

SEP 09 2013

ABSA

WELDING PROCEDURE SPECIFICATION NO.: 115 (Rev.1)

WELDING PROCEDURE QUALIFICATION RECORD NO.(S): 115-1, 115-2, 115-3

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 44.4 mm (0.125 to 1.750 in.) inclusive

COMBINED DEPOSITED WELD METAL THICKNESS

ASME B31.1 19.1 mm (0.750 in.) maximum

ASME B31.3 19.1 mm (0.750 in.) maximum

ASME SECTION VIII, DIVISION 1 38.1 mm (1.50 in.) maximum

ABSA

SAFETY CODES ACT - PROVINCE OF ALBERTA
WELDING PROCEDURE

Reg. No. WP 1312.2
Spec. No. 115 (REV.1)
Weld Process SMAW
Matl. Gr. P No. 1 Gr.1+2 WP No. 1 Gr.1+2
Elec. Gr. P No. 3+4 A No. 1
Th. Qual. For 3.2 to 44.4 mm P.W.H.T. NO
CVN -46°C

Yr. 13 Mo. 9 Day 18 signed **R. ROSEBERG, P.ENG.**
WELDING SPECIALIST

PROVINCIAL REGISTRATION

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Company Name R.J.V. GASFIELD SERVICES
Welding Procedure Specification No. 115 Date August 16, 2013
Supporting PQR No.(s) 115-1, 115-2, 115-3
Welding Process(es) Shielded Metal-Arc Welding (SMAW)

JOINTS (QW-402)

Joint Design All ASME groove & fillet, reference construction drawing for joint details.
Where joint details are not specified, refer to 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 (1)
(1) Reference ASME B31.3 Table 323.3.1 Impact Testing
Requirement for Metals, thickness limitations for Tests on
Welds in Fabrication or Assembly
Fillet All base metal thicknesses
Pipe Diameter Ranges: Groove All diameters
Fillet All diameters
Deposited Weld Metal (Per Pass) E6010: 3.2 mm (0.125 in.) maximum
E7018-1: 4.8 mm (0.188 in.) maximum

FILLER METALS (QW-404)

	SMAW	SMAW
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 3/16 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. (1)</u>	<u>38.1 mm (1.50 in.) max. (1)</u>
Fillet	<u>All fillet sizes</u>	<u>All fillet sizes</u>

(1) Combined deposited weld metal thickness shall not exceed 19.1 mm (0.750 in.)
for ASME B31.1, B31.3 and 38.1 mm (1.50 in.) for ASME Section VIII, Division 1

POSITION (QW-405)

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

PREHEAT (QW-406)

Preheat Temperature (Minimum) See attached preheat sheet prior to welding.
Interpass Temperature (Maximum) 288°C (550°F)
Preheat Maintenance See attached preheat sheet 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.

POSTWELD HEAT TREATMENT (QW-407)Temperature Range N/A Time Range N/A**ELECTRICAL CHARACTERISTICS (QW-409)**Current Direct Polarity Reverse, electrode positive
Amps See Table #1 Volts See Table #1**Maximum Heat Input**

Base Metal Thickness Range	E6010 Electrode	E7018-1 Electrode
0.125 - 0.499 in.	33,730 J/in.	40,460 J/in.
0.50 - 0.624 in.	39,550 J/in.	53,500 J/in.
0.625 - 1.750 in.	32,430 J/in.	74,550 J/in.

TECHNIQUE (QW-410)Manual or Automatic Manual
Multiple or Single Pass Per Side F3: Either F4: Multiple
String or Weave Either
Travel Speed See Table #1
Initial & Interpass Cleaning Brushing, chipping or grinding as required
Method of Back Gouging Air carbon arc, back-grind as required
Peening Not permitted
Use of Thermal Process N/A**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 - 34	35 - 300 (1.4 - 12)
SMAW	E6010	3.2 (1/8)	DCRP	60 - 140	19 - 34	44 - 350 (1.7 - 14)
SMAW	E6010	4.0 (5/32)	DCRP	115 - 250	21 - 34	93 - 400 (3.7 - 16)
SMAW	E6010	5.0 (3/16)	DCRP	120 - 300	21 - 34	97 - 460 (3.8 - 18)
SMAW	E7018-1	2.4 (3/32)	DCRP	60 - 110	18 - 26	22 - 300 (0.9 - 12)
SMAW	E7018-1	3.2 (1/8)	DCRP	90 - 170	19 - 28	35 - 350 (1.4 - 14)
SMAW	E7018-1	4.0 (5/32)	DCRP	110 - 220	20 - 30	45 - 400 (1.8 - 16)
SMAW	E7018-1	5.0 (3/16)	DCRP	160 - 320	20 - 30	65 - 500 (2.6 - 20)
SMAW	E7018-1	6.4 (1/4)	DCRP	275 - 360	21 - 32	118 - 550 (4.6 - 22)

Note: Welding parameters shall be adjusted to insure that the maximum heat input value specified in QW-409 above is not exceeded.
Heat Input (joules per inch) = (Amperage X Voltage X 60) / Travel Speed (inches per minute)

