

PIPELINE WELDING PROCEDURE SPECIFICATION

WPS NUMBER: ENB-MA-WPS-3 REV.0

AUGUST 11, 2014

REVISION LOG

REV. NO. 0:

SCOPE

This welding procedure specification details the procedure to be followed for **SMAW / Mechanized FCAW Up, section & tie-in field butt welding** of pipe as required by CSA Standard Z662, Oil and Gas Pipeline Systems. This procedure uses CRC Evans Welding Equipment and includes a provision for Mechanized Gas Shielded FCAW Up for fill and cap passes.

Normative References: This welding procedure specification was prepared in accordance to CSA Z662-11 and incorporates by undated references, provisions from other publications. Revision to this specification is not required unless subsequent referenced code and or specification additions include changes to essential welding variables.

Service Restrictions: Sweet

Temperature Restrictions: Notch Toughness Tested to -5°C (23°F)

1. WELDING PROCESS & METHOD

- 1.1. Shielded Metal Arc Welding (SMAW) manual method- Root, Hotpass & Lincoln LHD First Fill.
- 1.2. Flux Core Arc Welding (FCAW) Remaining Fill(s) & Cap- mechanized method.

2. BASE MATERIAL

2.1. Composition: This specification applies to pipe and/or component material manufactured in accordance with, or listed as "Acceptable Alternative Materials" in any of the following standards:

CSA Z662, Oil and Gas Pipeline Systems CAN/CSA-Z245.1, Steel Line Pipe CAN/CSA-Z245.11, Steel Fittings CAN/CSA-Z245.12, Steel Flanges CAN/CSA-Z245.15, Steel Valves

- 2.2. Pipe Grades: 483 MPa (SMYS) or less
- 2.3. Wall Thickness Qualified: 4.0 to 14.25 mm (0.157 to 0.561 in.) inclusive.
- 2.4. Pipe Diameters Qualified: 457 mm (18 in.) O.D. minimum
- 2.5. Carbon Equivalent: 0.33% maximum

3. FILLER METAL CLASSIFICATION & SIZE

- 3.1. Root Pass: E6010; 3.2 to 4.8 mm (1/8 to 3/16 in.)
- 3.2. Hot Pass: E8010-G; 4.0 to 6.4 mm (5/32 to 1/4 in.)
- 3.3. Fill Pass 1: E8045-P2 H4R (Lincoln LH D80); 3.2 to 4.8mm (1/8 to 3/16 in.)
- 3.4. Remaining Fill Pass(s): E81T1-GM (Lincoln Pipeliner 81M) 1.2mm (0.047in.)
- 3.5. Cap pass: E81T1-GM (Lincoln Pipeliner 81M) 1.2mm (0.047in.)



4. JOINT GEOMETRY

- 4.1. Joint Type: Groove Single Vee Butt
- 4.2. Bevel Angle: 30°, +6° / -1.5°
- 4.3. Root Face: 1.6mm (0.063 in.), +/- 0.8mm (0.031 in.)
- 4.4. Root Gap: 3.2mm (0.125 in.), +/- 1.6mm (0.063 in.)
- 4.5. The surfaces to be welded shall be smooth, uniform, free of fins, laminations, tears, scale, slag, grease, paint or other foreign matter, which may adversely affect the welding.

