>
</tr>
<tr>
<td>30. Laminations in body, minor dimension (if assoc'd with 31)</td>
<td>7.8.10</td>
<td>max 19.0 mm</td>
<td>9.10.4</td>
<td>max 6.4 mm</td>
</tr>
<tr>
<td>31. Laminations in body, area (if assoc'd with 30)</td>
<td>7.8.10</td>
<td>max 7742 mm^2</td>
<td>9.10.4</td>
<td>max 6.4 mm</td>
</tr>
<tr>
<td>32. Arc Burns</td>
<td>7.8.11</td>
<td>max 0 mm</td>
<td>9.10.4</td>
<td>max 0 mm</td>
</tr>
<tr>
<td>33. Undercut depth (see clause), lesser of</td>
<td>7.8.12a</td>
<td>min -12.5 %</td>
<td>9.10.2</td>
<td>max 0 mm</td>
</tr>
<tr>
<td>34. Undercut length (see clause)</td>
<td>7.8.12a</td>
<td>max 6.4 mm</td>
<td>9.10.2</td>
<td>max 6.4 mm</td>
</tr>
<tr>
<td>35. Other defects depth -</td>
<td>7.8.14</td>
<td>min 12.5% t</td>
<td>9.10.7</td>
<td>max 0.125 t</td>
</tr>
<tr>
<td>36. Bevel Angle</td>
<td>7.9.3</td>
<td>min 30 deg</td>
<td>max 35 deg</td>
<td>min 30 deg</td>
</tr>
<tr>
<td>37. Root face</td>
<td>7.9.3</td>
<td>min 0.8 mm</td>
<td>max 2.4 mm</td>
<td>min 0.8 mm</td>
</tr>
<tr>
<td>38. Taper Angle</td>
<td>7.9.3</td>
<td>max 7 deg</td>
<td>9.13.2.2</td>
<td>max 0.5 mm</td>
</tr>
<tr>
<td>39. End Square</td>
<td>7.9.3</td>
<td>max 1.6 mm</td>
<td>9.10.5.1</td>
<td>max 3.2 mm</td>
</tr>
<tr>
<td>40. ID flush-off distance/height</td>
<td>7.9.3</td>
<td>approx 101.6 mm</td>
<td>9.10.5.1</td>
<td>max 3.2 mm</td>
</tr>
<tr>
<td>41. local OOR</td>
<td>7.9.3</td>
<td>max 0.2% length</td>
<td>9.11.3.4</td>
<td>max 0.2% length</td>
</tr>
<tr>
<td>42. Straightness</td>
<td>7.6</td>
<td>max 0.2% length</td>
<td>9.11.3.4</td>
<td>max 0.2% length</td>
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<tr>
<td>43. Straightness - local (in 1 m)</td>
<td></td>
<td></td>
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</table>

**Where** API 5L (44th ed) is less restrictive than API 5L (43rd ed)

API 5L (44th ed) is identical to API 5L (43rd ed)

API 5L (44th ed) is marginally more restrictive than API 5L (43rd ed)

API 5L (44th ed) is more restrictive than API 5L (43rd ed)
Pipe End Diameter Tolerances

Graph Courtesy of OSM Tubular Camrose
### Dimensional Requirements (cont’d)

**API Spec 5L, Clauses 9.11 thru 9.14**

Weldment tolerances and dimensions

<table>
<thead>
<tr>
<th>Weld detail</th>
<th>Table / figure</th>
</tr>
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<tbody>
<tr>
<td>Max. permissible radial offset for SAW and COW pipes</td>
<td>14 / 4a &amp; 4b</td>
</tr>
<tr>
<td>Maximum permissible groove for EW and LW</td>
<td>15</td>
</tr>
<tr>
<td>Maximum permissible weld bead height for SAW and COW pipe</td>
<td>16</td>
</tr>
</tbody>
</table>
Dimensional Verifications

