Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
MATT TURNER	M.TU.	07,26,17		SAW	F7A6	2F	1¼"		XRAY # G2575

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 07, 28

4605-47 Street
Vermillion, AB. T9X 1L6
780-608-9589

QUALITY CONTROL MANUAL

Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
JOEL OVERGAARD	J.OV	07,26,17		SAW	F7A6	2G	1 1/4"		X RAY # G2574

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 07, 28

Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
KEVIN WRIGHT	K.W.R	07,26,17	SAS 1	SMAW	F3, F4	2G	1 1/4"		X-Ray G2572
	K.W.R	07,26,17	SAS 1	SMAW	F3, F4	3G	1 1/4"		X-Ray G2572
	K.W.R.	07,26,17	SAS 1	SMAW	F3 F4	4G	1 1/4"		X-Ray G2572
	K.W.R	07,26,17		SAW	F7 A6	2G	1 1/4"		X-Ray G2572

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 07, 28

Sub-Arc Systems Inc.	WELDERS' QUALIFICATION RECORD API 650	Exhibit 8, Rev A

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
TYLER MONCRIEF	T. MO	07.26.17	SAS 1	SMAW	F3, F4	2G	1 1/4"		XRAY # G2571
	T. MO	07.26.17	SAS 1	SMAW	F3, F4	3G	1 1/4"		XRAY # G2571
	T. MO	07.26.17	SAS 1	SMAW	F3 F4	4G	1 1/4"		XRAY # G2571.

QC (PRINT) SIGN:	DATE (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN SIGN: [signature]	DATE (yyyy-MM-dd): 2017, 07, 28

4605-47 Street
Vermillion, AB, T9X 1L6
780-608-9589

QUALITY CONTROL MANUAL

Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
CHRIS JAQUES	C.JA	06,21,17	SAS 1	SMAW	F3, F4	2G	1 1/4"		X-RAY G2339
	C.JA.	06,21,17	SAS 1	SMAW	F3, F4	3G	1 1/4"		X-RAY G2339
	C.JA.	06,21,17	SAS 1	SMAW	F3, F4	4G	1 1/4"		X-RAY G2339

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 06, 23

Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
JOEL OVEREARD	J.OV	06,21,17	SAS 1	SMAW	F3, F4	2G	1 1/4"		X-RAY G2340
	J.OV	06,21,17	SAS 1	SMAW	F3, F4	3G	1 1/4"		X-RAY G2340
	J.OV	06,21,17	SAS 1	SMAW	F3, F4	4G	1 1/4"		X-RAY G2340

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 06, 23.

Sub-Arc Systems Inc.	WELDERS' QUALIFICATION RECORD API 650	Exhibit 8, Rev A

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
MITCH GOULIGER	M.GO	06,21,17	SAS 1	SMAW	F3, F4	2G	1 1/4"		X-RAY G2341
	M.GO	06,21,17	SAS 1	SMAW	F3, F4	3G	1 1/4"		X-RAY G2341
	M.GO	06,21,17	SAS 1	SMAW	F3, F4	4G	1 1/4"		X-RAY G2341

QC (PRINT) SIGN:	DATE (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN SIGN:	DATE (yyyy-MM-dd): 2017, 06, 23

Sub-Arc Systems Inc.	WELDERS' QUALIFICATION RECORD API 650	Exhibit 8, Rev A

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
MATT TURMEL	M.TU	06,21,17	SAS 1	SMAW	F3, F4	2G	1 1/4"		X-RAY G2342
	M.TU	06,21,17	SAS 1	SMAW	F3, F4	3G	1 1/4"		X-RAY G2342
	M.TU	06,21,17	SAS 1	SMAW	F3, F4	4G	1 1/4"		X-RAY G2342

QC (PRINT) SIGN:	DATE (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN SIGN:	DATE (yyyy-MM-dd): 2017, 06, 23

Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
MATT MACKENZIE	M.MA	06,21,17	SAS 1	SMAW	F3, F4	2G	1 1/4"		X-RAY G2343
	M.MA	06,21,17	SAS 1	SMAW	F3, F4	3G	1 1/4"		X-RAY G2343
	M.MA.	06.21.17	SAS 1	SMAW	F3, F4	4G	1 1/4"		X-RAY G2343

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 06, 23

QUALITY CONTROL MANUAL

Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
QUITON POTTS	Q.PO	06,21,17	SAS 1	SMAW	F3, F4	2G	1 1/4"		X-Ray E2344
	Q.PO	06,21,17	SAS 1	SMAW	F3, F4	3G	1 1/4"		X-Ray E2344
	Q.PO	06,21,17	SAS 1	SMAW	F3, F4	4G	1 1/4"		X-Ray E2344

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) ROBERT HOFFMAN **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 06, 23

Sub-Arc Systems Inc.	**WELDERS' QUALIFICATION RECORD** **API 650**	**Exhibit 8, Rev A**

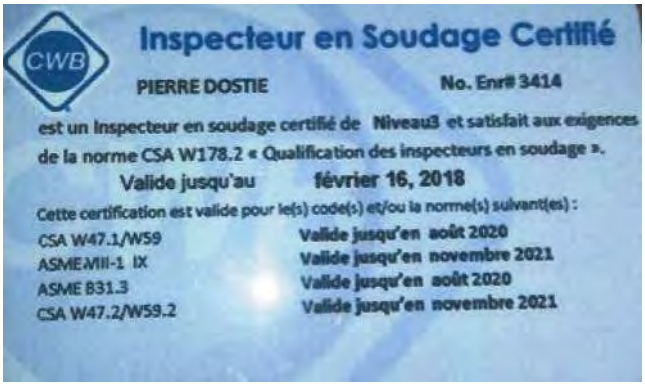
WELDER NAME	WELDER SYMBOL	DATE QUALIF.	QUALIFICATION PROCEDURE	LIMITATIONS					REMARKS
				PROCESS	ELECTRODE	POSITION	THICKNESS RANGE	DIAMETER RANGE	
Dustin ZuBach	D.ZU	06.21.17	SAS 1	SMAW	F3. F4	2G.	1 1/4"		X-Ray G2345
	D.ZU	06.21.17	SAS 1	SMAW	F3. F4	3G	1 1/4"		X-Ray G2345
	D.ZU	06.21.17	SAS 1	SMAW	F3, F4	4G	1 1/4"		X-Ray G2345

QC (PRINT) **SIGN:**	**DATE** (yyyy-MM-dd):
QA (PRINT) Robert Hoffman **SIGN:**	**DATE** (yyyy-MM-dd): 2017, 06, 23

Item 4 – Inspector Qualification

Contents

CWB Inspector Certification - Pierre Dostie



Inspecteur en Soudage Certifié

PIERRE DOSTIE **No. Enr# 3414**

est un Inspecteur en soudage certifié de **Niveau3** et satisfait aux exigences de la norme CSA W178.2 « Qualification des inspecteurs en soudage ».

