



## **CALHEX INDUSTRIES LTD.**

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# **DATA BOOK**

## **Installation, Maintenance and Operation Manuals**

### **Shell and Tube Heat Exchanger**

**Customer:** SPECTRUM PROCESS LTD.  
**For:** ENCANA CORP.  
**Description:** WARM LEAN / RICH GLYCOL EXCHANGER  
**Calhex Industries Job #:** 13-0856  
**Tag#:** E-322A  
**Purchase Order #:** 002359  
**C.R.N.#** W3145.21

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| LINE NO.   | REV NO. | CALHEX INDUSTRIES LIMITED   |   | Rev. No.:  | 2  |  |  |
|--|---------|---|---|--|--|--|--|
|  |         | 9515-48th Street SE Calgary, Alberta                                |   | Cust. Ref. #:  | Q13-023  |  |  |
| <b>SHELL and TUBE HEAT EXCHANGER SPECIFICATION SHEET - Metric Unit</b> |         |   |   |  |  |  |  |
| 1  | 0       | Customer: SPECTRUM PROCESS SYSTEMS                                  |   |  | Prop. No.:   | Q-13-2315                                |  |
| 2  | 0       | Address: Calgary, Alberta   |   |  | Date:  | August 29, 2013                          |  |
| 3  | 0       | Plant Location: Encana - Solaris, Saturn Compressor Station         |   |  | Ref. No.:  | Q-13-2315 E-101 A R0                     |  |
| 4  | 2       | Service of Unit: Warm Lean / Rich Glycol Exchanger                  |   |  | Item No.:  | E-322 A                                  |  |
| 5  | 1       | TEMA type & Size (mm):  | NEN 203 x 8534  | Connected In:  | 2-serie / 1-parallel   |  |  |
| 6  | 0       | Surface Area (m <sup>2</sup> ) ---->                                | Per Unit (eff.) / Per Shell (gross) / Per Shell (eff.): |  |  | 143.8 / 144.3 / 143.8                    |  |
| <b>PERFORMANCE OF ONE UNIT</b>   |         |   |   |  |  |  |  |
| 8  | 0       | Fluid Allocation  | <b>SHELL SIDE</b>                                       |  | <b>TUBE SIDE</b>   |  |  |
| 9  | 0       | Fluid Name  | Lean Glycol (TEG 99.7)                                  |  | Rich Glycol (TEG 94.9)                                       |  |  |
| 10   | 0       | Fluid Quantity (Total) kg/hr  | 8,485.9   |  | 8,766.3  |  |  |
| 11   | 0       | Vapor (In/Out) kg/hr  | --  | --   | --   | --                                       |  |
| 12   | 0       | Liquid kg/hr  | 8,485.9   | 8,485.9  | 8,766.3  | 8,766.3                                  |  |
| 13   | 0       | Steam kg/hr   | --  | --   | --   | --                                       |  |
| 14   | 0       | Water kg/hr   | --  | --   | --   | --                                       |  |
| 15   | 0       | Non-Condensables kg/hr  | --  | --   | --   | --                                       |  |
| 16   | 0       | Temperature (In/Out) °C   | 174.2   | 127.2  | 98.9   | 148.9                                    |  |
| 17   | 0       | Density Kg/m <sup>3</sup>   | -- V/L 998.6  | -- V/L 1037.7  | -- V/L 1061.5  | -- V/L 1022.0                            |  |
| 18   | 0       | Viscosity cP  | -- V/L 0.3552   | -- V/L 1.9968  | -- V/L 2.9565  | -- V/L 0.6408                            |  |
| 19   | 0       | Molecular Weight, Vapor   | --  | --   | --   | --                                       |  |
| 20   | 0       | Molecular Weight, Non-Condensables                                  | --  | --   | --   | --                                       |  |
| 21   | 0       | Specific Heat kJ/kg.°C  | -- V/L 3.041  | -- V/L 2.758   | -- V/L 2.705   | -- V/L 2.931                             |  |
| 22   | 0       | Thermal Conductivity W/m.°C   | -- V/L 0.132  | -- V/L 0.176   | -- V/L 0.223   | -- V/L 0.208                             |  |
| 23   | 0       | Latent Heat kJ/kg   | --  | --   | --   | --                                       |  |
| 24   | 0       | Inlet Pressure kPa (abs)  | 120.7   |  | 720.5  |  |  |
| 25   | 0       | Velocity, Average m/sec   | 0.09  |  | 0.49   |  |  |
| 26   | 0       | Pressure Drop, Allow./Calc. kPa                                     | 3.4   | 4.4  | 17.2   | 14.8                                     |  |
| 27   | 0       | Fouling Resistance (min) m <sup>2</sup> .°C/W                       | 0.000176  |  | 0.000176   |  |  |
| 28   | 0       | Total Heat Exchanged: 314.9 kW                                      | MTD (Corrected): 26.7 °C                                |  |  |  |  |
| 29   | 0       | Transfer Rate (W/m <sup>2</sup> .°C) -->                            | Service / Clean: 82.16 / 101.98                         |  |  |  |  |
| <b>CONSTRUCTION OF ONE SHELL</b>                                       |         |   |   |  |  | Sketch:                                  |  |
|  |         | Shell Side  |   | Tube Side  |  |  |  |
| 32   | 0       | Design/Vac./Test Pressure kPa                                       | 1,380   | --   | Code   | 1,380 -- Code                            |  |
| 33   | 0       | Design Temperature (Max/Min) °C                                     | 204   | /  | -29  | 204 / -29                                |  |
| 34   | 0       | No Passes per Shell   | 1   |  | 1  |  |  |
| 35   | 1       | Corrosion Allowance mm  | 1.6   |  | 1.6  |  |  |
| 36   | 0       | Connections   | Inlet: (1) 3  | 150# RFWN  | (1) 2  | 150# RFWN                                |  |
| 37   | 0       | Nominal Size & Rating (Inches)                                      | Outlet: (1) 3   | 150# RFWN  | (1) 2  | 150# RFWN                                |  |
| 38   | 0       | Intermediate: (--) ---  | 150# RFWN   | (--) ---   | 150# RFWN  |  |  |
|  |         | <b>SHELL DETAILS</b>  |   | <b>BAFFLE &amp; BUNDLE INTERNAL DETAILS</b>  |  | <b>TUBE DETAILS</b>                      |  |
| 40   | 0       | Shell Cylinder / Head   | SA-106-B  | Stationary Tubesheet(s)  | SA-516-70N   | Matl. SA-179                             |  |
| 41   | 0       | Shell Cyl. ID / OD (mm)   | 202.7 219.1   | Floating Tubesheet   | N/A  | Tube No. 68                              |  |
| 42   | 0       | Kettle Cyl. ID / OD (mm)  | n/a n/a   | Baffle Material  | G-44W (SA-36)  | OD (mm) 15.88                            |  |
| 43   | 0       | Shell Girth Flange(s)   | N/A   | Baffle Type / Orientation  | Single-Seg. / Perpend.                                       | Thickness (mm) 2,1082                    |  |
| 44   | 0       | Aux. Shell Cyl./OD (mm)   | n/a n/a   | Baffle No.   | 22   | Length (mm) 8,534                        |  |
| 45   | 0       | Expansion Jt. / Mat.  | n/a   | Spacing (Frt/C-C/Rear) (mm)  | 364 / 368 / 364  | Pitch (mm) 20.64                         |  |
| 46   | 0       | Shell Nozz. Fig.  | SA-105 N  | Baffle Cut (% Dia.)  | 41.18%   | Layout Ang. 30 deg                       |  |
| 47   | 0       | Shell Nozz. Neck  | SA-106-B  | Longitudinal Baffle / Seal   | n/a  | n/a                                      |  |
|  |         | <b>CHANNEL DETAILS</b>  |   | <b>GASKET &amp; BOLTING DETAILS</b>  |  |  |  |
| 49   | 0       | Front Ch. Cylinder  | SA-106-B  | Shell Side Girth:  | n/a  | N/A                                      |  |
| 50   | 0       | Frt. Ch. Cyl. ID / OD (mm)  | 202.7 219.1   | Tube Side Girth:   | Spiral Wnd T-316SS "CG"                                      | supplied                                 |  |
| 51   | 0       | Rear Ch. Cylinder   | SA-106-B  | Floating head:   | n/a  | n/a                                      |  |
| 52   | 0       | Rr. Ch. Cyl. ID / OD (mm)   | 202.7 219.1   | Shell side nozzles:  | Spiral Wnd T-316SS "CG"                                      | By customer                              |  |
| 53   | 0       | Front Ch. G.Fl./ Cvr.   | SA-105 N SA-105 N                                       | Tube side nozzles:   | Spiral Wnd T-316SS "CG"                                      | By customer                              |  |
| 54   | 1       | Rear Ch. G.Fl./ Cvr.  | SA-105 N SA-234-WPB                                     | Girth Bolting:   | SA-193-B7 <sup>2</sup>                                       | Floating Hd. Bolting: --- <sup>2</sup>   |  |
| 55   | 1       | Channel Nozz. Flg.  | SA-105 N  | SS Nozz. Bolting:  | SA-193-B7 <sup>2</sup>                                       | TS Nozz. Bolting: SA-193-B7 <sup>2</sup> |  |
| 56   | 0       | Channel Nozz. Neck  | SA-106-B  | 1- Bare bolt and nut, 2- Painted Bolt and nut, 3- Electro Galvanized, 4- Hot Dipped Galvanized |  |  |  |
| 57   | 0       | Impingement Protection:   | None - Not Required                                     |  | Tube to Tubesheet Joint: Dbl. Ring Grooved - Rolled Expanded |  |  |
| 58   | 0       | Est. Wgts per shell:  | Wet: 1,267 Kg   | Dry: 1,023 Kg  | Bundle:  | Fixed Kg                                 |  |
| 59   | 0       | Rho-V-Sqrd (kg/m-sec <sup>2</sup> ):                                | Shell Inlet/Outlet: 307 / 299                           | Tube Inlet/Outlet: 2716 / 2790   |  |  |  |
| 60   | -       | Code Requirements:  | ASME Sec VIII, Div.1                                    | Registered In:   | AB   | TEMA Type: 'R'                           |  |
| 61   | 0       | <b>Remarks:</b> Thermal Rating By Shell and Tube Software HTRI.     |   |  |  |  |  |
| 62   | 0       | 1. Design includes 11.24% excess surface area                       |   |  |  |  |  |
| 63   | 1       | 2. Tube side sweet service  |   |  |  |  |  |
| 64   | 0       | 3. Shell side sweet service   |   |  |  |  |  |
| 65   | 0       | 4. Two shells inseries with flanged interconnectors                 |   |  |  |  |  |
| 66   | 0       | 5. Lo-finned tubes used, 16 ga under the fin 19/in. 14 ga bare ends |   |  |  |  |  |
| 67   | 0       | 6.  |   |  |  |  |  |
| 68   | 0       | 7.  |   |  |  |  |  |
| 69   | 0       | 8.  |   |  |  |  |  |
| 70   | 0       | 9.  |   |  |  |  |  |
| 71   | 0       | 10.   |   |  |  |  |  |







TUBESHEET THICKNESS CALCULATION

Job number: 13-0856
Revision number: 0 Page number: 3 of 13

CODES:

ASME SEC VIII, DIV. 1 2010 ED,2011ADD. UHX-13, & FIG UHX-13.1 (a)

DIMENSIONS & PROPERTIES

Table with 5 columns: Material, Tubes, Channel, Shell, Tubesheet. Rows include Design Pressure, Design Temperature, Mean Oper. Temp.'s, Inlet/Outlet temp., Ambient Allowable Stress, Design temp Allowable Stress, Operating temp Allowable stress, Diameters, Thicknesses, Corrosion Allow., Poisson's ratio, and various Modulus and Coefficient of Thermal Expansion values.

NOTE: Pt & Ps are adjusted for vacuum pressure on opposite side when noted on pg 1. if both sides have vacuum both Ps & Pt are adjusted at the same time for a single conservative calculation, rather than running 2 calcs adjusting Ps and Pt individually.

\* Tube stresses are for seamless tubing per note UHX-11.3 and UHX-13.3

Table with 4 columns: Tube characteristics, No. of Tubes, Tube Length, and various expansion and layout parameters. Rows include Tube joint Expanded/Welded, Tube Pitch, Outer tube limit, Total Area of untubed lanes, Unsupported span, and Tube layout perimeter.

Errors:

EXPANSION JOINT DIMENSIONS AND PROPERTIES

Is an Expansion Joint required? (Y or N): N Joint Material:
Axial Rigidity, Kj = 0 Joint Inside Diameter, Dj = 0
Is Corrosion applicable to joint Material? (Y or N): N

IS THE UNIT TO EXPERIENCE CYCLICAL SERVICE OR DYNAMIC LOADING (Y or N): N

CALCULATIONS

GEOMETRY VALUES

Table with 4 columns: Parameter, Value, Description, Value. Rows include mu, rho new/corr, rho\*, hg, ao, hg' (1 to 3) new/corr, and hg' (4 to 7) both, along with d\* and mu\* values for different load cases and conditions.



**TUBE-SHEET THICKNESS CALCULATION cont.'d**

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$\rho_s$  NEW = 1.0547       $\rho_s$  CORR = 1.0712       $\rho_c$  NEW = 1.0547       $\rho_c$  CORR = 1.0712  
 $L$  NEW = 333.0000       $L$  CORR = 333.1250  
 $X_s$  = 0.5361       $X_t$  = 0.7498

**STIFFNESS FACTORS**

$K_s$  NEW (Case 1 to 3) = 693632.2       $K_t$  NEW (Case 1 to 3) = 11246.8  
 $K_s$  NEW (Case 4 to 7) = 706975.7       $K_t$  NEW (Case 4 to 7) = 11455.0  
 $K_s$  CORR (Case 1 to 3) = 562995.1       $K_t$  CORR (Case 1 to 3) = 11242.6  
 $K_s$  CORR (Case 4 to 7) = 573825.5       $K_t$  CORR (Case 4 to 7) = 11450.7  
 $K_{s,t}$  NEW (Case 1 to 3) = 0.9070       $K_{s,t}$  NEW (Case 4 to 7) = 0.9076  
 $K_{s,t}$  CORR (Case 1 to 3) = 0.7364       $K_{s,t}$  CORR (Case 4 to 7) = 0.7370  
 $J$  NEW (Case 1 to 3) = 1.0000       $J$  NEW (Case 4 to 7) = 1.0000  
 $J$  CORR (Case 1 to 3) = 1.0000       $J$  CORR (Case 4 to 7) = 1.0000

**SHELL COEFFICIENTS**

$B_s$  NEW = 1.1118       $B_s$  CORR = 1.2338  
 $k_s$  NEW (Case 1 to 3) = 186946.7       $k_s$  CORR (Case 1 to 3) = 108590.8  
 $k_s$  NEW (Case 4 to 7) = 190543.0       $k_s$  CORR (Case 4 to 7) = 110679.8  
 $\lambda_s$  NEW (Case 1 to 3) = 12731424.9       $\lambda_s$  CORR (Case 1 to 3) = 10090264.1  
 $\lambda_s$  NEW (Case 4 to 7) = 12976340.4       $\lambda_s$  CORR (Case 4 to 7) = 10284371.4  
 $\delta_s$  NEW (Case 1 to 3) = 0.00000153       $\delta_s$  CORR (Case 1 to 3) = 0.00000196  
 $\delta_s$  NEW (Case 4 to 7) = 0.00000150       $\delta_s$  CORR (Case 4 to 7) = 0.00000192

**CHANNEL COEFFICIENTS**

$B_c$  NEW = 1.1118       $B_c$  CORR = 1.2338  
 $k_c$  NEW (Case 1 to 3) = 186946.7       $k_c$  CORR (Case 1 to 3) = 108590.8  
 $k_c$  NEW (Case 4 to 7) = 190543.0       $k_c$  CORR (Case 4 to 7) = 110679.8  
 $\lambda_c$  NEW (Case 1 to 3) = 12731424.9       $\lambda_c$  CORR (Case 1 to 3) = 10090264.1  
 $\lambda_c$  NEW (Case 4 to 7) = 12976340.4       $\lambda_c$  CORR (Case 4 to 7) = 10284371.4  
 $\delta_c$  NEW (Case 1 to 3) = 0.00000153       $\delta_c$  CORR (Case 1 to 3) = 0.00000196  
 $\delta_c$  NEW (Case 4 to 7) = 0.00000150       $\delta_c$  CORR (Case 4 to 7) = 0.00000192

**TUBELAYOUT GEOMETRY COEFFICIENTS**

$h/p$  NEW = 1.692       $E^*/E$  NEW (Case 1 to 3) = 0.3761       $E^*/E$  CORR (Case 1 to 3) = 0.3821  
 $h/p$  CORR = 1.538       $E^*/E$  NEW (Case 4 to 7) = 0.3764       $E^*/E$  CORR (Case 4 to 7) = 0.3824  
 $v^*$  NEW (Case 1 to 3) = 0.3132       $v^*$  CORR (Case 1 to 3) = 0.3091  
 $v^*$  NEW (Case 4 to 7) = 0.3132       $v^*$  CORR (Case 4 to 7) = 0.3090  
 $X_a$  NEW (Case 1 to 3) = 1.2942       $X_a$  CORR (Case 1 to 3) = 1.3855  
 $X_a$  NEW (Case 4 to 7) = 1.2945       $X_a$  CORR (Case 4 to 7) = 1.3858  
 $Z_d$  NEW (1 -3) = 0.7690       $Z_v$  NEW (1 -3) = 0.1849       $Z_m$  NEW (1 -3) = 0.7451  
 $Z_d$  NEW (4 -7) = 0.7684       $Z_v$  NEW (4 -7) = 0.1849       $Z_m$  NEW (4 -7) = 0.7451  
 $Z_d$  CORR (1 -3) = 0.5986       $Z_v$  CORR (1 -3) = 0.1839       $Z_m$  CORR (1 -3) = 0.7425  
 $Z_d$  CORR (4 -7) = 0.5981       $Z_v$  CORR (4 -7) = 0.1839       $Z_m$  CORR (4 -7) = 0.7425  
 $Z_w$  NEW (1 -3) = 0.1849       $Z_w$  CORR (1 -3) = 0.1839  
 $Z_w$  NEW (4 -7) = 0.1849       $Z_w$  CORR (4 -7) = 0.1839

**TUBESHEET GEOMETRY COEFFICIENTS**

$K$  = 1.1398       $F$  NEW (Case 1 to 3) = 1.9299  
 $F$  NEW (Case 4 to 7) = 1.9326  
 $\Phi$  NEW (Case 1 to 3) = 2.5344       $F$  CORR (Case 1 to 3) = 1.5636  
 $\Phi$  NEW (Case 4 to 7) = 2.5378       $F$  CORR (Case 4 to 7) = 1.5657  
 $\Phi$  CORR (Case 1 to 3) = 2.0468  
 $\Phi$  CORR (Case 4 to 7) = 2.0494



TUBE-SHEET THICKNESS CALCULATION cont.'d

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TUBESHEET LOADING FACTORS

Table with 4 columns: Factor Name, Case 1-3, Case 4-7, and Value. Includes Q1 NEW, Q1 CORR, Q22 NEW, Q22 CORR, QZ1 NEW, QZ1 CORR, U NEW, and U CORR.

THERMAL EXPANSION LOADING FACTORS

Table with 4 columns: Factor Name, Case 1-3, Case 4-7, and Value. Includes gamma NEW, gamma CORR, omega\_s NEW, omega\_s CORR, omega\*\_s NEW, omega\*\_s CORR, omega\_c NEW, omega\_c CORR, omega\*\_c NEW, and omega\*\_c CORR.

PRESSURE LOADING DUE TO THERMAL EXPANSION UHX-13.8 (for cyclical type service only)

Table with 4 columns: Factor Name, Case 1-3, Case 4-7, and Value. Includes Ps\* NEW & CORR, Ps\* NEW, Ps\* CORR, Ts\*, Pc\* NEW & CORR, Pc\* NEW, Pc\* CORR, and Tc\*.

PRESSURE LOADING ON TUBESHEET

Table with 4 columns: Factor Name, Case 1-3, Case 4-7, and Value. Includes Ps NEW, Ps CORR, Pt NEW, Pt CORR, Py NEW, and Py CORR.

Table with 4 columns: Factor Name, Case 1-3, Case 4-7, and Value. Includes Pw NEW and Pw CORR.

TUBE BUCKLING FACTORS

Table with 4 columns: Factor Name, Value, NEW, and CORR. Includes Tubeshet to Baffle span, Baffle to Baffle span, Tube Yield stress, Ft, and Ct.



**TUBE-SHEET THICKNESS CALCULATION cont.'d**

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**SUMMARY OF LOADS, CO-EFFICIENTS, & STRESSES FOR NEW TUBESHEET**

| Case | $P_s$ | $P_t$ | $\gamma \cdot$ | $P_{S^*}$ | $P_{C^*}$ | $P'_s$ |
|------|-------|-------|----------------|-----------|-----------|--------|
| 1    | 0     | 200.0 | 0              | 0.0       | 0.0       | 0      |
| 2    | 200.0 | 0.00  | 0              | 0.0       | 0.0       | 281.6  |
| 3    | 200.0 | 200.0 | 0              | 0.0       | 0.0       | 281.6  |
| 4    | 0     | 0     | -0.0245        | 0.0       | 0.0       | 0.0    |
| 5    | 0     | 200.0 | -0.0245        | 0.0       | 0.0       | 0.0    |
| 6    | 200.0 | 0     | -0.0245        | 0.0       | 0.0       | 281.5  |
| 7    | 200.0 | 200.0 | -0.0245        | 0.0       | 0.0       | 281.5  |

| Case | $P'_t$ | $P_\gamma$ | $P_\omega$ | $P_w$ | $P_{rim}$ | $P_e$  |
|------|--------|------------|------------|-------|-----------|--------|
| 1    | 398.5  | 0          | 0.0        | 0.0   | -2.5      | -186.5 |
| 2    | 0.0    | 0          | 0.0        | 0.0   | 2.5       | 132.1  |
| 3    | 398.5  | 0          | 0.0        | 0.0   | 0.0       | -54.4  |
| 4    | 0      | -424.0     | 0.0        | 0.0   | 0.0       | -197.2 |
| 5    | 398.3  | -424.0     | 0.0        | 0.0   | -2.5      | -383.7 |
| 6    | 0.0    | -424.0     | 0.0        | 0.0   | 2.5       | -65.1  |
| 7    | 398.3  | -424.0     | 0.0        | 0.0   | 0.0       | -251.6 |

| Case | $Q_2$ | $Q_3$   | $F_m$  | $ \sigma $ | $\sigma_{allowable}$ |
|------|-------|---------|--------|------------|----------------------|
| 1    | 57.1  | -0.1861 | 0.1097 | 2562.5     | 30000                |
| 2    | -57.1 | -0.2038 | 0.1019 | 1686.1     | 30000                |
| 3    | 0.0   | -0.1433 | 0.1300 | 885.7      | 30000                |
| 4    | 0.0   | -0.1434 | 0.1300 | 3209.5     | 65000                |
| 5    | 57.1  | -0.1642 | 0.1201 | 5769.7     | 65000                |
| 6    | -57.1 | -0.0209 | 0.1882 | 1534.1     | 65000                |
| 7    | 0.0   | -0.1434 | 0.1300 | 4094.2     | 65000                |

| Case | $ \tau $ | $\tau_{allowable}$ | $F_{t \min}$ | $F_{t \max}$ |
|------|----------|--------------------|--------------|--------------|
| 1    | 1111.9   | 16000              | 0.9555       | 1.0305       |
| 2    | 787.7    | 16000              | 0.9600       | 1.0260       |
| 3    | 324.2    | 16000              | 0.9446       | 1.0417       |
| 4    | 1175.9   | 16000              | 0.9446       | 1.0417       |
| 5    | 2287.8   | 16000              | 0.9499       | 1.0363       |
| 6    | 388.2    | 16000              | 0.9132       | 1.0735       |
| 7    | 1500.1   | 16000              | 0.9446       | 1.0417       |

| Case | $\sigma_{t1}$ | $\sigma_{t2}$ | $\sigma_{t, allowable}$ | $F_s$ | $S_{tb}$ |
|------|---------------|---------------|-------------------------|-------|----------|
| 1    | 132.2018      | 197.6661      | 13400                   | 2.00  | ...      |
| 2    | -91.8336      | -132.5995     | 13400                   | 2.00  | 5740.7   |
| 3    | 40.3682       | 65.0666       | 13400                   | 2.00  | ...      |
| 4    | 871.8300      | 961.4526      | 26800                   | 2.00  | ...      |
| 5    | 1003.9819     | 1159.1008     | 26800                   | 2.00  | ...      |
| 6    | 779.9821      | 828.8113      | 26800                   | 2.00  | ...      |
| 7    | 912.1341      | 1026.4595     | 26800                   | 2.00  | ...      |

Wt = 163.8



**TUBE-SHEET THICKNESS CALCULATION cont.'d**

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| Case | $\sigma_{s,m}$ | $\sigma_{s,b}$ | $\sigma_s$ | $\sigma_{c,m}$ | $\sigma_{c,b}$ | $\sigma_c$ |
|------|----------------|----------------|------------|----------------|----------------|------------|
| 1    | 69.6           | -1830.9        | 1900.5     | 1146.8         | 5471.4         | 6618.1     |
| 2    | 796.9          | 4170.0         | 4966.9     | 0.0            | -910.4         | 910.4      |
| 3    | 866.5          | 2339.1         | 3205.6     | 1146.8         | 4561.0         | 5707.8     |
| 4    | -1016.6        | -2677.0        | 3693.7     | 0.0            | 3209.3         | 3209.3     |
| 5    | -947.1         | -4509.2        | 5456.2     | 1146.8         | 8682.0         | 9828.7     |
| 6    | -219.7         | 1493.8         | 1713.5     | 0.0            | 2298.2         | 2298.2     |
| 7    | -150.1         | -338.4         | 488.5      | 1146.8         | 7770.8         | 8917.6     |

| Case | $\sigma_{s, Allowable}$ | $\sigma_{c, Allowable}$ |
|------|-------------------------|-------------------------|
| 1    | 25650.0                 | 25650.0                 |
| 2    | 25650.0                 | 25650.0                 |
| 3    | 25650.0                 | 25650.0                 |
| 4    | 59800.0                 | 59800.0                 |
| 5    | 59800.0                 | 59800.0                 |
| 6    | 59800.0                 | 59800.0                 |
| 7    | 59800.0                 | 59800.0                 |

**ELASTIC - PLASTIC CALCULATION FOR TUBESHEET TO SHELL & / OR CHANNEL (UHX-13.7 if required)**

| Case:            | Shell to Tubesheet |   |   | Channel to Tubesheet |   |   |
|------------------|--------------------|---|---|----------------------|---|---|
|                  | 1                  | 2 | 3 | 1                    | 2 | 3 |
| $S_{s/c}^*$      | -                  | - | - | -                    | - | - |
| $Fact_{s/c}$     | -                  | - | - | -                    | - | - |
| $k_{s,c}$        | -                  | - | - | -                    | - | - |
| $\lambda_{s,c}$  | -                  | - | - | -                    | - | - |
| F                | -                  | - | - | -                    | - | - |
| $\Phi$           | -                  | - | - | -                    | - | - |
| $Q_1$            | -                  | - | - | -                    | - | - |
| $Q_{z1}$         | -                  | - | - | -                    | - | - |
| $Q_{z2}$         | -                  | - | - | -                    | - | - |
| U                | -                  | - | - | -                    | - | - |
| $P_w$            | -                  | - | - | -                    | - | - |
| $P_w$            | -                  | - | - | -                    | - | - |
| $P_{rim}$        | -                  | - | - | -                    | - | - |
| $P_e$            | -                  | - | - | -                    | - | - |
| $Q_2$            | -                  | - | - | -                    | - | - |
| $Q_3$            | -                  | - | - | -                    | - | - |
| $F_m$            | -                  | - | - | -                    | - | - |
| $ \sigma $       | -                  | - | - | -                    | - | - |
| $ \sigma _{all}$ | -                  | - | - | -                    | - | - |



**TUBE-SHEET THICKNESS CALCULATION cont.'d**

Job number: 13-0856  
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**SUMMARY OF LOADS, CO-EFFICIENTS, & STRESSES FOR CORRODED TUBESHEET**

| Case | $P_s$ | $P_t$ | $\gamma_s$ | $P_{S_s}$ | $P_{C_s}$ | $P'_s$ |
|------|-------|-------|------------|-----------|-----------|--------|
| 1    | 0     | 200.0 | 0          | 0.0       | 0.0       | 0      |
| 2    | 200.0 | 0     | 0          | 0.0       | 0.0       | 306.1  |
| 3    | 200.0 | 200.0 | 0          | 0.0       | 0.0       | 306.1  |
| 4    | 0     | 0     | -0.0245    | 0.0       | 0.0       | 0.0    |
| 5    | 0     | 200.0 | -0.0245    | 0.0       | 0.0       | 0.0    |
| 6    | 200.0 | 0     | -0.0245    | 0.0       | 0.0       | 306.0  |
| 7    | 200.0 | 200.0 | -0.0245    | 0.0       | 0.0       | 306.0  |

| Case | $P'_t$ | $P_\gamma$ | $P_\omega$ | $P_w$ | $P_{rim}$ | $P_e$  |
|------|--------|------------|------------|-------|-----------|--------|
| 1    | 449.6  | 0          | 0.0        | 0.0   | -3.3      | -186.2 |
| 2    | 0      | 0          | 0.0        | 0.0   | 3.3       | 127.2  |
| 3    | 449.6  | 0          | 0.0        | 0.0   | 0.0       | -59.0  |
| 4    | 0      | -424.0     | 0.0        | 0.0   | 0.0       | -174.4 |
| 5    | 449.4  | -424.0     | 0.0        | 0.0   | -3.3      | -360.6 |
| 6    | 0      | -424.0     | 0.0        | 0.0   | 3.3       | -47.2  |
| 7    | 449.4  | -424.0     | 0.0        | 0.0   | 0.0       | -233.4 |

| Case | $Q_2$ | $Q_3$   | $F_m$  | $ \sigma $ | $\sigma_{allowable}$ |
|------|-------|---------|--------|------------|----------------------|
| 1    | 53.7  | -0.1614 | 0.1199 | 3383.1     | 30000                |
| 2    | -53.7 | -0.1800 | 0.1111 | 2142.8     | 30000                |
| 3    | 0.0   | -0.1211 | 0.1387 | 1240.3     | 30000                |
| 4    | 0.0   | -0.1212 | 0.1387 | 3663.1     | 65000                |
| 5    | 53.6  | -0.1420 | 0.1289 | 7042.9     | 65000                |
| 6    | -53.6 | 0.0377  | 0.2130 | 1522.0     | 65000                |
| 7    | 0.0   | -0.1212 | 0.1387 | 4901.9     | 65000                |

| Case | $ \tau $ | $\tau_{allowable}$ | $F_{t\ min}$ | $F_{t\ max}$ |
|------|----------|--------------------|--------------|--------------|
| 1    | 1221.1   | 16000              | 0.9466       | 1.0352       |
| 2    | 834.2    | 16000              | 0.9543       | 1.0274       |
| 3    | 386.9    | 16000              | 0.9300       | 1.0521       |
| 4    | 1143.7   | 16000              | 0.9205       | 1.0618       |
| 5    | 2364.7   | 16000              | 0.9274       | 1.0547       |
| 6    | 309.4    | 16000              | 0.8675       | 1.1156       |
| 7    | 1530.5   | 16000              | 0.9205       | 1.0618       |

| Case | $\sigma_{t,1}$ | $\sigma_{t,2}$ | $\sigma_{t,O\ allowable}$ | $F_s$ | $S_{tb}$ |
|------|----------------|----------------|---------------------------|-------|----------|
| 1    | 123.0548       | 200.2370       | 13400                     | 2.00  | 5740.7   |
| 2    | -66.3228       | -109.8192      | 13400                     | 2.00  | 5740.7   |
| 3    | 56.7320        | 90.4178        | 13400                     | 2.00  | ...      |
| 4    | 751.1633       | 866.5034       | 26800                     | 2.00  | ...      |
| 5    | 863.0814       | 1077.9940      | 26800                     | 2.00  | ...      |
| 6    | 693.2751       | 748.0489       | 26800                     | 2.00  | ...      |
| 7    | 805.1933       | 959.5394       | 26800                     | 2.00  | ...      |

Wt = 152.4



**TUBE-SHEET THICKNESS CALCULATION cont.'d**

Job number: 13-0856  
 Revision number: 0 | Page number: 9 of 13

| Case | $\sigma_{s,m}$ | $\sigma_{s,b}$ | $\sigma_s$ | $\sigma_{c,m}$ | $\sigma_{c,b}$ | $\sigma_c$ |
|------|----------------|----------------|------------|----------------|----------------|------------|
| 1    | 88.3           | -2973.6        | 3061.9     | 1467.9         | 7598.4         | 9066.2     |
| 2    | 1002.3         | 5709.1         | 6711.4     | 0.0            | -1566.7        | 1566.7     |
| 3    | 1090.6         | 2735.5         | 3826.0     | 1467.9         | 6031.6         | 7499.5     |
| 4    | -1115.4        | -3436.1        | 4551.5     | 0.0            | 4024.8         | 4024.8     |
| 5    | -1027.1        | -6412.1        | 7439.2     | 1467.9         | 11625.5        | 13093.4    |
| 6    | -113.0         | 2274.4         | 2387.4     | 0.0            | 2456.6         | 2456.6     |
| 7    | -24.7          | -701.6         | 726.3      | 1467.9         | 10057.3        | 11525.2    |

| Case | $\sigma_{s, Allowable}$ | $\sigma_{c, Allowable}$ |
|------|-------------------------|-------------------------|
| 1    | 25650.0                 | 25650.0                 |
| 2    | 25650.0                 | 25650.0                 |
| 3    | 25650.0                 | 25650.0                 |
| 4    | 59800.0                 | 59800.0                 |
| 5    | 59800.0                 | 59800.0                 |
| 6    | 59800.0                 | 59800.0                 |
| 7    | 59800.0                 | 59800.0                 |

**ELASTIC - PLASTIC CALCULATION FOR TUBESHEET TO SHELL & / OR CHANNEL (UHX-13.7 if required)**

| Case:            | Shell to Tubesheet |   |   | Channel to Tubesheet |   |   |
|------------------|--------------------|---|---|----------------------|---|---|
|                  | 1                  | 2 | 3 | 1                    | 2 | 3 |
| $S^*_{s/c}$      | -                  | - | - | -                    | - | - |
| $Fact_{s/c}$     | -                  | - | - | -                    | - | - |
| $k_{s,c}$        | -                  | - | - | -                    | - | - |
| $\lambda_{s,c}$  | -                  | - | - | -                    | - | - |
| F                | -                  | - | - | -                    | - | - |
| $\Phi$           | -                  | - | - | -                    | - | - |
| $Q_1$            | -                  | - | - | -                    | - | - |
| $Q_{z1}$         | -                  | - | - | -                    | - | - |
| $Q_{z2}$         | -                  | - | - | -                    | - | - |
| U                | -                  | - | - | -                    | - | - |
| $P_w$            | -                  | - | - | -                    | - | - |
| $P_w$            | -                  | - | - | -                    | - | - |
| $P_{rim}$        | -                  | - | - | -                    | - | - |
| $P_e$            | -                  | - | - | -                    | - | - |
| $Q_2$            | -                  | - | - | -                    | - | - |
| $Q_3$            | -                  | - | - | -                    | - | - |
| $F_m$            | -                  | - | - | -                    | - | - |
| $ \sigma $       | -                  | - | - | -                    | - | - |
| $ \sigma _{all}$ | -                  | - | - | -                    | - | - |



**TUBESHEET WELD SIZING**

Job number: 13-0856  
Revision number: 0 | Page number: 10 of 13

CODES:

ASME SEC. VIII, DIV. 1 2010 ED. 2011ADD.: FIG. UW-13.2 (d)

|   | <u>Tube Side</u> | <u>Shell Side</u> |
|---|------------------|-------------------|
| Channel and Shell Outside Diameters:        | 8.625            | 8.625             |
| Channel and Shell Thicknesses:              | 0.322            | 0.322             |
| Tube Sheet Facing Thickness:                | 0.1875           | 0.1875            |
| Facing Outside Diameters:                   | 7.9185           | 7.9185            |
| Channel & Shell ID's - Facing OD's:         | 0.0625           | 0.0625            |
| Corrosion Allowances:                       | 0.0625           | 0.0625            |
| Is the tubesheet Supported or Unsupported : |                  | S                 |
| Tube Sheet weld groove angle (°) :          | 30               | 30                |

**CALCULATIONS**

|   | <u>Tube Side</u> | <u>Shell Side</u> |
|---|------------------|-------------------|
| Actual corroded thicknesses, t, :                                   | 0.2595           | 0.2595            |
| Facing Edge to Channel & Shell OD, a :                              | 0.35325          | 0.35325           |
| Minimum dimension b for supported Tubesheet [2t <sub>s</sub> -a]:   | 0.16575          | 0.16575           |
| Minimum dimension b for unsupported Tubesheet [3t <sub>s</sub> -a]: | 0.42525          | 0.42525           |
| Flat Land dimension of groove weld (1/16" of RF in Shell):          | 0.1250           | 0.1250            |
| Minimum TS Groove angle, supported Tubesheet (°):                   | 6.6              | 6.6               |
| Minimum TS Groove angle, unsupported Tubesheet (°):                 | 40.363           | 40.36336          |
| Actual b dimension :  | 0.3289           | 0.3289            |
| Minimum T <sub>p</sub> dimension :                                  | 0.25             | 0.25              |

**ACTUAL MINIMUM TUBESHEET THICKNESS**

T = 0.3289 + 0.3289 + 0.25 = 0.9079

**ACTUAL MINIMUM TUBESHEET THICKNESS INCLUDING CORROSION ALLOWANCE**

T<sub>c</sub> = 0.9079 + 0.125 = 1.0329



**SHELL ALLOWABLE COMPRESSIVE STRESS**

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Revision number: 0 | Page number: 11 of 13

