

Fermilab		Fermi National Accelerator Laboratory		
		<i>Technical Division-Machine Shop</i>		
Welding Procedure Specification		No. Fermi WPS Ti-1	Date	5/01/2008
Revision: 1	Date: 01/08/08	Remarks: Amended to correct clerical errors and welding position to 5G		Supporting PQR No.(s) Fermi PQR Ti-1
Welding Processes	(1) GTAW	Type 1	(Manual, Auto, Semi) Manual	
Welding Processes	(2)	Type 2	(Manual, Auto, Semi)	

Joints (QW-402)			
Joint Design	Single "V" Groove		
Backing Material (Type) Root	Gas		
Retainer	None	Type	
Backing	Open Root Gas Backing		
Remainder	Deposited Metal		
Non-Metallic	Metallic(non-fusing)		
0.160 wall x 5.50 OD Tube welded in Atmospheric Chamber 99.995% Argon Gas			

Details:

Gas Backing

Base Metals (QW -403)			
P No. 51	Group No.	TO	P No. 51
Specification Type & Grade	SB 338 Grade 2	TO	Specification Type & Grade
or Chemical Analysis & Mechanical Properties		N/A	
to Chemical Analysis & Mechanical Properties		N/A	
Thickness Range		Process	
Base Metal	Groove 0.0625-0.320	Fillet Unlimited	
Deposited Weld Metal	Groove 0.394 Max	Fillet Unlimited	
Pipe Diameter Range	Groove 2 7/8" Min-Unlimited	Fillet Unlimited	
Other:			

Filler Metals (QW-404)	Process 1	Process 2
Specification No. (SFA)	5.16	N/A
AWS No. (Class)	ERTi-2	N/A
F-No.	51	N/A
A No.	ERTi-2	N/A
Size of Filler Metals	3/32 diameter	N/A
Deposited Weld Metal Thickness Range	0.0625-0.394	N/A
Electrode-Flux (Class)	N/A	N/A
Flux Trade Name	N/A	N/A
Consumable Insert	N/A	N/A

Each Base Metal-Filler Metal combination should be recorded individually

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Positions (QW-405)			Post-weld Heat Treatment (QW-407)	
Positions of Groove	5G		Temperature Range	None
Welding Progression	Upward		Time Range	N/A
Positions of Fillet	N/A		Other	

Preheat (QW-408)		Gas (QW-408)		
Preheat Temperature	32°F	Percent Composition		
Interpass Temperature	350°F	Gas	Mixture	Flow Rate
Preheat Maintenance	N/A	Shielding	>99.99% Argon in Chamber @ 40 CFH	
Minimum Temperature for Welding	32°F	Trailing	None	
		Backing	>99.99% Argon in Chamber @ 40 CFH	

Electrical Characteristic (QW-409)				
Current AC or DC	Direct Current	Polarity	Straight	Characteristics: Non-Pulsing
AMPS (Range)	See Chart	Volts (Range)	See Chart	
Tungsten Electrode Size & Type:		3/32 diameter EWCe-2		
Mode of Metal Transfer for GMAW:		N/A		
Electrode Wire Feed Speed Range:		N/A		

Technique (QW-410)	
String or Weave Bead	String or weave. Weave not to exceed 1/8" wide
Orifice or Gas Cup Size	#4 Gas Lens
Initial/Interpass Cleaning (Brushing, Grinding, ect.)	Initial cleaning with alcohol solvent Break surface oxides with Carbide Burr (Optional)
Method of Back Gouging	None
Oscillation	None
Contact Tube to Work Distance	N/A
Multiple or Single Pass (per side)	Multi-pass
Multiple or Single Electrodes	Single
Travel Speed (Range)	As Required
Peening	None
Other	Weld in inert weld chamber purged with >99.99% Ultra Pure Argon @10 PPM

Weld Layers	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Other (Power Source)
		Class	Dia.	Type Polarity	Amp Range			
1	GTAW	ERTi-2	3/32	DCEN	65-85	8-12	As Req.	Keyhole
2-Final	GTAW	ERTi-2	3/32	DCEN	85-120	10-18	As Req.	Weave