



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

## CONFIRMATION OF WELDING PROCEDURE REGISTRATION SUBMISSION

**Attention: Ron Sobie**

**Fax Number: 403-884-2106**

The following was received from you on 2006-12-06.

When making inquiries about this submission, please quote Tracking Number: 2006-09150.

**A. Type of Submission:** New Submission  
**B. Category of Design:** Welding  
**C. Type of Design:** New Design  
**D. Manufacturer's Name:** PAINT EARTH ENERGY SERVICES INC  
**E. Submitted by:** LUDWIG & ASSOCIATES LTD  
**F. Invoice to be sent to:** Manufacturer  
**G. Welding Spec. No:** PESI-3 REV 0  
**Date Registration is req'd:** Not Specified  
**Anticipated response date:** 2006-12-20

**Design Survey Engineer Assigned:** BOB ROSEBERG, P. Eng.  
**Phone #:** (780) 433-0281 ext 3334  
**Fax #:** (780) 437-8797  
**E/Mail:** Roseberg@absa.ca

**Comments:**

Important note for Manufacturer's outside of Canada:

A B51-97 "Boiler, Pressure Vessel and Pressure Piping Code" requires that Manufacturers located outside of Canada who manufacture and export boilers and pressure vessels to Canada shall hold an ASME Certificate of Authorization, and shall ensure that all boilers and pressure vessels exported to Canada are stamped with the appropriate ASME symbol, and are registered with the National Board.



the pressure equipment safety authority

9410 - 20 Ave N.W.  
Edmonton, Alberta, Canada T6N 0A4  
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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. :** 2006-09150

**Reg Type :** New Design

**Spec. No. :** PESI-3 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-3 (Rev.0)

WELDING PROCEDURE QUALIFICATION RECORD NO. (S): DEML-3-1, DEML-3-2

QUALIFIED FOR

Base Metal (Typical): P1 Groups 1 & 2 to P1 Groups 1 & 2  
(SA 333 Gr.6, SA 350 Gr.LF2, SA 420 WPL6, SA 516 Gr.70, etc.)  
Process(es): SMAW Weld Types: GROOVE & FILLET  
Position: ALL POSITIONS Diameter: ALL DIAMETERS  
Filler Metal: E6010, E7018-1

BASE METAL CONDITIONS & GROOVE THICKNESS RANGE QUALIFIED:

NOTCH TOUGHNESS APPLICATIONS TO -46°C AS WELDED

BASE METAL THICKNESS RANGE 3.2 to 19.1 mm (0.125 to 0.750 in.) inclusive

COMBINED DEPOSITED WELD METAL THICKNESS

ASME B31.1	<u>19.1 mm (0.750 in.) maximum</u>
ASME B31.3	<u>19.1 mm (0.750 in.) maximum</u>
ASME SECT. VIII, DIV.1	<u>19.1 mm (0.750 in.) maximum</u>

ALBERTA BOILERS SAFETY ASSOCIATION	
PROVINCE OF ALBERTA	
SAFETY CODES ACT	
WELDING PROCEDURE	
Reg. No. WP	<u>1684.2</u>
Spec No.	<u>PESI-3</u>
Weld Process	<u>SMAW</u>
Matl. Gr. P No.	<u>1 Gr 1+2</u> to P No. <u>1 Gr 1+2</u>
Elec. Gr. F No.	<u>3+4</u> A No. <u>1</u>
Th. Qual. For	<u>3.2 to 19.1 mm</u> PWHT <u>NO</u>
<u>CVN -46°C</u>	
Yr <u>06</u> Mo <u>12</u> Day <u>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-3 (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-3. June 9, 2003  
Supporting PQR No. (s) DEML-3-1, DEML-3-2  
Welding Process(es) SMAW Type(s) Manual

### 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 Groups 1 & 2 To P-Number P1 Groups 1 & 2  
Thickness Range: Groove See cover page for thickness qualified by governing code  
Fillet All base metal thicknesses  
Base Metal 3.2 to 19.1 mm (0.125 to 0.750 in.) inclusive  
Pipe Diameter Ranges: Groove All diameters  
Fillet All diameters  
Deposited Weld Metal (Per Pass) F3: 4.8 mm (0.188 in.) maximum  
F4: 12.7 mm (0.500 in.) maximum