TYPICAL JOINT DESIGNS

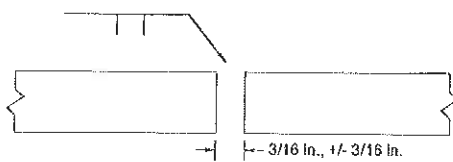


Figure 1
Single Square Butt

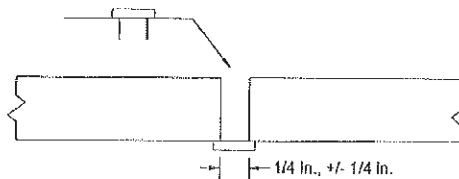


Figure 2
Single Square Butt with Backing Strip

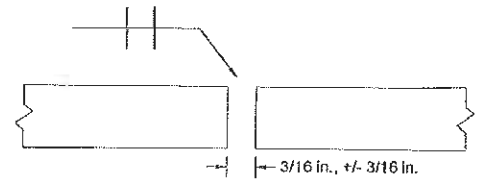


Figure 3
Double Square Butt

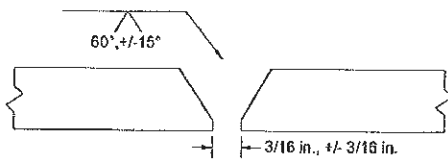


Figure 4
Single Vee Butt

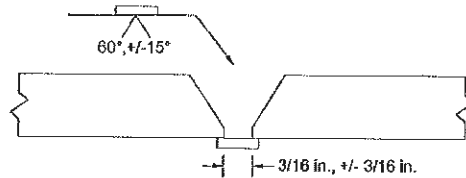


Figure 5
Single Vee Butt with Backing Strip

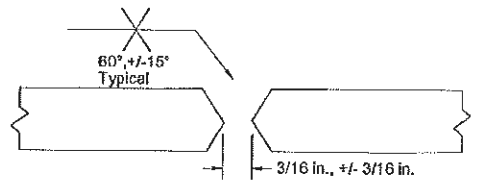


Figure 6
Double Vee Butt

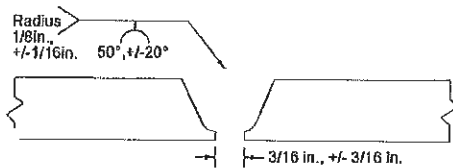


Figure 7
Single U Butt

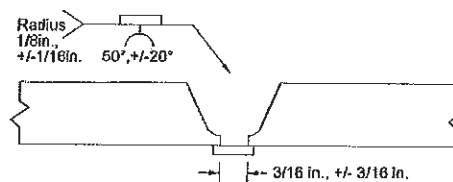


Figure 8
Single U Butt with Backing Strip

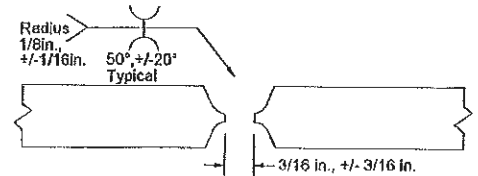


Figure 9
Double U Butt

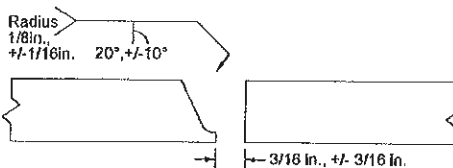


Figure 10
Single J Butt

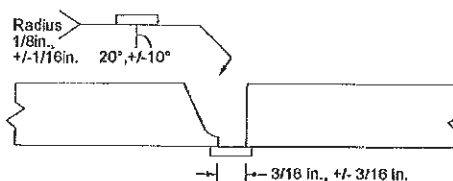


Figure 11
Single J Butt with Backing Strip



Figure 12
Double J Butt

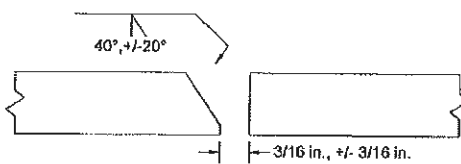


Figure 13
Single Bevel Butt

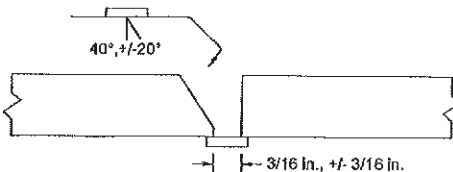


Figure 14
Single Bevel Butt with Backing Strip

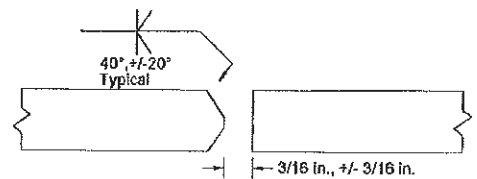


Figure 15
Double Bevel Butt

Additional joint designs and internal misalignment on circumferential welds shall be within the dimensional limits stated on the approved construction drawing and/or the engineering design.

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 32 mm (0 to 1.25 in.)	10°C (50°F)
Over 32 mm (Over 1.25 in.)	95°C (200°F)
Over 25 mm (1.0 in.) & specified maximum carbon content in excess of 0.30%.	79°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 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 mm (1.0 in.)	≤ 490 MPa (71 ksi)	10°C (50°F)
≥ 25 mm (1.0 in.)	All	79°C (175°F)
All	> 490 MPa (71 ksi)	79°C (175°F)

- The preheat zone shall extend at least 25 mm (1.0 in.) beyond each edge of the weld.
- The interruption of welding shall be subject to the requirements of paragraph 330.2.4.

POWER PIPING IN ACCORDANCE WITH ASME B31.1

NOMINAL WALL THICKNESS	MINIMUM PREHEAT TEMPERATURE
Over 25 mm (1.0 in.) & specified maximum carbon content in excess of 0.30%.	80°C (175°F)
All others	10°C (50°F)

- The preheat zone shall extend beyond each edge of the weld for at least 76.2 mm (3.0 in.) or 1.5 times the base metal thickness (as defined in paragraph 131.4.1), whichever is greater.

