

Appendix I: Thermosyphons

Appendix I.1: Themosophon Warranty



**ARCTIC
FOUNDATIONS
OF CANADA INC.**

LIMITED WARRANTY

Respecting agreement # HBP1-CO-357915
between **Arctic Foundations of Canada Inc.**
and **Nuna Logistics**
for the supply and installation of thermosyphons for the North Dam at Hope Bay Mine site.

Arctic Foundations of Canada Inc., the supplier of thermoprobes in accordance with the above-captioned contract, does hereby warrant that with respect to thermoprobes so supplied, the two phase heat transfer system will operate as specified for five years from the date of installation, and should any thermoprobe not so operate, same will be repaired or replaced at the election of Arctic Foundations of Canada Inc. free of charge and subject to the following limitations:

- (a) this warranty will not apply to any interruption in the heat transfer system caused or contributed to by owner's misrepair, or improper maintenance or if the thermoprobe system be in any way added to, altered or modified by anyone other than Arctic Foundations of Canada Inc.;
- (b) this warranty will not apply in the event that continuity of operation is interrupted in whole or in part due to external forces including but not limited to natural disasters or acts of God, collision or impact from external bodies, objects, vehicles, fire or other accident or similar disaster;
- (c) the above warranty is limited to repair or replacement within the time period of five years and subject to the above conditions. Arctic Foundations of Canada Inc. takes no responsibility for any consequential loss or damage resulting from design or as-built changes to the structure over which they had no control.

Dated this 30th day of April A.D. 2011 .

ARCTIC FOUNDATIONS OF CANADA INC.

per

John D. Jardine

Appendix I.2: Thermosyphon Operations and Maintenance

ARCTIC FOUNDATIONS OF CANADA INC.

THERMOSYPHONS

OPERATION & MAINTENANCE

North Dam

Hope Bay Nunavut

GENERAL CONTRACTOR:
Nuna Logistics

SUPPLIER:
ARCTIC FOUNDATIONS OF CANADA INC.

#15 Elie St. E.

Elie, Manitoba

R0H 0H0

Ph. 204-353-2510

Fax 204-353-2610

Contact Person: Bill Watt

April 30, 2011

Thermosyphons

Operation & Maintenance

Thermoprobes are a passive heat transfer device and do not require regularly scheduled maintenance. There are two items that can be monitored so that maintenance can be performed if required.

1) Painting

- Visual observation of the above ground portion of the thermoprobes will be sufficient to determine when paint restoration is required. The above ground portion of the thermoprobes as supplied are sand blasted to white metal, aluminized, and painted with a white epoxy. The optimum colour for heat transfer is white but other light colours could be used with a small reduction in operating efficiency.

2) Thermal operation

A. Monitoring

- Thermoprobes can be monitored to ensure that they are performing their heat transfer function. This monitoring has been done in two ways; Infrared monitoring and contact thermometers.

a) Infrared monitoring requires the use of an infrared camera which is relatively expensive and requires some training to use. By observing the thermoprobes through the infrared camera at a time when they should be operating, thermoprobes that are operating will appear as warm objects. Those not appearing warm are not operating at that time.

b) A digital contact thermometer with a sensitivity of 0.1°C can also be used to monitor thermoprobes. These devices are relatively inexpensive and require little training to use. Measure the temperature of the thermoprobe (the surface of the riser pipe) and compare this to the adjacent air temperature (or a piece of metal painted white that has been kept adjacent to the thermoprobe). If the thermoprobe is warmer than the air (or metal plate) then it is operating properly. If the thermoprobe is the same temperature as the air (or metal plate) it is not operating at that time.

B. Analysis

If it has been determined that a thermoprobe is not operating then it must be determined why it is not operating.

a) The thermoprobe is inactive at this time.

Operation may cease because the outside air adjacent to the thermoprobe condenser (above ground) is warmer than the ground adjacent to the thermoprobe evaporator (below ground). This will be the case in summer when the air is warm. It may also happen in the winter. An example of this would be when the thermoprobe is checked on a day when the air temperature is -20°C following an extended cold spell of -40°C weather. During the extended -40°C period the thermoprobe cooled the soils adjacent to the evaporator to a temperature below that of the current outside air temperature and as a result the thermoprobe has shut down temporarily. Checking the thermoprobe at a later date when the soils have warmed up may show that it has begun to operate again. A good time to perform an annual check is on a cold day in early winter or at a time when the temperature is going down such as the evening.

b) A leak has developed.

If there is little doubt that a leak has developed, repairs must be carried out by qualified personnel. Contact Arctic Foundations of Canada Inc. to make arrangements to repair the leak and recharge the thermoprobe.

Appendix I.3: Arctic Foundations Construction Documentation



COMPLETION OF CONSTRUCTION

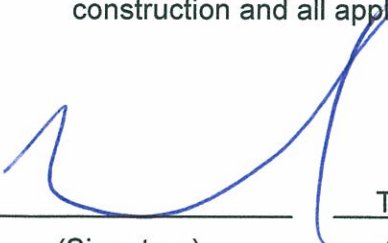
DECLARATION

NOTE: This declaration shall be completed and signed by the person responsible, in whole or part, for the construction, installation, testing and inspection of the project indicated below.

1. Owner of the facility: Newmont North America
 2. Contractor: Arctic Foundations of Canada Inc
 3. Construction: Thermosyphons on North Dam
 4. Location: Doris North, Hope Bay Mining Project, Nunavut, Canada
 5. Description: Sloped Thermosyphons
-

STATEMENT OF COMPLIANCE

I, the undersigned, declare that the described project complies in all respects with the regulations and codes for construction, installation, testing and inspection of the above listed construction and all applicable turn over documentation has been forwarded to the owner.

 _____ (Signature)	<u>Todd Carriere</u> _____ (Print Name)	<u>Supervisor</u> _____ (Title)	<u>4-25-11</u> _____ (Date)
<u>Arctic Foundations</u> _____ (Company)	<u>Box 359 Elie, Manitoba</u> _____ (Address)	<u>ROH OHO</u> _____ (City, Postal Code)	

MANITOBA

DEPARTMENT OF LABOUR
AND IMMIGRATION
500 - 401 York Avenue
Winnipeg, Manitoba R3C 0P8
Fax No. (204) 948-2309



CONSTRUCTION DATA REPORT FOR PIPING SYSTEMS

Construction Data Report For Piping Systems

Field Construction

Shop Construction

- Constructed or installed by Arctic Foundations of Canada Inc.
Name and address
- Constructed for Wana Logistics, 9839-31 Ave Edmonton Job No. 001
Name and address
- Owner and Location of Installation Newmont Mining Corp, Hope Bay, Nunavut
Alaska
- Provincial Piping Design Reg. No. _____ Prov. Reg. Welding Proc. _____
Nos. and Company WPS Nos. _____
- Provincial Quality Control Program Reg No. and Expiry Date MB-10-66, Jan. 27, 2014
- Code - ANSI/ASME B31.1 [] B31.3 ☒ B31.5 [] Other []

Line indent.	Process (air/stm etc)	Design press.	Design temp.	Test press.	Test medium	Matl spec	Pipe dia & sch	Flange primary rating	PWHT	NDE	Additional exam
①	CO ₂	See attached chart		200psi	helium	B31.3 2002	2" sch 40				

Shop Constructed Data Reports have been furnished for the following items detailed in this Report.

Line Indent.

Spool Indent.

Fabricator

CERTIFICATE OF COMPLIANCE

We certify the statement in this data report to be correct and that piping described in this Data Report was constructed in accordance with the Provincial Boilers and Pressure Vessels Act and Regulations.

Date April 25'11 Arctic Foundations of Canada by T. Carricoe
Contractor (Authorized Representative)

CERTIFICATE OF INSPECTION

I, the undersigned, employed by Arctic Foundations of Canada have inspected the piping described in this Construction Data Report and state that, to the best of my knowledge and belief, the Contractor has constructed this piping in accordance with the applicable Sections of the ANSI/ASME and Provincial Boilers and Pressure Vessels Act and Regulations.

Date April 25' 2011 Date _____
T. Carricoe _____
Owner's Inspector Provincial Inspector

CO2 Pressure.xls

Carbon Dioxide (Pressure VS Temperature)				
°F	PSI		°C	KPA
87.8	1069.4		31.0	7373.3
80	968.7		26.7	6679.0
70	853.4		21.1	5884.0
60	748.6		15.6	5161.4
50	653.6		10.0	4506.4
40	567.8		4.4	3914.8
30	490.8		-1.1	3383.9
20	421.8		-6.7	2908.2
10	360.2		-12.2	2483.5
0	305.5		-17.8	2106.3
-10	257.3		-23.3	1774.0
-20	214.9		-28.9	1481.7
-30	177.8		-34.4	1225.9
-40	145.8		-40.0	1005.3
-50	118.2		-45.6	815.0
-60	94.7		-51.1	652.9
-69.9	75.1		-56.6	517.8
-80	50.85		-62.2	350.6
-90	33.98		-67.8	234.3
-100	22.22		-73.3	153.2
-120	8.9		-84.4	61.4
-140	3.18		-95.6	21.9
°C	KPA		°F	PSI
10	4506.4		50.0	653.6
5	3971.4		41.0	576.0
0	3483.4		32.0	505.2
-5	3045.8		23.0	441.8
-10	2649.3		14.0	384.3
-15	2291.3		5.0	332.3

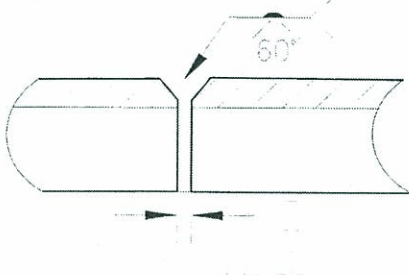
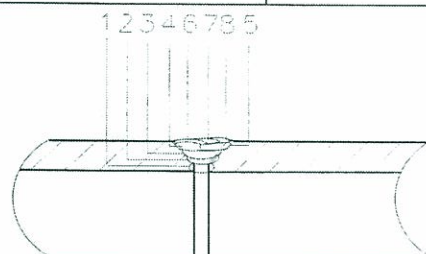
ARCTIC FOUNDATION OF CANADA INC

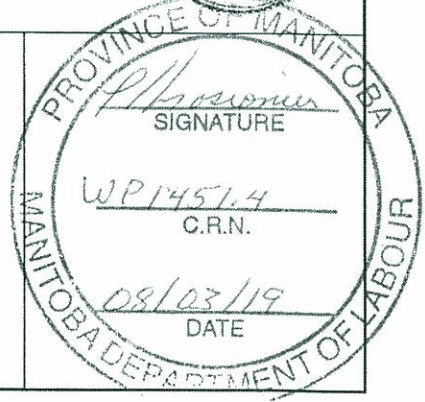
ELIE MANITOBA

WELDING PROCEDURE SPECIFICATION (QW-482)

(See ASME Boiler and Pressure Vessel Code - Section IX, Paragraph QW-201.1)

482/2004

Welding Process(es): SMAW Type(s): MANUAL		Date: February 8, 2008 Prepared By: Arthur J. Pankratz, P.Eng.	WPS No.: AF-CS-M-2-1
JOINT DESIGN (QW-402) Joint Design: AS SHOWN OR OTHER JOINTS AS SPECIFIED ON DRAWINGS Backing: NONE Retainer: No			Rev No.: 0 Rev Date: 29-Feb-08 Supporting PQR: CS-M-2-1 CS-F-2-1b
			