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ASME SEC. VIII, DIV. 1 2010 ED., per UG-23 (b)

Shell

|                      |          |         |     |                       |        |     |
|----------------------|----------|---------|-----|-----------------------|--------|-----|
| Material :           | SA-106-B | S or W: | S   | Allow. Amb. Stress:   | 17100  | psi |
| Pipe~ 1 / Plate~ 2 : |          |         | 1   | Allow. Design Stress: | 17100  | psi |
| Shell OD :           | 8.625    |         | in  | Corrosion Allowance : | 0.0625 | in  |
| Design Pressure :    | 200      |         | psi | Design Temperature :  | 400    | °F  |

**CALCULATIONS**

|  |        |    |                             |      |
|--|--------|----|-----------------------------|------|
| New uncorroded thickness :                           | 0.322  | in | EXTERNAL PRESSURE CHART # : | CS-2 |
| <i>Thickness reduced for pipe tolerance of 12.5%</i> |        |    |                             |      |
| Minimum thickness, t :                               | 0.2193 | in |                             |      |
| Outside radius, Ro :                                 | 4.3125 | in |                             |      |

$$\text{Factor A} = \frac{0.125}{(R_o / t)} = 0.0063551$$

Maximum Shell Compressive Stress, B ( $S_{B,S}$ ) = 15417 psi



HORIZONTAL SUPPORT SADDLE CALCULATION VERSION 3.0, MAR. 16, 2011 (JAN. 08, 2002)

**HORIZONTAL SUPPORT SADDLE STRESSES**

Job number: 13-0856 | Page number: 12 of 13  
Revision number: |

CODES:

Recommended Good practice : L.P. Zick analysis- Pressure Vessel Handbook latest

**DIMENSIONS & PROPERTIES**

|                                      |           |                                      |         |
|--------------------------------------|-----------|--------------------------------------|---------|
| Tema type unit (ie. NEN):            | NEN       | Length between shell seams, (L):     | 333.125 |
| Total Dry Weight:                    | 4700 Lbs  | Maximum Seam to Ctr. Of Saddle, (A): | 24      |
| Total Wet Weight:                    | 5800 Lbs  | Saddle Support Width (SSW):          | 8       |
| Design Pressure                      | 200 psi   | Saddle Gusset Width (SGW):           | 2.26    |
| Shell Material:                      | SA-106-B  | Support and Gusset thickness (tsg):  | 0.2200  |
| Allow. Stress in Tension:            | 17100 psi | Is a Wear Plate used (Y or N):       | Y       |
| Allow. Stress in Comp.:              | 15417 psi | Wear Plate Thickness (twp):          | 0.3050  |
| Shell <b>PI</b> pe or <b>PL</b> ate: | PI        | Wear Plate Width (WPW):              | 6       |
| Shell OD:                            | 8.625 IN  |                                      |         |
| Shell Thickness:                     | 0.3220 IN |                                      |         |
| Corrosion Allowance:                 | 0.0625 IN |                                      |         |
| Efficiency:                          | 1.0000    |                                      |         |

Tube Sheet Thickness : 1.375

**CALCULATIONS**

|  |            |                           |        |
|--|------------|---------------------------|--------|
| Weight of unit full of water:                | 5800.0 Lbs | Contact Angle, $\theta$ : | 120.1  |
| Load per Saddle, Q:                          | 2900 IN    | K <sub>1</sub> :          | 0.3353 |
| Minimum Shell thickness, t <sub>s</sub> :    | 0.2193     | K <sub>2</sub> :          | 1.1701 |
| Shell Outside Radius, R:                     | 4.3125     | K <sub>3</sub> :          | 0.3190 |
| Head or TS Length, H:                        | 1.375      | K <sub>4</sub> :          | 0.8790 |
| Min. Equiv. Head Thickness, t <sub>h</sub> : | 0.21925    | K <sub>5</sub> :          | 0.4008 |
|  |            | K <sub>6</sub> :          | 0.0530 |
|  |            | K <sub>7</sub> :          | 0.7598 |
|  |            | K <sub>8</sub> :          | 0.6034 |

|                                       | <u>ALLOWABLE</u> | <u>ACTUAL</u> |
|---------------------------------------|------------------|---------------|
| <u>LONGITUDINAL BENDING STRESSES:</u> |                  |               |
| Tension (at the saddles):             | 17100            | 5840.4        |
| Compression (at the saddles):         | 15417            | -185.3        |
| Tension (at midspan):                 | 17100            | 15289.9       |
| Compression (at the midspan):         | 15417            | 11356.0       |
| <u>TANGENTIAL SHEAR STRESSES</u>      |                  |               |
| Shell:                                | 13680            | 1277.6        |
| <u>CIRCUMFERENTIAL STRESS</u>         |                  |               |
| At Horn of Saddle:                    | 25650            | 5667.5        |
| At Bottom of Shell                    | 7709             | 912.6         |



LIFTING LUG CALCULATION VERSION 2.0 May 27, 2008

**LIFTING LUG CALCULATION**

Job number: 13-0856

Revision number: 0

Page number: 13 of 13

CODES:

ASME SEC. VIII, DIV. I, 2010 ed.,:  
TEMA Ninth Edition, 2007 :  
Pressure Vessel Design Manual :

UG-22  
RGP-G-7.24  
Pg. 171 - 189

LIFTING-LUG GEOMETRY

|                         |       |         |  |
|-------------------------|-------|---------|--|
| Lug Material SA-516-70N |       |         |  |
| Allowable Stress        | 20000 | psi     |  |
| Design Load             | 3525  | lbs/lug |  |
| Shackle Pin             | 1     | in      |  |
| Actual Hole             | 1.125 | in      |  |
| Lug Base Length         | 5     | in      |  |
| Lug Thickness           | 0.5   | in      |  |
| Fillet Weld Leg         | 0.25  | in      |  |
| Insulation Thk.         | 2     | in      |  |
| Lug Height              | 5     | in      |  |
| Pin offset              | 3.5   | in      |  |

SHELL GEOMETRY:

|                           |          |      |  |
|---------------------------|----------|------|--|
| Shell Material            | sa-106-b |      |  |
| Allowable Stress          | 17100    | psi  |  |
| Shell Type                | 0        | Pipe |  |
| Shell Thickness           | 0.322    | in   |  |
| Corrosion                 | 0.0625   | in   |  |
| Inside Diameter           | 7.981    | in   |  |
| Repad Thickness           | 0        | in   |  |
| Mill Tolerance            | 0.875    |      |  |
| Effective Shell Thickness | 0.2544   | in   |  |
| Shackle clearance         | 0.19     | in   |  |

Maximum Load / Lug:

|                     |         |
|---------------------|---------|
| Vertical Load =     | 3525 lb |
| Longitudinal Load = | 2946 lb |
| Cross Load =        | 648 lb  |

Shell Stress:

Shell Actual Stresses:

Code Allowable Stresses:

|                       |           |                               |
|-----------------------|-----------|-------------------------------|
| Radial stress =       | 9917 psi  | 17100 psi (Sa)                |
| Longitudinal stress = | 10944 psi | 25650 psi combined (1.5 x Sa) |

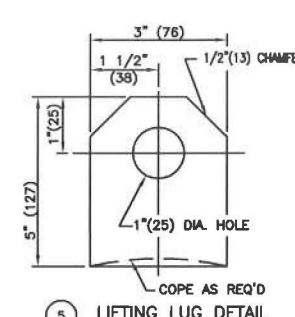
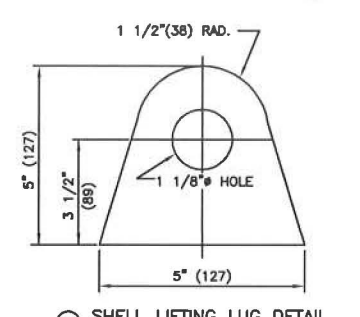
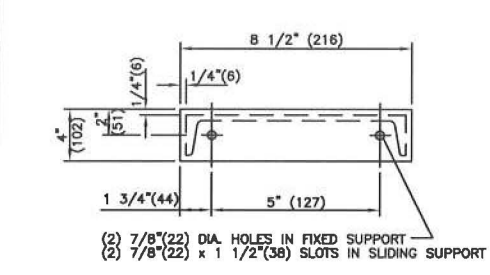
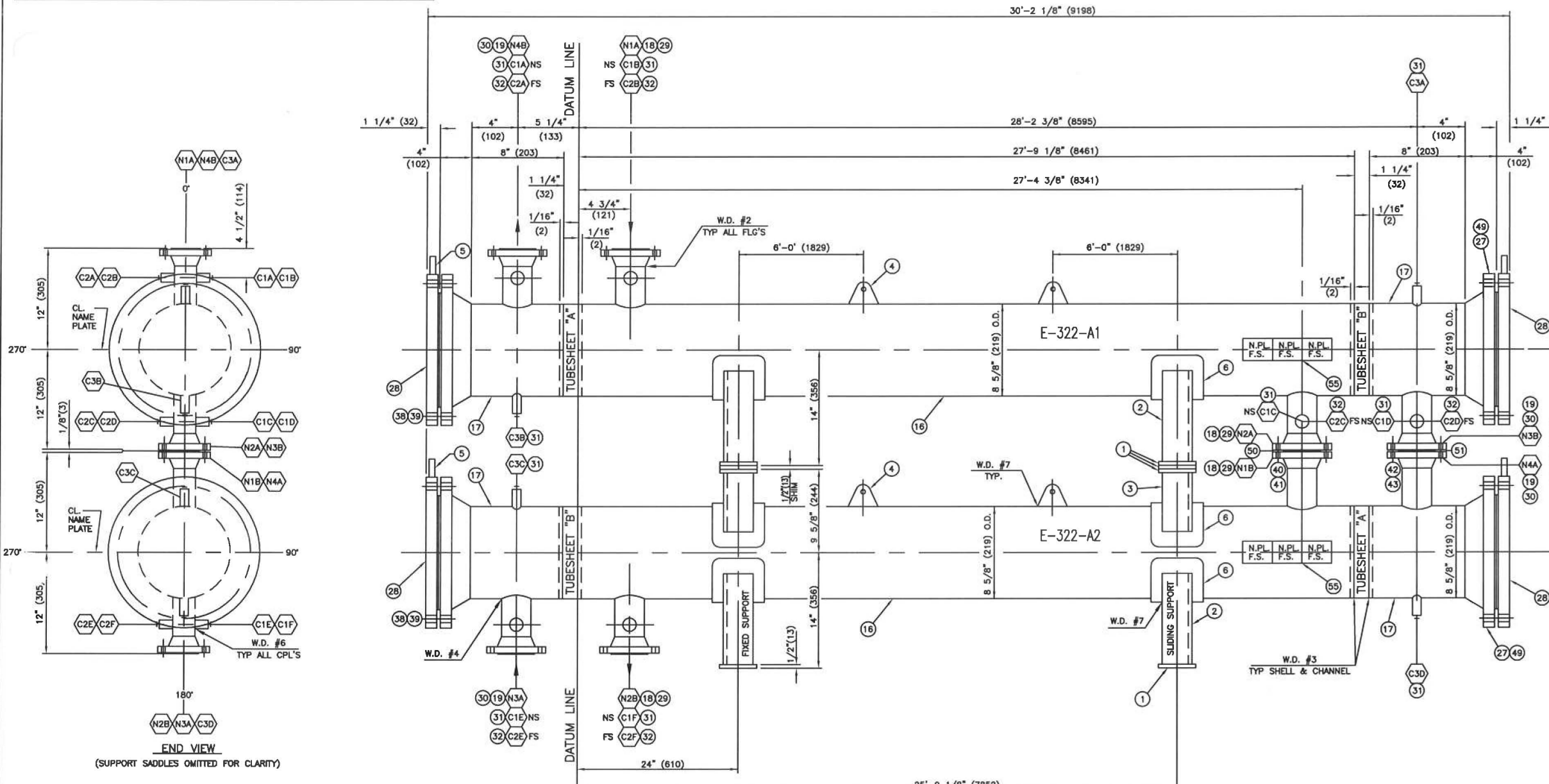
Lifting Details:

Minimum Sling or Chain Rating: **4600 lbs (2.3 ton)**

Maximum Off Vertical Angle for L **39.9 deg (for each lifting-lug)**

NOTE: If this angle is less then 30 degree, two crane or a spreader bar shall be used for the lift.

METRIC DIMENSIONS ARE IN BRACKETS



| BILL OF MATERIAL   |      |   |            |       |
|--------------------|------|---|------------|-------|
| ITEM               | QTY. | DESCRIPTION                                       | MATERIAL   | P.O.# |
| PLATE / STRUCTURAL |      |   |            |       |
| 1                  | 8    | 1/2" PL. x 4" x 8 1/2" LG. - BASE / BRM PLATES    | Q-44W      |       |
| 2                  | 4    | 8" CHANNEL x 11.5# x 11 3/16" LG. SADDLE SUPPORTS | Q-44W      |       |
| 3                  | 2    | 8" CHANNEL x 11.5# x 8 15/16" LG. SADDLE SUPPORTS | Q-44W      |       |
| 4                  | 4    | 1/2" THK PL. x 8" x 8" LG - SHELL LFT LUG         | SA-518-70N |       |
| 5                  | 4    | 3/8" THK PL. 3" x 8" LG - CHANNEL COVER LFT LUG   | SA-518-70N |       |
| 6                  | 8    | 8" - SCH. STD. (0.322") SPLIT IN HALF x 8" LG.    | SA-108-B   |       |
| 7                  |      |   |            |       |
| 8                  |      |   |            |       |
| 9                  |      |   |            |       |
| 10                 |      |   |            |       |
| 11                 |      |   |            |       |
| 12                 |      |   |            |       |
| 13                 |      |   |            |       |
| 14                 |      |   |            |       |
| 15                 |      |   |            |       |

| PIPE / FITTINGS |   |  |          |  |
|-----------------|---|--|----------|--|
| 16              | 2 | 6" - SCH. STD. (0.322") SMLS PIPE x 27'-0 1/8" LG - SHELL CYL. | SA-108-B |  |
| 17              | 4 | 6" - SCH. STD. (0.322") SMLS PIPE x 8" LG - CHANNEL CYL.       | SA-108-B |  |
| 18              | 4 | 3" - SCH. TH (0.300") SMLS PIPE x 8 3/16" LG - N1A/B, N2A/B    | SA-108-B |  |
| 19              | 4 | 2" - SCH. 160 (0.344") SMLS PIPE x 8 3/16" LG - N3A/B, N4A/B   | SA-108-B |  |
| 20              |   |  |          |  |
| 21              |   |  |          |  |
| 22              |   |  |          |  |
| 23              |   |  |          |  |
| 24              |   |  |          |  |
| 25              |   |  |          |  |

| FORGINGS                      |    |  |          |  |
|-------------------------------|----|--|----------|--|
| ANSI FLANGES / CPLG'S & MISC. |    |  |          |  |
| 27                            | 4  | 6" - CLASS 150 RF/IN (SCH STD BORE) - END FLANGES  | SA-108-N |  |
| 28                            | 4  | 6" - CLASS 150 RF BUNDS                            | SA-108-N |  |
| 29                            | 4  | 3" - CLASS 150 RF/IN (SCH TH BORE) - N1A/B, N2A/B  | SA-108-N |  |
| 30                            | 4  | 2" - CLASS 150 RF/IN (SCH 160 BORE) - N3A/B, N4A/B | SA-108-N |  |
| 31                            | 10 | 1" - CLASS 8000 BORD CPLG - C1A-F, C3 A-D          | SA-108-N |  |
| 32                            | 6  | 3/4" - CLASS 8000 BORD CPLG - C2A-F                | SA-108-N |  |
| 33                            |    |  |          |  |
| 34                            |    |  |          |  |
| 35                            |    |  |          |  |
| 36                            |    |  |          |  |
| 37                            |    |  |          |  |

| STUD BOLTS & NUTS |    |  |           |  |
|-------------------|----|--|-----------|--|
| 38                | 32 | 3/4" DIA. x 4 1/4" LG STUD BOLTS - END FLANGES | SA-193-B7 |  |
| 39                | 64 | 3/4" DIA. H. HEX NUTS                          | SA-194-2H |  |
| 40                | 4  | 8/8" DIA. x 3 3/4" LG STUD BOLTS - N1B TO N2A  | SA-193-B7 |  |
| 41                | 8  | 5/8" DIA. H. HEX NUTS - N1B TO N2A             | SA-194-2H |  |
| 42                | 4  | 8/8" DIA. x 3 1/4" LG STUD BOLTS - N3B TO N4A  | SA-193-B7 |  |
| 43                | 8  | 8/8" DIA. H. HEX NUTS - N3B TO N4A             | SA-194-2H |  |
| 44                |    |  |           |  |
| 45                |    |  |           |  |
| 46                |    |  |           |  |
| 47                |    |  |           |  |
| 48                |    |  |           |  |

| GASKETS |   |  |          |  |
|---------|---|--|----------|--|
| 49      | 8 | 6" - CLASS 150 RF. FLEXITALIC STYLE C.G. GASKET              | T-3188.S |  |
| 50      | 2 | 3" - CLASS 150 RF. FLEXITALIC STYLE C.G. GASKET - N2A TO N1B | T-3188.S |  |
| 51      | 2 | 2" - CLASS 150 RF. FLEXITALIC STYLE C.G. GASKET - N3B TO N4A | T-3188.S |  |
| 52      |   |  |          |  |
| 53      |   |  |          |  |
| 54      |   |  |          |  |

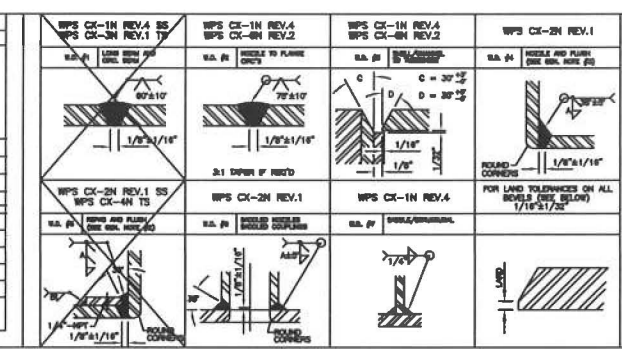
| NAME PLATES |   |   |            |  |
|-------------|---|---|------------|--|
| 55          | 2 | 6" x 18" T-BAR STYLE NAME PLATE BRACKETS C/W S.S. NAMEPLATE PLATE | SA-518-70N |  |

QUANTITIES LISTED ARE FOR ONE UNIT AS SHOWN

SPECIAL CHEMISTRY

**CERTIFIED AS BUILT**

| CONSTRUCTION / GENERAL NOTES |   |   |  |  |  |
|------------------------------|---|---|--|--|--|
| NO.                          | 1 | SURFACE PREP: SSPC-SP6 (COMMERCIAL GRADE)<br>PAINT: ONE COAT OF EPOXY PHENOLIC PRIMER INTERMEDIATE 228 (3.0-5.0 mils DFT.)<br>FINISH: ONE COAT OF EPOXY PHENOLIC PRIMER INTERMEDIATE 228 (3.0-5.0 mils DFT.)<br>*LOR: WARM GREY |  |  |  |
| NO.                          | 2 | REGISTRATION: ALBERTA, BRITISH COLUMBIA   |  |  |  |
| NO.                          | 3 | LO-FINISHED TUBES, 16 GA. UNDER THE FN, 18/AN, 14 GA. BARE ENDS   |  |  |  |



| NOZZLE / CONNECTION SCHEDULE |      |      |        |       |                          |             |             |               |                   |       |
|------------------------------|------|------|--------|-------|--------------------------|-------------|-------------|---------------|-------------------|-------|
| REF.                         | QTY. | SIZE | RATING | TYPE  | SERVICE                  | WELD SIZE A | WELD SIZE B | WELD DETAIL # | EXTERNAL PROJECT. | REPAD |
| N1A/B                        | 2    | 3"   | 150    | RF/IN | SHELL SIDE INLET         | 3/8"        | ---         | 2.4           | 7 11/16"          | NO    |
| N2A/B                        | 2    | 3"   | 150    | RF/IN | SHELL SIDE OUTLET        | 3/8"        | ---         | 2.4           | 7 11/16"          | NO    |
| N3A/B                        | 2    | 2"   | 150    | RF/IN | TUBE SIDE INLET          | 3/8"        | ---         | 2.4           | 7 11/16"          | NO    |
| N4A/B                        | 2    | 2"   | 150    | RF/IN | TUBE SIDE OUTLET         | 3/8"        | ---         | 2.4           | 7 11/16"          | NO    |
| C1A-F                        | 8    | 1"   | 8000   | SCR'D | T.L. C/W PLUGS           | 3/8"        | ---         | 8             | ---               | NO    |
| C2A-F                        | 8    | 3/4" | 8000   | SCR'D | P.L. C/W PLUGS           | 3/8"        | ---         | 8             | ---               | NO    |
| C3A-D                        | 4    | 1"   | 8000   | SCR'D | VENTS / DRAINS C/W PLUGS | 3/8"        | ---         | 8             | ---               | NO    |

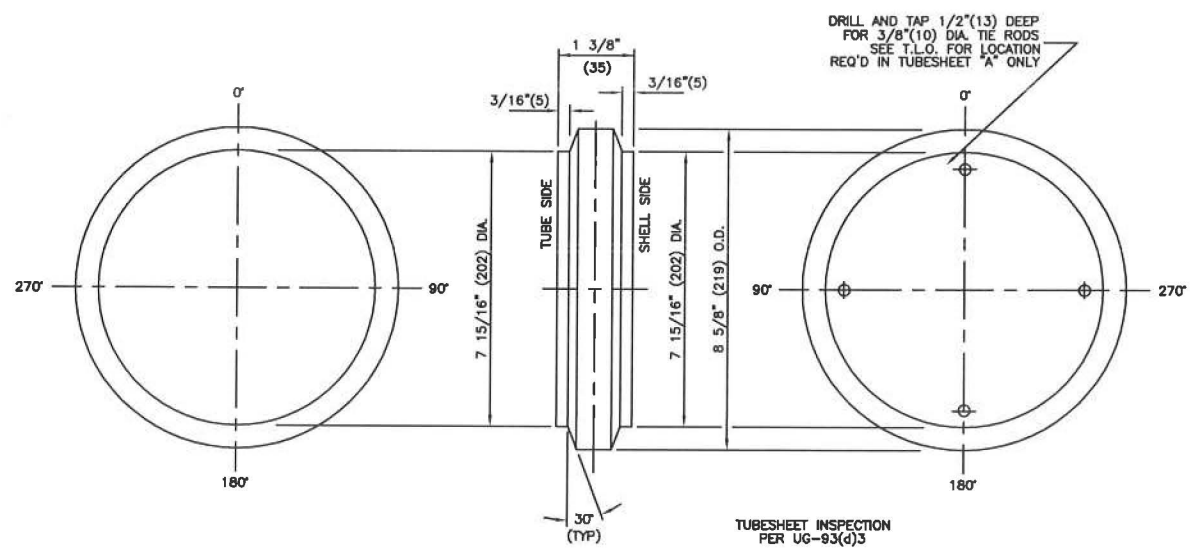
| DESIGN DATA  |                        |   |          |
|--|------------------------|---|----------|
|  | SHELL SIDE             | TUBE SIDE                                     |          |
| DESIGN PRESSURE:   | 200 PSIG               | 1379 kPa                                      | 200 PSIG |
| DESIGN TEMPERATURE:  | 400 °F                 | 204 °C  | 400 °F   |
| MIN. DESIGN METAL TEMPERATURE:   | -20 °F                 | -29 °C  | -20 °F   |
| RADIOPACITY:   | N/A PER FIG UG-13.2(e) | SPUT PER UW-11(a)(5)(b)                       |          |
| EFFICIENCY:  | 0.85 / 1.0             | N/R / 1.0                                     |          |
| STRESS RELIEVING:  | N/R                    | N/R   |          |
| CORROSION ALLOWANCE:   | 0.0625"                | 1.6 mm  | 0.0625"  |
| TEST PRESSURE:   | 280 PSIG               | 1793 kPa                                      | 280 PSIG |
| WELDING PROCEDURES: C1-IN REV.4, C1-BN REV.2, C2-BN REV.1 (INCL) INK WELDED, C2-IN REV.4, C2-BN REV.2, C3-BN REV.1 (INCL) INK WELDED |                        |   |          |
| MEAN DESIGN TEMP.: SHELL: 311.8°F TUBES: 301.8°F TUBESHEET 'A': 322.7°F TUBESHEET 'B': 238.4°F                                       |                        |   |          |
| IMPACT TESTING: ALL MATERIAL C.I.T. EXCEPT FOR UG-20(f), UCS-M(x)(4), AND UCS-B NOTE(4). MINIP LIMITED TO DESIGN PRESSURE.           |                        |   |          |
| NO CORROSION ALLOWANCE APPLICABLE TO TUBING MATERIAL.  |                        |   |          |
| CODE: ASME SECTION VIII, DIV. 1, 2010 ED., 2011 ADD DESIGN: TEMA "H", AP-600   |                        |   |          |
| REGISTRATION: ALBERTA, B.C. C.R.A.L. #:  |                        |   |          |
| WEIGHT OF BUNDLE: 2300 LBS / 460 KG (EACH BUNDLE)  |                        | VOLUME: 16.45 CU.FT. / 0.466 CU.M. (AS SHOWN) |          |
| SHIPPING WEIGHT (DRY): 4700 LBS / 2131 KGS (EACH BUNDLE)   |                        | TEST WEIGHT: 5800 LBS / 2587 KGS (AS SHOWN)   |          |
| HEATING SURFACE: 1553.3 SQ. FT. / 144.3 SQ.M. (EACH)   |                        |   |          |
| REGISTERED QUALITY CONTROL PROCEDURES AQP 1306   |                        | REGISTERED WELDING PROCEDURES WP 2380.2       |          |

**CALHEX INDUSTRIES LTD.**  
9515 - 48th STREET S.E.  
CALGARY, ALBERTA T2C 2R1

CUSTOMER: SPECTRUM PROCESS SYSTEMS FOR ENGANA, SOLARIS  
PROJECT: WARM LEAN / RICH GLYCOL EXCHANGER (2) NEN 8 x 336  
P.O. #: 002359 ITEM#: E-322-A1/2  
SATURN COMPRESSOR STATION

ENGINEERING RECORDS SCALE: L.S.D. NO.:  
DRAWING BY: B.JAHANGIR DATE: OCTOBER 7/13  
CHECKED BY: D.JLADNOK DATE: OCTOBER 7/13  
APPROVED BY: M.SOURA

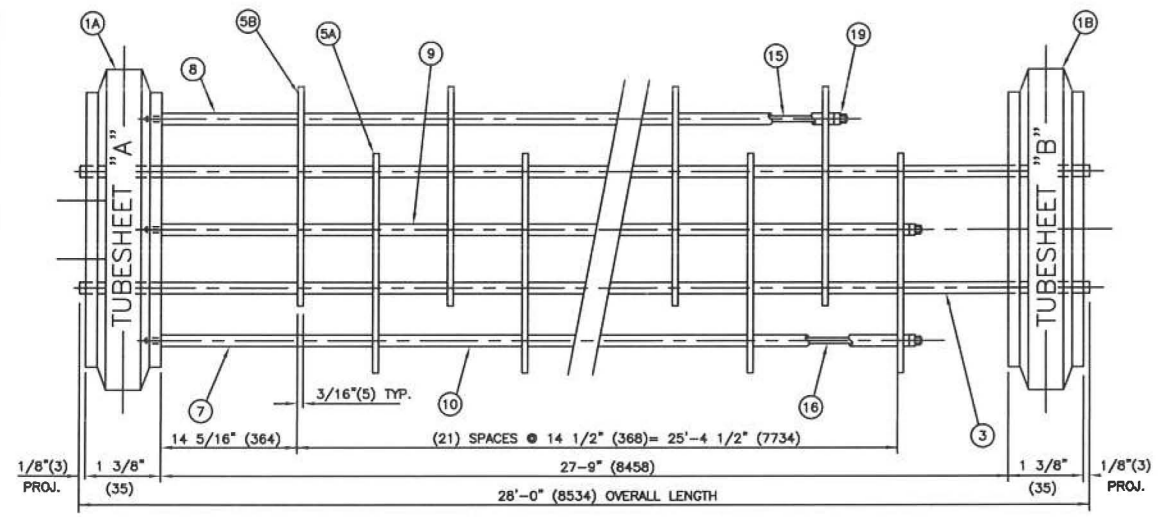
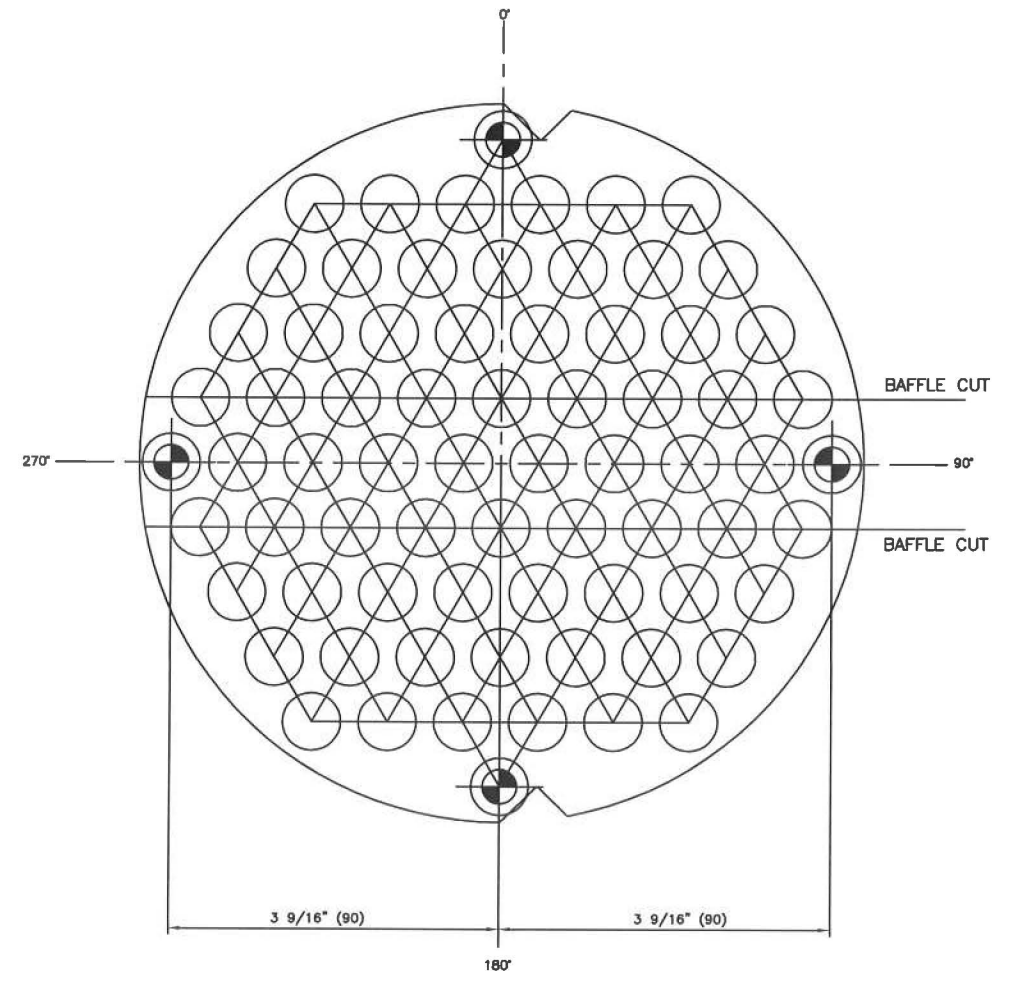
DWG. NO.: 13-0856-S



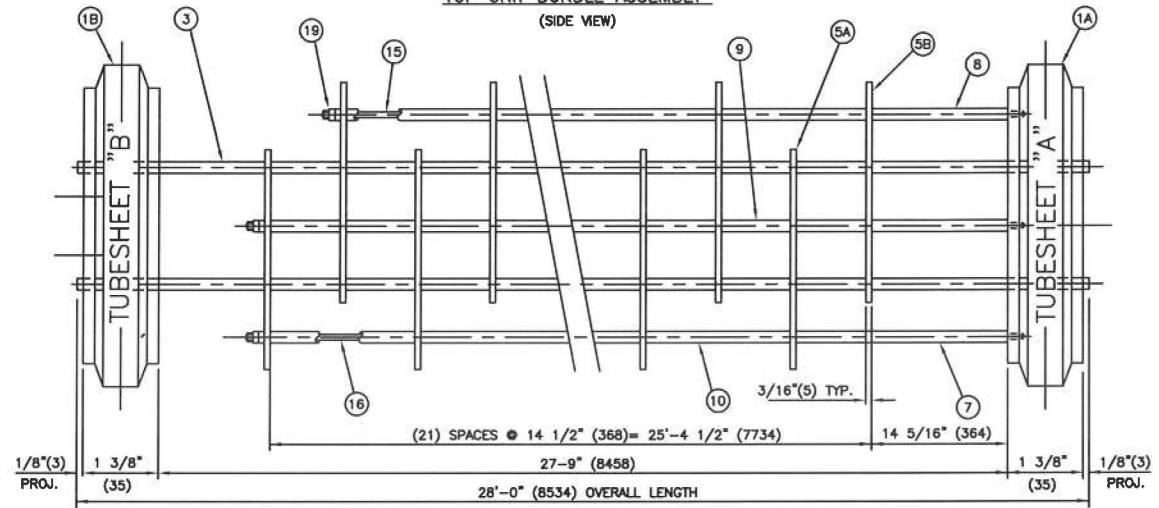
① TUBESHEET DETAIL

TUBE LAYOUT

(68) 5/8" (16) O.D. x #14GA(NOM), #16GA(UNDER THE FIN) x 28'-0" (8534) LG.  
 13/16" (21) 30° TRI. PITCH  
 CHANNEL SIDE I.D. = 7.9810" (203) DIA.  
 RF. DIA. CHANNEL SIDE = 7 15/16" (202) DIA.  
 SHELL SIDE I.D. = 7.9810" (203) DIA.  
 RF. DIA. SHELL SIDE = 7 15/16" (202) DIA.  
 OUTER TUBE LIMIT = 7.5670" (192) DIA.  
 TIE RODS (NO. & DIA.) = (4) - 3/8" (10) DIA.



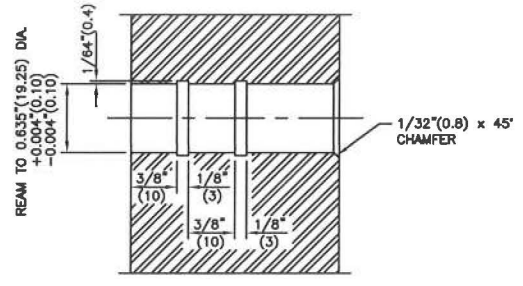
TOP UNIT BUNDLE ASSEMBLY (SIDE VIEW)



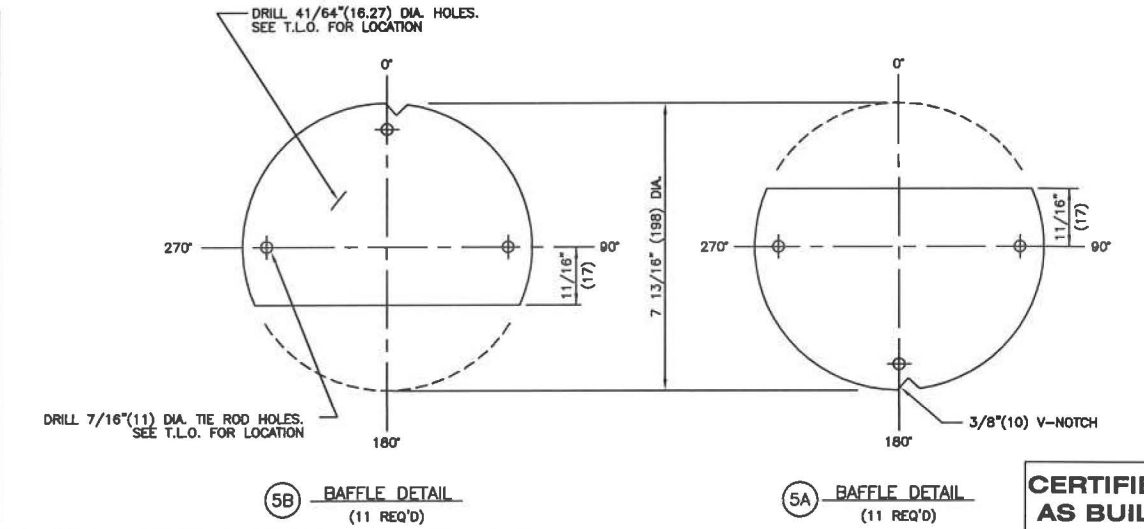
BOTTOM UNIT BUNDLE ASSEMBLY (SIDE VIEW)

| BILL OF MATERIAL                              |      |   |               |       |
|---|------|---|---------------|-------|
| ITEM  | QTY. | DESCRIPTION   | MATERIAL      | P.O.# |
| PLATE   |      |   |               |       |
| 1A/B  | 4    | 1 3/8" PL. x 8 9/8" DIA. TUBESHEET  | SA-316-70H    |       |
| 2   | -    | -   | -             | -     |
| TUBES   |      |   |               |       |
| 3   | 138  | 5/8" DIA. x #14GA (NOM) 18FINS/IN #16GA (UNDER THE FIN) C/W 2" BARE ENDS x 28'-0" | SA-179        |       |
| 4   | -    | -   | -             | -     |
| BAFFLES                                       |      |   |               |       |
| 5   | 44   | 3/16" PL. x 7 13/16" O.D. BAFFLES   | C-44W         |       |
| 6   | -    | -   | -             | -     |
| SPACERS                                       |      |   |               |       |
| 7   | 2    | 5/8" DIA. x #14 BWG (M/W) x 28 13/16" LG.   | SA-179/SA-214 |       |
| 8   | 6    | 5/8" DIA. x #14 BWG (M/W) x 14 5/16" LG.  | SA-179/SA-214 |       |
| 9   | 84   | 5/8" DIA. x #14 BWG (M/W) x 14 5/16" LG.  | SA-179/SA-214 |       |
| 10  | 40   | 5/8" DIA. x #14 BWG (M/W) x 28 13/16" LG.   | SA-179/SA-214 |       |
| 11  | -    | -   | -             | -     |
| 12  | -    | -   | -             | -     |
| 13  | -    | -   | -             | -     |
| 14  | -    | -   | -             | -     |
| TIE RODS                                      |      |   |               |       |
| 15  | 2    | 3/8" DIA. R.B. x 25'-7" LG. TIE ROD   | H.R. STL      |       |
| 16  | 6    | 3/8" DIA. R.B. x 26'-8 1/2" LG. TIE ROD   | H.R. STL      |       |
| 17  | -    | -   | -             | -     |
| 18  | -    | -   | -             | -     |
| NUTS  |      |   |               |       |
| 19  | 16   | 3/8" DIA. HEX NUTS  | SA-325        |       |
| 20  | -    | -   | -             | -     |
| IMPACT PLATE                                  |      |   |               |       |
| 21  | -    | -   | -             | -     |
| 22  | -    | -   | -             | -     |
| QUANTITIES                                    |      |   |               |       |
| MATERIAL LISTED IS FOR TWO BUNDLES (AS SHOWN) |      |   |               |       |
| SPECIAL CHEMISTRY NOTES                       |      |   |               |       |

METRIC DIMENSIONS ARE IN BRACKETS



TUBE HOLE GROOVING DETAIL  
 TUBE EXPANSION LENGTH = 1 3/8" (35) LG.