### FILLER METALS (QW-404)

Specification No. (SFA)	<u>SFA 5.1</u>	<u>SFA 5.1</u>
AWS No. (Class)	<u>E6010</u>	<u>E7018-1</u>
F-No.	<u>F3</u>	<u>F4</u>
A-No.	<u>A1</u>	<u>A1</u>
Size	<u>3/32 to 5/32 in. inclusive</u>	<u>3/32 to 1/4 in. inclusive</u>
Deposited Weld Metal Thickness Range:		
Groove	<u>4.8 mm (0.188 in.) max.</u>	<u>14.3 mm (0.562 in.) max.</u>
Fillet	<u>All fillet sizes</u>	<u>All fillet sizes</u>

### POSITION (QW-405)

Position of Groove All positions Position of Fillet All positions  
Weld Progression F3: Vertical up or vertical down F4: Vertical up

### PREHEAT (QW-406)

Preheat Temperature (Minimum) 10°C (50°F)  
Interpass Temperature (Maximum) 232°C (450°F)  
Preheat Maintenance 10°C 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 None Time Range N/A**ELECTRICAL CHARACTERISTICS (QW-409)**Current Direct Polarity Reverse, electrode positiveAmps See Table #1 Volts See Table #1

Maximum Heat Input

Base Metal Thickness Range	E6010 Electrode	E7018-1 Electrode
(0.125 - 0.750 in.)	53,468 J/in.	67,109 J/in.

**TECHNIQUE (QW-410)**String or Weave Either Travel Speed See Table #1Initial & Interpass Cleaning Brushing, chipping or grinding as requiredMethod of Back Gouging Air carbon arc, back-grind as requiredMultiple or Single Pass Per Side MultipleMultiple or Single Electrodes SinglePeening 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.)
SMAW	E6010	2.4 (3/32)	DCRP	50 - 100	18 - 35	25 - 300 (1.0 - 12)
SMAW	E6010	3.2 (1/8)	DCRP	60 - 140	19 - 35	33 - 350 (1.3 - 14)
SMAW	E6010	4.0 (5/32)	DCRP	115 - 250	21 - 35	71 - 400 (2.8 - 16)
SMAW	E7018-1	2.4 (3/32)	DCRP	60 - 110	18 - 30	25 - 300 (1.0 - 12)
SMAW	E7018-1	3.2 (1/8)	DCRP	90 - 150	19 - 30	41 - 350 (1.6 - 14)
SMAW	E7018-1	4.0 (5/32)	DCRP	110 - 220	21 - 30	53 - 400 (2.1 - 16)
SMAW	E7018-1	5.0 (3/16)	DCRP	160 - 320	22 - 30	81 - 500 (3.2 - 20)
SMAW	E7018-1	5.5 (7/32)	DCRP	240 - 340	23 - 32	127 - 550 (5.0 - 22)
SMAW	E7018-1	6.4 (1/4)	DCRP	275 - 360	23 - 32	145 - 550 (5.7 - 22)

Note: Welding parameters shall be adjusted to insure that the maximum heat input value specified in QW-409 above is not exceeded.

$$\text{Heat Input} = \frac{\text{Amps} \times \text{Volts} \times 60}{\text{Travel Speed (ipm)}}$$