Joint Design of Coupon		Pass and layer sequence	
BASE METALS (QW-403) P-No.: 1 Group No.: 1 to P-No.: 1 Group No.: 1 OR Spec, type and grade: SA-333 6 to Spec type and Grade: SA-333 6 OR Chemical and Mechanical: C-Mn-Si Chemical and Mechanical: C-Mn-Si Thickness Range: Base metal: Groove: 0.344" to 0.688" SECT IX WITH IMPACTS Fillet: ALL Other: 1/16" TO 0.688" NO IMPACT REQ'MTS 0.172" TO 0.688" B31.3 WITH IMPACTS			
FILLER METALS (QW-404) Spec No. (SFA): AWS No. (class): F-No.: A-No.: Size of Filler Metals: Weld Metal Thickness Range: Groove Fillet Electrode-Flux (Class): Flux Trade Name: Consumable Insert (GTAW): Form: Other:		SMAW 5.1 E6010 3 1 1/8" UP TO 0.3" ALL N/A N/A NA	SMAW 5.1 EXX18-X 4 1 1/8" UP TO 0.388" ALL N/A N/A N/A



ARCTIC FOUNDATION OF CANADA INC

ELIE MANITOBA

WELDING PROCEDURE SPECIFICATION (QW-482) (BACK)

WPS No.: AF-CS-M-2-1

Rev No. 0

POSITIONS (QW-405) Position(s) of Groove: ALL Welding Progression: UP Position(s) of Fillet: ALL		POSTWELD HEAT TREATMENT (QW-407) Temperature Range: NA Time Range:																																													
PREHEAT (QW-406) Preheat Temp. Min.: 50F MIN Preheat Temp. Max.: 500F MAX Preheat Maintenance: 50F to 500F Special Requirements:		GAS (QW-408) <table border="1"> <thead> <tr> <th></th> <th>Gas(es)</th> <th>Percent Composition Mixture (%)</th> <th>Flow Rate</th> </tr> </thead> <tbody> <tr> <td>Shielding:</td> <td>NONE</td> <td>NONE</td> <td>NONE</td> </tr> <tr> <td>Trailing:</td> <td>NONE</td> <td>NONE</td> <td>NONE</td> </tr> <tr> <td>Backing:</td> <td>NONE</td> <td>NONE</td> <td>NONE</td> </tr> </tbody> </table>			Gas(es)	Percent Composition Mixture (%)	Flow Rate	Shielding:	NONE	NONE	NONE	Trailing:	NONE	NONE	NONE	Backing:	NONE	NONE	NONE																												
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Weld Layer(s)	Process	Filler Metal Class	Diameter	Current Type/Polarity	Amp Range	Voltage Range	WFS Range (IPM)	Travel Speed Range (IPM)	Heat Input (KJ/in)	Other Remarks																																					
1	SMAW	E6010	1/8"	DCRP	75-80	23-24		6-7	14.8-19.2																																						
2	SMAW	E6010	1/8"	DCRP	85-90	25-26		7-8	15.9-20.1																																						
3	SMAW	EXX18-X	1/8"	DCRP	115-120	26-27		7-8	22.4-27.8																																						
4	SMAW	EXX18-X	1/8"	DCRP	115-120	26-27		7-8	22.4-27.8																																						
5	SMAW	EXX18-X	1/8"	DCRP	130-135	26-27		7-8	25.4-31.2																																						

ARCTIC FOUNDATION OF CANADA INC

ELIE MANITOBA

PROCEDURE QUALIFICATION RECORD (QW-483) (BACK)

PQR No.: CS-M-2-1

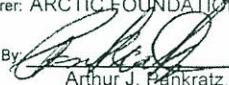
TENSILE TEST (QW-150)						
Specimen No.	Width (inches)	Thickness (inches)	Area (sq.in.)	Ultimate Load (pounds)	Ultimate Unit Stress (psi)	Type of Failure & Location
SAMPLE 1	0.496	0.325	0.161	11280	69975	DUCTILE IN PM
SAMPLE 2	0.502	0.322	0.162	11410	70587	DUCTILE IN PM

GUIDED-BEND TESTS (QW-160)	
Type and Figure Number	Result
1 TRANS. ROOT - QW-462.3(a)	PASS
2 TRANS. FACE - QW-462.3(a)	PASS
3 TRANS. ROOT - QW-462.3(a)	PASS
4 LONG. FACE - QW-462.3(b)	PASS

TOUGHNESS TESTS (QW-170)							
Specimen No.	Notch Location	Specimen Size	Test Temperature	Impact Values			Drop Weight Break (Yes/No)
				Ft.lbs.	% Shear	Mils	
1	WELD	7.5 mm	-60	41			
2	WELD	7.5 mm	-60	18			
3	WELD	7.5 mm	-60	55			
4	HAZ	7.5 mm	-60	69			
5	HAZ	7.5 mm	-60	71			
6	HAZ	7.5 mm	-60	64			

FILLET-WELD TEST (QW-180)			
Results Satisfactory:	N/A	Penetration into Parent Metal:	N/A
Macro Results:	N/A		

OTHER TESTS	
Type of Test:	N/A
Deposit Analysis:	N/A
Other:	N/A

Welder's Name:	MIKE WATT	Stamp No.:	60V
Tests Conducted By:	ALFOR METALLURGICAL COMPANY LTD	Laboratory Test No.:	08-163
<p>We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.</p>			
Date:	29-Feb-08	Manufacturer:	ARCTIC FOUNDATION OF CANADA INC
		By:	 Arthur J. Hankratz, P.Eng.
			February 29, 2008

ARCTIC FOUNDATION OF CANADA INC

ELIE MANITOBA

WELDER PERFORMANCE QUALIFICATIONS (QW-484)

484/2004

Welder's Name: MIKE WATT		Identification No.: 60V													
TEST DESCRIPTION															
Identification of WPS followed: AF-CS-M-2-1		Test Coupon or Production Weld: TEST COUPON													
Base Material Specification: SA-333 6		Base Material Thickness: 0.344"													
TESTING CONDITIONS AND QUALIFICATION LIMITS															
WELDING VARIABLES (QW-350)		ACTUAL VALUES	RANGE QUALIFIED												
Welding Process(es):		<u>SMAW</u>	<u>SMAW</u>												
Type Used:		<u>MANUAL</u>	<u>MANUAL</u>												
Backing:		<u>welded from one side w/o backing</u>	<u>ONE SIDE WITH OR W/O BACKING OR TWO SIDES</u>												
<input type="checkbox"/> Plate <input checked="" type="checkbox"/> Pipe (diameter)		<u>2 Sch.160</u>	<u>0.1875" TO 0.688" THICK [1" O.D. AND LARGER PIPE]</u>												
Base Metal P- or S-Number to P- or S-Number:		<u>P-1</u>	<u>P-No 1 thru P-No 11, P-No 34, P-No 41 thru P-No 47</u>												
Filler Metal or Electrode Specification(s) (SFA):		<u>5.10</u>	<u>5.1, 5.5, 5.1, 5.4 (other than austenitic & duplex), 5.5 EXX10, EXX11, E(X)XX10-X, E(X)XX11- X, EXX15, EXX16, EXX18, EXX18M, EXX48, EXX(X)-15, EXX(X)- 16, EXX(X)-17, E(X)XX15-X, E(X)XX16-X, E(X)XX18-X, E(X)XX18- M, E(X)XX18-M1</u>												
Filler Metal or Electrode Classification(s):		<u>E6010 & E7018-1</u>													
Filler Metal F-Numbers:		<u>3 & 4</u>	<u>F-No 1 thru F-No 4 WITH BACKING, F-No 4 W/O BACKING</u>												
Consumable Insert (GTAW, PAW):		<u>N/A</u>	<u>N/A</u>												
Filler Type (GTAW, PAW):		<u>N/A</u>	<u>N/A</u>												
Deposited Thickness for each process:															
Process 1:	<u>SMAW 3 Layers minimum: NO</u>	<u>0.15"</u>	<u>UP TO 0.3"</u>												
Process 2:	<u>SMAW 3 Layers minimum: YES</u>	<u>0.194"</u>	<u>UP TO 0.388"</u>												
Position Qualified:		<u>1G</u>	<u>1G, 1F</u>												
Vertical Progression:		<u>UP</u>	<u>UP</u>												
Type of Fuel Gas (OFW):		<u>NONE</u>	<u>NONE</u>												
Inert Gas Backing (GTAW, PAW, GMAW):		<u>NONE</u>	<u>NONE</u>												
Transfer Mode (GMAW):		<u>N/A</u>	<u>NONE</u>												
GTAW current type/polarity:		<u>N/A</u>	<u>NONE</u>												
RESULTS															
Visual Examination of Completed Weld (QW-191):															
Bend Test:															
<input checked="" type="checkbox"/> Trans. Root & Face [QW-462.3(a)]		<input checked="" type="checkbox"/> Long. Root & Face [QW-462.3(b)] <input type="checkbox"/> Side [QW-462.2]													
<input type="checkbox"/> Pipe - Corrosion Resistant Overlay [QW-462.5(c)]		<input type="checkbox"/> Plate - Corrosion Resistant Overlay [QW-462.5(d)]													
<input type="checkbox"/> Macro test for fusion [QW-462.5(b)]		<input type="checkbox"/> Macro test for fusion [QW-462.5(e)]													
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Type</th> <th>Result</th> <th>Type</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>1 TRANS. ROOT</td> <td>PASS</td> <td>3 TRANS. ROOT</td> <td>PASS</td> </tr> <tr> <td>2 TRANS. FACE</td> <td>PASS</td> <td>4 LONG. FACE</td> <td>PASS</td> </tr> </tbody> </table>		Type	Result	Type	Result	1 TRANS. ROOT	PASS	3 TRANS. ROOT	PASS	2 TRANS. FACE	PASS	4 LONG. FACE	PASS		
Type	Result	Type	Result												
1 TRANS. ROOT	PASS	3 TRANS. ROOT	PASS												
2 TRANS. FACE	PASS	4 LONG. FACE	PASS												
Alt. RT Examination Results (QW-191): <u>N/A</u>		Length and % of Defects: <u>N/A</u>													
Fillet Weld - Fracture Test (QW-180): <u>N/A</u>		Fillet Size (in): <u>N/A</u> Concavity/Convexity (in): <u>N/A</u>													
Macro examination (QW-184): <u>N/A</u>															
Other Tests: <u>N/A</u>															
Film or Specimens Evaluated By:		Company:													
Tests Conducted By: <u>ALFOR METALLURGICAL COMPANY LTD</u>		Laboratory Test No.: <u>08-163</u>													
Welding Supervised By: <u>MANITOBA LABOUR</u>															
We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.															
Date: <u>February 29, 2008</u>		Manufacturer: <u>ARCTIC FOUNDATION OF CANADA INC</u> By: <u>[Signature]</u> <u>Arthur J. Pankratz, P.Eng.</u> February 29, 2008													

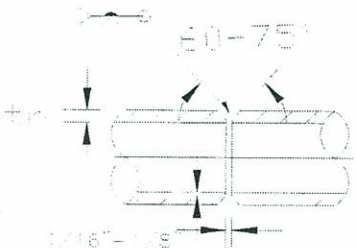
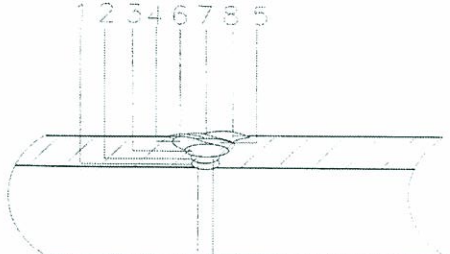
ARCTIC FOUNDATION OF CANADA INC

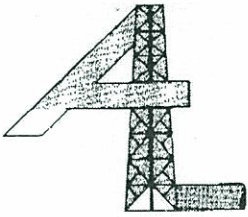
ELIE MANITOBA

PROCEDURE QUALIFICATION RECORD (QW-483)

(See ASME Boiler and Pressure Vessel Code - Section IX, Paragraph QW-201.2)