⑤B BAFFLE DETAIL (11 REQ'D)

⑤A BAFFLE DETAIL (11 REQ'D)

CERTIFIED AS BUILT

| CONSTRUCTION / GENERAL NOTES |    |  |                          |                         |               |
|------------------------------|----|--|--------------------------|-------------------------|---------------|
| NO.                          | 1  | SURFACE PREP: SSPC-SP8 (COMMERCIAL GRADE)                                    |                          |                         |               |
|                              |    | PAINT: ONE COAT OF EPOXY PHENOLIC PRIMER INTERTHERM 228 (3.0-5.0 mils DFT.)  |                          |                         |               |
|                              |    | FINISH: ONE COAT OF EPOXY PHENOLIC PRIMER INTERTHERM 228 (3.0-5.0 mils DFT.) |                          |                         |               |
|                              |    | COLOR: WARM GREY   |                          |                         |               |
| NO.                          | 2  | REGISTRATION: ALBERTA  |                          |                         |               |
| NO.                          | 3  | LO-FINISHED TUBES, 16 GA. UNDER THE FIN, 19/IN, 14 GA. BARE ENDS             |                          |                         |               |
| REV.                         | BY | DESCRIPTION  | CALC. PACKAGE REV. LEVEL | REVISED CALCS. RETURNED | APPROVAL DATE |
| 0                            | BH | ISSUED FOR APPROVAL  | 0                        | INITIAL ISSUE           | MS OCT. 7/13  |
| REVISION RECORD              |    |  |                          |                         |               |

**CALHEX INDUSTRIES LTD.**  
 9515 - 48th STREET S.E.  
 CALGARY, ALBERTA T2C 2R1

|  |   |
|--|---|
| CUSTOMER: SPECTRUM PROCESS SYSTEMS FOR ENCANVA, SOLARIS              | PROJECT: WARM LEAN / RICH GLYCOL EXCHANGER FOR (2) MEN B x 336 P.O. #: 002359 SATURN COMPRESSOR STATION |
| ENGINEERING RECORDS  | SCALE: L.S.D. NO.: -  |
| DRAWING BY: B.HANNO<br>CHECKED BY: D.JLADNIK<br>APPROVED BY: M.SOKKA | DATE: OCTOBER 7/13<br>OCTOBER 7/13  |
| N.T.S.   | DWG. NO.: 13-0856-T   |
|  | REV: 0  |

**E-1 PERFORMANCE OF HEAT EXCHANGERS**

Satisfactory operation of heat exchangers can be obtained only from units which are properly designed and have built-in quality. Correct installation and preventive maintenance are user responsibilities.

**E-1.1 PERFORMANCE FAILURES**

The failure of heat exchanger equipment to perform satisfactorily may be caused by one or more factors, such as:

- (1) Excessive fouling.
- (2) Air or gas binding resulting from improper piping installation or lack of suitable vents.
- (3) Operating conditions differing from design conditions.
- (4) Maldistribution of flow in the unit.
- (5) Excessive clearances between the baffles and shell and/or tubes, due to corrosion.
- (6) Improper thermal design.

The user's best assurance of satisfactory performance lies in dependence upon manufacturers competent in the design and fabrication of heat transfer equipment.

**E-2 INSTALLATION OF HEAT EXCHANGERS****E-2.1 HEAT EXCHANGER SETTINGS****E-2.11 CLEARANCE FOR DISMANTLING**

For straight tube exchangers fitted with removable bundles, provide sufficient clearance at the stationary head end to permit removal of the bundle from the shell and provide adequate space beyond the rear head to permit removal of the shell cover and/or floating head cover.

For fixed tubesheet exchangers, provide sufficient clearance at one end to permit withdrawal and replacement of the tubes, and enough space beyond the head at the opposite end to permit removal of the bonnet or channel cover.

For U-tube heat exchangers, provide sufficient clearance at the stationary head end to permit withdrawal of the tube bundle, or at the opposite end to permit removal of the shell.

**E-2.12 FOUNDATIONS**

Foundations must be adequate so that exchangers will not settle and impose excessive strains on the exchanger. Foundation bolts should be set to allow for setting inaccuracies. In concrete footings, pipe sleeves at least one size larger than bolt diameter slipped over the bolt and cast in place are best for this purpose, as they allow the bolt center to be adjusted after the foundation has set.

**E-2.13 FOUNDATION BOLTS**

Foundation bolts should be loosened at one end of the unit to allow free expansion of shells. Slotted holes in supports are provided for this purpose.

**E-2.14 LEVELING**

Exchangers must be set level and square so that pipe connections may be made without forcing.

**E-2.2 CLEANLINESS PROVISIONS****E-2.21 CONNECTION PROTECTORS**

All exchanger openings should be inspected for foreign material. Protective plugs and covers should not be removed until just prior to installation.

**E-2.22 DIRT REMOVAL**

The entire system should be clean before starting operation. Under some conditions, the use of strainers in the piping may be required.

## **SECTION 4            INSTALLATION, OPERATION AND MAINTENANCE**

### **E-2.23 CLEANING FACILITIES**

Convenient means should be provided for cleaning the unit as suggested under "Maintenance of Heat Exchangers," Paragraph E-4.

### **E-2.3 FITTINGS AND PIPING**

#### **E-2.31 BY-PASS VALVES**

It may be desirable for purchaser to provide valves and by-passes in the piping system to permit inspection and repairs.

#### **E-2.32 TEST CONNECTIONS**

When not integral with the exchanger nozzles, thermometer well and pressure gage connections should be installed close to the exchanger in the inlet and outlet piping.

#### **E-2.33 VENTS**

Vent valves should be provided by purchaser so units can be purged to prevent vapor or gas binding. Special consideration must be given to discharge of hazardous or toxic fluids.

#### **E-2.34 DRAINS**

Drains may discharge to atmosphere, if permissible, or into a vessel at lower pressure. They should not be piped to a common closed manifold.

#### **E-2.35 PULSATION AND VIBRATION**

In all installations, care should be taken to eliminate or minimize transmission of fluid pulsations and mechanical vibrations to the heat exchangers.

#### **E-2.36 SAFETY RELIEF DEVICES**

The ASME Code defines the requirements for safety relief devices. When specified by the purchaser, the manufacturer will provide the necessary connections for the safety relief devices. The size and type of the required connections will be specified by the purchaser. The purchaser will provide and install the required relief devices.

## **E-3 OPERATION OF HEAT EXCHANGERS**

### **E-3.1 DESIGN AND OPERATING CONDITIONS**

Equipment must not be operated at conditions which exceed those specified on the name plate(s).

### **E-3.2 OPERATING PROCEDURES**

Before placing any exchanger in operation, reference should be made to the exchanger drawings, specification sheet(s) and name plate(s) for any special instructions. Local safety and health regulations must be considered. Improper start-up or shut-down sequences, particularly of fixed tubesheet units, may cause leaking of tube-to-tubesheet and/or bolted flanged joints.

#### **E-3.21 START-UP OPERATION**

Most exchangers with removable tube bundles may be placed in service by first establishing circulation of the cold medium, followed by the gradual introduction of the hot medium. During start-up all vent valves should be opened and left open until all passages have been purged of air and are completely filled with fluid. For fixed tubesheet exchangers, fluids must be introduced in a manner to minimize differential expansion between the shell and tubes.

#### **E-3.22 SHUT-DOWN OPERATION**

For exchangers with removable bundles, the units may be shut down by first gradually stopping the flow of the hot medium and then stopping the flow of the cold medium. If it is necessary to stop the flow of cold medium, the circulation of hot medium through the exchanger should also be stopped. For fixed tubesheet exchangers, the unit must be shut down in a manner to minimize differential expansion between shell and tubes. When shutting down the system, all units should be drained completely when there is the possibility of freezing or corrosion damage. To guard against water hammer, condensate should be

drained from steam heaters and similar apparatus during start-up or shut-down. To reduce water retention after drainage, the tube side of water cooled exchangers should be blown out with air.

**E-3.23 TEMPERATURE SHOCKS**

Exchangers normally should not be subjected to abrupt temperature fluctuations. Hot fluid must not be suddenly introduced when the unit is cold, nor cold fluid suddenly introduced when the unit is hot.

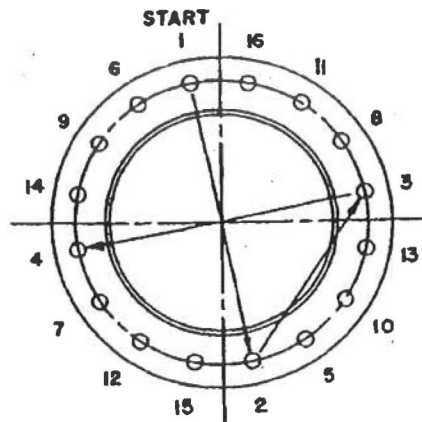
**E-3.24 BOLTED JOINTS**

Heat exchangers are pressure tested before leaving the manufacturer's shop in accordance with ASME Code requirements. However, normal relaxing of the gasketed joints may occur in the interval between testing in the manufacturer's shop and installation at the jobsite. Therefore, all external bolted joints may require retightening after installation and, if necessary, after the exchanger has reached operating temperature.

**E-3.25 RECOMMENDED BOLT TIGHTENING PROCEDURE**

It is important that all bolted joints be tightened uniformly and in a diametrically staggered pattern, as illustrated in Figure E-3.25, except for special high pressure closures when the instructions of the manufacturer should be followed.

FIGURE E-3.25



**E-4 MAINTENANCE OF HEAT EXCHANGERS**

**E-4.1 INSPECTION OF UNIT**

At regular intervals and as frequently as experience indicates, an examination should be made of the interior and exterior condition of the unit. Neglect in keeping all tubes clean may result in complete stoppage of flow through some tubes which could cause severe thermal strains, leaking tube joints, or structural damage to other components. Sacrificial anodes, when provided, should be inspected to determine whether they should be cleaned or replaced.

**E-4.11 INDICATIONS OF FOULING**

Exchangers subject to fouling or scaling should be cleaned periodically. A light sludge or scale coating on the tube greatly reduces its efficiency. A marked increase in pressure drop and/or reduction in performance usually indicates cleaning is necessary. The unit should first be checked for air or vapor binding to confirm that this is not the cause for the reduction in performance. Since the difficulty of cleaning increases rapidly as the scale thickness or deposit increases, the intervals between cleanings should not be excessive.

## SECTION 4      INSTALLATION, OPERATION AND MAINTENANCE

### E-4.12 DISASSEMBLY FOR INSPECTION OR CLEANING

Before disassembly, the user must assure himself that the unit has been depressurized, vented and drained, neutralized and/or purged of hazardous material.

To inspect the inside of the tubes and also make them accessible for cleaning, the following procedures should be used:

- (1) Stationary Head End
  - (a) Type A, C, D & N, remove cover only
  - (b) Type B, remove bonnet
- (2) Rear Head End
  - (a) Type L, N & P, remove cover only
  - (b) Type M, remove bonnet
  - (c) Type S & T, remove shell cover and floating head cover
  - (d) Type W, remove channel cover or bonnet

### E-4.13 LOCATING TUBE LEAKS

The following procedures may be used to locate perforated or split tubes and leaking joints between tubes and tubesheets. In most cases, the entire front face of each tubesheet will be accessible for inspection. The point where water escapes indicates a defective tube or tube-to-tubesheet joint.

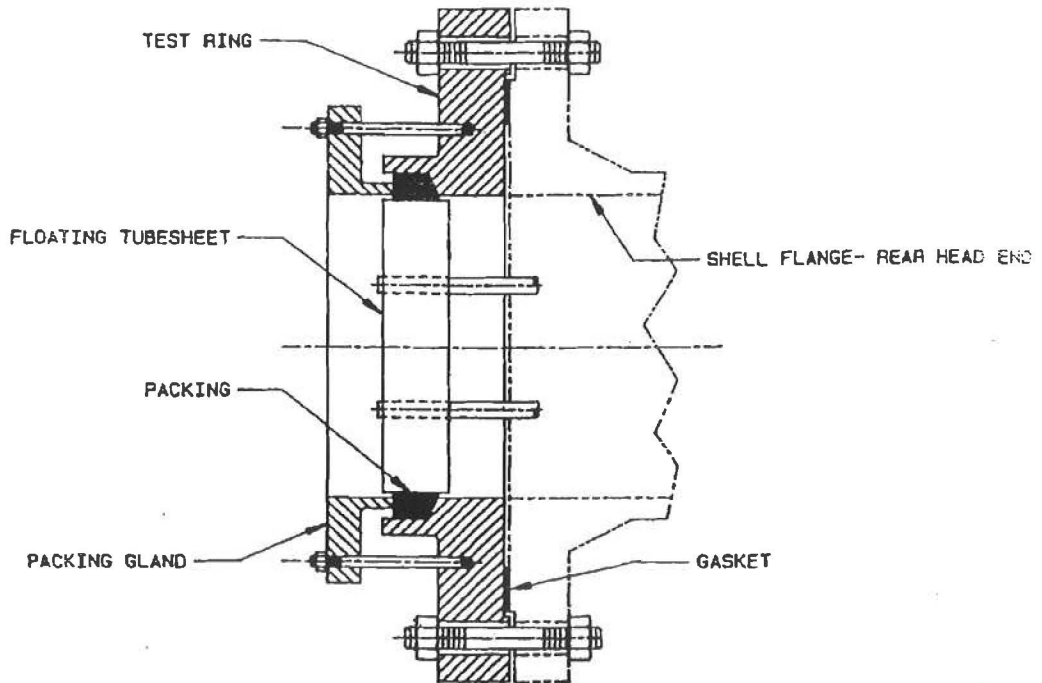
- (1) Units with removable channel cover: Remove channel cover and apply hydraulic pressure in the shell.
- (2) Units with bonnet type head: For fixed tubesheet units where tubesheets are an integral part of the shell, remove bonnet and apply hydraulic pressure in the shell. For fixed tubesheet units where tubesheets are not an integral part of the shell and for units with removable bundles, remove bonnet, re-bolt tubesheet to shell or install test flange or gland, whichever is applicable, and apply hydraulic pressure in the shell. See Figure E-4.13-1 for typical test flange and test gland.

FIGURE E-4.13-1



- (3) Units with Type S or T floating head: Remove channel cover or bonnet, shell cover and floating head cover. Install test ring and bolt in place with gasket and packing. Apply hydraulic pressure in the shell. A typical test ring is shown in Figure E-4.13-2. When a test ring is not available it is possible to locate leaks in the floating head end by removing the shell cover and applying hydraulic pressure in the tubes. Leaking tube joints may then be located by sighting through the tube lanes. Care must be exercised when testing partially assembled exchangers to prevent over extension of expansion joints or overloading of tubes and/or tube-to-tubesheet joints.
- (4) Hydrostatic test should be performed so that the temperature of the metal is over 60° F (16° C) unless the materials of construction have a lower nil-ductility transition temperature.

FIGURE E-4.13-2



**E-4.2 TUBE BUNDLE REMOVAL AND HANDLING**

To avoid possible damage during removal of a tube bundle from a shell, a pulling device should be attached to eyebolts screwed into the tubesheet. If the tubesheet does not have tapped holes for eyebolts, steel rods or cables inserted through tubes and attached to bearing plates may be used. The bundle should be supported on the tube baffles, supports or tubesheets to prevent damage to the tubes.

Gasket and packing contact surfaces should be protected.

**E-4.3 CLEANING TUBE BUNDLES**

**E-4.31 CLEANING METHODS**

The heat transfer surfaces of heat exchangers should be kept reasonably clean to assure satisfactory performance. Convenient means for cleaning should be made available.

Heat exchangers may be cleaned by either chemical or mechanical methods. The method selected must be the choice of the operator of the plant and will depend on the type of deposit and the facilities available in the plant. Following are several cleaning procedures that may be considered:

- (1) Circulating hot wash oil or light distillate through tubes or shell at high velocity may effectively remove sludge or similar soft deposits.
- (2) Some salt deposits may be washed out by circulating hot fresh water.
- (3) Commercial cleaning compounds are available for removing sludge or scale provided hot wash oil or water is not available or does not give satisfactory results.
- (4) High pressure water jet cleaning.
- (5) Scrapers, rotating wire brushes, and other mechanical means for removing hard scale, coke, or other deposits.

## SECTION 4            INSTALLATION, OPERATION AND MAINTENANCE

- (6) Employ services of a qualified organization that provides cleaning services. These organizations will check the nature of the deposits to be removed, furnish proper solvents and/or acid solutions containing inhibitors, and provide equipment and personnel for a complete cleaning job.

### E-4.32 CLEANING PRECAUTIONS

- (1) Tubes should not be cleaned by blowing steam through individual tubes since this heats the tube and may result in severe expansion strain, deformation of the tube, or loosening of the tube-to-tubesheet joint.
- (2) When mechanically cleaning a tube bundle, care should be exercised to avoid damaging the tubes.
- (3) Cleaning compounds must be compatible with the metallurgy of the exchanger.

### E-4.4 TUBE EXPANDING

A suitable tube expander should be used to tighten a leaking tube joint. Care should be taken to ensure that tubes are not over expanded.

### E-4.5 GASKET REPLACEMENT

Gaskets and gasket surfaces should be thoroughly cleaned and should be free of scratches and other defects. Gaskets should be properly positioned before attempting to retighten bolts. It is recommended that when a heat exchanger is dismantled for any cause, it be reassembled with new gaskets. This will tend to prevent future leaks and/or damage to the gasket seating surfaces of the heat exchanger. Composition gaskets become dried out and brittle so that they do not always provide an effective seal when reused. Metal or metal jacketed gaskets, when compressed initially, flow to match their contact surfaces. In so doing they are work hardened and, if reused, may provide an imperfect seal or result in deformation and damage to the gasket contact surfaces of the exchanger.

Bolted joints and flanges are designed for use with the particular type of gasket specified. Substitution of a gasket of different construction or improper dimensions may result in leakage and damage to gasket surfaces. Therefore, any gasket substitutions should be of compatible design.

Any leakage at a gasketed joint should be rectified and not permitted to persist as it may result in damage to the gasket surfaces.

Metal jacketed type gaskets are widely used. When these are used with a tongue and groove joint without a nubbin, the gasket should be installed so that the tongue bears on the seamless side of the gasket jacket. When a nubbin is used, the nubbin should bear on the seamless side.

### E-4.6 SPARE AND REPLACEMENT PARTS

The procurement of spare or replacement parts from the manufacturer will be facilitated if the correct name for the part, as shown in Section 1, Table N-2, of these Standards is given, together with the serial number, type, size, and other information from the name plate. Replacement parts should be purchased from the original manufacturer.

### E-4.7 PLUGGING OF TUBES

In U-tube heat exchangers, and other exchangers of special design, it may not be feasible to remove and replace defective tubes. Defective tubes may be plugged using commercially available tapered plugs with ferrules or tapered only plugs which may or may not be seal welded. Excessive tube plugging may result in reduced thermal performance, higher pressure drop, and/or mechanical damage. It is the user's responsibility to remove plugs and neutralize the bundle prior to sending it to a shop for repairs.



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|      |            |          |      |            |      |          |
|------|------------|----------|------|------------|------|----------|
| W    | MAWP       | 200      | PSIG | AT         | 400  | °F       |
| —    | TUBESIDE   | MDMT     | -20  | °F         | AT   | 200 PSIG |
| —    | MAWP       | 200      | PSIG | AT         | 400  | °F       |
| RP-1 | SHELLSIDE  | MDMT     | -20  | °F         | AT   | 200 PSIG |
| —    | SERIAL NO. | 13-0856A |      | YEAR BUILT | 2014 |          |

GRN **W3145.21** PROV. REG. **(A) 636695**

SHELL & CHAN THK - 0.322 / TUBE THK - 0.068

TAG NO. **E-322A1**



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**CALHEX INDUSTRIES LTD.**  
 CALGARY, ALBERTA, CANADA



|      |            |          |     |            |      |          |
|------|------------|----------|-----|------------|------|----------|
| W    | MAWP       | 1379     | kPa | AT         | 204  | °C       |
| —    | TUBESIDE   | MDMT     | -29 | °C         | AT   | 1379 kPa |
| —    | MAWP       | 1379     | kPa | AT         | 204  | °C       |
| RP-1 | SHELLSIDE  | MDMT     | -29 | °C         | AT   | 1379 kPa |
| —    | SERIAL NO. | 13-0856A |     | YEAR BUILT | 2014 |          |

GRN **W3145.21** PROV. REG. **[ ]**

SHELL & CHAN THK - 8.18MM / TUBE THK - 1.65MM

TAG NO. **E-322A1**



CERTIFIED BY  
**CALHEX INDUSTRIES LTD.**  
 CALGARY, ALBERTA, CANADA

CAUTION - THE CODE REQUIRED PRESSURES AND TEMPERATURES MARKED ON THE HEAT EXCHANGER RELATE TO THE BASIC DESIGN CONDITIONS. THE HEAT EXCHANGER DESIGN HAS BEEN EVALUATED FOR SPECIFIC OPERATING CONDITIONS AND SHALL BE RE-EVALUATED BEFORE IT IS OPERATED AT DIFFERENT OPERATING CONDITIONS.



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|       |            |          |      |            |      |     |      |
|-------|------------|----------|------|------------|------|-----|------|
| W     | MAWP       | 200      | PSIG | AT         | 400  | °F  |      |
| —     | TUBESIDE   | MDMT     | -20  | °F         | AT   | 200 | PSIG |
| —     | MAWP       | 200      | PSIG | AT         | 400  | °F  |      |
| R12-T | SHELLSIDE  | MDMT     | -20  | °F         | AT   | 200 | PSIG |
| —     | SERIAL NO. | 13-08561 |      | YEAR BUILT | 2014 |     |      |

CRN **W3145.21** PROV. REG. **(A) 636696**

SHELL & CHAN THK-0.322 / TUBE THK-0.065

TAG NO. **F-322A2**



CERTIFIED BY  
**CALHEX INDUSTRIES LTD.**  
 CALGARY, ALBERTA, CANADA



|       |            |          |     |            |      |      |     |
|-------|------------|----------|-----|------------|------|------|-----|
| W     | MAWP       | 1379     | kPa | AT         | 204  | °C   |     |
| —     | TUBESIDE   | MDMT     | -29 | °C         | AT   | 1379 | kPa |
| —     | MAWP       | 1379     | kPa | AT         | 204  | °C   |     |
| R12-T | SHELLSIDE  | MDMT     | -29 | °C         | AT   | 1379 | kPa |
| —     | SERIAL NO. | 13-08561 |     | YEAR BUILT | 2014 |      |     |

CRN **W3145.21** PROV. REG. **[ ]**

SHELL & CHAN THK-8.18MM / TUBE THK-1.65MM

TAG NO. **F-322A2**



CERTIFIED BY  
**CALHEX INDUSTRIES LTD.**  
 CALGARY, ALBERTA, CANADA

CAUTION: THE CODE REQUIRED PRESSURES AND TEMPERATURES MARKED ON THE HEAT EXCHANGER RELATE TO THE BASIC DESIGN CONDITIONS. THE HEAT EXCHANGER DESIGN HAS BEEN EVALUATED FOR SPECIFIC OPERATING CONDITIONS AND SHALL BE RE-EVALUATED BEFORE IT IS OPERATED AT DIFFERENT OPERATING CONDITIONS.



**MATERIAL CONTROL SHEET**

Job #: 13-0856

Item #: E-322 A1/A2

| Part Description  | Material Specification | Material Tracking #/<br>Heat # - Plate Identifier | Part Description | Material Specification | Material Tracking #/<br>Heat # - Plate Identifier |
|-------------------|------------------------|---|------------------|------------------------|---|
| TUBES             | SA179                  | 23841   | NOZZLE REWIN     | SA105-N                | 13/76222 <sup>3</sup>                             |
|                   |                        |   | "                | "                      | 1538/11   |
| TUBESHEETS        | SAS16-70N              | C120 (G8265-270521305)                            | "                | "                      | 4625126 <sup>2</sup>                              |
|                   |                        |   |                  |                        |   |
| SHELL CYLINDERS   | SA106-B                | C235 (60107)                                      | NOZZLE PIPE      | SA106-B                | (043 (47889)) <sup>3</sup>                        |
|                   |                        |   | "                | "                      | (281 (88784))                                     |
| CHANNEL REWIN     | SA105-N                | 548A2   | "                | "                      | (057 (24320)) <sup>2</sup>                        |
|                   |                        |   |                  |                        |   |
| CHANNEL CYLINDERS | SA106-B                | B196 (D01674)                                     |                  |                        |   |
|                   |                        |   |                  |                        |   |
| CHANNEL COVERS    | SA105-N                | 336303  |                  |                        |   |
|                   |                        |   |                  |                        |   |
| SADDLE WEAR PADS  | SAS16-70N              | C235 (60107)                                      |                  |                        |   |
|                   |                        |   |                  |                        |   |
| SHELL LIFT LOGS   | SAS16-70N              | C250 (NW4991-A38)                                 |                  |                        |   |
|                   |                        |   |                  |                        |   |

Above materials meet the requirements of ASME Section II Part A

Quality Control Signature: 

Date: FEB 18 2014



SGC / ISO 9001:2008

ABS QUALITY EVALUATIONS  
CERTIFICADO No. 32110

PRECITUBO, S.A. DE C.V.  
DEPTO. DE ASEGURAMIENTO DE CALIDAD

# CERTIFICADO DE CALIDAD MILL TEST REPORT



PRECITUBO, S.A. DE C.V. / Km. 11.4 Carretera a El Castillo, El Salto Jal. México C.P. 45680 Tel. (52) 33 3688-0002 /3688-0530. Fax (52) 33 3688-0631 / [www.precitubo.com.mx](http://www.precitubo.com.mx)

Pag: 1  
DATE: 11/20/2013

No. 49691

CUSTOMER: CONDUMEX, INC.      CUSTOMER REFERENCE: 29680      Ship No.: 0510      S.O.: OV14786  
SPECIFICATION : ASME-SA-179 ED.2010 ADD.2011a  
DESCRIPTION: SEAMLESS COLD-DRAWN LOW-CARBON STEEL HEAT-EXCHANGER AND CONDENSER TUBES

| ITEM | SIZE            | QUANTITY (Pces.) | LENGTH (Ft.) | WEIGHT (Lb.) | HEAT No. | # F.O.  |
|------|-----------------|------------------|--------------|--------------|----------|---------|
| 1    | 5/8" X 0.083"MW | 151              | 26.499       | 2021.34      | 23841    | 14786/1 |

| MECHANICAL TESTING RESULTS |        |                  |                |               |               |            |         |         |        |         |  |
|----------------------------|--------|------------------|----------------|---------------|---------------|------------|---------|---------|--------|---------|--|
| # F.O.                     | # Heat | Tensile Str(PSI) | Yield Str(PSI) | Elongation 2" | Hardness(HRB) | Flattening | Fla-Rev | Flaring | Flange | Bending |  |
| SPECIFIED                  | MIN:   | 0.00             | 0.00           | 0.00          | 0.00          |            |         |         |        |         |  |
|                            | MAX:   | 0.00             | 0.00           |               | 72.00         |            |         |         |        |         |  |
| 14786/1                    | 23841  | 0.00             | 0.00           | 0.00          | 67.00         | O.K.       | N.A.    | O.K.    | N.A.   | N.A.    |  |

| CHEMICAL ANALYSIS |       |       |       |       |       |       |       |       |       |       |       |       |
|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                   | % C   | % S   | % Si  | % Mn  | % P   | % Mo  | % Cr  | % Ni  | % Cu  | % V   | % Co  | % Al  |
| Std :             |       |       |       |       |       |       |       |       |       |       |       |       |
| SPECIFIED         | MIN:  | 0.060 | 0.000 | 0.000 | 0.270 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
|                   | MAX:  | 0.180 | 0.035 |       | 0.630 | 0.035 |       |       |       |       |       |       |
| F.O.              | Heat  |       |       |       |       |       |       |       |       |       |       |       |
| 14786/1           | 23841 | 0.160 | 0.003 | 0.180 | 0.560 | 0.005 | 0.040 | 0.080 | 0.053 | 0.120 | 0.002 | 0.000 |

### NONDESTRUCTIVE TEST

MATERIAL TESTED TO  
ASME SECTION II BY  
CALHEX INDUSTRIES LTD.

DATE: 08/01/2014

SIGNATURE:

MIN THK

CONFORMS TO 2016 EDITION 2011 ADDENDA

Meets NACE MR0175 Latest Edition.

- Este documento certifica que los productos aquí descritos fueron manufacturados, probados e inspeccionados conforme a la especificación de referencia y cumplen satisfactoriamente los requerimientos de la O.C. correspondiente. Este documento fue elaborado y validado por un representante autorizado del staff de Aseguramiento de Calidad, con total independencia al departamento de manufactura.

- This document certifies that the products supplied and described here were manufactured, sampled, inspected and tested in compliance with the referenced specification and P.O. requirements and meets all of them. This document was issued and validated by our Q.A. authorized representative staff with total independence of the manufacturing department.

GAC-06-020/5



SGC / ISO 9001:2008

ABS QUALITY EVALUATIONS  
CERTIFICADO No. 32110

PRECITUBO, S.A. DE C.V.  
DEPTO. DE ASEGURAMIENTO DE CALIDAD

**CERTIFICADO DE CALIDAD**  
**MILL TEST REPORT**



PRECITUBO, S.A. DE C.V. / Km. 11.4 Carretera a El Castillo, El Salto Jal. México C.P. 45680 Tel. (52) 33 3688-0002 /3688-0530. Fax (52) 33 3688-0631 / [www.precitubo.com.mx](http://www.precitubo.com.mx)

Pág: 2

FECHA: 11/20/2013

No. 49691

Product 100% tested by EDDY current with satisfactory results.

This inspection certificate was issued according to DIN/ EN 10204, Parr. 3.1,

Material fabricated according to ASME-SA-450

Fully Killed Steel

ASME Boiler and Pressure Vessel Code, Sect. II, Part. A, Ed.2010 Add.2011

Heat Treatment: ANNEALED

Material Free From Mercury Contamination.

Specification: ASME-SA-179/SA-179M-EDITION-2010

ASTM-A 179/A 179M-90a (Reapproved 2012)

Material fabricated according to NACE MR0175- 2003

Material fabricated according to NACE MR0103-2003

Country of Origin: ROMANIA

MANUFACTURING PROCESS: SEAMLESS COLD-DRAWN

REMARKS :

- Este documento certifica que los productos aqui descritos fueron manufacturados, probados e inspeccionados conforme a la especificación de referencia y cumplen satisfactoriamente los requerimientos de la O.C. correspondiente. Este documento fue elaborado y validado por un representante autorizado del staff de Aseguramiento de Calidad, con total independencia al departamento de manufactura.  
- This document certifies that the products supplied and described here were manufactured, sampled, inspected and tested in compliance with the referenced specification and P.O. requirements and meets all of them. This document was issued and validated by our Q.A. authorized representative staff with total independence of the manufacturing department.

GAC-06-020/6

Meets NACE MR0175 Latest Edition.

JOB #  
ITEM CODE#  
KIMTSUWORKS

**新日鐵住金株式会社**  
NIPPON STEEL & SUMITOMO METAL CORPORATION

社 址: 〒100-8071 東京都千代田区丸の内二丁目6番1号  
HEAD OFFICE: 2-6-1, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8071, JAPAN  
君津製鐵所: 〒299-1141 千葉県君津市君津1番地  
KIMITSUWORKS: 1, KIMITSU, KIMITSU-CITY, CHIBA-PREF, 299-1141 JAPAN

**鋼材検査証明書**  
**INSPECTION CERTIFICATE**

注文者 SHIPPER: HANWA CO., LTD.  
注文者照合番号 REFERENCE No.: 228410-685211000  
契約番号 CONTRACT No.: 3-811-H1-5-3-AT01  
商品名 COMMODITY: HOT ROLLED STEEL PLATES  
規格 SPECIFICATION: ASME SA-516 GRADE 70-E10-A11  
文書番号 DOCUMENT No.:

[ AS PER EN 10204 CERTIFICATE ON MATERIAL TESTS 3.1 )

証明書番号 CERTIFICATE No.: P-22373  
発行年月日 DATE OF ISSUE: 2013-03-25  
頁数: 47

需要家: EDMONTON EXCHANGER GROUP OF COMPANIES  
需要家管理番号: CUSTOMER'S CONTROL No. E10911-J1010ER E3001A02Q0 E05

| 寸法<br>DIMENSION<br>mm, inch, feet | 数量<br>QUANTITY | 質量<br>MASS<br>KG | 製鋼番号<br>CAST No.<br>試験番号<br>TEST No. | 製品番号<br>PLATE No.      | 位置<br>LOCATION<br>ORIENTATION | 引張試験<br>TENSILE TEST |                   |                 |                   | 衝撃試験<br>IMPACT TEST<br>2V - 50F<br>FT. LB<br>AVG EACH | HBW        | 化学成分<br>CHEMICAL COMPOSITION % |    |     |   |   |    |    |    |    |    |    |    |    |
|-----------------------------------|----------------|------------------|--------------------------------------|------------------------|-------------------------------|----------------------|-------------------|-----------------|-------------------|---|------------|--------------------------------|----|-----|---|---|----|----|----|----|----|----|----|----|
|                                   |                |                  |                                      |                        |                               | 耐力降伏点<br>YS<br>0.2%  | 引張強さ<br>TS<br>KSI | 伸び<br>E.L.<br>% | 断面収縮<br>R.A.<br>% |   |            | C                              | Si | Mn  | P | S | Cr | Ni | Mo | Nb | V  | Ta | N  | As |
| 1.500' X 121' X 480'              | 13             | 11:207           | G8265<br>04761                       | TESTED-PL<br>270021302 | TC1                           | 52                   | 76                | 34              |                   | TLF246<br>233<br>238<br>268                           | AVG<br>152 | 16                             | 37 | 146 | 8 | 3 | 1  | 2  | 2  | 0  | 12 | 0  | 33 | 41 |
| 1.500' X 121' X 480'              | 13             | 11:207           | G8265<br>04762                       | TESTED-PL<br>270021305 | TC1                           | 53                   | 76                | 35              |                   | TLF238<br>248<br>249<br>216                           | AVG<br>148 | 16                             | 37 | 146 | 8 | 3 | 1  | 2  | 2  | 0  | 13 | 0  | 41 |    |
| 1.500' X 121' X 480'              | 13             | 11:207           | G8265<br>04767                       | TESTED-PL<br>270021303 | TC1                           | 53                   | 76                | 35              |                   | TLF244<br>238<br>244<br>249                           | AVG<br>153 | 16                             | 37 | 146 | 8 | 3 | 1  | 2  | 2  | 0  | 12 | 0  | 33 | 41 |

注釈 NOTES: Location Orientation 位置・方向: T: 頂面 Top, B: 底面 Bottom, L: 経度方向 Longitudinal, C: 直角方向 Transverse, Z: 板厚方向 Through Thickness, R: 45° 方向 45Deg to the Longitudinal Axis  
 G.L: 試験距離 Gage Length, A: 50mm 平形試験片 Rectangular, B: 50mm 丸形試験片 Round, C: 70mm 平形試験片 Rectangular, D: 70mm 丸形試験片 Round, E: 80mm 平形試験片 Rectangular, F: 80mm 丸形試験片 Round, G: 200mm, H: 2", I: 8", J: 5.65√So, K: 4√So  
 R.A: 絞り Reduction of Area, Y.R: 降伏比 Yield Ratio, A: 合格 Acceptable, F: 標準寸法 FULL SIZE, 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品厚 Plate Thickness, P: 製品分析 Product Analysis  
 N: 焼戻 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, C.R: Controlled Rolled, N I C: NIC Process/TMC Process, C.L.C: CLC Process/TMC Process, A.R: As Rolled, T.M.R: TMR Process/TMC Process, N.R: Normalizing Rolled  
 S.F: せん断破壊 Shear Fracture, C.F: 脆性破壊 Fracture, L.E: 横断伸長 Lateral Expansion, A.G.S: オーステナイト粒径 Austenite Grain Size, F.G.S: フェライト粒径 Ferrite Grain Size, S.R: Stress Relieved/Post Weld Heat Treatment

上記注作品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN  
MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.