## TYPICAL JOINT DESIGNS

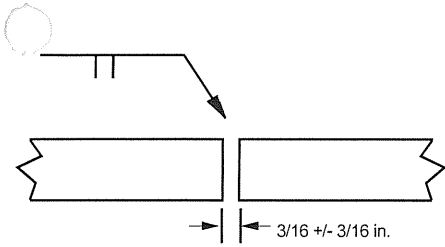


Figure 1  
Single Square Butt

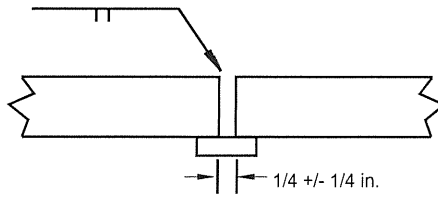


Figure 2  
Single Square Butt with Backing Strip

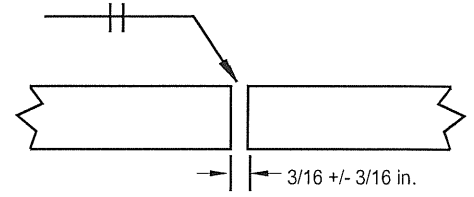


Figure 3  
Double Square Butt

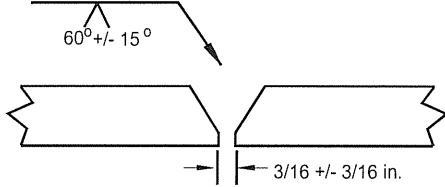


Figure 4  
Single Vee Butt

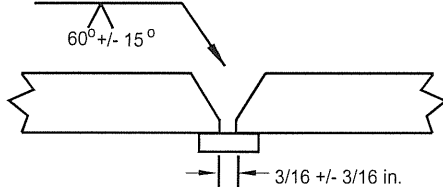


Figure 5  
Single Vee Butt with Backing Strip

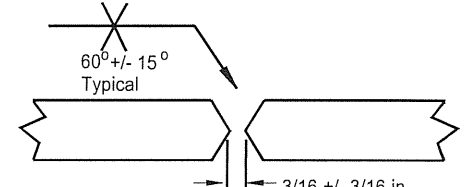


Figure 6  
Double Vee Butt

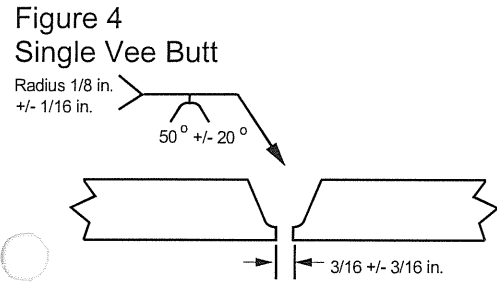


Figure 7  
Single U Butt

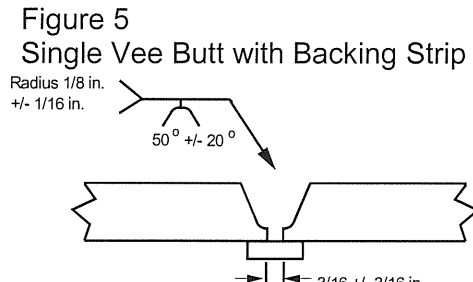


Figure 8  
Single U Butt with Backing Strip

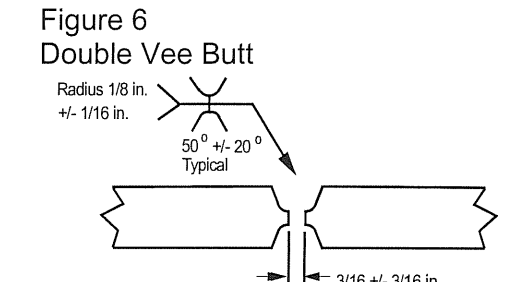


Figure 9  
Double U Butt

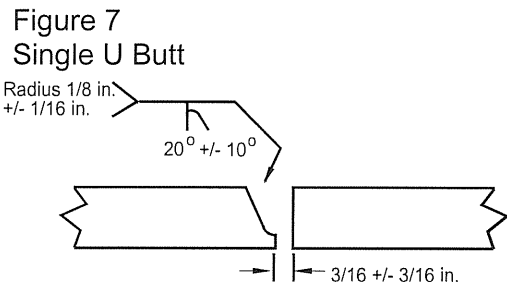


Figure 10  
Single J Butt

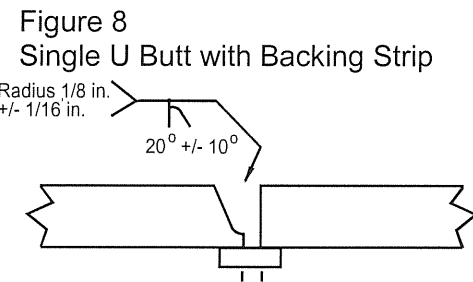


Figure 11  
Single J Butt with Backing Strip

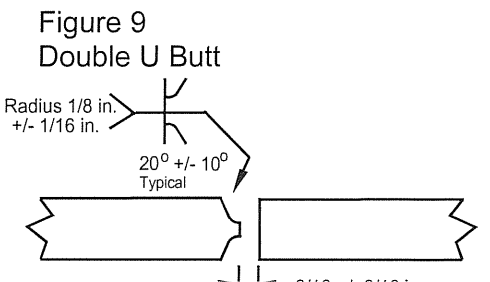


Figure 12  
Double J Butt

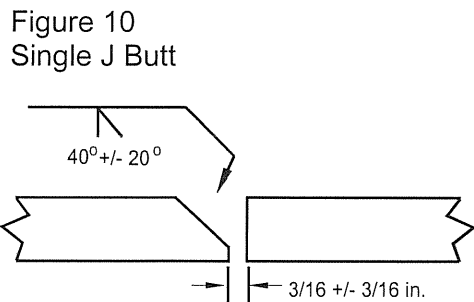


Figure 13  
Single Bevel Butt

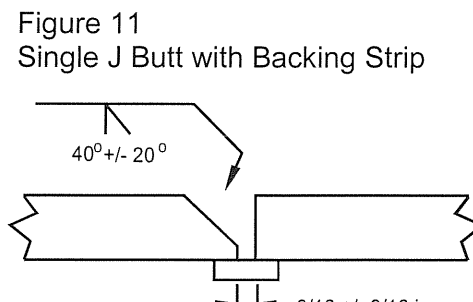


Figure 14  
Single Bevel Butt with Backing Strip

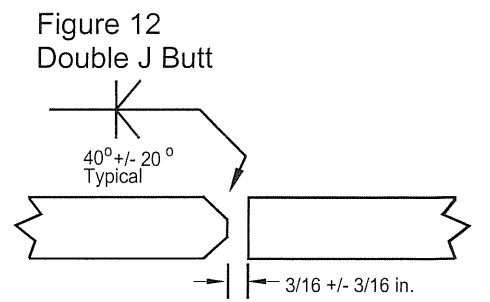


Figure 15  
Double Bevel Butt

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

## QW-483 WELDING PROCEDURE RECORD (PQR)

Paintearth Energy Services Inc.  
