SPECIFICATION: G-1064-22b

TITLE: Welding Procedure Specification for Shielded Metal Arc Welding of Steel Pipe and Fittings

VOLUME: 2 (Section 13.0), 10, and Yellow Book

COURSE ID: NONE

CORE GROUP: NONE

TARGET AUDIENCE: Gas Welders

REV 22a (04/02/18):
Section 6.1 & Section 9.0 Table 5, updated time between weld passes for clarity.

REV 22b (9/06/18):
Cover Page, added “Gas Welders” to Target Audience.
Section 12.1, added epoxy coating to list of material to be cleaned.

REVISIONS: (See ★)

1) Table of Contents - Added section 35.0 “Records”. Renumbered subsequent sections.
2) Section 27.1 - Reworded. Added reference to Records section.
3) Section 31.0 - Clarified minimum cylinder length to be cut out. Added note to consult with Gas Engineering if minimum cylinder length cannot be met.
4) Section 35.0 - New section, “Records”.
5) Section 36.0 - Added reference to CI-870-1, Records Management.
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<td>36.0</td>
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</table>

**REFERENCE:**
- Construction Standards, O&M Manual

**EFFECTIVE DATE:** 3/29/18

**NUMBER:** G-1064-22b

**DATE APPROVED:** 2/26/18

**VOLUME:** 2 (Section 13.0), 10, & Yellow Book

**PAGE:** 2 OF 24 PAGES
TITLE: Welding Procedure Specification for Shielded Metal Arc Welding of Steel Pipe and Fittings

1.0 SCOPE

This specification covers the welding of piping used in gas, steam, electric and cable type pipe and the standards of acceptability for production welds.

All welding parameters and requirements found in the paragraphs and tables of this specification are derived from the company Welding Procedures and Qualification Records, referenced in Section 35.0.

2.0 LEGAL REQUIREMENTS


New York State - NYCRR Title 16, Part 255, Sections 255.225 through 255.245 and Appendix 14-G.

3.0 WELDER QUALIFICATION

3.1 All welders and welding procedures shall be qualified in accordance with Specification G-1065, “Qualification of Welders and Welding Procedures”.

3.2 Each welder shall have in his possession an identification card issued by the Company which lists the welder's qualification.

4.0 WELDING PROCESS

Only the Shielded Metal Arc Welding process shall be used.

5.0 GRADE OF PIPE, FITTINGS, AND COMPONENTS

5.1 Only steel pipe, fittings, and components conforming to one of the following Specifications shall be used:

A) G-8107, “Steel Pipe for Gas Mains and Services”;  
B) G-100.281, “Weld End Forged Fittings for Gas Piping”;  
C) S-9035, “Steel Pipe for Steam Mains and Services for the 200psig Distribution System”;  
D) S-9036, “Steel Pipe for Steam Mains and Services for the 400psig Distribution System”;  
E) S-9040, “Steel Socket or Butt Welded Fittings for Use in the 200 and 400psig Steam Distribution Systems” and approved component specifications.
5.0 **GRADE OF PIPE, FITTINGS, AND COMPONENTS** (Continued)

F) All other miscellaneous gas fittings shall be reviewed by Gas Transmission Engineering, Major Projects/Transmission Maintenance.

5.2 For material with specified minimum yield strength (SMYS) of 70,000 psi, ONLY material approved by Gas Engineering may be used. Consult with Gas Engineering prior to welding any material with specified minimum yield strength of ≥65,000 psi.

**NOTE:** Material with a SMYS of 70,000 psi may only be welded to the same grade material OR to material with a SMYS of 60,000 psi.

5.3 Notches or laminations on pipe ends shall not be repaired on pipe to be operated at a pressure of 125 psig or more. The damaged portion shall be removed as a cylinder and the pipe re-beveled.

6.0 **TIME LAPSE BETWEEN PASSES**

6.1 15 minutes maximum between "Root Pass" and "Hot Pass" is permitted.

6.2 Once started, the welding of both the root pass and hot pass shall be continuous until complete.

6.3 The maximum time between completion of the second pass and the start of the other passes shall not exceed 1 hour. Deviation from this timeframe requires Engineering approval.

Prior to leaving a weld for extended periods, an unfinished weld shall be wrapped and protected from the weather.