*J. Adachi*  
君津製鐵所 品質保証室  
HEAD OF DEPARTMENT  
QUALITY ASSURANCE DEPT.  
KIMITSUWORKS

A73004702512

B

注 文 者 SHIPPER : HANWA CO., LTD.  
 注文者照合番号 REFERENCE No. : 228410-685211000  
 契約番号 CONTRACT No. : 3-811-H1-5-3-AT01  
 商 品 名 COMMODITY : HQT ROLLED STEEL PLATES  
 規 格 SPECIFICATION : ASME SA-516 GRADE 70-E10-A11  
 文 書 番 号 DOCUMENT No. :

**新日鐵住金株式会社**  
 NIPPON STEEL & SUMITOMO METAL CORPORATION

**鋼材検査証明書**  
**INSPECTION CERTIFICATE**

本 社 : 〒100-8071 東京都千代田区丸の内二丁目5番1号  
 HEAD OFFICE : 2-6-1, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8071, JAPAN  
 君津製鐵所 : 〒299-1141 千葉県君津市君津1番地  
 KIMITSU WORKS : 1, KIMITSU, KIMITSU-CITY, CHIBA-PREF. 299-1141 JAPAN

証明書番号 CERTIFICATE No. : P-22373 PAGE : 46  
 発行年月日 DATE OF ISSUE : 2013-03-25

( AS PER EN 10204 CERTIFICATE ON MATERIAL TESTS 3.1 )

需要家 EDMMONTON EXCHANGER GROUP OF C- 需要家管理番号 : E10911-J1010ER E3001A02Q0 ED5  
 CUSTOMER COMPANIES

| 寸 法<br>DIMENSION<br>mm, inch, feet | 数量<br>QUANTITY | 質量<br>MASS<br>KG | 製鋼番号<br>CAST No.<br>試験番号<br>TEST No. | 製品番号<br>PLATE No.      | 位置<br>LOCATION<br>ORIENTATION | 引張試験<br>TENSILE TEST   |            |               | 衝撃試験<br>IMPACT TEST<br>2V - 50F<br>FT. LB | 平均値<br>AVG | 個々値<br>EACH | 化学成分<br>CHEMICAL COMPOSITION % |    |     |   |   |    |    |    |    |    |   |     |     |
|------------------------------------|----------------|------------------|--------------------------------------|------------------------|-------------------------------|------------------------|------------|---------------|---|------------|-------------|--------------------------------|----|-----|---|---|----|----|----|----|----|---|-----|-----|
|                                    |                |                  |                                      |                        |                               | 耐力伸長率<br>YS YP<br>0.2% | 引張強さ<br>TS | 伸び<br>EL<br>% |   |            |             | C                              | Si | Mn  | P | S | CU | Ni | Cr | Mo | Nb | V | TAI | TAI |
| 1. 250' X 121' X 480'              | 12             | 9338             | G8266<br>04787                       | TESTED-PL<br>270021204 | TCI                           | 52                     | 77         | 33            | 223                                       | 212        | 153         | 16                             | 37 | 144 | 6 | 3 | 1  | 1  | 2  | 0  | 11 | 0 | 33  | 41  |
| 1. 250' X 121' X 480'              | 12             | 9338             | G8266<br>04796                       | TESTED-PL<br>270021206 | TCI                           | 54                     | 77         | 30            | 189                                       | 229        | 152         | 16                             | 37 | 144 | 6 | 3 | 1  | 1  | 2  | 0  | 11 | 0 | 33  | 41  |
| 1. 500' X 121' X 480'              | 13             | 11207            | G8265<br>04760                       | TESTED-PL<br>270021306 | TCI                           | 52                     | 77         | 34            | 220                                       | 213        | 153         | 16                             | 37 | 146 | 8 | 3 | 1  | 2  | 2  | 0  | 12 | 0 | 33  | 41  |

注 釈 NOTES 表1 Location Orientation 位置・方向, T:頂面 Top, B:底面 Bottom, L:圧延方向 Longitudinal, C:直角方向 Transverse, Z:板厚方向 Through Thickness, R:45° 方向 45Deg. to the Longitudinal Axis  
 表2 G1: 標点距離 Gege Length, A: 50mm 平形試験片 Rectangular, B: 50mm 丸形試験片 Round, C: 70mm 平形試験片 Rectangular, D: 70mm 丸形試験片 Round, E: 80mm 平形試験片 Rectangular, F: 80mm 丸形試験片 Round, G: 200mm, H: 2', I: 8', J: 5.65√So, K: 4√So  
 表3 RA: 絞り Reduction of Area, YR: 降伏比 Yield Ratio, 表4 A: 合格 Acceptable, 表5 F: 標準寸法 FULL SIZE, 2: 2.5mm, 3: 3.3mm, 4: 3.33mm, 5: 5.0mm, 6: 6.67mm, 7: 7.5mm, 8: 6.7mm, 9: 製品板厚 Plate Thickness, 表6 P: 要成分分析 Product Analysis  
 表7 N: 焼戻 Normalized, Q: 焼入れ Quenched, T: 焼戻し Tempered, CR: Controlled Rolled, N I C: NIC Process/TMC Process, C L C: CLC Process/TMC Process, A R: As Rolled, T M R: TMR Process/TMC Process, N R: Normalizing Rolled  
 S I: せん断破壊 Shear Fracture, C F: 脆性破壊面 Crystallinity Fracture, L E: 側膨出 Lateral Expansion, A G S: オーステナイト粒度 Austenite Grain Size, F G S: フェライト粒度 Ferrite Grain Size, S R: Stress Relieved/Post Weld Heat Treatment

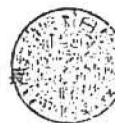
上記注作品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN  
 MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.



17703

J. Adachi  
 君津製鐵所 品質保証室  
 HEAD OF DEPARTMENT  
 QUALITY ASSURANCE DEPT.  
 KIMITSU WORKS







8" SCH STD SA106-B , #60107



**INSPECTION CERTIFICATE 3.1**  
**CERTIFICADO DE INSPECCIÓN 3.1**  
**EN 10204 3.1: 2004**

Number / Número: **12030983**  
 Page / Página: **1 / 6**  
 Date / Día: **May 11, 2012**

Tenaris de México S.A.  
 Carretera México-Veracruz KM 433.7 511  
 Del Rio, Veracruz, Veracruz, Veracruz  
 C.P. 91607 MF 4100  
 (52) 229 669 1100 tel  
 (52) 229 669 1800 fax

|  |                                  |  |   |   |
|--|----------------------------------|--|---|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) INC.</b>   |                                  | Customer's Order Item / Orden Cliente - Item: <b>PO 45001486 ITEM 1</b>                        | Customer's Reference / Ref. del Cliente: <b>N/A</b>   | Manufacturer's Works Order N° / Confirmación de Venta: <b>174191/01</b>   |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b><br><b>LAMINADO EN CALIENTE SIN COSTURA</b> |                                  | Product Type / Tipo de Producto:<br><b>LINE PIPE SEAMLESS</b><br><b>CONDUCCION SIN COSTURA</b> |   | Surface / Superficie:<br><b>VARNISHED</b><br><b>BARNIZADO</b>             |
| Standard or Specification / Normas o Especificaciones:<br><b>CSA Z245.1-07, ABRIL 2007</b>                               |                                  |  | Steel Grade / Grado de acero:<br><b>GR B/290 PSL1</b>   | Ends / Extremos:<br><b>NORMAL BEVEL</b><br><b>BISELADO NORMAL</b>         |
| Dimensions / Dimensiones:<br><b>8 5/8 X 0.322 INCH</b><br><b>219.1 X 8.2 MM</b>  | Schedule / Cédula:<br><b>040</b> | Length / Longitud:<br><b>38.02 / 44.00 FT</b><br><b>11.59 / 13.41 MTS</b>                      | Quantity / Cantidad: <b>72 Pcs/Pz</b><br><b>3134.252 FT</b> <b>90740.137 LB</b><br><b>955.320 MTS</b> <b>41159.000 KG</b> | Nominal Weight / Peso Nominal:<br><b>28.58 LB/FT</b><br><b>42.55 KG/M</b> |

**TENSILE TEST / ENSAYO DE TENSION**

| Heat N°<br>Cofada N° | Sample N°<br>Muestra N° | Zone<br>Zona | Pipe N°<br>Tubo N° | Specimen condition<br>Condición de la probeta |    |              |     | Specimen dimensions<br>Dimensiones de la probeta |                 | Test temp.<br>Temp. ensayo | Y.S.<br>Eul 0.50 %         |                            | U.T.S.<br>Req. |      | Y.S./U.T.S.<br>Req. Max. | Elongation / Alargamiento |    |                 |
|----------------------|-------------------------|--------------|--------------------|---|----|--------------|-----|--|-----------------|----------------------------|----------------------------|----------------------------|----------------|------|--------------------------|---------------------------|----|-----------------|
|                      |                         |              |                    | Ls  | Sc | Type<br>Tipo | Ori | Size<br>Tamaño                                   | Area<br>Sección |                            | Min: 42 000<br>Max: 71 790 | Min: 60 000<br>Max: 90 650 | Lo             | Min. |                          | Obt.                      |    |                 |
|                      |                         |              |                    |   |    |              |     |  |                 |                            |                            |                            |                |      |                          |                           | mm | mm <sup>2</sup> |
| 60107                | 92136                   | E2           | 1                  | B   | AM | Ss           | L   | 38.04 X 08.20                                    | 313.65          | RT                         | 48 287                     | 73 348                     | 0.68           | 2    | 27.1                     | 39.0                      |    |                 |
| 60107                | 92137                   | E2           | 2                  | B   | AM | Ss           | L   | 38.05 X 08.51                                    | 325.60          | RT                         | 44 049                     | 71 670                     | 0.61           | 2    | 27.3                     | 40.0                      |    |                 |

|  |  |  |  |
|--|--|--|--|
| AM: As manufactured / Según proceso de fabricación | Ls: Location of sample / Ubicación de la muestra | Req. Max: Required maximum / Máximo requerido    | U.T.S: Ultimate tensile strength / Resistencia |
| B: Body / Cuerpo                                   | Max: Maximum / Máximo                            | Req: Required / Requerido                        | Y.S: Yield strength / Fluencia                 |
| E1 / E2: Ends of Sampling / Extremos de Muestra    | Min: Minimum / Mínimo                            | RT: Room temperature / Temperatura ambiente      |  |
| L: Longitudinal / Longitudinal                     | Obt: Obtained / Obtenido                         | Sc: Specimen condition / Condición de la probeta |  |
| Lo: Initial length / Longitud inicial              | Ori: Orientation / Orientación                   | Ss: Strip specimen / Muestra rectangular         |  |

THIS CERTIFICATE IS SUBJECT TO  
 ANNIE SECTION II BY  
 CAL HEX INDUSTRIES LTD.  
 DATE **06/11/2013**  
 SIGNATURE **[Signature]**  
 MIN THICK **.333"**

CONFORMS TO 2010 EDITION: **2011 ADDENDA**  
 $\leq 1.00$       **CE = 0.34**  
 Meets NACE MR0175 Latest Edition.

JOB # **13-0856**  
 HEAT CODE # **C-235**  
**(60107)**

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es válido con firma electrónica. El certificado original posee impreso el logo "Tenaris" color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal o indebido. Cualquier alteración y/o falsificación estará sujeta a la ley.

APPROVED BY

FOR03171



**INSPECTION CERTIFICATE 3.1**  
**CERTIFICADO DE INSPECCIÓN 3.1**  
**EN 10204 3.1: 2004**

Number / Número:  
**12030983**

Page / Página:  
**2 / 6**

Date / Día: **May 11, 2012**

Tubos de Acero de México S.A.  
 Carretera México Veracruz, KM 435.7 3R.  
 Salinas Valenciana Tuxtla, Veracruz, Veracruz  
 C.P. 229 587 MEXICO  
 (52) 229 589 1100 tel  
 (52) 229 589 1500 fax

|  |                                  |  |   |   |   |  |  |
|--|----------------------------------|--|---|---|---|--|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) INC.</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001486 ITEM 1</b>                     |   | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>            |   | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>174191/01</b> |  |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b><br><b>LAMINADO EN CALIENTE SIN COSTURA</b> |                                  | Product Type / Tipo de Producto:<br><b>LINE PIPE SEAMLESS</b><br><b>CONDUCCION SIN COSTURA</b> |   | Surface / Superficie:<br><b>VARNISHED</b><br><b>BARNIZADO</b>     |   |  |  |
| Standard or Specification / Normas o Especificaciones:<br><b>CSA Z245.1-07, ABRIL 2007</b>                               |                                  | Steel Grade / Grado de acero:<br><b>GR B/290 PSL1</b>  |   | Ends / Extremos:<br><b>NORMAL BEVEL</b><br><b>BISELADO NORMAL</b> |   |  |  |
| Dimensions / Dimensiones:<br><b>8 5/8 X 0.322 INCH</b><br><b>219.1 X 8.2 MM</b>  | Schedule / Cédula:<br><b>040</b> | Length / Longitud:<br><b>38.02 / 44.00 FT</b><br><b>11.59 / 13.41 MTS</b>                      | Quantity / Cantidad: <b>72 Pcs/Pz</b><br><b>3134.252 FT</b> <b>90740.137 LB</b><br><b>955.320 MTS</b> <b>41159.000 KG</b> |   | Nominal Weight / Peso Nominal:<br><b>28.58 LB/FT</b><br><b>42.55 KG/M</b> |  |  |

**CHEMICAL COMPOSITION / COMPOSICIÓN QUÍMICA**

|           |            | Composition % / Composición % |     |     |    |    |        |     |     |     |     |     |    |         |     |     |       |    |    |       |       |        |        |      |
|-----------|------------|-------------------------------|-----|-----|----|----|--------|-----|-----|-----|-----|-----|----|---------|-----|-----|-------|----|----|-------|-------|--------|--------|------|
|           |            | X 100                         |     |     |    |    | X 1000 |     |     |     |     |     |    | X 10000 |     |     | X 100 |    |    |       |       |        |        |      |
|           |            | C                             | Mn  | Si  | Cr | Mo | S      | P   | Ni  | V   | Cu  | Al  | Sn | As      | Nb  | Ti  | Ca    | B  | N  | Co. 1 | Co. 2 | Col. 1 | Col. 2 |      |
|           | H Max      | 25                            | 135 | 50  | 40 | 15 | 10     | 30  | 400 | 80  | 400 | --  | -- | --      | 110 | 110 | --    | 10 | -- | 40    | --    | --     | 99.99  |      |
|           | Min        | --                            | 29  | 10  | -- | -- | --     | --  | --  | --  | --  | --  | -- | --      | --  | --  | --    | -- | -- | --    | --    | 300    | --     |      |
| Heat N°   | Sample N°  | P Max                         | 25  | 135 | 50 | 40 | 15     | 10  | 30  | 400 | 80  | 400 | -- | --      | --  | 110 | 110   | -- | 10 | --    | 40    | --     | 99.99  |      |
| Colada N° | Muestra N° | Min                           | --  | 29  | 10 | -- | --     | --  | --  | --  | --  | --  | -- | --      | --  | --  | --    | -- | -- | --    | --    | 300    | --     |      |
| 60107     | 00001      | H                             | 17  | 66  | 29 | 8  | 2.9    | 4.1 | 21  | 70  | 0   | 213 | 19 | 14      | 4   | 0   | 0     | 19 | 0  | 80    | 32    | 32     | 388.23 | 39.2 |
| 60107     | 92136      | P                             | 18  | 68  | 29 | 8  | 2.9    | 3.7 | 21  | 70  | 0   | 216 | 21 | 14      | 4   | 0   | 0     | 18 | 0  | 80    | 34    | 34     | 377.77 | 40.5 |
| 60107     | 92137      | P                             | 18  | 67  | 29 | 8  | 2.9    | 3.4 | 19  | 70  | 0   | 215 | 21 | 14      | 4   | 0   | 0     | 18 | 0  | 80    | 34    | 33     | 372.23 | 39.4 |

Co. 1: Carbon equivalent(Canadian)/Carbono

Col. 1: REL Mn/C

Max: Maximum / Máximo

equivalente(Canadiense)

Col. 2: SUMA Mo+Cr+Ni+Cu+V

Min: Minimum / Mínimo

Co. 2: Carbon equivalent/Carbono equivalente

H: Heat / Colada

P: Product / Producto

**THROUGH WALL HARDNESS / DUREZA EN EL ESPESOR**

| Required values    |           |      | Individuals / Individuales |                    |         |         | Average / Promedio |         |                |      | Hardness type HRC |      |      |      |      |      |      |      |      |      |
|--------------------|-----------|------|----------------------------|--------------------|---------|---------|--------------------|---------|----------------|------|-------------------|------|------|------|------|------|------|------|------|------|
| Valores requeridos |           |      | Min: --                    | Max: 22.0          | Var: -- | Min: -- | Max: --            | Var: -- | Tipo de dureza |      |                   |      |      |      |      |      |      |      |      |      |
| Heat N°            | Sample N° | Zone | Pipe N°                    | Specimen condition |         | Quad.   | Scale              | OD      |                |      |                   | MW   |      |      |      | ID   |      |      |      | Var. |
|                    |           |      |                            | Tube N°            | Ls      |         |                    | Sc      | 1              | 2    | 3                 | Avg. | 1    | 2    | 3    | Avg. | 1    | 2    | 3    |      |
| 60107              | 92136     | E2   | 1                          | B                  | AM      | 1       | HRBW               | 85.9    | 85.8           | 86.8 | 86.2              | 86.0 | 86.0 | 86.7 | 86.2 | 86.0 | 86.4 | 86.4 | 86.3 | 0.1  |
| 60107              | 92137     | E2   | 2                          | B                  | AM      | 1       | HRBW               | 85.8    | 86.1           | 86.4 | 86.1              | 85.3 | 85.9 | 86.0 | 85.7 | 86.0 | 86.0 | 86.4 | 86.7 | 1.0  |

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**INSPECTION CERTIFICATE 3.1**  
**CERTIFICADO DE INSPECCIÓN 3.1**  
**EN 10204 3.1: 2004**

Number / Número: **12030983** Page / Página: **3 / 6**  
 Date / Día: **May 11, 2012**

Tenaris de Acero de México, S.A.  
 Carretera México Veracruz KM 433.7 ST.  
 Dolmite Jalisco y Tepeh, Veracruz, Veracruz  
 C.P. 91897 MEXICO  
 (52) 229 569 1100 tel  
 (52) 229 569 1800 fax

|  |                                  |  |   |  |
|--|----------------------------------|--|---|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) INC.</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001486 ITEM 1</b>                     | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>174191/01</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b><br><b>LAMINADO EN CALIENTE SIN COSTURA</b> |                                  | Product Type / Tipo de Producto:<br><b>LINE PIPE SEAMLESS</b><br><b>CONDUCCION SIN COSTURA</b> |   | Surface / Superficie:<br><b>VARNISHED</b><br><b>BARNIZADO</b>              |
| Standard or Specification / Normas o Especificaciones:<br><b>CSA Z245.1-07, ABRIL 2007</b>                               |                                  |  | Steel Grade / Grado de acero:<br><b>GR B/290 PSL1</b>   | Ends / Extremos:<br><b>NORMAL BEVEL</b><br><b>BISELADO NORMAL</b>          |
| Dimensions / Dimensiones:<br><b>8 5/8 X 0.322 INCH</b><br><b>219.1 X 8.2 MM</b>  | Schedule / Cédula:<br><b>040</b> | Length / Longitud:<br><b>38.02 / 44.00 FT</b><br><b>11.59 / 13.41 MTS</b>                      | Quantity / Cantidad: <b>72 Pcs/Pz</b><br><b>3134.252 FT</b> <b>90740.137 LB</b><br><b>955.320 MTS</b> <b>41159.000 KG</b> | Nominal Weight / Peso Nominal:<br><b>28.58 LB/FT</b><br><b>42.55 KG/M</b>  |

**THROUGH WALL HARDNESS / DUREZA EN EL ESPESOR**

|  |  |  |                            |
|--|--|--|----------------------------|
| AM: As manufactured / Según proceso de fabricación | ID: Internal diameter / Diámetro interno         | MW: Middle wall / Centro                         | Var: Variation / Variación |
| Avg: Average / Promedio                            | LS: Location of sample / Ubicación de la muestra | OD: Outside diameter / Diámetro externo          |                            |
| B: Body / Cuerpo                                   | Max: Maximum / Máximo                            | Quad: Quadrant / Cuadrante                       |                            |
| E1 / E2: Ends of Sampling / Extremos de Muestra    | Min: Minimum / Mínimo                            | Sc: Specimen condition / Condición de la probeta |                            |

**FLATTENING TEST / ENSAYO DE APLASTAMIENTO**

| Standard / Norma:    |                         |                    |      |                     | Standard / Norma:    |                         |                    |      |                     |
|----------------------|-------------------------|--------------------|------|---------------------|----------------------|-------------------------|--------------------|------|---------------------|
| Heat N°<br>Colada N° | Sample N°<br>Muestra N° | Pipe N°<br>Tubo N° | Zone | Result<br>Resultado | Heat N°<br>Colada N° | Sample N°<br>Muestra N° | Pipe N°<br>Tubo N° | Zone | Result<br>Resultado |
| 60107                | 92136                   | 00001              | E2   | Good / Bueno        | 60107                | 92137                   | 00002              | E2   | Good / Bueno        |

E1 / E2: Ends of Sampling / Extremos de Muestra

**HYDROSTATIC TEST / PRUEBA HIDRAULICA**

| Pressure / Presión           | Time / Tiempo | Results / Resultado |
|------------------------------|---------------|---------------------|
| Unit / Unidad.               | Value / Valor | Seconds / Segundos  |
| psi                          | 2,360         | 5                   |
| Satisfactory / Satisfactorio |               |                     |

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**12030983**

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Date / Día: **May 11, 2012**

Tenaris de Acero de México, S.A.  
 Carretera México-Veracruz KM 433.7 SN  
 Cuff 7a. Vialfroncelo Tejería, Veracruz, Veracruz  
 C.P. 51597 MEXICO  
 (52) 229 969 1100 tel  
 (52) 229 969 1000 fax

|  |                                  |  |   |  |
|--|----------------------------------|--|---|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) INC.</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001486 ITEM 1</b>               | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>                      | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>174191/01</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED<br/>LAMINADO EN CALIENTE SIN COSTURA</b> |                                  | Product Type / Tipo de Producto:<br><b>LINE PIPE SEAMLESS<br/>CONDUCCION SIN COSTURA</b> |   | Surface / Superficie:<br><b>VARNISHED<br/>BARNIZADO</b>                    |
| Standard or Specification / Normas o Especificaciones:<br><b>CSA Z245.1-07, ABRIL 2007</b>                         |                                  |  | Steel Grade / Grado de acero:<br><b>GR B/290 PSL1</b>                       | Ends / Extremos:<br><b>NORMAL BEVEL<br/>BISELADO NORMAL</b>                |
| Dimensions / Dimensiones:<br><b>8 5/8 X 0.322 INCH<br/>219.1 X 8.2 MM</b>  | Schedule / Cédula:<br><b>040</b> | Length / Longitud:<br><b>38.02 / 44.00 FT<br/>11.59 / 13.41 MTS</b>                      | Quantity / Cantidad: <b>72 Pcs/Pz</b><br><b>3134.252 FT<br/>955.320 MTS</b> | Nominal Weight / Peso Nominal:<br><b>90740.137 LB<br/>41159.000 KG</b>     |

**HEAT TREATMENT / TRATAMIENTO TÉRMICO**

|  |
|--|
| Heat treatment / Tratamiento térmico: <b>Pipe / Tubo</b>   |
| Quench media of heat treatment process / Medio de enfriamiento del tratamiento térmico: <b>N/A</b> |
| Temperature Scale / Escala de Temperatura: <b>N/A</b>  |
| Type<br>Tipo   |
| As rolled  |

**SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA**

| Supplementary Information<br>Información Suplementaria   |  |
|--|--|
| Manufactured by TenarisTamsa<br>Steel making process:<br>Electric Arc Furnace-Ladle Furnace-Continuous Casting Machine.<br>Fully Killed Steel<br>Material free from Mercury contamination<br>Not repaired by welding<br>Non destructive test. Satisfactory<br>Inspection method<br>. - EMI - FLVI - MPI -<br>MATERIAL ACCORDING TO ASTM A106,11/ASME SA106, 2010 GR. B &<br>CSA Z245.1 GR. 290 CATI SS, APRIL 2007<br>MATERIAL ACCORDING TO NACE MR0175 & NACE MR0103, 2003<br>REL MnC MIN 3 | Fabricado por TenarisTamsa<br>Fabricación del acero:<br>Horno de Arco Eléctrico-Horno de Afinación-Máquina de Colada Continua.<br>Acero calmado con aluminio<br>Material libre de contaminación de Mercurio<br>No reparado por soldadura<br>Control no destructivo. Satisfactorio<br>Método de Inspección<br>. - EMI - FLVI - MPI -<br>MATERIAL DE ACUERDO A ASTM A106,11/ASME SA106, 2010 GR. B &<br>CSA Z245.1 GR. 290 CATI SS, ABRIL 2007<br>MATERIAL DE ACUERDO A NACE MR0175 & NACE MR0103, 2003<br>REL MnC MIN 3 |

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Date / Día: **May 11, 2012**

Tenaris de América México, S.A.  
 Carretera México-Veracruz KM 433.7 GR  
 Dullado, Veracruz, Veracruz, Veracruz  
 C.P. 91597 MEXICO  
 (52) 229 965 1100 tel  
 (52) 229 965 1800 fax

|  |                                  |  |   |  |
|--|----------------------------------|--|---|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) INC.</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001486 ITEM 1</b>               | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>174191/01</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED<br/>LAMINADO EN CALIENTE SIN COSTURA</b> |                                  | Product Type / Tipo de Producto:<br><b>LINE PIPE SEAMLESS<br/>CONDUCCION SIN COSTURA</b> |   | Surface / Superficie:<br><b>VARNISHED<br/>BARNIZADO</b>                    |
| Standard or Specification / Normas o Especificaciones:<br><b>CSA Z245.1-07, ABRIL 2007</b>                         |                                  | Steel Grade / Grado de acero:<br><b>GR B/290 PSL1</b>                                    |   | Ends / Extremos:<br><b>NORMAL BEVEL<br/>BISELADO NORMAL</b>                |
| Dimensions / Dimensiones:<br><b>8 5/8 X 0.322 INCH<br/>219.1 X 8.2 MM</b>  | Schedule / Cédula:<br><b>040</b> | Length / Longitud:<br><b>38.02 / 44.00 FT<br/>11.59 / 13.41 MTS</b>                      | Quantity / Cantidad: <b>72 Pcs/Pz</b><br><b>3134.252 FT                      90740.137 LB<br/>955.320 MTS                      41159.000 KG</b> | Nominal Weight / Peso Nominal:<br><b>28.58 LB/FT<br/>42.55 KG/M</b>        |

**SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA**

| Supplementary Information<br>Información Suplementaria                         |  |
|--|--|
| SUM Mo+Cr+Ni+Cu+V    MAX 0.9999<br>CERTIFICATE ACCORDING TO EN 10204 3.1: 2004 | SUM Mo+Cr+Ni+Cu+V    MAX 0.9999<br>CERTIFICADO DE ACUERDO A EN 10204 3.1: 2004 |

**MARKING / MARCACIÓN**

| Marking<br>Marcación   |  |
|--|--|
| <b>PIPE STENCIL:</b><br>#T***** TENARIS TM ASTM A106/ASME SA106 / CSA Z245.1 #FE1 219.1 8.20 42.55 SCH 040 GR B/290 CAT I SS<br>S TEST PRESSURE/NDE#M*** MT #K**** KG HEAT #C**** O.P 197596 / #T***** HABILITADA MADE IN MEXICO<br>WHERE:<br>Heat number #C****:<br>Manufacturing Date #FE1:<br>Net weight of pipe in Kgs #K****:<br>length Mts #M****:<br>Total Traceability Number #T*****:<br>HABILITADA PO 45001486 | <b>MASCARILLA DE TUBO ESTARCIDO:</b><br>#T***** TENARIS TM ASTM A106/ASME SA106 / CSA Z245.1 #FE1 219.1 8.20 42.55 SCH 040 GR B/290 CAT I SS<br>S TEST PRESSURE/NDE#M*** MT #K**** KG HEAT #C**** O.P 197596 / #T***** HABILITADA MADE IN MEXICO<br>DONDE:<br>Numero de colada #C****:<br>Fecha de Fabricación #FE1:<br>Peso real de tubo en Kgs #K****:<br>Longitud del tubo en Mts #M****:<br>Num. de Rastreab. Total #T*****:<br>HABILITADA PO 45001486 |

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es validado con firma electrónica. El certificado original posee impreso el logo Tenaris color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal o indebido. Cualquier alteración y/o falsificación estará sujeta a la ley.



**INSPECTION CERTIFICATE 3.1**  
**CERTIFICADO DE INSPECCIÓN 3.1**  
**EN 10204 3.1: 2004**

Number / Número:

**12030983**

Page / Página:

**6 / 6**

Date / Día: **May 11, 2012**

Tenaris de Acero de México S.A.  
 Carretera México Veracruz Km 453.7 S/N.  
 D.F. 01897 MEXICO  
 (52) 229 689 1100 tel  
 (52) 229 689 1800 fax

|  |                                  |  |   |  |  |
|--|----------------------------------|--|---|--|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) INC.</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001486 ITEM 1</b>                     |   | Customer's Reference / Ref. del Cliente:<br><b>N/A</b> | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>174191/01</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b><br><b>LAMINADO EN CALIENTE SIN COSTURA</b> |                                  | Product Type / Tipo de Producto:<br><b>LINE PIPE SEAMLESS</b><br><b>CONDUCCION SIN COSTURA</b> |   |  | Surface / Superficie:<br><b>VARNISHED</b><br><b>BARNIZADO</b>              |
| Standard or Specification / Norma o Especificaciones:<br><b>CSA Z245.1-07, ABRIL 2007</b>                                |                                  |  | Steel Grade / Grado de acero:<br><b>GR B/290 PSL1</b>   |  | Ends / Extremos:<br><b>NORMAL BEVEL</b><br><b>BISELADO NORMAL</b>          |
| Dimensions / Dimensiones:<br><b>8 5/8 X 0.322 INCH</b><br><b>219.1 X 8.2 MM</b>  | Schedule / Cédula:<br><b>040</b> | Length / Longitud:<br><b>38.02 / 44.00 FT</b><br><b>11.59 / 13.41 MTS</b>                      | Quantity / Cantidad: <b>72 Pcs/Pz</b><br><b>3134.252 FT</b> <b>90740.137 LB</b><br><b>955.320 MTS</b> <b>41159.000 KG</b> |  | Nominal Weight / Peso Nominal:<br><b>28.58 LB/FT</b><br><b>42.55 KG/M</b>  |



**SUMMARY REPORT / REPORTE RESUMEN**

| Heat N°<br>Colada N° | Quantity<br>Cantidad<br>(Pieces) | Length<br>Longitud |        | Weight<br>Peso<br>(Tons) |
|----------------------|----------------------------------|--------------------|--------|--------------------------|
|                      |                                  | (ft)               | (m)    |                          |
| 60107                | 72                               | 3,134.25           | 955.32 | 41.169                   |

| Average length per pipe    |        | Nominal weight per pipe |        |
|----------------------------|--------|-------------------------|--------|
| Longitud promedio por tubo |        | Peso nominal por tubo   |        |
| (ft)                       | (m)    | (lb/ft)                 | (kg/m) |
| 43.531                     | 13.268 | 28.951                  | 43.084 |

This is to certify that the product described here has been manufactured, sampled, tested, and inspected in accordance with purchaser order requirements. This certificate is not a declaration of origin nor may it be used as a declaration of origin.

Por el presente certificamos que el material aquí descrito ha sido fabricado, muestreado, ensayado e inspeccionado de acuerdo a los requisitos de su orden de compra. Este certificado no es, ni puede ser usado, como una declaración de origen.

|   |  |   |   |
|---|--|---|---|
| <b>CUSTOMER, THIRD PARTY</b>  |  | <b>TENARIS QUALITY DEPARTMENT SIGNATURE</b>   |   |
| INSPECTION COMPANY<br>COMPAÑÍA DE INSPECCIÓN<br><br>NO APLICA<br>Employee Name: N/A |  | <br><br>QUALITY CERTIFICATION DEPT.<br>DEPTO. DE CERTIFICACIÓN DE CALIDAD<br>Antonio Fontanes González | <br><br>CHIEF OF QUALITY CERTIFICATION DEPT.<br>RESPONSABLE DEL DEPTO. DE CERTIFICACIÓN DE CALIDAD<br>Ricardo Lozano Armenta |

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es validado con firma electrónica. El certificado original posee impreso el logo Tenaris color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal o indebido. Cualquier alteración y/o falsificación estará sujeta a la ley.

FOR03171

8" CL 150 W/N FLANGE RF STD BORE A105N

PO# CX-11158 Item# 11 Heat Number: 548A2 Trans Am Piping Products Ltd. Rev'd By: SB P.O./seq #: CL:13 10625

CLIENTE / Customer / Client  
**ALLIED FITTING CANADA**  
 172 TURBO DRIVE  
 SHERWOOD PARK, ALBERTA  
 T8H 2J6 - CANADA

**CERTIFICADO DE INSPECCION**  
 Inspection Certificate - Certificat de Réception

DIN EN 10204 / 3.1  
 ISO 10474 / 3.1



ULMA FORJA, S.COOP

FECHA: 19/10/2012 N.º 151965 HOJA: 1  
 Date: No. Page:

PRODUCTO **FLANGES**  
 Article - Produit

SU PEDIDO N.º **Z377627-ES - EDMONTON - KEARL**  
 Your Order No. / Votre Cde. N.º

DE **04/10/2012**  
 of. - de

Certified acc. PED 97/23/EC+AD2000-W0  
 by TÜV Rheinland  
 N.º 01 202 EQ 02 7443

Bº Zubillaga, 3 - Apdo. 14  
 20560 ONATI (Gipuzkoa) SPAIN  
 Tel.: 34 - 943 780552  
 Fax: 34 - 943 781808  
 E-mail: ulma@ulmapiping.com

NORMAS APLICABLES **ASME B16.5-09**  
 Requirements - Normes Applicables **ASME B16.47-11**

MARCA DEL FABRICANTE  
 Mark of factory  
 Marque du fabricant



Packing List: 96938

MATERIAL CORRESPONDIENTE **ASTM/ASME A/SA105N-11**  
 Material Correspondent - Qualité

DEPARTAMENTO **QUALITY ASSURANCE**  
 Section / Département

MODO DE FUSION (\*) **NACE MR0175/ISO15158-2-09 & MR0103-10**  
 Steel Making - Elaboration de l'acier **Clause 7.2.1.4, Annex A.2 and SSC Region 3.**  
 E = Elec. Y = Oxigeno básico **CSA-Z245.12-09 Gr.248 CAT I-SS (WN & BLIND FLANGES ONLY)**

| PARTIDA<br>Item<br>Poste | CANTIDAD<br>Quantity<br>Quantité | DESCRIPCION<br>Description<br>Description | OBSERVACIONES<br>Remarks<br>Observations (*) | COLADA N.º<br>Heat No<br>N.ºCoulée | RESISTENCIA<br>T.Strength<br>Resist Tens<br>N/mm2 | LIMITE ELAST.<br>Y.Strength<br>0.2 %<br>N/mm2 | ALARGAM.<br>Elongation<br>Allongement<br>Lo: 4 d<br>% | ESTRICCION<br>Red. Area<br>Striction<br>% | RESILIENCIA<br>Impact test<br>Résilience<br>Joules | CHARPY V 10x10mm |    | DUREZA<br>Hardness<br>Dureté<br>HBW |
|--------------------------|----------------------------------|---|--|------------------------------------|---|---|---|---|--|------------------|----|-------------------------------------|
|                          |                                  |   |  |                                    |   |   |   |   |  | Average          | °C |                                     |
| 8                        | 360                              | WN 8 150LB STD/40 RF A105N                | NE   | 548A2                              | 511   | 306   | 28,50   | 58,60                                     |  |                  |    | 150 154                             |

| COLADA N.º<br>Heat No<br>N.ºCoulée | COMPOSICION QUIMICA - STEEL MAKER'S LADLE ANALYSIS - ANALYSE CHIMIQUE |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|------------------------------------|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                    | C %   | Si %  | Mn %  | P %   | S %   | Cr %  | Ni %  | Mo %  | Nb %  | V %   | Cu %  | Al %  | Ti %  | N %   | CEq % |
| 548A2                              | 0.200   | 0.260 | 0.820 | 0.006 | 0.002 | 0.181 | 0.048 | 0.024 | 0.001 | 0.002 | 0.122 | 0.034 | 0.010 | 0.000 | 0.389 |

- Las dimensiones y la condición superficial se hallaron satisfactorias.
- Dimension and surface condition were found acceptable.
- Les dimensions et états de surface sont satisfaisants.
- Los materiales citados cumplen las normas aplicables.
- Manufacturing requirements are satisfied.
- Les normes applicables sont respectées.

(\*) OBSERVACIONES:  
 Remarks  
 Observations  
**N NORMALIZED AT 900 C AND ALLOWED TO COOL IN STILL AIR**

CONFORMS TO 2010 EDITION, 2011 ADDENDA  
 $\leq 1.00$   $CE = 0.39$   
 $\leq 0.32$   
 Meets NACE MR0175 Latest Edition.

MATERIAL CHECKED TO  
 ASME SECTION II BY  
 CALHEX INDUSTRIES LTD  
 DATE: 04/11/13  
 SIGNATURE: [Signature]  
 MIN. THK.:

EL INSPECTOR  
 Works Inspector - L'Inspecteur  
  
 ULMA FORJA S. COOP.  
 Dpto. de Garantía de calidad  
 Quality Assurance Dept.





