

WPS Record Number: CS-2110-0 **Rev. #:** 0 **WPS Date:** 30/6/22

Qualified To: ASME Section IX, B31.3 **Supporting PQR(s):** CS-315, CS-388, CS-396

Welding Process (Note 1)

Welding Process	GTAW	SMAW
Process Type	Manual	Manual

Notes (Welding Process)

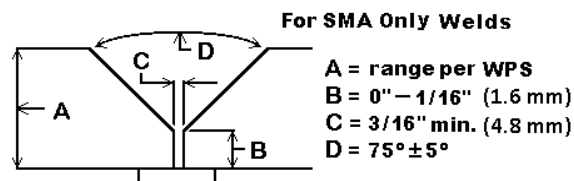
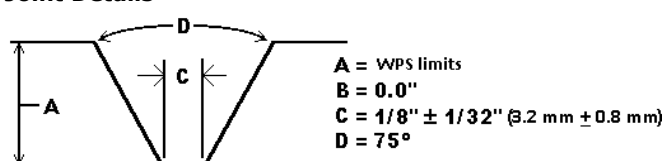
Note 1: GTAW and SMAW may be used singly or in combination within the deposit limits specified per the process.

Joints (QW-402)

Joint details for this welding procedure specification can be provided by this WPS, approved production design drawings, engineering specifications, or industry standards.

Joint Design	Butt joint groove welds; single or double side welded (Note 2) Fillet welds (Note 3)	Retainers	Not permitted
Backing	(Note 4)	Root Spacing	As per design (Note 4)
		Root Face	As per design

Joint Details



Notes (Joints)

Note 2: The SMAW process shall not be used for welding open root butt and groove welds unless the backside of the root is back-gouged and/or ground to sound metal and back-welded.

Note 3: Fillet welds for socket joints or couplings shall use a minimum of 2 passes of deposited weld metal and stops/starts shall be staggered. There shall be approximately 1/16 in. (1.6 mm) gap before welding.

Note 4: Single side welded groove joints made using only SMAW shall have metallic backing, and the minimum root opening shall be a minimum of 1/8 in. (3.2 mm). Backing may be used for GTAW if desired.

Base Metals (QW-403)

Material Type	Carbon steel	P-No.	1	Grp-No.	1 & 2
Welded To Material Type	Carbon steel	P-No.	1	Grp-No.	1 & 2
Backing		P-No.	Note 5	Grp-No.	Any
Thickness Qualified ("T")	As Welded Min.	As Welded Max.			
Complete Penetration	0.062 in. (1.6 mm)	1.6 in. (41 mm) (Note 6)			
Fillet Weld	0.062 in. (1.6 mm)	Note 7			
Pipe Diameter Qualified (in.)	No restriction	No restriction			

Notes (Base Metals)

Note 5: When metallic backing material is used, it shall conform to P-1 base material or A-1 or A-2 deposited weld metal composition/chemistry.

Note 6: Thicknesses greater than 1.0 in. (25.4 mm) shall have a minimum preheat of 200°F (93°C).

Filler Metals (QW-404)

Welding Process	GTAW	SMAW
SFA	5.18	5.1
Filler Metal AWS Classification	ER70S-2, ER70S-3, ER70S-6	E6010 E7018
F-No.	6	3/4
A-No.	1 or 2	1 or 2
Filler Nominal Composition	As per SFA and Class	As per SFA and Class
Filler Metal Form	Solid rod/wire	Flux covered solid rod
Filler Metal Diameter or Size	3/32 in. (2.4 mm) 1/8 in. (3.2 mm)	3/32 in. (2.4 mm) 1/8 in. (3.2 mm) 5/32 in. (4.0 mm) 3/16 in. (4.8 mm)



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Filler Metals (QW-404)

Welding Process	GTAW	SMAW	
Qualified Deposited Weld Metal Thickness			
As-Welded Min.	No restriction	No restriction	
As-Welded Max.	0.750 in. (19 mm)	1.6 in. (41 mm)	
Fillet Welds	Note 7	Note 7	
All Deposited Weld Passes $\leq$ 0.5 in.	Yes	Yes	
Flux Supplement	Not permitted	N/A	
Notes (Filler Metals) Note 7: The maximum effective throat for fillet welds shall be 0.625 in. (16.0 mm).			

