**QW-161.6 Longitudinal Face Bend.** The weld is parallel to the longitudinal axis of the specimen, which is bent so that the face surface becomes the convex surface of the bent specimen. Longitudinal face-bend test specimens shall conform to the dimensions shown in Figure QW-462.3(b).

**QW-161.7 Longitudinal Root Bend.** The weld is parallel to the longitudinal axis of the specimen, which is bent so that the root surface becomes the convex side of the bent specimen. Longitudinal root-bend test specimens shall conform to the dimensions shown in Figure QW-462.3(b).

**QW-162 GUIDED-BEND TEST PROCEDURE**

**QW-162.1 Jigs.** Guided-bend specimens shall be bent in test jigs that are in substantial accordance with QW-466. When using the jigs illustrated in Figure QW-466.1 or Figure QW-466.2, the side of the specimen turned toward the gap of the jig shall be the face for face-bend specimens, the root for root-bend specimens, and the side with the greater discontinuities, if any, for side-bend specimens. The specimen shall be forced into the die by applying load on the plunger until the curvature of the specimen is such that a 

\[ \frac{1}{8} \text{ in. (3 mm)} \]

cannot be inserted between the specimen and the die of Figure QW-466.1, or the specimen is bottom ejected if the roller type of jig (Figure QW-466.2) is used.

When using the wrap around jig (Figure QW-466.3), the side of the specimen turned toward the roller shall be the face for face-bend specimens, the root for root-bend specimens, and the side with the greater discontinuities, if any, for side-bend specimens.

When specimens wider than 1 1/2 in. (38 mm) are to be bent as permitted in Figure QW-462.2, the test jig mandrel must be at least 1/4 in. (6 mm) wider than the specimen width.

**QW-163 ACCEPTANCE CRITERIA — BEND TESTS**

The weld and heat-affected zone of a transverse weld-bend specimen shall be completely within the bent portion of the specimen after testing. The guided-bend specimens shall have no open discontinuity in the weld or heat-affected zone exceeding \( \frac{1}{16} \text{ in. (1.5 mm)} \), measured in any direction on the convex surface of the specimen after bending. Open discontinuities occurring on the corners of the specimen during testing shall not be considered unless there is definite evidence that they result from lack of fusion, slag inclusions, or other internal discontinuities. For corrosion-resistant weld overlay cladding, no open discontinuity exceeding \( \frac{1}{16} \text{ in. (1.5 mm)} \), measured in any direction, shall be permitted in the cladding, and no open discontinuity exceeding \( \frac{1}{16} \text{ in. (1.5 mm)} \) shall be permitted along the approximate weld interface.

**QW-170 TOUGHNESS TESTS**

**QW-171 TOUGHNESS TESTS**

**QW-171.1 General.** Toughness tests shall be made when required by referencing codes. Test procedures and apparatus shall conform to the requirements of the referencing code. When not specified by the referencing code, the test procedures and apparatus shall conform to the requirements of SA-370.

**QW-171.2 Acceptance.** The acceptance criteria shall be in accordance with that Section specifying toughness testing requirements.

**QW-171.3 Location and Orientation of Test Specimens.** The toughness test specimen removal and preparation requirements shall be as given in the Section requiring such tests.

When qualifying pipe in the 5G or 6G position, the toughness specimens shall be removed from the shaded portion of Figure QW-463.1(f).

**QW-172 TOUGHNESS TESTS — DROP WEIGHT**

**QW-172.1 General.** Drop-weight tests shall be made when required by referencing codes. Test procedures and apparatus shall conform to the requirements of the referencing code. When not specified by the referencing code, the test procedures and apparatus shall conform to the requirements of ASTM specification E208.

**QW-172.2 Acceptance.** The toughness test specimen removal and preparation requirements shall be as given in the Section requiring such tests.

When qualifying pipe in the 5G or 6G position, the toughness specimens shall be removed from the shaded portion of Figure QW-463.1(f).

**QW-180 FILLET-WELD TESTS**

**QW-181 PROCEDURE AND PERFORMANCE QUALIFICATION SPECIMENS**

**QW-181.1 Procedure.** The dimensions and preparation of the fillet-weld test coupon for procedure qualification as required in QW-202 shall conform to the requirements in Figure QW-462.4(a) or Figure QW-462.4(d). The test coupon for plate-to-plate shall be cut transversely to provide five test specimen sections, each approximately 2 in. (50 mm) long. For pipe-to-plate or pipe-to-pipe, the test coupon shall be cut transversely to provide four approximately equal test specimen sections. The test specimens shall be macro-examined to the requirements of QW-183.
Figure QW-466.1
Test Jig Dimensions

As required
As required

Tapped hole to suit testing machine

Hardened rollers 1½ in. (38 mm) may be substituted for jig shoulders

Shoulers hardened and greased

Yoke 7½ in. (190 mm)
9 in. (225 mm)

Plunger 3½ in. (75 mm)
2 in. (50 mm)

2 in. (50 mm)

3/4 in. (19 mm)

3/4 in. (19 mm)

1¼ in. (6 mm)

1⅛ in. (29 mm)

3/4 in. (19 mm)

3/4 in. (19 mm)

