



the pressure equipment safety authority

9410 - 20 Ave N.W.
Edmonton, Alberta, Canada T6N 0A4
Tel: (780) 437-9100 / Fax: (780) 437-7787

December 13, 2006

Ron Sobie
PAINTEARTH ENERGY SERVICES INC
BOX 24
HALKIRK, AB

Dear Ron Sobie,

The welding procedures received on December 06, 2006 are accepted for registration as follows:

Reg. No. : WP-1684.2

Accepted on: December 13, 2006

Tracking No. : 2006-09153

Reg Type : New Design

Spec. No. : PESI-8SR REV 0

Registered under owner / manufacturer name PAINTEARTH ENERGY SERVICES INC

Please note the acceptance of the registration does not allow the use of this welding procedure in the construction, modification, or repair of any boiler, pressure vessel, pressure piping system or fitting in Alberta unless the contractor/manufacturer has registered a Quality Control system for such work with ABSA.

Welding procedures, which specify impact testing, have been accepted in accordance with A.S.M.E. Section IX only. Other A.S.M.E. Code Sections may have additional requirements respecting impact testing.

An invoice covering survey and registration fees will be forwarded from our Revenue Accounts.

Enclosed is a stamped welding procedure for your reference.

Sincerely,

ROSEBERG, BOB, P. Eng.
Design Survey Engineer

WELDING PROCEDURE SPECIFICATION NO.: PESI-8sr (Rev.0)

WELDING PROCEDURE QUALIFICATION RECORD NO.(S): CCL-8SR-1, CCL-9-1
CCL-13SR(B)-1

QUALIFIED FOR

Base Metal (Typical): P1 Group 2 to P1 Group 2
(SA 350 Gr. LF2, SA 105, SA 516 Gr. 70, etc.)

Process(es): GMAW / SMAW / SAW Weld Types: GROOVE & FILLET

Position: GMAW & SMAW: ALL SAW: FLAT & HORIZONTAL

Diameter: ALL DIAMETERS

Filler Metal: (Standard Applications) GMAW: ER70S-2, 3 or 6

SMAW: E7018, E7018-1 SAW: F7AX-EM12K

Filler Metal: (N.T. Applications) GMAW: ER70S-6

SMAW: E7018-1 SAW: F7A6-EM12K

BASE METAL CONDITIONS & GROOVE THICKNESS RANGE QUALIFIED:

NOTCH TOUGHNESS APPLICATIONS TO -46°C WITH P.W.H.T.

ASME B31.1 15.9 to 203 mm (0.625 to 8.00 in.) inclusive

ASME B31.3 15.9 to 203 mm (0.625 to 8.00 in.) inclusive

ASME SECT. VIII, DIV.1 15.9 to 203 mm (0.625 to 8.00 in.) inclusive

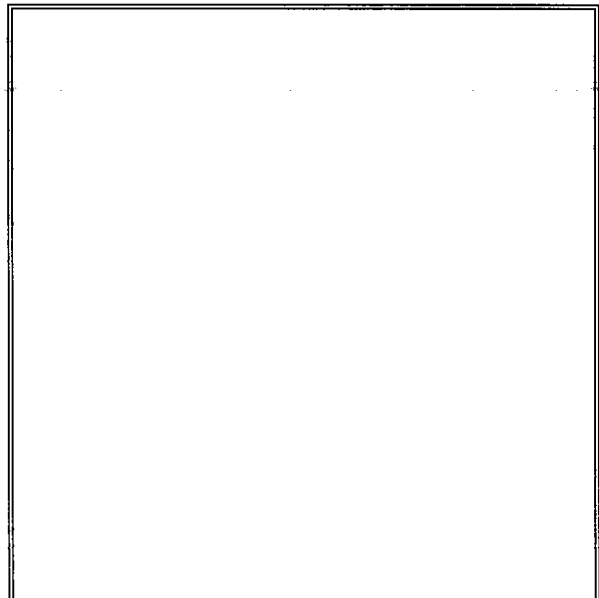
STANDARD APPLICATIONS WITH P.W.H.T

ASME B31.1 4.8 to 203 mm (0.188 to 8.00 in.) inclusive

ASME B31.3 4.8 to 203 mm (0.188 to 8.00 in.) inclusive

ASME SECT. VIII, DIV.1 4.8 to 203 mm (0.188 to 8.00 in.) inclusive

ALBERTA BOILERS SAFETY ASSOCIATION	
PROVINCE OF ALBERTA	
SAFETY CODES ACT	
WELDING PROCEDURE	
Reg. No. WP	<u>16842</u>
Spec No.	<u>PESI-8sr</u>
Weld Process	<u>GMAW / SMAW / SAW</u>
Matl. Gr. P No.	<u>1 Gr 2</u> to P No. <u>1 Gr 2</u>
Elec. Gr. F No.	<u>6+4+6</u> A No. <u>1</u>
Th. Qual. For	<u>203 mm</u> PWHT <u>YES</u>
<u>MIN TH. QUAL 15.8 mm, C.V.N. -46°C</u>	
Yr. Mo. Day	<u>06. 12. 13</u> Signed <u>[Signature]</u>
R. ROSEBERG, P.ENG. WELDING SPECIALIST	
PROVINCIAL REGISTRATION	



QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Paintearth Energy Services Inc.

Welding Procedure Specification No. PESI-8sr (Rev.0) Date November 22, 2006
Revision(s) Rev.0 - (Non-Essential) Format update, company name change, (formerly IPS
Manufacturing Limited) & WPS No. change, formerly IPS-8sr (Rev.1) September 27, 2005
Supporting PQR No.(s) CCL-8SR-1, CCL-9-1, CCL-13SR(B)-1
Welding Process(es) GMAW / SMAW / SAW Type(s) Semi-automatic/Manual/Machine

JOINTS (QW-402)

Joint Design All ASME groove & fillet, reference construction drawing for joint details.
Where joint details are not specified, see figures 1 to 15 attached.
Root Opening As per attached typical groove designs, see figures 1 to 15 attached.
Backing With or without Retainers Not required

BASE METALS (QW-403)

P-Number P1 Group 2 To P-Number P1 Group 2
Thickness Range: Groove See cover page for thickness qualified by governing code
Fillet All base metal thicknesses
Base Metal Std. Appl.: 4.8 to 203 mm (0.188 to 8.00 in.) inclusive
N.T. Appl.: 15.9 to 203 mm (0.625 to 8.00 in.) inclusive
Pipe Diameter Ranges: Groove All diameters
Fillet All diameters
Deposited Weld Metal (Per Pass) GMAW: 3.5 mm (0.138 in.) maximum
SMAW & SAW: 12.7 mm (0.500 in.) maximum

FILLER METALS (QW-404)

	GMAW	SMAW
Specification No. (SFA)	<u>SFA 5.18</u>	<u>SFA 5.1</u>
AWS No. (Class) (Std. Appl.)	<u>ER70S-2,3 or 6</u>	<u>E7018 / E7018-1</u>
AWS No. (Class) (N.T. Appl.)	<u>ER70S-6</u>	<u>E7018-1</u>
F-No.	<u>F6</u>	<u>F4</u>
A-No.	<u>A1</u>	<u>A1</u>
Size	<u>.030 to .045 in. inclusive</u>	<u>3/32 to 1/4 in. inclusive</u>
Filler Metal Product Form	<u>GMAW: Solid wire without the addition of supplementary fillers</u>	
Deposited Weld Metal Thickness Range:		
Groove	<u>3.5 mm (0.138 in.) max.*</u>	<u>203 mm (8.00 in.) max.*</u>
Fillet	<u>All fillet sizes</u>	<u>All fillet sizes</u>

FILLER METALS (QW-404)

