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SPECIFICATION: **G-1064-23a**

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:** **GAS0588**

★ **CORE GROUP:** **Gas Engineering Major Projects, Gas Engineering Transmission Maintenance**

★ **TARGET AUDIENCE:** **Gas Welders, Gas Construction**

Administrative Revisions

REV 23a (06/17/2022)

Header page 3: Updated the title to match the titles on the other pages.

Section 5.1 B - Replaced the title for G-100,281, “Weld End Forged Fittings for Gas Piping” with “Butt Weld Fittings for Gas Piping”

Section 7.2 - Updated numbering for FIGURE NO. 5.0

Section 24.1 - Added the title for G-11870 “Integrity Assessment and Repair of Steel Gas Transmission Pipelines Operating at 125 PSIG or More”.

Section 26.2 – Added the title for IP-9 “Requirements for Long Form Written Procedures and Contingency Plans”

Section 37.0 - Replaced the title for G-100,281, “Weld End Forged Fittings for Gas Piping” with “Butt Weld Fittings for Gas Piping” Replaced the title for IP-9, “Requirements for Written Procedures and Contingency Plans” with “Requirements for Long Form Written Procedures and Contingency Plans”.

Throughout the document minor grammar revisions were made and units changed for concurrence.

SUBSTANTIVE REVISIONS: (See ★)

1)	Cover Page	-	Added “Course ID” and “Core Group”; revised “Target Audience” to include Construction.
2)	Table of Contents	-	Added Section 34.0 “Welding Procedure for High Pressure Fittings”. Renumbered subsequent sections.
3)	Section 5.2	-	Reworded. Added wording for 65,000 psi yield strength material.
4)	Section 8.2	-	New Table II added. Renumbered subsequent table in section.
5)	Section 9.2	-	Removed Tables III and IV. Renumbered Table V to Table IV. Added New Table V and VI.
6)	Section 16.1	-	Revised Yield Strength to Preheat section.
7)	Section 26.1	-	Added new section on JSA Library. Renumbered subsequent sections.
8)	Section 28.2	-	Added prohibition on welder self-checking.
9)	Section 34.0	-	Added new Section: Welding Procedure for High Pressure Fittings. Renumbered subsequent sections.
10)	Section 37.0	-	Added to references.

Gas Operations Standards

TITLE: ★ **WELDING PROCEDURE SPECIFICATION FOR SHIELDED METAL ARC WELDING OF STEEL PIPE AND FITTINGS**

★ TABLE OF CONTENTS

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

Federal - 49 CFR Part 192, Sub Part E, “Welding of Steel in Pipelines”

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 their 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, “Butt Weld Fittings for Gas Piping”.

C) S-9035, “Steel Pipe for Steam Mains and Services for the 200 psig Distribution System”.

★ 5.0 **GRADE OF PIPE, FITTINGS, AND COMPONENTS** (Continued)

5.1 (Continued)

D) S-9036, "Steel Pipe for Steam Mains and Services for the 400 psig Distribution System".

E) S-9040, "Steel Socket or Butt Welding Fittings for Use in the 200 and 400 psig Steam Distribution Systems" and approved component specifications.

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 Major Projects/Transmission Maintenance may be used. Consult with Gas Engineering Major Projects/Transmission Maintenance 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 or 65,000 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.

6.0 **TIME LAPSE BETWEEN PASSES** (Continued)

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 deg, +5 deg, -0 deg 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.

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.

7.0 **JOINT DESIGN** (Continued)

7.1 Butt Weld (Continued)

FIGURE NO. 1 BUTT JOINT

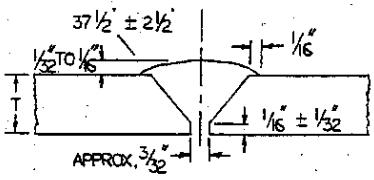


FIGURE NO. 2 SEQUENCE OF BEADS

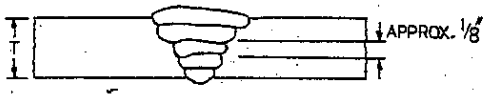
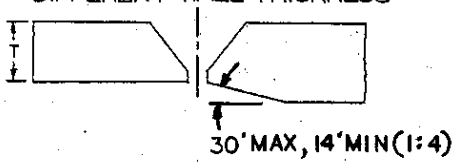


FIGURE NO. 3 DIFFERENT WALL THICKNESS



7.0 **JOINT DESIGN** (Continued)

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, W_1, W_2, and W_3.

