Fermilab — Fermi National Accelerator Laboratory

Technical Division-Machine Shop

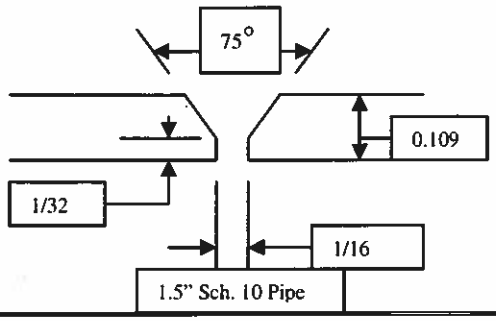
Procedure Qualification Record	No. Fermi PQR Ti-2	Date	6/13/2008
Revision: 1 Date: 1/08/09 Remarks: Revised to correct clerical errors			
Welding Process/Weld Type: GTAW/Manual	WPS No. Fermi WPS Ti-2		

Joints (QW-402)

Weld Type: *Single V Groove Weld*
Backing: *Open Butt, Gas Backing Only*
Root Opening: *0.0625"*
Root Face: *0.031"*

1.5" x Schedule 10 Pipe
Manual Weld in Chamber

Details:



Base Metals (QW-403)
Material Spec., Type or Grade
SB-861, Grade 2 to *SB-861, Grade 2*
P-No. *51* to **P-No.** *51*
Thickness of Coupon (in.) *0.109 inches*
Diameter of Test Coupon (in.) *1.900 inches*

Post Weld Heat Treatment (QW-407)
Type: *No PWHT performed*
Temperature: *None*
Time: *None*

Filler Metals (QW-404)
SFA Specification: *5.16*
AWS Classification: *ERTi-2*
Filler Metal F-No.: *51*
Weld Metal Analysis A-No.: *N/A*
Size of Filler Metal (in.): *3/32 diameter*
Weld Deposit "t"(in.): *0.109 inches*
Filler Metal Product Form: *Solid/Bare Wire*

Gas (QW-408)

	Gas	Percent Composition Mixture %	Flow Rate
Shielding:	*Argon*	*>99.995%*	*@ 30 CFH*
Trailing:		*None*	
Backing:	*Argon*	*>99.995%*	*@ 7 CFH*

Other: *Welding done in Argon Chamber at <10 PPM using Oxygen Analyzer*

Positions (QW-405)
Position of Joint: *5G*
Weld progression: *Upward*
Coupon welded in Chamber @ 10 PPM

Electrical Characteristics (QW-409)
Current/Polarity: *DCEN (Straight)*
Amps: *65-95* **Volts:** *6-14*
Tungsten Type & Size: *EWCe-2* *3/32 diameter*
Other: *Non-Pulsing Current*

Preheat (QW-406)
Preheat Temperature: *32° F Minimum*
Interpass Temperature: *350° F Maxium*

Technique (QW-410)
Travel (ipm): *As Required* **Oscillation:** *None*
String/Weave Bead: *Stringer & Weave*
Multiple/Single Pass (per side) *Multiple one side*
Multiple/Single Electrode: *Single Electrode*
Nozzle/Gas Cup Size: *#4 Gas Lens welded in chamber*

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Welding Process/Weld Type: *GTAW/Manual*	**WPS No.** *Fermi WPS Ti-2*		

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (Squared in.)	Ultimate Total Load (lbs.)	Ultimate Stress (PSI)	Failure Type & Location
1	*0.7465*	*0.1474*	*0.1100*	*6580*	*59,800*	*Ductile-WM*
2	*0.7440*	*0.1562*	*0.1162*	*7137*	*61,400*	*Ductile-WM*

Guided Bend Test (QW-160)

Figure Number & Type	Result	Figure Number Type	Result
QW-462.3 (a) Face Bend	***Acceptable***	QW-462.3 (a) Root Bend	***Acceptable***
QW-462.3 (a) Face Bend	***Acceptable***	QW-462.3 (a) Root Bend	***Acceptable***

Visual Examination: *Acceptable* | **X-ray per ASME Section IX, QW-191.2.2** *Acceptable*

Welder's Name: *Daniel J. Watkins* **ID #** *03991N* **Weld Stamp #** *24*

Welding of coupon Verified by: *Michael P. Reynolds ID# 03993N*

Tests Conducted by: *Bodycote Testing Group* **Test ID#:** *T-714091*

We Certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

PQR prepared by: ***Fermi National Accelerator Laboratory***

Authorized Representative _____ ID# 00362N