	SAW
Specification No. (SFA)	<u>SFA 5.17</u>
AWS No. Class	<u>EM12K</u>
Flux / Wire Classification (Std. Appl.)	<u>F7AX-EM12K</u>
Flux / Wire Classification (N.T. Appl.)	<u>F7A6-EM12K</u>
F-No.	<u>F6</u>
A-No.	<u>A1</u>
Size	<u>5/64 to 3/16 in. inclusive</u>
Flux Type	<u>Neutral</u>
Deposited Weld Metal Thickness Range:	
Groove	<u>203 mm (8.00 in.) max.*</u>
Fillet	<u>All fillet sizes</u>
Other	<u>1) Recrushed slag must be tested and meet ASME Section II, Part C requirements</u> <u>2) Without additional fillers and without supplementary powders</u> <u>1) * Combined deposited weld metal thickness shall not exceed 203 mm (8.00 in.)</u>

POSITION (QW-405)

Position of Groove GMAW & SMAW: All SAW: Flat
 Position of Fillet GMAW & SMAW: All SAW: Flat & Horizontal
 Weld Progression GMAW (Std. Appl.): Vertical up or down
GMAW (N.T. Appl.): Vertical down
SMAW: Vertical up SAW: N/A

PREHEAT (QW-406)

Preheat Temperature (Minimum) 38°C (100°F) or per attached preheat sheet, whichever is greater
 Interpass Temperature (Maximum) 232°C (450°F) for Notch Toughness applications
371°C (700°F) for Standard applications
 Preheat Maintenance As per minimum preheat temperature above prior to welding. Preheat maintenance is not required if welding is interrupted or after the completion of welding unless required by the code of construction.

POST WELD HEAT TREATMENT (QW-407)

Temperature Range See P.W.H.T. sheet Time Range See P.W.H.T. sheet
 Other P.W.H.T. time at temperature shall not exceed 262 min. for notch toughness applications

GAS (QW-408)

Specification No. (SFA) SFA 5.32 AWS No. SG-ACO-5/4
 Shielding (GMAW) 91% Argon, 5% CO₂, 4% O₂ 10 - 25 liters per minute (20 - 50 cfph)
 Backing None Trailing Not required

ELECTRICAL CHARACTERISTICS (QW-409)

Current Direct Polarity Reverse, electrode positive
 Amps See Table #1 Volts See Table #1
 Electrode Wire Feed Speed GMAW: 1,300 to 10,000 mm/min. (50 to 400 ipm)
SAW: 500 to 7,500 mm/min. (20 to 300 ipm)

Maximum Heat Input for Notch Toughness Applications

Base Metal Thickness Range	GMAW	SMAW	SAW
(0.625 - 8.00 in.)	64,800 J/in.	86,250 J/in.	76,500 J/in.

Mode of Metal Transfer GMAW: Short circuiting arc

TECHNIQUE (QW-410)

String or Weave GMAW & SMAW: Either SAW: String Travel Speed See Table #1
 Orifice or Gas Cup Size 9.52 mm (0.375 in.) to 19.1 mm (0.750 in.) inclusive
 Initial & Interpass Cleaning Brushing, chipping or grinding as required
 Method of Back Gouging Air carbon arc, back-grind as required
 Contact Tube to Work Distance (GMAW) 6.35 mm (0.250 in.) to 19.1 mm (0.750 in.) inclusive
 Contact Tube to Work Distance (SAW) 12.7 mm (0.500 in.) to 44.5 mm (1.75 in.) inclusive
 Multiple or Single Pass Per Side (Standard applications): Either
 (Notch toughness applications): Multiple
 Multiple or Single Electrodes Single
 Peening Not permitted

TABLE 1 - WELDING PARAMETERS

Process	Filler Metal	Diameter mm (in.)	Current Type & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
GMAW	ER70S-2,3 or 6	0.8 (0.030)	DCRP	70 - 130	14 - 21	26 - 250 (1.0 - 10)
GMAW	ER70S-2,3 or 6	0.9 (0.035)	DCRP	75 - 200	15 - 22	28 - 600 (1.1 - 25)
GMAW	ER70S-2,3 or 6	1.1 (0.045)	DCRP	115 - 250	16 - 25	46 - 900 (1.8 - 35)
SMAW	E7018/E7018-1	2.4 (3/32)	DCRP	60 - 120	18 - 30	21 - 300 (0.8 - 12)
SMAW	E7018/E7018-1	3.2 (1/8)	DCRP	90 - 150	19 - 30	31 - 350 (1.2 - 14)
SMAW	E7018/E7018-1	4.0 (5/32)	DCRP	110 - 220	21 - 31	44 - 400 (1.7 - 16)
SMAW	E7018/E7018-1	5.0 (3/16)	DCRP	160 - 320	22 - 31	64 - 500 (2.5 - 20)
SMAW	E7018/E7018-1	5.5 (7/32)	DCRP	240 - 340	23 - 32	100 - 550 (3.9 - 22)
SMAW	E7018/E7018-1	6.4 (1/4)	DCRP	275 - 360	23 - 32	112 - 550 (4.4 - 22)
SAW	F7AX-EM12K	2.0 (5/64)	DCRP	200 - 500	25 - 32	102 - 750 (4.0 - 30)
SAW	F7AX-EM12K	2.4 (3/32)	DCRP	250 - 600	25 - 33	127 - 812 (5.0 - 32)
SAW	F7AX-EM12K	3.2 (1/8)	DCRP	250 - 700	26 - 33	130 - 890 (5.1 - 35)
SAW	F7AX-EM12K	4.0 (5/32)	DCRP	370 - 800	26 - 34	193 - 1015 (7.6 - 40)
SAW	F7AX-EM12K	5.0 (3/16)	DCRP	500 - 1000	28 - 36	355 - 1143 (14 - 45)
Notes: Standard Applications Size of electrode, filler metal, number of passes, voltage, amperage, and travel speed will vary with position, joint thickness, joint type etc. Notch Toughness Applications Welding parameters shall be adjusted to insure that the maximum heat input value specified in QW-409 above is not exceeded. Heat Input = $\frac{\text{Amps} \times \text{Volts} \times 60}{\text{Travel Speed (ipm)}}$						

TYPICAL JOINT DESIGNS

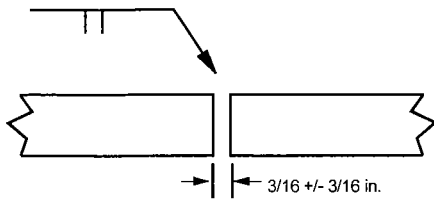


Figure 1
Single Square Butt

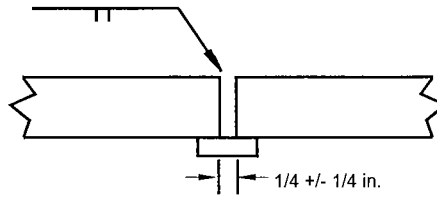
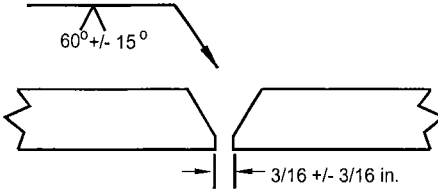


Figure 2
Single Square Butt with Backing Strip

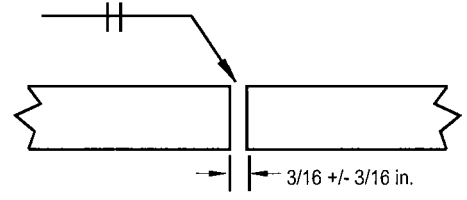
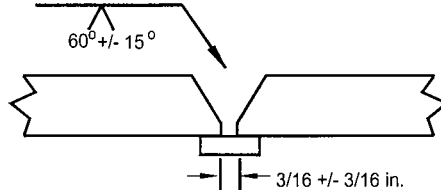


Figure 3
Double Square Butt

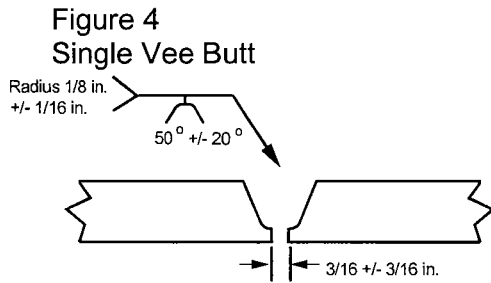
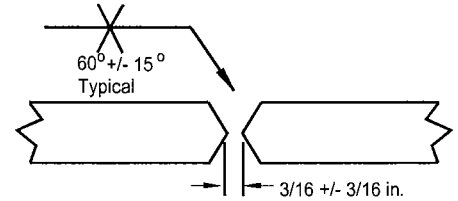