Valide jusqu'au **février 16, 2018**

Cette certification est valide pour le(s) code(s) et/ou la norme(s) suivant(es) :

CSA W47.1/W59	**Valide jusqu'en août 2020**
ASME-MII-1 IX	**Valide jusqu'en novembre 2021**
ASME B31.3	**Valide jusqu'en août 2020**
CSA W47.2/W59.2	**Valide jusqu'en novembre 2021**

Conditions

1. La possession de cette carte ne signifie nullement que son détenteur représente un organisme d'inspection certifiée en vertu de la norme CSA W178.1 et ayant du personnel et des procédures approuvées par le Bureau canadien de soudage.
2. Cette carte demeure la propriété du Bureau et peut être rappelée en tout temps.
3. L'usage de la présente carte à des fins frauduleuses peut entraîner son annulation.

Pour toute question concernant cette qualification, veuillez communiquer avec :

1-800-844-6790 | www.cwbgroup.org

CWB Inspector Certification - Sylvain Germain

Inspecteur en Soudage Certifié

SYLVAIN GERMAIN **No. Enr# 4935**

est un Inspecteur en soudage certifié de **Niveau3** et satisfait aux exigences de la norme CSA W178.2 « Qualification des inspecteurs en soudage ».

Valide jusqu'au **avril 30, 2020**

Cette certification est valide pour le(s) code(s) et/ou la norme(s) suivant(es) :

CSA W47.1-09/W59-13

Expiration de recertification après 6 ans **avril 30, 2020**

Conditions

1. La possession de cette carte ne signifie nullement que son détenteur représente un organisme d'inspection certifié en vertu de la norme CSA W178.1 et ayant du personnel et des procédures approuvées par le Bureau canadien de soudage.
2. Cette carte demeure la propriété du Bureau et peut être rappelée en tout temps.
3. L'usage de la présente carte à des fins frauduleuses peut entraîner son annulation.

Pour toute question concernant cette qualification, veuillez communiquer avec :

1-800-844-6790 | www.cwbgroup.org

Item 5 – Weld Procedures

Contents

SUB-ARC SYSTEMS INC.

Welding Procedure Specification

in accordance with

ASME Section IX

Welding Procedure Specification No.: **SAS-1 Revision 1[1]**

Supporting PQR No. (s): **SAS-1-1, SAS-1-2, SAS-1-3 Revision 1, SAS-1-4**

Qualified for

Process(es):	SMAW / SMAW / SAW	**Position(s):**	All / All / Flat or Horizontal[2]
Filler Metal F-No.:	F-3 / F-4 / F-6	**A-No.:**	A-1 / A-1 / A-1
AWS Classification:	E6010 / E7018-1 / F7A6-EM12K	**Weld Type(s):**	Groove, Fillet, Weld buildup
Base Metal:	P-1 Group 1 or 2	To:	P-1 Group 1 or 2
Typical Materials:	This procedure is qualified for all P-1 materials as specified in Table QW-422 of ASME Section IX for applications where proven notch toughness properties are not required, and P-1 Group 1 or 2 materials only for applications where proven notch toughness properties are required.		
Diameter Range:	All diameters	**Condition(s):**	As welded

Thickness Range:	**Normal Service**	**Impact Tested to -50°F**
ASME Section IX	0.062” to 1.500”	0.125” to 1.500”
ASME Section VIII	0.062” to 1.500”	0.125” to 1.500”
ASME B31.1	0.062” to 0.750”	0.125” to 0.750”
ASME B31.3	0.062” to 0.750”	0.125” to 0.750”

[1]Revision 1: Revision to accommodate revision of PQR SAS-1-3 as well as the addition PQR SAS-1-4 to expand the base metal thickness range where proven notch toughness properties are required at -50°F.

[2]SAW position limited by process usability.

Provincial Registration

ABSA

SAFETY CODES ACT - PROVINCE OF ALBERTA
WELDING PROCEDURE

Reg. No. WP 2389.2
Spec No. SAS-1 (Rev 1)
Weld Process SMAW / SMAW / SAW
Matl. Gr. P No. 1 Gr 1+2 to P No. 1 Gr 1+2
Elect Gr. F No. 3+4+6 A No. 1
Th. Qual For 38.1mm P.W.H.T. NO
MIN TH QUAL 3.2mm, CVN -46°C

Yr. 14 Mo. 11 Day 5 Signed
JASON REINHART, P.ENG.
WELDING SPECIALIST

Provincial Registration

WELDING PROCEDURE SPECIFICATION (WPS) QW-482

(Section IX, ASME Boiler and Pressure Vessel Code)

Company Name:	Sub-Arc Systems Inc.	**By:**	Gary Kohlman
WPS No.:	SAS-1	**Date:**	January 4, 2002
Revision No.:	1[1]	**Revision Date:**	July 15, 2014
Supporting PQR's:	SAS-1-1, SAS-1-2, SAS-1-3 Revision 1, SAS-1-4		
Welding Process(es):	SMAW / SMAW / SAW	**Type(s):**	Manual / Manual / Machine

JOINTS QW-402		**Joint Details**
Joint Design:	Butt, Tee, Lap, Corner, etc.	**All ASME joint designs.** Reference construction
Backing:	F-3 SMAW with or without backing.	drawings for joint details. Where joint details are not
	F-4 SMAW with backing only.	specified, refer to typical joint detail sheet provided.
	SAW with backing only.	-----
Backing Material (Type):	Similar base or weld metal or backwelding as required. No Retainers.	