5. POSITION & DIRECTION OF WELDING

5.1. Position: Pipe horizontal, fixed position (5G)

5.2. Direction of Welding: Root, Hotpass & First Fill Pass: Vertical Down Remaining Fill(s) and Cap Passes: Vertical Up

6. PREHEATING, INTERPASS TEMPERATURE & CONTROLLED COOLING

- 6.1. Butt Welds: A minimum preheat temperature of 120°C (250°F) shall be applied to an area at least 51 mm (2.0 in.) on each side of the weld joint for its entire circumference prior to welding.
- 6.2. During root and second pass welding, under no circumstances shall the minimum temperature fall below the minimum interpass temperature from the start of the root pass until after the completion of the second pass. Reheating is permitted before the start of the fill/cap passes.
- 6.3. If the interpass temperature falls below the minimum preheat temperature after completion of the second pass, the entire weld joint shall be heated to the minimum preheat temperature prior to starting the next weld pass.
- 6.4. The maximum interpass temperature shall not exceed 204°C (400°F).
- 6.5. Preheating may be applied by oxy-fuel torch, propane torch, electrical induction coils or any other method approved by the owner.
- 6.6. Temperature of the joint shall be verified using temperature indicating crayons, thermocouples, pyrometers or other suitable method.
- 6.7. Where applicable, precautions shall be taken through the use of insulating covers or other means to control the cooling rate of the weld after any pass.

7. POSTWELD HEAT TREATMENT

Welds prepared in accordance with this specification shall not be subjected to postweld heat treatment.

8. SHIELDING GAS

- 8.1. Root, Hotpass & Fill 1: N/A
- 8.2. Remaining Fill(s) & Cap Pass(es): 75/25 Argon/CO2 @ 23.6 to 28.3 LPM (50 to 60 CFH)

9. ELECTRICAL CHARACTERISTICS

- 9.1. Current Type: Direct current, reverse polarity (DCRP)
- 9.2. Voltage, amperage & travel speed: See Table #1
- 9.3. Heat Input: See Table #1

10. TECHNIQUE

- 10.1. Minimum number of welders: Two for all passes.
- 10.2. String or Weave:

Bead Root, Hotpass & Fill 1-String Fill & Cap-Weave



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- 10.3. Number of Weld Layers: Five layers minimum.
- 10.4. Type of line-up clamp & removal: Internal line-up clamps shall be used wherever practicable and shall not be removed until the root bead is completed.
- 10.5. Movement shall be minimized until the required hot pass on the bottom has been completed as per table below.

Pipe Outside Diameter (OD)	Minimum Length of Second Pass
610 mm and Greater	250 mm
Less than 610 mm to 323.9 mm inclusive	150mm
Less than 323.9 mm	Not Required

- 10.6. When external line-up clamps are used, the root bead shall be uniformly spaced around the circumference of the joint and, where practicable, shall have a cumulative length of at least 50% of the circumference prior to removal.
- 10.7. Cleaning methods: Hand or power tools may be used. Each pass shall be thoroughly cleaned and free of slag and scale prior to depositing the next weld layer. The completed weld shall be brushed and free of spatter.
- 10.8. Finish Profile: The completed weld shall have a substantially uniform cross-section for its entire circumference. The crown of the weld shall not be below the surface of the adjacent base metal.
- 10.9. The time and interval requirements for each welding pass is as follows:

Interval	Time
Root pass to hot pass	10 minutes maximum
Hot pass to fill 1	60 minutes maximum
Fill 1 to completion	24 Hours maximum (Unless otherwise Authorized by Enbridge Assigned Designate)

11. REMOVAL AND REPAIR OF DEFECTS

- 11.1. Repairable areas are restricted to the weld cap and shall be removed by grinding. Welding of such repairable areas shall be performed following the details outlined in this specification.
- 11.2. Subsurface weld repairs shall be made in accordance with WPS# EPI-11-WP9 Rev.1.

12. ATTACHMENTS

- 12.1. Procedure Qualification Test Records: E2H-MA-11.4-1
- 12.2.Laboratory Test Reports: E14-413.1
- 12.3. Radiographic, Automated Ultrasonic & MPI Examination Results:
 - CRC Evans RT Report: 1071U (E2H-MA-11.4-1)