483/2004

Welding Process(es): SMAW Type(s): MANUAL		Date: February 29, 2008 Prepared By: Arthur J. Pankratz, P.Eng.		PQR No.: CS-M-2-1 WPS No.: AF-CS-M-2-1													
Joints (QW-402)  Joint Design of Test Coupon			 Pass and layer sequence														
BASE METALS (QW-403) Material Specification: SA-333 Type or grade: 6 P-No.: 1 Group No.: 1 Thickness of test coupon: 0.344" Diameter of Test Coupon: 2 DIA. SCH. 160 Other:		Material 1 Material 2		POSTWELD HEAT TREATMENT (QW-407) Temperature Range: NA Time Range:													
FILLER METALS (QW-404) Spec No. (SFA): 5.1 & 5.1 AWS No. (class): E6010 & E7018-1 F-No.: 3 & 4 A-No.: 1 Size of Filler Metals: 1/8" & 1/8" Deposited Weld Metal: 0.15" & 0.194" Other:		GAS (QW-408) <table border="1"> <thead> <tr> <th>Gas(es)</th> <th>Percent Composition Mixture (%)</th> <th>Flow Rate</th> </tr> </thead> <tbody> <tr> <td>Shielding:</td> <td>NONE</td> <td>NONE</td> </tr> <tr> <td>Trailing:</td> <td>NONE</td> <td>NONE</td> </tr> <tr> <td>Backing:</td> <td>NONE</td> <td>NONE</td> </tr> </tbody> </table>				Gas(es)	Percent Composition Mixture (%)	Flow Rate	Shielding:	NONE	NONE	Trailing:	NONE	NONE	Backing:	NONE	NONE
Gas(es)	Percent Composition Mixture (%)	Flow Rate															
Shielding:	NONE	NONE															
Trailing:	NONE	NONE															
Backing:	NONE	NONE															
POSITIONS (QW-405) Position of Joint: 1G Welding Progression: UP Other:		ELECTRICAL CHARACTERISTICS (QW-409) Current: DC Polarity: REVERSE Amps: 75 to 135 Volts: 23 to 27 Tungsten Electrode Size: N/A Other:															
PREHEAT (QW-406) Preheat Temp.: 50F Interpass Temperature: 50F to 500F Other:		TECHNIQUE (QW-410) Travel Speed: 6 to 8 IPM String or Weave Bead: STRING Oscillation: NONE Multiple or Single Pass (per side): MULTIPLE Single or Multiple Electrodes: SINGLE Other:															

**ALFOR METALLURGICAL COMPANY LTD.**
CONSULTING ENGINEERS

FILE #08-163

A.J.P. Engineering Services
1239 Manahan Avenue
Winnipeg, Manitoba R3T 5S8

March 5, 2008

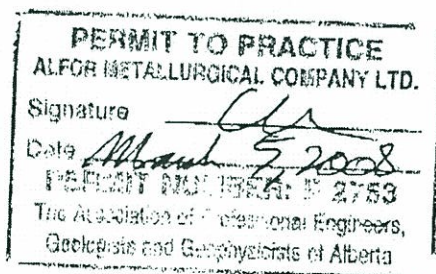
METAL TEST REPORT

Material Description: ASME SA-333, Grade 6; NPS2 X 0.344" W.T. pipe; Arctic Foundations of Canada Ltd. - Job 08115; Coupon #AF-CS-M-2-1.

Specimen Type: Reduced-section tensile, as per Figure QW-462.1(c) of the ASME Code;
guided face and root bend, as per Figure QW-462.3(a) of the ASME Code.

Results:	Sample 1	Sample 2
Width:	0.508 in.	0.509 in.
Thickness:	0.315 in.	0.315 in.
Area:	0.160 sq. in.	0.160 sq. in.
Ultimate Load:	11 230 lb	11 290 lb
Ultimate Tensile Strength:	70 200 psi	72 400 psi
Fracture Character:	Ductile	Ductile
Fracture Location:	Parent	Parent

Guided face bend (samples 2 and 4), guided root bend (samples 1 and 3): Pass Tests.

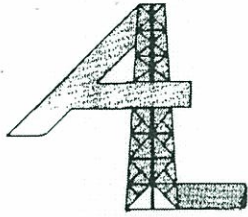


Yours very truly,

ALFOR METALLURGICAL COMPANY LTD.

CHARLES E. MOZESON, P. ENG.



**ALFOR METALLURGICAL COMPANY LTD.**
CONSULTING ENGINEERS

FILE #08-163

A.J.P. Engineering Services
1239 Manahan Avenue
Winnipeg, Manitoba R3T 5S8

March 5, 2008

CHARPY V-NOTCH IMPACT TEST RESULTS

Material Description: ASME SA-333, Grade 6; NPS2 X 0.344" W.T. pipe; Arctic Foundations of Canada Ltd. - Job 08115; Coupon #AF-CS-M-2-1.

Specimen Type: Charpy V-notch 7.5 mm-sized weld zone and heat-affected zone impact specimen, as per Part UG-84 of the ASME Code.

Testing Temperature: -60 F.

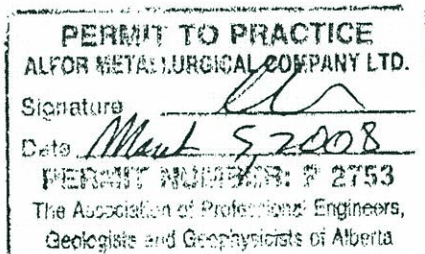
Results:

Weld zone: 41, 18, 55 ft-lb;

Heat-affected zone: 69, 71, 64 ft-lb.

Yours very truly,

ALFOR METALLURGICAL COMPANY LTD.



CHARLES E. MOZESON, P.Eng.



2 11378 2 5160 1 333 147 # 20907



MILL TEST REPORT

IN ACCORDANCE WITH EN 10204. 1B

JAN 16 8
810
NO 146-B

BUYER: 

DATE: 21.12.2008

SIZE: 2" SCH160SMLS(2.375x0.344)

PURCHASE ORDER # P.O.200822

SPECIFICATION:	ASTM A333-2/ASME B36.10
GRADE:	NDE NACE MR-0175/ISO 15848
	Q355

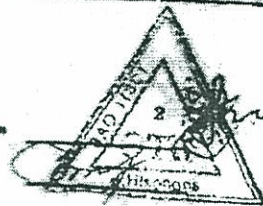
LADLE ANALYSIS-STEEL						PRODUCT CHEMISTRY %						OTHER VALUES		
HEAT NUMBER	C	Si	Mn	S	P	Cr	Mo	Cu	Al	Nb	V	REH MAX	ANVC	REH I
20907	0.26	0.20	0.48	0.004	0.008	0.02	0.05	0.15	0.01	0.01	0.01	0.22	2.4	0.25

MECHANICAL PROPERTIES

HEAT NUMBER	TENSILE	YIELD	Elongation	FLATTENING	BEND TEST	IMPACT TEST CHARTY VNOTCH L=10x57				TEMP	HYDROSTATIC TEST	NON-DESTRUCTIVE TEST	WELDING
						1	2	3	4				
20907	2701	44800	44800	32	9000	NONE	10.5	24.1	24.1	-30	NONE	EDDY CURRENT	WELDING

Normal size of longitudinal strip sample for stretching test: width, mm: 12.5±0.38, calculated length, mm: 760
 * CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED WITH THE ORDERED SPECIFICATION AND THAT THE TEST INFORMATION IS CORRECT, AS CONTAINED IN THE RECORDS OF THE COMPANY

Senior Control Foreman
 Prepared by



The Lincoln Electric Company
22801 St. Clair Avenue
Cleveland, Ohio 44117-1199

CERTIFICATE OF CONFORMANCE
(APPLIES ONLY TO U.S. PRODUCTS)



Product: Fleetweld® 5P+
Classification: E6010
Specification: AWS A5.1-2004, ASME SFA-5.1
Test Completed: August 31, 2007

[1 Year]

This is to certify that the product named above and supplied on the referenced order number is of the same classification, manufacturing process, and material requirements as the material which was used for the test that was concluded on the date shown, the results of which are shown below. All tests required by the specifications shown for classification were performed at that time and the material tested met all requirements. It was manufactured and supplied according to the Quality System Program of the Lincoln Electric Company, Cleveland, Ohio, U.S.A., which meets the requirements of ISO9001, NCA3800, ANSI/AWS A5.01, JIS Z9902, and other specification and Military requirements, as applicable. The Quality System Program has been approved by ASME, ABS, and VdTUV.

Operating Settings	AWS/ASME Requirements	Results	
Electrode Size		5/32 inch	3/16 inch
Polarity		DC+	DC+
Plate Thickness, mm (in.)		19 (3/4)	19 (3/4)
Current, amps		140	160
Passes/Layers		14/7	16/8
Preheat Temp, °C (°F)	(225 min.)	105 (225)	105 (225)
Interpass Temp, °C (°F)	(225 - 350)	150 (300)	150 (300)
Mechanical properties of the weld deposits (in the as-welded condition)			
Tensile Strength, MPa (ksi)	(60 min.)	540 (79)	520 (76)
Yield Strength, 0.2% offset MPa (ksi)	(48 min.)	440 (63)	430 (62)
Elongation %	22 min.	24	30
Average Hardness Rockwell B	Not Required	88	85
Charpy V-notch Impact Properties Avg. Joules @ -29 °C (ft-lbf @ -20 °F)	(20 min.)	76 (56) 74,77,77 (55,57,57)	73 (54) 72,74,74 (53,55,55)
Chemical composition (weight %)			
C	0.20 max.	0.16	0.12
Mn	1.20 max.	0.62	0.58
Si	1.00 max.	0.18	0.15
S	Not Specified	0.008	0.009
P	Not Specified	0.009	0.007
Cr	0.20 max.	0.03	0.03
Ni	0.30 max.	0.03	0.03
Mo	0.30 max.	0.02	0.01
V	0.08 max.	0.00	0.00

The electrode diameters required to be tested for this classification are 5/32 in. and 3/16 in. The 3/32 in. and 1/8 in. sizes will also meet these requirements.

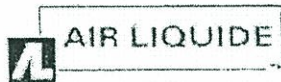
Radiographic Test: Grade 2: Met requirements. Fillet Weld Test: (positions as required): Met requirements.
Test assembly constructed of ASTM A36.

This certificate complies to the requirements of EN 10204 Type 2.2.

Results below the detection limits of the instrument or lower than the precision required by specification are reported as zero.
Strength values in SI units are reported to the nearest 10 MPa converted from actual data. Preheat and interpass temperature values in SI units are reported to the nearest 5 degrees.

Philip D. Woodring September 24, 2007
Philip D. Woodring, Certification Supervisor Date

David A. Fink 25 Sept 2007
David A. Fink, Manager, Compliance Engineering, Date
Consumable R&D Department



Air Liquide Canada
1250 Rene-Lévesque West
Suite 1700
Montreal, QC H3B 5E6
Canada

TYPICAL CERTIFICATE OF CONFORMANCE

This is to certify that LA 7018 electrode, classification E7018-1 / E7018-1-H4, as supplied on the above order number, is of the same classification, manufacturing process and material requirements as the electrode used for this test. All tests required by specifications CSA W48-01 and AWS/ASME A5.1-2004 were performed in conformance with these specifications and results meet all requirements. The chemical analysis and mechanical properties were as follows:

Chemical Analysis

	Carbon	Manganese	Silicon	Sulphur	Phosphorus	Molybdenum	Nickel	Chromium	Vanadium	Mn + Ni + Cr + Mo + V
AWS	0.15 max	1.6 max	0.75 max	0.035 max	0.035 max	0.3 max	0.3 max	0.2 max	0.08 max	1.75 max
Results	0.07	0.99	0.58	0.011	0.013	0.01	0.04	0.04	0.01	1.09

Radiographic Test
Met requirements

Transverse Tensile Test
Not required

Longitudinal guided bend test
Not required

Diffusible hydrogen test (mL/100g)
Met requirements 16%RH 69.8°F
Results: 2.4, 2.1, 2.2, 2.2 (avg: 2.23)

Mechanical Properties - Welding Parameters

Electrode Diameter: 5/32"
Wire Feed Speed: N/A
Arc Voltage: 20.8
Current / Polarity: AC
Electrical Extension: N/A

Welding Travel Speed: 5.3 in/min
Amperage: 175
No of Passes/Layer: 14/7
Preheat Temperature: 220°F
Interpass Temperature: 350°F

Shielding Gas: N/A
Welding Position: flat
Base Material: A516 Gr. 70
Buttered: No
Post Weld Heat Treatment: As welded

Test Results

	Requirements (AWS)	Results
Tensile Strength (Psi):	70000 min.	81400
Yield Strength (Psi):	58000 min.	68600
Elongation:	22% min.	31.8%
Hardness:	N/A	N/A
Charpy V-notch Impact (ft-lb):	20 avg. min. @ -50°F	80 (68,100,82,77,72)


Issued at: Montréal, Québec
Date: 2006/06/26
Authorized Representative: Jocelyn Turcotte
Air Liquide Canada Inc.