7.0 **JOINT DESIGN**

7.1 Butt Weld

A) Standard joint design and spacing between abutting pipe ends shall conform to Figure No.1. An optional bevel end preparation of 30°+5°,-0° may be used.

B) Sequence of weld beads shall conform to Figure No. 2. All passes shall be completed before the next pass is started.

C) Backing rings are **NOT** to be used on gas or steam pipelines.

D) Adjoining gas or steam pipelines of different wall thickness may be butt welded in accordance with Figure No. 3, or back welded.
7.0 **JOINT DESIGN** (Continued)

7.1 Butt Weld (Continued)

E) Seams on longitudinal welded pipe shall be separated by a minimum rotation distance of approximately 1/4 the diameter of the pipe.

F) Stop locations for subsequent weld beads shall not coincide with the start/stop location of the previous bead.

7.2 Branch and Fillet Welds

A) Details of welding a branch connection to a header pipe shall be in accordance with Figure No. 4.

B) Concave shapes for fillet welds are preferred to minimize corner stress concentration.

1) Do not reduce the weld throat to achieve concave weld.

2) Use dimensions shown in Figure 4 and Figure 5 for fillet weld dimensions W, W₁, W₂, and W₃.

C) When required, branch connections shall be reinforced in accordance with Figure No. 5.
7.0 **JOINT DESIGN** (Continued)

D) Forged weld-o-let fittings for connections to the main may be used in accordance with Figure No. 5.1.

1) Weld-o-let fittings are welded with a branch fillet weld. Single welder qualification tests for butt welding do not qualify a welder to make this weld.

2) Weld-o-lets are ordered for a specific application, that is, for the required run and branch size. If the fittings are ordered in this manner, the appropriate bevel at the base of the weld-o-let is correct for the application.

---

**FIGURE NO. 4**

**WELD ON METHOD**

---

**WELD IN METHOD**

---

**NOTE:**

\[ N = \frac{1}{16} \text{ to } \frac{3}{8} \]

\[ W = \frac{1}{4} \text{ minimum} \]
7.0 **JOINT DESIGN** (Continued)

**Figure NO. 5**

---

**PADD**

**SADDLE**

---

**FULL ENCIRCLEMENT SADDLE**

---

**NOTE:**

- \(W_1 \text{MIN} = \frac{3}{8}B, \text{but not less than} \frac{3}{4}\)
- \(W_2 \text{MIN} = \frac{1}{2}N, \text{but not less than} \frac{3}{4}\)
- \(W_3 \text{MIN} = M, \text{but not greater than} H\)
- \(N = \frac{1}{16} \text{MIN, to} \frac{1}{8} \text{MAX, unless back welded.}\)

If \(N\) is thicker than \(H\), the reinforcing member shall be tapered down to the header wall thickness.

Provide hole in reinforcement to reveal leakage in buried welds and to provide venting during welding.
FIGURE NO. 5.1

WELD-O-LET

\[ t_{nb} = \text{NOMINAL THICKNESS OF BRANCH WALL} \]

**NOTE 1**  WHEN THE FITTING MANUFACTURER HAS NOT PROVIDED A VISIBLESCRIBE LINE ON THE BRANCH FITTING, THE WELD LINE SHALL BE THE EDGE OF THEFIRST BEVEL ON THE BRANCH FITTING ADJACENT TO THE RUN PIPE.

**NOTE 2**  \[ t_c = \text{THE SMALLER OF } \frac{1}{4}'' \text{ OR } 0.7t_{nb} \]

**NOTE 3**  A COVER WELD OF THICKNESS \( t_c \) SHALL BE MADE WHEN THE ANGLE BETWEEN THE BRANCH FITTING GROOVE WELD FACE AND THE RUN PIPE SURFACE ISLESS THAN 135 DEG (I.E. 90 DEG). WHEN THE ANGLE IS 135 DEG OR GREATER,THE COVER WELD MAY TRANSITION TO NOTHING. COVER WELD SHALL PROVIDE ASMooth Transition TO THE RUN PIPE.