BASE METALS QW-403

P-No.:	P-1	**Group No.:**	*1 or 2	**to P-No.:**	P-1
Group No.:	*1 or 2				
OR					
Spec. type & grade:	Not Applicable	**to Spec. type & grade:**	Not Applicable		
OR					
Chem. Analysis & Mech. Prop.:	Not Applicable	**to Chem. Analysis & Mech. Prop.:**	Not Applicable		

Thickness Range

		Normal Service	**Impact Tested to -50°F**		
Base Metal: Groove:	Section IX	0.062" to 1.500"	0.125" to 1.500"	**Fillet:**	All
	Section VIII	0.062" to 1.500"	0.125" to 1.500"	**Fillet:**	All
	B31.1	0.062" to 0.750"	0.125" to 0.750"	**Fillet:**	All
	B31.3	0.062" to 0.750"	0.125" to 0.750"	**Fillet:**	All
Pipe Dia Range: Groove:	All diameters			**Fillet:**	All

Other: Maximum thickness of any weld layer shall not exceed 0.500"

*Limited to P-1 Group 1 or 2 only when proven notch toughness properties are required.

FILLER METALS QW-404

Process:	**SMAW**	**SMAW**	**SAW**
Specification No. (SFA):	5.1	5.1	5.17
AWS Classification No.:	E6010	E7018-1	EM12K
F-No.:	F-3	F-4	F-6
A-No.:	A-1	A-1	A-1
Size of Filler Metals:	3/32", 1/8", 5/32"	3/32", 1/8", 5/32, 3/16", 1/4"	3/32", 1/8", 5/32", 3/16"
Weld Metal Thickness - Groove:	0.250" max.	1.500" max.	1.500" max.
- Fillet:	Unlimited	Unlimited	Unlimited
Electrode-Flux (Class):	Not Applicable	Not Applicable	F7A6-EM12K-H8
Manufacturer:	Not Applicable	Not Applicable	Lincoln Electric
Tradename:	Not Applicable	Not Applicable	LA-61
Flux Trade Name:	Not Applicable	Not Applicable	Lincoln 882 Flux
Alloy Flux:	Not Applicable	Not Applicable	Neutral
Consumable Insert:	Not Applicable	Not Applicable	Not Applicable
Supplemental Filler Metals:	Not Applicable	Not Applicable	Not Applicable
Product Form:	Covered Electrode	Covered Electrode	Coiled Solid Wire
Other:	E6010 limited to root pass only when proven notch toughness properties are required.		

[1]Revision 1: Revision to accommodate revision of PQR SAS-1-3 as well as the addition PQR SAS-1-4 to expand the base metal thickness range where proven notch toughness properties are required at -50°F.

WELDING PROCEDURE SPECIFICATION (WPS) QW-482

(Section IX, ASME Boiler and Pressure Vessel Code)

WPS # SAS-1 Rev.1

POSITIONS QW-405		POSTWELD HEAT TREATMENT QW-407	
Position(s) of Groove:	All	**Temp. Range:**	
Welding Progression:	F-3 SMAW Vertical Up or Down	**Time Range:**	
	F-4 SMAW Vertical Up or Down	**Heating:**	***(None – As Welded)***
	F-6 SAW Flat or Horizontal[1]		
Position(s) of Fillet:	All	**Cooling:**	
PREHEAT QW-406		**GAS QW-408**	
Temperature Min.:		**Shielding Gas(es):**	
Interpass Temp. Max.:	(***See Next Page***)	**Composition:**	
Interpass Min.:		**Flow Rate:**	***(Not Applicable)***
Preheat Maintenance:	Monitor using tempilstiks, pyrometer or other suitable methods.	**Gas Backing:**	
		Other:	

ELECTRICAL CHARACTERISTICS QW-409

Current:	**F-3 SMAW:**	Direct - DC	**F-4 SMAW:**	Direct - DC	**F-6 SAW:**	Direct - DC
Polarity:	**F-3 SMAW:**	Reverse - EP	**F-4 SMAW:**	Reverse - EP	**F-6 SAW:**	Reverse - EP
Amps (Range):	**F-3 SMAW:**	50 - 180	**F-4 SMAW:**	50 - 360	**F-6 SAW:**	250 - 750
Volts (Range):	**F-3 SMAW:**	18 - 34	**F-4 SMAW:**	18 - 34	**F-6 SAW:**	22 - 38
Travel Speed (Range):	**F-3 SMAW:**	1 - 16	**F-4 SMAW:**	1 - 20	**F-6 SAW:**	4 - 35
Maximum Heat Input: 0.125" to 0.625":	**F-3 SMAW:**	25 200 J/in	**F-4 SMAW:**	29 640 J/in	**F-6 SAW:**	36 428 J/in
0.625" to 1.500":	**F-3 SMAW:**	69 300 J/in	**F-4 SMAW:**	63 000 J/in	**F-6 SAW:**	73 636 J/in
Electrode Wire feed speed range:	50 - 550 ipm					
Tungsten Electrode Size & Type:	Not Applicable					
Mode of Metal Transfer for GMAW:	Not Applicable					
Other:	Maximum heat input mandatory only when proven notch toughness is required.					

TECHNIQUE QW-410

String or Weave Bead:	String and weave. Weave size shall be controlled to prevent exceeding maximum heat inputs.
Orifice or Gas Cup Size:	Not Applicable
Initial Cleaning:	Base material must be thoroughly cleaned of all foreign material (scale, rust, oil, grease, paint, tar, etc.) at least 1" back on each side of the joint prior to welding. All surfaces to be welded shall be smooth, uniform and free from notches, slag, fins and burrs.
Interpass Cleaning:	Perform by wire brush, chipping hammer, power brushing, grinding, etc. after each weld layer.
Method of Back Gouging:	Arc air, gouge, grind, etc., grind to clean metal where thermal processes are used if required.
Oscillation:	Not Applicable
Contact Tube to Work Distance:	1/4" to 1 1/4"
Multiple or Single Pass (per side):	Single or multiple passes per side, multiple only when proven notch toughness properties are required.
Multiple or Single Electrodes & Spacing:	Single or Multiple, multiple only when proven notch toughness properties are required.
Peening:	Peening is not allowed