Jocelyn Turcotte

NOTE : The information showed in the section "Mechanical Properties - Welding Parameters" is the latest "Canadian Welding Bureau" test performed to certify this product. Therefore, the diameter chosen for this test gave mechanical and chemical test results which are representative and valid for all the other diameters of electrodes of the same type as the one mentioned above.

Apprenticeship

A partnership for industry training

Manitoba 

L'apprentissage

Un partenariat favorisant la formation dans l'industrie

Having complied with the Apprenticeship and
Trades Qualifications Act and associated
regulations, this is to certify that

A satisfait aux exigences de la Loi sur l'apprentis-
sage et la qualification professionnelle, et de ses
règlements, nous attestons par la présente que

Chad L. Herle

Holds a Certificate of Qualification
for the trade of

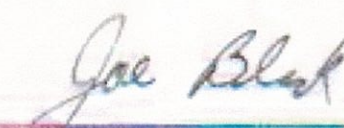
est titulaire un certificat de qualification
pour la profession de

Industrial Welder

Certificate No. /N° de certificat 702

Red Seal No. /N° G-22-20276

Work experience with examination


Director, Apprenticeship and Trades Qualifications
Directeur de l'apprentissage de la
qualification professionnelle

INTERPROVINCIAL
STANDARD

CANADA

G-22-20276

NORME
INTERPROVINCIALE

Welder's Licence
Permis de Soudeur

Manitoba
Labour and
Immigration

Travail et
Immigration
Manitoba



The Department of Labour certifies that/le ministere du travail atteste que.

Chad Herle

96-U

Name/Nom

Symbol/Symbole

is qualified to weld under Section IX of
the A.S.M.E. Code within the following
specifications and limitations:

est autorise(e), en vertu de l'article
IX du Code de l'A.S.M.E., a exercer
les fonctions de soudeur dans les
conditions et limites suivantes:

1) Employer/Employeur **Unrestricted**

2) Welding Process/Technique de soudage **SMAW**

3) Base Metal (P-No)/Metal de base (P-No) **P1**

4) Weld Metal (A-No)/Metal fondu (A-No) **(E6010,E7018) INFO**

5) Electrode or Welding Rod(F-No.)/Electrode ou baguette de soudure (F-No.)
F3 F4

6) Positions/Positions **ALL**

7) Thickness Range/Gamme d'epaisseurs **F3 (.200") to F4 (.488")**

8) Diameter of Pipe/Diametre (tuyaux)

9) Weld Progression/Soudage vertical

RESTRICTIONS/RESTRICTIONS

a) Licence expires one year from date of issue unless:

- 1) Cancelled upon an adverse report by an inspector of the Department.
- 2) Automatically terminates if the holder ceases, for six consecutive months, to be actively employed upon welding of the type authorized hereby.

b) is strictly limited to the types and positions of welding listed on the face hereof.

NOTE: Holder must apply to Department for retest.

Terry Rieger

.....
Director, Mechanical and Engineering
Directeur, mecanique et technique

**1" to UNLIMITED
Vert Up**

a) Le present permis expire un an apres sa date d'entree en vigueur, sauf dans les cas suivants:

- 1) Il est revoke a la reception d'un rapport defavorable depose par un inspecteur du ministere.
- 2) Il est resilie d'office si le titulaire cesse, durant six mois consecutifs, d'exercer activement les fonctions de soudeur que le present permis l'autorise a exercer.

b) Le titulaire doit s'en tenir strictement aux types de soudures et aux positions de soudage precises au recto du present permis

NOTA: Le titulaire doit presenter une demande au ministere pour passer d'autres tests de competence.

Expires/date d'expiration 2011-12-0

.....
Signature of Holder/
Signature du titulaire

Welder's Licence
Permis de Soudeur

Manitoba
Labour and
Immigration

Travail et
Immigration
Manitoba



The Department of Labour certifies that/le ministère du travail atteste que.

Mike Watt

60-V

Name/Nom

Symbol/Symbole

is qualified to weld under Section IX of
the A.S.M.E. Code within the following
specifications and limitations:

est autorisé(e), en vertu de l'article
IX du Code de l'A.S.M.E., à exercer
les fonctions de soudeur dans les
conditions et limites suivantes:

1) Employer/Employeur **Unrestricted**

2) Welding Process/Technique de soudage

SMAW

3) Base Metal (P-No)/Métal de base (P-No)

P1

4) Weld Metal (A-No)/Métal fondu (A-No)

(E6010, E7018) INFO

5) Electrode or Welding Rod (F-No.) / Electrode ou baguette de soudure (F-No.)

F3 F4

6) Positions/Positions **ALL**

7) Thickness Range/Gamme d'épaisseurs

F3 (.200") to F4 (.488")

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regulations, this is to certify that

A satisfait aux exigences de la Loi sur l'apprentis-
sage et la qualification professionnelle, et de ses
règlements, nous attestons par la présente que

Michael J. D. Watt

Holds a Certificate of Qualification
for the trade of
Industrial Welder

est titulaire un certificat de qualification
pour la profession de

Certificate No. /N° de certificat 703

Red Seal No. /N° G-22-20277

Work experience with examination

Joe Blak
Director, Apprenticeship and Trades Qualifications
Directeur de l'apprentissage de la
qualification professionnelle

- 8) Diameter of Pipe/Diametre (tuyaux)
9) Weld Progression/Soudage vertical

RESTRICTIONS/RESTRICTIONS

- a) Licence expires one year from date of issue unless:
- 1) Cancelled upon an adverse report by an inspector of the Department.
 - 2) Automatically terminates if the holder ceases, for six consecutive months, to be actively employed upon welding of the type authorized hereby.
- b) is strictly limited to the types and positions of welding listed on the face hereof.

NOTE: Holder must apply to Department for retest.

Terry Rieger
Director, Mechanical and Engineering
Directeur, mecanique et technique

**1" to UNLIMITED
Vert Up**

- a) Le present permis expire un an apres sa date d'entree en vigueur, sauf dans les cas suivants:
- 1) Il est revoque a la reception d'un rapport defavorable depose par un inspecteur du ministere.
 - 2) Il est resilie d'office si le titulaire cesse, durant six mois consecutifs, d'exercer activement les fonctions de soudeur que le present permis l'autorise a exercer.
- b) Le titulaire doit s'en tenir strictement aux types de soudures et aux positions de soudage precises au recto du present permis.
- NOTA: Le titulaire doit presenter une demande au ministere pour passer d'autres tests de competence.