E) Steam may also use the drain, bypass, and blow off connectionsdepicted in EO-16905-B “Drain, Bypass and Blowoff Connectionsfor 200 psig and 400 psig Steam Mains”. 
7.0 **JOINT DESIGN** (Continued)

7.3 **Electric Cable Type Pipe Welds**

A) Combinations of the basic joint design may be required for high pressure electric pipe joints as shown in Figures 6 and 7.

B) Backing rings for cable pipe shall be used when the ends of the pipe to be welded are flared.

C) Immediately prior to installing backing rings, the flared pipe ends shall be checked for roundness and, if necessary, rounded out with a suitable die.

D) Backing rings shall be carefully fitted into the end of the pipe with the pipe end against the chamfer extrusion of the backing ring.

E) The opening in the backing ring shall be located at the three or six o'clock position.

F) Care shall be taken to insure that the opening of the backing rings in welded joints at bends or offsets are not in a position to interfere with the pulling of cable.

G) For sleeve joints, the pipe ends shall be reamed to remove all sharp edges and burrs and leave a 1/8" radius on the inside edge of the pipe.
7.0 **JOINT DESIGN** (Continued)

7.3 **Electric Cable Type Pipe Welds** (Continued)

8.0 **FILLER METAL**

8.1 Class E-6010, E-7010 and E-8010 electrodes shall be used as specified in Tables I and II.

8.2 Tables I and II are guides for the number of passes, class and size of electrodes to be used. Variations in electrode size are acceptable based on field conditions.
### TABLE I - Specified Minimum Yield Strength (SMYS) of Less Than 65,000 psi

<table>
<thead>
<tr>
<th>Pipe Wall Thickness</th>
<th>Minimum No of Passes</th>
<th>Pass Identification</th>
<th>Class of Rod</th>
<th>Size of Rod</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 3/16&quot;</td>
<td>2</td>
<td>1 Root, 2 Cap</td>
<td>E-6010, E-6010</td>
<td>3/32, 3/32</td>
</tr>
<tr>
<td>3/16&quot; to under 1/4&quot;</td>
<td>3</td>
<td>1 Root, 2 Hot, 3 Cap</td>
<td>E-6010, E-7010, E-6010</td>
<td>5/32, 5/32, 3/16</td>
</tr>
<tr>
<td>1/4&quot; to under 3/8&quot;</td>
<td>4</td>
<td>1 Root, 2 Hot, 3 Filler, 4 Cap</td>
<td>E-6010, E-7010, E-7010, E-6010</td>
<td>5/32, 5/32, 3/16, 3/16</td>
</tr>
<tr>
<td>3/8&quot; to under 7/16&quot;</td>
<td>5</td>
<td>1 Root, 2 Hot, 3 Filler, 4 Filler, 5 Cap</td>
<td>E-6010, E-7010, E-7010, E-7010, E-6010</td>
<td>5/32, 5/32, 3/16, 3/16, 3/16</td>
</tr>
<tr>
<td>7/16&quot; to under 1/2&quot;</td>
<td>6</td>
<td>1 Root, 2 Hot, 3 Filler, 4 Filler, 5 Filler, 6 Cap</td>
<td>E-6010, E-7010, E-7010, E-7010, E-7010, E-6010</td>
<td>5/32, 5/32, 3/16, 3/16, 3/16</td>
</tr>
<tr>
<td>1/2&quot; and over</td>
<td>7</td>
<td>1 Root, 2 Hot, 3 Filler, 4 Filler, 5 Filler, 6 Filler, 7 Cap</td>
<td>E-6010, E-7010, E-7010, E-7010, E-7010, E-6010</td>
<td>5/32, 5/32, 3/16, 3/16, 3/16</td>
</tr>
</tbody>
</table>
### TABLE II - Specified Minimum Yield Strength (SMYS) of 70,000 psi

