

Engineering Procedure

SAEP-1104

29 October, 2003

Welding Test Supplement S04 for
SMAW, Stainless Steel / Nickel, Backing

Document Responsibility: Inspection Department

Saudi Aramco DeskTop Standards

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Previous Issue: 30 April, 2000 Next Planned Update: 1 November, 2008

Revised paragraphs are indicated in the right margin

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1 Scope

This welder performance qualification Test Supplement shall govern the testing of welders with the Shielded Metal Arc Welding (SMAW) process, welding progression vertical up, for welding stainless steel and nickel-based alloy pipe (limited application - refer to the restrictions in paragraph 3.9).

2 Applicable Documents

The requirements contained in the following documents apply to the extent specified in this procedure.

2.1 Saudi Aramco References

Saudi Aramco Engineering Procedures

[SAEP-321](#)

*Performance Qualification Testing and
Certification of Saudi Aramco Welders*

[SAEP-1101](#)

*Welding Test Supplement S01 for SMAW, Carbon
and Low Alloy Steel Pipe, Uphill*

2.2 Industry Code(s) and Standard(s)

American Society of Mechanical Engineers

ASME SEC IX

*Qualification Standard for Welding and Brazing
Procedures, Welders, Brazers, and Welding
and Brazing Operators*

3 Instructions

Conduct the Performance qualification testing of welders following the requirements of [SAEP-321](#) as supplemented by the subsequent instructions.

3.1 Applications

Piping	Yes *
Pipelines	Yes *
Pressure Vessels	Yes *
Tanks	Yes *
Structural	Yes *
Dissimilar Metals	Yes *

	CRWMO	Yes *
	* See restrictions in paragraph 3.9	
3.7	Testing and Inspection Requirements	
	Time Limit of Test	Four (4) hours total
	Radiography	100% (ASME QW-191)
	Visual Inspection	See paragraph 6.1.3 of SAEP-321
3.8	Qualification Limits	
	Material Form	Plate or pipe
	Joint Type	Groove welds with backing and fillet welds
	Base Material	Stainless steel (P8), nickel (P41) and Ni-based (P42-47) alloys to themselves. Dissimilar metal welds include: Ni-based alloys to carbon steels, low alloy steels, stainless steels, nickel and Monel alloys; Monel alloys joined to carbon steels; nickel joined to stainless steels; and stainless steels joined to carbon steels.
	Process	SMAW
	Filler Metal (Root/Fill/Cap):	
	Stainless Steels	EXXX-15/16 (A5.4 austenitic)
	Nickel Alloys	Ni-based (A5.11)
	Dissimilar Welds	Ni-based (A5.11)
	Base Metal Thickness	Unlimited
	Diameter Range	2.5" NPS and greater
	Positions	All
	Vertical Progression	Uphill
3.9	Restrictions	
	(A)	Piping - root pass welding is only permitted when the backside of the root is accessible for back grinding and back welding (welding from one side is only permitted when backing is used).

- (B) Pipelines - nickel-based SMAW welding electrodes shall not be used for root pass welding when welding stainless steel fittings (i.e., COSASCO fittings) to pipelines (root pass welds must be made with the GTAW process which requires a Test Supplement S08 certification).
- (C) Pressure Vessels and Tanks - limited to single sided full penetration welds with backing, double sided full penetration welds (second side back gouged or back ground to sound metal prior to welding), fillet welds and CRWMO welding [see (E) below].
- (D) Dissimilar Metal Welding (Piping, Pressure Vessels, Tanks, Pipelines and Structural) is permitted for the following applications:
 - (1) Nickel-Based Electrodes shall be used to weld ferritic steels to austenitic stainless steels, duplex stainless steels and nickel-based alloys in NON-SOUR SERVICE APPLICATIONS ONLY (dissimilar welds are not permitted in sour service environments), and
 - (2) E309 Austenitic Stainless Steel welding electrodes can only be used to weld dissimilar welds between ferritic steels and austenitic stainless steels in:
 - (a) structural welding applications where welds are not in contact with service fluid, the design temperature is less than 300°C, and the service environment is NON-SOUR, or
 - (b) the welding of stainless steel nameplates to pressure vessel shells.
- (E) Corrosion-Resistant Weld Metal Overlay - welders with valid certifications can be allowed to perform corrosion-resistant overlay welding provided a CRWMO Ability Performance Test is performed and passed (refer to paragraph 6.5.1 of [SAEP-321](#)).

Revision Summary

29 October, 2003

Minor revision to convert the text statements into a form layout (ASME SEC IX format).
Revised the "Next Planned Update".