Expires/date d'expiration 2012-02-09

Signature of Holder/
Signature du titulaire

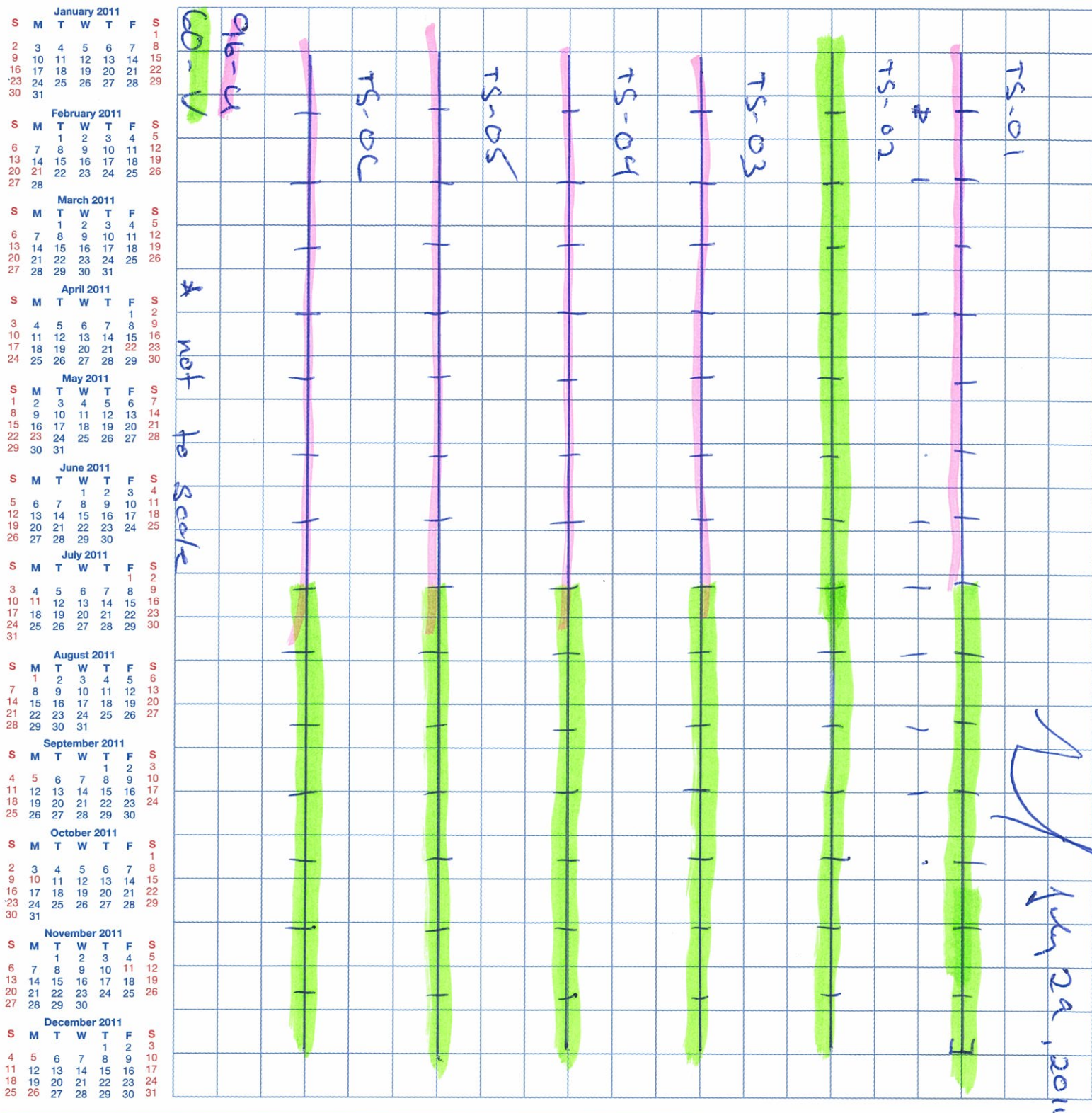




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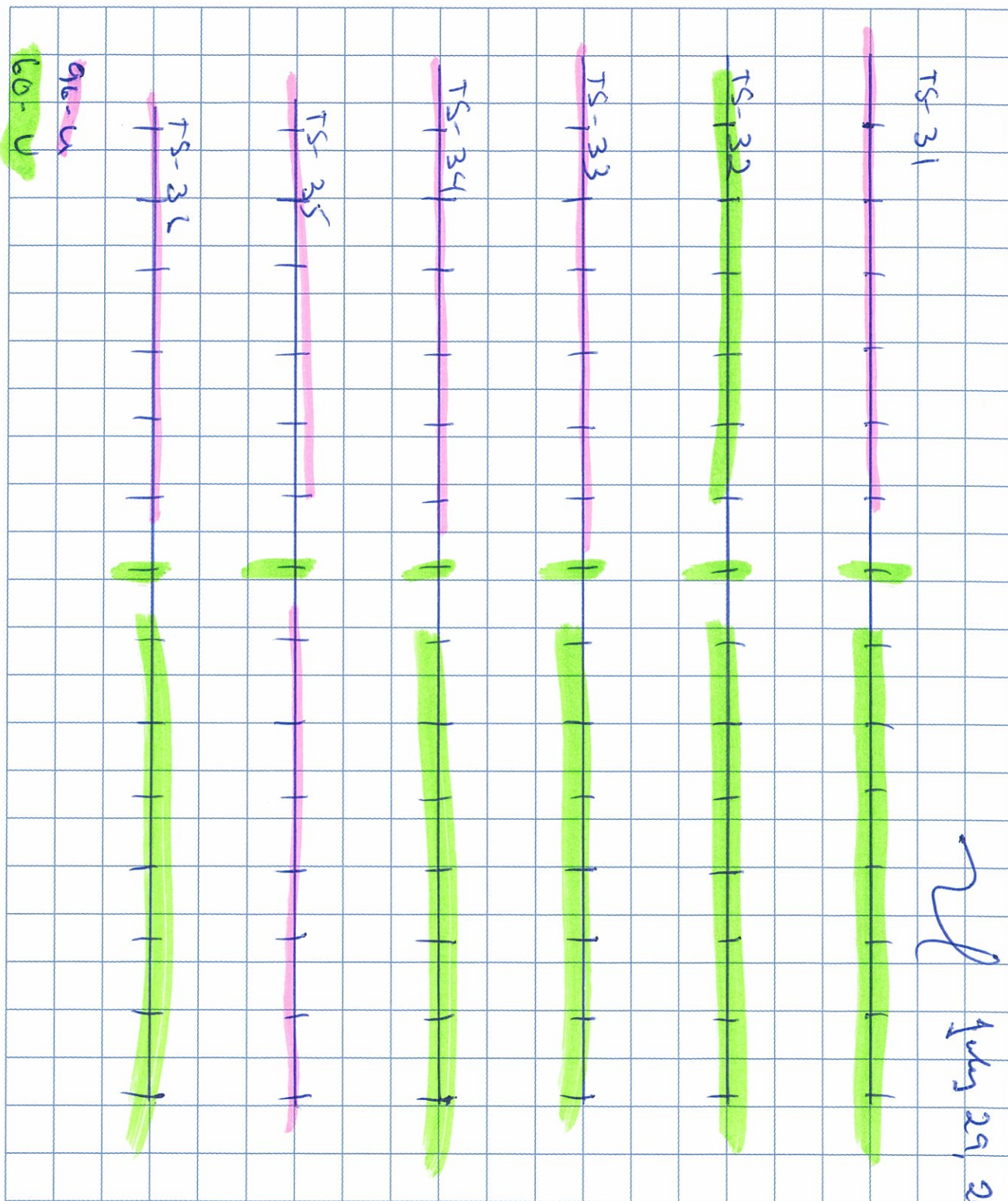


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January 2011						
S	M	T	W	T	F	S
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30	31					
December 2011						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					



Aluminum • Stainless Steel • Aircraft Alloys • Nickel Alloys

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1-800-465-2389
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1-204-953-1910
Winnipeg

1-866-272-8265
Sarnia


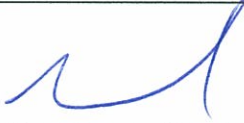
1-800-387-9166
Etobicoke

1-888-387-9166
Sudbury

1-800-363-6646
Montreal



Quality Control Visual Inspection Report

Project Name: North Dam	Contract No.: HBP 1-CO-357915	Date: April 19, 2011
Job No.: Installation of sloped Thermosyphons in North Dam		Inspected By: Todd Carriere, Arctic Foundations of Canada Inc.
Item(s) Inspected: Base Material used below evaporators		
Location: North Dam		
Comments: Material placed below evaporators is acceptable		
Arctic Foundations of Canada Representative:	 (Print Name)	 (Sign)
		4.19.11 (Date)



VARIAN



Varian Vacuum Technologies
Varian S.p.A.
Via Fratelli Varian, 54
I - 10040 Leini (TO) - Italy
Phone: +39-011-9979-111
Fax : +39-011-9979-350
<http://www.varianinc.com>

QUALITY CERTIFICATE

The following instrumentation has passed the final inspection test, and the main operating parameters have been measured as indicated hereunder. **The unit is in a serviceable condition.**

Part Number

9694650

Description

PHD- 4

Serial Number

205318

Tested with certified Helium / Nitrogen mixture
50PPM (Analytical tolerance + - 5% relative)

ppm

49,2

PHD reading (the PHD calibration can be
adjusted as indicated in the instruction manual)

ppm

$5,1 \times 10^{-1}$

Drift (Max 10 PPM / 10min.)

ppm/10min

0

Final Control Operator

ELISEO REAMI

Date & Signature

27/01/2010

Date	Unit I.D.	Vac Start	Vac Finish	mTorr	Charged	Tech.	Notes
4.16.11	TS31	1010	0725	485	✓	TC _{mw}	
"	TS32	1010	0725	485	✓	TC _{mw}	
"	TS33	1015	1430	490	✓	TC _{mw}	
"	TS34	1015	1430	490	✓	TC _{mw}	
"	TS35	1435	1750	385	✓	TC _{mw}	
"	TS36	1435	1750	385	✓	TC _{mw}	
4.17.11	TS06	1430	0630	385	✓	TC _{mw}	upstream vac all night (4.18)
4.17.11	TS05	1430	0630	385	✓	TC _{mw}	vac all night (4.18)
4.18.11	TS04	0640	0840	475	✓	TC _m	
4.18.11	TS03	0640	0840	475	✓	TC _m	
4.18.11	01	0845	1100	485	✓	TC _{mw}	
4.18.11	01	0845	1100	485	✓	TC _{mw}	

South
1001

Contract No: 2110001617

HENGYANG VALIN STEEL TUBE CO., LTD

Add: 10 Dalixincun, Hengyang City, Hunan, China

Customer: R AND R TRADING CO., LTD.

MILL TEST REPORTS

Tel and Fax: +86 734 8873739 8872942

PO NO: 402609

Cable: 6993

DESCRIPTION: PRIME SEAMLESS STEEL PIPES

Date: OCT 22, 2010

P.C. 421001

TOTAL: 882 PIECES, 24 BUNDLES, 36.408 MT

Page: 1/1

TOTAL: 882 PIECES,24 BUNDLES,36.408 MT													Page: 1/1				
SPEC: API 5LB 44TH/ASTM A53B-2007/ASTM A106B-2006/ASME SA106B-2007/SA53B -2007											CERTIFICATE NO: 2010-03-1024						
NO	BATCH NO.	HEAT NO.	STEEL GRADE	SIZE	BUNDLES	PIECES	FEET	THEORETICAL WEIGHT (MT)	part code								
6	908202104	1013555	B	2"*0.154"*21FT	12	445	9345	15.491	N/A								
7	908202108	1025034	B	2"*0.218"*21FT	12	437	9177	20.917	N/A								
Total					24	882	18522	36.408	N/A								
NO.	DELIVERY CONDITION	NONDESTRUCTIVE TEST			CHEMICAL COMPOSITION (%)												
		ET	UT	TYPE:	C	SI	Mn	P	S	Cu	Ni	Cr	Mo	V	Ti	B	Nb
6	HOT-ROLLED	OK	N/A	P	0.19	0.24	0.41	0.012	0.003	0.05	0.02	0.05	0.01	0.0100	0.002	0.0001	0.001
				P	0.20	0.23	0.41	0.012	0.003	0.05	0.02	0.05	0.01	0.0100	0.002	0.0001	0.001
				L	0.20	0.24	0.41	0.012	0.003	0.05	0.02	0.05	0.02	0.0100	0.002	0.0002	0.001
7	HOT-ROLLED	OK	N/A	P	0.19	0.23	0.40	0.015	0.003	0.05	0.02	0.04	0.01	0.0100	0.002	0.0001	0.001
				P	0.18	0.22	0.40	0.015	0.003	0.05	0.02	0.04	0.01	0.0100	0.002	0.0001	0.001
				L	0.18	0.22	0.39	0.018	0.003	0.05	0.02	0.04	0.04	0.0100	0.002	0.0001	0.001
NO	TENSILE STRENGTH σ _b (Psi)	YIELD STRENGTH σ _s (Psi)	ELONGATION δ (%)	IMPACT			HARDNESS (HRC≤22)	HYDROSTATIC TEST (PSI/6s)	FLATTEN TEST		BEND TEST						
	strip ,L ₀ =19mm,L _e =50mm			SIZE	AK (J)	Ori/Tem											
6	67425	48575	38	N/A	N/A		N/A	OK	2500	N/A		OK					
7	67425	47125	35	N/A	N/A		N/A	OK	2500	N/A		OK					

- REMARKS: 1. We hereby certify that this certificate of quality is issued and signed by the manufacturer.
2. We hereby certify that the properties described herein meet the requirement of the above specification
3. We hereby certify that this certificate is issued accordance with EN10204 3.1B/NACE MR0175
4. Type: P-Product analysis, L-Ladle analysis;

QUALITY MANAGER:

*Material acceptable
as per AFC Quality
control
L. Carrere*





NIKOPOL STEEL PIPE
"YTIST", CJSCo
56, TRUBNIKOV AV., NIKOPOL
CITY DNIPROPETROVSK
REG., UKRAINE, 53201
REG. #: +38-05662-25062
WWW.STEELPROM.COM



MILL TEST REPORT

No 55

IN ACCORDANCE WITH EN 10204/3. 1B

BUYER:



DATE: 18.08.2008

SIZE:

3" SCH 40 SMLS (3.500" x 0.216")

PURCHASE

ORDER #



SPECIFICATION:	API 5L/ASTM A-106-06/ASME SA 106-06, NACE MR - 0175/94
GRADE:	B

LADLE ANALYSIS-STEEL

PRODUCT CHEMISTRY %

OTHER VALUES

HEAT NUMBER	C	Si	Mn	S	P	Cr	Ni	Cu	Mo	V	CE	Mn/C	Cr+Cu+Mo+Ni+V
11273-1	0,19	0,27	0,44	0,012	0,009	0,04	0,04	0,08	<0,01	<0,01	0,40 max 0,27	2,32	max 1 0,16

MECHANICAL PROPERTIES

HEAT NUMBER	Beat No	YIELD STRENGTH (PSI)	TENSILE STRENGTH (PSI)	Elongation%	FLATTENING TEST	BEND TEST	HYDROSTATIC TEST (PSI)	NON-DESTRUCTIVE TEST METHOD USED	HARDNESS TEST
11273-1	39	54500	69500	33	GOOD	NONE	2500	EDDY CURRENT	<22HRC

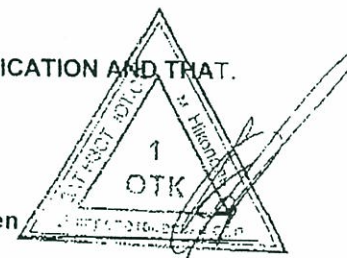
Nominal size of longitudinal strip sample for stretching test: width, mm: 25,4 calculated length, mm: 50,8.

* I CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED WITH THE ORDERED SPECIFICATION AND THAT THE TEST INFORMATION IS CORRECT AND CONTAINED IN THE RECORDS OF THE COMPANY.

Quality Management System is certified acc.to ISO 9001:2000 TUV CERT certificate №78 100 3367.