<table>
<thead>
<tr>
<th>Pipe Wall Thickness</th>
<th>Minimum No of Passes</th>
<th>Pass</th>
<th>Class of Electrode</th>
<th>Diameter of Electrode in.</th>
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</thead>
<tbody>
<tr>
<td>1/4&quot; to under 3/8&quot;</td>
<td>4</td>
<td>1 Root</td>
<td>E-6010</td>
<td>5/32</td>
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<tr>
<td></td>
<td></td>
<td>2 Hot</td>
<td>E-8010</td>
<td>5/32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Filler</td>
<td>E-8010</td>
<td>3/16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Cap</td>
<td>E-8010</td>
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<td>3/8&quot; to under 7/16&quot;</td>
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<td>2 Hot</td>
<td>E-8010</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>5 Cap</td>
<td>E-8010</td>
<td>3/16</td>
</tr>
<tr>
<td>7/16&quot; to under 1/2&quot;</td>
<td>6</td>
<td>1 Root</td>
<td>E-6010</td>
<td>5/32</td>
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<td>2 Hot</td>
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<td>5 Filler</td>
<td>E-8010</td>
<td>3/16</td>
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<tr>
<td></td>
<td></td>
<td>6 Cap</td>
<td>E-8010</td>
<td>3/16</td>
</tr>
<tr>
<td>1/2&quot; to 5/8&quot;</td>
<td>7</td>
<td>1 Root</td>
<td>E-6010</td>
<td>5/32</td>
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<tr>
<td></td>
<td></td>
<td>2 Hot</td>
<td>E-8010</td>
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</tr>
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<td>3 Filler</td>
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<td></td>
<td>7 Filler</td>
<td>E-8010</td>
<td>3/16</td>
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<td></td>
<td></td>
<td>8 Cap</td>
<td>E-8010</td>
<td>3/16</td>
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</table>
8.0 **FILLER METAL** (Continued)

8.3 The welder shall take necessary steps to protect the coating of the welding rods to prevent deterioration and contact with water.

9.0 **ELECTRIC CHARACTERISTICS**

9.1 Only direct current, reverse polarity shall be used.

9.2 The voltage and amperage range shall conform to Table III to Table V.

**TABLE III**

**WALL THICKNESS 3/16" AND LARGER**

<table>
<thead>
<tr>
<th>Arc Voltage</th>
<th>Amperage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>120</td>
<td>240</td>
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</tbody>
</table>

**TABLE IV**

**WALL THICKNESS LESS THAN 3/16"**

<table>
<thead>
<tr>
<th>Arc Voltage</th>
<th>Amperage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>80</td>
<td>120</td>
</tr>
</tbody>
</table>

**TABLE V**

**WALL THICKNESS 1/4" to 3/4" (inclusive)**

And

Specified Minimum Yield Strength (SMYS) of 70,000 psi

<table>
<thead>
<tr>
<th>Weld Layer(s)</th>
<th>Process</th>
<th>Filler Metal</th>
<th>Current</th>
<th>Amp Range</th>
<th>Volt Range</th>
<th>Travel Speed Range</th>
<th>Time Between Weld Passes</th>
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</thead>
<tbody>
<tr>
<td>Root Hot Pass</td>
<td>SMAW</td>
<td>E6010</td>
<td>DCRP</td>
<td>130-180</td>
<td>23-26</td>
<td>Target 4-8 IPM</td>
<td>15 Minutes Max</td>
</tr>
<tr>
<td>Fill Cap</td>
<td>SMAW</td>
<td>E8010</td>
<td>DCRP</td>
<td>150-180</td>
<td>26-30</td>
<td>Target 4-8 IPM</td>
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<tr>
<td></td>
<td>SMAW</td>
<td>E8010</td>
<td>DCRP</td>
<td>170-200</td>
<td>26-30</td>
<td>Target 4-8 IPM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMAW</td>
<td>E8010</td>
<td>DCRP</td>
<td>150-200</td>
<td>26-30</td>
<td>Target 4-8 IPM</td>
<td></td>
</tr>
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</table>
TITLE: Welding Procedure Specification for Shielded Metal Arc Welding of Steel Pipe and Fittings

10.0 **POSITION AND DIRECTION OF WELDING**

10.1 The pipe shall be held in a stationary position.

10.2 The vertical down-hill direction shall be used.

11.0 **NUMBER OF WELDERS**

11.1 On pipe sizes 14” OD or less, one welder is sufficient.

11.2 On pipe sizes larger than 14” OD, two welders shall be used for the root and hot pass. Filler beads and cap pass may be done by one welder.

12.0 **CLEANING**

12.1 The surfaces to be welded shall be smooth, uniform, free of burrs, laminations, tears, scale, slag, grease, paint, epoxy coating and other deleterious material which might adversely affect the welding.