TYPICAL WELDING PARAMETERS

	Filler Metal		Current			
Process	**AWS Classification**	**Diameter (in)**	**Type & Polarity**	**Amp. Range**	**Volt Range**	**Travel Speed (IPM)**
SMAW	E6010	3/32	DC EP	50 - 100	18 - 30	1 - 12
SMAW	E6010	1/8	DC EP	50 - 150	20 - 32	2 - 14
SMAW	E6010	5/32	DC EP	60 - 180	22 - 34	4 - 16
SMAW	E7018-1	3/32	DC EP	50 - 130	18 - 28	1 - 14
SMAW	E7018-1	1/8	DC EP	70 - 180	19 - 30	2 - 16
SMAW	E7018-1	5/32	DC EP	90 - 230	20 - 32	3 - 18
SMAW	E7018-1	3/16	DC-EP	130 - 290	20 - 34	4 - 19
SMAW	E7018-1	1/4	DC-EP	180 - 360	22 - 34	4 - 20
SAW	F7A6-EM12K	3/32	DC EP	250 - 750	22 - 38	4 - 35
SAW	F7A6-EM12K	1/8				
SAW	F7A6-EM12K	5/32				
SAW	F7A6-EM12K	3/16				

Notes: Number of weld layers and size of filler metal may vary with thickness of base material and position of weld.

[1]SAW position limited by process usability.

WELDING PROCEDURE SPECIFICATION (WPS) QW-482

(Section IX, ASME Boiler and Pressure Vessel Code)

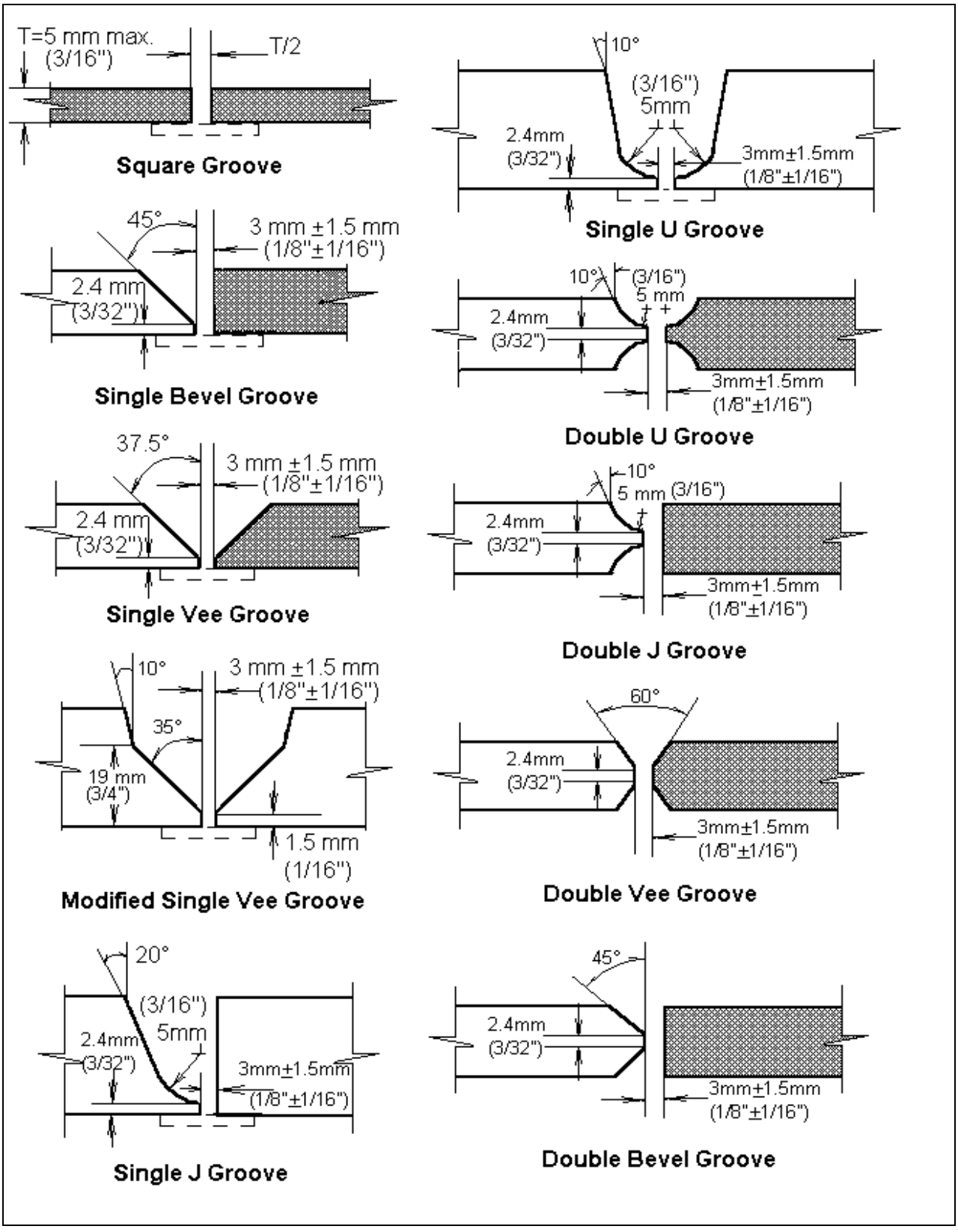
WPS # SAS-1 Rev.1

PREHEAT & INTERPASS TEMPERATURE MINIMUM AND MAXIMUM	
Section VIII :	50°F minimum for all P-1 materials except as listed below :
	175°F if the joint thickness exceeds 1.000" and the specified carbon content exceeds 0.30%
	200°F if the joint thickness is 1.250" to 1.500"
B31.1 :	50°F minimum for all P-1 materials
B31.3 :	50°F for all P-1 materials except as listed below:
	175°F if the specified minimum tensile strength of the base material exceeds 71 ksi
Max. Interpass Temp.:	650°F for normal service, 550°F for applications where proven notch toughness is required

Reference to relevant construction codes is mandatory prior to production welding to determine any supplementary restrictions.