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Company Name R.J.V. GASFIELD SERVICES
Procedure Qualification Record No. 115-1 Date August 9, 2013
Welding Procedure Specification No. 115
Welding Process(es) Shielded Metal-Arc Welding (SMAW)

JOINTS (QW-402)

Type Butt joint, single vee groove, see next page

BASE METALS (QW-403)

Material Specification No. SA 333 to SA 350 Type or Grade Gr.6 to Gr.LF2
P-No. P1 Grp.1 To P-No. P1 Grp.2 Thickness 6.32 mm (0.249 in.)
Heat Number 81183 to 12/32057 Carbon Equivalent (1) 0.22 to 0.37
Diameter 168.3 mm (6.625 in.) O.D. Other Schedule 40 m/c to 0.249 in.
Deposited Weld Metal (Per Pass) Did not exceed 2.4 mm (0.094 in.) for E6010,
and 3.2 mm (0.125 in.) for E7018-1

(1) Per CSA Z662 Carbon Equivalent formula. See attached chemical composition product analysis material test report

FILLER METALS (QW-404)

Specification No. (SFA)	<u>SFA 5.1</u>	<u>SFA 5.1</u>
AWS No. (Class)	<u>E6010 (1)</u>	<u>E7018-1 (2)</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>2.38 mm (0.094 in.)</u>	<u>3.94 mm (0.155 in.)</u>

(1) Lincoln Electric Company: Lincoln Fleetweld 5P+
(2) Air Liquide Canada Inc.: LA 18 Plus

POSITION (QW-405)

Position of Groove 5G 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 N/A Time N/A

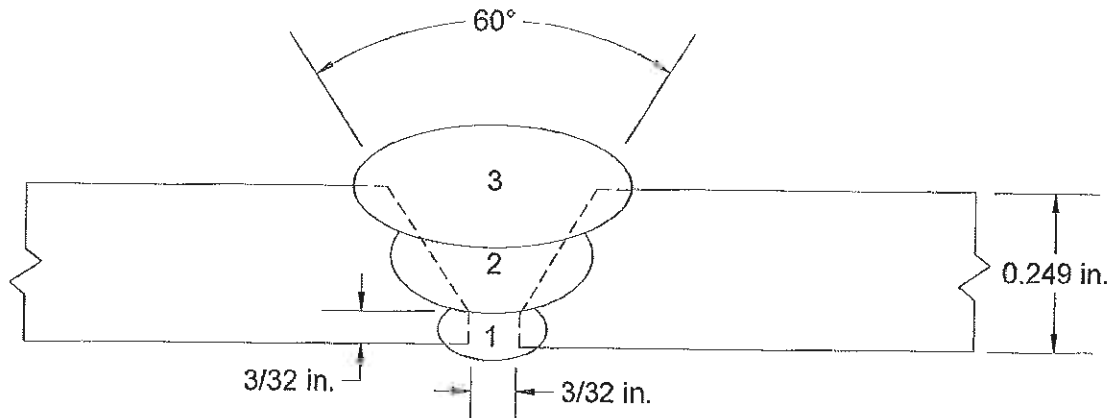
ELECTRICAL CHARACTERISTICS (QW-409)

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: 33,700 J/in. maximum</u>		<u>F4: 40,460 J/in. maximum</u>

TECHNIQUE (QW-410)

Manual or Automatic	<u>Manual</u>	
Multiple or Single Pass Per Side	<u>F3: Single</u>	<u>F4: Multiple</u>
String or Weave	<u>Root: String</u>	<u>Remainder: Weave</u>
Travel Speed	<u>See next page</u>	
Use of Thermal Process	<u>N/A</u>	

PQR NO. 115-1



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	82 - 86	24 - 26	95 (3.7)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	80 - 84	21 - 22	126 (5.0)
3	SMAW	E7018-1	2.4 (3/32)	DCRP	80 - 84	21 - 22	65 (2.0)

PQR NO. 115-1**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	19.3 (0.760)	5.06 (0.199)	97.7 (0.151)	50 250 (11,300)	515 (74,600)	Partial Cup & Cone Parent Metal (SA 333 Gr.6)
T2	19.3 (0.760)	5.21 (0.205)	101 (0.156)	51 608 (11,600)	513 (74,400)	Partial Cup & Cone Parent Metal (SA 333 Gr.6)

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Type & Figure No.	Result
QW-462.3a, TRB - R1	Pass	QW-462.3a, TFB - F1	Pass
QW-462.3a, TRB - R2	Pass	QW-462.3a, TFB - F2	Pass

NOTCH-TOUGHNESS TEST

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)
D2.1	Weld Metal	18.7 (13.8)
D2.2	Weld Metal	20.1 (14.8)
D2.3	Weld Metal	28.2 (20.8)
D3.1	P1 Grp.1 - HAZ	>141 (>104)
D3.2	P1 Grp.1 - HAZ	40.7 (30.0)
D3.3	P1 Grp.1 - HAZ	>141 (>104)
D4.1	P1 Grp.2 - HAZ	59.9 (44.2)
D4.2	P1 Grp.2 - HAZ	35.3 (26.0)
D4.3	P1 Grp.2 - HAZ	48.8 (36.0)

OTHER TESTS

Vickers Hardness - see attached laboratory test report

Welders Name Bernie Sorbora Certificate File No. W-6819
 Tests Conducted By SGS Ludwig Associates Ltd.
 Laboratory Test No. E13-551.1

We certify 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 R.J.V. GASFIELD SERVICES

Date _____ Signed _____

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Company Name R.J.V. GASFIELD SERVICES
Procedure Qualification Record No. 115-2 Date August 9, 2013
Welding Procedure Specification No. 115
Welding Process(es) Shielded Metal-Arc Welding (SMAW)

JOINTS (QW-402)

Type Butt joint, single vee groove, see next page

BASE METALS (QW-403)

Material Specification No. SA 516 to SA 516 Type or Grade Gr.60 to Gr.70
P-No. P1 Grp.1 To P-No. P1 Grp.2 Thickness 12.7 mm (0.50 in.)
Heat Number 354638 to 354638 Carbon Equivalent (1) 0.38 to 0.38
Diameter N/A Other Plate Product Form
Deposited Weld Metal (Per Pass) Did not exceed 2.4 mm (0.094 in.) for E6010,
and 3.2 mm (0.125 in.) for E7018-1

(1) Per CSA Z662 Carbon Equivalent formula. See attached chemical composition product analysis material test report

FILLER METALS (QW-404)