Accounted
To Carriage

Senior control foremen



Prepared by

Signature



江阴市无缝钢管总厂

JST JIANGYIN CITY SEAMLESS STEEL TUBE FACTORY

产品质量证明书 (日期: 2004.3.1)

MILL TEST CERTIFICATE

江苏省江阴市夏港镇澄澄路375号

No. 375, Zhencheng Rd. Xiagang Town Jiangyin City

Jiangsu Province, China (214442) http://www.cjgg.cn

Tel: 86-510-86160723 Fax: 86-510-88160732

总件数 Total Bundles		18		总支数 Total Pieces		90		总重量 (t) Total Weight		24.498		日期 Date: 2008年09月23日		No: 11004470-3											
收货单位 PURCHASER																									
产品名称 Product		CARBON STEEL SEAMLESS PIPE				技术标准 Spec.		ASTM A53-04/ASME SA106-04/API 5L NACE MR0175-02				许可证号 License No.		0503											
规格 Size (mm)		NPS8" * 0.322 * 6400				钢级 Grade		B		牌号 Steel Type		交货状态 Delivery Status		HOT-ROLLING											
序号 NO.	炉号 Heat No.	批号 Batch No.	件数 BDL	支数 PCS	重量 (t) WT	拉伸试验 Tensile Test					冲击试验 Impact Test		硬度试验												
						尺寸 Dimen- sion	标距长度 Gauge Length (mm)	屈服强度 Y.S PSI	伸长率 E.L (%)	抗拉强度 T.S PSI	冲击值 (J) Impact Value		硬度值 Hardness Value (HRC)												
											横向冲击 Ak Transverse	纵向冲击 Ak Longitudinal													
1	08204709	Y10808-194	18	90	24.498	*1-A2	50	45685/45685	36/35	71790/71790			20												
2																									
3																									
4																									
序号 NO.	类别 Type *5	化学成分 (%) Chemical Composition											低倍组织 (级) M.S			金相分析 Metallogical Analysis									
		C	Si	Mn	P	S	Cr	Ni	Cu	Mo	V	CE	Mn/C	Cr+Cu+Mo+Ni+V	一般 疏松 Ordinary Porosity	中心 疏松 Central Porosity	偏析 Segregation	显微组织 *6 Microstructure	晶粒度 (级) Grain size	夹杂物 Inclusion				带状 组织 (级) B.S	脱碳层 (mm) D.L
压扁 Flattening		冷弯 Cold Bending		扩口 Flaring		超声检验 U.T		涡流检验 E.T		磁粉检验 M.P.I		漏磁检验 L.M.T		通径 N.D		表面 & 尺寸 S&D		水压 Hydro Test ≥ 5s		1		1600		PSI	
OK								OK				OK				OK				2				PSI	
																				3				PSI	
																				4				PSI	
注释 Notes		*1: 纵向条状 Longitudinal Strip: A1-12.7mm, A2-19.05mm, A3-25.4mm, A4-38.1mm, F-全截面 Full-section *2: 棒状 Clubbed: B1=12.7mm, B2=8.9mm, B3=8mm, B4=10mm *3: 横向条状 Transverse Strip: C1-12.7mm, C2-19.05mm, C3-25.4mm, C4-38.1mm, *4: D1=10×10×55mm, D2=10×7.5×55mm, D3=10×5×55mm *5: C-成品成分 Product composition R-熔炼成分 Melting composition *6: F-铁素体 Ferrite B-贝氏体 Bainite P-珠光体 Pearlite S-回火索氏体 Tempered Sorbite M-马氏体 Martensite																							
备注 Remark		1. NO WELD REPAIRS WERE PERFORMED; 2. PIPES ARE FREE OF MERCURY AND SILICONE; 3. CE=C+Mn/6+(Cr+Mo+V)/5+(Ni+Cu)/15; 4. API 5L Gr.B -43rd Edition, ASTM A53-04a ASME SA53B 2004 Edition; ASTM A106-04b ASME SA106 2004 Edition (NACE MR0175-2002); 5. ON THEORETICAL WEIGHT BASIS.																							

质量管理部负责人:
Quality Manager:

胡才望

审核人:
Auditor:

胡才望

制证人:
Certification-maker:

胡才望

Account
T. Carriene



NIKOPOL STEEL PIPE
"YTIST", CJSC
56, TRUBNIKOV AV., NIKOPOL
CITY DNIPROPETROVSK
REG., UKRAINE, 53201
FAX: +38-05662-25062
WWW.STEELFROM.COM



MILL TEST REPORT

No 85

IN ACCORDANCE WITH EN 10204/J3. 1B

BUYER:



DATE: 03.09.2008

SIZE:

3" SCH 40 SMLS (3.500" x 0.216")

PURCHASE
ORDER #



SPECIFICATION:	API 5L/ASTM A-106-06/ASME SA 106-06, NACE MR - 0175/94
GRADE:	B

LADLE ANALYSIS-STEEL

PRODUCT CHEMISTRY %

OTHER VALUES

HEAT NUMBER	C	SI	Mn	S	P	Cr	Ni	Cu	Mo	V	CE 0.40 max	Mn/C	Cr+Cu+Mo+Ni+V max 1
293-1	0,14	0,27	0,51	0,015	0,009	0,07	0,04	0,06	<0,01	<0,01	0,24	3,64	0,17

MECHANICAL PROPERTIES

HEAT NUMBER	production-run	YIELD STRENGTH (PSI)	TENSILE STRENGTH (PSI)	Elongation%	FLATTENING TEST	BEND TEST	HYDROSTATIC TEST (PSI)	NON-DESTRUCTIVE TEST METHOD USED	HARDNESS TEST
293-1	326	48900	66000	36	GOOD	NONE	2500	EDDY CURRENT	<22HRC

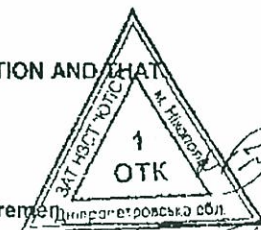
Nominal size of longitudinal strip sample for stretching test: width, mm: 25,4 calculated length, mm: 50,8.

* I CERTIFY THAT THE MATERIAL HEREIN DESCRIBED HAS BEEN MANUFACTURED WITH THE ORDERED SPECIFICATION AND THAT THE TEST INFORMATION IS CORRECT AND CONTAINED IN THE RECORDS OF THE COMPANY.

Quality Management System is certified acc.to ISO 9001:2000 TUV CERT certificate №78 100 3367.

Accounted
T. Lyvonen

Senior control foreman



Prepared by

[Signature]

Nova Tube Inc.

5870, rue St-Patrick
Montréal, QC H4E 1B3
Téléphone: (800) 361-4344
Télécopie: (514) 762-5355

REÇU 10

Rép. 403

NOTRE NUMÉRO DE COMMANDE
OUR SALES ORDER NUMBER
PTM9-1812

NO DE BON DE COMMANDE DU CLIENT
CUSTOMER'S ORDER NUMBER
193983S

DATE DE COMMANDE
ORDER DATE
11/11/10

NUMÉRO DE CONNAISSANCEMENT
BILL OF LADING NUMBER
PTU42219

F.A.B.
F.O.B.

ORIGINE
ACHEMINEMENT
ROUTING

MADACO

01/01/11 PREPAID AND CHARGED

NO DE PERMIS
PERMIT NUMBER
1013790759TQ0001LE

EXPÉDIÉ À - SHIPPED TO

CERTIFICAT D'ESSAI - TEST CERTIFICATE

VENDU À - SOLD TO

MUELLER FLOW CONTROL
A DIVISION OF MUELLER CANADA, LTD.
470 SEAMAN STREET
STONE CREEK ONTARIO CANADA
L8E 2V9

MUELLER FLOW CONTROL
UNE DIVISION DE MUELLER CANADA, LTE
1820 CHEMIN ST-FRANCOIS
DORVAL QC CANADA
H9P 2P6

NOTES:

This product has been manufactured, sampled, tested and inspected in accordance with the requirements of ASTM A53-07 / ASME SA-53-98, type E, grade B. The results for Flattening test, Hydrostatic test for 5 seconds, NDT test on weld line are all acceptable

CODE CODE	NO D'ART. ITEM NO.	DESCRIPTION DESCRIPTION	NO DE COULÉE HEAT NO.	LIMITE D'ÉLASTICITÉ YIELD STRENGTH	RÉSISTANCE À LA RUPT. ULTIMATE STRENGTH	ALLONGEMENT % ELONGATION
Origin		Hot Rolled Steel coils made from steel melted and manufactured in Canada Manufacturing: Pipe produced in Canada Certificate: DIN EN 10204-2005 type 3.1 FM approved for Dry and Wet system for 1,1.25,1.5,2,2.5,3,4 and 6 in diam. UL/ULC approved for sprinkler system for all S40 products		Min (PSI)	Min (PSI)	Min
6342811	9	STEEL PIPE, STD ERW, BLACK, BEVELLED END 3" X .216 X 21'	220106 220105 220106	55700 55900 55700	64800 65200 64800	31 32 31
		Traceability W/O Nbr 2010-11-25 25110 13				

ANALYSE CHIMIQUE - CHEMICAL ANALYSIS (%)

NO D'ART. ITEM NO.	NO DE COULÉE HEAT NO.	C	Mn	P	S	Si	V	Nb	Cu	Ni	Cr	Mo	Al	Ti	Sn	N
		MAX 0.30	MAX 1.20	MAX .050	MAX .045		MAX .080		MAX 0.50	MAX 0.40	MAX 0.40	MAX .150				
9	220106	0.06	0.63	.010	.014	0.01	.001	.012	0.05	0.01	0.04	.003	.038	.001	.002	.0043
9	220105	0.05	0.65	.009	.009	0.02	.002	.012	0.06	0.01	0.03	.003	.027	.001	.003	.0041

APPROUVÉ PAR / APPROVED BY

Raphael Ciccariello ing.

DATE D'ÉMISSION / DATE ISSUED

2010/12/16

CLIENT

The Lincoln Electric Company
22801 St. Clair Avenue
Cleveland, Ohio 44117-1199

CERTIFICATE OF CONFORMANCE
(APPLIES ONLY TO U.S. PRODUCTS)



[1 Year]

Product: Fleetweld® 5P+
Classification: E6010
Specification: AWS A5.1-2004, ASME SFA-5.1
Test Completed: June 15, 2010

This is to certify that the product named above and supplied on the referenced order number is of the same classification, manufacturing process, and material requirements as the material which was used for the test that was concluded on the date shown, the results of which are shown below. All tests required by the specifications shown for classification were performed at that time and the material tested met all requirements. It was manufactured and supplied according to the Quality System Program of the Lincoln Electric Company, Cleveland, Ohio, U.S.A., which meets the requirements of ISO9001, NCA3800, ANSI/AWS A5.01 and other specification and Military requirements, as applicable. The Quality System Program has been approved by ASME, ABS, and VdTUV.

Operating Settings	AWS/ASME Requirements	Results	
Electrode Size		5/32 inch	3/16 inch
Polarity		DC+	DC+
Plate Thickness, mm (in.)		19 (3/4)	19 (3/4)
Current, amps		135	160
Passes/Layers		14/7	14/7
Preheat Temp, °C (°F)	(225 min.)	105 (225)	105 (225)
Interpass Temp, °C (°F)	(225 - 350)	150 (300)	150 (300)
Mechanical properties of the weld deposits (in the as-welded condition)			
Tensile Strength, MPa (ksi)	(60 min.)	560 (81)	510 (74)
Yield Strength, 0.2% offset MPa (ksi)	(48 min.)	440 (64)	420 (61)
Elongation %	22 min.	23	25
Average Hardness Rockwell B	Not Required	85	82
Charpy V-notch Impact Properties Avg. Joules @ -29 °C (ft-lbf @ -20 °F)	(20 min.)	80 (59) 75,81,83 (55,60,61)	68 (50) 61,69,75 (45,51,55)
Chemical composition (weight %)			
C	0.20 max.	0.16	0.14
Mn	1.20 max.	0.58	0.57
Si	1.00 max.	0.18	0.17
S	Not Specified	0.004	0.005
P	Not Specified	0.013	0.011
Cr	0.20 max.	0.05	0.02
Ni	0.30 max.	0.02	0.02
Mo	0.30 max.	0.01	0.00
V	0.08 max.	0.00	0.00

The electrode diameters required to be tested for this classification are 5/32 in. and 3/16 in.. The 3/32 in. and 1/8 in. sizes will also meet these requirements.

