



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPTEMBER 2014 SESSION

SUBJECT CODE	:	FWD22403
SUBJECT TITLE	:	WELDING PROCEDURE AND SPECIFICATION
LEVEL	:	DIPLOMA
TIME / DURATION	:	9.00 AM – 11.00 AM (2.0 HOURS)
DATE	:	11 JANUARY 2014

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY**.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. Answer all questions in English.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer FIVE (5) questions only.

Please use the answer booklet provided.

Question 1

Quality of the welded structure dependable on many factors such as welding procedure specification (WPS), performance qualification record (PQR) and joint penetration. Answer the following questions.

(a) What is WPS?

(5 marks)

(b) What is PQR?

(5 marks)

(c) Describe Pre qualify WPS.

(5 marks)

(d) Interpret the joint penetration.

(5 marks)

Question 2

Many company referring to **ASME IX** for welding procedure specification (WPS) and welder qualification test (WQT) qualification. The following are the questions related ASME IX.

(a) Explain the purpose to qualify WPS.

(5 marks)

(b) Explain the purpose of WQT.

(5 marks)

(c) What is WPQR?

(5 marks)

(d) Recommend **FIVE (5)** tests that may require for your PQR or WPQR coupon test.

(5 marks)

Question 3

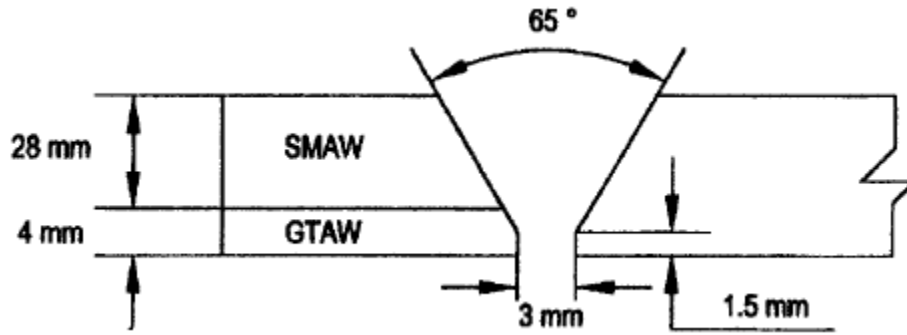


Fig. 1

All questions are related to **Fig. 1**.

A welder is tested to weld a joint for welding procedure specification (WPS) as in **Fig. 1**. He should pass all tests. Solve the following questions.

- Write the base metal thickness approved range for the above welded joint. (5 marks)
- If the base metal used for procedure qualification is **P No. 1 to P No. 2**. Write the range of base metal qualified. (5 marks)
- Determine the range qualified for each welding process. (10 marks)

Question 4

There are many codes and standard related in welding qualification today. Solve the following questions.

- State **FIVE (5)** codes and standard available related to welding qualification. (5 marks)
- List **FIVE (5)** codes and standards related to fabrication of pressure vessel and pipe. (5 marks)
- Outline the purposes of code and standard related to welding. (5 marks)
- Classify the variable the related to fabrication of WPS. (5 marks)

Question 5

To answer these questions, please refer to **Appendix A**.

- (a) Under **QW 408** of the WPS, it is stated a shielding gas used for the welding process.
Explain the function the shielding gas.
(5 marks)
- (b) Classify the consumable used in this WPS.
(5 marks)
- (c) Write the information under **QW 409** of the WPS.
(5 marks)
- (d) As determine by Vickers Hardness test in this WPS. Explain why the hardness of weld metal is superior compare with HAZ and base metal.
(5 marks)

Question 6

To answer these questions, please refer to **Appendix B**.