Procedure Qualification Record No. DEML-3-1 Date August 16, 2002  
PQR Revision(s) Format update & company name change,  
(formerly Delaney Energy Manufacturing Ltd.), November 22, 2006  
Welding Procedure Specification No. PESI-3 (Rev.0)  
Welding Process(es) SMAW Type(s) Manual

### JOINTS (QW-402)

Type Butt joint, single vee groove, see next page

### BASE METALS (QW-403)

Material Spec. SA 516 to SA 516 Type or Grade Gr. 60N to Gr. 70N  
P-No. P1 Grp. 1 To P-No. P1 Grp. 2 Thickness 6.3 mm (0.249 in.)  
Diameter N/A Other Plate product form

### FILLER METALS (QW-404)

Specification No. (SFA)	<u>SFA 5.1</u>	<u>SFA 5.1</u>
AWS No. (Class)	<u>E6010</u>	<u>E7018-1</u>
Filler Metal F-No.	<u>F3</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>2.4 mm (0.094 in.)</u>	<u>3.9 mm (0.155 in.)</u>

### POSITION (QW-405)

Position of Groove 3G  
Weld Progression Vertical Up

### PREHEAT (QW-406)

Preheat Temperature 10°C (50°F) Interpass Temp. (Max.) 232°C (450°F)

### POSTWELD HEAT TREATMENT (QW-407)

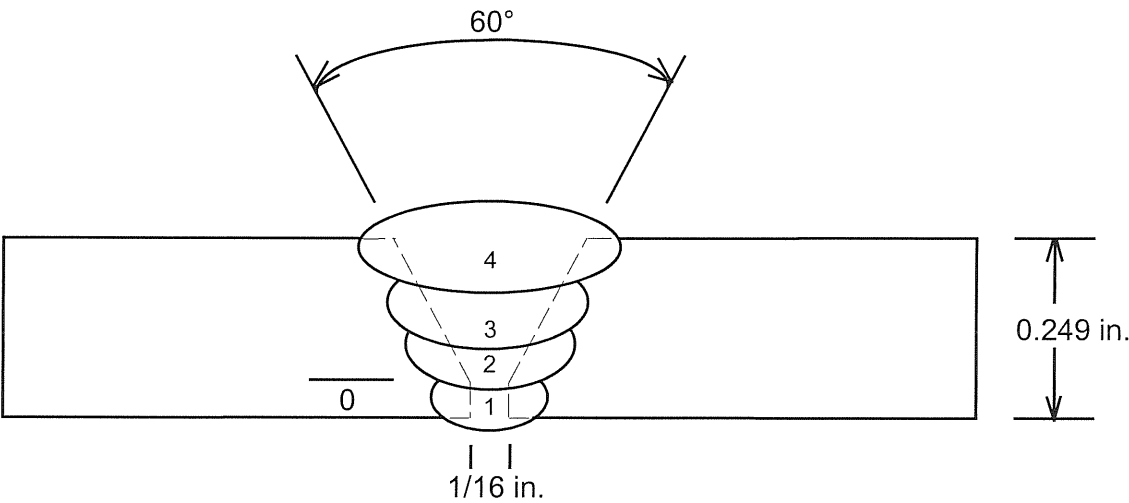
Temperature None Time N/A

### ELECTRICAL CHARACTERISTICS (QW-409)

Current	<u>Direct</u>	Polarity	<u>Reverse, electrode positive</u>
Amps	<u>See next page</u>	Volts	<u>See next page</u>
Heat Input	<u>F3: 53,468 J/in. maximum</u>		<u>F4: 67,109 J/in. maximum</u>