Applus RTD AUT Report: E2H-MA-11.4/15.9-WPQ

12.4. Material Test Reports: Evraz Heat No.514112



ENB-MA-WPS-3

TABLE #1
WELDING PARAMETERS

		Electrode							
Pass	Process	Size mm (in.)	AWS Class	Wire Speed mm/min (in/min)	Amperage Range Amperes	Voltage Range volts	Travel Speed mm/min (in./min)	OSC/ BPM	Heat Input kJ/mm (J/in.)
Root	SMAW	4.0mm (5/32)	E6010	NA	104-191	17.9-32.5	215-349 (8.5 – 13.7)	NA	0.50-1.14 (12700-28956)
Hot Pass	SMAW	4.8mm (3/16)	E8010-G	NA	151-245	19.6-40	320-508 (12.6 -20)	NA	0.55 – 1.15 (13970-29210)
Fill-1	SMAW	4.0mm (5/32)	*E8045-P2 H4R	NA	166-275	14.9-28.6	197-300 (7.7-11.8)	NA	0.76 – 1.57 (19304-39878)
Fill(s) Mech.	Mech FCAW	1.2mm (0.047)	**E81T1-GM	5029-7645 (198-301)	142-264	18.1-28.5	120-280 (4.7-11.0)	As Req.	0.96 – 2.13 (24384-54102)
Cap(s) Mech.	Mech FCAW	1.2mm (0.047)	**E81T1-GM	4623-7010 (182-276)	129-240	18.2-28.6	102-210 (4.0-8.3)	As Req.	1.11-2.56 (28194-65024)

* - Lincoln LH-D80

**- Lincoln Pipeliner 81M

Note #1 - The use of stripper passes is optional, however welding parameters must remain within the parameters of the above table.

Note#2 - Maximum cap height above adjacent parent material: 2.5mm for W.T.≤ 10.0mm. 3.5mm for W.T. >10.0 mm. (+1mm permitted in localized areas).

