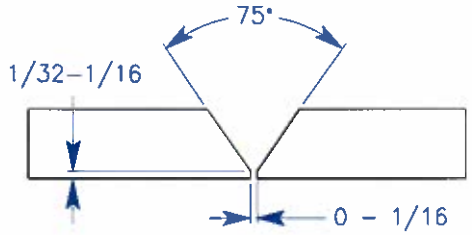
Fermilab	*Fermi National Accelerator Laboratory* *Technical Division-Machine Shop*		
Welding Procedure Specification	No. *Fermi WPS Ti-1*	Date	*5/01/2008*

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*	**Group No.**
Specification Type & Grade	*SB 338 Grade 2*	TO	**Specification Type & Grade**	*SB 338 Grade 2*
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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Welding Procedure Specification – Fermi WPS Ti-1

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:
AMPS (Range)	*See Chart*	Volts (Range)	*See Chart*	*Non-Pulsing*
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*

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