**METALFAR**  
**PRODOTTI INDUSTRIALI S.P.A.**

STRABAGIO & CALDO DI ACCIAI CALDI - LEGATI E INOSSIDABILI

23051 CASARSA BRIANZA (LC) - Italy  
 Via G. Pirelli, 28  
 Tel. +39 031 659441  
 Fax +39 031 655149  
 quality.metal@metal.it

COMPANY WITH  
 QUALITY SYSTEM  
 CERTIFIED BY DNV  
 = ISO 9001 =

SALA PROVE E ANALISI MATERIALI / MATERIAL TEST DEPARTMENT

**CERTIFICATO DI COLLAUDO SECONDO EN 10204 - 3.1 INSPECTION CERTIFICATE**

|   |  |   |                                   |
|---|--|---|-----------------------------------|
| Certif. N. 4343<br>DDT / Del Note N. 3410   | Del/Dated 29.07.2013<br>Del/Dated 26.07.2013 | Fattura / Invoice N. 2946<br>No.Ord. / Our ref. N. 0                                    | Del/Dated 28.07.2013<br>Del/Dated |
| TRANS AM PIPING PRODUCTS LTD<br>9335 ENDEAVOR DRIVE S.E.<br>T3S 0A1 CALGARY, ALBERTA CA |  | Dest.: TRANS AM "PROJECT" Warehouse<br>1711 - 66 Avenue<br>T6P 1Y9 Edmonton, ALBERTA CA |                                   |

Pag. 5 - 8

|  |   |  |
|--|---|--|
| COD. COL. COLATA POS. VS.ORDINE Q.TA' DESCRIZIONE DIM.IN ACC. A VISIVO E DIMENS. | HEAT CODE HEAT ITEM YOUR REFERENCE Q.TY DESCRIPTION DIM. ACCORDANCE TO VIS. & DIMENS. | 12/72081 030 CI-13-329 231,00 W/N 300 RF 2" STD A105N ASME/ANSI B16.5 -2009 SATISFACTORY |
|--|---|--|

MATERIALE / MATERIAL

ASTM A105 (LADLE)

|       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| C%    | Si%   | Mn%   | S%    | P%    | Cr%   | Ni%   | Mo%   | Ti%   | Cu%   | V%    | Nb%   | N%    | Al%   | C.E.% |
| 0,185 | 0,250 | 0,910 | 0,010 | 0,010 | 0,110 | 0,050 | 0,010 | 0,021 | 0,160 | 0,002 | 0,002 | 0,000 | 0,027 | 0,375 |

|  |                           |  |   |                                   |   |                            |   |  |               |
|--|---------------------------|--|---|-----------------------------------|---|----------------------------|---|--|---------------|
| PROVETTA / TEST SPECIMEN<br>SEZ. mm2 LUNG. mm<br>SECT. mm2 LENGTH mm | FORMA<br>SHAPE<br>1-Ø 2-□ | SVERNAMENTO<br>YIELD POINT<br>N/mm2 >=0,2% | ROTTURA<br>TENSILE STRENGTH<br>N/mm2 >= | ALLUNGAMENTO<br>ELONGATION<br>%>= | CONTRAZIONE<br>REDUCTION OF AREA<br>%>= | DUREZZA<br>HARDNESS<br>HBW | RESILLENZA / IMPACT TEST - JOULE/cm2<br>TIPO / TYPE 10x10mm | SVERNAMENTO<br>YIELD POINT<br>N/mm2 >=1,0% | NUM. OUR REF. |
| 126,60 50,80   | 1                         | 327,0                                      | 515,0                                   | 31,0                              | 58,0                                    | 156,0 - 159,0              | KV C 1 2 3  | 0,0  |               |

MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO  
 ASTM/ASME A 105/SA 105 M - 11a ASME CODE SECT. II, PART A, ED. 2010  
 ADD. 2011a  
 CSA Z245.12 GRADE 248 CAT.I SOUR SERVICE

TRATTAMENTO TERMICO / HEAT TREATMENT  
 NORMALIZED AT 920 C - COOLED IN STILL AIR

FORNO / FURNACE ORIGINE / ORIGIN OF STEEL  
 ELECTRIC FURNACE EUROPEAN UNION

|  |   |   |
|--|---|---|
| COD. COL. COLATA POS. VS.ORDINE Q.TA' DESCRIZIONE DIM.IN ACC. A VISIVO E DIMENS. | HEAT CODE HEAT ITEM YOUR REFERENCE Q.TY DESCRIPTION DIM. ACCORDANCE TO VIS. & DIMENS. | 336303 076 CI-13-329 54,00 BLIND 150 RF 8" A105N ASME/ANSI B16.5 -2009 SATISFACTORY |
|--|---|---|

MATERIALE / MATERIAL

ASTM A105 (LADLE)

|       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| C%    | Si%   | Mn%   | S%    | P%    | Cr%   | Ni%   | Mo%   | Ti%   | Cu%   | V%    | Nb%   | N%    | Al%   | C.E.% |
| 0,197 | 0,201 | 1,120 | 0,012 | 0,013 | 0,070 | 0,020 | 0,018 | 0,002 | 0,030 | 0,003 | 0,000 | 0,004 | 0,036 | 0,405 |

|  |                           |  |   |                                   |   |                            |   |  |               |
|--|---------------------------|--|---|-----------------------------------|---|----------------------------|---|--|---------------|
| PROVETTA / TEST SPECIMEN<br>SEZ. mm2 LUNG. mm<br>SECT. mm2 LENGTH mm | FORMA<br>SHAPE<br>1-Ø 2-□ | SVERNAMENTO<br>YIELD POINT<br>N/mm2 >=0,2% | ROTTURA<br>TENSILE STRENGTH<br>N/mm2 >= | ALLUNGAMENTO<br>ELONGATION<br>%>= | CONTRAZIONE<br>REDUCTION OF AREA<br>%>= | DUREZZA<br>HARDNESS<br>HBW | RESILLENZA / IMPACT TEST - JOULE/cm2<br>TIPO / TYPE 10x10mm | SVERNAMENTO<br>YIELD POINT<br>N/mm2 >=1,0% | NUM. OUR REF. |
| 126,60 50,80   | 1                         | 326,0                                      | 520,0                                   | 34,0                              | 64,0                                    | 156,0 - 158,0              | KV C 1 2 3  | 0,0  |               |

MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO  
 ASTM/ASME A 105/SA 105 M - 11a ASME CODE SECT. II, PART A, ED. 2010  
 ADD. 2011a  
 CSA Z245.12 GRADE 248 CAT.I SOUR SERVICE

TRATTAMENTO TERMICO / HEAT TREATMENT  
 NORMALIZED AT 920 C - COOLED IN STILL AIR

FORNO / FURNACE ORIGINE / ORIGIN OF STEEL  
 ELECTRIC FURNACE EUROPEAN UNION

CONFORMS TO 2010 EDITION 2011 ADDENDA

≤1.00 CE = 0.91  
 ≤0.32

Meets NACE MR0175 Latest Edition.

MATERIAL CHECKED BY  
 ASME SECTION II (B)  
 CALHEX INDUSTRIES LTD  
 DATE 04/11/13  
 SIGNATURE  
 MIN. THK.

|  |   |  |   |
|--|---|--|---|
| NOTE 100% MANUFACTURED IN ITALY<br>NOTES MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION<br>MATERIAL IN ACCORDANCE WITH NACE MR-0175/2009 ISO 15156-2009 - SOUR SERVICE<br>MATERIAL IN ACCORDANCE WITH NACE MR-0103/2012 - SOUR SERVICE | UFFICIO CONTROLLO QUALITA'<br>QUALITY CONTROL DEPARTEMENT<br> | ENTE UFFICIALE DI COLLAUDO<br>INSPECTION AUTHORITY | MARCHIO PRODUZIONE<br>MANUFACTURER'S SYMBOL<br> |
|--|---|--|---|

PO# CX.11158 Item# 2 Heat Number: 336303 Trans Am Piping Products Ltd. - Rev'd By: SB 13.1527 7  
 8" CL 150 BLIND FLANGE RF 8" A105N



EVRAZ INC. NA

EvrAZ Oregon Steel 14400 N. Rivergate Blvd., Portland, Oregon 97203

HT# 111,491  
PL# 108

## REPORT OF CHEMICAL/PHYSICAL TESTS

OCT 12 2012



CERTIFICATE NO. DATE 64A030664

1253242 Aug 20, 2012 6

MILL ORDER NO. DATE

256467

CUSTOMER ORDER NO.

64036346

JOB REQ. NO.

SHIPPING NO.

1253242

DATE

08/20/2012

CARRIER

BURLINGTON NORTHERN

CAR/TRUCK NO.

CW6093

ISO 9001  
REGISTERED  
U.S. PLATE PRODUCERS  
O  
L  
D  
T  
ORUSSEL METALS INC [CALGARY]  
ATTN: CAROLYN SPEERS  
5724-40TH STREET S.E.  
CALGARY, AB T2C 2A1  
CARUSSEL METALS INC-CALGARY  
5724-40TH STREET S.E.  
CALGARY, AB T2C 2A1  
CANADA  
*111-491-1301*  
*111-491-350*  
*NW491-135*THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS  
EOS CARBON PRESSURE VESSEL QUALITY ASTM A516-06 GRADE 70 ASME SA516 GRADE 70  
2010/11A ADD. NORMALIZED PER NACE MR0175 NO WELD REPAIR. PRESSURE VESSEL  
QUALITY. REPORT TI. LCVN 20 FT.LBF AVG @ -50 F (P) 20 FT.LBF (continued)

## PHYSICAL PROPERTIES

| ITEM | DESCRIPTION   | HEAT NO. | SLAB | YIELD<br>PSI X 100 | TENSILE<br>PSI X 100 | % ELONG |    | % RA | HARDNESS<br>BHN | BEND<br>TEST | IMPACTS                  |
|------|---|----------|------|--------------------|----------------------|---------|----|------|-----------------|--------------|--------------------------|
|      |   |          |      |                    |                      | 8"      | 2" |      |                 |              |                          |
|      | MIN. 200 MAX BHN (P).   |          |      |                    |                      |         |    |      |                 |              |                          |
| 2    | 0.5000 X 96.000ME X 384.000   |          |      |                    |                      |         |    |      |                 |              |                          |
|      | 1 PC 5227 LBS 12H3262 ^ NW4991 A38<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED |          |      |                    |                      |         |    |      | 157             |              |                          |
|      | 1 PC 5227 LBS 12H3263 ^ NW4991 A38<br>^ NW6234 A32  |          |      | 520                | 760                  | 25      |    |      | 160             |              |                          |
|      | THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED                                       |          |      |                    |                      |         |    |      |                 |              | 107 27 129 / 87.7 ft.lbf |
|      | 1 PC 5227 LBS 12H3255 ^ NW6234 A32<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED |          |      |                    |                      |         |    |      | 162             |              |                          |
|      | 1 PC 5227 LBS 12H3256 ^ NW6234 A32<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED |          |      |                    |                      |         |    |      | 159             |              |                          |

## CHEMICAL ANALYSIS

| HEAT NO. | C   | Mn   | P    | S    | Si  | Cu  | Ni  | V    | Cr  | Al   | Cr  | Mo  | Ti   | B     | N | Ca | CE | McQuay-nirx<br>Grain Size |
|----------|-----|------|------|------|-----|-----|-----|------|-----|------|-----|-----|------|-------|---|----|----|---------------------------|
| NW4991   | .19 | 1.33 | .013 | .007 | .32 | .01 | .05 | .030 | .04 | .049 | .04 | .00 | .003 | .0000 |   |    |    |                           |
| NW6234   | .20 | 1.32 | .014 | .005 | .33 | .01 | .06 | .024 | .03 | .049 | .03 | .00 | .003 | .0000 |   |    |    |                           |

HEATS INDICATED WITH (+) WERE MELTED &amp; MANUFACTURED IN THE USA. HEATS INDICATED WITH (^) WERE ROLLED IN THE USA.

QUALITY COORDINATOR

I certify the above to be correct as contained in the records of EVRAZ INC. NA By \_\_\_\_\_

SEP 04 2012



EVRAZ INC. NA

Evraz Oregon Steel 14400 N. Rivergate Blvd., Portland, Oregon 97203

REPORT OF CHEMICAL/PHYSICAL TESTS

|                     |              |     |
|---------------------|--------------|-----|
| CERTIFICATE NO.     | DATE         | PN# |
| 1253242             | Aug 20, 2012 | 5   |
| MILL ORDER NO.      | DATE         |     |
| 256467              |              |     |
| CUSTOMER ORDER NO.  |              |     |
| 64036346            |              |     |
| JOB/REQ. NO.        |              |     |
| SHIPPING NO.        | DATE         |     |
| 1253242             | 08/20/2012   |     |
| CARRIER             |              |     |
| BURLINGTON NORTHERN |              |     |
| CAR/TRUCK NO.       |              |     |
| CW6093              |              |     |



SOLD TO

RUSSEL METALS INC [CALGARY]  
ATTN: CAROLYN SPEERS  
5724-40TH STREET S.E.  
CALGARY, AB T2C 2A1  
CA

RUSSEL METALS INC-CALGARY  
5724-40TH STREET S.E.  
CALGARY, AB T2C 2A1  
CANADA

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS  
EOS CARBON PRESSURE VESSEL QUALITY ASTM A516-06 GRADE 70 ASME SA516 GRADE 70  
2010/11A ADD. NORMALIZED PER NACE MR0175 NO WELD REPAIR. PRESSURE VESSEL  
QUALITY. REPORT TI. LCVN 20 FT.LBF AVG @ -50 F (P) 20 FT.LBF (continued)

PHYSICAL PROPERTIES

| ITEM NO. | DESCRIPTION  | HEAT NO. | SLAB | YIELD<br>PSI X 100 | TENSILE<br>PSI X 100 | % ELONG<br>8" 2" | % RA | HARDNESS<br>BHN | BEND<br>TEST | IMPACTS                  |
|----------|--|----------|------|--------------------|----------------------|------------------|------|-----------------|--------------|--------------------------|
| MIN.     | 200 MAX BHN (P).   |          |      |                    |                      |                  |      |                 |              |                          |
| 1        | 0.3750 X 96.000ME X 384.000<br>1 PC 3920 LBS 12H3239 ^<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 15 MINUTES AND AIR COOLED            | NW5020   | A36  |                    |                      |                  |      | 163             |              |                          |
| 2        | 0.5000 X 96.000ME X 384.000<br>SCHEDULE B:7208.51.00<br>PT# 76762<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED | NW5020   | A36  |                    |                      |                  |      | 163             |              |                          |
|          |  | NW4991   | A38  | 525                | 770                  | 24               |      |                 |              | 114 99 93 / 102.0 ft.lbf |
|          | 1 PC 5227 LBS 12H3261 ^<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED   | NW4991   | A38  |                    |                      |                  |      | 152             |              |                          |

CHEMICAL ANALYSIS

| HEAT NO. | C   | Mn   | P    | S    | Si  | Cu  | Ni  | V    | Co   | Al   | Cr  | Mo  | Ti   | B     | N | Ca | CE | McQuaid Etn<br>Green Size |
|----------|-----|------|------|------|-----|-----|-----|------|------|------|-----|-----|------|-------|---|----|----|---------------------------|
| NW5020   | .20 | 1.33 | .012 | .005 | .30 | .01 | .05 | .021 | .005 | .055 | .03 | .00 | .002 | .0000 |   |    |    |                           |
| NW4991   | .19 | 1.33 | .013 | .007 | .32 | .01 | .05 | .030 | .005 | .049 | .04 | .00 | .003 | .0000 |   |    |    |                           |

HEATS INDICATED WITH (+) WERE MELTED & MANUFACTURED IN THE USA. HEATS INDICATED WITH (^) WERE ROLLED IN THE USA.

QUALITY COORDINATOR

I certify the above to be correct as contained in the records of EVRAZ INC. NA By \_\_\_\_\_



EVRAZ INC. NA

Evraz Oregon Steel 14400 N. Rivergate Blvd., Portland, Oregon 97203

REPORT OF CHEMICAL/PHYSICAL TESTS

SEP 04 2012

|                    |              |     |
|--------------------|--------------|-----|
| CERTIFICATE NO.    | DATE         | PKT |
| 1253242            | Aug 20, 2012 | 7   |
| MILL ORDER NO.     | DATE         |     |
| 256467             |              |     |
| CUSTOMER ORDER NO. | 64036346     |     |
| JOB/REQ. NO.       |              |     |
| SHIPPING NO.       | DATE         |     |
| 1253242            | 08/20/2012   |     |

ISO 9001  
REGISTERED

U.S. PLATE PRODUCER

SOLD TO

RUSSEL METALS INC [CALGARY]  
ATTN: CAROLYN SPEERS  
5724-40TH STREET S.E.  
CALGARY, AB T2C 2A1  
CA

RUSSEL METALS INC-CALGARY  
5724-40TH STREET S.E.  
CALGARY, AB T2C 2A1  
CANADA

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS  
EOS CARBON PRESSURE VESSEL QUALITY ASTM A516-06 GRADE 70 ASME SA516 GRADE 70  
2010/11A ADD. NORMALIZED PER NACE MR0175. NO WELD REPAIR. PRESSURE VESSEL  
QUALITY. REPORT TI. LCVN 20 FT.LBF AVG @ -50 F (P) 20 FT.LBF (continued)

|                     |
|---------------------|
| CARRIER             |
| BURLINGTON NORTHERN |
| CAR/TRUCK NO.       |
| CW6093              |

PHYSICAL PROPERTIES

| ITEM NO. | DESCRIPTION   | HEAT NO. | SLAB       | YIELD<br>PSI X 100 | TENSILE<br>PSI X 100 | % ELONG<br>8" 2" | % RA | HARDNESS<br>BHN | BEND<br>TEST | IMPACTS |
|----------|---|----------|------------|--------------------|----------------------|------------------|------|-----------------|--------------|---------|
| MIN. 200 | MAX BEN (P)   |          |            |                    |                      |                  |      |                 |              |         |
| 2        | 0.5000 X 96.000ME X 384.000<br>1 PC 5227 LBS 12H3257 ^                            | NW6234   | A32<br>A33 | 535                | 770                  | 26               |      | 151             |              |         |
|          | LCVN @ -50 DEG F 10.0mm 67 116 115 / 99.3 ft.lbf                                  |          |            |                    |                      |                  |      |                 |              |         |
|          | THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED |          |            |                    |                      |                  |      |                 |              |         |
|          | 1 PC 5227 LBS 12H3254 ^   | NW6234   | A33        |                    |                      |                  |      | 158             |              |         |
|          | THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED |          |            |                    |                      |                  |      |                 |              |         |
|          | 1 PC 5227 LBS 12H3267 ^   | NW6234   | A33        |                    |                      |                  |      | 159             |              |         |
|          | THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 22 MINUTES AND AIR COOLED |          |            |                    |                      |                  |      |                 |              |         |
|          | 1 PC 5227 LBS 12H3268 ^   | NW6234   | A33        |                    |                      |                  |      | 157             |              |         |
|          |   | NW6235   | A24        | 520                | 755                  | 29               |      |                 |              |         |

CHEMICAL ANALYSIS

| HEAT NO. | C  | Mn   | P    | S    | Si  | Cu  | Ni  | V    | Co   | Al   | Cr  | Mo  | Ti   | B     | N | Ca | CE | Micro Hardness |
|----------|----|------|------|------|-----|-----|-----|------|------|------|-----|-----|------|-------|---|----|----|----------------|
| NW6234   | 20 | 1.32 | .014 | .005 | .33 | .01 | .06 | .024 | .005 | .049 | .03 | .00 | .003 | .0000 |   |    |    |                |
| NW6235   | 19 | 1.31 | .014 | .006 | .30 | .02 | .06 | .023 | .005 | .050 | .02 | .00 | .002 | .0000 |   |    |    |                |

HEATS INDICATED WITH (+) WERE MELTED & MANUFACTURED IN THE USA. HEATS INDICATED WITH (^) WERE ROLLED IN THE USA.

I certify the above to be correct as contained in the records of EVRAZ INC. NA By \_\_\_\_\_

QUALITY COORDINATOR





EVRAZ INC. NA

Evraz Oregon Steel 14400 N. Rivergate Blvd., Portland, Oregon 97203

REPORT OF CHEMICAL/PHYSICAL TESTS

OCT 12 2012

|                     |                |
|---------------------|----------------|
| CERTIFICATE NO.     | DATE           |
| 1253242             | Aug 20, 2012 9 |
| MILL ORDER NO.      | DATE           |
| 256467              |                |
| CUSTOMER ORDER NO.  |                |
| 64036346            |                |
| JOB/REQ. NO.        |                |
| SHIPPING NO.        | DATE           |
| 1253242             | 08/20/2012     |
| CARRIER             |                |
| BURLINGTON NORTHERN |                |
| CAR/TRUCK NO.       |                |
| CW6093              |                |

**ISO 9001**  
REGISTERED  
U.S. PLATE PRODUCER

**SOLD TO**

RUSSEL METALS INC [CALGARY]  
ATTN: CAROLYN SPEERS  
5724-40TH STREET S.E.  
CALGARY, AB T2C 2A1  
CA

RUSSEL METALS INC-CALGARY  
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CANADA

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS  
EOS CARBON PRESSURE VESSEL QUALITY ASTM A516-06 GRADE 70 ASME SA516 GRADE 70  
2010/11A ADD. NORMALIZED PER NACE MR0175 NO WELD REPAIR. PRESSURE VESSEL  
QUALITY. REPORT TI. LCVN 20 FT.LBF AVG @ -50 F (P) 20 FT.LBF (continued)

**PHYSICAL PROPERTIES**

| ITEM NO | DESCRIPTION  | HEAT NO. | SLAB | YIELD<br>PSI X 100 | TENSILE<br>PSI X 100 | % ELONG<br>8" 2" | % RA | HARDNESS<br>BHN | BEND<br>TEST | IMPACTS                   |
|---------|--|----------|------|--------------------|----------------------|------------------|------|-----------------|--------------|---------------------------|
| MIN.    | 200 MAX BHN (P).   |          |      |                    |                      |                  |      |                 |              |                           |
| 2       | 0.5000 X 96.000ME X 384.000<br>1 PC 5227 LBS 12H3258 ^<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED                  | NW6235   | A25  |                    |                      |                  |      | 160             |              |                           |
|         | 1 PC 5227 LBS 12H3264 ^<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 20 MINUTES AND AIR COOLED   | NW6235   | A25  |                    |                      |                  |      | 156             |              |                           |
| 3       | 1.5000 X 96.000ME X 384.000<br>SCHEDULE B:7208.51.00<br>PT# 75502<br>^<br>THE FOLLOWING PLATES WERE NORMALIZED AT 1660 DEGS F FOR 115 MINUTES AND AIR COOLED | NW6235   | A25  |                    |                      |                  |      | 156             |              |                           |
|         |  | NW5003   | A29  | 460                | 745 35               |                  |      |                 |              | 93 102 116 / 103.7 ft.lbf |

**CHEMICAL ANALYSIS**

| HEAT NO. | C   | Mn   | P    | S    | Si  | Cu  | Ni  | V    | Cb   | Al   | Cr  | Mo  | Ti   | B     | N | Ca | CE | McQuay Em<br>Grain Size |
|----------|-----|------|------|------|-----|-----|-----|------|------|------|-----|-----|------|-------|---|----|----|-------------------------|
| NW6235   | .19 | 1.31 | .014 | .006 | .30 | .02 | .06 | .023 | .005 | .050 | .02 | .00 | .002 | .0000 |   |    |    |                         |
| NW5003   | .20 | 1.33 | .011 | .008 | .34 | .01 | .05 | .022 | .005 | .044 | .03 | .00 | .002 | .0000 |   |    |    |                         |

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I certify the above to be correct as contained in the records of EVRAZ INC. NA By \_\_\_\_\_ **QUALITY COORDINATOR**

FLANGE RF XH

3" CL 150 W/N BORE A105N

Rev'd By: SB

2

PO# CX.111158 Item# 1376222  
Heat Number: 1376222  
Trans Am Piping Products Ltd.  
\$ 13.1502  
Shipment / Seq #:



PRODOTTI INDUSTRIALI S.P.A.

SALA PROVE E ANALISI MATERIALI / MATERIAL TEST DEPARTMENT

23961 CESANA BRIANZA (LC) - Italy  
Via G. Paroli, 28  
Tel. +39 031 665443  
Fax +39 031 655148  
quality.metalfar.com

COMPANY WITH  
QUALITY SYSTEM  
CERTIFIED BY DNV  
= ISO 9001 =

CERTIFICATO DI COLLAUDO SECONDO EN 10204 - 3.1 INSPECTION CERTIFICATE

|   |  |  |                                   |
|---|--|--|-----------------------------------|
| Certif. N. 3997<br>DDT / Del Nota N. 3173   | Del/Dated 16.07.2013<br>Del/Dated 15.07.2013 | Fattura / Invoice N. 2701<br>Na.Ord. / Our ref. N. 0   | Del/Dated 15.07.2013<br>Del/Dated |
| TRANS AM PIPING PRODUCTS LTD<br>9335 ENDEAVOR DRIVE S.E.<br>T3S 0A1 CALGARY, ALBERTA CA |  | Dest.: TRANS AM PIPING PRODUCTS LTD<br>9335 - Endeavor Drive S.E.<br>T3S 0A1 Calgary, ALBERTA CA |                                   |

Pag. 2 - 12

| COD. COL. COLATA<br>HEAT CODE HEAT   | POS. ITEM | VS. ORDINE<br>YOUR REFERENCE | Q.TA'<br>Q.TY | DESCRIZIONE<br>DESCRIPTION                | DIM. IN ACC. A<br>DIM. ACCORDANCE TO | VISIVO E DIMENS.<br>VIS. & DIMENS. |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|--|-----------|------------------------------|---------------|---|--------------------------------------|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|----|-----|----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1376222  | 016       | CI-12-430                    | 123,00        | W/N 150 RF 3" XS A105N                    | ASME/ANSI B16.5 -2009                | SATISFACTORY                       |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| MATERIALE / MATERIAL   |           |                              |               |   |                                      |                                    |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ASTM A105 (LADLE)  |           |                              |               |   |                                      |                                    |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| <table border="0"> <tr> <td>C%</td><td>Si%</td><td>Mn%</td><td>S%</td><td>P%</td><td>Cr%</td><td>Ni%</td><td>Mo%</td><td>Ti%</td><td>Cu%</td><td>V%</td><td>Nb%</td><td>N%</td><td>Al%</td><td>C.E.%</td> </tr> <tr> <td>0,195</td><td>0,170</td><td>0,890</td><td>0,009</td><td>0,015</td><td>0,150</td><td>0,060</td><td>0,010</td><td>0,019</td><td>0,190</td><td>0,001</td><td>0,002</td><td>0,000</td><td>0,025</td><td>0,392</td> </tr> </table> |           |                              |               |   |                                      |                                    | C%    | Si%   | Mn%   | S%    | P%    | Cr%   | Ni%   | Mo%   | Ti% | Cu% | V% | Nb% | N% | Al% | C.E.% | 0,195 | 0,170 | 0,890 | 0,009 | 0,015 | 0,150 | 0,060 | 0,010 | 0,019 | 0,190 | 0,001 | 0,002 | 0,000 | 0,025 | 0,392 |
| C%   | Si%       | Mn%                          | S%            | P%  | Cr%                                  | Ni%                                | Mo%   | Ti%   | Cu%   | V%    | Nb%   | N%    | Al%   | C.E.% |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 0,195  | 0,170     | 0,890                        | 0,009         | 0,015                                     | 0,150                                | 0,060                              | 0,010 | 0,019 | 0,190 | 0,001 | 0,002 | 0,000 | 0,025 | 0,392 |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO   |           |                              |               |   |                                      |                                    |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ASTM/ASME A 105/SA 105 M - 11a ASME CODE SECT. II, PART A, ED. 2010  |           |                              |               | TRATTAMENTO TERMICO / HEAT TREATMENT      |                                      | ORIGINE / ORIGIN OF STEEL          |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ADD. 2011a   |           |                              |               | NORMALIZED AT 920 C - COOLED IN STILL AIR |                                      | EUROPEAN UNION                     |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| CSA Z245.12 GRADE 248 CAT.I SOUR SERVICE   |           |                              |               | FORNO / FURNACE                           |                                      | ELECTRIC FURNACE                   |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

| COD. COL. COLATA<br>HEAT CODE HEAT   | POS. ITEM | VS. ORDINE<br>YOUR REFERENCE | Q.TA'<br>Q.TY | DESCRIZIONE<br>DESCRIPTION                | DIM. IN ACC. A<br>DIM. ACCORDANCE TO | VISIVO E DIMENS.<br>VIS. & DIMENS. |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|--|-----------|------------------------------|---------------|---|--------------------------------------|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|----|-----|----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1376222  | 059       | CI-12-430                    | 78,00         | W/N 300 RF 6" XS A105N                    | ASME/ANSI B16.5 -2009                | SATISFACTORY                       |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| MATERIALE / MATERIAL   |           |                              |               |   |                                      |                                    |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ASTM A105 (LADLE)  |           |                              |               |   |                                      |                                    |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| <table border="0"> <tr> <td>C%</td><td>Si%</td><td>Mn%</td><td>S%</td><td>P%</td><td>Cr%</td><td>Ni%</td><td>Mo%</td><td>Ti%</td><td>Cu%</td><td>V%</td><td>Nb%</td><td>N%</td><td>Al%</td><td>C.E.%</td> </tr> <tr> <td>0,200</td><td>0,230</td><td>0,950</td><td>0,008</td><td>0,011</td><td>0,110</td><td>0,050</td><td>0,010</td><td>0,018</td><td>0,120</td><td>0,003</td><td>0,002</td><td>0,009</td><td>0,025</td><td>0,394</td> </tr> </table> |           |                              |               |   |                                      |                                    | C%    | Si%   | Mn%   | S%    | P%    | Cr%   | Ni%   | Mo%   | Ti% | Cu% | V% | Nb% | N% | Al% | C.E.% | 0,200 | 0,230 | 0,950 | 0,008 | 0,011 | 0,110 | 0,050 | 0,010 | 0,018 | 0,120 | 0,003 | 0,002 | 0,009 | 0,025 | 0,394 |
| C%   | Si%       | Mn%                          | S%            | P%  | Cr%                                  | Ni%                                | Mo%   | Ti%   | Cu%   | V%    | Nb%   | N%    | Al%   | C.E.% |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 0,200  | 0,230     | 0,950                        | 0,008         | 0,011                                     | 0,110                                | 0,050                              | 0,010 | 0,018 | 0,120 | 0,003 | 0,002 | 0,009 | 0,025 | 0,394 |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO   |           |                              |               |   |                                      |                                    |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ASTM/ASME A 105/SA 105 M - 11a ASME CODE SECT. II, PART A, ED. 2010  |           |                              |               | TRATTAMENTO TERMICO / HEAT TREATMENT      |                                      | ORIGINE / ORIGIN OF STEEL          |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| ADD. 2011a   |           |                              |               | NORMALIZED AT 920 C - COOLED IN STILL AIR |                                      | EUROPEAN UNION                     |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| CSA Z245.12 GRADE 248 CAT.I SOUR SERVICE   |           |                              |               | FORNO / FURNACE                           |                                      | ELECTRIC FURNACE                   |       |       |       |       |       |       |       |       |     |     |    |     |    |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

CONFORMS TO 2010 EDITION, 2011 ADDENDA

≤ 1.00  
≤ 0.32

CE = 0.39

MATERIALE CHECKED TO  
ASME SECTION II BY  
CALHEX INDUSTRIES LTD.

DATE: 04/11/13

SIGNATURE: *[Signature]*

MIN. THK.:

|  |  |  |   |
|--|--|--|---|
| NOTE 100% MANUFACTURED IN ITALY<br>NOTES MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION<br>MATERIAL IN ACCORDANCE WITH NACE MR-0175/2009 ISO 15156-2009 - SOUR SERVICE<br>MATERIAL IN ACCORDANCE WITH NACE MR-0103/2012 - SOUR SERVICE | UFFICIO CONTROLLO QUALITA'<br>QUALITY CONTROL DEPARTMENT | ENTE UFFICIALE DI COLLAUDO<br>INSPECTION AUTHORITY | MARCHIO PRODUZIONE<br>MANUFACTURER'S SYMBOL |
|  | <i>[Signature]</i>                                       |  |   |

3" CL 150 W/N FLANGE RF XH BORE A105N

Heat Number: 1538/11 Trans Am Piping Products Ltd. Rev'd By: SB Shipments/Seq #: S 11 : 1959 5



**METALFAR**

PRODOTTI INDUSTRIALI S.P.A.