Typical Joint Details QW-482

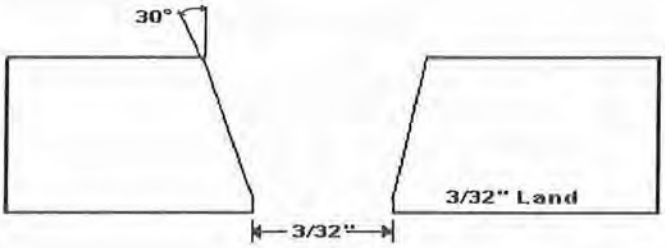
Prepared by: Qualimet

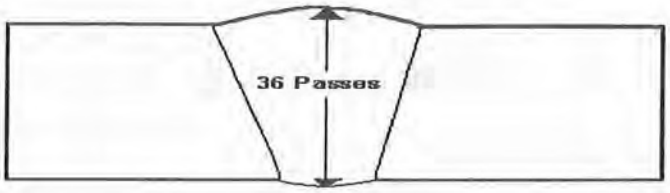


PROCEDURE QUALIFICATION RECORD (PQR) QW-483
(Section IX, ASME Boiler and Pressure Vessel Code)

Company Name:	Sub Arc Systems		
PQR No:	SAS-1-1	**Date:**	January 4, 2002
Revision No.:	-----	**Revision Date:**	-----
WPS No:	SAS-1		
Welding Process(es):	SMAW/ SMAW/ SAW		
Types:	Manual/ Manual/ Machine		

JOINTS QW-402





BASE METALS QW-403

Material Spec.:	SA-516	to	SA-516
Type or Grade:	Grade 60		Grade 70
P-No.:	P-1 Group 1		P-1 Group 2
Thickness of Test Coupon:	1.75" wt.		
Diameter of Test Coupon:	Plate		
Other:	Carbon Equivalent (C.E) : 0.40		

POSTWELD HEAT TREATMENT QW-407

Temperature:	
Time:	
Other:	*Not Applicable*

PREHEAT QW-406

Preheat & Interpass Min.:	175 °F
Interpass Max.:	600°F
	Temperature monitored using Tempilstick

SHIELDING GAS QW-408

Shielding Gas:	N/A
Composition:	N/A
Flow Rate:	N/A

FILLER METALS QW-404

Process	SMAW	SMAW	SAW
SFA Spec No:	5.1	5.1	5.17
AWS Class. No:	E6010	E7018-1	EM12K
F-No:	F-3	F-4	F-6
A-No:	A-1	A-1	A-1
Size of Filler Metal:	1/8"	1/8"	3/32"
Deposited Metal:	0.250"	0.750"	0.750"
Flux Class:	N/A	N/A	F7A6 (Neutral)
Other:	Covered Electrode	Covered Electrode	Coiled Solid Wire
			(Lincoln L61/882)

ELECTRICAL CHARACTERISTICS QW-409

Process:	SMAW	SMAW	SAW
Current:	Direct (DC)	Direct (DC)	Direct (DC)
Polarity:	Reverse (EP)	Reverse (EP)	Reverse (EP)
Volts:	21	21	31
Amps:	110	125	450
Heat Input (J/in):	69 300	63 000	73 636

TECHNIQUE QW-410

Process:	SMAW	SMAW	SAW
Position:	3G	3G	2G
Progression:	Vertical Up	Vertical Up	Horizontal
Travel Speed (ipm):	2.5	2.25	16
String or Weave:	String	String and Weave	String
Oscillation:	N/A	N/A	N/A
Single / Multi Pass:	Multiple	Multiple	Multiple
Single / Multi Electrodes:	Single	Single	Single
Wire Feed Rate:	N/A	N/A	80 ipm

PROCEDURE QUALIFICATION RECORD (PQR) QW-483
(Section IX, ASME Boiler and Pressure Vessel Code)

PQR # SAS-1-1

Tensile Test
QW-462

Specimen No.	Width In	Thickness In	Area in^2	Ultimate Total Load Lb	Ultimate Unit Stress psi	Type of Failure & Location
		See Attached Report				

Guided Bend Tests
QW-462

Type and Figure No.	Result
See Attached Report	

Toughness Tests
QW-170

Specimen No.	Notch Location	Notch Type	Test Temp	Impact Values	Lateral Exp		Drop Weight	
					% Shear	Mils	Break	No Brk
			See Attached Report					

Fillet-Weld Tests
Not Applicable

Result-Satisfactory: Yes ____ No ____ Pen. Into Parent Material: Yes ____ No ____
Macro-Results:

Other Tests

Type of Test: Vickers Hardness Test to NACE MR01
Deposit Analysis: N/A

Welder's Name: Gary Kolman Clock No.: W-2638 Stamp ID: CC
Tests Conducted By: Qualimet Inc. Lab. Test No.: 636 – 01001

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.

Manufacturer: Sub Arc Systems

Date: January 4, 2002 By: Gary Kolman

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MECHANICAL TEST REPORT

for Procedure Qualification Record # SAS-1-1

Client:	Sub Arc Systems	**Job Number:**	636-01001
Address:	4605-47 Steet Vermillion, AB	**Date:**	January 4, 2002
Materials:	SA-516 Grade 60 to 70		
Size:	1.750" wt plate	**Condition:**	As Welded
Test Specification:	ASME Section IX		

Tensile Tests QW - 462.1(a)

Sample Identification:	CCT1	CCT2
Sample Size – inch:(W x T)	1.723 x 0.753	1.717 x 0.759
Least X-Sect. Area - in^2:	1.30	1.30
Ultimate Load - lbs:	102 526	104 116
Ult. Ten. Strength - ksi:	72.3	71.6
Character of Failure:	Ductile	Ductile
Location of Failure:	Base Metal 516 Gr.60 Side	Base Metal 516 Gr.60 Side
Req'd Tensile Strength - ksi:	60.0	60.0
Pass or Fail:	Passed	Passed
Remarks:		

*Bend Test QW - 462.2

Sample Identification:	CCB1	CCB2	CCB3	CCB4
Type of Bend Test:	TSB	TSB	TSB	TSB
Pass or Fail:	Pass	Pass	Pass	Pass
Remarks:				

*Types of Bend Tests

TSB, TFB, TRB = transverse side, face or root bend

LSB, LFB, LRB = longitudinal side, face or root bend

We certify that the statements in this record are acceptable, in accordance with the requirements of ASME Section IX.