3/4 in. (19 mm)

3/4 in. (19 mm)

3/4 in. (19 mm)

3/4 in. (19 mm)

As required

U.S. Customary Units

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness of Specimen, ( t ), in.</th>
<th>( A ), in.</th>
<th>( B ), in.</th>
<th>( C ), in.</th>
<th>( D ), in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-No. 23 to P-No. 21 through P-No. 25; P-No. 21 through P-No. 25 with F-No. 23 or 26; P-No. 35; any P-No. metal with F-No. 33, 36, or 37</td>
<td>( \frac{1}{8} )</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{1}{2} )</td>
</tr>
<tr>
<td>P-No. 11A, P-No. 11B; P-No. 25 to P-No. 21 or P-No. 22 or P-No. 25</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{4} )</td>
</tr>
<tr>
<td>P-No. 51; P-No. 49</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{5}{8} )</td>
<td>( \frac{5}{8} )</td>
</tr>
<tr>
<td>P-No. 52; P-No. 53; P-No. 61; P-No. 62</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{4} )</td>
</tr>
<tr>
<td>All others with greater than or equal to 20% elongation</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{4} )</td>
</tr>
<tr>
<td>Materials with 3% to less than 20% elongation</td>
<td>( \frac{3}{8} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{4} )</td>
<td>( \frac{3}{4} )</td>
</tr>
</tbody>
</table>

[Note (1)]

A + 2t + 1/8
C/2 + 1/16

NOTE TO EDITOR: Insert "(max.)" below both "A, in." and "B, in." as part of both column headers.

NOTES TO EDITOR: (1) Replace equations with blue equations as shown. The new equation is to replace the existing equations in six places in each column. (2) For all single values in columns C & D, insert the word "max." after each.
### Test Jig Dimensions (Cont'd)

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness of Specimen, $t$, mm</th>
<th>$A$, mm</th>
<th>$B$, mm</th>
<th>$C$, mm</th>
<th>$D$, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-No. 23 to P-No. 21 through P-No. 25; P-No. 21 through P-No. 25 with F-No. 23 or 26; P-No. 35; any P-No. metal with F-No. 33, 36, or 37</td>
<td>Less than 3</td>
<td>$6\frac{7}{16}t$</td>
<td>$8\frac{3}{16}t$</td>
<td>$10\frac{1}{2}t + 1.6$</td>
<td>$9\frac{1}{8}t + 0.8$</td>
</tr>
<tr>
<td>P-No. 11A, P-No. 11B; P-No. 25 to P-No. 21 or P-No. 22 or P-No. 25</td>
<td>Less than 10</td>
<td>$6\frac{7}{16}t$</td>
<td>$8\frac{3}{16}t$</td>
<td>$8\frac{1}{2}t + 3.2$</td>
<td>$4\frac{7}{16}t + 1.6$</td>
</tr>
<tr>
<td>P-No. 51; P-No. 49</td>
<td>Less than 10</td>
<td>$8t$</td>
<td>$4t$</td>
<td>$10t + 3.2$</td>
<td>$5t + 1.6$</td>
</tr>
<tr>
<td>P-No. 52; P-No. 53; P-No. 61; P-No. 62</td>
<td>Less than 10</td>
<td>$10t$</td>
<td>$5t$</td>
<td>$12t + 3.2$</td>
<td>$6t + 1.6$</td>
</tr>
<tr>
<td>All others with greater than or equal to 20% elongation</td>
<td>Less than 10</td>
<td>$4t$</td>
<td>$2t$</td>
<td>$6t + 3.2$</td>
<td>$3t + 1.6$</td>
</tr>
<tr>
<td>Materials with 3% to less than 20% elongation</td>
<td>[Note (1)]</td>
<td>$32\frac{7}{8}t$</td>
<td>$16\frac{7}{8}t$</td>
<td>$A + 2t + 1.6$</td>
<td>$C/2 + 0.8$</td>
</tr>
</tbody>
</table>

**GENERAL NOTES:**

(a) For P-Numbers, see QW/QB-422; for F-Numbers, see QW-432.

(b) For guided-bend jig configuration, see QW-466.2, QW-466.3, and QW-466.4.

(c) The weld and heat-affected zone, in the case of a transverse weld bend specimen, shall be completely within the bend portion of the specimen after testing.

(d) When the bending properties of the weldment make it unlikely that the requirements of General Note (c) can be met, the wrap around jig shown in Figure QW-466.3 should be considered.

**NOTE:**

(1) The dimensions of the test jig shall be such as to give the bend test specimen a calculated percent outer fiber elongation equal to at least that of the base material with the lower minimum elongation as specified in the base material specification.

\[
\text{percent outer fiber elongation} = \frac{100t}{A + 2t + 3.0}
\]

The following equation is provided for convenience in calculating the bend specimen thickness:

\[
\text{thickness of specimen} = \frac{A \times \text{percent elongation}}{\left(100 - \text{percent elongation}\right)}
\]

**NOTES TO EDITORS:** (1) Replace equations with blue equations as shown. The new equation is to replace the existing equations in six places in each column. (2) For all single values in columns C & D, insert the word "max." after each.