Width = 0.25 in. ± 0.02 in. (6.4 mm ± 0.5 mm)

Wall thickness

6.0 in. to 8.5 in. (150 mm to 215 mm)

Length of test specimen
12.0 in. to 17.0 in. (300 mm to 430 mm)

(c) Guided Side-Bend Test Specimen

Ø 0.75 in. (19 mm)

R = 0.50 in. to 1.00 in. (13 mm to 25 mm)

60 deg ±10 deg

Centerline of butt fusion

(d) Guided Side-Bend Test Machine Dimensions

Fig. QF-463(d) was revised under record# 13-467 and should have been incorporated in 2017 edition, see next pages
Figure QF-463
Bend Test Specimen Removal, Configuration, and Testing (Cont’d)

width = 0.25 in. +/- 0.02 in. (6.4 mm +/- 0.5 mm)

NOTE TO VOTERS & EDITORS: For recirculation ballot, the change of "t" to "width" here is the only change being voted.

width = 0.25 in. +/- 0.02 in. (6.4 mm +/- 0.5 mm)

t = 0.25" +/- 0.02"
(6.4mm +/- 0.5mm)

(c) Guided Side-Bend Test Specimen

REPLACE

wall thickness

REPLACE

Loading Nose with Radius
R= 0.50" +/- 0.02"
(12.7mm +/- 0.5mm)

2.31" +/- 0.01"
(58.7mm +/- 0.2mm)

Centerline of Butt Fusion

(d) Guided Side-Bend Test Machine Dimensions
Figure QF-463
Bend Test Specimen Removal, Configuration, and Testing (Cont’d)

Width = wall thickness

Length of test specimen
12.0 in. to 17.0 in. (300 mm to 430 mm)

6.0 in. to 8.5 in. (150 mm to 215 mm)

(c) Guided Side-Bend Test Specimen

(d) Guided Side-Bend Test Machine Dimensions

60 deg ±10 deg

Centerline of butt fusion

R = 0.50 in. to 1.00 in. (13 mm to 25 mm)

t = 0.25 in. to 0.50 in. (6 mm to 13 mm)

Ø 0.75 in. (19 mm)

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Bend Angle 90°

Side Bend Test Specimen

Loading Nose with Radius
R = 0.50” ± 0.02”
(12.7mm ± 0.5mm)

Ø .75 in. Rotatable Support

2.31” ± 0.01”
(58.7mm ± 0.2mm)

Centerline of Butt Fusion

t = 0.25” ± 0.02”
(6.4mm ± 0.5mm)
## Joints (QF-402)

<table>
<thead>
<tr>
<th>Joint Design</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe End Cut max. out-of-square</td>
<td></td>
</tr>
<tr>
<td>Maximum Fit-up Gap</td>
<td></td>
</tr>
<tr>
<td>Max. Axial Misalignment</td>
<td></td>
</tr>
<tr>
<td>Max. out-of-roundness</td>
<td></td>
</tr>
</tbody>
</table>

Sketches, production drawings, joint symbols, or written description should show the general arrangement of the parts to be fused. Where applicable, the details of the joint groove may be specified.

## Materials (QF-403)

<table>
<thead>
<tr>
<th>Fitting Specification</th>
<th>Classification</th>
<th>to Pipe Specification</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Thermal Conditions (QF-405)

<table>
<thead>
<tr>
<th>Minimum material &amp; fusing temperature °F (°C)</th>
<th>Maximum material and fusing temperature °F (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal fusion time at minimum temp</td>
<td>Nominal fusion time at maximum temp</td>
</tr>
<tr>
<td>Minimum cool down time at min. temp</td>
<td>Minimum cool down time at max. temp</td>
</tr>
<tr>
<td>Fusion Voltage</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
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</tbody>
</table>

## Equipment (QF-406)

<table>
<thead>
<tr>
<th>Minimum Power Supply (KVA)</th>
<th>Processor Manufacturer</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Cord: Material</td>
<td>Max. length (ft/m)</td>
<td>Min. Gage</td>
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<tr>
<td>Saddle Clamp Type</td>
<td>N/A</td>
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<tr>
<td>Other</td>
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</table>

## Technique (QF-407)

<table>
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<th>Pre-scrape cleaning fluid</th>
<th>Post-scrape cleaning agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scraping Device</td>
<td>Pipe marker type</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

(07/15)
**FORM QF-482(a)  Suggested Format for Butt-Fusing Procedure Specifications (FPS or SFPS)**

(See QF-201.3, Section IX, ASME Boiler and Pressure Vessel Code)

<table>
<thead>
<tr>
<th>Company Name</th>
<th>By</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusing Procedure Specification No.</td>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Revision No.</td>
<td>Date</td>
<td></td>
</tr>
</tbody>
</table>

**Fusing Process Type**

- FPS Qualification: [ ] By testing  [ ] SFPS  If qualified by testing, supporting PQR No.(s) ____________

**Joints (QF-402)**

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe End Preparation</td>
<td></td>
</tr>
<tr>
<td>Miter Joint Angle</td>
<td></td>
</tr>
<tr>
<td>Pipe Surface Alignment</td>
<td></td>
</tr>
</tbody>
</table>

Sketches, production drawings, weld symbols, or written description should show the general arrangement of the parts to be fused. Where applicable, the details of the joint groove may be specified.