### TECHNIQUE (QW-410)

String or Weave F3: String F4: Weave Travel Speed See next page  
Multiple or Single Pass Per Side 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	SMAW	E6010	2.4 (3/32)	DCRP	80 - 90	30 - 35	79 - 147 (3.1 - 5.8)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	100 - 110	25 - 30	97 - 137 (3.8 - 5.4)
3	SMAW	E7018-1	2.4 (3/32)	DCRP	100 - 110	24 - 26	114 - 124 (4.5 - 4.9)
4	SMAW	E7018-1	2.4 (3/32)	DCRP	100 - 110	23 - 26	58 - 109 (2.3 - 4.3)



**CHARPY IMPACT TOUGHNESS**

Type of Test Charpy V Notch Orientation Transverse  
Test Temperature -48°C (-55°F) Specimen Size 10 X 5 mm

Specimen No.	Notch Location	Impact Values J (ft. lbs)
X2.1	Weld Metal	19.5 (14.4)
X2.2	within 1/16 in.	19.3 (14.2)
X2.3	of root	25.8 (19.0)
X3.1	Gr. 60N - HAZ	52.9 (39.0)
X3.2	Gr. 60N - HAZ	43.9 (32.4)
X3.3	Gr. 60N - HAZ	43.7 (33.2)
Y3.1	Gr. 70N - HAZ	12.7 (9.4)
Y3.2	Gr. 70N - HAZ	15.4 (11.4)
Y3.3	Gr. 70N - HAZ	10.8 (8.0)

**OTHER TESTS**

Vickers Hardness Survey - see attached laboratory test report, C02-662.1

Welders Name Vance Schilling Certificate File No. W-16541  
Tests Conducted By Ludwig & Associates Ltd.  
Laboratory Test No. C02-662.1

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  
Delaney Energy Manufacturing Ltd.

Date DEC 1/06. Signed 

## QW-483 WELDING PROCEDURE RECORD (PQR)

Paintearth Energy Services Inc.  
Procedure Qualification Record No. DEML-3-2 Date August 16, 2002  
PQR Revision(s) Format update & company name change,  
(formerly Delaney Energy Manufacturing Ltd.), November 22, 2006  
Welding Procedure Specification No. PESI-3 (Rev.0)  
Welding Process(es) SMAW Type(s) Manual

### JOINTS (QW-402)

Type Butt joint, single vee groove, see next page

### BASE METALS (QW-403)

Material Spec. SA 516 to SA 516 Type or Grade Gr. 60N to Gr. 70N  
P-No. P1 Grp. 1 To P-No. P1 Grp. 2 Thickness 9.52 mm (0.375 in.)  
Diameter N/A Other Plate product form

### 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 2.4 mm (0.094 in.) 7.1 mm (0.281 in.)

### POSITION (QW-405)

Position of Groove 3G  
Weld Progression Vertical Up

### PREHEAT (QW-406)

Preheat Temperature 10°C (50°F) Interpass Temp. (Max.) 232°C (450°F)