C) When required, branch connections shall be reinforced in accordance with Figure No. 5.

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

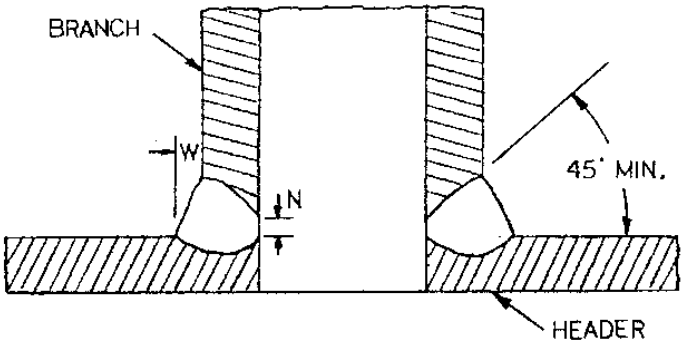
1) Weld-o-let fittings are welded with a branch fillet weld. Single welder qualification tests for butt welding do not qualify a welder to make this weld.

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.

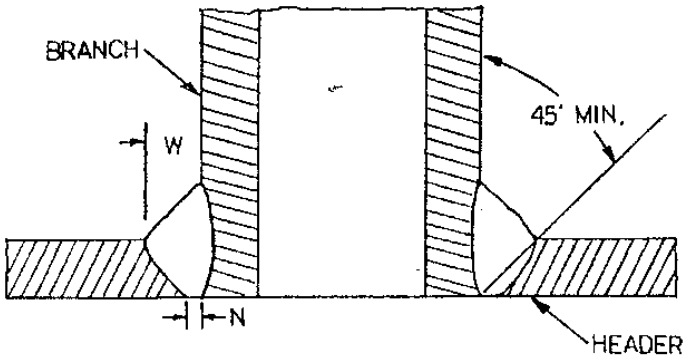
7.0 **JOINT DESIGN** (Continued)

7.2 Branch and Fillet Welds (Continued)

FIGURE NO. 4 WELD ON METHOD



WELD IN METHOD

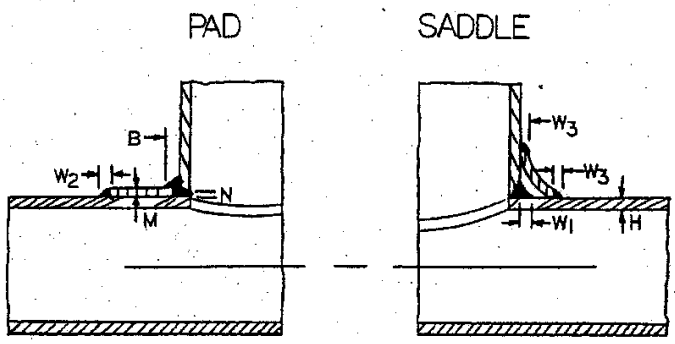


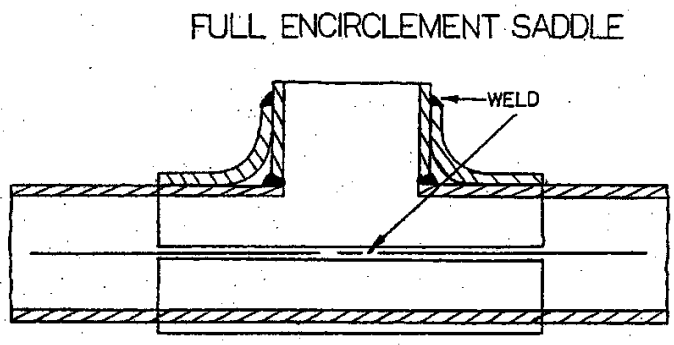
NOTE: N = 1/16" TO 1/8"
W = 1/4" MINIMUN

7.0 **JOINT DESIGN** (Continued)

7.2 Branch and Fillet Welds (Continued)

FIGURE NO. 5.0





NOTE: W_1(MIN) = $\frac{3}{8}$"B, BUT NOT LESS THAN $\frac{1}{4}$"

W_2(MIN) = $\frac{1}{2}$"M, BUT NOT LESS THAN $\frac{1}{4}$"

W_3(MIN) = M, BUT NOT GREATER THAN H

N = $\frac{1}{16}$" MIN. TO $\frac{1}{8}$" MAX., UNLESS BACK WELDED.