13. JOINT GEOMETRY





STANLEY													POR No				
CRC-E		3		Procedure Qualification Record									E2H-MA-11.4-1 (1071-U)				
© AUTOMATIC WELDING					Semi-I	Mechaniz	ed Tie-In Weld -	F1 SMAW Low Hydrogen Downhill					Sheet 1 c	of 1			Rev. 2
Material Specification	on		[]	·	CSA Z2	245.1-07		Client		Enbridge						4	
Type or Grade					Gr. 483 C	AT I M5C	:	Project		E2H Proj	ect						
Nominal Thickness				1	1.4mm t	o 11.4m	m	% C	Not Appl	icable							
Nominal Diameter				91	4.4mm t	.o 914.4n	nm	CE	0.280								
Manufacturer(s)					Evraz t	o Evraz		Pcm	Not Appl	icable							
Heat Number(s)					514112 t	.0 51411	2										
							Welding	Paramet	ters	1		1					
Pass No.		Units	Ro	oot	Hot	Pass	Fill 1	Rema	ning Fills	Ca	aps						
Travel Direction			Vertica	I Down	Vertica	I Down	Vertical Down	Vert	ical Up	Verti	cal Up						
El./Wire Manufactu	rer		Lincoln	Electric	Lincoln	Electric	Lincoln Electric	Lincoli		Lincoln	Electric						
EL/WIRE Trade Nam	ne	-	Fleetwe	310 5P+	Snieid-		Pipeliner LH-D8			Pipelin							
EL/Wire Heat Num	bor				EoU II		E0045-P2 H4R	E01	nlicabla		I-Givi						
EL/Wire Diameter	Jei	(mm)						NOLA		1	2						
Gas Flow Rate			Not An	.u nlicable	Hot An	.0 Inlicable	4.0 Not Applicable	22.6	20.2	22.6	.2						
Shielding Gas Type	2	(LFIVI)	Not Ap	nlicable	Not An	nlicable	Not Applicable	75%Ar	20.3 /25%CQ2	23.0 75%Ar/	20.3 25%CO2						
	,	(70) (mm)	Not Ap	plicable	Not An	plicable	Not Applicable	9.5	19.0	9.5	19.0						
Oscillation Rate		(BPM)	As Re	auired	As Re	auired	As Required	As R	equired	As Re	auired						
Oscillation Width		(mm)	As Re	quired	As Re	auired	As Required	As R	equired	As Re	quired						
Dwell Time		(sec)	As Re	quired	As Re	quired	As Required	As R	equired	As Re	quired						
Head Angle		. ,	As Re	quired	As Re	quired	As Required	As R	equired	As Re	quired						
Equipment Type			Not Ap	plicable	Not Ap	plicable	Not Applicable	P	-260	P-:	260						
Welding Process			SM	SMAW S		AW	SMAW	FC	AW-G	FCA	W-G						
Welding Position			5G/F	ixed	5G/I	Fixed	5G/Fixed	5G.	/Fixed	5G/	Fixed						
Electrical Current/P	olarity		DC	ΈP	DC	ΈР	DCEP	D	CEP	DC	ЕР						
			1.1	° → ↓ ↓ ↑ mm - 2.	- 0mm							J	A A A A A A A A A A A A A A A A A A A)			
Pass No	Linito	Beet	Het	Eill 4	Eill 2	Can								<u> </u>	<u> </u>		
Max Amps	(A)	178	HOL 211	237	220	200											
Min Amps	(A)	125	175	189	178	161											
Max Volts	(V)	28.0	35.0	24.5	23.7	23.8										1	1
Min Volts	(V)	21.0	24.0	18.0	22.6	22.8										-	-
Max WFS	(mm/min)) N/A	N/A	N/A	6,375	5,842											
Min WFS	(mm/min)) N/A	N/A	N/A	6,274	5,766											
Max Travel Speed	(mm/min)	393	497	288	234	175											
Min Travel Speed	(mm/min)) 182	345	187	150	127											
Max Heat Input	(kJ/mm)	1.64	1.28	1.86	1.78	2.13											
Min Heat Input	(kJ/mm)	0.40	0.51	0.71	1.20	1.39											
Max Interpass	(°C)	N/A	133	184	131	130		Ļ									
							N	otes									
CW Side Welded	l By	Trevor V	Vilson	ot Hot E					CCV	V Side W	elded By	Chris Sc	hubert				
Method of Heating	opiles	Propane	1 350 - RO		liis, and C	ар		Location	of Seams		N/A						
Grinding		Power Gr	rinder as n	eeded				Cleaning]		Power B	rush as ne	eded				
Clamp/Released		After 50%	o Completi	ion of the	Root Pass	;		Minimun	n Preheat		121°C						
Fronius Program		Not Appli	cable														
Comments:																	
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T I		<u> </u>		0005								Prepared	Ву	<u> </u>	Ian M.	Murphy	
This information	r is the ph	opnetary p	roperty of	CRC-Eva	Ins Autom	atic weiui	CRC-Evans A	utomatic V	ets and/or /elding.	KHOW HOW	anu may	only be us	eu în conj	unction w	illi equipii	ient rente	



TENSILE / BEND / NICK BREAK

Customer:	Enbridge Pip PO Box 398, Edmonton, A T5J 2J9	belines Inc. 10201 Jasper A Iberta	Avenue	nue			Laboratory Test No.: E14-413.1 Date: July 16, 2014 P.O. No.: WP-41001-10135				
Attention:	Luke Ludwig										
Weld I.D.: Project: Material: Size: Thermal Cor	E2l Edi CS 91 ⁴ ndition: As	H-MA-11.4-1 (N monton to Hard A Z245.1 Gr. 4i 4.4 mm (36.0 in Welded	II) isty 83 .) O.D. x 11	.4 mm (0.4	49 in.) w.t.						
Governing Sp	ec.: CSA	Z662-2011									
SAMPLE NO WIDTH mm THICKNESS AREA sq. mi ULTIMATE L ULTIMATE S FRACTURE FRACTURE Note:	D. (in.) 5 mm (in.) m (sq. in.) OAD N (lbf) STRESS MPa TYPE LOCATION Imperial values	(psi) calculated by dire	T1 25.3 11.5 291 183 504 631 Partial Cup Parent Met <i>ect conversic</i>	(0.996) (0.453) (0.451) (41,300) (91,500) & Cone al		T2 25.4 11.3 292 185 634 Par Par	4 (5 (6 260 (6 tial Cup 8 ent Metal	(1.00) (0.453) (0.453) (41,600) (92,000) & Cone			
SAMPLE TY SAMPLE NC RESULTS	PE).	Face Bend F1 Pass	d	Face Benc F2 Pass	I Roo R1 Pas	ot Bend ss	Ro R2 Pa	oot Bend ss			
NICK BREAI REMARKS	K NO.	N1 Pass		N2 Pass							
Test Conduc	ted By: Tong Teate) is issued by the Co sellers from exercising a	Zhao, T.T. ompany under its General all their rights and dischars	Conditions for Insp ing all their liabilit	ection and Testing ies under the Cont	Certified By Services (copy availa ract of Sale, Stipulati	y:	Karen Ko y are not bindin	oens, R.E.T. of this report (or certificate) does not g on the Company. The Company's			