Position (QW-405)

Welding Process	GTAW	SMAW	
Position(s) of Groove	All	All	
Weld Progression	Uphill	Uphill	
Position(s) of Fillet	All	All	

Preheat (QW-406)

Welding Process	GTAW	SMAW	
Min. Preheat / Interpass Temp.	50°F (10°C) (Note 8)	50°F (10°C) (Note 8)	
Maximum Interpass Temp.	500°F (260°C)	500°F (260°C)	
Notes: Note 8: Base metal thicknesses greater than 1.0 in. (25.4 mm) shall have a minimum preheat of 200°F (93°C).			

PWHT (QW-407)

Is Postweld Heat Treatment Performed?	Yes ☐	No ☒
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Gas (QW-408)

Welding Process	GTAW	SMAW	
Shielding Type / Composition (%)	Argon	N/A	
Flow Rate	15-30 CFH (7-14 LPM)	N/A	
Trailing Type/Composition (%)	None	N/A	
Flow Rate	N/A	N/A	
Backing Type/Composition (%)	None	N/A	
Flow Rate	N/A	N/A	

Electrical Characteristics (QW-409)

Welding Process			GTAW		SMAW				
Tungsten Electrode Size (in.)			3/32 in. (2.4 mm) 1/8 in. (3.2 mm)		N/A				
Tungsten Electrode Type			EWTh-2		N/A				
Pulsing Current			Not permitted		N/A				
Supplemental Flux			Not permitted		N/A				
Pass/Layer	Process	Filler Metal Class	Electrode Diameter		Current & Polarity	Amperage (Amps)	Voltage (Volts)	Travel Speed	
All	GTAW	ER70S-2 ER70S-3 ER70S-6	3/32 in. (2.4 mm)		DCEN	70 - 110	9 - 13	Manual	
			1/8 in. (3.2 mm)			80 - 150	9 - 14		
All	SMAW	E6010 E7018	3/32 in. (2.4 mm)		DCEP	70 - 95	20 - 24		
			1/8 in. (3.2 mm)			100 - 140	21 - 25		
			5/32 in. (4.0 mm)			140 - 190	22 - 26		
			3/16 in. (4.8 mm)			180 - 240	23 - 28		



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Technique (QW-410)

Welding Process	GTAW	SMAW
Stringer or Weave	Both permitted	Both permitted
Gas Cup Size (#)	4 - 10	N/A
Weave Width	Max. ½ in. (12.7 mm)	Max 4X inner electrode core dia.
Oscillation Weave	N/A	N/A
Multiple or Single Pass / Side	Both permitted	Both permitted
Process Type	Manual	Manual
Workmanship	Starts and stops shall be blended before subsequent passes are welded.	
Tack Welds	Tack welds that are to be incorporated into the weld shall be taper ground at each end of the tack weld.	
Initial Cleaning	Prior to tacking or welding, adjacent internal and external base metal surfaces shall be cleaned to remove all grease, oil, dirt, coating, etc. within 2 in. (51 mm) from the prepared joint edge. Cleaning shall be performed by grinding, filing, wire brush, flapper wheel and may include cleaning using an approved, light, non-residue solvent.	
Interpass Cleaning	Chip, grind as needed, finish with powered wire brush	
Back Gouging Method	Thermal or mechanical as appropriate (Notes 9, 10, 11)	
Peening	Not permitted	

Notes (Technique)

Note 9: If thermal cutting/gouging is performed, the surfaces shall be ground to sound metal prior to welding.

Note 10: Preheat requirements for thermal cutting/gouging shall be the same as required for welding.

Note 11: Double welded SMAW joints (if performed) shall be back-gouged to sound metal prior to welding the back side.

Document Version Notes

WPS Revision Notes:

Revision 0 of this WPS is the original issue written for PEI applications.

Authorization

Name	Signature	Date
Alon Mandel Process Control Manager - Operations		30/6/22