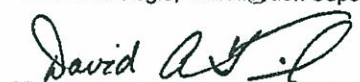
Radiographic Test: Grade 2: Met requirements. Fillet Weld Test: (positions as required): Met requirements.
Test assembly constructed of ASTM A36.

This certificate complies to the requirements of EN 10204, Type 2.2.

Results below the detection limits of the instrument or lower than the precision required by specification are reported as zero. Strength values in SI units are reported to the nearest 10 MPa converted from actual data. Preheat and interpass temperature values in SI units are reported to the nearest 5 degrees.


James R. Fogle, Certification Supervisor

June 17, 2010
Date


David A. Fink, Manager, Compliance Engineering,
Consumable R&D Department

22 June 2010
Date



CERTIFICATE OF CONFORMANCE

Air Liquide Canada Inc.

1250 René-Lévesque Blvd West, Suite 1700
Montreal, Quebec H3B 5E5

Product: Blueshield LA 7018
Item #: BLU-32971708 (3.2mm - 1/8")

Standard/Classification: CSA W48-06 / E4918-1-H4
AWS 5.1-2004/ASME SFA A5.1 / E7018-1-H4

Test Date: 01-Nov-2011

The above named product is of the same classification as the filler metal used for testing. The typical chemical analysis and mechanical properties were as follows:

CHEMICAL ANALYSIS (%)

	Carbon	Chromium	Manganese	Molybdenum	Nickel	Phosphorus	Silicon	Sulphur	Vanadium	Mn + Ni + Cr + Mo + V
Deposit	0.04	0.04	1.11	<0.01	0.01	0.01	0.52	0.01	<0.01	1.16
CSA E4918-1-H4	<0.15	<0.2	<1.6	<0.3	<0.3	<0.035	<0.75	<0.035	<0.08	<1.75
AWS E7018-1-H4	<0.15	<0.2	<1.6	<0.3	<0.3	<0.035	<0.75	<0.035	<0.08	<1.75

Radiographic Test
Met requirements

Fillet Weld Test
Met requirements

Diffusible Hydrogen Test (as per AWS A4.3)

RH (%): 21.0 AbsH g/kg (gr/lb): 14.6 (102.2) Temp °C (°F): 20.0 (68.0) Average (ml/100g): 3.0

MECHANICAL PROPERTIES

AS WELDED

WELDING PARAMETERS

Prepared according to : AWS CSA
Diameter used for testing mm (in): 4.0 (5/32)
Amperage (A): 180
Arc Voltage (V): 23.0
Current Polarity : AC
Weld Travel Speed cm/min (ipm): 12.8 (5.0)
No. of passes/layers : 13/6
Preheat Temp. °C (°F): 105 (221)
Interpass Temp. °C (°F): 170 (338)
Base Material : A516 Gr. 70
Welding Position : Flat

TEST RESULTS

	Typical Results	CSA E4918-1-H4 Requirements	AWS E7018-1-H4 Requirements
Tensile Strength MPa (ksi):	540 (78.4)	490-650 (70.0-94.0)	>490 (70.0)
Yield Strength MPa (ksi):	450 (65.3)	>400 (58.0)	>400 (58.0)
Elongation (%):	32.0	>22.0	>22.0
Charpy V-notch Impact Energy J (ft-lb):	127.0 (93.7)	>27.0 (20.0)	>27.0 (20.0)
Charpy Temperature °C (°F):	-45.0 (-49.0)	-45.0 (-50.0)	-45.0 (-50.0)
Charpy Lateral Expansion mm (in):	1.5 (0.0604)		
Charpy Shear Fracture (%):	36.7		

The undersigned certifies that the product supplied will meet the requirements of the applicable filler metal standard when tested in accordance with that standard's classification, and that no significant change has been made in the formulation and manufacturing procedures described in the qualification approval.

Signed by:


Eric Cormier, Product Manager Filler Metals

Note: The information showed in the section "Mechanical Properties - Welding Parameters" is the latest test performed to certify this product. Therefore, the diameter chosen for this test gave mechanical and chemical test results which are representative and valid for all the other diameters of the product mentioned above.

Product Test Id: 979 Rev: 1

39384

APCO

APCO PIPE FITTINGS CO., LTD.

No. 50, Shiji Road South, Gaoxin Area, Yizheng 113021, China
Tel: 86 431-83546615 Fax: 86 431-83546621

Email: apcnpipes@mail.jl.cn Web: www.apcnpipes.com

CUSTOMER: TFF CANADA INC
P.O. NO.: B-10009MATERIALS TESTING CERTIFICATE
BUTT-WELDING PIPE FITTINGS

EN 10204 3.1

CERTIFICATE NO.
10009-2

MATERIAL STANDARDS: ASTM A234 WPB/ASME SA234-WPB 2007

DIMENSION STANDARD: ANSI B16.9-2007

SPECIAL CONDITIONS: Caps: Made of steel plate Others: Made of seamless pipes

CE = C + $\frac{Mn}{8}$ + $\frac{Cr+Mo+V}{5}$ + $\frac{Ni+Cu}{15}$

APCO PED CERTIFICATE No VC3260/331

APCO ISO CERTIFICATE NO 00159011791R2S2200

APCD ISO CERTIFICATE NO 00159011791R25/2200					MECHANICAL PROPERTIES					CHEMICAL COMPOSITION														
MINIMUM STANDARD AS PER ABOVE SPECIFICATIONS					415 Mpa	240 Mpa	Elongation	197 HB	COLD	HOT	0.3	0.25 To	0.05	0.058	0.1	0.4	C.15	0.4	0.4	0.08	0.02	0.5		
ITEM	NPS	DESCRIPTION	QTY	HEAT #	TENSILE	YIELD	(longitudinal)	FORM	FORMED	max													max	max
					MIN	MIN	22%	HARDEN	Y/N	TEMP C	C	Min	P	S	Si	Cr	Mo	Ni	Cu	V	Nb	C		
27	4"	TEE STD	100	34173	475	280	32	125	YES	-	0.18	0.55	0.012	0.008	0.24	0.02	0.03	0.02	0.05	0.008	0.009	0.29		
28	6"	TEE STD	75	34903	475	330	33	125	YES	-	0.20	0.57	0.015	0.009	0.27	0.05	0.01	0.03	0.06	0.009	0.006	0.32		
29	8"	TEE STD	25	45114	475	290	33	125	YES	-	0.20	0.50	0.011	0.005	0.25	0.06	0.02	0.04	0.05	0.005	0.009	0.31		
30	3x2-1/2"	TEE STD	25	99873	472	285	35	124	YES	-	0.20	0.55	0.013	0.005	0.25	0.04	0.04	0.03	0.05	0.009	0.008	0.31		
31	6x4"	TEE STD	25	34003	475	330	33	125	YES	-	0.20	0.57	0.015	0.009	0.27	0.05	0.01	0.03	0.06	0.009	0.008	0.32		
32	8x4"	TEE STD	15	45114	475	290	33	125	YES	-	0.20	0.50	0.011	0.005	0.25	0.06	0.02	0.04	0.05	0.005	0.009	0.31		
33	10x6"	TEE STD	15	84604	465	285	32	122	YES	-	0.20	0.52	0.015	0.006	0.23	0.06	0.02	0.04	0.05	0.006	0.007	0.31		
34	10x6"	TEE STD	5	84604	465	295	32	122	YES	-	0.20	0.52	0.015	0.006	0.23	0.06	0.02	0.04	0.05	0.006	0.007	0.31		
35	2x1-1/4"	CON RED STD	25	18545	465	275	33	123	NO	870	0.20	0.51	0.015	0.009	0.25	0.05	0.02	0.04	0.05	0.009	0.007	0.31		
36	2-1/2x1-1/2"	CON RED STD	25	56026	465	280	32	122	NO	870	0.20	0.49	0.017	0.007	0.25	0.03	0.04	0.05	0.04	0.008	0.007	0.30		
37	2-1/2x2"	CON RED STD	25	58026	465	280	32	122	YES	-	0.20	0.49	0.017	0.007	0.25	0.03	0.04	0.05	0.04	0.008	0.007	0.30		
38	3x1-1/2"	CON RED STD	15	99873	472	285	35	124	NO	870	0.20	0.55	0.013	0.005	0.25	0.03	0.04	0.05	0.04	0.008	0.007	0.30		
39	3x2"	CON RED STD	150	99873	472	285	35	124	NO	870	0.20	0.55	0.013	0.005	0.25	0.04	0.04	0.03	0.05	0.009	0.006	0.31		
40	3x2-1/2"	CON RED STD	100	99873	472	285	35	124	NO	870	0.20	0.55	0.013	0.005	0.25	0.04	0.04	0.03	0.05	0.009	0.008	0.31		
41	4x2"	CON RED STD	100	34173	475	280	32	125	NO	870	0.18	0.55	0.012	0.008	0.24	0.02	0.03	0.02	0.05	0.008	0.009	0.29		
42	4x2-1/2"	CON RED STD	40	34173	475	280	32	125	NO	870	0.18	0.55	0.012	0.008	0.24	0.02	0.03	0.02	0.05	0.008	0.009	0.29		
43	4x3"	CON RED STD	100	34173	475	280	32	125	NO	870	0.18	0.55	0.012	0.008	0.24	0.02	0.03	0.02	0.05	0.008	0.009	0.29		
44	5x4"	CON RED STD	25	11781	473	285	35	124	NO	870	0.18	0.52	0.013	0.005	0.24	0.02	0.03	0.02	0.05	0.008	0.009	0.29		
45	6x3"	CON RED STD	25	34003	475	330	33	125	NO	870	0.20	0.57	0.015	0.009	0.27	0.04	0.05	0.05	0.05	0.008	0.009	0.29		
46	6x4"	CON RED STD	100	34003	475	330	33	125	NO	870	0.20	0.57	0.015	0.009	0.27	0.05	0.01	0.03	0.06	0.008	0.009	0.32		
47	6x5"	CON RED STD	10	34003	475	330	33	125	NO	870	0.20	0.57	0.015	0.009	0.27	0.05	0.01	0.03	0.06	0.008	0.009	0.32		
48	8x3"	CON RED STD	100	45114	475	290	33	125	NO	870	0.20	0.50	0.011	0.005	0.25	0.06	0.02	0.04	0.05	0.005	0.009	0.31		
49	8x4"	CON RED STD	25	45114	475	290	33	125	NO	870	0.20	0.50	0.011	0.005	0.25	0.06	0.02	0.04	0.05	0.005	0.009	0.31		
50	8x6"	CON RED STD	25	45114	475	290	33	125	NO	870	0.20	0.50	0.011	0.005	0.25	0.06	0.02	0.04	0.05	0.005	0.009	0.31		
51	10x6"	CON RED STD	25	84604	465	285	32	122	NO	870	0.20	0.52	0.015	0.006	0.23	0.06	0.02	0.04	0.05	0.006	0.007	0.31		
52	2-1/2x2"	CON RED STD	25	56026	465	280	32	122	NO	870	0.20	0.49	0.017	0.007	0.25	0.03	0.04	0.05	0.04	0.008	0.007	0.30		
We hereby certify that the material described herein has been inspected and certified to be accordance with																								

We hereby certify that the material described herein has been inspected/tested satisfactorily in accordance with the standards specified above and purchase order requirements.

- REMARKS: 1 VISUAL EXAMINATION: GOOD
2 DIMENSIONAL EXAMINATION: GOOD
3 MELTING PROCEDURE: E
4 MATERIAL IN ACCORDANCE WITH NACE MR0175-2002
5 HEAT TREATMENT: HOT FORMED FITTINGS HAVE BEEN FORMED AT TEMP 870 C AND COOLED IN STILL AIR

DATE: Dec 17, 2010

APCO PIPE FITTINGS CO., LTD.