- (a) Write the information stated in **QW 403** of the WPS.
(5 Marks)
- (b) Under **QW 407**. Determine the temperature and time for the post weld heat treatment.
(5 marks)
- (c) In **QW 406** stated that the interpass temperature shall be maintained at 218 °F - 431 °F.
Determine the purposes of maintaining the inter pass temperature.
(5 marks)
- (d) In **QW 150** stated the results of the tensile test. Determine the maximum load used and failure type of both test coupons.
(5 marks)

END OF QUESTION

Appendix A



PT. SURYA BESINDO SAKTI

FABRICATOR & ENGINEERING SERVICES

Komplek Duta Merlin Blok C 16
Jl. Gajah Mada 3 - 5
P.O Box 4627 Jakarta - Indonesia

Telp. : (021) 6340175 - 6344963
Fax No. : (021) 6340766 - 6341852
Email @ RAD.NET.ID

WELDING PROCEDURE SPECIFICATION (WPS)

ASME SECT. IX

WPS : 72-GF8A 01 PW

POSITIONS (QW-405) Position(S) of Groove <u>1 G</u> Welding Progression Up <u>□ □</u> Position(s) of Fillet <u>-</u>		POST WELD HEAT TREATMENT (QW-407) Temperature Range <u>1140 °F</u> Time Range <u>1 hour and 30 Minutes</u>																													
PREHEAT (QW-406) Preheat Temp. Min <u>200 °F</u> Interpass Temp. Max. <u>482 °F</u> Preheat Maintenance <u>None</u> (Continuous or special heating where applicables should be recorded)		GAS (QW-408) <table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Gas (es)</th> <th rowspan="2">(Mixture)</th> <th colspan="2">Flow Rate</th> </tr> <tr> <th>GTAW</th> <th>FCAW</th> <th>GTAW</th> <th>FCAW</th> </tr> </thead> <tbody> <tr> <td>Shielding</td> <td>Ar/99.9%</td> <td>CO₂</td> <td>-</td> <td>15-30 l/min</td> <td>15-30 l/min</td> </tr> <tr> <td>Trailing</td> <td>None</td> <td>None</td> <td>-</td> <td>None</td> <td>None</td> </tr> <tr> <td>Backing</td> <td>None</td> <td>None</td> <td>-</td> <td>None</td> <td>None</td> </tr> </tbody> </table>			Gas (es)		(Mixture)	Flow Rate		GTAW	FCAW	GTAW	FCAW	Shielding	Ar/99.9%	CO ₂	-	15-30 l/min	15-30 l/min	Trailing	None	None	-	None	None	Backing	None	None	-	None	None
	Gas (es)		(Mixture)		Flow Rate																										
	GTAW	FCAW		GTAW	FCAW																										
Shielding	Ar/99.9%	CO ₂	-	15-30 l/min	15-30 l/min																										
Trailing	None	None	-	None	None																										
Backing	None	None	-	None	None																										
ELECTRICAL CHARACTERISTICS (QW-409) Current AC or DC <u>DC</u> Polarity <u>SP(GTAW), RP(FCAW) & RP(SAW)</u> Amps (Range) <u>See Below</u> Volts (Range) <u>See Below</u>																															
Tungsten Electrode Size and Type Mode of Metal Transfer for GMAW Electrode Wire feed speed range		<u>2.4 mm ϕ, 2% Thoriated (GTAW)</u> (Pure Tungsten, 2 % Thoriated, etc.) <u>(Spray arc, short circuiting arc, etc.)</u> <u>6-12 m/min (FCAW)</u>																													
TECHNIQUE (QW-410) String or Weave Bead Orifice or Gas Cup Size Initial and Interpass Cleaning Method of Back Gouging Oscillation Contact Tube to Work Distance Multiple or Single Pass (per side) Multiple or Single Electrodes Travel Speed (Range) Peening Other		<u>String and Weave</u> <u>7.9 mm (GTAW), 19 mm (FCAW)</u> <u>Grinding & Wire Brushing</u> (Brushing, Grinding, etc.) <u>None</u> <u>None</u> <u>10 - 20 mm (For SAW)</u> <u>Multiple</u> <u>Single</u> <u>See Below</u> <u>Peening is not Allowed.</u> <u>No Weld bead or layer can be thicker than 10 mm</u>																													