12.2 Prior to fitting the sections together, but after all cutting and end preparation operations have been completed, the inside and outside surfaces of the pipe and/or fittings to be welded shall be inspected for corrosion product build up or debris. If observed, it shall be manually removed before welding.

12.3 Pipe cleaning shall be done by power brush and/or grinding between every pass.

13.0 **ALIGNMENT**

13.1 The alignment distance between abutting ends of pipe, and/or fitting = 1/16” ± 1/32”.

13.2 Hammering of the pipe to achieve proper lineup shall be held to a minimum.

13.3 Forged fittings shall be properly prepared and anchored in position by means of tack welds at no more than four locations uniformly spaced.

13.4 Seams on longitudinal welded pipe shall be separated by a minimum rotation distance of approximately ¼ the diameter of the pipe.
14.0 **TYPE OF LINEUP CLAMPS**

Line-up clamps are required for piping butt welds greater than or equal to 16" NPS. When required, either external or internal clamps may be used. Other methods of alignment may be used with Engineering approval.

15.0 **REMOVAL OF LINEUP CLAMPS**

15.1 External lineup clamps shall be removed after at least 50% of the root bead is completed, and uniformly spaced around the circumference of the pipe.

15.2 When an internal lineup clamp is used, the root bead shall be completed before releasing clamp tension.

16.0 **PREHEAT**

16.1 Preheating shall be required for the following:

A) For all incomplete welds. Welds may be left incomplete; only after a minimum root and hot passes have been completed.

B) Carbon steel that has a carbon content in excess of 0.32 percent or a carbon equivalent (\(C + \frac{1}{4} Mn\)) of 0.65 percent or higher. Other new materials where the pipe grade or carbon content is unknown shall be referred to Gas Engineering for advice on preheating and stress-relief.

C) On all welds on pipe with a specified minimum yield strength of 70,000 psi.

16.2 Preheating may be accomplished by any suitable method, provided that it is uniform and that the temperature does not fall below the prescribed minimum during the actual welding. The weld area shall be preheated to a minimum of 225°F, and checked with a tempil temperature indicator or similar means. For material with specified minimum yield strength of 70,000 psi, the maximum inter-pass temperature shall be controlled to 400°F.

17.0 **POST WELD HEAT TREATMENT (PWHT)**

17.1 PWHT on pipe welds in material with a SMYS less than 65,000 psi shall be required for the following:

A) Welds on carbon steel that have a carbon content in excess of 0.32 percent or a carbon equivalent (\(C + \frac{1}{4} Mn\)) in excess of 0.65 percent.
17.0 **POST WELD HEAT TREATMENT (PWHT)** (Continued)

B) When conditions exist that would cause the weld to cool at a rate detrimental to the quality of the weld.

C) When welds are subjected to a caustic environment such as sodium hydroxide (NaOH), resulting in caustic cracking of the welds.

D) For welds on carbon steel pipe with a wall thickness of more than 1-1/4 inches, consult stress relieving requirements with Gas Engineering.

E) When a weld connects pipe or components that are of different thickness, the wall thickness to be used in determining whether stress relieving is required under this section is:

1) in the case of pipe connections, the thicker of the two pipes joined; or

2) in the case of branch connections, slip-on flanges, or socket weld fittings, the thickness of the pipe run or header.

F) Each weld of different materials must be stress relieved, if either material requires stress relieving under this section.

G) Stress relieving is not required for the following:

1) a fillet or groove weld one-half inch, or less, in size (leg) that attaches a connection two inches, or less, in diameter; or

2) a fillet or groove weld three-eighths inch, or less, in groove size that attaches a supporting member or other non-pressure attachment.
17.0 POST WELD HEAT TREATMENT (PWHT) (Continued)

17.2 When applying PWHT, the temperature shall be monitored to ensure that a uniform temperature is maintained and that the following PWHT cycle is followed:

ACCEPTABLE PWHT PARAMETERS

1) Raise temperature from ambient to 600°F - No set heating rate

2) Raise temperature from 600°F to 1,100°F - Minimum 1 hour heating time

3) Maintain temperature at a minimum of 1,100°F - Minimum of 1 hour

4) Lower temperature from 1,100°F to 600°F - Minimum 1 hour cooling time

5) Lower temperature from 600°F to ambient - No set cooling rate (forced cooling is not allowed)