Specification No. (SFA)	<u>SFA 5.1</u>	<u>SFA 5.1</u>
AWS No. (Class)	<u>E6010 (1)</u>	<u>E7018-1 (2)</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>2.38 mm (0.094 in.)</u>	<u>10.3 mm (0.406 in.)</u>
(1)	<u>Lincoln Electric Company: Lincoln Fleetweld 5P+</u>	
(2)	<u>Air Liquide Canada Inc.: LA 18 Plus</u>	

POSITION (QW-405)

Position of Groove 3G Weld Progression Vertical up

PREHEAT (QW-406)

Preheat Temperature 10°C (50°F) Interpass Temp. (Max.) 260°C (500°F)

POSTWELD HEAT TREATMENT (QW-407)

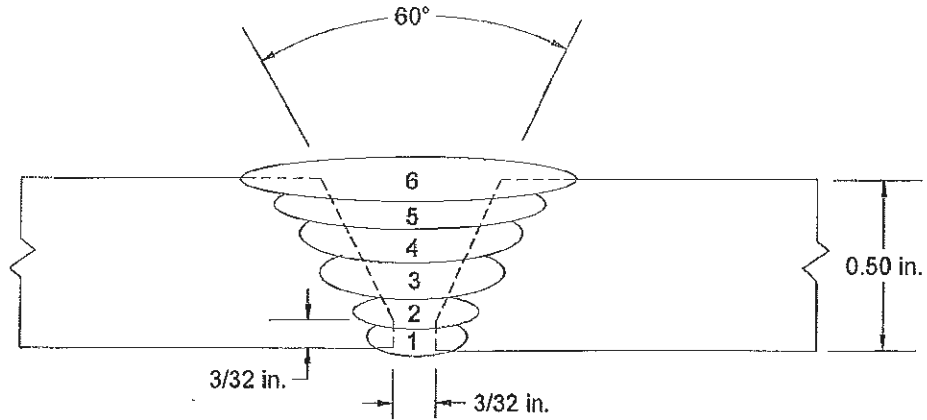
Temperature N/A Time N/A

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: 39,550 J/in. maximum</u>		<u>F4: 53,500 J/in. maximum</u>

TECHNIQUE (QW-410)

Manual or Automatic	<u>Manual</u>	
Multiple or Single Pass Per Side	<u>F3: Single</u>	<u>F4: Multiple</u>
String or Weave	<u>Root: String</u>	<u>Remainder: Weave</u>
Travel Speed	<u>See next page</u>	
Use of Thermal Process	<u>N/A</u>	



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	76 - 80	23 - 25	72 (3.8)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	81 - 85	21 - 22	73 (2.9)
3	SMAW	E7018-1	2.4 (3/32)	DCRP	85 - 89	21 - 22	81 (3.2)
4	SMAW	E7018-1	2.4 (3/32)	DCRP	84 - 88	21 - 22	88 (3.5)
5	SMAW	E7018-1	2.4 (3/32)	DCRP	84 - 88	21 - 22	95 (3.7)
6	SMAW	E7018-1	2.4 (3/32)	DCRP	84 - 88	21 - 22	51 (2.0)

PQR NO. 115-2

NOTCH-TOUGHNESS TEST

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)
E2.1	Weld Metal	79.2 (58.4)
E2.2	Weld Metal	54.8 (40.4)
E2.3	Weld Metal	102 (75.0)
E3.1	P1 Grp.1 - HAZ	>141 (>104)
E3.2	P1 Grp.1 - HAZ	114 (84.0)
E3.3	P1 Grp.1 - HAZ	118 (87.0)
E4.1	P1 Grp.2 - HAZ	132 (97.2)
E4.2	P1 Grp.2 - HAZ	>141 (>104)
E4.3	P1 Grp.2 - HAZ	104 (76.4)

OTHER TESTS

Vickers Hardness - see attached laboratory test report

Welders Name Bernie Sorbora Certificate File No. W-6819
Tests Conducted By SGS Ludwig Associates Ltd.
Laboratory Test No. E13-551.2

We certify 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 R.J.V. GASFIELD SERVICES

Date _____ Signed _____

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Company Name R.J.V. GASFIELD SERVICES
Procedure Qualification Record No. 115-3 Date August 9, 2013
Welding Procedure Specification No. 115
Welding Process(es) Shielded Metal-Arc Welding (SMAW)

JOINTS (QW-402)

Type Butt joint, single vee groove, see next page

BASE METALS (QW-403)

Material Specification No. SA 516 to SA 516 Type or Grade Gr.60 to Gr.70
P-No. P1 Grp.1 To P-No. P1 Grp.2 Thickness 22.2 mm (0.875 in.)
Heat Number 365803 to 365803 Carbon Equivalent (1) 0.39 to 0.39
Diameter N/A Other Plate Product Form
Deposited Weld Metal (Per Pass) Did not exceed 2.4 mm (0.094 in.) for E6010,
and 3.2 mm (0.125 in.) for E7018-1

(1) Per CSA Z662 Carbon Equivalent formula. See attached chemical composition product analysis material test report

FILLER METALS (QW-404)

Specification No. (SFA)	<u>SFA 5.1</u>	<u>SFA 5.1</u>
AWS No. (Class)	<u>E6010 (1)</u>	<u>E7018-1 (2)</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>2.38 mm (0.094 in.)</u>	<u>19.8 mm (0.781 in.)</u>

(1) Lincoln Electric Company: Lincoln Fleetweld 5P+
(2) Air Liquide Canada Inc.: LA 18 Plus

POSITION (QW-405)

Position of Groove 3G Weld Progression Vertical up

PREHEAT (QW-406)

Preheat Temperature 10°C (50°F) Interpass Temp. (Max.) 260°C (500°F)

POSTWELD HEAT TREATMENT (QW-407)