Weld Layer	Process	Filler Metal		Current		Volt Range	Travel Speed Range (cm / Min)	Other
		AWS Class	Dia. (mm)	Type Polarity	Amp. Range			
ROOT (1 & 2)	GTAW	ER-70 S-3	2.4	DC-SP	90 - 160	8 - 18	3 - 12	
FILLER (3 & 4)	FCAW	E-71 T-1	1.2	DC-RP	150 - 350	23 - 30	6 - 20	
FILLER (REM)	SAW	F7A2-EM12K	2.4	DC-RP	400 - 800	22 - 30	20 - 32	

Form : 060/SBS/100998/WPS

Rev. 2

Factory : Jl. Raya Rangkasbitung Km. 3, Cikande Kab. Serang - Jawa Barat
Telp. (0254) 402313 - 402314 Fax. (0254) 402315

Page : 2 of 2

Appendix B



PT. SURYA BESINDO SAKTI

FABRICATOR & ENGINEERING SERVICES

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P.O Box 4627 Jakarta - Indonesia

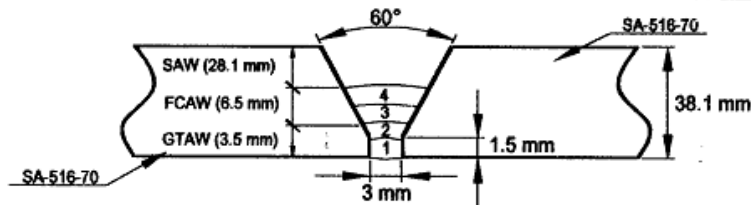
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Email @ RAD.NET.ID

PROCEDURE QUALIFICATION RECORD (PQR)

ASME SECT. IX

Company Name : PT. Surya Besindo Sakti PQR No : 72-GFSA 01 PW
WPS No. : 72-GFSA 01 PW Date : 1 September, 2003
Welding Process (es) : GTAW + FCAW + SAW Type (es) : Manual+ Semi Automatic+ Machine

JOINT (QW-402)



BASE METAL (QW-403)

Material Spec. : SA-516
Type or Grade : 70
P. No. : 1 GROUP 2
Thickness of Test Coupon : 38.1 mm
Diameter of Test Coupon : -
Other : Thickness of any pass < 10 mm

POSTWELD HEAT TREATMENT (QW-407)

Temperature : 1148 °F
Time : 1 Hour and 30 Minutes
Other : -

FILLER METAL (QW-404)

	GTAW	FCAW	SAW
SFA Spec.	5.18	5.20	5.17
AWS Classification	ER-70S-3	E-71T-1	F7A2-EM12K
Filler Metal F. No.	6	6	6
Weld Metal Analysis A-No.	1	1	1
Size of Filler Metal	2.4 mm Ø	1.2 mm Ø	2.4 mm Ø
Weld Metal Thickness	3.5 mm	6.5 mm	28.1 mm
Electrode Flux (class)	-	-	860/L-61
Other	Solid	Tubular	Flux : Neutral

GAS (QW-408)

	Gas(es) (Mixture)		Flow Rate	
	GTAW	FCAW	GTAW	FCAW
Shielding	Ar/99.9% CO ₂	-	20-25 l/min.	20-30 l/min.
Trailing	None	None	None	None
Backing	None	None	None	None

ELECTRICAL CHARACTERISTICS (QW-409)

Current : DC
Polarity : SP(GTAW), RP(FCAW) & RP(SAW)
Amps. : See Below Volts : See Below
Tungsten Electrode Size : 2.4 mm Ø, 2% Thoriated (GTAW)
Other/Speed Range : 0

POSITION (QW-405)

Position of Groove : 1 G
Weld Prog. (uphill, downhill) : -
Other : -

PREHEAT (QW-406)

Preheat Temp. : 230 °F ~ 254 °F
Interpass Temp. : 218 °F ~ 431 °F
Other : None

TECHNIQUE (QW-410)