CHIEF ENGINEER:

Version: 20080603

Accepted
T. Carriere

Appendix I.4: Quality Assurance Testing Field Measurements

Project: **Hope Bay - North Dam**
 Client: Hope Bay Mining Ltd

Project #: 1CH008.058

Thermosyphon Station: South Thermosyphon Radiations
Thermosyphon Component: Evaporator Pipe - as it exits the dam fill
Equipment:

Notes: Evaporator pipe numbers correspond to the numbers used in Drawing HB+T-CIV-CIV-OND-0024

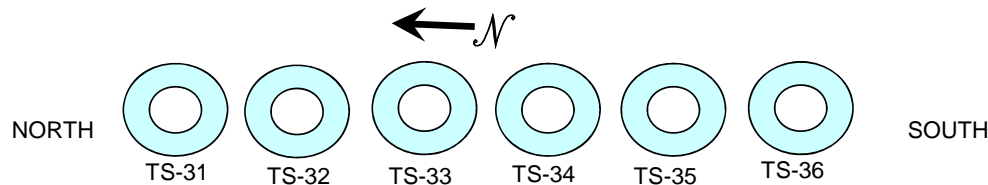
Pipe preparation: a thermocouple was placed on the white vertical section of the evaporator pipe, covered with silver bubble wrap pipe insulation and held in place with a bungee cord.

Readings were taken minimum 10 minutes after pipe was prepared.

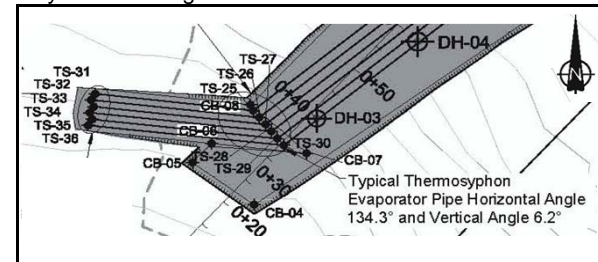
Date	Time	Read By	Reading (kΩ) at Dial Setting			Temp (°C)	Δ Temp (°C)	Comment
			Measured			Calculated	Calculated	
			SB12	SB16	SB17			
25-Mar-12	4:30	JBK	94.70	94.60	94.60	-30.86		Ambient Air Temperature before start of readings (average of 3 beads)
25-Mar-12	4:52	JBK		65.40		-24.94	-6.24	Evaporator Pipe TS-31
25-Mar-12	4:59	JBK	66.20			-25.14	-6.04	Evaporator Pipe TS-32
25-Mar-12	5:04	JBK			68.10	-25.61	-5.57	Evaporator Pipe TS-33
25-Mar-12	5:15	JBK		68.20		-25.63	-5.55	Evaporator Pipe TS-34
25-Mar-12	5:19	JBK			65.80	-25.04	-6.14	Evaporator Pipe TS-35
25-Mar-12	5:16	JBK	64.80			-24.79	-6.39	Evaporator Pipe TS-36
25-Mar-12	5:26	JBK	98.70	98.80	98.50	-31.51		Ambient Air Temperature after end of the readings (average of 3 beads)
							-31.18	Average Ambient Air Temperature (average of 3 beads)

Notes:

- Three thermosyphons were tested at a time using three different single beads (beads 12, 16 and 17).
- Silver Hi-Performance A2A Reflective Insulation 'Ayr Foil™' (similar to aluminum double sided bubble wrap) used.



Layout from Dwg: HB+T-CIV-CIV-OND-0024



Project: **Hope Bay - North Dam**
 Client: Hope Bay Mining Ltd

Project #: 1CH008.058

Thermosyphon Station: North Thermosyphon Radiations
Thermosyphon Component: Evaporator Pipe - as it exits the dam fill
Equipment:

Notes: Evaporator pipe numbers correspond to the numbers used in Drawing HB+T-CIV-CIV-OND-0024

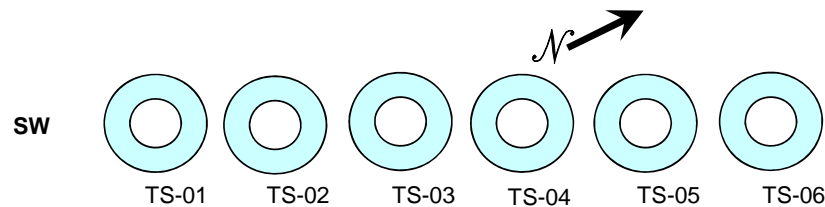
Pipe preparation: a thermocouple was placed on the white vertical section of the evaporator pipe, covered with silver bubble wrap pipe insulation and held in place with a bungee cord.

Readings were taken minimum 10 minutes after pipe was prepared.

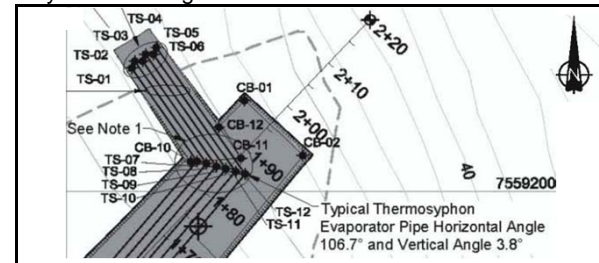
Date	Time	Read By	Reading (kΩ) at Dial Setting			Temp (°C)	Δ Temp (°C)	Comment
			Measured			Calculated	Calculated	
			SB12	SB16	SB17			
25-Mar-12	5:35	JBK	93.90	93.70	94.10	-30.74		Ambient Air Temperature before start of readings
25-Mar-12	5:58	JBK		51.70		-21.03	-9.66	Evaporator Pipe TS-01
25-Mar-12	6:08	JBK	82.30			-28.66	-2.03	Evaporator Pipe TS-02
25-Mar-12	6:03	JBK			53.00	-21.45	-9.24	Evaporator Pipe TS-03
25-Mar-12	6:22	JBK	55.30			-22.16	-8.53	Evaporator Pipe TS-04
25-Mar-12	6:20	JBK		55.30		-22.16	-8.53	Evaporator Pipe TS-05
25-Mar-12	6:21	JBK			53.50	-21.60	-9.08	Evaporator Pipe TS-06
25-Mar-12	6:40	JBK	93.20	93.50	93.30	-30.64		Ambient Air Temperature after end of the readings
							-30.69	Average Ambient Air Temperature

Notes:

- Three thermosyphons were tested at a time using three different single beads (beads 12, 16 and 17).
- Silver Hi-Performance A2A Reflective Insulation 'Ayr Foil™' (similar to aluminum double sided bubble wrap) used.



Layout from Dwg: HB+T-CIV-CIV-OND-0024



Project: **Hope Bay - North Dam**
 Client: Hope Bay Mining Ltd

Project #: 1CH008.058

Thermosyphon Station: South Thermosyphon Radiations
Thermosyphon Component: Evaporator Pipe - as it exits the dam fill
Equipment:

Notes: Evaporator pipe numbers correspond to the numbers used in Drawing HB+T-CIV-CIV-OND-0024

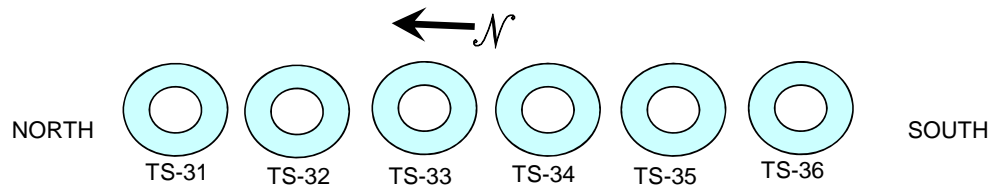
Pipe preparation: a thermocouple was placed on the white vertical section of the evaporator pipe, covered with silver bubble wrap pipe insulation and held in place with a bungee cord.

Readings were taken minimum 10 minutes after pipe was prepared.

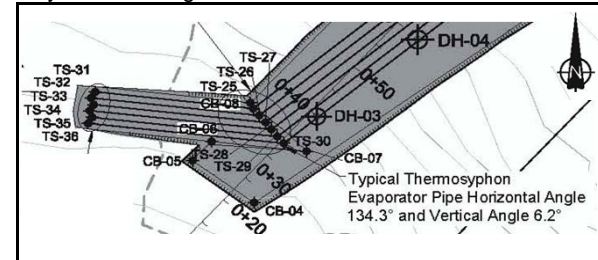
Date	Time	Read By	Reading (kΩ) at Dial Setting			Temp (°C) Calculated	Δ Temp (°C) Calculated	Comment
			SB12	SB16	SB17			
								Ambient Air Temperature before start of readings (average of 3 beads)
								Evaporator Pipe TS-31
								Evaporator Pipe TS-32
								Evaporator Pipe TS-33
								Evaporator Pipe TS-34
								Evaporator Pipe TS-35
								Evaporator Pipe TS-36
								Ambient Air Temperature after end of the readings (average of 3 beads)
								Average Ambient Air Temperature (average of 3 beads)

Notes:

- Three thermosyphons were tested at a time using three different single beads (beads 12, 16 and 17).
- Silver Hi-Performance A2A Reflective Insulation 'Ayr Foil™' (similar to aluminum double sided bubble wrap) used.



Layout from Dwg: HB+T-CIV-CIV-OND-0024



Project: **Hope Bay - North Dam**
 Client: Hope Bay Mining Ltd

Project #: 1CH008.058

Thermosyphon Station: North Thermosyphon Radiations
Thermosyphon Component: Evaporator Pipe - as it exits the dam fill
Equipment:

Notes: Evaporator pipe numbers correspond to the numbers used in Drawing HB+T-CIV-CIV-OND-0024

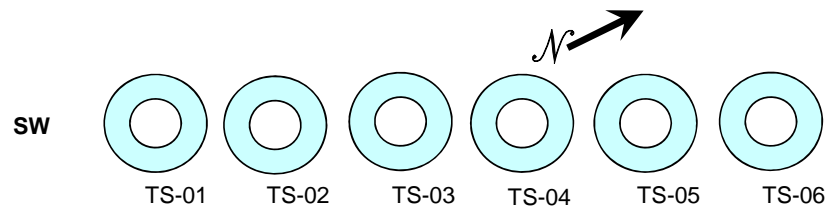
Pipe preparation: a thermocouple was placed on the white vertical section of the evaporator pipe, covered with silver bubble wrap pipe insulation and held in place with a bungee cord.

Readings were taken minimum 10 minutes after pipe was prepared.

Date	Time	Read By	Reading (kΩ) at Dial Setting			Temp (°C)	Δ Temp (°C)	Comment
			Measured			Calculated	Calculated	
			SB12	SB16	SB17			
8-Apr-12	8:50	IM	56.80	56.40		-22.55		Ambient Air Temperature before start of readings
8-Apr-12	8:55	IM	43.90			-18.23	-4.32	Evaporator Pipe TS-01
8-Apr-12	8:55	IM		54.10		-21.79	-0.76	Evaporator Pipe TS-02
8-Apr-12	8:55	IM			44.90	-18.62	-3.93	Evaporator Pipe TS-03
8-Apr-12	9:20	IM	44.00			-18.27	-2.69	Evaporator Pipe TS-04
8-Apr-12	9:20	IM		44.30		-18.39	-2.58	Evaporator Pipe TS-05
8-Apr-12	9:20	IM			43.40	-18.03	-2.93	Evaporator Pipe TS-06
8-Apr-12	9:25	IM	51.50			-20.96		Ambient Air Temperature after end of the readings
							-21.76	Average Ambient Air Temperature

Notes:

- Three thermosyphons were tested at a time using three different single beads (beads 12, 16 and 17).
- Silver Hi-Performance A2A Reflective Insulation 'Ayr Foil™' (similar to aluminum double sided bubble wrap) used.



Layout from Dwg: HB+T-CIV-CIV-OND-0024