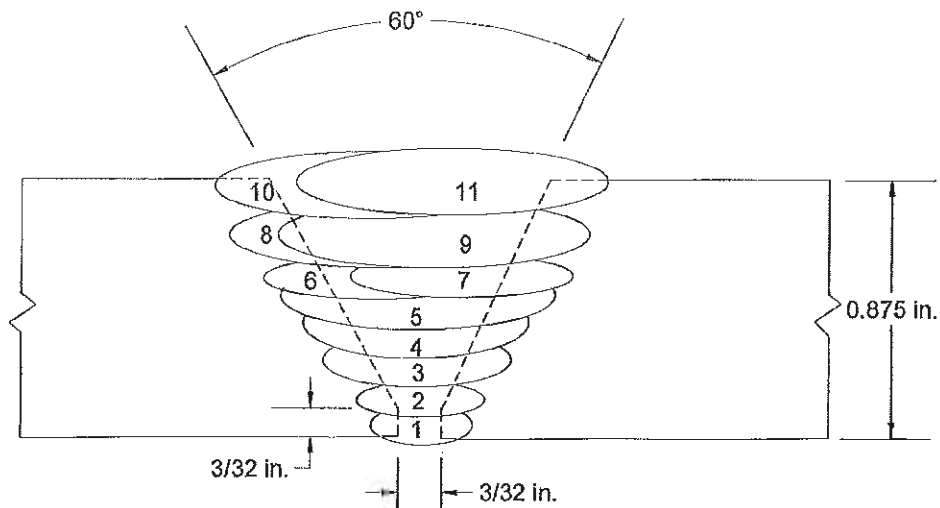
Temperature N/A Time N/A

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: 32,430 J/in. maximum</u>		<u>F4: 74,550 J/in. maximum</u>

TECHNIQUE (QW-410)

Manual or Automatic	<u>Manual</u>	
Multiple or Single Pass Per Side	<u>F3: Single</u>	<u>F4: Multiple</u>
String or Weave	<u>Root: String</u>	<u>Remainder: Weave</u>
Travel Speed	<u>See next page</u>	
Use of Thermal Process	<u>N/A</u>	



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	84 - 88	24 - 26	101 (4.0)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	88 - 92	21 - 22	81 (3.2)
3	SMAW	E7018-1	2.4 (3/32)	DCRP	92 - 96	21 - 22	74 (2.9)
4	SMAW	E7018-1	3.2 (1/8)	DCRP	118 - 122	21 - 22	71 (2.8)
5	SMAW	E7018-1	3.2 (1/8)	DCRP	116 - 120	21 - 22	51 (2.0)
6	SMAW	E7018-1	3.2 (1/8)	DCRP	119 - 123	21 - 22	122 (4.8)
7	SMAW	E7018-1	3.2 (1/8)	DCRP	119 - 123	21 - 22	114 (4.5)
8	SMAW	E7018-1	3.2 (1/8)	DCRP	119 - 123	21 - 22	122 (4.8)
9	SMAW	E7018-1	3.2 (1/8)	DCRP	115 - 119	21 - 22	121 (4.8)
10	SMAW	E7018-1	3.2 (1/8)	DCRP	115 - 119	21 - 23	92 (3.6)
11	SMAW	E7018-1	3.2 (1/8)	DCRP	115 - 119	21 - 23	77 (3.0)

PQR NO. 115-3**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	19.0 (0.748)	20.6 (0.811)	391 (0.606)	205 772 (46,300)	526 (76,300)	Partial Cup & Cone Parent Metal (SA 516 Gr.60)
T2	19.1 (0.752)	20.3 (0.799)	388 (0.601)	207 (46,700)	535 (77,600)	Partial Cup & Cone Parent Metal (SA 516 Gr.60)

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

NOTCH-TOUGHNESS TEST

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)
F2.1	Weld Metal	92.5 (68.2)
F2.2	Weld Metal	16.8 (12.4)
F2.3	Weld Metal	52.1 (38.4)
F3.1	P1 Grp.1 - HAZ	>141 (>104)
F3.2	P1 Grp.1 - HAZ	107 (79.0)
F3.3	P1 Grp.1 - HAZ	>141 (>104)
F4.1	P1 Grp.2 - HAZ	21.7 (16.0)
F4.2	P1 Grp.2 - HAZ	>141 (>104)
F4.3	P1 Grp.2 - HAZ	89.5 (66.0)

OTHER TESTS

Vickers Hardness - see attached laboratory test report

Welders Name Bernie Sorbora Certificate File No. W-6819
 Tests Conducted By SGS Ludwig Associates Ltd.
 Laboratory Test No. E13-551.3

We certify 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 R.J.V. GASFIELD SERVICES

Date _____ Signed _____



LUDWIG

TENSILE / BEND TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1G3

Laboratory Test No.: E13-551.1
Date: August 20, 2013

Attention: Dale Laniuk

PQR No.: 115-1
Material: SA 333 Gr. 6 to SA 350 Gr. LF2
Size: 168.3 mm (6.625 in.) O.D. x 6.32 mm (0.249 in.) w.t.
Thermal Condition: As Welded

Heat No.: 81183 to 12/32057

Governing Spec.: ASME Section IX, 2011a edition and latest addenda

SAMPLE NO.(QW-150)	T1	T2
WIDTH mm (in.)	19.3 (0.760)	19.3 (0.760)
THICKNESS mm (in.)	5.06 (0.199)	5.21 (0.205)
AREA sq. mm (sq. in.)	97.7 (0.151)	101 (0.156)
ULTIMATE LOAD N (lbf)	50 250 (11,300)	51 608 (11,600)
ULTIMATE STRESS MPa (psi)	515 (74,600)	513 (74,400)
FRACTURE TYPE	Partial Cup & Cone	Partial Cup & Cone
FRACTURE LOCATION	Parent Metal (SA 333 Gr. 6)	Parent Metal (SA 333 Gr. 6)

Note: Imperial values calculated by direct conversion.