IF M IS THICKER THAN H, THE REINFORCING MEMBER SHALL BE TAPERED DOWN TO THE HEADER WALL THICKNESS.

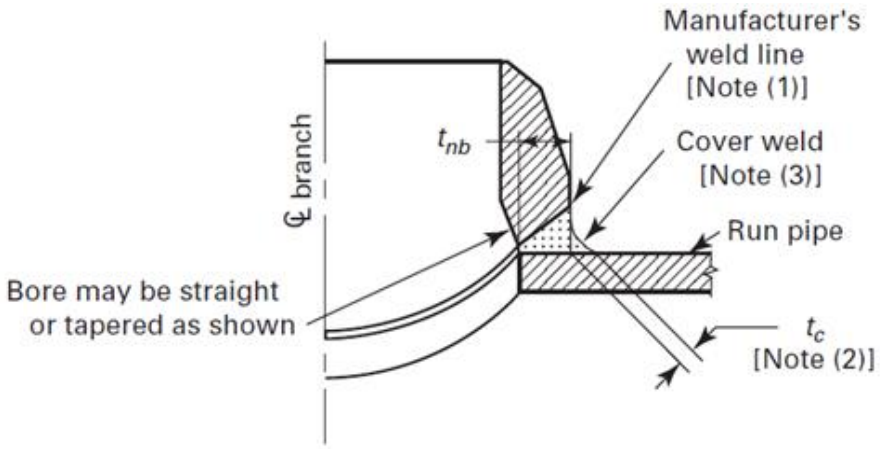
PROVIDE HOLE IN REINFORCEMENT TO REVEAL LEAKAGE IN BURIED WELDS AND TO PROVIDE VENTING DURING WELDING.

7.0 **JOINT DESIGN** (Continued)

7.2 Branch and Fillet Welds (Continued)

FIGURE NO. 5.1

WELD-O-LET



t_{nb} = nominal thickness of branch wall

NOTE 1 When the fitting manufacturer has not provided a visible scribe line on the branch fitting, the weld line shall be the edge of the first bevel on the branch fitting adjacent to the run pipe.

NOTE 2 t_c = the smaller of ¼" 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 is less 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 a smooth transition to the run pipe.

E) Steam may also use the drain, bypass, and blow off connections depicted in EO-16905-B "Drain, By-pass and Blow-off Connections for 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 ensure that the opening of the backing rings in welded joints at bends or offsets are not able 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)

FIGURE NO. 6 SOCKET WELDS

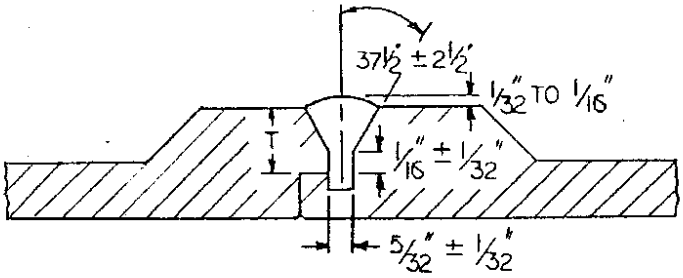
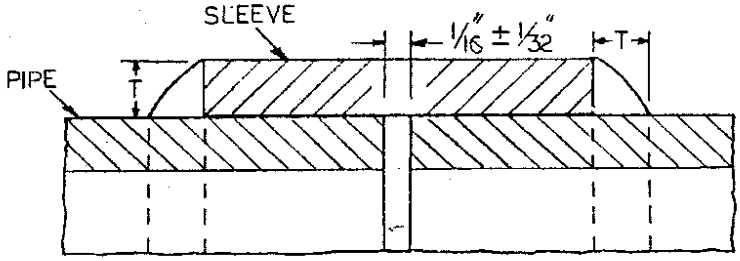


FIGURE NO. 7 SLEEVE WELD



NOTE: THICKNESS OF SLEEVE SHALL BE EQUAL TO OR GREATER THAN THICKNESS OF PIPE.

WELDS SHALL BE CONVEX.