Note: PWHT of welds in materials with a SMYS ≥ 65,000 psi is not allowed

18.0 WELDING PROCEDURE – SPHERICAL FITTINGS (24” AND GREATER)

18.1 Pre-heat the area of the two longitudinal seams to 300 degrees F. (Maintain temperature during welding.)

18.2 Weld the longitudinal seams on the spherical fitting. Weld only the portion of the longitudinal seams which are on the spherical part of the fitting. The ends of the longitudinal seams which are in contact with the pipe are not to be welded. (Welds to be magnetic particle tested.)

18.3 Pre-heat the area of the first circumferential weld to 300 degrees F. (Maintain temperature during welding.)

18.4 Weld the first (root) pass for the circumferential weld. (Weld to be magnetic particle tested.)

18.5 Complete the second (hot) pass for the circumferential weld. (Weld to be magnetic particle tested.)
18.0 WELDING PROCEDURE – SPHERICAL FITTINGS (24” AND GREATER)  
(Continued)

18.6 Complete the entire circumferential weld. Welding is to be performed continuously. Complete the incomplete longitudinal welds adjacent to the circumferential weld. (Welds to be magnetic particle tested.)

18.7 Remove the pre-heat and allow the circumferential weld to cool.

18.8 Follow the same process (18.3 to 18.7) for the second circumferential weld on the fitting.

19.0 ATMOSPHERIC CONDITIONS

19.1 The Field Representative shall decide if weather conditions are suitable for welding.

19.2 Windshields, rain tarps, and welding shields shall be installed to completely protect the weld, if the weld could be impaired by the prevailing weather conditions.

20.0 MITER JOINTS

20.1 GAS TRANSMISSION MAINS (125 PSIG AND GREATER)  
Except for offsets up to 3°, bends in the pipeline shall be accomplished by cutting the proper angle from a forged elbow fitting.

20.2 GAS DISTRIBUTION MAINS (100 PSIG AND LESS)  
Miter welds up to 12 1/2 degrees are permitted.

20.3 LOW PRESSURE GAS MAINS (12" WC MAXIMUM)  
Miter bends up to 45 degrees are permitted.

20.4 STEAM MAINS  
Miter bends in steam piping are allowed up to 2 degrees. For offsets greater than 2 degrees, but less than 5 degrees, approval from Steam Distribution Engineering shall be obtained. For offsets greater than 5 degrees, bends in the pipeline shall be accomplished by cutting the proper angle from a forged elbow.

20.5 Miter welds shall be fabricated by mitering both ends of the adjoining pipes equally.
21.0 **BRANCH CONNECTIONS**

Shall be contoured, and beveled with full penetration welds.

22.0 **BACK WELDING**

Where back welding is performed, the inside bead shall be run after all outside welding is completed.

23.0 **GROUND CLAMPS**

23.1 External pressure type clamps, or similar devices, shall be used.

23.2 The ground lead shall not be tack welded to a pipe or appurtenance.

24.0 **ARC BURNS, GOUGES, AND NOTCHES**

24.1 Arc burns and shallow notches or gouges shall be eliminated by blend grinding per Specification G-11870.

24.2 Gouges or notches deeper than 10% of the wall thickness of the pipe shall be cut-out by removing a cylinder of the pipe. See Section 31.0 for the minimum size of cylinder to be removed.

25.0 **SLEEVE WELDING**

The sleeve shall be centered over the pipe ends and welded in position in accordance with Figure No. 7.

26.0 **EH&S CONSIDERATIONS WHEN WELDING**

26.1 Welders must wear proper PPE and follow safe work practices as outlined in CEHSP S15.00 - "Welding, Cutting, and Other Hot Work Operations". Welding is prohibited in flammable/combustible atmospheres. Purging with an inert gas (such as described in Gas Specification IP-9) is an acceptable means of ensuring that a flammable/combustible atmosphere is not present. Combustible material must be removed from the vicinity of the welding operation. Any combustible material in the vicinity of the welding operation that cannot be moved must be adequately protected by welding blankets, etc.

