Document No : UniKL MFI\_SD\_AC41 Revision No: 02 Effective Date: 01 December 2008

**SET A** 

# 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.

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**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?

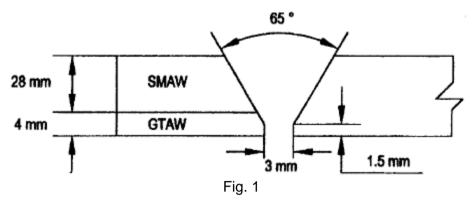
(5 marks)

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

(5 marks)

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#### **Question 3**



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.

(a) Write the base metal thickness approved range for the above welded joint.

(5 marks)

(b) 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)

(c) 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.

(a) State **FIVE (5)** codes and standard available related to welding qualification.

(5 marks)

(b) List FIVE (5) codes and standards related to fabrication of pressure vessel and pipe.

(5 marks)

(c) Outline the purposes of code and standard related to welding.

(5 marks)

(d) Classify the variable the related to fabrication of WPS.

(5 marks)

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#### **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 interpass 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



Komplex 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

		ASME	E SPECIFIC SECT. IX			
Company Name WPS No. Revision No.	: 72-GFSA (			ng PQR No.(s)	: 3ubaglo : 1 September : 72-GFSA 01	PW
Welding Process (es) JOINTS (QW-402)	: GIAW+F	CAW + SAW	Type (s)		: Manual+Semi Aut automatic, Manual, M	
Joint Design Backing Backing Material (Type)	: Single - Ve : None : None		_		± 5°	
Metal Nonmetallic		oth backing and retainer Nonfusing Metal Other	5)		1.5 mm ± 0	0.5 mm
P No. 1	Group N	o. 2 to P No	. 1	Group No.	2	
OR Specification type and gr to specification type and OR Chem. Analysis and medito Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range:	ade grade h. Prop. ech. Prop. Groove	e: 4.8 mm ~	200 mm	SA-516-70 SA-516-70 - - Fillet Fillet		
OR Specification type and gr to specification type and OR Chem. Analysis and meci to Chem. Analysis and m Thickness Range: Base Metal:	ade grade h. Prop. ech. Prop. Groove	e: 4.8 mm ~	200 mm	SA-516-70 SA-516-70 - - Fillet Fillet		<u> </u>
OR Specification type and gr to specification type and OR Chem. Analysis and meci to Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b	ade grade h. Prop. ech. Prop. Groove groove pead or layer	e: 4.8 mm ~ e: F can be thicker than	200 mm uli n 10 mm	SA-516-70 SA-516-70 - - Fillet Fillet		3 MIGAS
OR Specification type and gr to specification type and OR Chem. Analysis and mecto Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b FILLER METALS (QW-404) Spec. No. (SFA)	ade grade h. Prop. ech. Prop. Groove gead or layer	e: 4.8 mm ~ Acan be thicker that	200 mm uli n 10 mm SAW 5.17	SA-516-70 SA-516-70 - - Fillet Fillet		<u> </u>
OR Specification type and gr to specification type and or OR Chem. Analysis and medito Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b  FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class)	ade grade h. Prop. ech. Prop. Groove groove pead or layer  GTAW 5.18 ER-70S-3	e: 4.8 mm ~ e: A can be thicker that FCAW 5.20 E-71 T-1	200 mm uli 1 10 mm SAW 5.17 F7A2-EM12K	SA-516-70 SA-516-70	8 OCI 200 By:	MIGAS
OR Specification type and gr to specification type and OR Chem. Analysis and medito Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class) F- No.	ade grade h. Prop. ech. Prop. Groove gead or layer	e: 4.8 mm ~ e: A can be thicker than FCAW 5.20 E-71 T-1	200 mm uli n 10 mm SAW 5.17 F7A2-EM12K	SA-516-70 SA-516-70		MIGAS
OR Specification type and gr to specification type and OR Chem. Analysis and meci to Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld t  FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class) F- No. A- No.	ade grade h. Prop. ech. Prop. Groove Groove Groove Grad or layer  5.18 ER-70S-3 6	e: 4.8 mm ~ e: A can be thicker than FCAW 5.20 E-71 T-1 6	200 mm NI 110 mm SAW 5.17 F7A2-EM12K 6	SA-516-70 SA-516-70	8 OCI 200 By:	MIGAS  WFS 1 Znv3
OR Specification type and gr to specification type and OR Chem. Analysis and medito Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class) F- No.	ade grade h. Prop. ech. Prop. Groove groove pead or layer  GTAW 5.18 ER-70S-3	e: 4.8 mm ~ e: A can be thicker than FCAW 5.20 E-71 T-1	200 mm uli n 10 mm SAW 5.17 F7A2-EM12K	SA-516-70 SA-516-70	8 OCI 200 By:	MIGAS
OR Specification type and gr to specification type and OR Chem. Analysis and meci to Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class) F- No. A- No. Size of Filler Metals Weld Metal Thickness Range: Groove Max	ade grade h. Prop. ech. Prop. Groove Groove Bead or layer  GTAW 5.18 ER-70S-3 6 1 2.4 mm Ø	# : 4.8 mm ~ # Can be thicker that # FCAW	200 mm  VII 10 mm  SAW 5.17  F7A2-EM12K 6 1 2.4 mm Ø	SA-516-70 SA-516-70	8 OCT 200 By:	MIGAS  WFS / Zro3  AWS 0 s i  OC 1  PEZAL ASIR
OR Specification type and gr to specification type and OR Chem. Analysis and medito Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld k  FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class) F- No. A- No. Size of Filler Metals Weld Metal Thickness Range: Groove Max Fillet	ade grade h. Prop. ech. Prop. Groove Groove bead or layer  GTAW 5.18 ER-70S-3 6 1 2.4 mm Ø	e: 4.8 mm ~ e:	200 mm  III 110 mm  SAW 5.17  F7A2-EM12K 6 1 2.4 mm Ø	SA-516-70 SA-516-70	8 OCT 200 By:	MIGAS  WFS / Zev3
OR Specification type and gr to specification type and OR Chem. Analysis and meci to Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class) F- No. A- No. Size of Filler Metals Weld Metal Thickness Range: Groove Max	ade grade h. Prop. ech. Prop. Groove Groove Bead or layer  GTAW 5.18 ER-70S-3 6 1 2.4 mm Ø	## 4.8 mm ~ ## Can be thicker than  FCAW  5.20  E-71 T-1  6  1  1.2 mm Ø  13 mm  All  - 7100 ULTRA,	200 mm  VII 10 mm  SAW 5.17  F7A2-EM12K 6 1 2.4 mm Ø	SA-516-70 SA-516-70	8 OCT 200 By:	MIGAS  WFS / Zro3  AWS 0 s i  OC 1  PEZAL ASIR
OR Specification type and gr to specification type and OR Chem. Analysis and meci to Chem. Analysis and m Thickness Range: Base Metal: Pipe Dia. Range: Other: No Weld b FILLER METALS (QW-404) Spec. No. (SFA) AWS No. (Class) F- No. A- No. Size of Filler Metals Weld Metal Thickness Range: Groove Max Fillet Electrode-Flux (Class)	grade h. Prop. Groove Groove groove grad or layer  GTAW 5.18 ER-70S-3 6 1 2.4 mm Ø  7 mm All	e: 4.8 mm ~ e:	200 mm  VII 10 mm  SAW 5.17  F7A2-EM12K 6 1 2.4 mm Ø  200 mm - 860/L-61	SA-516-70 SA-516-70	8 OCT 200 By:	MIGAS  WFS / Zro3  AWS 0 s i  OC 1  PEZAL ASIR