TEST RESULTS CERTIFIED BY: QUALIMET INC.

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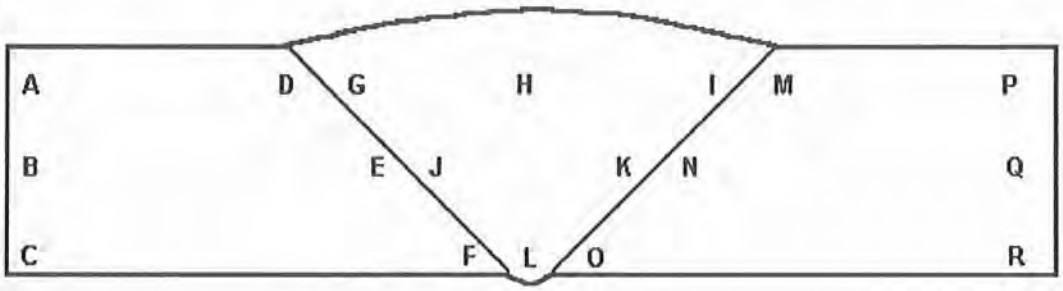
HARDNESS TEST REPORT

for Procedure Qualification Record # SAS-1-1

Client:	Sub Arc Systems	**Job Number:**	636-01001
Address:	4605-47 Steet Vermillion, Alberta T9X-1L6	**Date:**	January 4, 2002
Materials:	SA-516 Grade 60 to 70		
Size:	1.750" wt plate	**Condition:**	As Welded
Test Method:	Hardness testing performed in accordance with ASTM E-92 using a Vickers Hardness Tester with a 10 kg load. (HV10)		
Equipment:	Matsuzawa Seiki Co. Ltd. Vickers Hardness Tester S/N: 7193M		
Calibration:	**Test Block :** 197 ± 6 DPH	**Act. Reading:**	197 DPH



Hardness Values

A	177	D	198	G	205	J	210	M	189	P	178
B	182	E	205	H	103	K	207	N	196	Q	181
C	173	F	201	I	208	L	202	O	194	R	179

These hardness values do not exceed 248 HV10 (HRC 22).

We certify that the statements in this record are acceptable, in accordance with the requirements of ASME Section IX and NACE MR01

Test Results Certified by: MBCamm **QUALIMET INC.**

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CHARPY V-NOTCH IMPACT TEST RESULTS

For Procedure Qualification Report # SAS-1

Client:	Sub Arc Systems	**Job Number:**	636-01001
Address:	4605-47 Steet Vermillion, AB	**Date:**	January 4, 2002
Materials:	SA-516 Grade 60 to 70		
Size:	1.750" wt plate	**Condition:**	As Welded
Specimen Type:	10.0 mm Charpy V Notch impact specimens		
Specification:	ASTM A-370, ASME Section VIII UG-84		
Qualification Temp.:	-46°C (-50°F)		

Sample Set	Sample Number	Impact Energy Ft-lb	(Joule)	Converted Full Size Impact Energy (J)	% Shear
Weld Zone – Root	1	14	19	24	20
Includes Both	2	48	65	81	20
SMAW Processes	3	38	51	64	20
	Average:	33	45	57	20
Weld Zone – Fill	1	58	79	79	10
	2	45	61	61	20
	3	88	119	119	40
	Average:	64	86	86	23
Heat Affected Zone	1	18	24	24	20
SA-516 Gr. 70	2	122	165	165	60
	3	101	137	137	70
	Average:	80	109	109	50
Heat Affected Zone	1	98	133	133	40
SA-516 Gr. 70	2	132	179	179	100
	3	86	117	117	40
	Average:	105	143	143	60

Remarks: These Charpy v-notch impact test results exceed the minimum requirements of ASME Section VIII and B31.3 Codes for –46°C; or CSA Z662-99 Codes for -46°C.

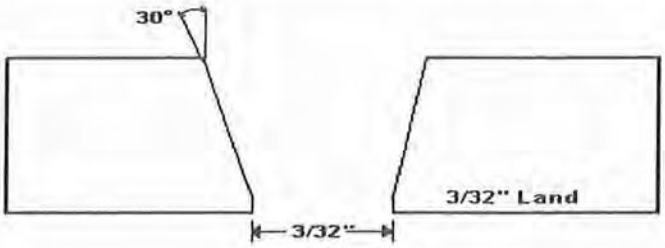
We certify that the statements in this record are acceptable, in accordance with the requirements of ASME Section IX.

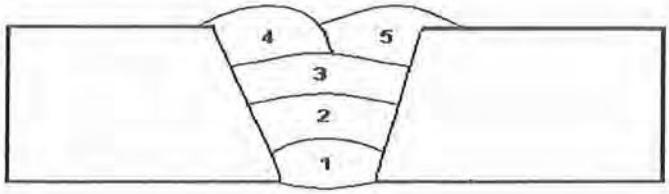
Test Results Certified By: M Flynn **QUALIMET INC.**

PROCEDURE QUALIFICATION RECORD (PQR) QW-483
(Section IX, ASME Boiler and Pressure Vessel Code)

Company Name:	Sub Arc Systems		
PQR No:	SAS-1-2	**Date:**	January 4, 2002
Revision No.:	-----	**Revision Date:**	-----
WPS No:	SAS-1		
Welding Process(es):	SMAW/ SMAW/ SAW		
Types:	Manual/ Manual/ Machine		

JOINTS QW-402





BASE METALS QW-403

Material Spec.:	SA-516	To	SA-516
Type or Grade:	Grade 60		Grade 70
P-No.:	P-1 Group 1		P-1 Group 2
Thickness of Test Coupon:	0.375" wt.		
Diameter of Test Coupon:	Plate		
Other:	Carbon Equivalent (C.E) : 0.38		

POSTWELD HEAT TREATMENT QW-407

Temperature:	
Time:	
Other:	*Not Applicable*

PREHEAT QW-406

Preheat & Interpass Min.:	50 °F
Interpass Max.:	600°F
	Temperature monitored using Tempilstick