SAMPLE TYPE(QW-462.3a)	Face Bend	Face Bend	Root Bend	Root Bend
SAMPLE NO.	F1	F2	R1	R2
RESULTS	Pass	Pass	Pass	Pass

Test Conducted By: Nina Laderoute, T.T.

Certified By: 
Karen Koens, R.E.T.

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LUDWIG ASSOCIATES LTD. IS NOW PART OF SGS, THE WORLD'S LEADING INSPECTION, VERIFICATION, TESTING AND CERTIFICATION COMPANY.



LUDWIG

CHARPY V-NOTCH IMPACT TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1C3

Laboratory Test No.: E13-551.1
Date: August 19, 2013

Attention: Dale Laniuk

PQR No.:	115-1	Heat No.:	81183 to 12/32057
Material:	SA 333 Gr. 6 to SA 350 Gr. LF2		
Size:	168.3 mm (6.625 in.) O.D. x 6.32 mm (0.249 in.) w.t.		
Thermal Condition:	As Welded		

Specimen Size:	10 x 5 mm (0.394 x 0.197 in.)	Machine:	Satec SI-1K3, S/N: 1503
Orientation:	Transverse	Capacity:	407 J (300 ft-lbf)
Test Temperature:	-48°C (-55°F)	Verified Range:	3.4-141 J (2.5-104 ft-lbf)
Governing Spec.:	ASME Section VIII, Div. 1, UG-84 – 2011a edition and latest addenda		

Specimen Number	Notch Location	Impact Values	
		Joules	(ft-lbf)
D2.1	Weld Metal within 1/16" of root	18.7	(13.8)
D2.2	Weld Metal within 1/16" of root	20.1	(14.8)
D2.3	Weld Metal within 1/16" of root	28.2	(20.8)
D3.1	Gr. 6 - HAZ	>141	(>104)
D3.2	Gr. 6 - HAZ	40.7	(30.0)
D3.3	Gr. 6 - HAZ	>141	(>104)
D4.1	Gr. LF2 - HAZ	59.9	(44.2)
D4.2	Gr. LF2 - HAZ	35.3	(26.0)
D4.3	Gr. LF2 - HAZ	48.8	(36.0)

Note: Imperial values calculated by direct conversion.

Test Conducted By: Natasha Collier, C.E.T.

Certified By: 
Natasha Collier, C.E.T.

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LUDWIG

HARDNESS TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1C3

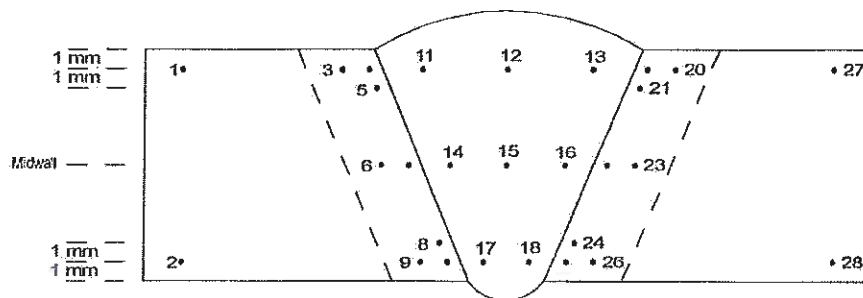
Laboratory Test No.: E13-551.1
Date: August 16, 2013

Attention: Dale Laniuk

PQR No.: 115-1
Material: SA 333 Gr. 6 to SA 350 Gr. LF2
Size: 168.3 mm (6.625 in.) O.D. x 6.32 mm (0.249 in.) w.t.
Thermal Condition: As Welded

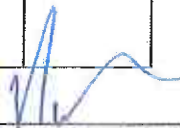
Heat No.: 81183 to 12/32057

Type of Test: Vickers 10kg (HV10)
Instrument: Leco V-100-C1
Governing Spec.: ASTM E384-11e1



SA 350 Gr. LF2				Weld Metal		SA 333 Gr. 6			
Parent Metal		HAZ				HAZ		Parent Metal	
1	191	3	171	11	179	19	164	27	149
2	169	4	178	12	191	20	141	28	157
		5	169	13	184	21	177		
		6	173	14	162	22	180		
		7	178	15	161	23	172		
		8	173	16	172	24	172		
		9	167	17	165	25	170		
		10	177	18	171	26	162		

Test Conducted By: Natashua Collier, C.E.T.

Certified By: 
Natashua Collier, C.E.T.

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LUDWIG ASSOCIATES LTD. IS NOW PART OF SGS, THE WORLD'S LEADING INSPECTION, VERIFICATION, TESTING AND CERTIFICATION COMPANY.



LUDWIG

CHARPY V-NOTCH IMPACT TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1C3

Laboratory Test No.: E13-551.2
Date: August 19, 2013

Attention: Dale Laniuk

PQR No.: 115-2
Material: SA 516 Gr. 60 to SA 516 Gr. 70
Thickness: 12.7 mm (0.500 in.)
Thermal Condition: As Welded

Heat No.: 354638 to 354638

Specimen Size: 10 x 10 mm (0.394 x 0.394 in.)

Orientation: Transverse

Test Temperature: -46 °C (-50 °F)

Governing Spec.: ASME Section VIII, Div. I, UG-84 – 2011a edition and latest addenda

Machine: Satec SI-1K3, S/N: 1503

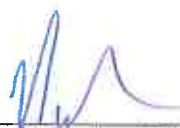
Capacity: 407 J (300 ft-lbf)

Verified Range: 3.4-141 J (2.5-104 ft-lbf)

Specimen Number	Notch Location	Impact Values	
		Joules	(ft-lbf)
E2.1	Weld Metal within 1/16" of root	79.2	(58.4)
E2.2	Weld Metal within 1/16" of root	54.8	(40.4)
E2.3	Weld Metal within 1/16" of root	102	(75.0)
E3.1	Gr. 60 - HAZ	>141	(>104)
E3.2	Gr. 60 - HAZ	114	(84.0)
E3.3	Gr. 60 - HAZ	118	(87.0)
E4.1	Gr. 70 - HAZ	132	(97.2)
E4.2	Gr. 70 - HAZ	>141	(>104)
E4.3	Gr. 70 - HAZ	104	(76.4)

Note: Imperial values calculated by direct conversion.