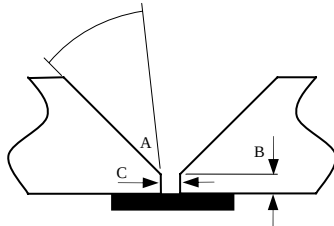
WELDING PROCEDURE SPECIFICATION (WPS)

WPS S04
COUPON 1
Rev. 0

Page 1 of 2

Procedure Qualification Record (PQR): <u>None</u>	Welding Process: <u>SMAW, manual</u>
Scope: <u>For welder qualification only</u>	Prior Qualification Requirements: <u>S01</u>

BASE MATERIAL (QW-403)	POST WELD HEAT TREATMENT (QW-407)
Test coupon type: <u>Pipe</u>	Temperature: <u>None</u>
Material Spec, type or Grade: <u>Carbon Steel</u>	Time: _____
Diameter of test coupon: <u>8" NPS</u>	Other: _____
Thickness of test coupon: <u>0.812"</u>	
To Material spec. type or grade: <u>Carbon Steel</u>	
Other: _____	
FILLER METALS (QW-404)	GAS (QW-408)
Weld Metal Analysis Number: <u>8</u>	Gas: _____ Composite: _____ Flow (CFH): _____
Filler Metal F No.: <u>5</u>	Shielding: <u>None</u>
AWS specification: <u>A 5.4</u>	Backing: <u>None</u>
AWS Classification: <u>See Below</u>	Trailing: _____
POSITION (QW-405)	TECHNIQUE
Position of Groove: <u>6G</u>	String or weave: <u>Stringer or Weave</u>
Weld Progression: <u>Uphill</u>	Oscillation: _____
PREHEAT (QW 406)	Multiple or Single pass per side: <u>Multiple</u>
Preheat Temperature: <u>10°C</u>	Single or multiple electrode: <u>Single</u>
Interpass temperature: <u>177°C</u>	Other: _____
Other: _____	



Joint Design: Single Vee

A = 22.5 +/- 2.5°

B = None

C = 6.4 +1.6 /- 0.8mm

With Carbon Steel backup bar

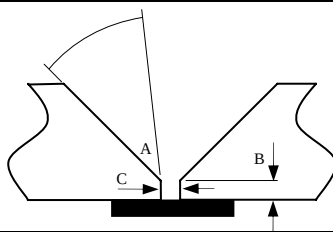
		WELDING PROCEDURE SPECIFICATION (WPS)				WPS S04 COUPON 1 Rev. 0 Page 2 of 2	
WELD LAYER	PROCESS	FILLER METAL		CURRENT		VOLTAGE	TRAVEL SPEED (cm/min)
		Class	Dia. (mm)	Polarity	Amps.		
Root	SMAW	E308/308L/309/ 310/316/316L	2.4	DCEN	55-85	19-25	3.8-8.9
All	SMAW	E308/308L/309/ 310/316/316L	3.2	DCEN	75-110	19-25	3.8-10.2



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Scope: <u>For welder qualification only</u>	Prior Qualification Requirements: <u>S01</u>

BASE MATERIAL (QW-403)		POST WELD HEAT TREATMENT (QW-407)			
Test coupon type: <u>Pipe</u>		Temperature: <u>None</u>			
Material Spec, type or Grade: <u>Carbon Steel</u>		Time: _____			
Diameter of test coupon <u>8" NPS</u>		Other: _____			
Thickness of test coupon: <u>0.812"</u>					
To Material spec. type or grade: <u>Carbon Steel</u>					
Other: _____					
FILLER METALS (QW-404)		GAS (QW-408)			
Weld Metal Analysis Number: <u>N/A</u>			Gas	Composite	Flow (CFH)
Filler Metal F No.: <u>43</u>		Shielding	None		
AWS specification: <u>A 5.11</u>		Backing	None		
AWS Classification: <u>ENiCrFe-3</u>		Trailing			
POSITION (QW-405)		TECHNIQUE			
Position of Groove: <u>6G</u>		String or weave: <u>Stringer or Weave</u>			
Weld Progression: <u>Uphill</u>		Oscillation: _____			
PREHEAT (QW 406)		Multiple or Single pass per side: <u>Multiple</u>			
Preheat Temperature: <u>10°C</u>		Single or multiple electrode: <u>Single</u>			
Interpass temperature: <u>177°C</u>		Other: _____			
Other: _____					



A = 22.5 +/- 2.5°
B = None
C = 6.4 +1.6 /- 0.8mm

With Carbon Steel backup bar

		WELDING PROCEDURE SPECIFICATION (WPS)				WPS S04 COUPON 2 Rev. 0 Page 2 of 2	
WELD LAYER	PROCESS	FILLER METAL		CURRENT		VOLTAGE	TRAVEL SPEED (cm/min)
		Class	Dia. (mm)	Polarity	Amps.		
All	SMAW	ENiCrFe-3	2.4	DCEP	45-70	19-25	3.8-8.9
All	SMAW	ENiCrFe-3	3.2	DCEP	70-105	19-25	3.8-10.2