26.2 Proper welding screens shall be used at all times when welding in order to prevent employees and the public from being exposed to ultraviolet light.
26.0 **EH&S CONSIDERATIONS WHEN WELDING** (Continued)

26.3 Burning of solid debris or sludge has the potential to release harmful vapors into the atmosphere, including dioxins if PCBs are present. Therefore, a visual inspection must be performed prior to flame cutting/burning pipe to insure there is no solid debris or sludge inside the pipe. This includes live gas mains as well as previously abandoned mains. In addition, discovery of debris or sludge in a gas main requires sampling. If solid debris or sludge is found, stop work and notify the Field Representative who will contact EH&S Operations (Gas) for assistance.

Windows burned in the top of a gas main or service cannot be used to perform a visual inspection, since this will result in hot slag dropping onto possible debris or sludge, if present on the bottom of the main. Inspection through tap holes, service tees, or open-ended pipe is permitted. An inspection may also be made by inspecting the bottom coupon from a control fitting or at the tie-in-point after the main has been mechanically cut and separated.

27.0 **IDENTIFICATION OF WELDS**

27.1 A complete written record of all welds as to location, date, weld number and welder identification number shall be prepared by the Field Representative, for gas mains operating at or above 125 psig. These records shall be given to Major Projects of Gas Engineering who shall be responsible for retaining these records. Refer to Records section 35.0 for records management.

27.2 For gas mains operating at less than 125 psig, the welders shall mark with a pipe marker adjacent to the weld made, the weld passes the welder completed. For example: root, hot, filler, or cap.

28.0 **VISUAL INSPECTION**

28.1 For gas mains that will operate less than 125 psig and steam mains, welders shall inspect their own welds to insure that the welds have a clean appearance and are free of cracks, inadequate penetration, burn-through, or other defects as specified in API 1104 "American Petroleum Institute Standard for Welding Pipeline and Related Facilities" (20th Edition).

28.2 For gas mains that will operate at 125 psig or more, welds shall be inspected by a person qualified by experience and training; minimum Level II inspector or a certified welding inspector (AWS CWI).
29.0 **RADIOGRAPHIC EXAMINATION**

29.1 Radiographic examination of the welds shall be made by the Company's duly authorized outside agency as per G-1070, “Radiographic Inspection of Pipeline Welds”.

29.2 Radiographic Film shall be identified as specified in Specification G-1070.

30.0 **ACCEPTABILITY OF WELDS**

30.1 Acceptability of welds shall be based upon G-1070 and API 1104.

30.2 The Chief Gas Transmission Engineer of the Gas Engineering Department or duly authorized representative may require that test coupons be cut from welds.

30.3 Welding shall not be done over defects. Defects shall be removed by grinding. Repaired areas shall be re-radiographed, or inspected by the same means previously used. If the repair is not acceptable, the weld shall be removed as a cylinder of pipe, see Section 31.0.

31.0 **MINIMUM CUT OUT CYLINDER SIZES**

Welds or pipe sections with repairs in excess of the preceding limits must be cut out. The installing organization shall remove cylinders containing the defective welds or pipe section. Minimum lengths for cylinders are as follows:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Minimum Cylinder Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal to 6&quot;</td>
<td>6&quot; (3&quot; on either side of weld)</td>
</tr>
<tr>
<td>Greater than 6&quot; but less than 24&quot;</td>
<td>2 times diameter (1 times diameter on either side of weld)</td>
</tr>
<tr>
<td>Greater than or equal to 24&quot;</td>
<td>48&quot; (24&quot; on either side of weld)</td>
</tr>
</tbody>
</table>

Note: If the minimum cylinder length cannot be met, consult with Gas Engineering.

32.0 **COMPONENTS FABRICATED BY WELDING**

32.1 Except for branch connections and assemblies of standard pipe and fittings joined by circumferential welds, the design pressure of each component fabricated by welding, whose strength cannot be determined, must be established in accordance with paragraph UG-101 of section VIII of the ASME Boiler and Pressure Vessel Code, Division I (as referenced in Section 10.3 of the latest edition of Title 16 NYCRR.).
32.0 COMPONENTS FABRICATED BY WELDING (Continued)

32.2 Each prefabricated unit that uses plate and longitudinal seams must be designed, constructed, and tested in accordance with the ASME Boiler and Pressure Vessel Code (as described in Section 10.3 of Title 16 NYCRR), except for:

A) manufactured butt-welded fittings;
B) pipe that has been produced and tested under a specification listed in Appendix 14-B of the latest edition of Title 16 NYCRR;
C) partial assemblies such as split rings or collars; or
D) prefabricated units that the manufacturer certifies have been tested to at least twice the maximum pressure to which they will be subjected under the anticipated operating conditions.