Test Conducted By: Natashua Collier, C.E.T.

Certified By: 

Natashua Collier, C.E.T.

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SGS

LUDWIG

HARDNESS TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1G3

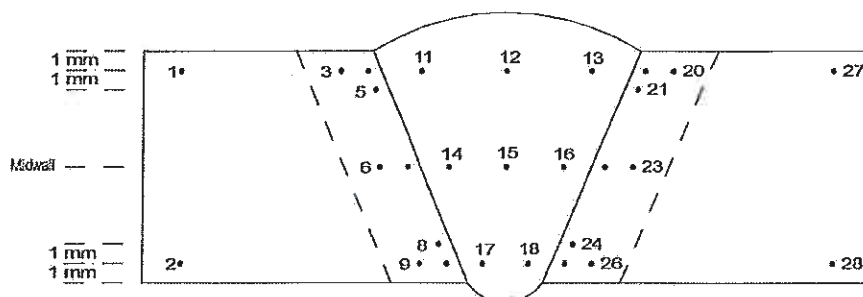
Laboratory Test No.: E13-551.2
Date: August 19, 2013

Attention: Dale Laniuk

PQR No.: 115-2
Material: SA 516 Gr. 60 to SA 516 Gr. 70
Thickness: 12.7 mm (0.500 in.)
Thermal Condition: As Welded

Heat No.: 354638 to 354638

Type of Test: Vickers 10kg (HV10)
Instrument: Buehler 5112
Governing Spec.: ASTM E384-11e1



SA 516 Gr. 70				Weld Metal		SA 516 Gr. 60			
Parent Metal		HAZ				HAZ		Parent Metal	
1	156	3	176	11	180	19	204	27	152
2	155	4	200	12	182	20	180	28	158
		5	189	13	197	21	194		
		6	170	14	176	22	175		
		7	175	15	177	23	161		
		8	192	16	172	24	193		
		9	189	17	189	25	180		
		10	194	18	192	26	178		

Test Conducted By: Karen Koens, R.E.T.

Certified By: 

Karen Koens, R.E.T.

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LUDWIG

TENSILE / BEND TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1C3

Laboratory Test No.: E13-551.3
Date: August 19, 2013

Attention: Dale Laniuk

PQR No.: 115-3
Material: SA 516 Gr. 60 to SA 516 Gr. 70
Thickness: 22.2 mm (0.875 in.)
Thermal Condition: As Welded

Heat No.: 365803 to 365803

Governing Spec.: ASME Section IX, 2011a edition and latest addenda

SAMPLE NO.(QW-150)	T1	T2
WIDTH mm (in.)	19.0 (0.748)	19.1 (0.752)
THICKNESS mm (in.)	20.6 (0.811)	20.3 (0.799)
AREA sq. mm (sq. in.)	391 (0.606)	388 (0.601)
ULTIMATE LOAD N (lbf)	205 772 (46,300)	207 565 (46,700)
ULTIMATE STRESS MPa (psi)	526 (76,300)	535 (77,600)
FRACTURE TYPE	Partial Cup & Cone	Partial Cup & Cone
FRACTURE LOCATION	Parent Metal (SA 516 Gr. 60)	Parent Metal (SA 516 Gr. 60)

Note: Imperial values calculated by direct conversion.

SAMPLE TYPE(QW-462.2)	Side Bend	Side Bend	Side Bend	Side Bend
SAMPLE NO.	S1	S2	S3	S4
RESULTS	Pass	Pass	Pass	Pass

Test Conducted By: Wilson Symington, T.T

Certified By: 
Karen Koens, R.E.T.

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LUDWIG

CHARPY V-NOTCH IMPACT TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1C3

Laboratory Test No.: E13-551.3
Date: August 20, 2013

Attention: Dale Laniuk

PQR No.: 115-3
Material: SA 516 Gr. 60 to SA 516 Gr. 70
Thickness: 22.2 mm (0.875 in.)
Thermal Condition: As Welded

Heat No.: 365803 to 365803

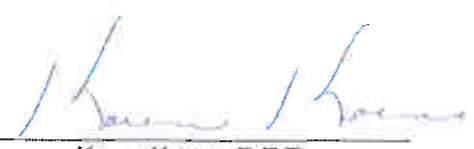
Specimen Size: 10 x 10 mm (0.394 x 0.394 in.)
Orientation: Transverse
Test Temperature: -46°C (-50°F)
Governing Spec.: ASME Section VIII, Div. 1, UG-84 – 2011a edition and latest addenda

Machine: Satec SI-1K3, S/N: 1503
Capacity: 407 J (300 ft-lbf)
Verified Range: 3.4-141 J (2.5-104 ft-lbf)

Specimen Number	Notch Location	Impact Values	
		Joules	(ft-lbf)
F2.1	Weld Metal within 1/16" of root	92.5	(68.2)
F2.2	Weld Metal within 1/16" of root	16.8	(12.4)
F2.3	Weld Metal within 1/16" of root	52.1	(38.4)
F3.1	Gr. 60 - HAZ	>141	(>104)
F3.2	Gr. 60 - HAZ	107	(79.0)
F3.3	Gr. 60 - HAZ	>141	(>104)
F4.1	Gr. 70 - HAZ	21.7	(16.0)
F4.2	Gr. 70 - HAZ	>141	(>104)
F4.3	Gr. 70 - HAZ	89.5	(66.0)

Note: Imperial values calculated by direct conversion.

Test Conducted By: Nina Laderoute, T.T.

Certified By: 

Karen Koens, R.E.T.

