Fermilab — *Fermi National Accelerator Laboratory*

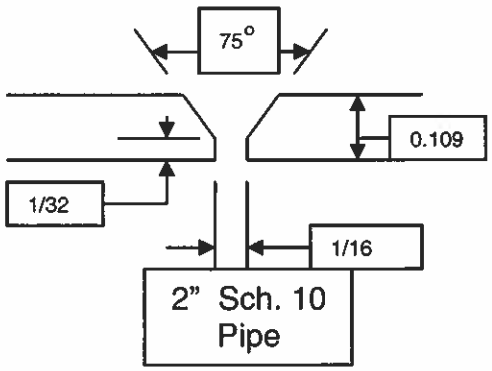
Technical Division-Machine Shop

Welding Procedure Specification	No. *Fermi WPS Ti-6*	Date	*4/06/2009*

Revision: 0	Date:	Remarks:	Supporting PQR No.(s) *Fermi PQR Ti-6*

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	*N/Al*		
Non-Metallic	***Metallic(non-fusing)***		



Base Metals (QW -403)				
P No. *51*	**Group No.**	TO	**P No.** *51*	**Group No.**
Specification Type & Grade	*ASME SB 861 Grade 2*	TO	**Specification Type & Grade**	*ASME SB 861 Grade 2*
or Chemical Analysis & Mechanical Properties	*N/A*			
to Chemical Analysis & Mechanical Properties	*N/A*			

Thickness Range	**Process**	
Base Metal	*Groove 0.0625-0.218*	*Fillet Unlimited*
Deposited Weld Metal	*Groove 0.109 Max*	*Fillet Unlimited*
Pipe Diameter Range	*Groove 1" 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	*1/16 diameter*	*N/A*
Deposited Weld Metal Thickness Range	*0.0625-0.294*	*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 Ti-6

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

Preheat (QW-408)		**Gas (QW-408)**			
Preheat Temperature	*None*	Percent Composition			
Interpass Temperature	*350° F*		Gas	Mixture	Flow Rate
Preheat Maintenance	*None*	Shielding	*Argon*	*>99.99% @ 20 CFH*	
		Trailing	*None*		
		Backing	*Argon*	*>99.99% @ 10 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 acetone/alcohol solvent* *Break surface oxides with Carbide Burr (Optional)*
Method of Back Gouging	*None*
Oscillation	*N/A*
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 Layers	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Other (Power Source)
		Class	Dia.	Type Polarity	Amp Range			
1	*GTAW*	*ERTi-2*	*1/16*	*DCEN*	*65-85*	*6-10*	*As Req.*	
2-Final	*GTAW*	*ERTi-2*	*3/32*	*DCEN*	*75-95*	*8-14*	*As Req.*	

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