★ 8.0 FILLER METAL

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

★ 8.2 Tables I, II and III 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)

Pipe Wall Thickness	Minimum No of Passes	Pass Identification	Class of Rod	Size of Rod
Under 3/16”	2	1 Root 2 Cap	E-6010 E-6010	3/32 3/32
3/16” to under 1/4”	3	1 Root 2 Hot 3 Cap	E-6010 E-7010 E-6010	5/32 5/32 3/16
1/4” to under 3/8”	4	1 Root 2 Hot 3 Filler 4 Cap	E-6010 E-7010 E-7010 E-6010	5/32 5/32 3/16 3/16
3/8” to under 7/16”	5	1 Root 2 Hot 3 Filler 4 Filler 5 Cap	E-6010 E-7010 E-7010 E-7010 E-6010	5/32 5/32 3/16 3/16 3/16
7/16” to under 1/2”	6	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Cap	E-6010 E-7010 E-7010 E-7010 E-7010 E-6010	5/32 5/32 3/16 3/16 3/16 3/16
1/2” and over	7	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Filler 7 Cap	E-6010 E-7010 E-7010 E-7010 E-7010 E-7010 E-6010	5/32 5/32 3/16 3/16 3/16 3/16 3/16

★ 8.0 **FILLER METAL** (Continued)

8.2 (Continued)

★ **TABLE II - Specified Minimum Yield Strength (SMYS) 65,000 psi**

Pipe Wall Thickness	Minimum No of Passes	Pass	Class of Electrode	Diameter of Electrode in.
1/4" to under 3/8"	4	1 Root 2 Hot 3 Filler 4 Cap	E-7010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16
3/8" to under 7/16"	5	1 Root 2 Hot 3 Filler 4 Filler 5 Cap	E-7010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16
7/16" to under 1/2"	6	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Cap	E-7010 E-8010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16 3/16
1/2" to 5/8"	7	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Filler 7 Cap	E-7010 E-8010 E-8010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16 3/16 3/16
5/8" to 3/4"	8	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Filler 7 Filler 8 Cap	E-7010 E-8010 E-8010 E-8010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16 3/16 3/16 3/16

★ 8.0 **FILLER METAL** (Continued)

8.2 (Continued)

TABLE III - Specified Minimum Yield Strength (SMYS) 70,000 psi

Pipe Wall Thickness	Minimum No of Passes	Pass	Class of Electrode	Diameter of Electrode in.
1/4" to under 3/8"	4	1 Root 2 Hot 3 Filler 4 Cap	E-6010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16
3/8" to under 7/16"	5	1 Root 2 Hot 3 Filler 4 Filler 5 Cap	E-6010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16
7/16" to under 1/2"	6	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Cap	E-6010 E-8010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16 3/16
1/2" to 5/8"	7	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Filler 7 Cap	E-6010 E-8010 E-8010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16 3/16 3/16
5/8" to 3/4"	8	1 Root 2 Hot 3 Filler 4 Filler 5 Filler 6 Filler 7 Filler 8 Cap	E-6010 E-8010 E-8010 E-8010 E-8010 E-8010 E-8010 E-8010	5/32 5/32 3/16 3/16 3/16 3/16 3/16 3/16

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 IV to Table VI.

TABLE IV
WALL THICKNESS 1/4" to 3/4" (inclusive)

And

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

Weld Layer(s)	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Time Between Weld Passes
		Class	Diameter	Type Polarity	Amp Range			
Root	SMAW	E6010	5/32”	DCRP	130-180	23-26	Target 4-8 IPM	15 Minutes Max
Hot Pass	SMAW	E8010	5/32”	DCRP	150-180	26-30	Target 4-8 IPM	
Fill	SMAW	E8010	3/16”	DCRP	170-200	26-30	Target 4-8 IPM	
Cap	SMAW	E8010	3/16”	DCRP	150-200	26-30	Target 4-8 IPM	

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

And

Specified Minimum Yield Strength (SMYS) of 65,000 psi

Weld Layer(s)	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Time Between Weld Passes
		Class	Diameter	Type Polarity	Amp Range			
Root	SMAW	E7010	5/32”	DCRP	105-160	23-30	Target 4-8 IPM	15 Minutes Max
Hot Pass	SMAW	E8010	5/32”	DCRP	105-160	23-30	Target 4-8 IPM	
Fill	SMAW	E8010	3/16”	DCRP	105-160	23-30	Target 4-8 IPM	
Cap	SMAW	E8010	3/16”	DCRP	105-160	23-30	Target 4-8 IPM	

9.0 **ELECTRIC CHARACTERISTICS** (Continued)

9.2 (Continued)

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

And

Specified Minimum Yield Strength (SMYS) of less than 65,000 psi

Weld Layer(s)	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Time Between Weld Passes
		Class	Diameter	Type Polarity	Amp Range			
Root	SMAW	E6010	5/32”	DCRP	120-190	25-70	Target 4-8 IPM	
Hot Pass	SMAW	E7010	5/32”	DCRP	120-190	25-70	Target 4-8 IPM	15 Minutes Max
Fill	SMAW	E7010	3/16”	DCRP	120-190	25-70	Target 4-8 IPM	
Cap	SMAW	E6010	3/16”	DCRP	120-190	25-70	Target 4-8 IPM	

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.