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LUDWIG

HARDNESS TEST

Customer: R.J.V. Gasfield Services
4901 Bruce Road
Vegreville, Alberta
T9C 1C3

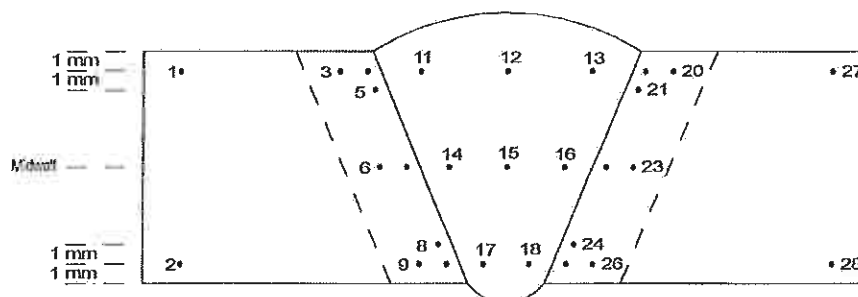
Laboratory Test No.: E13-551.3
Date: August 19, 2013

Attention: Dale Lanluk

PQR No.: 115-3
Material: SA 516 Gr. 60 to SA 516 Gr. 70
Thickness: 22.2 mm (0.875 in.)
Thermal Condition: As Welded

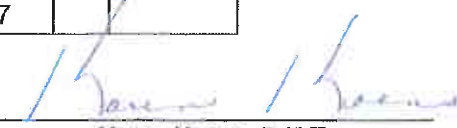
Heat No.: 365803 to 365803

Type of Test: Vickers 10kg (HV10)
Instrument: Buehler 5112
Governing Spec.: ASTM E384-11a



SA 516 Gr. 60				Weld Metal		SA 516 Gr. 70			
Parent Metal		HAZ				HAZ		Parent Metal	
1	157	3	177	11	212	19	212	27	158
2	157	4	225	12	204	20	176	28	159
		5	217	13	205	21	212		
		6	179	14	193	22	178		
		7	188	15	187	23	173		
		8	171	16	194	24	176		
		9	184	17	172	25	197		
		10	180	18	173	26	177		

Test Conducted By: Karen Koens, R.E.T.

Certified By: 

Karen Koens, R.E.T.

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SGS Ludvig Associates Ltd.

4027 - 14 Street S.E. Calgary AB T2G 3K6 t +1 (403) 262-7072 f +1 (403) 266-3169
7925 Davies Road Edmonton AB T6E 4N1 t +1 (780) 468-3030 f +1 (780) 468-3032

www.ludwigassociatesltd.com www.sgs.com

Member of the SGS Group (SGS SA)

Sheet

Sheet

LF

1

Case
Notes
Value

	CAS	Mass	Yield
3			
2			
1	207	150	173
0	126	114	128
	198	153	114
	141	125	153
	122	145	125

MSB	SN	T
000	0,003	0,0
000	0,001	0,0

22

AG der Dillinger Hüttenwerke
Postfach 1580, D-66748 Dillinger/Saar

QM-System: Certification as per ISO:9001

Erklärung: siehe Rückseite/Explications voir au verso/See reverse for explanations (www.dillinger.de/certificate)



DILLINGER HÜTTE

A02 INSPECTION CERTIFICATE 3.1 AS PER EN 10204:2004

INSPECTION CERTIFICATE 3.1.B AS PER EN 10204:1991+A1:1995 + AS PER ISO 10474:1991

MATERIAL TEST REPORT (MTR)

A05 Established inspecting body

A06 Purchaser
EDMONTON STEEL, EDMON
EDMONTON STEEL, EDMON

A10 Advice of dispatch No./
Date of dispatch
405555-20.11.11

A08 Manufacturer's order/
A03 Certificate No.
368979-001

Sheet
4 / . . .

DH

Final receiver

A07.1 No. ED10578-J1010-ER

A07.2 No.

B01 Product
HOT ROLLED PLATES

B02 Steel design. SA516-60

B03 Any suppl. ASME-III-A:10.

requirements DIL-HOE-2-R31-2010-11-22

SA20-S5

C40-C49 Impact test

B14 Item No.	B07.1 Heat No.	B07.1 Rol./plate/ Test No.	B05 Reference (heat) treatment	C01 C02/ C03 Temp. C/F	C41 Width of test piece	C40 Type of test place	C44 Testing method	C46 Energy	C45 C42 Individual values	C43 Mean value
01	365805	97546		K1 LV -51		CHP-V			AV 198	226
01	365805	97554		K1 LV -51		CHP-V			AV 152	145

C70-C99 Chemical composition % - Heat analysis

B07.2 Heat	C70	C	SI	MN	P	S	N	CU	MO	NI	CR	V	NB	SN	TI
365803	Y	0,175	0,376	1,16	0,008	0,0018	0,0072	0,035	0,012	0,048	0,041	0,000	0,000	0,000	0,001
365805	Y	0,165	0,365	1,14	0,008	0,0009	0,0060	0,035	0,012	0,043	0,035	0,000	0,000	0,001	0,002

C94 Heat analysis Carbon equivalent / Alloying restrictions

B07.2 Heat	C94	FO-02=	FO-02=	FO-51=	FO-55=	FO-78=	FO-91=
365803	Y	0,38	0,37	0,000	0,14	0,05	6,6
365805	Y	0,37	0,37	0,000	0,13	0,05	6,9

C95 Ladle treatment

ITEM NO.: 01

HEAT OF THE INDICATED ITEM: VACUUM DEGASSED / SULPHIDE SHAPE CONTROL

C95 Further information about ladle treatment

ITEM NO.: 01

CALCIUM TREATED

with the terms of order.



Manufacturer's mark

B. BALDAUF
Test House Manager



AG der Dillinger Hüttenwerke:
Postfach 1580, D-66748 Dillingen/Saar
Inspection department

Inspector's stamp Date 21.11.11

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