SHIELDING GAS QW-408

Shielding Gas:	N/A
Composition:	N/A
Flow Rate:	N/A

FILLER METALS QW-404

Process	SMAW	SMAW	SAW
SFA Spec No:	5.1	5.1	5.17
AWS Class. No:	E6010	E7018-1	EM12K
F-No:	F-3	F-4	F-6
A-No:	A-1	A-1	A-1
Size of Filler Metal:	1/8"	3/32"	3/32"
Deposited Metal:	0.100"	0.125"	0.150"
Flux Class:	N/A	N/A	F7A6 (Neutral)
Other:	Covered Electrode	Covered Electrode	Coiled Solid Wire
			(Lincoln L61/882)

ELECTRICAL CHARACTERISTICS QW-409

Process:	SMAW	SMAW	SAW
Current:	Direct (DC)	Direct (DC)	Direct (DC)
Polarity:	Reverse (EP)	Reverse (EP)	Reverse (EP)
Volts:	21	21	30
Amps:	110	110	425
Heat Input (J/in):	39 610	55 428	36 428

TECHNIQUE QW-410

Process:	SMAW	SMAW	SAW
Position:	3G	3G	2G
Progression:	Vertical Up	Vertical Up	Horizontal
Travel Speed (ipm):	3.5	2.5	21
String or Weave:	String	String and Weave	String
Oscillation:	N/A	N/A	N/A
Single / Multi Pass:	Multiple	Multiple	Multiple
Single / Multi Electrodes:	Single	Single	Single
Wire Feed Rate:	N/A	N/A	83 ipm

PROCEDURE QUALIFICATION RECORD (PQR) QW-483
(Section IX, ASME Boiler and Pressure Vessel Code)

PQR # SAS-1-2

Tensile Test
QW-462

Specimen No.	Width In	Thickness In	Area In^2	Ultimate Total Load Lb	Ultimate Unit Stress psi	Type of Failure & Location
		See Attached Report				

Guided Bend Tests
QW-462

Type and Figure No.	Result
See Attached Report	

Toughness Tests
QW-170

Specimen No.	Notch Location	Notch Type	Test Temp	Impact Values	Lateral Exp % Shear	Lateral Exp Mils	Drop Weight Break	Drop Weight No Brk
			See Attached Report					

Fillet-Weld Tests
Not Applicable

Result-Satisfactory: Yes ____ No ____ Pen. Into Parent Material: Yes ____ No ____
Macro-Results:

Other Tests

Type of Test: Vickers Hardness Test to NACE MR01
Deposit Analysis: N/A

Welder's Name: Gary Kolman **Clock No.:** W-2368 **Stamp ID:** CD
Tests Conducted By: Qualimet Inc. **Lab. Test No.:** 636 – 01001

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.

Manufacturer: Sub Arc Systems

Date: January 4, 2002 **By:** Gary Kolman Gary Kolman

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MECHANICAL TEST REPORT

for Procedure Qualification Record # SAS-1-2

Client:	Sub Arc Systems	**Job Number:**	636-01001
Address:	4605-47 Steet Vermillion, AB	**Date:**	January 4, 2002
Materials:	SA-516 Grade 60 to 70		
Size:	0.375" wt plate	**Condition:**	As Welded
Test Specification:	ASME Section IX		

Tensile Tests QW - 462.1(a)

Sample Identification:	CDT1	CDT2
Sample Size - inch:(W x T)	0.7300 x 0.3600	0.7200 x 0.380
Least X-Sect. Area – In^2:	0.263	0.360
Ultimate Load – lbs:	22 340	22 408
Ult. Ten. Strength – ksi:	85.0	86.4
Character of Failure:	Ductile	Ductile
Location of Failure:	Base Metal SA-516 Gr.60 Side	Base Metal SA-516 Gr.60 Side
Req'd Tensile Strength – ksi:	60.0	60.0
Pass or Fail:	Passed	Passed
Remarks:		

*Bend Test QW - 462.2

Sample Identification:	CDB1	CDB2	CDB3	CDB4
Type of Bend Test:	TSB	TSB	TSB	TSB
Pass or Fail:	Pass	Pass	Pass	Pass
Remarks:				

*Types of Bend Tests

TSB, TFB, TRB = transverse side, face or root bend

LSB, LFB, LRB = longitudinal side, face or root bend

We certify that the statements in this record are acceptable, in accordance with the requirements of ASME Section IX.

TEST RESULTS CERTIFIED BY: N. B. Rawlin **QUALIMET INC.**

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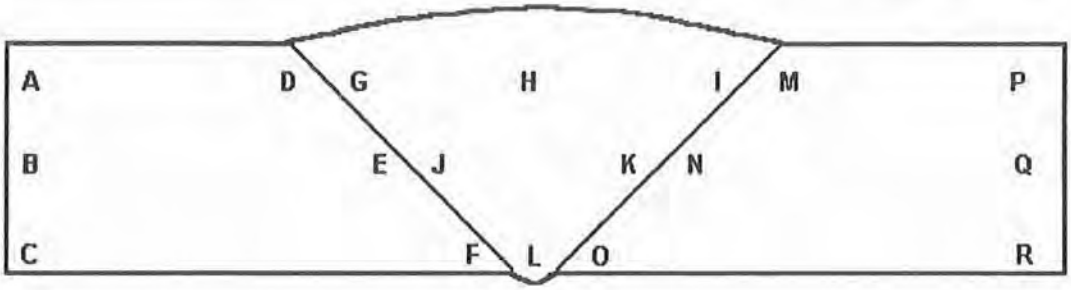
HARDNESS TEST REPORT

for Procedure Qualification Record # SAS-1-2

Client:	Sub Arc Systems	**Job Number:**	636-01001
Address:	4605-47 Steet Vermillion, AB	**Date:**	January 4, 2002
Materials:	SA-516 Grade 60 to 70		
Size:	0.375" wt plate	**Condition:**	As Welded
Test Method:	Hardness testing performed in accordance with ASTM E-92 using a Vickers Hardness Tester with a 10 kg load. (HV10)		
Equipment:	Matsuzawa Seiki Co. Ltd. Vickers Hardness Tester S/N: 7193M		
Calibration:	**Test Block :** 197 ± 6 DPH	**Act. Reading:**	197 DPH



Hardness Values

A	198	D	208	G	215	J	212	M	204	P	193
B	195	E	203	H	211	K	215	N	202	Q	189
C	196	F	206	I	210	L	209	O	207	R	195

These hardness values do not exceed 248 HV10 (22 HRC).