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CHARPY V-NOTCH IMPACT TEST

Customer:	Enbridge Pipelines Inc. PO Box 398, 10201 Jasper Avenue Edmonton, Alberta T5J 2J9

Laboratory Test No.: E14-413.1 Date: July 21, 2014 P.O. No.: WP-41001-10135

Attention: Luke Ludwig

Weld I.D.:	E2H-MA-11.4-1 (NI)
Project:	Edmonton to Hardisty
Material:	CSA Z245.1 Gr. 483
Size:	914.4 mm (36.0 in.) O.D. x 11.4 mm (0.449 in.) w.t.
Thermal Condition:	As Welded

Specimen Size: $10 \times 10 mm (0.394 \times 0.394 in.)$ Machine:Satec SI-1K3, S/N: 1503Orientation:TransverseCapacity:407 J (300 ft-lbf)Test Temperature: $-5 \circ C (23 \circ F)$ Verified Range:3.4-149 J (2.5-110 ft-lbf)Governing Spec.:ASME Section VIII, Div. I, UG-84 – 2013Verified Range:3.4-149 J (2.5-110 ft-lbf)

Specimen	Notch	Impact	Shear	
Number	Location	Joules	(ft-lbf)	%
D2.1	Weld Metal within 1/16" of root	87.6	(64.6)	70
D2 2	Weld Metal within 1/16" of root	77.8	(57.4)	56
D2.3	Weld Metal within 1/16" of root	62.6	(46.2)	59
D3 1	HAZ (fusionline @ midwall)	149	(110)	75
D3 2	HAZ (fusionline @ midwall)	>149	(>110)	85
D3.3	HAZ (fusionline @ midwall)	97.1	(71.6)	66

Note: Metric values calculated by direct conversion.

Test Conducted By: Eric Dacyk, C.E.T.

Certified By: Erid Dacyk, C.E.T.

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HARDNESS TEST

Customer:	Enbridge Pipelines Inc.						
	PO Box 398, 10201 Jasper Avenue						
	Edmonton, Alberta						
	T5J 2J9						

Laboratory Test No.: E14-413.1 Date: July 18, 2014 P.O. No.: WP-41001-10135

Attention: Luke Ludwig

Weld I.D.:	E2H-MA-11.4-1 (NI)
Project:	Edmonton to Hardisty
Material:	CSA Z245.1 Gr. 483
Size:	914.4 mm (36.0 in.) O.D. x 11.4 mm (0.449 in.) w.t.
Thermal Condition:	As Welded

Type of Test:Vickers 10kg (HV10)Instrument:DuraScan 70Governing Spec.:ASTM E384-11^{ε1}



				We	d Metal					
Parent Metal			HAZ		werd werd		HAZ	Parent Metal		
1	216	3	201	9	200	17	215	23	215	
2	220	4	206	10	197	18	193	24	218	
		5	211	11	203	19	210			
		6	199	12	175	20	183			
		7	195	13	184	21	225			
		8	233	14	182	22	203			
				15	196	2				
				16	192					

Test Conducted By: Tong Zhao, T.T.