Photos Courtesy of OSM Tubular Camrose
## Mechanical Property Comparison

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Orient’n/Location</th>
<th>Size</th>
<th>Specifics</th>
<th>API 5L 43rd Edition</th>
<th>API 5L 44th Edition (1116 bar)</th>
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<tbody>
<tr>
<td>Chemistry</td>
<td>Heat Product</td>
<td>NA</td>
<td>Heat Chemical Composition</td>
<td>RT</td>
<td>See composition limits</td>
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<td>NA</td>
<td>Heat Chemical Composition</td>
<td>RT</td>
<td>See composition limits</td>
<td>RT</td>
</tr>
<tr>
<td>Tensile</td>
<td>TPA</td>
<td>FS or RB</td>
<td>0.5% EUL YS (MPa)</td>
<td>RT</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>TPA</td>
<td>FS or RB</td>
<td>TS (MPa)</td>
<td>RT</td>
<td>-</td>
</tr>
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<td>TPA</td>
<td>FS or RB</td>
<td>Y.T</td>
<td>RT</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>TPA</td>
<td>FS or RB</td>
<td>Elong in 2” g.l. (%)</td>
<td>RT</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>TLW Flat Strap</td>
<td>FS or RB</td>
<td>TS (MPa)</td>
<td>RT</td>
<td>-</td>
</tr>
<tr>
<td>Charpy</td>
<td>TPA full-equiv.</td>
<td>CVN En (J)</td>
<td>0</td>
<td>20</td>
<td>27</td>
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<td>TPA full-equiv.</td>
<td>Ductility (%shr)</td>
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<tr>
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<td>TLW full-equiv.</td>
<td>CVN En (J)</td>
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<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>TLW HAZ full-equiv.</td>
<td>CVN En (J)</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DWTT</td>
<td>TPA full PN</td>
<td>DWTT Ductility (%shr)</td>
<td>0</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td>Guided Bend</td>
<td>TLW full</td>
<td>Guided Bend Crack - weld/HAZ (mm)</td>
<td>RT</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hard spot</td>
<td>BM/HAZ/WM full</td>
<td>Rockwell C Hardness (HRC)</td>
<td>RT</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Where:
- **TPA** Transverse pipe axis
- **BM/HAZ/WM** Base Metal/Heat affected zone/weld metal
- **full-equiv** full-sized equivalent
- **full PN** Full-sized Pressed Notch DWTT
- **RT** Room temperature
- **AR** As rolled
- **FS** Flattened strap specimen
- **RB** Round bar specimen
- **RE** Ring expansion
- **-** Not specified

And where:
- API 5L (44th ed) is less restrictive than API 5L (43rd ed)
- API 5L (44th ed) is identical to API 5L (43rd ed)
- API 5L (44th ed) is marginally more restrictive than API 5L (43rd ed)
- API 5L (44th ed) is more restrictive than API 5L (43rd ed)
Tensile Testing

Photo Courtesy of OSM Tubular Camrose
Guided Bend Test

Photo Courtesy of OSM Tubular Camrose
Hardness Test

Photo Courtesy of OSM Tubular Camrose
Crush Test

Photo Courtesy of OSM Tubular Camrose
Surface Conditions, Imperfections and Defects

- Described in Clause 9.10
  - Undercuts in seam welds
  - Arc burns
  - Laminations
  - Flat spots, peaks, dents and gouges
  - Hard spots
  - Other imperfections, such as gouges

- Acceptance criteria are given to determine when these are considered a defect
Disposition of Pipe with Defects  
(API Spec Q1, Section 8.3)

• Defects and imperfections
  – **Defect, Clause 4.13** — an imperfection of a size or density greater than the acceptance criteria
  – **Imperfection, Clause 4.20** — a discontinuity or irregularity detectable by inspection

• Disposition of defects is addressed in section C
  – **Defects are treated in accordance with Clause C.2 and C.3**
    • Removed by grinding or repaired by welding if in a seam weld made with filler metal
    • A section containing the defect is removed by cutting
    • The pipe is rejected
Non-Destructive Inspection (NDI) Requirements

- Types of inspections required are based on the product form and the PSL level and include:
  - Visual for defects and dimensions
  - Radiographic
  - Electromagnetic
  - Ultrasonic
  - Magnetic particle
  - Hydrotesting
Non-Destructive Inspection (NDI) Requirements (cont’d)

Visual (API Spec 5L, Clauses 10.2.7 and 10.2.8)

• Visual Inspection
  – All pipe shall be 100% visually inspected over its entire length on its external surface and as much as is practical on the inside surface