Figure 4
Single Vee Butt

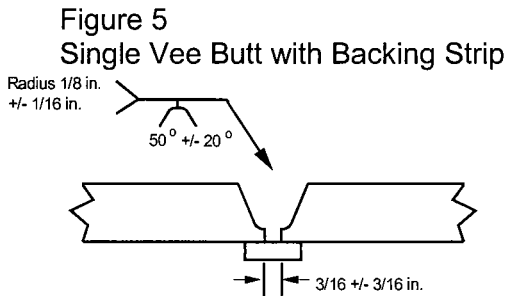
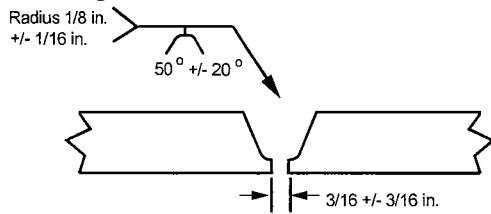


Figure 5
Single Vee Butt with Backing Strip

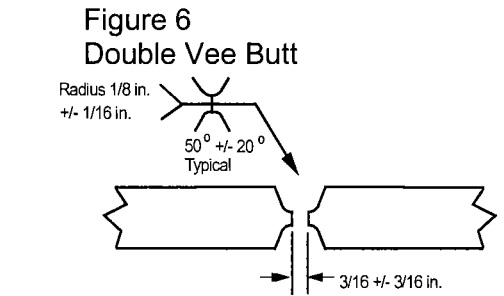
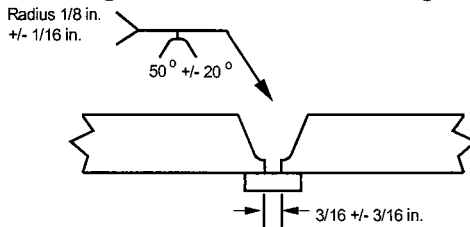


Figure 6
Double Vee Butt

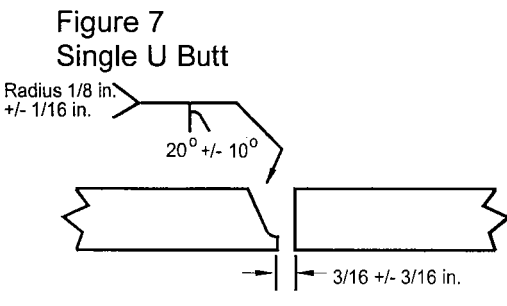
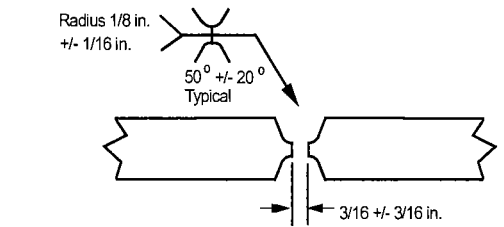


Figure 7
Single U Butt

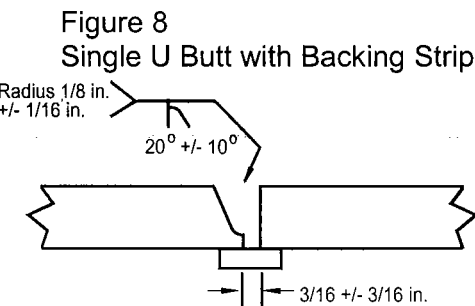
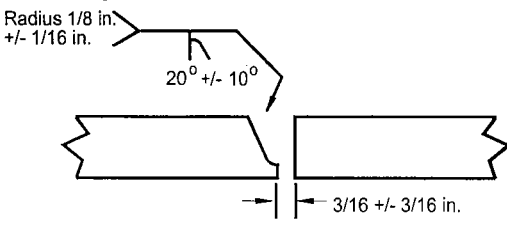


Figure 8
Single U Butt with Backing Strip

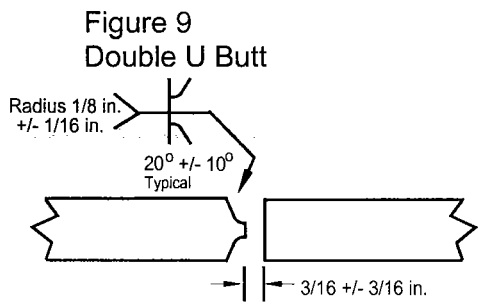
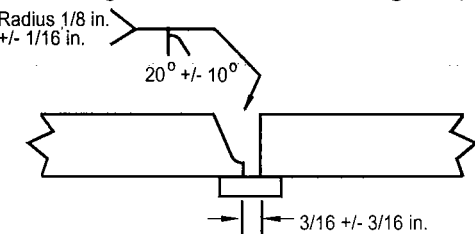


Figure 9
Double U Butt

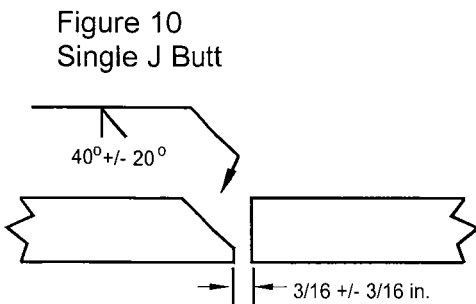
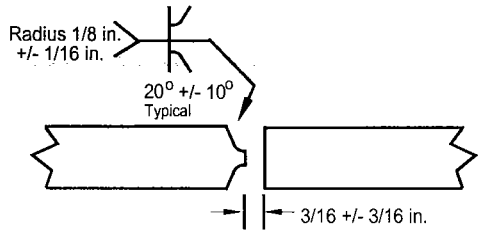


Figure 10
Single J Butt

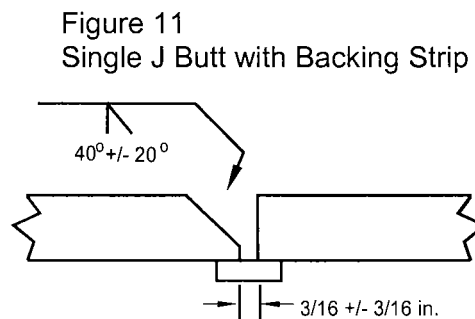
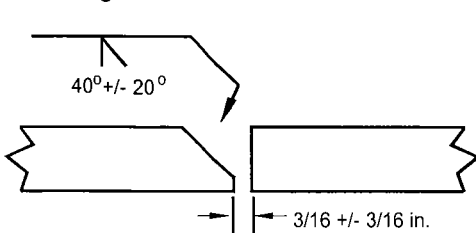


Figure 11
Single J Butt with Backing Strip

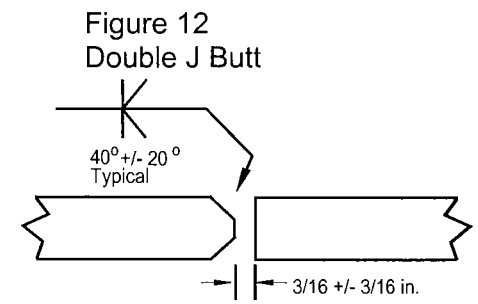
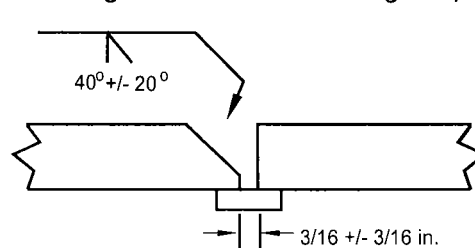


Figure 12
Double J Butt

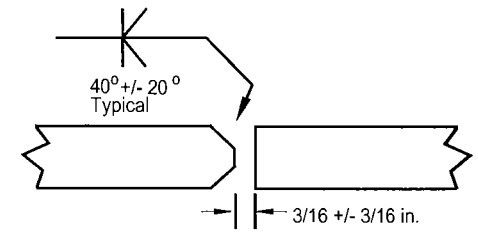


Figure 13
Single Bevel Butt

Figure 14
Single Bevel Butt with Backing Strip

Figure 15
Double Bevel Butt

Or as per the joint design on the approved construction drawing.