Certified By:_

Karen Koens, R.E.T.

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Site report Date Tested: 24 May 2014 ROTOSCAN examination

Job number

Report number E2H-M-11,4/15.9-WPQ 5504-36 Street T6B 3P3 Edmonton, Alberta Canada +1 780 440 6600 +1 780 440 2538



Project	Edmonton to Hardisty Pipeline	Equipment No	PA128 SPA 027
Client	Enbridge Pipelines Inc	Acceptance procedure	CSA Z662-11
Contractor	Midwest Pipelines	Diameter	36in (914mm)

No.	Weld No.	Insp. Ti me	W.T. (mm)	Distance (mm)	Length (mm)	Depth (mm)	Height (mm)	Location	+Thr	Evaluati on	Comment
1	E2H-M-11,4-01-U-Inf	16:12:1	11.4	0-0	0	0.0	0.0		0	Acc.	Bohler on CW and CCW
2		16:12:1 9	11.4	0-0	0	0.0	0.0		0	Acc.	INFO Only - 11.4 CRC cal blo ck used
3	E2H-M-11,4-02-V-Inf	16:20:2 7	11.4	0-0	0	0.0	0.0		0	Acc.	INFO Only - 11.4 CRC cal blo ck used
4		16:20:2 7	11.4	0-0	0	0.0	0.0		0	Acc.	Lincoln on CW and CCW
5	E2H-M-15,9-01 and 0 2-Info	15:26:3 4	15.9	0-1439	1439	0.0	0.0		0	Acc.	Weld E2H-MA-15,9-01; Bohl er on CW
6		15:26:3	15.9	0-0	0	0.0	0.0		0	Acc.	INFO-ONLY; using long seam CRC cal block
7		15:26:3 4	15.9	1739-2878	1139	0.0	0.0		0	Acc.	Weld E2H-MA-15,9-02; Linco In on CCW
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-											
											3.1
-			1.1.1.1 1.1.1								
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			-								
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Applus RT	D Operator	Report checked by Enbridge Pipelines Inc	Contractor Midwest Pipelines
Name:	Gerard Volbert CGSB UT2	Name: Luke Ludwig	Name:
Signature:	Dorard Wellest	Signature:	Signature:



7011 High Life Road Houston Tx, 77066 Phone: 832-249-3100 Fax: 832-249-3292

RADIOGRAPHY REPORT

CUSTOMER:	ENBRIDGE
INSPECTION STD:	CSA-Z662-11
BASE METAL:	CSA 483 X-70
DIA/WT:	36"x 11.4mm
WELD NO:	1071-U (E2H-MA-11.4-1)
PROJECT:	E2H

DATE: 05/24/2014 FILM TYPE: FUJI 50 NO FILMS: 1 SENSITIVITY: 2.0% 100% X-RAY RT Procedure #: 1071-1

WELD ACCEPTED

□REJECTED

Film Number	Acceptable	Unacceptable	No Discontinuities	Porosity	Slag Inclusions	LSF	LCP	Undercut	Incomplete Penetration	Excessive Penetration	REMARKS
0-2			2000		\checkmark						
3-19			\checkmark								
20-22				\checkmark							
23-33			\checkmark								
34-40	V			\checkmark							
41-66											
67-72	\bigvee			\checkmark							
73-243	\bigvee										
244-245	\checkmark			\checkmark							
246-262	V		\checkmark								
263-264	\checkmark										Hollow Bead
265-0	\checkmark		\checkmark								
		L									
RADIOG	RAPH	HER /	INTE	ERPR	ETEI	D BY	: Rob	ert C	Collier	·Kul	EVEL: II
ACCEPTED BY:											

This information is the proprietary property of CRC-Evans Automatic Welding which contains trade secrets and/or know how and may only be used in conjunction with equipment rented from CRC-Evans Automatic Welding.