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

#### Appendix A



#### PT. SURYA BESINDO SAKTI FABRICATOR & ENGINEERING SERVICES

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

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

#### WELDING PROCEDURE SPECIFICATION (WPS) ASME SECT. IX WP8: 72-GF8A 01 PW POSITIONS (QW-405) POST WELD HEAT TREATMENT (QW-42/) Position(S) of Groove Welding Progression Up Temperature Range 1 G 1140 °F Time Range 1 Afour 22d 30 Minutes Position(s) of Fillet GAS (QW-408) PREHEAT (QW-406) Percent Composition Preheat Temp. Min 200 °F 482 °F Interpass Temp. Max. Gas (es) (Mixture) Flow Rate GTAW Preheat Maintenance FCAW None GTAW FCAW Shielding (Continuous or special heating where applicableshould be recorded) Ar/99.9% C02 15-30 I/Min 15-30 I/Min Trailing None None None None Backing None None None **ELECTRICAL CHARACTERISTICS (QW-409)** Current AC or DC DC Polarity SP(GTAW), RP(FCAW) & RP(SAW) Amps (Range) See Below Volts (Range) See Below Tungsten Electrode Size and Type 2.4 mm •, 2% Thoriated (GTAW) (Pure Tungsten, 2 % Thoriated, etc.) Mode of Metal Transfer for GMAW (Spray arc, short circuriting arc, etc.) Electrode Wire feed speed range 6-12 m/min (FCAW) 1 00 1WPS 1 200 TECHNIQUE (QW-410) 2 8 OCT 2003 String or Weave Bead Tauggal: String and Weave Orifice or Gas Cup Size 7.9 mm (GTAW), 19 mm (FCAW) Grinding & Wire Brushing Initial and Interpass Cleaning ( Brushing, Grinding, etc. ) Method of Back Gouging None Oscillation None Contact Tube to Work Distance

Weld Layer	Process	Filler Metal		Current			Travel	
		AWS Class	Dia. (mm)	Type Polarity	Amp. Range	Voit Range	Speed Range (cm / Min)	Other
ROOT (1 & 2)	GTAW	ER-70 S-3	2.4	DC-SP	90 - 160	8 - 16	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 - 600	22 - 30	20 - 32	

10 - 20 mm (For SAW)

Peening is not Allowed.