Travel Speed : See Below
String or Weave Bead : String and Weave
Oscillation : None
Multipass or Single Pass (per side) : Multiple
Single or Multiple Electrodes : Single
Other : No Weld bead or layer can be thicker than 10 mm

Weld Layer	Process	Filler Metal		Current		Volt Range	Travel Speed Range (cm/Min.)	Other
		AWS Class	Dia. (mm)	Type Polarity	Amp. Range			
ROOT (1 & 2)	GTAW	ER-70S-3	2.4	DC-SP	98 - 142	13 - 15	5.3 - 6.8	
FILLER (3 & 4)	FCAW	E-71T-1	1.2	DC-RP	182 - 196	24 - 26	12 - 19	
5 - 12	SAW	F7A2-EM12K	2.4	DC-RP	486 - 498	26 - 28	24 - 26	

Form : 061/SBS/100997/PQR

Rev. 1

Page : 1 of 2

Factory : Jl. Raya Rangkasbitung Km. 3, Cikande Kab. Serang - Jawa Barat
Telp. (0254) 402313 - 402314 Fax. (0254) 402315

Appendix B



PT. SURYA BESINDO SAKTI

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PROCEDURE QUALIFICATION RECORD (PQR)

ASME SECT. IX

PQR : 72-GFSA 01 PW

TENSILE TEST (QW-150)

Specimen No	Width (mm)	Thickness (mm)	Area (SQR. mm)	Ultimate Total Load Kg.F	Ultimate Unit Stress Kg.F/in. ²	Type of Failure & Location
T-1, QW 462.1 (a)	20.3	37.8	767.34	41692	54.33	Ductile, BM
T-2, QW 462.1 (a)	20.8	38.74	804.24	41896	52.09	Ductile, BM

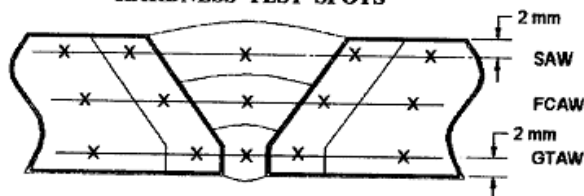
GUIDED-BEND TEST (QW-160)

Type and Figure No.	Result
Side Bend-1, QW-462.2	No Defect, Satisfactory
Side Bend-2, QW-462.2	No Defect, Satisfactory
Side Bend-3, QW-462.2	No Defect, Satisfactory
Side Bend-4, QW-462.2	0.5 mm Open Defect, Acc

VICKER HARDNESS TEST (10 Kg.F)

SPECIMENT	LOCATION	BM	H.A.Z	WELD	H.A.Z	BM
SAW	2 MM FROM UPPER SURFACE	156	164	200	211	164
FCAW	CENTER OF WELD	190	164	181	185	181
GTAW	2 MM FROM LOWER SURFACE	200	190	181	190	181

HARDNESS TEST SPOTS



OTHER TESTS

Type of Test Radiography taken by PT. Manggala Jaya Perkasa, Report No. 07/MJP/RT/WPS/03, Result : Satisfactory

Deposit Analysis

Other

Macro Test taken by PT. Biro Klasifikasi Indonesia, Lab Test No. 381-2/P-343/K/03, Result : Satisfactory

Welder Name

Supardi

Stamp No.

03

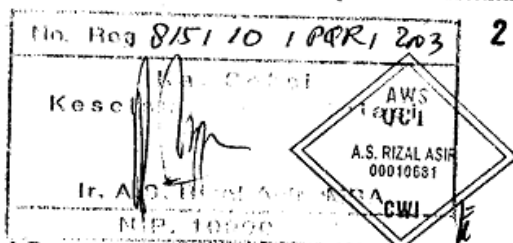
Mechanical Test conducted by

PT. Biro Klasifikasi Indonesia

Laboratory Test No.

381-1/P-343/K/09-03, Sept.26, 2003

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 sectional IX of the ASME Code



Date : October 6, 2003

Verified By : MIGAS

Manufacturer By : Subagio

Form : 061/SBS/100997/PQR

Rev. 1