EVRAZ Canada	Reporting and Mill Certificates
Date:	April 24, 2014
Customer:	ENBRIDGE PIPELINES INC.
Specification:	Enbridge Submerged-Arc-Welded Steel Pipe Specification Supplementary to CSA Z245.1-07 EES102- 2010 Revision 1 March 4, 2010 and CSA Z245.1-07.
Product:	914.4 mm OD x 11.4 mm WT, Grade 483 CAT I EVRAZ Changeover L-314E
Mill Order:	TU-001156
Customer P.O.:	P4000-12652-2W
Mill Certificate:	EVRAZ Certification Package ID 5686

All supplied pipe have been manufactured, sampled, tested, and inspected in accordance with the requirements of the Enbridge Submerged-Arc-Welded Pipe Specification Supplementary to CSA Z245.1-07 EES102-2010 Rev.1 and CSA Z245.1-07 and was found to have met such requirements.

EES102-2010 Clause 17 Certification

- 17.2 Reported on Mill Certificate (Chemistry).
- 17.3 Reported on Mill Certificate (Chemistry).
- 17.4 Reported on Mill Certificate (Chemistry).
- 17.8 a) Reported on Mill Certificates (All).
- 17.8 b) Reported on Mill Certificates (Microhardness Test & Tensile).
- 17.8 c) Reported on Mill Certificate (Tensile).
- 17.8 d) Reported on Mill Certificate (Tensile).
- 17.8 e) Non-destructive inspection was performed in accordance with, and met the requirements of Enbridge Submerged-Arc-Welded Pipe Specification Supplementary to CSA Z245.1-07 EES102-2010 Rev. 1 and CSA Z245.1-07.
- 17.8 f) Reported on Heat to Pipe Correlation.
- 17.8 g) Pipe have been manufactured in accordance with the approved EVRAZ Manufacturing Procedure Specification Enbridge E2H Project Revision 2 January 20, 2014, CSA Z245.1-07, and Enbridge Submerged-Arc-Welded Pipe Specification Supplementary to CSA Z245.1-07 EES102-2010 Rev. 1.
- 17.8 h) Not applicable.

David Crone Quality Assurance Manager – Regina Tubular CC: File

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EVRAZ Regina Spiral Mill EVRAZ Regina CERTIFICATE OF TESTING Microhardness Test Heat Qualifiers

Diameter: 914.400

04/24/2014 13:28:17 Certificate ID: **5686** Form No: **L 4443** Customer PO: **P4000126522W**

Mill Order No: TU001156

 Specification:
 CSA Z245.1-07 / ENBRIDGE SPECIFICATION EES102-2010 REV 1

 Coil
 Pipe
 Test Type
 Scale
 MS
 PM
 PM
 HAZ
 HAZ
 WMZ
 WMZ
 HAZ
 HAZ

Customer: ENBRIDGE PIPELINES INC.

Changeover	Heat	Coil	Pipe	Test Type	Scale	MS		PM	PM	PM	HAZ	HAZ	HAZ	WMZ	WMZ	WMZ	HAZ	HAZ	HAZ	PM	PM	PM
Supplier:	EVRAZ R	EGINA																				
L-314E	495826	A0175	10114	QUAL INITIAL	Vickers	ок	OD	237			224			247			229			212	2	
							MID	245			227			237			218			229	•	
							ID	241			245			205			222			231	I	
L-314E	514112	A0073	40063	QUAL INITIAL	Vickers	ок	OD	208			227			249			243			210)	
							MID	229			213			239			213			224	L	
							ID	224			222			226			202			239	•	

mm Wall Thickness: 11.400 mm Grade: 483 CAT I

MS = Micro Structure	l v	Ne certify that the product described above has
	l b	peen manufactured, sampled,inspected, and
	t	ested in accordance to the referenced specification.
Measurement Taken In HV500	т	The product has been found to be in compliance
	v	with all requirements.
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		Quality Assurance