PREHEAT**P-No. 1**

1. Welds joining pressure parts or attachments shall be preheated to not less than the minimum preheat temperatures stated in paragraph 5.
2. The preheat temperature shall be maintained during welding.
3. If welding is interrupted, the weld joint and adjacent areas shall be reheated to the minimum preheat temperature stated in paragraph 5, prior to the start of welding.
4. Preheat temperatures shall be checked by the welder or inspector, using temperature indicating crayons or other reputable methods.
5. Minimum preheating temperatures shall be as follows:

PRESSURE VESSELS IN ACCORDANCE WITH ASME SECTION VIII, DIV. 1

NOMINAL WALL THICKNESS	MINIMUM PREHEAT TEMPERATURE
0 to 31.8 mm (0 to 1.25 in)	38°C (100°F)
Over 31.8 mm (Over 1.25 in.)	93°C (200°F)
Over 25.4 mm (1.0 in.) & specified maximum carbon content in excess of 0.30%.	80°C (175°F)

- The conditions of UW-30 shall apply for base metal temperatures below 0°C (32°F).
- The preheat zone shall extend at least 50.8 mm (2.0 in.) beyond each edge of the weld.

PROCESS PIPING IN ACCORDANCE WITH ASME B31.3

NOMINAL WALL THICKNESS	MINIMUM SPECIFIED BASE METAL TENSILE STRENGTH	MINIMUM PREHEAT TEMPERATURE
< 25.4 mm (1.0 in.)	≤ 490 MPa (71 ksi)	38°C (100°F)
≥ 25.4 mm (1.0 in.)	All	80°C (175°F)
All	> 490 MPa (71 ksi)	80°C (175°F)

- The preheat zone shall extend at least 25.4 mm (1.0 in.) beyond each edge of the weld.
- The interruption of welding shall be subject to the requirements of paragraph 320.2.4.

POWER PIPING IN ACCORDANCE WITH ASME B31.1

NOMINAL WALL THICKNESS	MINIMUM PREHEAT TEMPERATURE
Over 25.4 mm (1.0 in.) & specified maximum carbon content in excess of 0.30%.	80°C (175°F)
All others	38°C (100°F)

- The preheat zone shall extend at least 76.2 mm (3.0 in.) beyond each edge of the weld.

POSTWELD HEAT TREATMENT**P-No. 1****PRESSURE VESSELS IN ACCORDANCE WITH ASME SECTION VIII, DIV. 1**

1. All postweld heat treatment shall be in accordance with ASME Section VIII, Division I, UW-40 & UCS-56 latest edition and addenda.
2. Post weld heat treatment temperatures and minimum holding times are as follows:

NOMINAL WALL THICKNESS	HEAT TREAT TEMPERATURE	HOLDING TIME
Up to 50.8 mm (2.0 in.)	595°C (1100°F) minimum	1 Hour / 25.4 mm (inch), 15 minutes minimum
Over 50.8 mm (2.0 in.)	595°C (1100°F) minimum	2 Hours plus 15 minutes for each additional 25.4 mm (inch) over 50.8 mm (2.0 in.)

PROCESS PIPING IN ACCORDANCE WITH ASME B31.3

1. All postweld heat treatment shall be in accordance with Table 331.1.1 of ASME B31.3 latest edition and addenda.
2. Post weld heat treatment temperatures and minimum holding times are as follows:

NOMINAL WALL THICKNESS	MINIMUM SPECIFIED TENSILE STRENGTH	HEAT TREAT TEMPERATURE	HOLDING TIME
All	All	595 - 650°C (1100 - 1200°F)	1 Hour / 25.4 mm (inch), 1 Hour minimum

POWER PIPING IN ACCORDANCE WITH ASME B31.1

1. All postweld heat treatment shall be in accordance with Table 132 of ASME B31.1 latest edition and addenda.
2. Post weld heat treatment temperatures and minimum holding times are as follows:

NOMINAL WALL THICKNESS	HEAT TREAT TEMPERATURE	HOLDING TIME
Up to 50.8 mm (2.0 in.)	595 - 650°C (1100 - 1200°F)	1 Hour / 25.4 mm (inch), 15 minutes minimum
Over 50.8 mm (2.0 in.)	595 - 650°C (1100 - 1200°F)	2 Hours plus 15 minutes for each additional 25.4 mm (inch) over 50.8 mm (2.0 in.)

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Paintearth Energy Services Inc.

Procedure Qualification Record No. CCL-8SR-1 Date October 26, 1999
PQR Revision(s) Format update, company name change,
(formerly Chadco Canada Ltd.) November 22, 2006
Welding Procedure Specification No. PESI-8sr (Rev.0)
Welding Process(es) GMAW / SMAW / SAW Type(s) Semi-Auto./Manual/Machine

JOINTS (QW-402)

Type Butt joint, single vee groove, see next page

BASE METALS (QW-403)

Material Spec. SA 516 Type or Grade Gr. 70
P-No. P1 Grp. 2 To P-No. P1 Grp. 2 Thickness 38.1 mm (1.50 in.)
Diameter N/A Other Plate (HT. No.: 195291-1)

FILLER METALS (QW-404)

	GMAW	SMAW
Specification No. (SFA)	<u>SFA 5.18</u>	<u>SFA 5.1</u>
AWS No. (Class)	<u>ER70S-6</u>	<u>E7018-1</u>
Filler Metal F-No.	<u>F6</u>	<u>F4</u>
Filler Metal A-No.	<u>A1*</u>	<u>A1</u>
Size of Electrode	<u>See attached sketch</u>	
Other	<u>* See attached weld pad chemistry for ER70S-6 wire lab test report Co5-1246.1</u>	
Deposited Weld Metal Thickness	<u>3.2 mm (0.125 in.)</u>	<u>4.7 mm (0.187 in.)</u>

FILLER METALS (QW-404)

	SAW
Specification No. (SFA)	<u>SFA 5.17</u>
AWS No. (Class)	<u>EM12K</u>
Flux / Wire Classification	<u>F7A6-EM12K</u>
Filler Metal F-No.	<u>F6</u>
Filler Metal A-No.	<u>A1</u>
Size of Electrode	<u>See attached sketch</u>
Deposited Weld Metal Thickness	<u>30.2 mm (1.188 in.)</u>

POSITION (QW-405)

Position of Groove	<u>GMAW & SMAW: 3G</u>	<u>SAW: 1G</u>
Weld Progression	<u>GMAW & SMAW: Vertical up</u>	<u>SAW: N/A</u>

PREHEAT (QW-406)

Preheat Temperature 38°C (100°F) Interpass Temp. (Max.) 260°C (500°F)

POSTWELD HEAT TREATMENT (QW-407)

Temperature 607°C (1125°F) Time 3.5 hours

GAS (QW-408)

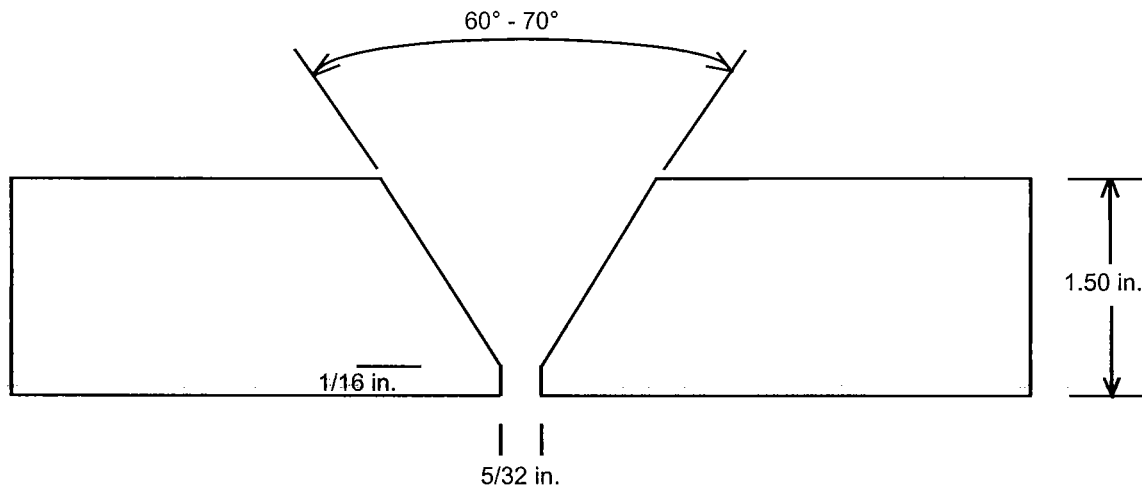
Shielding (GMAW) 91% Argon, 5% CO₂, 4% O₂ @ 12.5 - 15 liters per minute (25 - 30 cfph)
Backing None Trailing Without