E) A component having a design pressure established in accordance with 255.153 (a) or (b) and subject to the strength testing requirements of 49 CFR192.505(b) must be tested to at least 1.5 times the MAOP.

32.3 Orange-peel bull plugs and orange-peel swages may not be used on pipelines that are to operate at a pressure of 125 psig or more.

32.4 Except for flat closures designed in accordance with section VIII of the ASME Boiler and Pressure Vessel Code (as described in Section 10.3 of Title 16 NYCRR), flat closures and fish tails may not be used on pipe that either operates at 100 psig or more, or is more than 3 inches nominal diameter.

33.0 REINFORCEMENT OF WELDED BRANCH CONNECTIONS

33.1 Each welded branch connection made to pipe in the form of a single connection, or in a header or manifold as a series of connections, must be designed to ensure that the strength of the pipeline system is not reduced, taking into account the stresses in the remaining pipe wall due to the opening in the pipe or header, the shear stresses produced by the pressure acting on the area of the branch opening, and any external loadings due to thermal movement, weight, and vibration.

33.2 The reinforcement required in a welded branch connection shall be determined by the rule that the metal area available for reinforcement shall be equal to or greater than the required area as defined in Rules for Reinforcement of Welded Branch Connections and examples 1 and 2 in Appendix 14-G of the latest edition of Title 16 NYCRR.
33.0 **REINFORCEMENT OF WELDED BRANCH CONNECTIONS** (Continued)

33.3 If a reinforcement member is required, and the branch diameter is such that a localized type of reinforcement member would extend around more than half the circumference of the header, then a complete encirclement type of reinforcement member shall be used, regardless of the design hoop stress, or a smoothly contoured wrought steel tee of proven design may be used.

34.0 **WROUGHT IRON WELDING**

Wrought iron welding shall follow the same welding parameter as stipulated above for the welding of steel. Wrought iron welding should be kept at a minimum when possible.

35.0 **Records**

Any records generated in the course of performing work in accordance with this specification shall be maintained as required by Corporate Instruction CI-870-1 "Records Management". Guidance on the retention of Company Gas Operations records can also be found on the Records Management intranet site.

36.0 **REFERENCES**

ASME Boiler and Pressure Vessel Code, Division 1

API 1104 American Petroleum Institute Standard for Welding Pipeline and Related Facilities" (20th Edition)

CEHSP S15.00 Welding Cutting and Other Hot Work Operations

CI-870-1 Records Management

**PQR- Procedure Qualification Record**

- PQR1 Weld Procedure Qualification for G-1064 - Grade B to X60 Pipe
- PQR2 Weld Procedure Qualification for G-1064 - X60 to X70 Pipe
- PQR3 Weld Procedure Qualification for G-1064 - Wrought Iron Grade B - Fillet Welding
- PQR4 Weld Procedure Qualification for G-1064 - Wrought Iron Grade B - Butt Welding
36.0 REFERENCES (Continued)

**Gas**

- **G-1065** Qualification of Welders and Welding Procedures
- **G-1070** Radiographic Inspection of Pipeline Welds
- **G-8107** Steel Pipe for Gas Mains and Services
- **G-100.281** Weld End Forged Fittings for Gas Piping
- **GEHSI E06.11** Liquids and solids from natural gas mains during main cut-outs
- **IP-9** Requirements for Written Procedures and Contingency Plans

**Steam**

- **EO-16905-B** Drain, Bypass and Blow off Connections for 200 psig and 400 psig Steam Mains
- **S-9035** Steel Pipe for Steam Mains and Services for the 200psig Distribution System
- **S-9036** Steel Pipe for Steam Mains and Services for the 400psig Distribution System
- **S-9040** Steel Socket or Butt Welded Fittings for Use in the 200 and 400psig Steam Distribution Systems