12.0 **CLEANING** (Continued)

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.

15.0 **REMOVAL OF LINEUP CLAMPS** (Continued)

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 more than 0.32 percent or a carbon equivalent (C + ¼ 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 65,000 psi.

16.2 Preheating may be accomplished by any suitable method, so long as the temperature is uniform and does not fall below the prescribed minimum during the actual welding. The weld area shall be preheated to a minimum of 225ºF 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 400ºF.

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 greater than 0.32 percent or a carbon equivalent (C + ¼ Mn) greater than 0.65 percent.

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

17.1 (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.

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

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

17.2 (Continued)

ACCEPTABLE PWHT PARAMETERS

1)	Raise temperature from ambient to 600º F	- No set heating rate
2)	Raise temperature from 600º F to 1,100º F	- Minimum 1 hour heating time
3)	Maintain temperature at a minimum of 1,100º F	- Minimum of 1 hour
4)	Lower temperature from 1,100º F to 600º F	- Minimum 1 hour cooling time
5)	Lower temperature from 600º 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 FITTING (24" AND GREATER)**

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

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

18.0 **WELDING PROCEDURE – SPHERICAL FITTINGS (24" AND GREATER)**
(Continued)

18.5 Complete the second (hot) pass for the circumferential weld. (Weld to be magnetic particle tested.)

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 degrees, 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.

20.0 **MITER JOINTS** (Continued)

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 "Integrity Assessment and Repair of Steel Gas Transmission Pipelines Operating at 125 PSIG or More".

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 "Prior to starting any task pursuant to this specification, Con Edison Gas Operations employees must be familiar with any Job Safety Analysis contained in Con Edison's Job Safety Analysis (JSA) Library. Any Con Edison Gas Operations employee preparing a job briefing for any task to be accomplished pursuant to this specification shall review the JSA Library to determine if there is a JSA applicable to the task. Any relevant JSA found in the library shall be discussed during the job briefing for the task. This provision is only applicable to Con Edison Gas Operations Employees."

26.2 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 as outlined in IP-9 "Requirements for Long Form Written Procedures and Contingency Plans" 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.

26.3 Proper welding screens should always be used when welding to prevent employees and the public from being exposed to ultraviolet light.

26.4 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.

26.0 **EH&S CONSIDERATIONS WHEN WELDING** (Continued)

26.4 (Continued)

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 36.0 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 ensure 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). Self-inspection of the weld by the welder is prohibited.

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

Pipe Diameter	Minimum Cylinder Length
Less than or equal to 6”	6” (3” on either side of weld)
Greater than 6” but less than 24”	2 times diameter (1 times diameter on either side of weld)
Greater than or equal to 24”	48” (24” on either side of weld)

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.).

32.2 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.

33.3 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 WELDING PROCEDURE FOR HIGH PRESSURE FITTINGS

34.1 Main should be cleaned to bare metal.

34.2 Place halves of fitting around main and tack weld (both sides). Prior to welding, completion plug shall be removed, and the screw cap shall be hand tight. Do not install plug until all welding has been completed and the fitting has cooled.

34.3 Weld longitudinal seams, both sides. Fitting may be turned, so the longitudinal seams can be welded on top. Both longitudinal seams may also be welded simultaneously.

34.4 Turn fitting to desired position on pipe.
Existing seam welds on the pipe and seam welds on the fittings shall not terminate at the same location.

★ 34.0 **WELDING PROCEDURE FOR HIGH PRESSURE FITTINGS** (Continued)

34.4 (Continued)

Complete one circumferential weld, both sides. Prior to welding the second circumferential weld, the first circumferential weld shall be cool to the touch.

35.0 **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.

36.0 **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.

★ 37.0 **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

★ 37.0 **REFERENCES** (Continued)

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
★ PQR5	Weld Procedure Qualification for G-1064 - X60 to X65 and X65 to X70 Pipe

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	Butt Weld Fittings for Gas Piping
GEHSI E06.11	Liquids and solids from natural gas mains during main cut-outs
IP-9	Requirements for Long Form Written Procedures and Contingency Plans

★ 37.0 **REFERENCES** (Continued)

Steam

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