ELECTRICAL CHARACTERISTICS (QW-409)

Current Direct Polarity Reverse, electrode positive
 Amps See table below Volts See table below
 Mode of Metal Transfer for GMAW Short circuiting arc
 Heat Input GMAW: 64,800 J/in. max. SMAW: 89,700 J/in. max. SAW: 76,500 J/in. max.

TECHNIQUE (QW-410)

String or Weave Both Travel Speed See table this page
 Multiple or Single Pass Per Side Multipass from groove side
 Multiple or Single Electrodes Single



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
1	GMAW	ER70S-6	0.89 (0.035)	DCRP	150	18	63 - 76 (2.5 - 3.0)
2	SMAW	E7018-1	3.2 (1/8)	DCRP	115	26	51 - 102 (2.0 - 4.0)
3	SMAW	E7018-1	4.0 (5/32)	DCRP	135	26	127 - 152 (5.0 - 6.0)
4 - 14	SAW	F7A6-EM12K	2.4 (3/32)	DCRP	425	26 - 30	254 - 305 (10 - 12)

PQR NO. CCL-8SR-1**TENSILE TEST (QW-150)**

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Ultimate Load kN (lbs.)	Ultimate Stress Mpa (Ksi)	Character & Fracture Location
No.1	19.20	37.85	---	361.21	497	Ductile
	(0.756)	(1.490)	---	(81,200)	(72.1)	Weld metal
No.2	19.18	37.85	---	362.99	500	Ductile
	(0.755)	(1.490)	---	(81,600)	(72.5)	Weld metal

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Type & Figure No.	Result
QW-462.2, TSB - S1	Pass	QW-462.2, TSB - S3	Pass
QW-462.2, TSB - S2	Pass	QW-462.2, TSB - S4	Pass

CHARPY IMPACT TOUGHNESS

Type of Test Charpy V Notch Orientation Transverse
 Test Temperature -46°C (-50°F) Specimen Size 10 x 10 mm

Specimen No.	Notch Location	Impact Values J (ft. lbs)
A	Weld Metal	30 (22)
B	Within 1/16"	38 (28)
C	Of Surface	65 (48)
A	HAZ	30 (22)
B	HAZ	26 (19)
C	HAZ	31 (23)

OTHER TESTS

Vickers hardness test, see attached laboratory test report 206-99-05-15622B

Welders Name M. Creasey Certificate File No. W-17190
 Welders Name T. Knobel Certificate File No. Apprentice
 Tests Conducted By Canspec Group Inc.
 Laboratory Test No. 206-99-05-15622B

We hereby recertify that the statements in this record have been revised in accordance with paragraph QW-200.2 and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer PAINTEARTH ENERGY SERVICES INC., formerly
Chadco Canada Ltd.

Date DEC 1 / 06. Signed [Signature]

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Paintearth Energy Services Inc.

Procedure Qualification Record No. CCL-9-1 Date January 6, 1998
PQR Revision(s) Format update, company name change,
(formerly Chadco Canada Ltd.) November 22, 2006
Welding Procedure Specification No. PESl-8sr (Rev.0)
Welding Process(es) GMAW / SMAW / SAW Type(s) Semi-automatic/Manual/Machine

JOINTS (QW-402)

Type Butt joint, single vee groove, see next page

BASE METALS (QW-403)

Material Spec. SA 516 Type or Grade Gr. 60N to 70N
P-No. P1 Grp. 1 To P-No. P1 Grp. 2 Thickness 12.7 mm (0.500 in.)
Diameter N/A Other Plate

FILLER METALS (QW-404)

	GMAW	SMAW
Specification No. (SFA)	<u>SFA 5.18</u>	<u>SFA 5.1</u>
AWS No. (Class)	<u>ER70S-2</u>	<u>E7018-1</u>
Filler Metal F-No.	<u>F6</u>	<u>F4</u>
Filler Metal A-No.	<u>A1</u>	<u>A1</u>
Size of Electrode	<u>See attached sketch</u>	
Deposited Weld Metal Thickness	<u>3.18 mm (0.125 in.)</u>	<u>4.77 mm (0.188 in.)</u>

FILLER METALS (QW-404)

	SAW
Specification No. (SFA)	<u>SFA 5.17</u>
AWS No. (Class)	<u>EM12K</u>
Flux / Wire Classification	<u>F7A7-EM12K</u>
Filler Metal F-No.	<u>F6</u>
Filler Metal A-No.	<u>A1</u>
Size of Electrode	<u>See attached sketch</u>
Other	<u>Air Liquide LA59 flux combined with LA 12K wire</u>
Deposited Weld Metal Thickness	<u>4.75 mm (0.187 in.)</u>

POSITION (QW-405)

Position of Groove GMAW: 30° off flat SMAW & SAW: 1G (flat)
Weld Progression GMAW: Vertical down SMAW & SAW: N/A

PREHEAT (QW-406)

Preheat Temperature 93°C (200°F) Interpass Temp. (Max.) 260°C (500°F)

POSTWELD HEAT TREATMENT (QW-407)

Temperature 621°C (1150°F) Time 1 hour

GAS (QW-408)

Shielding (GMAW) 91% Argon, 5% CO₂, 4% O₂ @ 15 liters per minute (30 cfph)
Backing None Trailing Without

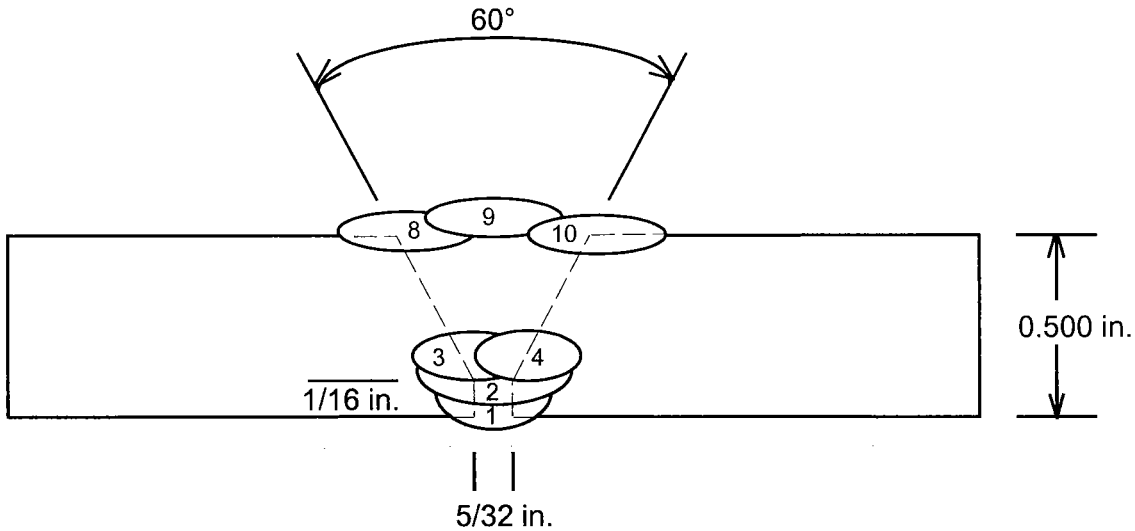
PQR NO. CCL-9-1

ELECTRICAL CHARACTERISTICS (QW-409)

Current	Direct	Polarity	Reverse - electrode positive
Amps	See table this page	Volts	See table this page
Heat Input	GMAW: 19,200 J/in. max. SMAW: 45,790 J/in. max. SAW: 33,600 J/in. max.		