STAMPAGGIO A CALDO DI ACCIAI COMUNI - LEGATI E INOSSIDABILI

SEDE AMMINISTRATIVA E STABILIMENTO:  
23861 CESANA BRIANZA (LC) - Italy  
Via G. Parini, 28  
Tel. +39 031 655441  
Fax +39 031 655149  
quality.mff@larimas.com

COMPANY WITH QUALITY MANAGEMENT  
SYSTEM CERTIFIED BY DNV  
= ISO 9001:2008 =

**CERTIFICATO DI COLLAUDO SECONDO EN 10204 - 3.1 INSPECTION CERTIFICATE**

|   |                      |   |                      |
|---|----------------------|---|----------------------|
| Certif. N. 5651   | Del/Dated 22.11.2011 | Fattura / Invoice N. 3773                               | Del/Dated 22.11.2011 |
| DDT / Del Note N. 4312                                  | Del/Dated 22.11.2011 | Ns.Ord. / Our ref. N.                                   | Del/Dated            |
| TRANS AM PIPING PRODUCTS LTD                            |                      | Dest.: F.F.F. c/o TRANS AM PIPING PRODUCTS LTD          |                      |
| 9335 ENDEAVOR DRIVE S.E.<br>T3S 0A1 CALGARY, ALBERTA CA |                      | 9335 Endeavor Drive S.E.<br>T3S 0A1 CALGARY, ALBERTA CA |                      |

Pag. 10 - 16

**SALA PROVE E ANALISI MATERIALI / MATERIAL TEST DEPARTMENT**

| COD. COL. COLATA POS. VS. ORDINE                                   | DESCRIZIONE            |              |                  |   |                   |          |                                      |                  |       |       |       |                  |          |       |       |  | DIM IN ACC. A         | VISIVO E DIMENS. |
|--|------------------------|--------------|------------------|---|-------------------|----------|--------------------------------------|------------------|-------|-------|-------|------------------|----------|-------|-------|--|-----------------------|------------------|
| HEAT CODE HEAT ITEM  | DESCRIPTION            |              |                  |   |                   |          |                                      |                  |       |       |       |                  |          |       |       |  | DIM. ACCORDANCE TO    | VIS. & DIMENS    |
| 1538/11 016  | W/N 150 RF 3" XS A105N |              |                  |   |                   |          |                                      |                  |       |       |       |                  |          |       |       |  | ASME/ANSI B16.5 -2009 | SATISFACTORY     |
| MATERIALE / MATERIAL   | C%                     | Si%          | Mn%              | S%  | P%                | Cr%      | Ni%                                  | Mo%              | Ti%   | Cu%   | V%    | Nb%              | N%       | Al%   | C.E % |  |                       |                  |
| ASTM A105  | 0,187                  | 0,190        | 1,050            | 0,005                                     | 0,006             | 0,110    | 0,160                                | 0,060            | 0,021 | 0,140 | 0,003 | 0,002            | 0,000    | 0,025 | 0,417 |  |                       |                  |
| PROVETTA / TEST SPECIMEN   | FORMA                  | SNERVAMENTO  | ROTTURA          | ALLUNGAMENTO                              | CONTRAZIONE       | DUREZZA  | RESILIENZA / IMPACT TEST - JOULE/cm2 |                  |       |       |       | SNERVAMENTO      | No. Rif. |       |       |  |                       |                  |
| SEZ. mm2 LUNG. mm SHAPE  | 1=O 2=□                | YIELD POINT  | TENSILE STRENGTH | ELONGATION                                | REDUCTION OF AREA | HARDNESS | TIPO / TYPE 10x10mm                  | °C               | 1     | 2     | 3     | YIELD POINT      | OUR REF. |       |       |  |                       |                  |
| 126,60 50,80 1   |                        | N/mm2 >=0,2% | N/mm2 >=         | % >=                                      | % >=              | HBW      | KV                                   | 20               | 83    | 86    | 86    | N/mm2 >=1,0%     |          |       |       |  |                       |                  |
| MATERIALE IN ACCORDO A / MATERIAL IN ACC. TO                       |                        |              |                  | TRATTAMENTO TERMICO / HEAT TREATMENT      |                   |          |                                      | FORNO / FURNACE  |       |       |       | ORIGINE / ORIGIN |          |       |       |  |                       |                  |
| ASTM/ASME A 105/SA 105 M - 10 ASME CODE SECT. II, PART A, ED. 2010 |                        |              |                  | NORMALIZED AT 920 C - COOLED IN STILL AIR |                   |          |                                      | ELECTRIC FURNACE |       |       |       | EUROPE           |          |       |       |  |                       |                  |
| CSA Z245.12 GRADE 248 CAT.I  |                        |              |                  |   |                   |          |                                      |                  |       |       |       |                  |          |       |       |  |                       |                  |

MATERIAL CHECKED TO  
ASME SECTION II BY  
CALIBEX INDUSTRIES LTD.  
DATE: FEB. 18, 2014  
SIGNATURE: *[Signature]*  
MIN. THK: *[Signature]*

CONFORMS TO 2010 EDITION: 2010 ADDENDA

Meets NACE MR0175 Latest Edition.

|   |                             |                              |                       |
|---|-----------------------------|------------------------------|-----------------------|
| NOTE: MANUFACTURING IN ACCORDANCE WITH ORDER AND SPECIFICATION      | UFFICIO CONTROLLO QUALITA'  | AGENTE UFFICIALE DI COLLAUDO | MARCHIO PRODUZIONE    |
| NOTES: MATERIAL IN ACCORDANCE WITH NACE MR-0175/2003 ISO:15166-2009 | QUALITY CONTROL DEPARTEMENT | INSPECTION AUTHORITY         | MANUFACTURER'S SYMBOL |
| MATERIAL IN ACCORDANCE WITH NACE MR-0103/2010                       | <i>[Signature]</i>          |                              |                       |

PO# CX.111158 Item# 4  
 Heat Number: 4625126  
 Trans Am Piping Products Ltd.  
 Shipment/Seq #: S 13 : 1277  
 Rev'd By: SB  
 2" CL 150 W/N FLANGE RF  
 SCH 160 BORE A105N



**SAN ENG STEEL FORGING CO LTD**  
 311, Jen Hein Road, Jen Wu District  
 Kaohsiung, Taiwan, R.O.C.  
 TEL:07-3724249 ; FAX:07-3712923  
 URL: www.saneng.com.tw  
 e-mail: saneng@ksts.seed.net.tw

**MILL TEST CERTIFICATE**

EN10204-3.1.B(DIN50049/3.1.B)  
 Customer: **TRANS AM PIPING PRODUCTS LTD.**  
 Order No.: **7009307(8)-T/A**

Certificate No.: **SE-8307H**  
 Date: **04/15/2013**  
 Page: **1 OF 1**

| PRODUCT                     |         | MATERIAL SPECIFICATIONS      |          |                          |       |       |       |       |       |       |       | DIMENSIONAL SPECIFICATIONS   |       |       |       |   |        |  |
|-----------------------------|---------|------------------------------|----------|--------------------------|-------|-------|-------|-------|-------|-------|-------|------------------------------|-------|-------|-------|---|--------|--|
| FORGED CARBON STEEL FLANGES |         | ASTM A105-11a/ASME SA105-11a |          |                          |       |       |       |       |       |       |       | ASME B16.5-09<br>CSA Z245.12 |       |       |       |   |        |  |
| Item No.                    | CODE NO | DESCRIPTION                  | QUANTITY | CHEMICAL COMPOSITION (%) |       |       |       |       |       |       |       |                              |       |       |       |   |        |  |
|                             |         |                              |          | Min                      | C     | Si    | Mn    | P     | S     | Cu    | Cr    | Ni                           | Mo    | V     | Nb    | N | CE(*)3 |  |
| 1                           |         | 150 WNRF S120 4" A105N       | 25 PCE   | 0.210                    | 0.220 | 1.210 | 0.017 | 0.006 | 0.008 | 0.020 | 0.010 | 0.002                        | 0.003 | 0.001 | 0.007 |   | 0.418  |  |
| 2                           |         | 150 WNRF S160 2" A105N       | 490 PCE  | 0.220                    | 0.200 | 1.180 | 0.019 | 0.009 | 0.007 | 0.020 | 0.010 | 0.003                        | 0.004 | 0.001 | 0.008 |   | 0.420  |  |
| 3                           |         | 800 WNRF XS 6" A105N         | 200 PCE  | 0.200                    | 0.200 | 1.140 | 0.017 | 0.006 | 0.007 | 0.010 | 0.010 | 0.002                        | 0.004 | 0.001 | 0.008 |   | 0.394  |  |
| 4                           |         | 900 BLRF 10" A105N           | 2 PCE    | 0.210                    | 0.230 | 1.180 | 0.010 | 0.014 | 0.108 | 0.060 | 0.060 | 0.010                        | 0.010 | 0.001 | 0.010 |   | 0.430  |  |
| 5                           |         | 900 BLRF 10" A105N           | 2 PCE    | 0.200                    | 0.200 | 1.100 | 0.014 | 0.008 | 0.130 | 0.110 | 0.070 | 0.020                        | 0.010 | 0.002 | 0.008 |   | 0.425  |  |
| 6                           |         | 150 BLRF 20" A105N           | 1 PCE    | 0.220                    | 0.230 | 1.130 | 0.018 | 0.017 | 0.150 | 0.060 | 0.090 | 0.010                        | 0.001 | 0.001 | 0.011 |   | 0.439  |  |
| 7                           |         | 150 BLRF 20" A105N           | 2 PCE    | 0.180                    | 0.220 | 0.910 | 0.021 | 0.016 | 0.190 | 0.150 | 0.130 | 0.010                        | 0.001 | 0.010 | 0.008 |   | 0.395  |  |

| Item No. | Heat No. | T.S.(*)<br>(MPA) | Y.S.(*)<br>(MPA) | E.L.(*)<br>(%) | Hardness<br>(HB) | R.A.(*)<br>(%) | Impact Test<br>Temp: |       |   | Material Supplier | HEAT TREATMENT(*)2  |         |
|----------|----------|------------------|------------------|----------------|------------------|----------------|----------------------|-------|---|-------------------|---|---------|
|          |          |                  |                  |                |                  |                | Minimum              | Joule | 3 |                   | <input checked="" type="checkbox"/> N   | REMARKS |
| 1        | 4609489  | 531.0            | 364.0            | 33.8           | 154/151          | 70.4           |                      |       |   | ACOMINAS          | 880°CX3HRS  |         |
| 2        | 4825126  | 535.0            | 358.0            | 32.6           | 154/151          | 69.5           |                      |       |   | ACOMINAS          | CONFORMS WITH NACE MR0103-12 AND NACE MR0175/ISO15156.2-09 CLAUSE 7.2.1.4 REGION 3 AND ANNEX A.   |         |
| 3        | 4677182  | 524.0            | 372.0            | 38.0           | 154/151          | 72.1           |                      |       |   | ACOMINAS          | CONFORMS WITH Z245.12 CAT I GR248 SOUR SERVICE-09(FOR USE AS WELDING NECK AND BLIND FLANGES ONLY) |         |
| 4        | 24639    | 541.0            | 380.0            | 34.2           | 155/153          | 68.8           |                      |       |   | EVRAZ ZSMK        |   |         |
| 5        | 292404   | 625.8            | 383.4            | 35.8           | 154/151          | 72.1           |                      |       |   | SEAH BESTEEL      |   |         |
| 6        | 10705    | 539.4            | 360.1            | 32.2           | 157/155          | 65.9           |                      |       |   | EVRAZ ZSMK        |   |         |
| 7        | 67114    | 515.8            | 342.3            | 35.0           | 153/151          | 69.0           |                      |       |   | RED OCTOBER       |   |         |

\*1: T.S. = Tensile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area.  
 \*2: N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Stress Relieved, A.C=Air Cooled, F.C=Furnace Cooled, W.C=Water Cooled, O.C=Oil Cooled.  
 \*3: C.E. Value = C + (Mn / 8) + (Cr + Mo + V) / 5 + (Ni + Cu) / 15

We hereby certify that the material has been tested in accordance with the above specification and also with the requirements called for by the above order.



Manager of Quality Assurance Dept

CONFORMS TO 2010 EDITION: 2011 ADDENDA  
 ≤1.00 CE = 0.42  
 ≤0.32  
 Meets NACE MR0175 Latest Edition.

MATERIAL CHECKED BY  
 ASME SECTION II BY  
 CALHEX INDUSTRIES LTD.  
 DATE: 04/11/13  
 SIGNATURE: [Signature]  
 MIN. THR...

3" SCH. XH

7MOB-B



**INSPECTION CERTIFICATE**

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

641869

Page / Página:

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Date / Día: January 12, 2012

SATON S.A. S.  
De Avda. A. Sur 4250  
B2054MHA, Comarca  
Buenos Aires, Argentina  
(54) 3489 4331 ext 101  
(54) 3489 4332 ext 102

|  |  |   |  |   |  |  |  |
|--|--|---|--|---|--|--|--|
| Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) INC   |  | Customer's Order Item / Orden Cliente - Item:<br>PO# 45001447-00002 |  | Customer's Reference / Ref. del Cliente:<br>N/A |  | Manufacturer's Works Order N° / Confirmación de Venta:<br>53803/02 |  |
| Manufacturing Process / Proceso de Manufactura:<br>SEAMLESS HOT ROLLED   |  |   | Product Type / Tipo de Producto:<br>CARBON STEEL PIPE-HIGH TEMPERATURE SERV. |   |  | Surface / Superficie:<br>INT BARE /EXT VARNISHED                   |  |
| Standard or Specification / Normas o Especificaciones:<br>ASTM/A5ME A/SA108+CSA Z245.1-07 CAT.I SPS08373/1+NACE MR0175/0103+PRO LP-008 |  |   |  | Steel Grade / Grado de acero:<br>B2209 CAT I SS |  | Ends / Extremos:<br>BEVELLED AT 30 DEG. ASTM                       |  |
| Dimensions / Dimensiones:<br>3 1/2 X 0.309 INCH<br>88.90 X 7.82 MM   |  | Schedule / Cédula:<br>000   | Length / Longitud:<br>SRL (SP)   |   | Quantity / Cantidad: 242 Pcs/pz<br>4584.71 FT<br>1397.42 MTS |  | Nominal Weight / Peso Nominal:<br>47787 LB<br>21678 KG |

**TENSILE TEST / ENSAYO DE TENSION**

| Heat N°<br>Calada N° | Sample N°<br>Muestra N° | Zone<br>Zona | Pipe N°<br>Tubo N° | Specimen condition<br>Condición de la probeta |    |              |     | Specimen dimensions<br>Dimensiones de la probeta |                        | Test<br>Temp.<br>ensayo | Y.S.                             |                              | U.T.S.            | Y.S./U.T.S. |      |      | Elongation / Alargamiento |    |     |
|----------------------|-------------------------|--------------|--------------------|---|----|--------------|-----|--|------------------------|-------------------------|----------------------------------|------------------------------|-------------------|-------------|------|------|---------------------------|----|-----|
|                      |                         |              |                    | Ls  | Sc | Type<br>Tipo | Ori | Size<br>Tamaño<br>mm                             | Area<br>Sección<br>mm2 |                         | Eul 0.50 %<br>Min: 200<br>Max: - | Req.<br>Min: 415<br>Max: 625 | Req. Max.<br>8.83 | Lo<br>2"    | Min. | Max. | Obt.                      |    |     |
|                      |                         |              |                    |   |    |              |     |  |                        |                         |                                  |                              |                   |             |      |      |                           | °C | mpa |
| 2078S                | 1770638                 | M            | 1                  | B   | AM | Se           | L   | 19.21 x 7.38                                     | 143.13                 | RT                      | 372                              | 522                          | 0.71              | 50.8        | 23.5 | 30.7 |                           |    |     |
| 4788S                | 1775108                 | M            | 1                  | B   | AM | Se           | L   | 19.36 x 7.74                                     | 151.48                 | RT                      | 380                              | 533                          | 0.71              | 50.8        | 23.5 | 28.8 |                           |    |     |

|  |                                |  |  |
|--|--------------------------------|--|--|
| AM: As manufactured / Según proceso de fabricación | M: Middle / Medio              | Req. Max: Required maximum / Máximo requerido    | U.T.S: Ultimate tensile strength / Resistencia |
| B: Body / Cuerpo                                   | Max: Maximum / Máximo          | Req: Required / Requerido                        | Y.S: Yield strength / Fluencia                 |
| L: Longitudinal / Longitudinal                     | Min: Minimum / Mínimo          | RT: Room temperature / Temperatura ambiente      |  |
| Lo: Initial length / Longitud inicial              | Obt: Obtained / Obtenido       | Sc: Specimen condition / Condición de la probeta |  |
| Ls: Location of sample / Ubicación de la muestra   | Ori: Orientation / Orientación | Se: Strip specimen / Muestra rectangular         |  |

IN STOCK  
INITIALS OF # 6043  
(4788S)

CE=0.36  
Meets NACE MR0175 Latest Edition.

CONFORMS TO 2010 EDITION: 2011 Addenda

VENUE...  
DATE 26/5/13  
SIGNATURE  
-311

This certificate is issued by a computerized system and is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one being responsible for any allowed or not allowed use. Any alteration and/or falsification will be subjected to the law.  
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APPROVED BY  
  
FOR03171



## INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**641869**

Page / Página:

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Date / Día: **January 12, 2012**

E. Aceras S.A. S.C.  
D. Jorge A. Simón 250  
182804K(MA) Comodoro  
Barriles Aires, Argentina  
(54) 3489 4331 CC to  
(54) 3489 4304 CC fax

|  |  |  |   |  |  |  |   |   |  |
|--|--|--|---|--|--|--|---|---|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |  | Customer's Order Item / Orden Cliente - Item:<br><b>PO# 45001447-00002</b> |   | Customer's Reference / Ref. del Cliente:<br><b>N/A</b> |  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>53803/02</b>  |   |   |  |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |  |  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |  |  | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>  |   |   |  |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CBA Z246.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+IPRO LP-006</b> |  |  |   | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b> |  |  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b> |   |  |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88.90 X 7.62 MM</b>   |  | Schedule / Cédula:<br><b>080</b>   |   | Length / Longitud:<br><b>SRL (SP)</b>                  |  | Quantity / Cantidad: <b>242 Pcs/lpz</b><br><b>4584.71 FT                      47787 LB<br/>1397.42 MT8                      21676 KG</b> |   | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT<br/>15.27 KG/M</b> |  |

### CHEMICAL COMPOSITION / COMPOSICIÓN QUÍMICA

|                      |                         | Composition % / Composición % |                    |    |     |    |        |        |    |    |    |    |    |     |    |     |    |    |    |     |     |         |    |    |    |       |    |         |      |     |    |    |    |      |      |
|----------------------|-------------------------|-------------------------------|--------------------|----|-----|----|--------|--------|----|----|----|----|----|-----|----|-----|----|----|----|-----|-----|---------|----|----|----|-------|----|---------|------|-----|----|----|----|------|------|
|                      |                         | x 100                         |                    |    |     |    |        | x 1000 |    |    |    |    |    |     |    |     |    |    |    |     |     | x 10000 |    |    |    | x 100 |    | x 10000 |      |     |    |    |    |      |      |
|                      |                         | C                             | Mn                 | Si | Cr  | Mo | Al sol | S      | P  | Ni | V  | Cu | Al | Sn  | As | Nb  | Ti | Pb | Sb | Co  | Zr  | Bi      | Ce | B  | N  | Mg    | W  | Ca,1    | Ce,2 | F,1 |    |    |    |      |      |
| Heat N°<br>Cofada N° | Sample N°<br>Muestra N° | Lot N°<br>Lote N°             | Pipe N°<br>Tubo N° | P  | Max | 25 | 135    | 50     | 40 | 15 | -- | 10 | 30 | 400 | 80 | 400 | -- | -- | -- | 110 | 110 | --      | -- | -- | -- | --    | -- | 42      | 40   | 99  |    |    |    |      |      |
|                      |                         |                               |                    |    | Min | -- | 29     | 10     | -- | -- | -- | -- | -- | --  | -- | --  | -- | -- | -- | --  | --  | --      | -- | -- | -- | --    | -- | --      | --   | --  | -- | -- | -- |      |      |
| 20785                | 1770638                 | 0                             | 1                  | H  | Max | 16 | 110    | 23     | 4  | 1  | 3  | 1  | 10 | 36  | 26 | 80  | 30 | 7  | 3  | 1   | 2   | 1       | 1  | 1  | 7  | 20    | 22 | 23      | 2    | 84  | 3  | 20 | 37 | 36   | 19.4 |
|                      |                         |                               |                    |    | Min | 16 | 100    | 23     | 4  | 2  | -- | 1  | 10 | 36  | 26 | 80  | 30 | 8  | 4  | 2   | 2   | 1       | 2  | 1  | 2  | 7     | 20 | 22      | 24   | 2   | 85 | 3  | 20 | 37   | 36   |
| 20785                | 1770639                 | 0                             | 2                  | P  | Max | 16 | 100    | 24     | 4  | 2  | -- | 1  | 10 | 36  | 26 | 80  | 31 | 8  | 4  | 2   | 3   | 2       | 2  | 7  | 20 | 22    | 23 | 2       | 84   | 3   | 20 | 37 | 36 | 20.2 |      |
|                      |                         |                               |                    |    | Min | 16 | 100    | 25     | 4  | 2  | 3  | 1  | 12 | 28  | 26 | 86  | 30 | 5  | 3  | 1   | 3   | 1       | 1  | 7  | 20 | 22    | 14 | 2       | 82   | 5   | 20 | 36 | 36 | 18   |      |
| 47889                | 1775108                 | 0                             | 1                  | P  | Max | 16 | 100    | 25     | 4  | 2  | -- | 1  | 11 | 30  | 25 | 80  | 29 | 8  | 3  | 2   | 3   | 1       | 2  | 7  | 20 | 22    | 14 | 2       | 80   | 3   | 20 | 36 | 36 | 17.6 |      |
|                      |                         |                               |                    |    | Min | 16 | 110    | 25     | 4  | 2  | -- | 1  | 10 | 28  | 26 | 80  | 29 | 8  | 4  | 2   | 3   | 1       | 2  | 7  | 20 | 22    | 12 | 2       | 80   | 2   | 20 | 37 | 36 | 17.6 |      |

← 1.00

|  |                    |                       |
|--|--------------------|-----------------------|
| Ce.1: C+(MN/6)+(CR+MO+V)/5+(NI+CU)/15              | (5*B))             | Max: Maximum / Máximo |
| Ce.2:  | F.1: CR+CU+MO+NI+V | Min: Minimum / Mínimo |
| C+F((MN/6)+(SI/24)+(CU/15)+(NI/20)+(CR+MO+V+NB)/5) | H: Heat / Colada   | P: Product / Producto |

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y se valida con firma electrónica. El certificado original posee impreso el logo Tenaris color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal o indebido. Cualquier alteración y/o falsificación estará sujeta a la ley.





## INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**641869**

Page / Página:

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Date / Día: **January 12, 2012**

Siderca S.A. S.  
 Dr. Jorge A. Serra 250  
 (B2604)114, Carrara  
 Buenos Aires, Argentina  
 (54) 3489 431100 fax  
 (54) 3489 413065 fax

|   |                                  |   |  |   |
|---|----------------------------------|---|--|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>  |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO# 45001447-00002</b>          | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>   | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>53803/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>   |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |  | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Norma o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.J SSPSP00373/1+NACE MR0175/0103+IPRO LP-006</b> |                                  | Steel Grade / Grado de acero:<br><b>B/200 CAT I SS</b>                              |  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensione / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88.90 X 7.62 MM</b>  | Schedule / Cédula:<br><b>080</b> | Length / Longitud:<br><b>SRL (SP)</b>   | Quantity / Cantidad: <b>242 Pcs/pz</b><br><b>4584.71 FT                      47787 LB</b><br><b>1397.42 MT\$                    21676 KG</b> | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT</b><br><b>15.27 KG/M</b> |

### SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA

Supplementary Information  
 Información Suplementaria

|  |  |
|--|--|
| <p>*MANUFACTURED BY TENARIS SIDERCA*</p> <p>*ACIERAGE PROCESS*</p> <p>STEEL MAKING PROCESS: E.A.F./L.F. AND CONTINUOUS CASTING - FULL ALUMINIUM KILLED AND FINE GRAIN PRACTICE.</p> <p>-THE LF PRACTICE INCLUDES ARGON RINSE AND A FINAL INJECTION OF CALCIUM SILICIDE WIRE FOR MICROINCLUSION SHAPE CONTROL.</p> <p>-MATERIAL FREE FROM MERCURY CONTAMINATION.</p> <p>*ROLLING PROCESS*</p> <p>-MANUFACTURING PROCESS : SEAMLESS HOT ROLLED.</p> <p>*CONTROLS*</p> <p>-VISUAL AND DIMENSIONAL INSPECTION : SATISFACTORY.</p> <p>*MATERIAL CONDITIONS*</p> <p>-NOT REPAIRED BY WELDING.</p> <p>-MATERIAL COMPLIES WITH NACE MR 0103.</p> <p>-HARDNESS ACCORDING TO NACE MR-01-75/ ISO-15158-2</p> <p>*STANDARDS*</p> <p>-EDITION OF REGULATION: ASTM A 106/A 106M-2010</p> <p>-EDITION REGULATION: ASME SA 106/ 2010</p> <p>-EDITION OF REGULATION: NACE MR-01-03 EDITION 2010</p> <p>-EDITION OF REGULATION: NACE MR 01-75 - ISO 15158-2 : 2009</p> <p>-EDITION OF REGULATION : CSA Z245 : 2007</p> | <p>*FABRICADO POR TENARIS SIDERCA*</p> <p>*PROCESO DE ACERACIÓN*</p> <p>FABRICACIÓN DE ACERO: FUNDICIÓN POR ARCO ELECTRICO Y COLADO CONTINUO - ACERO CALMADO AL ALUMINIO.</p> <p>-LA PRÁCTICA DE AFINO EN EL HORNO - CUCHARA INCLUYE AGITACION POR ARGON Y UNA INYECCIÓN FINAL DE UNA VARILLA DE SILICIURO DE CALCIO PARA OBTENER UNA FORMA GLOBULAR DE EVENTUALES MICROINCLUSIONES.</p> <p>-MATERIAL LIBRE DE CONTAMINACIÓN DE MERCURIO.</p> <p>*PROCESO DE LAMINACIÓN*</p> <p>-FABRICACIÓN DE TUBO: LAMINADO EN CALIENTE Y SIN COSTURA.</p> <p>*CONTROLES*</p> <p>-CONTROL VISUAL Y DIMENSIONAL: SATISFACTORIO.</p> <p>*CONDICIONES DEL MATERIAL*</p> <p>-NO REPARADO POR SOLDADURA.</p> <p>-EL MATERIAL CUMPLE CON LOS REQUERIMIENTOS NACE MR 0103.</p> <p>-LA DUREZA CUMPLE CON LA NACE MR-01-75/ISO-15158-2</p> <p>*NORMAS*</p> <p>-EDICIÓN DE LA NORMA: ASTM A 106/A 106M-2010</p> <p>-EDICIÓN DE LA NORMA: ASME SA 106/ 2010</p> <p>- EDICIÓN DE LA NORMA: NACE MR-01-03 EDITION 2010</p> <p>-EDICIÓN DE LA NORMA: NACE MR 01-75 - ISO 15158-2 : 2009</p> <p>-EDICIÓN DE LA NORMA : CSAZ245: 2007</p> |
|--|--|

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es validado con firma electrónica. El certificado original posee impreso el logo Tenaris color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal o indebido. Cualquier alteración y/o falsificación estará sujeta a la ley.

FOR03171



### INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**641869**

Page / Página:

**5 / 6**

Date / Día: **January 12, 2012**

Siderca S.A. C.  
Dr. Jorge A. Gómez 240  
(02904MIA) Comodoro  
Bustos Aires, Argentina  
(54) 3489 433 00 10  
(54) 3489 433 05 fax

|  |                                  |   |   |   |
|--|----------------------------------|---|---|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO# 45001447-00002</b>          | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>53803/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |   | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I 8SP9P00373/1+NACE MR0175/0103+IPRO LP-006</b> |                                  | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>                              |   | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.390 INCH<br/>88.90 X 7.62 MM</b>   | Schedule / Cédula:<br><b>080</b> | Length / Longitud:<br><b>9RL (SP)</b>   | Quantity / Cantidad: <b>242 Pcs/ps</b><br><b>4584.71 FT                      47787 LB<br/>1397.42 MTS                    21676 KG</b> | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT<br/>15.27 KG/M</b>       |

### SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA

|  |  |
|--|--|
| Additional Information<br>Información Adicional  | Additional Information<br>Información Adicional  |
| HEAT TREATMENT: AS ROLLED.<br>NON DESTRUCTIVE TEST: SATISFACTORY.<br>INSPECTION METHODS: E.M.I. LONG. (EXT.) NOTCH 5% (INT.) NOTCH 10% +E.M.I. TRANSV. (EXT./INT.) | NOTCH 10% + M.P.I. LONG/TRANSV. (EXT./INT.) ENDS + W.M.P.I. ON BEVELS.<br>ONE BLUE BAND ON EACH END. |

### MARKING / MARCACIÓN

|  |   |
|--|---|
| Marking<br>Marcación   | Marking<br>Marcación  |
| - & = Monograma / Monogram SIDERCA<br>- NNNNN = Número de tubo / Nbr of pipe<br>- LLL = Longitud / length<br>- PPP = Peso / Weight | - @ = Monograma / Monogram API<br>- MM.YY = Mes / Año Month / Year<br>- Y/T = Año / Trimestre Year / Quarter<br>- HNX000X = Colada / Heat |
| Stenciling (Pipe)<br>Estarcido (Tubo)  | Stenciling (Pipe)<br>Estarcido (Tubo)   |
| TENARIS 00 MM.YY ASTM/ASME A/SA106 88,9 7,62 15,27 3 SCH80 XS B/290 CAT I SS SEAMLESS 20/K/PAX103 NDE                              | CSA Z245.1-07 MADE IN ARGENTINA HNX000X NNNNN LLLL PPPPP  |

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

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## INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**641869**

Page / Página:

**6 / 6**

Date / Día: **January 12, 2012**

Service D & C  
Dr. Jorge A. Simón, 250  
(B2204) (P.A.) Cas. Santa  
Buenos Aires, Argentina  
(54) 3459 433100 ext.  
(54) 3459 433400 fax

|  |                                  |   |  |   |
|--|----------------------------------|---|--|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO# 45001447-00002</b>  | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>   | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>53803/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b>   |  | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CBA Z245.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+PRO LP-006</b>  |                                  | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>  |  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. A&amp;TM</b>                   |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88.90 X 7.62 MM</b>   | Schedule / Cédula:<br><b>080</b> | Length / Longitud:<br><b>SRL (SP)</b>   | Quantity / Cantidad: <b>242 Pcs/pz</b><br><b>4584.71 FT                      47767 LB<br/>1387.42 MTS                    21676 KG</b>  | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT<br/>15.27 KG/M</b>       |
| This is to certify that the product described here has been manufactured, sampled, tested, and inspected in accordance with purchaser order requirements. This certificate is not a declaration of origin nor may it be used as a declaration of origin. |                                  | Por el presente certificamos que el material aquí descrito ha sido fabricado, muestreado, ensayado e inspeccionado de acuerdo a los requisitos de su orden de compra. Este certificado no es, ni puede ser usado, como una declaración de origen. |  |   |
| <b>CUSTOMER . THIRD PARTY</b>  |                                  | <b>TENARIS QUALITY DEPARTMENT SIGNATURE</b>   |  |   |
| INSPECTION COMPANY<br>COMPAÑIA DE INSPECCIÓN<br><br>Company Name: <b>N/A</b><br>Employee Name: <b>N/A</b>  |                                  | <br><br>QUALITY CERTIFICATION DEPT.<br>DEPTO. DE CERTIFICACIÓN DE CALIDAD<br><b>PAOLINA Soledad</b>  | <br><br>CHIEF OF QUALITY CERTIFICATION DEPT.<br>RESPONSABLE DEL DEPTO. DE CERTIFICACIÓN DE CALIDAD<br><b>AYERBB Eduardo</b> |   |

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3" SCH XH 4100-B

HT# 88784

### INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

661222

Page / Página:

1 / 6

Date / Día: May 23, 2012

CONTROL  
No. 10204 3.1: 2004  
No. 10474 3.1B: 1991  
No. 10204 3.1: 2004  
No. 10474 3.1B: 1991  
No. 10204 3.1: 2004  
No. 10474 3.1B: 1991

|  |  |   |  |  |  |   |  |
|--|--|---|--|--|--|---|--|
| Customer / Cliente: VAN LEEUWEN PIPE & TUBE (CANADA) IN - VAN LEE  |  | Customer's Order Item / Orden Cliente - Item: PO 45201465-00003           |  | Customer's Reference / Ref. del Cliente: N/A |  | Manufacturer's Works Order N° / Confirmación de Venta: 38103/02               |  |
| Manufacturing Process / Proceso de Manufactura: SEAMLESS HOT ROLLED  |  | Product Type / Tipo de Producto: CARBON STEEL PIPE-HIGH TEMPERATURE SERV. |  |  |  | Surface / Superficie: INT BARE /EXT VARNISHED                                 |  |
| Standard or Specification / Normas o Especificaciones: ASTM/ASME A/SA106+CSA Z245.1-07 CAT J SSPSP003731+NACE MR0175/0103+PRO LP-006 |  |   |  | Steel Grade / Grado de acero: B290 CAT I SS  |  | Ends / Extremos: BEVELLED AT 30 DEG. ASTM                                     |  |
| Dimensions / Dimensiones: 3 1/2 X 0.300 INCH<br>88.90 X 7.62 MM  |  | Schedule / Cédula: 800  |  | Length / Longitud: S.R. (SP)                 |  | Quantity / Cantidad: 300 Pcs/pz<br>8263.5 FT 85674 LB<br>2524.81 MTS 38851 KG |  |
|  |  |   |  |  |  | Nominal Weight / Peso Nominal: 10.25 LB/FT<br>15.27 KG/M                      |  |

### TENSILE TEST / ENSAYO DE TENSION

| Heat N°<br>Caleada N° | Sample N°<br>Muestra N° | Zone<br>Zona | Pipe N°<br>Tubo N° | Specimen condition<br>Condición de la probeta |    |              |     | Specimen dimensions<br>Dimensiones de la probeta |                                    | Test temp<br>Temp. ensayo | Y.S.              |                            | U.T.S             |          | Elongation / M alargamiento |           |    |
|-----------------------|-------------------------|--------------|--------------------|---|----|--------------|-----|--|------------------------------------|---------------------------|-------------------|----------------------------|-------------------|----------|-----------------------------|-----------|----|
|                       |                         |              |                    | La  | Sc | Type<br>Tipo | Ori | Size<br>Tamaño<br>in                             | Area<br>Sección<br>in <sup>2</sup> |                           | Min: 42<br>Max: ∞ | Req.<br>Min: 80<br>Max: 91 | Req. Max.<br>0.93 | Lo<br>2" | Min.<br>%                   | Obt.<br>% |    |
|                       |                         |              |                    |   |    |              |     |  |                                    |                           |                   |                            |                   |          |                             |           | °C |
| 22806                 | 1868127                 | M            | 1                  | B   | AM | Ss           | L   | 0.757 x 0.304                                    | 0.233                              | RT                        | 51.8              | 76.1                       | 0.69              | 50.8     | 23.5                        | 29.8      |    |
| 22923                 | 1868126                 | M            | 2                  | B   | AM | Ss           | L   | 0.754 x 0.298                                    | 0.227                              | RT                        | 51.6              | 75.0                       | 0.69              | 50.8     | 23.5                        | 31.1      |    |
| 88784                 | 1861053                 | M            | 1                  | B   | AM | Ss           | L   | 0.752 x 0.302                                    | 0.229                              | RT                        | 64.8              | 76.0                       | 0.72              | 50.8     | 23.5                        | 29.0      |    |
| 88784                 | 1861055                 | M            | 1                  | B   | AM | Ss           | L   | 0.745 x 0.296                                    | 0.222                              | RT                        | 64.3              | 75.7                       | 0.72              | 50.8     | 23.5                        | 29.0      |    |

|  |                                |  |  |
|--|--------------------------------|--|--|
| AM: As manufactured / Según proceso de fabricación | M: Middle / Medio              | Req. Max: Required maximum / Máximo requerido    | U.T.S: Ultimate tensile strength / Resistencia |
| B: Body / Cuerpo                                   | Max: Maximum / Máximo          | Req: Required / Requerido                        | Y.S: Yield strength / Fluencia                 |
| L: Longitudinal / Longitudinal                     | Min: Minimum / Mínimo          | RT: Room temperature / Temperatura ambiente      |  |
| Lo: Initial length / Longitud inicial              | Obt: Obtained / Obtenido       | Sc: Specimen condition / Condición de la probeta |  |
| Ln: Location of sample / Ubicación de la muestra   | Ori: Orientation / Orientación | Ss: Strip specimen / Muestra rectangular         |  |

ASME SECTION II BY  
VALTEX INDUSTRIES LTD.  
DATE: 05/23/2012  
SIGNATURE: [Signature]  
IN HR - 306"

INSPECTION CERTIFICATE 2011 0012315  
NICKEL ALLOY MARKING - Latest Edition.  
= 1.00  
CE = 0.34

JOB # 10-3423  
LIL V. 00010000 226  
28334

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FOR03171



VL QA Approved



**INSPECTION CERTIFICATE**

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

|                                   |                                |
|-----------------------------------|--------------------------------|
| Number / Número:<br><b>661222</b> | Page / Página:<br><b>2 / 6</b> |
| Date / Día: <b>May 23, 2012</b>   |                                |

Tenaris is  
a registered trademark of  
Tenaris S.p.A. - Italy  
www.tenaris.com

|  |  |   |   |  |  |   |   |                                |  |
|--|--|---|---|--|--|---|---|--------------------------------|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN - VAN LEE</b>   |  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001465-00003</b> |   | Customer's Reference / Ref. del Cliente:<br><b>N/A</b> |  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>56103/02</b> |   |                                |  |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |  |   | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |  |  | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |   |                                |  |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+IPRO LP-006</b> |  |   |   | Steel Grade / Grado de acero:<br><b>B/290 CAT I S6</b> |  |   | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b> |                                |  |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88.90 X 7.62 MM</b>   |  | Schedule / Cédula:<br><b>080</b>  |   | Length / Longitud:<br><b>S.R. (SP)</b>                 |  | Quantity / Cantidad: <b>380 Pcs/pz</b>                                    |   | Nominal Weight / Peso Nominal: |  |
|  |  |   |   |  |  | <b>8283.5 FT      85674 LB</b>  |   | <b>10.25 LB/FT</b>             |  |
|  |  |   |   |  |  | <b>2524.81 MTS      38981 KG</b>  |   | <b>15.27 KG/M</b>              |  |

**CHEMICAL COMPOSITION / COMPOSICIÓN QUÍMICA**

|           |            |         |         | Composition % / Composición % |     |     |     |    |        |    |    |        |    |     |     |     |    |    |    |     |     |       |    |         |    |    |    |    |    |      |      |     |      |    |    |
|-----------|------------|---------|---------|-------------------------------|-----|-----|-----|----|--------|----|----|--------|----|-----|-----|-----|----|----|----|-----|-----|-------|----|---------|----|----|----|----|----|------|------|-----|------|----|----|
|           |            |         |         | x 100                         |     |     |     |    |        |    |    | x 1000 |    |     |     |     |    |    |    |     |     | x 100 |    | x 10000 |    |    |    |    |    |      |      |     |      |    |    |
|           |            |         |         | C                             | Mn  | Si  | Cr  | Mo | Al sol | S  | P  | Ni     | V  | Cu  | Al  | Sn  | As | Nb | Ti | Pb  | Sb  | Co    | Zr | Bi      | Ca | B  | N  | Mg | W  | Ce.1 | Ce.2 | F.1 |      |    |    |
| Heat N°   | Sample N°  | Lot N°  | Pipe N° | H                             | Max | 25  | 135 | 50 | 40     | 15 | -- | 10     | 30 | 400 | 80  | 400 | -- | -- | -- | 110 | 110 | --    | -- | --      | -- | -- | -- | -- | -- | --   | --   | 42  | 40   | 99 |    |
| Colada N° | Muestra N° | Lote N° | Tubo N° | Min                           | --  | 20  | 10  | -- | --     | -- | -- | --     | -- | --  | --  | --  | -- | -- | -- | --  | --  | --    | -- | --      | -- | -- | -- | -- | -- | --   | --   | --  | --   |    |    |
|           |            |         |         | P                             | Max | 25  | 135 | 50 | 40     | 15 | -- | 10     | 30 | 400 | 80  | 400 | -- | -- | -- | 110 | 110 | --    | -- | --      | -- | -- | -- | -- | -- | --   | --   | --  | 42   | 40 | 99 |
|           |            |         |         | Min                           | --  | 20  | 10  | -- | --     | -- | -- | --     | -- | --  | --  | --  | -- | -- | -- | --  | --  | --    | -- | --      | -- | -- | -- | -- | -- | --   | --   | --  | --   | -- |    |
| 22806     |            |         |         | H                             | 17  | 107 | 27  | 7  | 4      | 2  | 1  | 10     | 58 | 27  | 120 | 24  | 12 | 4  | 1  | 3   | 1   | 1     | 7  | 20      | 22 | 13 | 2  | 77 | 3  | 20   | 39   | 39  | 31.5 |    |    |
| 22806     | 1868127    | 0       | 1       | P                             | 17  | 106 | 26  | 7  | 5      | -- | 2  | 10     | 60 | 25  | 130 | 27  | 14 | 5  | 4  | 4   | 2   | 2     | 7  | 20      | 22 | 12 | 2  | 71 | 2  | 20   | 39   | 39  | 33.5 |    |    |
| 22806     | 1868126    | 0       | 2       | P                             | 16  | 106 | 25  | 7  | 5      | -- | 2  | 10     | 60 | 25  | 120 | 26  | 13 | 5  | 3  | 3   | 1   | 2     | 7  | 20      | 22 | 14 | 2  | 71 | 3  | 20   | 38   | 37  | 32.5 |    |    |
| 22923     |            |         |         | H                             | 18  | 107 | 24  | 10 | 5      | 3  | 1  | 11     | 48 | 32  | 120 | 28  | 10 | 4  | 2  | 4   | 1   | 1     | 7  | 20      | 26 | 13 | 2  | 74 | 4  | 20   | 39   | 38  | 35   |    |    |
| 22923     | 1868126    | 0       | 2       | P                             | 17  | 106 | 25  | 10 | 5      | -- | 2  | 10     | 51 | 29  | 130 | 24  | 12 | 5  | 3  | 4   | 2   | 2     | 7  | 20      | 22 | 11 | 2  | 71 | 1  | 20   | 39   | 39  | 36   |    |    |
| 22923     | 1868125    | 0       | 1       | P                             | 16  | 105 | 24  | 10 | 5      | -- | 2  | 11     | 51 | 28  | 120 | 26  | 12 | 4  | 2  | 4   | 1   | 2     | 7  | 20      | 22 | 12 | 2  | 71 | 1  | 20   | 38   | 37  | 34.9 |    |    |
| 88784     |            |         |         | H                             | 16  | 108 | 25  | 5  | 4      | 3  | 1  | 12     | 65 | 27  | 80  | 26  | 7  | 4  | 1  | 2   | 1   | 1     | 7  | 20      | 22 | 11 | 2  | 77 | 3  | 20   | 37   | 37  | 26.2 |    |    |
| 88784     | 1861053    | 0       | 1       | P                             | 16  | 108 | 25  | 5  | 4      | -- | 1  | 11     | 67 | 27  | 80  | 28  | 8  | 4  | 2  | 3   | 1   | 2     | 7  | 20      | 22 | 11 | 2  | 70 | 2  | 20   | 37   | 37  | 27.4 |    |    |
| 88784     | 1861056    | 0       | 1       | P                             | 16  | 108 | 24  | 5  | 4      | -- | 1  | 12     | 68 | 26  | 80  | 29  | 7  | 4  | 2  | 3   | 1   | 2     | 7  | 20      | 22 | 12 | 2  | 79 | 2  | 20   | 37   | 37  | 26.4 |    |    |
| 88784     | 1861054    | 0       | 2       | P                             | 16  | 110 | 26  | 5  | 4      | -- | 1  | 11     | 67 | 25  | 80  | 25  | 8  | 4  | 2  | 3   | 1   | 2     | 7  | 20      | 22 | 11 | 2  | 81 | 2  | 20   | 38   | 37  | 27.2 |    |    |
| 88784     | 1861056    | 0       | 2       | P                             | 16  | 108 | 25  | 6  | 4      | -- | 1  | 11     | 67 | 25  | 80  | 30  | 7  | 4  | 2  | 3   | 1   | 2     | 7  | 20      | 22 | 12 | 2  | 75 | 3  | 20   | 37   | 36  | 28.2 |    |    |

|   |                    |                       |
|---|--------------------|-----------------------|
| Ce.1: C+(MN/8)+(CR+MO+V)/5+(NI+CU)/15               | (5'B)              | Max: Maximum / Máximo |
| Ce.2:   | F.1: CR+CU+MO+NI+V | Min: Minimum / Mínimo |
| C+H*((MN/6)+(SI/24)+(CU/15)+(NI/20)+(CR+MO+V+NB)/5+ | H: Heat / Colada   | P: Product / Producto |