### POSTWELD HEAT TREATMENT (QW-407)

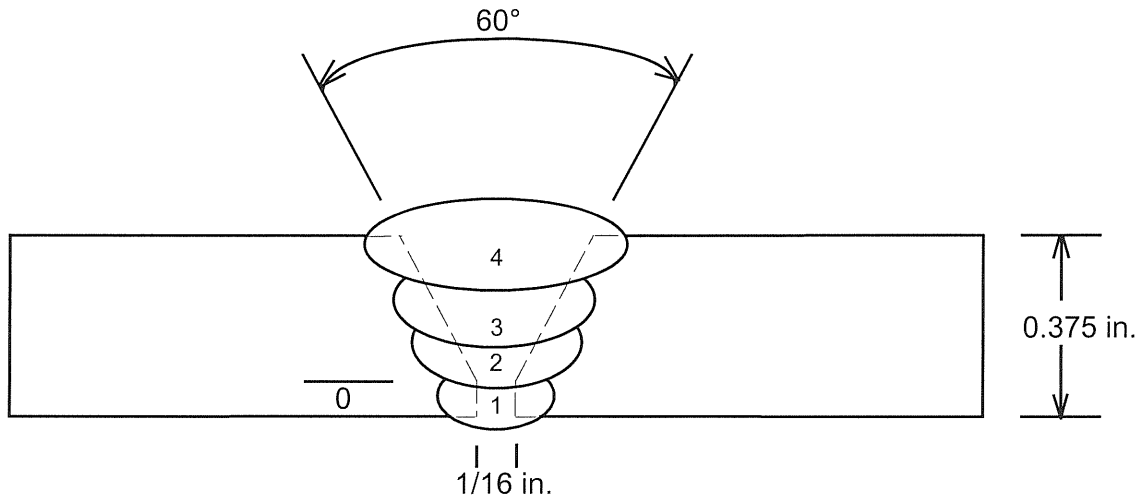
Temperature None Time N/A

### ELECTRICAL CHARACTERISTICS (QW-409)

Current Direct Polarity Reverse, electrode positive  
Amps See next page Volts See next page  
Heat Input F3: 24,407 J/in. maximum F4: 57,600 J/in. maximum

### TECHNIQUE (QW-410)

String or Weave F3: String F4: Weave Travel Speed See next page  
Multiple or Single Pass Per Side 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	SMAW	E6010	2.4 (3/32)	DCRP	80	30	150 - 157 (5.9 - 6.2)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	100	23 - 25	76 - 91 (3.0 - 3.6)
3	SMAW	E7018-1	2.4 (3/32)	DCRP	100	23 - 25	74 - 112 (2.9 - 4.4)
4	SMAW	E7018-1	2.4 (3/32)	DCRP	100	23 - 25	63 - 84 (2.5 - 3.3)

**TENSILE TEST (QW-150)**

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Ultimate Load N (lbs.)	Ultimate Stress MPa (psi)	Character & Fracture Location
T1	18.9 (0.744)	8.01 (0.315)	151 (0.235)	81 900 (18,400)	541 (78,500)	Partial Cup & Cone Parent Metal (Gr. 70N)
T2	18.8 (0.740)	7.41 (0.292)	139 (0.216)	76 700 (17,200)	551 (79,800)	Partial Cup & Cone Parent Metal (Gr. 70N)

**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 -48°C (-55°F) Specimen Size 10 X 7.5 mm

Specimen No.	Notch Location	Impact Values J (ft. lbs)
Z2.1	Weld Metal	50.7 (37.4)
Z2.2	within 1/16 in.	69.4 (51.2)
Z2.3	of root	61.0 (45.0)
Z3.1	Gr. 60N - HAZ	241 (178)
Z3.2	Gr. 60N - HAZ	74.0 (54.6)
Z3.3	Gr. 60N - HAZ	202 (149)
A3.1	Gr. 70N - HAZ	213 (157)
A3.2	Gr. 70N - HAZ	100 (73.8)
A3.3	Gr. 70N - HAZ	84.1 (62.0)

**OTHER TESTS**

Vickers Hardness Survey - see attached laboratory test report, C02-662.2

Welders Name Vance Schilling Certificate File No. W-16541  
 Tests Conducted By Ludwig & Associates Ltd.  
 Laboratory Test No. C02-662.2

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  
Delaney Energy Manufacturing Ltd.

Date DEC 1 / 06. Signed [Signature]



# LUDWIG & ASSOCIATES LTD.

Materials and Welding Engineering

## LABORATORY TEST REPORT

**CUSTOMER:** Delaney Energy Manufacturing Ltd.  
Box 24, Hwy. 855 North  
Halkirk, Alberta  
T0C 1M0

**Laboratory Test No.:** C02-662.1  
**Date:** August 28, 2002

**Attention:** Christine Kelly

**PQR Number:** DEML-3-1  
**Material:** SA 516 Gr. 60N to SA 516 Gr. 70N  
**Thickness:** 6.32 mm (0.249 in.)  
**Thermal Condition:** As Welded

### NOTCH-TOUGHNESS TEST

**TYPE OF TEST:** Charpy V-Notch  
**TEST TEMPERATURE:** -48°C (-55°F)

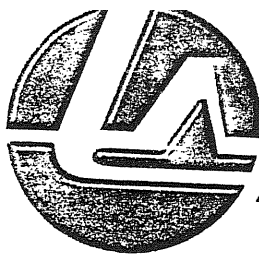
**ORIENTATION:** Transverse  
**SPECIMEN SIZE:** 10 x 5 mm

Specimen Number	Notch Location	Impact Values Joules (ft.lbs)	
X2.1	Weld Metal within 1/16 in. of root	19.5	(14.4)
X2.2		19.3	(14.2)
X2.3		25.8	(19.0)
X3.1	Gr. 60N - HAZ	52.9	(39.0)
X3.2		43.9	(32.4)
X3.3		43.7	(33.2)
Y3.1	Gr. 70N - HAZ	12.7	(9.4)
Y3.2		15.4	(11.4)
Y3.3		10.8	(8.0)

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. 1, UG-84, 2001 edition and latest addenda. 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:

Chris Lachuk, T.T. / Troy Drummond, C.E.T.