No Weld bead or layer can be thicker than 10 mm

Multiple

See Below

Single

Form: 060/SBS/100998/WPS

Multiple or Single Pass (per side)

Multiple or Single Electrodes

Travel Speed (Range)

Peening

Other

Rev. 2

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

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#### Appendix B



## PT. SURYA BESINDO SAKTI FABRICATOR & ENGINEERING SERVICES

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#### PROCEDURE QUALIFICATION RECORD (POR) 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 (cs) : GTAW + FCAW + SAW Type (es) Manual+Semi Automatic+Machine 60° JOINT (QW-402) SA-516-70 SAW (28.1 mm) FCAW (6.5 mm) 38.1 mm GTAW (3.5 mm) 1.5 mm SA-516-70 3 mm BASE METAL (QW-403) POSTWELD HEAT TREATMENT (QW-407) Material Spec. SA-516 Temperature 1148 °F Type or Grade 70 Time 1 Hour and 30 Minutes P. No. **GROUP 2** Other Thickness of Test Coupon 38.1 mm Diameter of Test Coupon GAS (QW-408) Thickness of any pass < 10 mm Percent Composition Gas(es) (Mixture) FILLER METAL (QW-404) FCAW GTAW GTAW FCAW GTAW FCAW SAW Shielding Ar/99.9% CO<sub>2</sub> 20-25 I/Min. 20-30 VMin None SFA Spec. 5.18 Trailing None None None 5.20 5.17 AWS Classification ER-70S-3 F7A2-EM12K Backing None None None None Filler Metal F. No. 6 Weld Metal Analysis A-No. ELECTRICAL CHARACTERISTICS (QW-409) Size of Filler Metal 1.2 mm Ø 2.4 mm Ø 2.4 mm Ø Current DC Weld Metal Thickness Polarity 3.5 mm 6.5 mm 28.1 mm SP(GTAW), RP(FCAW) & RP(SAW) Electrode Flux (class) 860/L-61 Amps. See Below Volts See Below Other Solid Tubular Flux : Neutral Tungsten Electrode Size 2.4 mm ¢, 2% Thoriated (GTAW) POSITION (QW-405) Other/Speed Range 0 Position of Groove Weld Prog. (uphill,downhill) TECHNIQUE (QW-410) Other Travel Speed See Below String or Weave Bead String and Weave PREHEAT (OW-406) Oscillation None Preheat Temp. 230 °F ~ 254 °F Multipass or Single Pass (per side) Multiple Interpas Temp. 218 °F ~ 431 °F Single or Multiple Electrodes Single Other None No Weld bead or layer can be thicker than 10 mm Other Filler Metal Current Weld Travel Other Layer Process AWS Class Dia. (mm) Type Polarity Amp. Range Volt Range Speed Range (cm/Min.) ROOT GTAW ER-70S-3 DC-SP 98 - 142 13 - 155.3 - 6.8(1 & 2)FILLER FCAW E-71T-1 1.2 DC-RP 182 - 196 24 - 26 12 - 19 (3 & 4)5 ~ 12 SAW F7A2-EM12K 24 DC-RP 486 - 498 26 - 28 24 - 26

Form: 061/SBS/100997/PQR

Rev. 1

Factory: Jl. Raya Rangkasbitung Km. 3, Cikande Kab. Serang - Jawa Barat

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1: 10 .. 815 1 LA 19001 9-2

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#### Appendix B



### PT. SURYA BESINDO SAKTI FABRICATOR & ENGINEERING SERVICE

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

Telp.

: (021) 6340175 - 6344963 (021) 6340766 - 6341852

Fax No. Email @ RAD.NET.ID

## PROCEDURE QUALIFICATION RECORD (PQR)

ASME SECT. IX

PQR : 72-GFSA 01 PW

TENSILE	TEST	(QW-150)
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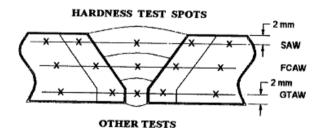
	Specimen No	Width (mm)	Thickness (mm)	Area (SQR. mm)	Ultimate Total Load Kg.F	Ultimate Unit Stress Kg.Fir2	Type of Failure & Location
L	T-1, QW 462.1 (a)	20.3	37.8	767.34	41692	54.33	Ductile, BM
L	T-2, QW 462.1 (a)	20.8	38.74	804.24	41896	52.09	Ductile, BM

GUIDED-BEND TEST (OW-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 )

PECIMENT	LOCATION	ВМ	II.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



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/,5/05 03; illesuit : Satisfactory

Welder Name

Supardi

Stamp No.

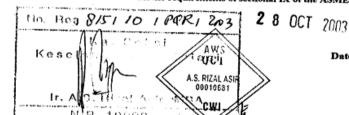
Mechanical Test conducted by

PT. Biro Klasifikasi Indonesia

Laboratory Test No.

38t-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

Subagio

Form: 061/SBS/100997/PQR

Verified By :

MIGAS

Manufacturer By :