• Qualifications of visual inspectors are identified

• Covered Inspections
  – OD
  – Out of roundness
  – Wall thickness
  – Flat spots in SAW and COW welded pipe
Non-Destructive Inspection (NDI) Requirements (cont’d)

Radiography (API Spec 5L, Annex E)
Radiographic Inspection of weld seams
• Clause E.4 and sub clauses
  – Volumetric imperfections (Slag or Gas pockets) Acceptance criteria are given in Tables E.5 and E.6
• Linear imperfections (cracks, lack of penetration or fusion) Acceptance criteria for are given in Tables E.8
Radiographic Inspection

Photo Courtesy of OSM Tubular Camrose
Non-Destructive Inspection (NDI) Requirements (cont’d)

Ultrasonic and Electromagnetic Inspection (API Spec 5L, Annex E)
  - Acceptance criteria given in Clauses E.5.5 and E.5.6
  - Disposition of pipes containing defects Clause E.10
    - Remove defect by grinding
    - Repair by welding if permitted
    - Cut the section with defect out
    - Reject the pipe
  - Magnetic particle inspection Clause E.6
    - If this method is employed for inspection of surface defects the entire length shall be inspected
Electromagnetic Inspection

Photo Courtesy of OSM Tubular Camrose
Non-Destructive Inspection (NDI) Requirements (cont’d)

Hydrostatic Testing

- **Test requirements are given in Clause 10.2.6 and Table 26**
- **Table 26 lists the standard and alternative test pressures as a % of SMYS (specified minimum yield strength)
Hydrotester SAW Line

Photo Courtesy of OSM Tubular Camrose
Hydrotester EW Line

Photo Courtesy of OSM Tubular Camrose
Marking (API Spec Q1, Section 7.5.3)

API Spec 5L, Section 11 and Annexes N and O

- Very prescriptive including the pipe attributes that must be marked on the pipe
  - *i.e.*, Standard, diameter, wall thickness, grade, PSL, type of pipe (seamless or type of weld), annexes, and manufacturer

- Provides specific examples on the marking sequence
  - Both USC (US Customary) and SI units

- Allows dual marking of Spec 5L and ISO 3183 if requirements of both specifications are met
Final Stencil Marking

Photo Courtesy of OSM Tubular Camrose
Monogramming
(API Spec Q1, ANNEX A)

API Spec 5L, Annex O

- Application of the API Trademark is permitted only by a licensee
- Provides specific examples on the marking sequence
  - Both USC (US Customary) and SI units
- In addition to annex allows marking of other standards if the requirements are met.
- Includes marking of couplings and small diameter pipe bundle tags
Retention of Records
(API Spec Q1, Section 4.2.4)

API Spec 5L, Section 13

- Requires that records be retained for a minimum of 3 years (Spec Q1 requires a 5 year minimum retention)
- Section contains a list of the pertinent test and examination records
- Heat number
  - Tensile/Guided Bend/Hydrotest, etc.
  - Nondestructive Inspections
  - Qualification for NDI Personnel
  - Welding WPS and PQRs
Shipping  
(API Spec Q1, Section 7.5.5)

API Spec 5L, Section 14 – Pipe loading
  – Manufacturer is responsible for properly loading the pipe
  – Loading shall comply with jurisdictional rules, codes and standards
    • API RP 5L1 is referenced for rail transport
    • API RP 5LW is referenced for marine transport by ship or barge.
Pipe Loading

Photo Courtesy of OSM Tubular Camrose
Transition from API 5L, 43rd Ed to 44th Ed

API modified their policy and extended the 6 month transition period to 12 months to allow manufacturers to switch their QA and manufacturing processes to the 44th edition requirements.

Published Date
October 1, 2007

12 months

Effective Date
October 1, 2008

Industry Recommendation:
OPS/DOT harmonize the October 1, 2008 effective date with API for the 44th edition of 5L
Reasons for Extension of 5L Effective Date

Manufacturer Issues
* Rewrite pipe tracking, marking and release computer systems;
* Specify/purchase/manufacture new gauges;
* Review/modify/purchase roll/die sets & marking systems; and
* Modify mechanical & hydro testing equipment & software, and
* Rewrite quality system documentation.

Operator Issues
* Backlog/in-process orders starting on 43rd finishing 44th edition;
* Mixed application of 43rd and 44th edition pipe; and
* Inventory availability of new edition during transition.
Contact Information

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