# LUDWIG & ASSOCIATES LTD.

## Materials and Welding Engineering

### LABORATORY TEST REPORT

**CUSTOMER:** Delaney Energy Manufacturing Ltd.  
Box 24, Hwy. 855 North  
Halkirk, Alberta  
T0C 1M0

**Laboratory Test No.:** C02-662.1  
**Date:** August 28, 2002

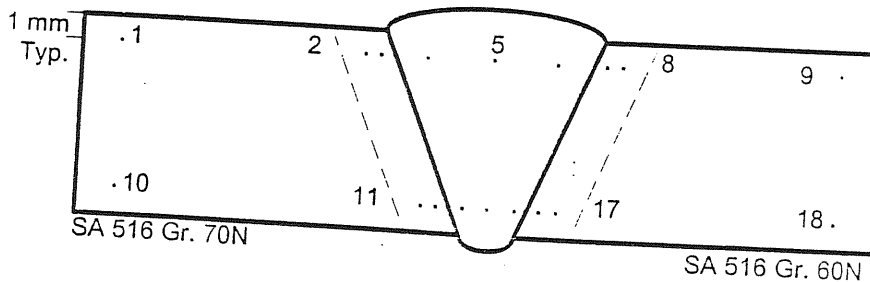
**Attention:** Christine Kelly

**PQR Number:** DEML-3-1  
**Material:** SA 516 Gr. 60N to SA 516 Gr. 70N  
**Thickness:** 6.32 mm (0.249 in.)  
**Thermal Condition:** As Welded

### HARDNESS TEST

**TYPE OF TEST:** Vickers  
**INSTRUMENT TYPE:** Mitutoyo AVK-C1


**LOAD:** 500 g

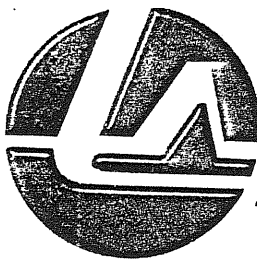


- |           |            |            |            |
|-----------|------------|------------|------------|
| 1) 170 HV | 6) 188 HV  | 11) 175 HV | 16) 187 HV |
| 2) 185 HV | 7) 212 HV  | 12) 188 HV | 17) 178 HV |
| 3) 198 HV | 8) 191 HV  | 13) 194 HV | 18) 147 HV |
| 4) 180 HV | 9) 161 HV  | 14) 177 HV |            |
| 5) 176 HV | 10) 162 HV | 15) 178 HV |            |

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E384 - 99. 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:

  
Chris Lachuk, T.T. / Troy Drummond, C.E.T.



# LUDWIG & ASSOCIATES LTD.

Materials and Welding Engineering

## LABORATORY TEST REPORT

**CUSTOMER:** Delaney Energy Manufacturing Ltd.  
Box 24, Hwy. 855 North  
Halkirk, Alberta  
T0C 1M0

**Laboratory Test No.:** C02-662.2  
**Date:** August 23, 2002

**Attention:** Christine Kelly

**PQR Number:** DEML-3-2  
**Material:** SA 516 Gr. 60N to SA 516 Gr. 70N  
**Thickness:** 9.52 mm (0.375 in.)  
**Thermal Condition:** As Welded

### TENSILE TEST QW-150

SAMPLE NUMBER	T1 QW-462.1(a)	T2 QW-462.1(a)
WIDTH mm (in)	18.9 (0.744)	18.8 (0.740)
THICKNESS mm (in)	8.01 (0.315)	7.41 (0.292)
AREA sq mm (sq in)	151 (0.235)	139 (0.216)
ULT. LOAD N (lbs)	81 900 (18,400)	76 700 (17,200)
UTS MPa (psi)	541 (78,500)	551 (79,800)
FRACTURE TYPE	Partial Cup & Cone	Partial Cup & Cone
FRACTURE LOCATION	Parent Metal (SA 516 Gr. 70N)	Parent Metal (SA 516 Gr. 70N)

### GUIDED-BEND TEST QW-160

SAMPLE WIDTH:	9.52 mm (0.375 in.)	SAMPLE THICKNESS:	9.52 mm (0.375 in.)
PLUNGER SIZE:	38.1 mm (1.50 in.)	YOKE SIZE:	60.3 mm (2.375 in.)
QW-462.2	Side Bend		Side Bend
SAMPLE NUMBER(S)	S1		S4
RESULTS	Pass		Pass

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX, 2001 edition and latest addenda. 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:

Chris Lachuk, T.T. / Troy Drummond, C.E.T.