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04/24/2014 13:28:20

Certificate ID: 5686

Form No: I AAAA

RAZ

EVRAZ Regina CERTIFICATE OF TESTING

Spiral Mill

Customer: ENB		NES INC.		Diameter: 914.4	00 mm Wall ⁻	Custor	Customer PO: P4000126522W											
	-			Specification: CSA	Z245.1-07 / ENBRIE	Mill O	Mill Order No: TU001156											
						Test Width	Yield Strength	Tensile Strength	% Elon	gation	Y/T	Weld Break						
Changeover	Heat	Coil	Pipe	Test Type	Orientation	(mm)	(MPa)	(MPa)	50 mm	Uniform		(mm)						
Supplier:	EVRAZ REGINA																	
L-314E	495826	A0175	10114	QUAL INITIAL	PIPE TPA	38.21	516	659	40.0		.78							
L-314E	495826	A0175	10114	QUAL INITIAL	PIPE TWA	38.19		713	28.0									
L-314E	514112	A0073	40063	QUAL INITIAL	PIPE TPA	38.16	510	646	40.0		.79							
L-314E	514112	A0073	40063	QUAL INITIAL	PIPE TWA	38,11		715	26.0									

TPA - Transverse Pipe Axis

LPA - Longitudinal Pipe Axis TWA - Transverse Weld Axis

LRD - Longitudinal Rolling Direction TRD - Transverse Rolling Direction

FST - Full Section (Width is the Diameter)

Hydrostatic Parameters: Pressure: 11400 KPA Hydro(%): 95.0 Hold Time: 10 sec.

Guided Bend Tests Were Performed In Accordance With And Meet The Requirements Of The Above Specification. We certify that the product described above has been manufactured, sampled, inspected, and tested in accordance to the referenced specification. The product has been found to be in compliance with all requirements.

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																							9-	-
		FVRA7 Regina											04/2	04/24/2014 13:28:15										
Spiral		L			CERTIFICATE OF TESTING Chemistry								Cer	Certificate ID: 5686 Form No: L 4442										
Custome	Diameter: 914.400 mm Wall Thickness: 11.400 mm Grade: 483 CAT I								Cu	Customer PO: P4000126522W														
					Specification: CSA Z245.1-07 / ENBRIDGE SPECIFICATION EES102-2010 REV 1							М	Mill Order No: TU001156											
Heat	Changeover	Coil	Pipe	Туре	С	Mn	S	Р	Si	Cu	Ni	Cr	V	Cb	Sn	Мо	AI	Ca	В	Ti	Ν	Ce	CE ceq	SoAl
Sup	plier: EVRAZ	REGINA																						
495826				HEAT	0.05	1.72	0.002	0.009	0.27	0.21	0.07	0.22	0.001	0.079	0.008	0.116	0.041	0.0025	0.0001	0.017	0.007	0.000	0.26	0.035
495826	L-314E	A0175	10114	PRODUCT	0.05	1.72	0.001	0.009	0.28	0.20	0.06	0.23	0.001	0.078	0.008	0.118	0.040	0.0022	0.0001	0.017	0.007	0.000	0.26	0.035
514112				HEAT	0.06	1.74	0.002	0.009	0.24	0.26	0.09	0.22	0.001	0.079	0.009	0.116	0.040	0.0031	0.0002	0.015	0.009	0.000	0.28	0.034
514112	L-314E	A0073	40063	PRODUCT	0.06	1.78	0.002	0.009	0.24	0.26	0.09	0.23	0.001	0.077	0.009	0.117	0.040	0.0026	0.0001	0.015	0.009	0.000	0.28	0.034

	Deoxidization Practice: Alum	inum Fully Killed
Furnace: ELECTRIC ARC	Casting: CONTINUOUS SLAB	Rolling Mill: STECKEL

We certify that the product described above has been manufactured, sampled,inspected, and tested in accordance to the referenced specification. The product has been found to be in compliance with all requirements.

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