Sketches may be attached to illustrate joint design.

**Materials (QF-403)**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Classification</th>
<th>to Specification</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size (Diameter)</td>
<td>Pipe Wall Thickness</td>
<td>Cross-Sectional Area</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Thermal Conditions (QF-405)**

| Heater Surface Temperature Range |
| Fusing Interfacial Pressure Range |
| Drag Pressure Range | Butt-Fusing Pressure Range |
| Melt Bead Size Range | Heater Plate Removal Time Range |
| Cool-Down Time at Butt-Fusing Pressure Range |

**Equipment (QF-406)**

| Fusing Machine Manufacturer |
| Data Acquisition Used | Yes | No |
| Data Acquisition Machine Manufacturer |
| Hydraulic Extension Hose Length |

**Technique (QF-407)**

| Location | Fabrication Shop | Field |

(07/15)
### Table 1  
**Chemical Composition Requirements for Solid Electrodes**

<table>
<thead>
<tr>
<th>Electrode Classification</th>
<th>UNS Number</th>
<th>wt. percent&lt;sup&gt;(1)(2)&lt;/sup&gt;</th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>S</th>
<th>P</th>
<th>Cu&lt;sup&gt;(3)&lt;/sup&gt;</th>
<th>Ti</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-Manganese Electrodes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EL8</td>
<td>K01008</td>
<td>0.10</td>
<td>0.25/0.60</td>
<td>0.07</td>
<td>0.030</td>
<td>0.030</td>
<td>0.35</td>
<td>—</td>
<td></td>
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<tr>
<td>EL9K</td>
<td>K01009</td>
<td>0.10</td>
<td>0.25/0.60</td>
<td>0.10/0.25</td>
<td>0.030</td>
<td>0.030</td>
<td>0.35</td>
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<td></td>
</tr>
<tr>
<td>EL12</td>
<td>K01012</td>
<td>0.04/0.14</td>
<td>0.25/0.60</td>
<td>0.10</td>
<td>0.030</td>
<td>0.030</td>
<td>0.35</td>
<td>—</td>
<td></td>
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<tr>
<td><strong>Medium-Manganese Electrodes</strong></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>EM11K</td>
<td>K01111</td>
<td>0.07/0.15</td>
<td>1.00/1.50</td>
<td>0.65/0.85</td>
<td>0.030</td>
<td>0.025</td>
<td>0.35</td>
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<td></td>
</tr>
<tr>
<td>EM12</td>
<td>K01112</td>
<td>0.06/0.15</td>
<td>0.80/1.25</td>
<td>0.10</td>
<td>0.030</td>
<td>0.030</td>
<td>0.35</td>
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</tr>
<tr>
<td>EM13K</td>
<td>K01113</td>
<td>0.05/0.15</td>
<td>0.80/1.25</td>
<td>0.10/0.35</td>
<td>0.030</td>
<td>0.030</td>
<td>0.35</td>
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</tr>
<tr>
<td>EM13K</td>
<td>K01313</td>
<td>0.06/0.16</td>
<td>0.90/1.40</td>
<td>0.35/0.75</td>
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<td>0.030</td>
<td>0.35</td>
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<td>K01314</td>
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<td>0.90/1.40</td>
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<td>0.35</td>
<td>0.03/0.17</td>
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<td>K01515</td>
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<td>0.80/1.25</td>
<td>0.10/0.35</td>
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<td>0.030</td>
<td>0.35</td>
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<tr>
<td><strong>High-Manganese Electrodes</strong></td>
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<td>1.40/1.85</td>
<td>0.80/1.15</td>
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<td>1.50/2.00</td>
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<td>0.030</td>
<td>0.030</td>
<td>0.35</td>
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</tr>
</tbody>
</table>

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ANSI/AWS A5.17/A5.17M-97 (R2007)

**Table 1**  
**Chemical Composition Requirements for Solid Electrodes**

<table>
<thead>
<tr>
<th>Electrode Classification</th>
<th>UNS Number</th>
<th>wt. percent&lt;sup&gt;(1)(2)&lt;/sup&gt;</th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>S</th>
<th>P</th>
<th>Cu&lt;sup&gt;(3)&lt;/sup&gt;</th>
<th>Ti</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low-Manganese Electrodes</strong></td>
<td></td>
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<tr>
<td>EL12</td>
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<td>0.04–0.14</td>
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<tr>
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<td>EM11K</td>
<td>K01111</td>
<td>0.07–0.15</td>
<td>1.00–1.50</td>
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Not Specified