TECHNIQUE (QW-410)

String or Weave	GMAW & SMAW: Weave	SAW: String	Travel Speed	See table this page
Multiple or Single Pass Per Side	GMAW & SMAW: Single		SAW: Multiple	
Multiple or Single Electrodes	Single			



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
1	GMAW	ER70S-2	0.89 (0.035)	DCRP	75 - 85	16	102 (4.0)
2	SMAW	E7018-1	4.8 (3/16)	DCRP	250	23 - 29	241 (9.5)
3 - 10	SAW	F7A7-EM12K	3.2 (1/8)	DCRP	350 - 400	32	508 - 610 (20.0 - 24.0)

PQR NO. CCL-9-1**TENSILE TEST (QW-150)**

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Ultimate Load kN (lbs.)	Ultimate Stress MPa (ksi)	Character & Fracture Location
No.1	19.02	12.34	---	121.44	517	Ductile
	(0.749)	(0.486)	---	(27,300)	(75.0)	in weld metal
No.2	19.05	12.24	---	125.44	538	Ductile
	(0.750)	(0.482)	---	(28,200)	(78.0)	in base metal

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Type & Figure No.	Result
QW-462.2, TSB - S1	Acceptable	QW-462.2, TSB - S3	Acceptable
QW-462.2, TSB - S2	Acceptable	QW-462.2, TSB - S4	Acceptable

CHARPY IMPACT TOUGHNESS

Type of Test Charpy V Notch Orientation Transverse
 Test Temperature -46°C (-50°F) Specimen Size 10 X 10 mm

Sample No.	Notch Location	Impact Values J (ft. lbs)
Weld	Weld	81 (60)
Weld	Weld	111 (82)
Weld	Weld	88 (65)
HAZ	SA 516 Gr. 60N	146 (108)
HAZ	SA 516 Gr. 60N	82 (60)
HAZ	SA 516 Gr. 60N	119 (88)
HAZ	SA 516 Gr. 70N	122 (90)
HAZ	SA 516 Gr. 70N	138 (102)
HAZ	SA 516 Gr. 70N	56 (41)

OTHER TESTS

Welders Name Drew Gorman / E. Ward Certificate File No. W-3128 / W-14092
 Tests Conducted By Canspec Group Inc.
 Laboratory Test No. C97-11-2586

We hereby recertify that the statements in this record have been revised in accordance with paragraph QW-200.2 and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer PAINTEARTH ENERGY SERVICES INC., formerly
Chadco Canada Ltd.

Date DEC 1/06. Signed 

QW-483 WELDING PROCEDURE RECORD (PQR)

Paintearth Energy Services Inc.
Procedure Qualification Record No. CCL-13SR(B)-1 Date October 26, 1999
PQR Revision(s) Format update, company name change,
(formerly Chadco Canada Ltd.) November 22, 2006
(PQR originally certified by Christine Kelly, Dec. 6, 1999)
Welding Procedure Specification No. PESI-8sr (Rev.0)
Welding Process(es) SMAW Type(s) Manual

JOINTS (QW-402)

Type Butt joint, single vee groove welded from both sides, see next page

BASE METALS (QW-403)

Material Spec. SA 516 Type or Grade Gr. 70
P-No. P1 Grp. 2 To P-No. P1 Grp. 2 Thickness 38.1 mm (1.50 in.)
Diameter N/A Other Plate (HT. No.: 195291-1)

FILLER METALS (QW-404)

Specification No. (SFA) SFA 5.1 SFA 5.1
AWS No. (Class) E6010 E7018-1
Filler Metal F-No. F3 F4
Filler Metal A-No. A1 A1
Size of Electrode See attached sketch
Deposited Weld Metal Thickness 3.8 mm (0.150 in.) 34.3 mm (1.350 in.)

POSITION (QW-405)

Position of Groove 3G
Weld Progression Vertical Up

PREHEAT (QW-406)

Preheat Temperature 38°C (100°F) Interpass Temp. (Max.) 232°C (450°F)

POSTWELD HEAT TREATMENT (QW-407)

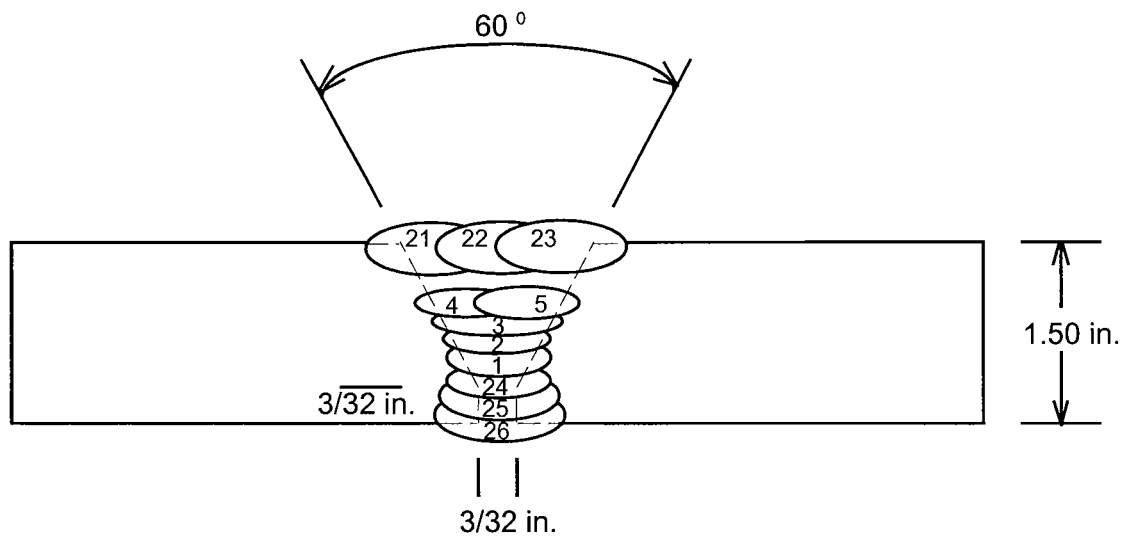
Temperature 607°C (1125°F) Time 3.5 hours

ELECTRICAL CHARACTERISTICS (QW-409)

Current Direct Polarity Reverse, electrode positive
Amps See next page Volts See next page
Heat Input F3: 62,250 J/in. maximum F4: 86,250 J/in. maximum

TECHNIQUE (QW-410)

String or Weave Both Travel Speed See next page
Multiple or Single Pass Per Side Multipass
Multiple or Single Electrodes Single



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
1	SMAW	E6010	3.2 (1/8)	DCRP	83	25	51 - 76 (2 - 3)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	79	22	76 (3)
3	SMAW	E7018-1	2.4 (3/32)	DCRP	111	23	102 (4)
4 & 5	SMAW	E7018-1	3.2 (1/8)	DCRP	111	23	178 (7)
6	SMAW	E7018-1	3.2 (1/8)	DCRP	115	25	51 (2)
7 - 12	SMAW	E7018-1	4.0 (5/32)	DCRP	135	26	152 (6)
13 - 20	SMAW	E7018-1	4.0 (5/32)	DCRP	133	26	127 (5)
21 - 23	SMAW	E7018-1	2.4 (3/32)	DCRP	96	24	76 (3)
24 - 26	SMAW	E7018	2.4 (3/32)	DCRP	111	23	102 - 152 (4 - 6)

Note: Backgouged to sound metal prior to depositing pass 24

PQR NO. CCL-13SR(B)-1**TENSILE TEST (QW-150)**

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Ultimate Load kN (lbs.)	Ultimate Stress MPa (ksi)	Character & Fracture Location
No.1	19.20	38.02	---	371.44	509	Ductile
	(0.756)	(1.497)	---	(83,500)	(73.8)	Weld Metal
No.2	19.13	37.77	---	368.77	510	Ductile
	(0.753)	(1.487)	---	(82,900)	(74.0)	Weld Metal