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## INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**661222**

Page / Página:

**3 / 6**

Date / Día: **May 23, 2012**

|  |  |   |   |  |  |   |   |  |
|--|--|---|---|--|--|---|---|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN - VAN LEE</b>   |  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001465-00003</b> |   | Customer's Reference / Ref. del Cliente<br><b>N/A</b>  |  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>56103/02</b> |   |  |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |  |   | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |  |  | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |   |  |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+IPRO LP-006</b> |  |   |   | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b> |  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |   |  |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88.90 X 7.62 MM</b>   |  | Schedule / Cédula:<br><b>080</b>  | Length / Longitud:<br><b>S.R. (SP)</b>  |  | Quantity / Cantidad: <b>380 Pcs/pz</b><br><b>8283.5 FT                      85674 LB<br/>2524.81 MTS                    38861 KG</b> |   | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT<br/>15.27 KG/M</b> |  |

### THROUGH WALL HARDNESS / DUREZA EN EL ESPESOR

| Required values<br>Valores requeridos |                         |              | Individuals / Individuales |                    |        |                          | Average / Promedio |       |       |       |       | Hardness type HV10<br>Tipo de dureza |       |       |       |       |       |       |       |       |       |       |      |
|---------------------------------------|-------------------------|--------------|----------------------------|--------------------|--------|--------------------------|--------------------|-------|-------|-------|-------|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| Heat N°<br>Colada N°                  | Sample N°<br>Muestra N° | Zone<br>Zona | Min: -                     | Max: -             | Var: - | Specimen condition<br>Ls | Quad.              | OD    |       |       |       |                                      | MW    |       |       |       |       | ID    |       |       |       |       | Var. |
|                                       |                         |              | Lot N°<br>Lote N°          | Pipe N°<br>Tubo N° | 1      |                          |                    | 2     | 3     | 4     | Avg.  | 1                                    | 2     | 3     | 4     | Avg.  | 1     | 2     | 3     | 4     | Avg.  |       |      |
| 22806                                 | 1868127                 | M            | 0                          | 1                  |        | B                        | 1                  | 144.0 | 155.0 | 157.0 | 166.0 | 155.5                                | 155.0 | 154.0 | 160.0 | 160.0 | 157.3 | 159.0 | 155.0 | 157.0 | 151.0 | 155.5 | 1.8  |
| 22923                                 | 1868126                 | M            | 0                          | 2                  |        | B                        | 1                  | 149.0 | 181.0 | 154.0 | 155.0 | 154.8                                | 157.0 | 156.0 | 153.0 | 154.0 | 155.0 | 159.0 | 160.0 | 150.0 | 147.0 | 154.0 | 1.0  |
| 88784                                 | 1861053                 | M            | 0                          | 1                  |        | B                        | 1                  | 167.0 | 168.0 | 171.0 | 170.0 | 169.0                                | 160.0 | 164.0 | 167.0 | 161.0 | 163.0 | 161.0 | 158.0 | 159.0 | 159.0 | 159.3 | 9.8  |
| 88784                                 | 1861055                 | M            | 0                          | 1                  |        | B                        | 1                  | 182.0 | 184.0 | 179.0 | 187.0 | 183.0                                | 155.0 | 165.0 | 162.0 | 164.0 | 161.5 | 163.0 | 169.0 | 167.0 | 167.0 | 166.5 | 21.5 |

|  |  |   |                            |
|--|--|---|----------------------------|
| Avg: Average / Promedio                  | Ln: Location of sample / Ubicación de la muestra | Min: Minimum / Mínimo                   | Quad: Quadrant / Cuadrante |
| B: Body / Cuerpo                         | M: Middle / Medio                                | MW: Middle wall / Centro                | Var: Variation / Variación |
| ID: Internal diameter / Diámetro interno | Max: Maximum / Máximo                            | OD: Outside diameter / Diámetro externo |                            |

### HYDROSTATIC TEST / PRUEBA HIDRAULICA

| Pressure / Presión |               | Time / Tiempo      |  | Results / Resultado          |  |
|--------------------|---------------|--------------------|--|------------------------------|--|
| Unit / Unidad.     | Value / Valor | Seconds / Segundos |  |                              |  |
| PSI                | 3,000         | 5                  |  | Satisfactory / Satisfactorio |  |

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|   |                                   |                                |
|---|-----------------------------------|--------------------------------|
| <b>INSPECTION CERTIFICATE</b><br>(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991) | Number / Número:<br><b>661222</b> | Page / Página:<br><b>4 / 6</b> |
| Date / Día: <b>May 23, 2012</b>   |                                   |                                |

No. de Cert. 661222  
 Fecha de Emisión 23/05/2012  
 No. de Cliente 45001465-00003  
 No. de Producto 56103/02

|   |                                  |   |  |   |
|---|----------------------------------|---|--|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN - VAN LEE</b>  |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001465-00003</b>           | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>   | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>56103/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>   |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |  | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+PRO LP-006</b> |                                  | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>                              |  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88.90 X 7.62 MM</b>  | Schedule / Cédula:<br><b>080</b> | Length / Longitud:<br><b>S.R. (SP)</b>  | Quantity / Cantidad: <b>380 Pcs/pz</b><br><b>8283.5 FT                      85674 LB<br/>2524.81 MTS                    38861 KG</b> | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT<br/>15.27 KG/M</b>       |

**SPECIAL REQUIREMENTS / REQUERIMIENTOS ESPECIALES**

| Condition / Condición                                  | Description / Descripción  |
|--|--|
| Pipe residual magnetism / Magnetismo remanente de tubo | 30 GAUSS   |
| End protectors / Protector de extremo                  | NON LIFTABLE CLOSED PLASTIC PROTECTOR FOR FLAT / BEVELED PIPE. SUPPLIER METALCENTRO. |

**SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA**

| Supplementary Information / Información Suplementaria  |  |
|--|--|
| <p><b>*MANUFACTURED BY TENARIS SIDERCA*</b></p> <p><b>*ACIERAGE PROCESS*</b></p> <p>STEEL MAKING PROCESS: E.A.F./L.F. AND CONTINUOUS CASTING - FULL ALUMINIUM KILLED AND FINE GRAIN PRACTICE.</p> <p>-THE LF PRACTICE INCLUDES ARGON RINSE AND A FINAL INJECTION OF CALCIUM SILICIDE WIRE FOR MICROINCLUSION SHAPE CONTROL.</p> <p>-MATERIAL FREE FROM MERCURY CONTAMINATION.</p> <p><b>*ROLLING PROCESS*</b></p> <p>-MANUFACTURING PROCESS : SEAMLESS HOT ROLLED.</p> <p><b>*CONTROLS*</b></p> <p>-VISUAL AND DIMENSIONAL INSPECTION : SATISFACTORY.</p> <p><b>*MATERIAL CONDITIONS*</b></p> <p>-NOT REPAIRED BY WELDING.</p> <p><b>*STANDARDS*</b></p> <p>-EDITION OF REGULATION: ASTM A 106/A 106M-2011</p> <p>-EDITION REGULATION: ASME SA 106/ 2010</p> <p>-EDITION OF REGULATION: NACE MR-01-03 EDITION 2010</p> | <p><b>*FABRICADO POR TENARIS SIDERCA*</b></p> <p><b>*PROCESO DE ACERACIÓN*</b></p> <p>FABRICACIÓN DE ACERO: FUNDICIÓN POR ARCO ELECTRICO Y COLADO CONTINUO - ACERO CALMADO AL ALUMINIO PRACTICA DE GRANO FINO</p> <p>-LA PRACTICA DE AFINO EN EL HORNO - CUCHARA INCLUYE AGITACION POR ARGON Y UNA INYECCION FINAL DE VARILLA DE SILICIURO DE CALCIO PARA OBTENER UNA FORMA GLOBULAR DE EVENTUALES MICROINCLUSIONES.</p> <p>-MATERIAL LIBRE DE CONTAMINACIÓN DE MERCURIO.</p> <p><b>*PROCESO DE LAMINACIÓN*</b></p> <p>-FABRICACIÓN DE TUBO: LAMINADO EN CALIENTE Y SIN COSTURA.</p> <p><b>*CONTROLES*</b></p> <p>-CONTROL VISUAL Y DIMENSIONAL: SATISFACTORIO.</p> <p><b>*CONDICIONES DEL MATERIAL*</b></p> <p>-NO REPARADO POR SOLDADURA</p> <p><b>*NORMAS*</b></p> <p>-EDICIÓN DE LA NORMA: ASTM A 106/A 106M-2011</p> <p>-EDICIÓN DE LA NORMA: ASME SA 106/ 2010</p> <p>-EDICIÓN DE LA NORMA: NACE MR-01-03 EDITION 2010</p> |

|   |  |
|---|--|
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|---|--|



|  |  |                                   |                                |
|--|--|-----------------------------------|--------------------------------|
| <b>INSPECTION CERTIFICATE</b>                  |  | Number / Número:<br><b>661222</b> | Page / Página:<br><b>5 / 6</b> |
| (BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991) |  | Date / Día: <b>May 23, 2012</b>   |                                |

Welded  
Seamless  
Steel Pipe  
Manufactured  
in Argentina  
SA 3450/ASME B31.3

|  |                                  |   |  |   |
|--|----------------------------------|---|--|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN - VAN LEE</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45001465-00003</b>           | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>   | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>56103/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |  | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+IPRO LP-006</b> |                                  |   | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>   | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88,90 X 7,62 MM</b>   | Schedule / Cédula:<br><b>080</b> | Length / Longitud:<br><b>S.R. (SP)</b>  | Quantity / Cantidad: <b>380 Pcs/pz</b><br><b>8283.5 FT      85674 LB<br/>2524.81 MTS      38861 KG</b> | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT<br/>15.27 KG/M</b>       |

**SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA**

|   |   |
|---|---|
| Supplementary Information<br>Información Suplementaria      |   |
| - EDITION OF REGULATION: NACE MR 01-75 - ISO 15156-2 : 2009 | - EDICIÓN DE LA NORMA: NACE MR 01-75 - ISO 15156-2 : 2009 |
| - EDITION OF REGULATION : CSA Z245 : 2007                   | - EDICIÓN DE LA NORMA : CSAZ245: 2007                     |

|   |   |
|---|---|
| Additional Information<br>Información Adicional                   | Additional Information<br>Información Adicional   |
| HEAT TREATMENT: AS ROLLED.<br>NON DESTRUCTIVE TEST: SATISFACTORY. | INSPECTION METHODS: E.M.I LONG. (EXT.) NOTCH 5% (INT.) NOTCH 10% + E.M.I TRANSV. (EXT./INT.)<br>NOTCH 10% + M.P.I. LONG./TRANSV. (EXT./INT.) ENDS + W.M.P.I. ON BEVELS. |

**MARKING / MARCACIÓN**

|  |   |
|--|---|
| Marking<br>MARCACIÓN   | Marking<br>MARCACIÓN  |
| - & = Monograma / Monogram SIDERCA<br>- NNNNN = Número de tubo / Nbr of pipe<br>- LLL = Longitud / length<br>- PPP = Peso / Weight | - @ = Monograma / Monogram API<br>- MM.YY = Mes / Año Month / Year<br>- Y/T = Año / Trimestre Year / Quarter<br>- HNX000X = Colada / Heat |
| Stencilling (Pipe)<br>Estarcido (Tubo)   | Stencilling (Pipe)<br>Estarcido (Tubo)  |
| TENARIS SD MM.YY ASTM/ASME A/SA106 88,9 7,62 15,27 3 SCH80 XS B/290 CAT I SS SEAMLESS 207KPAX100 NDE                               | CSA Z245.1-07 45001465 MADE IN ARGENTINA HNX000X NNNNN LLLL PPPPP   |

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|  |                                  |   |   |   |   |
|--|----------------------------------|---|---|---|---|
| <b>INSPECTION CERTIFICATE</b>  |                                  |   |   | Number / Número:<br><b>661222</b>   | Page / Página:<br><b>6 / 6</b>  |
| (BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)   |                                  |   |   | Data / Día: <b>May 23, 2012</b>   |   |
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN - VAN LEE</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>PO 45901465-00003</b>           |   | Customer's Reference / Ref del Cliente:<br><b>N/A</b>                     |   |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |   | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>56103/02</b> |   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I SPPSP00373/1+NACE MR0175/0103+IPRO LP-006</b>   |                                  | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>                              |   | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |   |
| Dimensions / Dimensiones:<br><b>3 1/2 X 0.300 INCH<br/>88.90 X 7.62 MM</b>   | Schedule / Cédula:<br><b>080</b> | Length / Longitud:<br><b>5.R. (SP)</b>  | Quantity / Cantidad: <b>380 Pcs/pz</b><br><b>8283.5 FT                      85674 LB<br/>2524.81 MTS                    38861 KG</b>  | Nominal Weight / Peso Nominal:<br><b>10.25 LB/FT<br/>15.27 KG/M</b>       |   |
| This is to certify that the product described here has been manufactured, sampled, tested, and inspected in accordance with purchaser order requirements. This certificate is not a declaration of origin nor may it be used as a declaration of origin. |                                  |   | Por el presente certificamos que el material aquí descrito ha sido fabricado, muestreado, ensayado e inspeccionado de acuerdo a los requisitos de su orden de compra. Este certificado no es, ni puede ser usado, como una declaración de origen. |   |   |
| <b>CUSTOMER . THIRD PARTY</b>  |                                  |   | <b>TENARIS QUALITY DEPARTMENT SIGNATURE</b>   |   |   |
| INSPECTION COMPANY<br>COMPAÑIA DE INSPECCIÓN<br><br>Company Name: N/A<br>Employee Name: N/A  |                                  |   | <br><br>QUALITY CERTIFICATION DEPT<br>DEPTO. DE CERTIFICACIÓN DE CALIDAD<br><b>REALE Jorge</b>   |   | <br><br>CHIEF OF QUALITY CERTIFICATION DEPT<br>RESPONSABLE DEL DEPTO. DE CERTIFICACIÓN DE CALIDAD<br><b>AYERBE Eduardo</b> |

3 0474 3.1 B  
 10474 3.1 B  
 10474 3.1 B  
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 10474 3.1 B

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# INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**678572**

Page / Página:

**1 / 6**

Date / Día: **August 24, 2012**

30000 3.1  
10204 3.1B  
10474 3.1B  
10474 3.1B  
10474 3.1B  
10474 3.1B

|  |                                  |   |   |   |
|--|----------------------------------|---|---|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>45001532-00012</b>              | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>50993/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |   | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.J SSPSP00373/1+NACE MR0175/0103+IPRO LP-006</b> |                                  |   | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensions / Dimensiones:<br><b>2 3/8 X 0.344 INCH<br/>60.30 X 8.74 MM</b>   | Schedule / Cédula:<br><b>160</b> | Length / Longitud:<br><b>SRL (SP)</b>   | Quantity / Cantidad: <b>17 Pcs/pz</b><br><b>323.62 FT      2400 LB<br/>96.64 MTS      1116 KG</b> | Nominal Weight / Peso Nominal:<br><b>7.46 LB/FT<br/>11.11 KG/M</b>        |

## TENSILE TEST / ENSAYO DE TENSION

| Heat N°<br>Cofada N° | Sample N°<br>Muestra N° | Zone<br>Zona | Pipe N°<br>Tubo N° | Specimen condition<br>Condición de la probeta |    |              |     | Specimen dimensions<br>Dimensiones de la probeta |                 | Test temp.<br>Temp. ensayo | Y.S.<br>Eul 0.50 % |                      | U.T.S.<br>Req.    |          | Y.S./U.T.S.<br>Req. Max. |           | Elongation / Alargamiento |                 |    |
|----------------------|-------------------------|--------------|--------------------|---|----|--------------|-----|--|-----------------|----------------------------|--------------------|----------------------|-------------------|----------|--------------------------|-----------|---------------------------|-----------------|----|
|                      |                         |              |                    | Ls  | Sc | Type<br>Tipo | Ori | Size<br>Tamaño                                   | Area<br>Sección |                            | Min: 299<br>Max: - | Min: 415<br>Max: 625 | Req. Max.<br>0.93 | Lo<br>2" | Min.<br>%                | Obt.<br>% |                           |                 |    |
|                      |                         |              |                    |   |    |              |     |  |                 |                            |                    |                      |                   |          |                          |           | mm                        | mm <sup>2</sup> | °C |
| 24320                | 1920244                 | M            | 1                  | B   | AM | Ss           | L   | 19.38 x 8.91                                     | 177.22          | RT                         | 368                | 522                  | 0.70              | 50.8     | 24.0                     | 32.4      |                           |                 |    |
| 24320                | 1920246                 | M            | 1                  | B   | AM | Ss           | L   | 19.41 x 9.20                                     | 183.36          | RT                         | 355                | 503                  | 0.71              | 50.8     | 24.0                     | 31.7      |                           |                 |    |

|  |                                |  |   |
|--|--------------------------------|--|---|
| AM: As manufactured / Según proceso de fabricación   | M: Middle / Medio              | Req. Max: Required maximum / Máximo requerido    | U.T.S.: Ultimate tensile strength / Resistencia |
| B: Body / Cuerpo                                     | Max: Maximum / Máximo          | Req: Required / Requerido                        | Y.S: Yield strength / Fluencia                  |
| L: Longitudinal / Longitudinal                       | Min: Minimum / Mínimo          | RT: Room temperature / Temperatura ambiente      |   |
| Lo: Initial length / Longitud inicial                | Obt: Obtained / Obtenido       | Sc: Specimen condition / Condición de la probeta |   |
| Lo: Location of the sample / Ubicación de la muestra | Ori: Orientation / Orientación | Ss: Strip specimen / Muestra rectangular         |   |

JOB# STOCK  
HEAT CODE# 2-057  
24320-1920244

CE=0.37

19/15  
D.341

CONFORMS TO 2010 EDITION 2011 ADDENDA

51.00

34

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

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Meets NACE MR0175 Latest Edition.

FOR03171



VL QA Approved



## INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**678572**

Page / Página:

**2 / 6**

Date / Día: **August 24, 2012**

Source: SAIC  
 Group: B. O. 101250  
 B22542077 (San Luis)  
 B22542077 (Argentina)  
 C.I. 125455330 (Id)  
 1641715943245134

|   |                               |  |   |   |   |  |  |
|---|-------------------------------|--|---|---|---|--|--|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>  |                               | Customer's Order Item / Orden Cliente - Item: <b>45601532-00012</b>              |   | Customer's Reference / Ref. de Cliente: <b>N/A</b>  |   | Manufacturer's Works Order N° / Confirmación de Venta: <b>50993/02</b> |  |
| Manufacturing Process / Proceso de Manufactura: <b>SEAMLESS HOT ROLLED</b>  |                               | Product Type / Tipo de Producto: <b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |   |   |   | Surface / Superficie: <b>INT BARE /EXT VARNISHED</b>                   |  |
| Standard or Specification / Normas o Especificaciones: <b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.J S5SP80373/1+MACE MR0175/0103+PRO LP-006</b> |                               |  |   | Steel Grade / Grado de acero: <b>B/290 CAT I SS</b> |   | Ends / Extremos: <b>BEVELLED AT 30 DEG. ASTM</b>                       |  |
| Dimensions / Dimensiones: <b>2 3/8 X 0.344 INCH<br/>60.30 X 8.74 MM</b>   | Schedule / Cédula: <b>160</b> | Length / Longitud: <b>SRL (SP)</b>   | Quantity / Cantidad: <b>17 Pcs/pz<br/>323.62 FT<br/>96.64 MTS</b> |   | Nominal Weight / Peso Nominal: <b>2460 LB<br/>1118 KG<br/>7.46 LB/FT<br/>11.11 KG/M</b> |  |  |

### CHEMICAL COMPOSITION / COMPOSICIÓN QUÍMICA

|           |            |         |         |     | Composition % / Composición % |     |    |    |    |        |    |    |     |     |     |    |    |     |     |       |    |         |    |    |    |    |    |    |    |    |      |      |     |
|-----------|------------|---------|---------|-----|-------------------------------|-----|----|----|----|--------|----|----|-----|-----|-----|----|----|-----|-----|-------|----|---------|----|----|----|----|----|----|----|----|------|------|-----|
|           |            |         |         |     | X 100                         |     |    |    |    | X 1000 |    |    |     |     |     |    |    |     |     | X 100 |    | X 10000 |    |    |    |    |    |    |    |    |      |      |     |
|           |            |         |         |     | C                             | Mn  | Si | Cr | Mo | Al sol | S  | P  | Ni  | V   | Cu  | Al | Sn | As  | Nb  | Ti    | Pb | Sb      | Co | Zr | Bi | Ca | B  | N  | Mg | W  | Ce.1 | Ce.2 | F.1 |
| Heat N°   | Sample N°  | Lot N°  | Pipe N° | P   | 25                            | 135 | 50 | 40 | 15 | --     | 10 | 30 | 400 | 80  | 400 | -- | -- | 110 | 110 | --    | -- | --      | -- | -- | -- | -- | 10 | -- | -- | -- | 42   | 40   | 89  |
| Colada N° | Muestra N° | Lote N° | Tubo N° | Min | --                            | 20  | 10 | -- | -- | --     | -- | -- | --  | --  | --  | -- | -- | --  | --  | --    | -- | --      | -- | -- | -- | -- | -- | -- | -- | -- | --   | --   |     |
| 24320     | 1920244    | 0       | 1       | H   | 16                            | 105 | 24 | 6  | 4  | 3      | 12 | 44 | 27  | 120 | 26  | 7  | 5  | 2   | 3   | 1     | 2  | 7       | 20 | 22 | 10 | 2  | 78 | 5  | 20 | 37 | 36   | 29.7 |     |
| 24320     | 1920246    | 0       | 1       | P   | 15                            | 105 | 24 | 6  | 4  | --     | 13 | 46 | 27  | 120 | 26  | 6  | 5  | 2   | 3   | 1     | 2  | 7       | 20 | 22 | 9  | 2  | 75 | 1  | 20 | 36 | 35   | 29.1 |     |
| 24320     | 1920245    | 0       | 2       | P   | 16                            | 105 | 24 | 6  | 4  | --     | 10 | 44 | 28  | 110 | 26  | 8  | 5  | 2   | 3   | 2     | 2  | 7       | 20 | 22 | 9  | 2  | 79 | 1  | 20 | 37 | 36   | 28.2 |     |
| 24320     | 1920247    | 0       | 2       | P   | 16                            | 105 | 24 | 6  | 4  | --     | 12 | 44 | 27  | 120 | 26  | 7  | 5  | 2   | 3   | 1     | 2  | 7       | 20 | 22 | 10 | 2  | 78 | 1  | 20 | 37 | 36   | 29.1 |     |

|  |                    |                       |
|--|--------------------|-----------------------|
| Co.1: C+(MN/8)+(CR+MO+V)/5+(NI+CU)/16              | (5*8)              | Max: Maximum / Máximo |
| Co.2:  | F.1: CR+CU+MO+NI+V | Min: Minimum / Mínimo |
| C+F((MN/8)+(SI/24)+(CU/15)+(NI/20)+(CR+MO+V+NB)/5+ | H: Heat / Colada   | P: Product / Producto |

### THROUGH WALL HARDNESS / DUREZA EN EL ESPESOR

| Required values    |            | Individuals / Individuales |         |         | Average / Promedio |            |         | Hardness type HV10 |       |       |       |       |       |       |       |       |       |       |       |       |       |     |
|--------------------|------------|----------------------------|---------|---------|--------------------|------------|---------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| Valores requeridos |            | Min: --                    | Max: -- | Var: -- | Min: --            | Max: 248.0 | Var: -- | Tipo de dureza     |       |       |       |       |       |       |       |       |       |       |       |       |       |     |
| Heat N°            | Sample N°  | Zone                       | Lot N°  | Pipe N° | Specimen condition | Qued.      | OD      |                    |       |       | MW    |       |       |       | ID    |       |       |       | Var.  |       |       |     |
| Colada N°          | Muestra N° | Zona                       | Lote N° | Tubo N° | LS                 |            | 1       | 2                  | 3     | 4     | Avg.  | 1     | 2     | 3     | 4     | Avg.  | 1     | 2     | 3     | 4     | Avg.  |     |
| 24320              | 1920244    | M                          | 0       | 1       | B                  | 1          | 148.0   | 151.0              | 151.0 | 148.0 | 149.5 | 148.0 | 148.0 | 149.0 | 150.0 | 148.8 | 147.0 | 150.0 | 149.0 | 150.0 | 149.0 | 0.8 |

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es validado con firma electrónica. El certificado original posee marcado al logo "Tenaris" color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal e inbido. Cualquier alteración y/o falsificación estará sujeta a la ley.



## INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**678572**

Page / Página:

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Date / Día: **August 24, 2012**

Sector: S.A. S.A.  
 Dirección: Calle 101  
 19000000 - Argentina  
 Sucursal: San Antonio  
 1911 3449-1400 - 1911  
 1911 3449-1400 - 1911

|  |                                  |   |   |   |
|--|----------------------------------|---|---|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>45001532-00012</b>              | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>50993/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |   | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I S8PSP00373/1+NACE MR0175/0103+HPRO LP-006</b> |                                  |   | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensions / Dimensiones:<br><b>2 3/8 X 0.344 INCH<br/>60.30 X 8.74 MM</b>   | Schedule / Cédula:<br><b>160</b> | Length / Longitud:<br><b>SRL (SP)</b>   | Quantity / Cantidad: <b>17 Pcs/pz</b><br><b>323.62 FT      2480 LB</b><br><b>98.64 MTS      1116 KG</b> | Nominal Weight / Peso Nominal:<br><b>7.46 LB/FT</b><br><b>11.11 KG/M</b>  |

### THROUGH WALL HARDNESS / DUREZA EN EL ESPESOR

| Required values / Valores requeridos |                        |             | Individuals / Individuales |                   |                         | Average / Promedio |            |         |       |       | Hardness type HV10 / Tipo de dureza |       |       |       |       |       |       |       |       |       |       |     |  |      |
|--------------------------------------|------------------------|-------------|----------------------------|-------------------|-------------------------|--------------------|------------|---------|-------|-------|-------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|--|------|
| Heat N° / Coleda N°                  | Sample N° / Muestra N° | Zone / Zona | Min: --                    | Max: --           | Var: --                 | Min: --            | Max: 248.0 | Var: -- | OD    |       |                                     |       |       | MW    |       |       |       |       | ID    |       |       |     |  | Var. |
|                                      |                        |             | Lot N° / Lote N°           | Pipe N° / Tubo N° | Specimen condition / Ls | Quad.              | 1          | 2       | 3     | 4     | Avg.                                | 1     | 2     | 3     | 4     | Avg.  | 1     | 2     | 3     | 4     | Avg.  |     |  |      |
| 24320                                | 1920246                | M           | 0                          | 1                 | B                       | 1                  | 144.0      | 148.0   | 136.0 | 146.0 | 143.5                               | 150.0 | 149.0 | 149.0 | 148.0 | 149.0 | 144.0 | 146.0 | 149.0 | 150.0 | 147.3 | 5.5 |  |      |

|  |  |   |                            |
|--|--|---|----------------------------|
| Avg: Average / Promedio                  | Ls: Location of sample / Ubicación de la muestra | Min: Minimum / Mínimo                   | Quad: Quadrant / Cuadrante |
| B: Body / Cuerpo                         | M: Middle / Medio                                | MW: Middle wall / Centro                | Var: Variation / Variación |
| ID: Internal diameter / Diámetro interno | Max: Maximum / Máximo                            | OD: Outside diameter / Diámetro externo |                            |

### BENDING / DOBLEZ

| Standard / Norma:   |                        |    |                    | Standard / Norma:   |                        |    |                    |
|---------------------|------------------------|----|--------------------|---------------------|------------------------|----|--------------------|
| Heat N° / Coleda N° | Sample N° / Muestra N° | Ls | Result / Resultado | Heat N° / Coleda N° | Sample N° / Muestra N° | Ls | Result / Resultado |
| 24320               | 1920246                | B  | Good / Bueno       | 24320               | 1920244                | B  | Good / Bueno       |

|                  |  |
|------------------|--|
| B: Body / Cuerpo | Ls: Location of sample / Ubicación de la muestra |
|------------------|--|

|   |   |
|---|---|
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|---|---|



## INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**678572**

Page / Página:

**4 / 6**

Date / Día: **August 24, 2012**

Siderca S.A.S.  
 Calle 30 - Simón Bolívar  
 Bogotá - Colombia  
 Business Hours: Monday to Friday  
 8:00 AM - 5:00 PM

|  |                                  |   |   |   |
|--|----------------------------------|---|---|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>45001532-00012</b>              | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>50993/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |   | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+IPRO LP-006</b> |                                  |   | Steel Grade / Grado de acero:<br><b>B/290 CAT I SS</b>  | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensions / Dimensiones:<br><b>2 3/8 X 0.344 INCH<br/>60.30 X 8.74 MM</b>   | Schedule / Cédula:<br><b>160</b> | Length / Longitud:<br><b>SRL (SP)</b>   | Quantity / Cantidad: <b>17 Pcs/pz</b><br><b>323.62 FT      2400 LB<br/>98.64 MTS      1116 KG</b> | Nominal Weight / Peso Nominal:<br><b>7.48 LB/FT<br/>11.11 KG/M</b>        |

### HYDROSTATIC TEST / PRUEBA HIDRAULICA

| Pressure / Presión |               | Time / Tiempo      | Results / Resultado          |
|--------------------|---------------|--------------------|------------------------------|
| Unit / Unidad.     | Value / Valor | Seconds / Segundos |                              |
| PSI                | 3,000         | 5                  | Satisfactory / Satisfactorio |

### SPECIAL REQUIREMENTS / REQUERIMIENTOS ESPECIALES

| Condition / Condición                                  | Description / Descripción  |
|--|--|
| Pipe residual magnetism / Magnetismo remanente de tubo | 30 GAUSS   |
| End protectors / Protector de extremo                  | NON LIFTABLE CLOSED PLASTIC PROTECTOR FOR FLAT / BEVELED PIPE. SUPPLIER METALCENTRO. |

### SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA

| Supplementary Information / Información Suplementaria   |   |
|---|---|
| <p>*MANUFACTURED BY TENARIS SIDERCA*</p> <p>*ACIERAGE PROCESS*</p> <p>STEEL MAKING PROCESS: E.A.F./L.F. AND CONTINUOUS CASTING - FULL ALUMINIUM KILLED AND FINE GRAIN PRACTICE.</p> <p>-THE LF PRACTICE INCLUDES ARGON RINSE AND A FINAL INJECTION OF CALCIUM SILICIDE WIRE FOR MICROINCLUSION SHAPE CONTROL.</p> <p>-MATERIAL FREE FROM MERCURY CONTAMINATION.</p> <p>*ROLLING PROCESS*</p> <p>-MANUFACTURING PROCESS : SEAMLESS HOT ROLLED.</p> | <p>*FABRICADO POR TENARIS SIDERCA*</p> <p>*PROCESO DE ACERACIÓN*</p> <p>FABRICACIÓN DE ACERO: FUNDICIÓN POR ARDO ELECTRICO Y COLADO CONTINUO - ACERO CALMADO AL ALUMINIO PRACTICA DE GRANO FINO</p> <p>-LA PRÁCTICA DE AFINO EN EL HORNO - CUCHARA INCLUYE AGITACION POR ARGON Y UNA INYECCIÓN FINAL DE VARILLA DE SILICIURO DE CALCIO PARA OBTENER UNA FORMA GLOBULAR DE EVENTUALES MICROINCLUSIONES.</p> <p>-MATERIAL LIBRE DE CONTAMINACIÓN DE MERCURIO.</p> <p>*PROCESO DE LAMINACIÓN*</p> <p>-FABRICACIÓN DE TUBO: LAMINADO EN CALIENTE Y SIN COSTURA.</p> |

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### INSPECTION CERTIFICATE

(BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991)

Number / Número:

**678572**

Page / Página:

**5 / 6**

Date / Día: August 24, 2012

Tenaris S.p.A.  
 Via S. Giovanni, 251  
 40138 Bologna, Italia  
 Tel. +39 051 4331111  
 Fax. +39 051 4331112

|  |                                  |   |   |   |
|--|----------------------------------|---|---|---|
| Customer / Cliente: <b>VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |                                  | Customer's Order Item / Orden Cliente - Item:<br><b>45001532-00012</b>              | Customer's Reference / Ref. del Cliente:<br><b>N/A</b>  | Manufacturer's Works Order N° / Confirmación de Venta:<br><b>50993/02</b> |
| Manufacturing Process / Proceso de Manufactura:<br><b>SEAMLESS HOT ROLLED</b>  |                                  | Product Type / Tipo de Producto:<br><b>CARBON STEEL PIPE-HIGH TEMPERATURE SERV.</b> |   | Surface / Superficie:<br><b>INT BARE /EXT VARNISHED</b>                   |
| Standard or Specification / Normas o Especificaciones:<br><b>ASTM/ASME A/SA106+G8A Z245.1-07 CAT.1 SSPSP00373/1+NACE MR0175/0103+HPRO LP-006</b> |                                  | Steel Grade / Grado de acero:<br><b>B/290 CAT   SS</b>                              |   | Ends / Extremos:<br><b>BEVELLED AT 30 DEG. ASTM</b>                       |
| Dimensions / Dimensiones:<br><b>2 3/8 X 0.344 INCH<br/>60.30 X 8.74 MM</b>   | Schedule / Cédula:<br><b>160</b> | Length / Longitud:<br><b>SRL (SP)</b>   | Quantity / Cantidad: <b>17 Pcs/pz</b><br><b>323.62 FT      2460 LB<br/>98.64 MTS      1116 KG</b> | Nominal Weight / Peso Nominal:<br><b>7.46 LB/FT<br/>11.11 KG/M</b>        |

### SUPPLEMENTARY INFORMATION / INFORMACIÓN SUPLEMENTARIA

| Supplementary Information<br>Información Suplementaria   |
|--|
| *CONTROLS*<br>-VISUAL AND DIMENSIONAL INSPECTION : SATISFACTORY<br>*MATERIAL CONDITIONS*<br>-NOT REPAIRED BY WELDING.<br>*STANDARDS*<br>-EDITION OF REGULATION: ASTM A 106/A 106M-2011<br>-EDITION REGULATION: ASME SA 106/ 2010<br>-EDITION OF REGULATION: NACE MR-01-03 EDITION 2010<br>-EDITION OF REGULATION: NACE MR 01-75 - ISO 15156-2 : 2009<br>-EDITION OF REGULATION : CSA Z245 : 2007 |
| *CONTROLES*<br>-CONTROL VISUAL Y DIMENSIONAL: SATISFACTORIO.<br>*CONDICIONES DEL MATERIAL*<br>-NO REPARADO POR SOLDADURA.<br>*NORMAS*<br>-EDICIÓN DE LA NORMA: ASTM A 106/A 106M-2011<br>-EDICIÓN DE LA NORMA: ASME SA 106/ 2010<br>- EDICIÓN DE LA NORMA: NACE MR-01-03 EDICION 2010<br>-EDICIÓN DE LA NORMA: NACE MR 01-75 - ISO 15156-2 : 2009<br>EDICIÓN DE LA NORMA : CSAZ245: 2007         |

| Additional Information<br>Información Adicional   | Additional Information<br>Información Adicional |
|---|---|
| HEAT TREATMENT: AS ROLLED.<br>NON DESTRUCTIVE TEST: SATISFACTORY.<br>INSPECTION METHODS: E.M.I. LONG. (EXT.) NOTCH 5 % (INT.) NOTCH 10 % + E.M.I. TRANSV. (EXT./INT.) | NOTCH 10 %.<br>ONE BLUE BAND ON EACH END.       |

### MARKING / MARCACIÓN

| Marking<br>Marcación   | Marking<br>Marcación                               |
|--|--|
| - & = Monograms / Monogram SIDERCA<br>- NNNNN = Número de tubo / Nbr of pipe | - LLL = Longitud / length<br>- PPP = Peso / Weight |

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

Este certificado se emite mediante sistema computarizado y es válido con firma electrónica. El certificado original posee impreso el logo Tenaris color verde. En caso de que el poseedor del certificado entregue una copia, deberá garantizar la conformidad con el original haciéndose responsable por cualquier uso ilegal o indebido. Cualquier alteración y/o falsificación estará sujeta a la ley.



|  |  |  |                                       |
|--|--|--|---------------------------------------|
| <b>INSPECTION CERTIFICATE</b>                  |  | <b>Number / Número:</b><br><b>678572</b> | <b>Page / Página:</b><br><b>6 / 6</b> |
| (BS EN 10204 3.1: 2004 - ISO 10474 3.1B: 1991) |  | <b>Date / Día: August 24, 2012</b>       |                                       |

Tenaris S.A.  
 Av. Hipólito Yrigoyen 425  
 (B2204TAM) San Martín  
 Buenos Aires, Argentina  
 Tel: (54) 011 4754 2000 ext.  
 Fax: (54) 011 4754 2008

|  |                                  |   |  |   |
|--|----------------------------------|---|--|---|
| <b>Customer / Cliente: VAN LEEUWEN PIPE &amp; TUBE (CANADA) IN</b>   |                                  | <b>Customer's Order Item / Orden Cliente - Item:</b><br>45001532-00012              | <b>Customer's Reference / Ref. del Cliente:</b><br>N/A                                     | <b>Manufacturer's Works Order N° / Confirmación de Venta:</b><br>50893/02 |
| <b>Manufacturing Process / Proceso de Manufactura:</b><br>SEAMLESS HOT ROLLED  |                                  | <b>Product Type / Tipo de Producto:</b><br>CARBON STEEL PIPE-HIGH TEMPERATURE SERV. |  | <b>Surface / Superficie:</b><br>INT BARE /EXT VARNISHED                   |
| <b>Standard or Specification / Normas o Especificaciones:</b><br>ASTM/ASME A/SA106+CSA Z245.1-07 CAT.I SSPSP00373/1+NACE MR0175/0103+HPRO LP-006 |                                  |   | <b>Steel Grade / Grado de acero:</b><br>B/290 CAT I SS                                     | <b>Ends / Extremos:</b><br>BEVELLED AT 30 DEG. ASTM                       |
| <b>Dimensions / Dimensiones:</b><br>2 3/8 X 0.344 INCH<br>60.30 X 8.74 MM  | <b>Schedule / Cédula:</b><br>160 | <b>Length / Longitud:</b><br>SRL (SP)   | <b>Quantity / Cantidad: 17 Pcs/pz.</b><br>323.62 FT      2460 LB<br>98.64 MTS      1116 KG | <b>Nominal Weight / Peso Nominal:</b><br>7.46 LB/FT<br>11.11 KG/M         |

**MARKING / MARCACIÓN**

|  |
|--|
| <b>Marking<br/>Marcación</b>                                       |
| - @ = Monograma / Monogram API<br>- MMLYY = Mes / Año Month / Year |



|   |
|---|
| <b>Marking<br/>Marcación</b>  |
| - Y/T = Año / Trimestre Year / Quarter<br>- HNXXXXX = Colada / Heat |

|  |
|--|
| <b>Stenciling (Pipe)<br/>Estarcido (Tubo)</b>  |
| TENARIS SD MM.YY ASTM/ASME A/SA106 60.3 8.74 11.11 2 SCH160 B/290 CAT I SS SEAMLESS 207KPAX100 NDE |

|   |
|---|
| <b>Stenciling (Pipe)<br/>Estarcido (Tubo)</b>                     |
| CSA Z245.1-07 45001532 MADE IN ARGENTINA HNXXXXX NNNNN LLLL PFFFF |

This is to certify that the product described here has been manufactured, sampled, tested, and inspected in accordance with purchaser order requirements. This certificate is not a declaration of origin nor may it be used as a declaration of origin.