We certify that the statements in this record are acceptable, in accordance with the requirements of ASME Section IX and NACE MR01

Test Results Certified by: M Kamm **QUALIMET INC.**

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CHARPY V-NOTCH IMPACT TEST RESULTS

For Procedure Qualification Report # SAS-1-2

Client:	Sub Arc Systems	**Job Number:**	636-01001
Address:	4605-47 Steet Vermillion, AB	**Date:**	January 4, 2002
Materials:	SA-516 Grade 60 to 70		
Size:	0.375" wt plate	**Condition:**	As Welded
Specimen Type:	8.5 mm Charpy V Notch impact specimens		
Specification:	ASTM A-370, ASME Section VIII UG-84		
Qualification Temp.:	-46°C (-50°F)		

Sample Set	Sample Number	Impact Energy Ft-lb	(Joule)	Converted Full Size Impact Energy (J)	% Shear
	1	10	14	16	20
Weld	2	12	16	19	20
	3	24	33	38	20
	Average:	15	21	24	20
Heat Affected Zone	1	82	111	131	70
SA516 Gr. 60	2	106	144	169	80
	3	146	198	233	100
	Average:	111	151	178	83
Heat Affected Zone	1	98	133	166	40
SA516 Gr. 70	2	132	179	224	100
	3	86	117	146	40
	Average:	105	143	179	60

Remarks: These Charpy v-notch impact test results exceed the minimum requirements of ASME Section VIII and B31.3 Codes for -46°C; or CSA Z662-99 Codes for -46°C.

We certify that the statements in this record are acceptable, in accordance with the requirements of ASME Section IX.

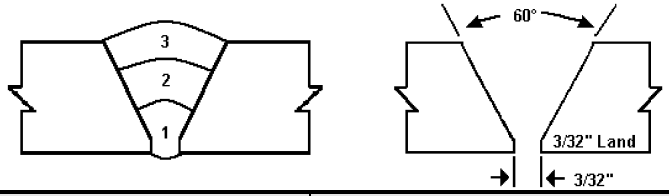
Test Results Certified By: **QUALIMET INC.**

PROCEDURE QUALIFICATION RECORD (PQR) QW-483

(Section IX, ASME Boiler and Pressure Vessel Code)

Company Name:	Sub Arc Systems	**By:**	Gary Kohlman
PQR No.:	SAS-1-3	**Date:**	January 4, 2002
Revision No.:	1[1]	**Revision Date:**	July 15, 2014
Welding Process(es):	SMAW / SMAW / SAW	**Types:**	Manual / Manual / Machine

JOINTS QW-402



BASE METALS QW-403

Material Spec.:	SA-516		SA-516
Grade/Type/Class:	Gr. 60		Gr. 70
P-No. Group No.:	P-1 Group 1	**to**	P-1 Group 2
Heat No.:	Not Recorded		Not Recorded
ASME C.E.:	Not Recorded		Not Recorded
CSA C.E.:	Not Recorded		Not Recorded
Thickness & Diameter:	0.249" thick plate (machined)		
Max Weld Deposit:	<0.500" per pass		

POSTWELD HEAT TREATMENT QW-407

Temperature:	
Time:	
Heating:	
	(Not Applicable)
Cooling:	
Other:	

PREHEAT QW-406

Preheat Temp. Min.:	50°F
Interpass Temp. Max.:	600°F
Interpass Temp. Min.:	50°F
Other:	Temperature monitored by tempilstiks

POSITIONS QW-405

Process:	F-3 SMAW	F-4 SMAW	SAW
Position:	3-G	3-G	2-G
Progression:	Vertical Up	Vertical Up	Horizontal
Other:	Not Applicable	Not Applicable	Not Applicable

FILLER METALS QW-404

Process:	**SMAW**	**SMAW**	**SAW**
SFA Specification No.:	5.1	5.1	5.17
AWS Classification No.:	E6010	E7018-1	EM12K
F-No.:	F-3	F-4	F-6
A-No.:	A-1	A-1	A-1
Size of Filler Metal:	1/8"	3/32"	3/32"
Deposited Weld Metal:	0.050"	0.075"	0.125"
Electrode-Flux (Class):	Not Applicable	Not Applicable	F7A6
Flux Trade Name:	Not Applicable	Not Applicable	Lincolnweld 882
Alloy Element/Flux:	Not Applicable	Not Applicable	None
Manufacturer:	Not Recorded	Not Recorded	Lincoln Electric
Trade Name:	Not Recorded	Not Recorded	L-61
Heat Number:	Not Recorded	Not Recorded	Not Recorded
Product Form:	Covered Electrode	Covered Electrode	Coiled Metal Cored Wire

SHIELDING GAS QW-408

Shielding Gas:			
Composition:			
Flow Rate:	***(Not Applicable)***	***(Not Applicable)***	***(Not Applicable)***
Trailing / Backing Gas:			
Flow Rate:			

ELECTRICAL CHARACTERISTICS QW-409

Current:	Direct (DC)	Direct (DC)	Direct (DC)
Polarity:	Reverse (EP)	Reverse (EP)	Reverse (EP)
Volts:	21	20	30
Amps:	110	105	425
Travel Speed (ipm):	5.5	4.3	24
Maximum Heat Input (J/in):	25 200	29 640	36 428
Wire Feed Speed (ipm):	Not Applicable	Not Applicable	82
Mode of Metal Transfer:	Not Applicable	Not Applicable	Not Applicable

TECHNIQUE QW-410

String or Weave:	String	String & Weave	String
Oscillation:	Not Applicable	Not Applicable	Not Applicable
Single / Multi Pass:	Single Pass from one side	Single Pass from one side	Single Pass from one side
Single / Multi Electrodes:	Single	Single	Single
Thermal Processes	Not Applicable	Not Applicable	Not Applicable
Wire Stick Out:	Not Applicable	Not Applicable	Not Recorded
Nozzle / Cup Size:	Not Applicable	Not Applicable	Not Applicable

[1] **Revision 1: Revision to correct editorial error.**