# LUDWIG & ASSOCIATES LTD.

Materials and Welding Engineering

## LABORATORY TEST REPORT

**CUSTOMER:** Delaney Energy Manufacturing Ltd.  
Box 24, Hwy. 855 North  
Halkirk, Alberta  
T0C 1M0

**Laboratory Test No.:** C02-662.2  
**Date:** August 23, 2002

**Attention:** Christine Kelly

**PQR Number:** DEML-3-2  
**Material:** SA 516 Gr. 60N to SA 516 Gr. 70N  
**Thickness:** 9.52 mm (0.375 in.)  
**Thermal Condition:** As welded

### NOTCH-TOUGHNESS TEST

**TYPE OF TEST:** Charpy V-Notch  
**TEST TEMPERATURE:** -48°C (-55°F)

**ORIENTATION:** Transverse  
**SPECIMEN SIZE:** 10 x 7.5 mm

Specimen Number	Notch Location	Impact Values Joules (ft.lbs)	
Z2.1	Weld Metal within 1/16 in. of root	50.7	(37.4)
Z2.2		69.4	(51.2)
Z2.3		61.0	(45.0)
Z3.1	Gr. 60N - HAZ	241	(178)
Z3.2		74.0	(54.6)
Z3.3		202	(149)
A3.1	Gr. 70N - HAZ	213	(157)
A3.2		100	(73.8)
A3.3		84.1	(62.0)

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. 1, UG-84, 2001 edition and latest addenda. 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:

Chris Lachuk, T.T. / Troy Drummond, C.E.T.





# LUDWIG & ASSOCIATES LTD.

## Materials and Welding Engineering

### LABORATORY TEST REPORT

**CUSTOMER:** Delaney Energy Manufacturing Ltd.  
Box 24, Hwy. 855 North  
Halkirk, Alberta  
T0C 1M0

**Laboratory Test No.:** C02-662.2  
**Date:** August 28, 2002

**Attention:** Christine Kelly

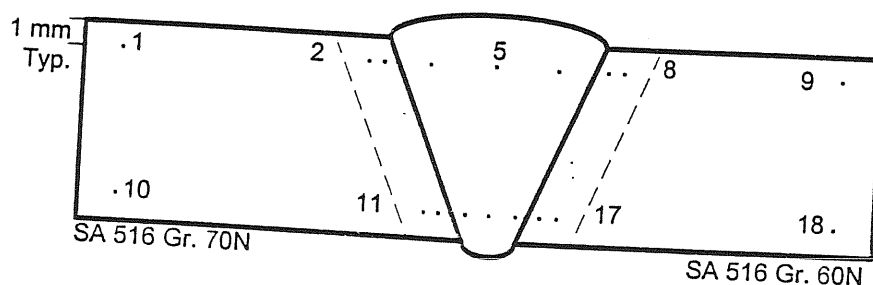
**PQR Number:** DEML-3-2  
**Material:** SA 516 Gr. 60N to SA 516 Gr. 70N  
**Thickness:** 9.52 mm (0.375 in.)  
**Thermal Condition:** As Welded

### HARDNESS TEST

**TYPE OF TEST:** Vickers

**INSTRUMENT TYPE:** Mitutoyo AVK-C1

**LOAD:** 500 g



- |           |            |            |            |
|-----------|------------|------------|------------|
| 1) 159 HV | 6) 192 HV  | 11) 170 HV | 16) 188 HV |
| 2) 196 HV | 7) 202 HV  | 12) 179 HV | 17) 177 HV |
| 3) 202 HV | 8) 182 HV  | 13) 198 HV | 18) 153 HV |
| 4) 187 HV | 9) 155 HV  | 14) 178 HV |            |
| 5) 188 HV | 10) 158 HV | 15) 184 HV |            |

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E384 - 99. 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:

Chris Lachuk, T.T./ Troy Drummond, C.E.T.