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Type & Figure No.	Result
QW-462.2, TSB - S1	Pass	QW-462.2, TSB - S3	Pass
QW-462.2, TSB - S2	Pass	QW-462.2, TSB - S4	Pass

CHARPY IMPACT TOUGHNESS

Type of Test Charpy V Notch Orientation Transverse
 Test Temperature -46°C (-50°F) Specimen Size 10 X 10 mm

Specimen No.	Notch Location	Impact Values J (ft. lbs)
A	Weld Metal	260 (192)
B	Within 1/16"	89 (66)
C	Of Surface	233 (172)
A	HAZ	187 (138)
B	HAZ	165 (122)
C	HAZ	35 (26)

OTHER TESTS

Vickers Hardness Test- see attached laboratory test report, 206-99-05-15622A

Welders Name Leroy Gerald Certificate File No. W-14206
 Tests Conducted By Canspec Group Inc.
 Laboratory Test No. 206-99-05-15622A

We hereby recertify that the statements in this record have been revised in accordance with paragraph QW-200.2 and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer PAINTEARTH ENERGY SERVICES INC., formerly
Chadco Canada Ltd.

Date DEC 1 / 06. Signed 



Canspec Group Inc.
7450 - 18 Street
Edmonton, AB, Canada T6P 1N8

Phone: (780) 440-2131
Fax: (780) 440-1167

Materials Engineering and Testing
A Rockwood Company

TENSILE & GUIDED BEND TESTS

Client: Chadco Canada Ltd.
Address: Box 24

Canspec Project #: 206-99-05-015622B

Test Date: July 6, 1999

Attention: Christine Kelly

Sample Description: Weld Procedure Specification CCL-8SR-1
Procedure Qualification Record CCL-8SR-1
1-1/2 in. Welded Plate, GMAW, SMAW & SAW Process,
Heat #195291-1,
PWHT: 1125°F for 3-1/2 hours,
Welder: M. Creasey (GMAW & SMAW, T. Knobel (SAW)
Equipment Used: Satec Universal Testing Machine, Unit #2352
Specimen Type: Tensiles as per QW 462.1(a), Side Bends as per QW 462.2
Governing Specification: ASME SA 516

Canspec Specimen ID	Dimensions		Tensile Properties		Fracture Location	Fracture Type	Gov. Spec. Requirements (Ultimate Strength, ksi)
	Width (in.)	Thickness (in.)	Ult. Load (lbs.)	UTS (ksi)			
1	0.756	1.490	81200	72.1	Weld Metal	Ductile	70-90
2	0.755	1.490	81600	72.5	Weld Metal	Ductile	70-90

	Dimensions		Tensile Properties		Fracture Location	Fracture Type	Gov. Spec. Requirements (Ultimate Strength, MPa)
	Width (mm)	Thickness (mm)	Ult. Load (kN)	UTS (MPa)			
1	19.20	37.85	361.21	497	Weld Metal	Ductile	485-620
2	19.18	37.85	362.99	500	Weld Metal	Ductile	485-620

Guided Side Bends: All four passed

Reviewed By:


Dale W. Harsulla, P. Eng
Engineering Operations Leader



Canspec Group Inc.
7450 - 18 Street
Edmonton, AB, Canada T6P 1N8
Phone: (780) 440-2131
Fax: (780) 440-1167
Materials Engineering and Testing
A Rockwood Company

CVN IMPACT TEST

Client: Chadco Canada Ltd.
Address: Box 24

Canspec Project #: 206-99-05-015622B

Test Date: May 28, 1999

Attention: Christine Kelly

Sample Description: Weld Procedure Specification CCL-8SR-1
Procedure Qualification Record CCL-8SR-1
1-1/2 in. Welded Plate, GMAW, SMAW & SAW Process,
Heat #195291-1,
PWHT: 1125°F for 3-1/2 hours,
Welder: M. Creasey (GMAW & SMAW, T. Knobel (SAW)
Equipment Used: Avery Denison Impact Tester, Unit #2350
Specimen Type: 45°V Charpy (ASTM A370 & E23), 10mm x 10mm
Notch Location: Normal to the surface
Governing Specification: ASME VIII

Test Temperature: -46°C

Weld within 1/16 in. of Surface	Test Results	
	Energy Absorbed	
	(J)	(ft. lbs.)*
A	30	22
B	38	28
C	65	48
Average	44	33

HAZ	Test Results	
	Energy Absorbed	
	(J)	(ft. lbs.)*
A	30	22
B	26	19
C	31	23
Average	29	21

*Denotes values obtained by conversion.

Reviewed By:

Dale W. Harsulla, P. Eng
Engineering Operations Leader



Canspec Group Inc.
7450 - 18 Street
Edmonton, AB, Canada T6P 1N8

Phone: (780) 440-2191
Fax: (780) 440-1167

Materials Engineering and Testing
A Rockwood Company

HARDNESS TEST

Client: Chadco Canada Ltd.
Address: Box 24

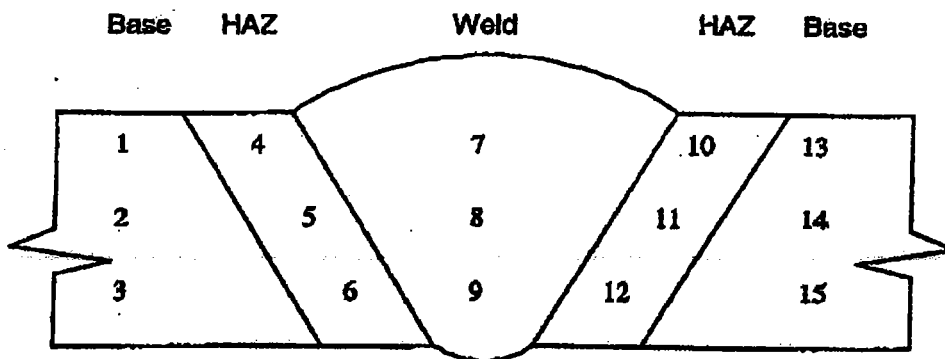
Canspec Project #: 206-99-05-015622B

Test Date: July 6, 1999

Attention: Christine Kelly

Sample Description: Weld Procedure Specification CCL-8SR-1
Procedure Qualification Record CCL-8SR-1
1-1/2 in. Welded Plate, GMAW, SMAW & SAW Process,
Heat #195291-1,
PWHT: 1125°F for 3-1/2 hours,
Welder: M. Creasey (GMAW & SMAW, T. Kuobel (SAW)
Equipment Used: Wilson Rockwell Macrohardness Tester, Unit #2348

Hardness Scale: HV



Base		HAZ		Weld		HAZ		Base	
Point	HV	Point	HV	Point	HV	Point	HV	Point	HV
1	144	4	200	7	147	10	200	13	144
2	141	5	180	8	150	11	200	14	147
3	147	6	176	9	150	12	159	15	132

Reviewed By:

Dale W. Harsulla, P. Eng

Engineering Operations Leader

IMPACT TEST REPORT

CUSTOMER: Chadco Canada Ltd. **PURCHASE ORDER NO.:**
ADDRESS: Box 24-Halkirk, AB. **DATE TESTED:** 13-Jan-98
ATTENTION: Thomas Chadwick **CANSPEC JOB NO.:** C97-11-2586
SAMPLE DESCRIPTION: 1/2" WT SA516 Gr. 60N HT#: T 04449-53X1 to
1/2" WT SA516 Gr. 70N HT#: I 04449-53X1
EQUIPMENT USED: Avery Denison impact tester, unit #2350
SPECIMEN TYPE: 45°V Charpy (ASTM A370 & E23) **SIZE:** 10 mm X 10 mm
NOTCH LOCATION: Normal to the surface **DIRECTION** Longitudinal
THERMAL CONDITION: PWHT: 1150°F for 1.0 hr (Heating and Cooling as per ASME Sec. VIII)
WPS: CCL-9 **PQR:** CCL-9-1
GOVERNING SPECIFICATION: ASME VIII, Div. I

Sample	Energy Absorbed	
	Joules	ft.-lbs.*
WELD -46°C	81	60
	111	82
	88	65
	Average	93
HAZ SA 516 Gr. 60N -46°C	146	108
	82	60
	119	88
	Average	116
HAZ SA 516 Gr. 70N -46°C	122	90
	138	102
	56	41
	Average	105

* Denotes values obtained by conversion


KELLY FREY, CET
LABORATORY TECHNICIAN
72586CC6.KFL

CANSPEC GROUP INC.

2805 - 12 STREET N.E., CALGARY, ALBERTA, CANADA T2E 7J2 • TELEPHONE (403) 291-3128 • FAX (403) 250-1015

QUASAR
ISO 9002



Canspec Group Inc.
7450 - 18 Street
Edmonton, AB. Canada T6P 1N8
Phone: (780) 440-2131
Fax: (780) 440-1167

Materials Engineering and Testing
A Rockwood Company

TENSILE & GUIDED BEND TESTS

Client: Chadco Canada Ltd.
Address: Box 24

Canspec Project #: 206-99-05-015622A

Test Date: July 6, 1999

Attention: Christine Kelly

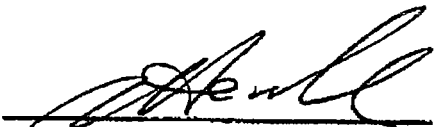
Sample Description: Weld Procedure Specification CCL-13SR(B)-1
Procedure Qualification Record CCL-13SR(B)-1
1-1/2 in. Welded Plate, SMAW Process,
Heat #195291-1,
PWHT: 1125°F for 3-1/2 hours,
Welder: L. Gerald (SMAW)
Equipment Used: Satec Universal Testing Machine, Unit #2352
Specimen Type: Tensiles as per QW 462.1(a), Side Bends as per QW 462.2
Governing Specification: ASME SA 516

Canspec Specimen ID	Dimensions		Tensile Properties		Fracture Location	Fracture Type	Gov. Spec. Requirements (Ultimate Strength, ksi)
	Width (in.)	Thickness (in.)	Ult. Load (lbs.)	UTS (ksi)			
1	0.756	1.497	83500	73.8	Weld Metal	Ductile	70-90
2	0.753	1.487	82900	74.0	Weld Metal	Ductile	70-90

	Dimensions		Tensile Properties		Fracture Location	Fracture Type	Gov. Spec. Requirements (Ultimate Strength, MPa)
	Width (mm)	Thickness (mm)	Ult. Load (kN)	UTS (MPa)			
1	19.20	38.02	371.44	509	Weld Metal	Ductile	485-620
2	19.13	37.77	368.77	510	Weld Metal	Ductile	485-620

Guided Side Bends: All four passed

Reviewed By:


Dale W. Harsulla, P. Eng
Engineering Operations Leader



Canspec Group Inc.
7450 - 18 Street
Edmonton, AB, Canada T6P 1N8
Phone: (780) 440-2131
Fax: (780) 440-1167
Materials Engineering and Testing
A Rockwood Company

CVN IMPACT TEST

Client: Chadco Canada Ltd.
Address: Box 24

Canspec Project #: 206-99-05-015622A

Test Date: May 28, 1999

Attention: Christine Kelly

Sample Description: Weld Procedure Specification CCL-13SR(B)-1
Procedure Qualification Record CCL-13SR(B)-1
1-1/2 in. Welded Plate, SMAW Process,
Heat #195291-1,
PWHT: 1125°F for 3-1/2 hours,
Welder: L. Gerald (SMAW)
Equipment Used: Avery Denison Impact Tester, Unit #2350
Specimen Type: 45°V Charpy (ASTM A370 & E23), 10mm x 10mm
Notch Location: Normal to the surface
Governing Specification: ASME VIII

Test Temperature: -46°C

Weld within 1/16 in. of Surface	Test Results	
	Energy Absorbed	
	(J)	(ft. lbs.)*
A	260	192
B	89	66
C	233	172
Average	194	143

HAZ	Test Results	
	Energy Absorbed	
	(J)	(ft. lbs.)*
A	187	138
B	165	122
C	35	26
Average	129	95

*Denotes values obtained by conversion.

Reviewed By:

Dale W. Harsulla, P. Eng
Engineering Operations Leader



Canspec Group Inc.
7450 - 18 Street
Edmonton, AB, Canada T6P 1N8

Phone: (780) 440-2131
Fax: (780) 440-1167

Materials Engineering and Testing
A Rockwood Company

HARDNESS TEST

Client: Chadco Canada Ltd.
Address: Box 24

Canspec Project #: 206-99-05-015622A

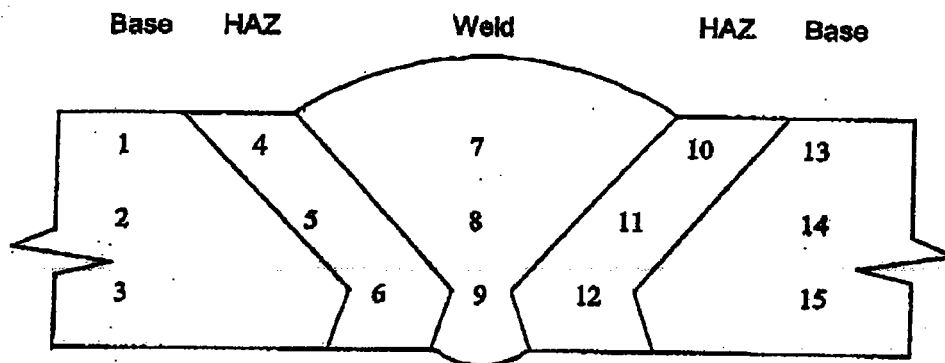
Test Date: July 6, 1999

Attention: Christine Kelly

Sample Description: Weld Procedure Specification CCL-13SR(B)-1
Procedure Qualification Record CCL-13SR(B)-1
1-1/2 in. Welded Plate, SMAW Process,
Heat #195291-1,
PWHT: 1125°F for 3-1/2 hours,
Welder: L. Gerald (SMAW)

Equipment Used: Wilson Rockwell Macrohardness Tester, Unit #2348

Hardness Scale: HV



Base		HAZ		Weld		HAZ		Base	
Point	HV	Point	HV	Point	HV	Point	HV	Point	HV
1	144	4	200	7	159	10	234	13	147
2	144	5	180	8	165	11	176	14	150
3	147	6	169	9	169	12	190	15	150

Reviewed By:

Dale W. Harsulla, P. Eng
Engineering Operations Leader



LUDWIG & ASSOCIATES LTD.

Materials and Welding Engineering

LABORATORY TEST REPORT

LABORATORY
ACCREDITATION
BUREAU
ISO/IEC 17025 ACCREDITED
Certificate Number L2057

CUSTOMER: IPS Manufacturing Limited
Box 24, Hwy. 855 North
Halkirk, Alberta
T0C 1M0

Laboratory Test No.: C05-1246.1
Date: September 21, 2005

Attention: Ron Sobie

WPS Number: IPS-8sr

Base Metal: SA 36 - 12.7 mm (0.500 in.) thick

Filler Metal: SFA 5.18, ER70S-6, 0.9 mm (0.035 in.) dia.

Trade Name: Air Liquide Blueshield LA S-6

Batch/Lot No.: 1488/P-50113

Shielding Gas: Air Liquide Blueshield 23 (91% Argon / 5% CO₂ / 4% O₂)

Test Location: Weld pad surface

CHEMICAL ANALYSIS

(% by weight)

Instrument Type: ARL 3460 Optical Emission Spectrometer

Carbon	0.05
Manganese	1.19
Sulphur	0.013
Phosphorus	0.010
Silicon	0.63
Chromium	<0.05
Nickel	<0.02
Molybdenum	<0.02
Copper	0.14
Vanadium	<0.01

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with ASTM A751 - 01 specification. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By: _____

Steve Rieberger, C.E.T.