Por el presente certificamos que el material aquí descrito ha sido fabricado, muestreado, ensayado e inspeccionado de acuerdo a los requisitos de su orden de compra. Este certificado no es, ni puede ser usado, como una declaración de origen.

|   |   |   |
|---|---|---|
| <b>CUSTOMER . THIRD PARTY</b>   | <b>TENARIS QUALITY DEPARTMENT SIGNATURE</b>   |   |
| INSPECTION COMPANY<br>COMPAÑIA DE INSPECCIÓN<br><br>Company Name: N/A<br>Employee Name: N/A | <br><br>QUALITY CERTIFICATION DEPT.<br>DEPTO. DE CERTIFICACIÓN DE CALIDAD<br>CADELAGO Romina | <br><br>CHIEF OF QUALITY CERTIFICATION DEPT.<br>RESPONSABLE DEL DÉPTO. DE CERTIFICACIÓN DE CALIDAD<br>AYERBE Eduardo |

This certificate is issued by a computerized system and it is valid with electronic signature. On the original certificate the trade-mark green colored "Tenaris" is stamped. In case the owner of the original certificate would release a copy of it, he must attest its conformity to the original one taking upon himself the responsibility for any unlawful or not allowed use. Any alteration and/or falsification will be subjected to the law.

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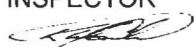
# SPECTRUM N.D.T. LTD

## MAGNETIC PARTICLE TEST REPORT

|  |  |                                |
|--|--|--------------------------------|
| Client<br>CALHEX INDUSTRIES                        | Job #<br><b>13-0856-A</b>                    | Report #<br><b>153903-1</b>    |
| Address<br>CALGARY, ALBERTA                        | PO #   | Work Sheet #<br>50307          |
| Work Description<br>INSPECTION OF NOZZLE CUT OUTS. | Requested by<br>ANDREW BENNS                 | Demo #<br>1014                 |
| Code<br>ASME V ART 7                               | Acceptance Criteria<br>ASME VIII DIV 1 APP 6 | Procedure #<br>MP2 REV4        |
| Technique<br>CONTINUOUS MAGNETISM                  | Equipment/Serial #<br>HAND YOKE / 21608      | Material<br>CARBON STEEL       |
| Particle type<br>MI-GLOW 820                       | Batch #<br>17381                             | Surface<br>AS WELDED           |
| Light Source<br>GE 12V AUTO BULB                   | Light intensity<br>1100 LUX                  | Ambient Temp<br>18 DEG C       |
|  |  | Power<br>AC 110 V              |
|  |  | Particle Size<br><20 Um AVG.   |
|  |  | Inspection surface<br>EXTERNAL |
|  |  | Inspector<br>S. Taffs/K.Gowler |

| Identification         | Description        | Comments  |   |
|------------------------|--------------------|---|---|
| 13-0856-A<br>Shellside | Nozzle C1b cut out | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
|                        | Nozzle C1c cut out | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
|                        | Nozzle C2b cut out | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
|                        | Nozzle C2c cut out | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
|                        | Tubeside           | Nozzle N3b cut out  | No indications found at time of inspection.<br>-ACCEPTABLE- |
| Nozzle N4b cut out     |                    | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
| Nozzle C3a cut out     |                    | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
| Nozzle C3b cut out     |                    | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
| Nozzle C1a cut out     |                    | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
| Nozzle C1d cut out     |                    | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
| Nozzle C2a cut out     |                    | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
| Nozzle C2d cut out     |                    | No indications found at time of inspection.<br>-ACCEPTABLE- |   |
| Ind No                 | Position           | Length  | Remarks   |
|                        |                    |   |   |
|                        |                    |   |   |

CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.

|  |  |                                  |                       |
|--|--|----------------------------------|-----------------------|
| CLIENT<br><br>FEB 03 2014 | INSPECTOR<br> | LEVEL<br>CGSB II # 1259 / SNT II | DATE<br>Jan. 27, 2014 |
|--|--|----------------------------------|-----------------------|



# SPECTRUM N.D.T. LTD

## MAGNETIC PARTICLE TEST REPORT

|  |                                     |                                       |                                      |
|--|-------------------------------------|---------------------------------------|--------------------------------------|
| Client<br>CALHEX INDUSTRIES LTD.                                 |                                     | Job #<br>13-0856-A                    | Report #<br>158439                   |
| Address<br>CALGARY AB.   |                                     | Requested by<br>MR A BENNS            | Work Sheet #<br>54191                |
| Work Description<br>SHELL SIDE/TUBE SIDE WELDS AND PICK UP AREAS |                                     | Material<br>CARBON STEEL              | Surface<br>SMOOTH                    |
| Code<br>ASME VIII DIV I  | Acceptance Criteria<br>APP6         | Ambient Temp<br>20 DEG C              | Background / Batch<br>WCP 2 62K38946 |
| Technique<br>AC CONTINUOUS                                       | Equipment/Serial #<br>B-300 / 15288 | Power<br>120 V A/C                    | Lifting Capability Check<br>20LB.    |
| Particle type<br>MI GLOW 820                                     | Batch #<br>18721                    | Particle Size<br>LESS THAN 20 MICRONS | Particle Manufacture<br>MAGNAFLUX    |
| Light Source<br>12 V AUTO LIGHT                                  | Light intensity<br>1000 uW          | Inspection surface<br>SMOOTH          | Inspector<br>JESSE TAYLOR/ K GOWLER  |

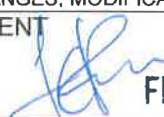

INSPECTION WAS CARRIED OUT ON THE FOLLOWING ITEMS

**TUBE SHEETS A & B exposed edges after welding**

**SHELL SIDE** All attachment welds  
 All temp. attachment/ground areas  
 Nozzle cat."D" welds N-1a, N-2a  
 2x saddle repads to shell welds  
 2x lift lugs to shell fillet welds  
 Name plate bracket to shell fillet welds

**TUBE SIDE** All attachment welds  
 All temp. attachment/ground areas  
 Nozzle cat "D" welds N-3b, N-4b, C-3a, C-3b.

THERE WERE NO REJECTABLE DEFECT INDICATIONS ACCEPTABLE

| Ind No   | Position   | Length                                      | Remarks             |
|--|--|---|---------------------|
|  |  |   |                     |
|  |  |   |                     |
|  |  |   |                     |
|  |  |   |                     |
| Reg Hrs 1.5  | OT1 Hrs  | OT2 Hrs                                     | Consumables 1CAN    |
| CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.                |  |   |                     |
| CLIENT<br><br>FEB 18 2014 | INSPECTOR<br> | LEVEL<br>CGSB LEVEL II 1259<br>SNT LEVEL II | DATE<br>FEB 14 2014 |





# SPECTRUM N.D.T. LTD



## ULTRASONIC TEST REPORT

|   |                      |                      |  |                  |         |                |
|---|----------------------|----------------------|--|------------------|---------|----------------|
| Client<br>CALHEX  |                      | Job #<br>13-0856-A   | Report #<br>169086                             |                  |         |                |
| Address<br>CALGARY; ALBERTA   |                      | Req # or PO #        | Work Sheet #<br>49370                          |                  |         |                |
| Requested by<br>MR. A BENNS   |                      | Demo #<br>1018       | Procedure#<br>UP4 REV 1                        |                  |         |                |
| Work Description<br>INSPECTION OF NOZZLE CAT D's  |                      | Code<br>ASME V ART 4 | Acceptance criteria<br>ASME VIII DIV. 1 APP 12 |                  |         |                |
| Material<br>CARBON STEEL  | Surface<br>AS WELDED | Size<br><0.5"        | Scanning Surface<br>I.D.                       |                  |         |                |
| Instrument<br>GE  | Model<br>USN 58L     | Serial #<br>02240X   | Calibration Std<br>IIW BLOCK 99-6262           |                  |         |                |
| Sensitivity<br>3/32 INCH DIAMETER HOLE, DAC.  |                      | Couplant<br>EXOSEN   | Inspector<br>A. DACHY,                         |                  |         |                |
| Search Unit   | Serial Number        | Size                 | Ref Sensitivity                                | Scan Sensitivity |         |                |
| 60 Deg 4 mHz PHOENIX  | C3570                | 8 X 9 mm             | 47 dB  | + 6 dB           |         |                |
| 70 Deg 4 mHz PHOENIX  | B7880                | 8 X 9 mm             | 48 dB  | + 6 dB           |         |                |
| 0 Deg 5 mHz Long  | 02217X               | 1/2" Dia             | 80 % BWE                                       | + 6 dB           |         |                |
| Identification  | Description          | Remarks              |  |                  |         |                |
| SHELLSIDE - N1a, N2a  | INITIAL INSPECTION   | ACCEPTED             |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
| Ind #   | Depth (Inch)         | Length (Inch)        | Amplitude (dB's)                               | Probe(s)         | Remarks | Classification |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
|   |                      |                      |  |                  |         |                |
| A = Acceptable minor non reportable indication B = Acceptable reportable indication C = Rejectable indication |                      |                      |  |                  |         |                |
| Reg Hrs   | 0.5                  | OT1 Hrs              | OT2 Hrs  | Consumables      |         |                |
| CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.                 |                      |                      |  |                  |         |                |
| CLIENT  | INSPECTOR            |                      | LEVEL  | DATE             |         |                |
| <i>[Signature]</i><br>FEB 10 2014   | <i>[Signature]</i>   |                      | CGSB II # 14261 / SNT II                       | FEB 07, 2014     |         |                |



# SPECTRUM N.D.T. LTD



## ULTRASONIC TEST REPORT

|   |                 |  |                     |                                      |         |                      |
|---|-----------------|--|---------------------|--------------------------------------|---------|----------------------|
| Client<br>CALHEX  |                 | Job #<br>13-0856 A   |                     | Report #<br>164409                   |         |                      |
| Address<br>CALGARY; ALBERTA   |                 | Requested by<br>Q.C DEPT.  |                     | Work Sheet #<br>9333                 |         |                      |
| Work Description<br>INSPECTION OF CAT D WELDMENTS   |                 | Acceptance Criteria<br>ASME VIII DIV. 1 APP 12   |                     | Code<br>ASME V ART 4                 |         |                      |
| Material<br>CARBON STEEL  |                 | Surface<br>FLUSH   |                     | Thickness<br>UP TO 1.00 "            |         |                      |
| Instrument<br>GE  |                 | Model<br>USN 58L   |                     | Serial #<br>01T15K                   |         |                      |
| Sensitivity<br>3/32" DIA. HOLE SET AT 80% FSH + 6db   |                 | Couplant<br>EXOSEN   |                     | Calibration Std<br>IIW BLOCK-99-6262 |         |                      |
| Inspector<br>C MAGDEE/ M EDWARDS  |                 |  |                     |                                      |         |                      |
| Search Unit   | Serial Number   | Size   | Ref Sensitivity     | Scan Sensitivity                     |         |                      |
| 45 Deg 2 mHz MWB  | 7001            | 8 X 9 mm   | 51 dB               | + 6 dB                               |         |                      |
| 60 Deg 2 mHz MWB  | 32458           | 8 X 9 mm   | 58 dB               | + 6 dB                               |         |                      |
| 70 Deg 4 mHz MWB  | 50161           | 8 X 9 mm   | 59 dB               | + 6 dB                               |         |                      |
| 0 Deg 2.25 mHz Long   | 013WR8          | 1" Dia   | 75 % BWE            | + 6 dB                               |         |                      |
| Identification  |                 | Description  |                     | Remarks                              |         |                      |
| N3B   |                 | CAT D WELD<br>INITIAL INSPECTION   |                     | ACCEPTABLE                           |         |                      |
| Ind #   | Depth<br>(Inch) | Length<br>(Inch)   | Amplitude<br>(dB's) | Probe(s)                             | Remarks | Classification       |
|   |                 |  |                     |                                      |         |                      |
|   |                 |  |                     |                                      |         |                      |
|   |                 |  |                     |                                      |         |                      |
|   |                 |  |                     |                                      |         |                      |
|   |                 |  |                     |                                      |         |                      |
| A = Acceptable minor non reportable indication B = Acceptable reportable indication C = Rejectable indication |                 |  |                     |                                      |         |                      |
| Reg Hrs 2   |                 | OT1 Hrs  |                     | OT2 Hrs                              |         | Consumables          |
| CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.                 |                 |  |                     |                                      |         |                      |
| CLIENT<br><br>FEB 18 2014  |                 | INSPECTOR<br> |                     | LEVEL<br>CGSB II / SNT III           |         | DATE<br>FEB. 14 2014 |



# SPECTRUM N.D.T. LTD

## ULTRASONIC TEST REPORT

|   |   |  |                     |                                      |                                       |                |  |
|---|---|--|---------------------|--------------------------------------|---------------------------------------|----------------|--|
| Client<br>CALHEX  |   | Job #  | 13-0856 A           |                                      | Report #                              | 164406         |  |
| Address<br>CALGARY; ALBERTA   |   | Requested by<br>Q.C DEPT.                      |                     |                                      | Work Sheet #                          | 9331           |  |
| Work Description<br>INSPECTION OF CAT D WELDMENTS   |   | Acceptance Criteria<br>ASME VIII DIV. 1 APP 12 |                     |                                      | Code                                  | ASME V ART 4   |  |
| Material<br>CARBON STEEL  | Surface<br>FLUSH  | Thickness<br>UP TO 1.00 "                      |                     |                                      | Scanning Surface<br>EXTERNAL/INTERNAL |                |  |
| Instrument<br>GE  | Model<br>USN 58L  | Serial #<br>01T15K                             |                     | Calibration Std<br>IIW BLOCK-99-6262 |                                       |                |  |
| Sensitivity<br>3/32" DIA. HOLE SET AT 80% FSH + 6db   |   | Couplant<br>EXOSEN                             |                     | Inspector<br>C MAGDEE/ M EDWARDS     |                                       |                |  |
| Search Unit   | Serial Number   | Size   | Ref Sensitivity     | Scan Sensitivity                     |                                       |                |  |
| 45 Deg 2 mHz MWB  | 7001  | 8 X 9 mm                                       | 51 dB               | + 6 dB                               |                                       |                |  |
| 60 Deg 2 mHz MWB  | 32458   | 8 X 9 mm                                       | 58 dB               | + 6 dB                               |                                       |                |  |
| 70 Deg 4 mHz MWB  | 50161   | 8 X 9 mm                                       | 59 dB               | + 6 dB                               |                                       |                |  |
| 0 Deg 2.25 mHz Long   | 013WR8  | 1" Dia   | 75 % BWE            | + 6 dB                               |                                       |                |  |
| Identification  |   | Description                                    |                     |                                      | Remarks                               |                |  |
| N4B   |   | CAT D WELD<br>INITIAL INSPECTION               |                     |                                      | ACCEPTABLE                            |                |  |
| Ind #   | Depth<br>(Inch)   | Length<br>(Inch)                               | Amplitude<br>(dB's) | Probe(s)                             | Remarks                               | Classification |  |
|   |   |  |                     |                                      |                                       |                |  |
|   |   |  |                     |                                      |                                       |                |  |
|   |   |  |                     |                                      |                                       |                |  |
|   |   |  |                     |                                      |                                       |                |  |
| A = Acceptable minor non reportable indication B = Acceptable reportable indication C = Rejectable indication |   |  |                     |                                      |                                       |                |  |
| Reg Hrs 2   |   | OT1 Hrs  |                     | OT2 Hrs                              |                                       | Consumables    |  |
| CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.                 |   |  |                     |                                      |                                       |                |  |
| CLIENT  | INSPECTOR   |  | LEVEL               |                                      | DATE                                  |                |  |
| <br>FEB 18 2014            |  |  | CGSB II / SNT III   |                                      | FEB. 14 2014                          |                |  |











# SPECTRUM N.D.T. LTD

## MAGNETIC PARTICLE TEST REPORT

|  |                                     |                                       |                          |                                      |          |
|--|-------------------------------------|---------------------------------------|--------------------------|--------------------------------------|----------|
| Client<br>CALHEX INDUSTRIES LTD.                                 |                                     | Job #                                 | 13-0856-B                | Report #                             | 158440   |
| Address<br>CALGARY AB.   |                                     | Requested by<br>MR A BENNS            |                          | Work Sheet #                         | 54191    |
|  |                                     |                                       |                          | Demo #                               | 1013     |
|  |                                     |                                       |                          | Procedure #                          | MP2 REV4 |
| Work Description<br>SHELL SIDE/TUBE SIDE WELDS AND PICK UP AREAS |                                     |                                       | Material<br>CARBON STEEL | Surface<br>SMOOTH                    |          |
| Code<br>ASME VIII DIV I  | Acceptance Criteria<br>APP6         | Ambient Temp<br>20 DEG C              |                          | Background / Batch<br>WCP 2 62K38946 |          |
| Technique<br>AC CONTINUOUS                                       | Equipment/Serial #<br>B-300 / 15288 | Power<br>120 V A/C                    |                          | Lifting Capability Check<br>20LB.    |          |
| Particle type<br>MI GLOW 820                                     | Batch #<br>18721                    | Particle Size<br>LESS THAN 20 MICRONS |                          | Particle Manufacture<br>MAGNAFLUX    |          |
| Light Source<br>12 V AUTO LIGHT                                  | Light intensity<br>1000 uW          | Inspection surface<br>SMOOTH          |                          | Inspector<br>JESSE TAYLOR/ K GOWLER  |          |

INSPECTION WAS CARRIED OUT ON THE FOLLOWING ITEMS

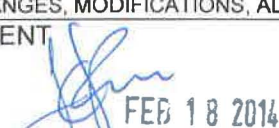

**TUBE SHEETS A & B exposed edges after welding**

**SHELL SIDE**  
 All attachment welds  
 All temp. attachment/ground areas  
 Nozzle cat."D" welds N-1a, N-2a  
 2x saddle repads to shell welds  
 2x lift lugs to shell fillet welds  
 Name plate bracket to shell fillet welds

**TUBE SIDE**  
 All attachment welds  
 All temp. attachment/ground areas  
 Nozzle cat "D" welds N-3b, N-4b, C-3a, C-3b.

THERE WERE NO REJECTABLE DEFECT INDICATIONS ACCEPTABLE

| Ind No | Position | Length | Remarks |
|--------|----------|--------|---------|
|        |          |        |         |
|        |          |        |         |
|        |          |        |         |

|  |  |   |                     |
|--|--|---|---------------------|
| Reg Hrs 2  | OT1 Hrs  | OT2 Hrs                                     | Consumables 1CAN    |
| CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.                |  |   |                     |
| CLIENT<br><br>FEB 18 2014 | INSPECTOR<br> | LEVEL<br>CGSB LEVEL II 1259<br>SNT LEVEL II | DATE<br>FEB 14 2014 |





# SPECTRUM N.D.T. LTD



## ULTRASONIC TEST REPORT

|   |                      |                                      |  |              |         |                |
|---|----------------------|--------------------------------------|--|--------------|---------|----------------|
| Client<br>CALHEX  |                      | Job #<br>13-0856-B                   | Report #<br>169087                             |              |         |                |
| Address<br>CALGARY; ALBERTA   |                      | Req # or PO #                        | Work Sheet #<br>49370                          |              |         |                |
| Work Description<br>INSPECTION OF NOZZLE CAT D's  |                      | Requested by<br>MR. A BENNS          | Demo #<br>1018                                 |              |         |                |
| Code<br>ASME V ART 4  |                      | Procedure#<br>UP4 REV 1              |  |              |         |                |
| Material<br>CARBON STEEL  | Surface<br>AS WELDED | Size<br><0.5"                        | Acceptance criteria<br>ASME VIII DIV. 1 APP 12 |              |         |                |
| Instrument<br>GE  | Model<br>USN 58L     | Serial #<br>02240X                   | Scanning Surface<br>I.D.                       |              |         |                |
| Sensitivity<br>3/32 INCH DIAMETER HOLE, DAC.  | Couplant<br>EXOSEN   | Calibration Std<br>IIW BLOCK 99-6262 |  |              |         |                |
| Inspector<br>A. DACHY,  |                      |                                      |  |              |         |                |
| Search Unit   | Serial Number        | Size                                 | Ref Sensitivity                                |              |         |                |
| 60 Deg 4 mHz PHOENIX  | C3570                | 8 X 9 mm                             | 47 dB  |              |         |                |
| 70 Deg 4 mHz PHOENIX  | B7880                | 8 X 9 mm                             | 48 dB  |              |         |                |
| 0 Deg 5 mHz Long  | 02217X               | 1/2" Dia                             | 80 % BWE                                       |              |         |                |
| Scan Sensitivity  |                      |                                      |  |              |         |                |
|   |                      | + 6 dB                               |  |              |         |                |
|   |                      | + 6 dB                               |  |              |         |                |
|   |                      | + 6 dB                               |  |              |         |                |
| Identification  |                      | Description                          | Remarks  |              |         |                |
| SHELLSIDE - N1b, N2b  |                      | INITIAL INSPECTION                   | ACCEPTED                                       |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
| Ind #   | Depth (Inch)         | Length (Inch)                        | Amplitude (dB's)                               | Probe(s)     | Remarks | Classification |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
|   |                      |                                      |  |              |         |                |
| A = Acceptable minor non reportable indication B = Acceptable reportable indication C = Rejectable indication |                      |                                      |  |              |         |                |
| Reg Hrs   | 0.5                  | OT1 Hrs                              | OT2 Hrs  | Consumables  |         |                |
| CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.                 |                      |                                      |  |              |         |                |
| CLIENT  | INSPECTOR            |                                      | LEVEL  | DATE         |         |                |
|   |                      |                                      | CGSB II # 14261 / SNT II                       | FEB 07, 2014 |         |                |
|   | FEB 10 2014          |                                      |  |              |         |                |



# SPECTRUM N.D.T. LTD

## ULTRASONIC TEST REPORT

|   |   |  |                           |                 |                                      |                |  |
|---|---|--|---------------------------|-----------------|--------------------------------------|----------------|--|
| Client<br>CALHEX  |   | Job #  | 13-0856 B                 |                 | Report #                             | 164407         |  |
| Address<br>CALGARY; ALBERTA   |   | Requested by<br>Q.C DEPT.                      |                           |                 | Work Sheet #                         | 9331           |  |
| Work Description<br>INSPECTION OF CAT D WELDMENTS   |   | Acceptance Criteria<br>ASME VIII DIV. 1 APP 12 |                           |                 | Demo #                               | 1018           |  |
| Material<br>CARBON STEEL  |   | Surface<br>FLUSH                               | Thickness<br>UP TO 1.00 " |                 | Procedure#                           | UP4 REV1       |  |
| Instrument<br>GE  |   | Model<br>USN 58L                               | Serial #<br>01T15K        |                 | Calibration Std<br>IIW BLOCK-99-6262 |                |  |
| Sensitivity<br>3/32" DIA. HOLE SET AT 80% FSH + 6db   |   |  | Couplant<br>EXOSEN        |                 | Inspector<br>C MAGDEE/ M EDWARDS     |                |  |
| Search Unit   | Serial Number   |  | Size                      | Ref Sensitivity | Scan Sensitivity                     |                |  |
| 45 Deg 2 mHz MWB  | 7001  |  | 8 X 9 mm                  | 51 dB           | + 6 dB                               |                |  |
| 60 Deg 2 mHz MWB  | 32458   |  | 8 X 9 mm                  | 58 dB           | + 6 dB                               |                |  |
| 70 Deg 4 mHz MWB  | 50161   |  | 8 X 9 mm                  | 59 dB           | + 6 dB                               |                |  |
| 0 Deg 2.25 mHz Long   | 013WR8  |  | 1" Dia                    | 75 % BWE        | + 6 dB                               |                |  |
| Identification  |   | Description                                    |                           |                 | Remarks                              |                |  |
| N3A,N4A   |   | CAT D WELD<br>INITIAL INSPECTION               |                           |                 | ACCEPTABLE                           |                |  |
| Ind #   | Depth<br>(Inch)   | Length<br>(Inch)                               | Amplitude<br>(dB's)       | Probe(s)        | Remarks                              | Classification |  |
|   |   |  |                           |                 |                                      |                |  |
|   |   |  |                           |                 |                                      |                |  |
|   |   |  |                           |                 |                                      |                |  |
|   |   |  |                           |                 |                                      |                |  |
| A = Acceptable minor non reportable indication B = Acceptable reportable indication C = Rejectable indication |   |  |                           |                 |                                      |                |  |
| Reg Hrs 2   |   | OT1 Hrs  |                           | OT2 Hrs         |                                      | Consumables    |  |
| CHANGES, MODIFICATIONS, ALTERATIONS OR ADDITIONAL WELDING WITHOUT RE-INSPECTION VOIDS REPORT.                 |   |  |                           |                 |                                      |                |  |
| CLIENT  | INSPECTOR   |  | LEVEL                     |                 | DATE                                 |                |  |
| <br>FEB 18 2014            |  |  | CGSB II / SNT III         |                 | FEB. 14 2014                         |                |  |





the pressure equipment safety authority

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

October 25, 2013

**Attention:** Document Control  
CALHEX INDUSTRIES LTD  
9515-48 STREET SE  
CALGARY, AB T2C 2R1

The design submission, tracking number 2013-07659, originally received on October 15, 2013 was surveyed and accepted for registration as follows:

**CRN :** W3145.2 **Accepted on:** October 25, 2013

**Reg Type:** New Design

**Drawing No. :** 13-0856-S/-T Rev 0/0

| Description          | MAWP    | Design Temperature | MDMT   |
|----------------------|---------|--------------------|--------|
| TS Internal Pressure | 1379kPa | 204 °C             | -29 °C |
| SS Internal Pressure | 1379kPa | 204 °C             | -29 °C |

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

If you have any question don't hesitate to contact me by phone at (780) 433-0281 ext 3335 or fax (780) 437-7787 or e-mail [dedovic@absa.ca](mailto:dedovic@absa.ca).

Sincerely,

DEDOVIC, BLAZO



505 - 6th Street, Suite 200  
New Westminster, BC V3L 0E1

Toll Free: 1-866-566-SAFE  
Fax: (778) 396 - 2064  
www.safetyauthority.ca

CALHEX INDUSTRIES LTD  
9515 48TH STREET SE  
CALGARY AB T2C 2R1

**Date:** November 16, 2013  
**Account #:** 39806  
**Journal #:** 58431  
**Our File #:** 5475972

**Attn:** DARREN KLADNIK

**Re:** Application for Design Registration

The design, as detailed in your, Dwg:13-0856-S/T, for a Heat Exchanger is accepted for registration as follows:

**Registered To:** CALHEX INDUSTRIES LTD      **CRN:** W3145.21

|       |                        |                        |                       |
|-------|------------------------|------------------------|-----------------------|
| Shell | <b>MDMT:</b> -20 deg F | <b>MAWT:</b> 400 deg F | <b>MAWP:</b> 200 psig |
| Tube  | <b>MDMT:</b> -20 deg F | <b>MAWT:</b> 400 deg F | <b>MAWP:</b> 200 psig |

**Drawing #:** 13-0856-S/-T

**Drawing Revision:** 0 / 0

**Conditions Of Registration:**

Registration of Warm Lean / Rich Glycol Exchanger.

This design was registered based on a technical review performed by the province of initial registration in accordance with the Association of Chief Inspectors policy on reciprocal recognition of design review.

Contact me if you have any questions. The invoice for registration will be forwarded under separate cover.

SHARON PETERS  
(778) 396-2027  
Sharon.Peters@safetyauthority.ca  
Design Administration

**cc:**

**Calhex Industries**

**Ltd.**

**Welding Procedures**

**Welding Procedure:**

**CX-1N**

**Rev. 4**



*original.*

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

March 26, 2008

Sheldon Alcock  
CALHEX INDUSTRIES LTD  
9515-48 STREET SE  
CALGARY, AB T2C 2R1

Dear Sheldon Alcock,

The welding procedures received on March 17, 2008 are accepted for registration as follows:

**Reg. No. :** WP-2380.2 **Accepted on:** March 26, 2008  
**Tracking No. :** 2008-01881  
**Reg Type :** Revision To Acc. Design  
**Spec. No. :** CX-1N REV 4

Registered under owner / manufacturer name CALHEX INDUSTRIES LTD

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

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

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

Enclosed is a stamped welding procedure for your reference.

Sincerely,

ROSEBERG, BOB, P. Eng.  
Design Survey Engineer

original

WELDING PROCEDURE SPECIFICATION NO.: CX-1N (Rev. 4)

WELDING PROCEDURE QUALIFICATION RECORD NO.(S): PQ1, PQ3, PQ16, PQ31, PQ32

QUALIFIED FOR

Base Metal (Typical): P1 Groups 1 & 2 to P1 Groups 1 & 2  
 (SA 333 Gr. 6, SA 350 Gr. LF2, SA 420 WPL6, SA 516 Gr. 70, etc.)

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

Position: ALL POSITIONS Diameter: ALL DIAMETERS

Filler Metal: GMAW: ER70S-2 or 6 SMAW: E7018-1

BASE METAL CONDITIONS & GROOVE THICKNESS RANGE QUALIFIED:

NOTCH TOUGHNESS APPLICATIONS TO -46°C AS WELDED

BASE METAL THICKNESS RANGE 3.0 to 203 mm (0.119 to 8.00 in.) inclusive

COMBINED DEPOSITED WELD METAL THICKNESS

|                        |                                    |
|------------------------|------------------------------------|
| ASME B31.1             | <u>19.1 mm (0.750 in.) maximum</u> |
| ASME B31.3             | <u>19.1 mm (0.750 in.) maximum</u> |
| ASME SECT. VIII, DIV.1 | <u>38.1 mm (1.50 in.) maximum</u>  |

**ALBERTA BOILERS SAFETY ASSOCIATION**  
**PROVINCE OF ALBERTA**  
**SAFETY CODES ACT**  
**WELDING PROCEDURE**

Reg. No. WP. 2380.2

Spec No. CX-1N (REV. 4)

Weld Process GMAW / SMAW

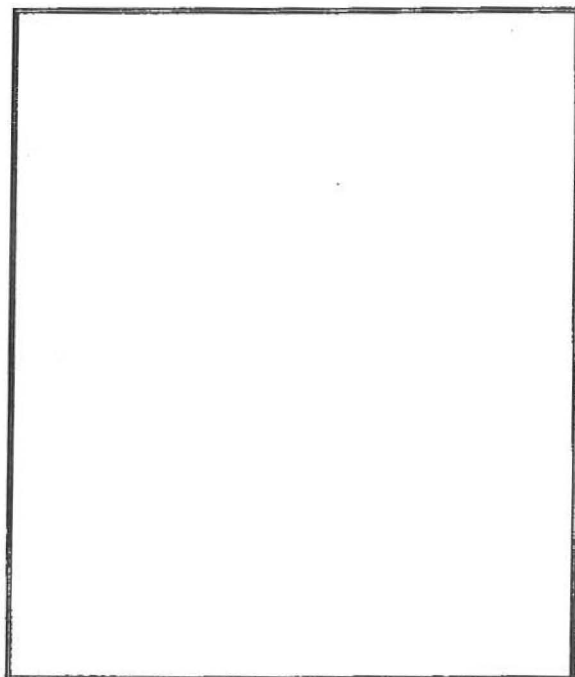
Matl. Gr. P No. 1 Gr. 1 & 2 to P No. 1 Gr. 1 & 2

Elec. Gr. F No. 6+4 A No. 1

Th. Qual. For 3 to 203 mm PWHT NO  
CVM -46°C

Yr. 05 Mo. 03 Day 21 Signed [Signature]  
**R. ROSEBERG, P.ENG.**  
**WELDING SPECIALIST**

**PROVINCIAL REGISTRATION**



**Calhex Industries**

**Ltd.**

**Welding Procedures**

**Welding Procedure:**

**CX-2N**

**Rev. 1**



the pressure equipment safety authority

#200, 4208 - 97 Street  
Edmonton, Alberta, Canada T6E 5Z9  
Tel: (780) 437-9100 / Fax: (780) 437-7787

September 01, 2005

Sheldon Alcock  
CALHEX INDUSTRIES LTD  
9515 48 STREET SE  
CALGARY, AB T2C 2R1

Dear Sheldon Alcock,

The welding procedures received on August 18, 2005 are accepted for registration as follows:

**Reg. No. :** WP-2380.2 **Accepted on:** September 01, 2005

**Tracking No. :** 2005-06606

**Reg Type :** Revision To Acc. Design

**Spec. No. :** CX-2N REV 1

Registered under owner / manufacturer name CALHEX INDUSTRIES LTD

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

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

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

Enclosed is a stamped welding procedure for your reference.

Sincerely,

ROSEBERG, BOB, P. Eng.  
Design Survey Engineer



**CALHEX INDUSTRIES LTD.**

9515-48<sup>th</sup> STREET S.E., Calgary, Alberta, T2C 2R1

Bus: (403) 225 - 4395 {CALHEX 5}

Fax: (403) 261 - 2761

WELDING PROCEDURE SPECIFICATION NO.: \_\_\_\_\_ CX-2N (Rev.1)

WELDING PROCEDURE QUALIFICATION RECORD NO. (S): \_\_\_\_\_ PQ4, PQ5, PQ16

QUALIFIED FOR

Base Metal (Typical): \_\_\_\_\_ P1 Groups 1 & 2 to P1 Groups 1 & 2  
 (SA 333 Gr. 6, SA 350 Gr. LF2, SA 420 WPL6, SA 516 Gr. 70, etc.)

Process(es): \_\_\_\_\_ SMAW Weld Types: \_\_\_\_\_ GROOVE & FILLET

Position: \_\_\_\_\_ ALL POSITIONS Diameter: \_\_\_\_\_ ALL DIAMETERS

Filler Metal: \_\_\_\_\_ E6010, E7018-1

**BASE METAL CONDITIONS & GROOVE THICKNESS RANGE QUALIFIED:**

BASE METAL THICKNESS RANGE

NOTCH TOUGHNESS APPLICATIONS TO -46°C AS WELDED

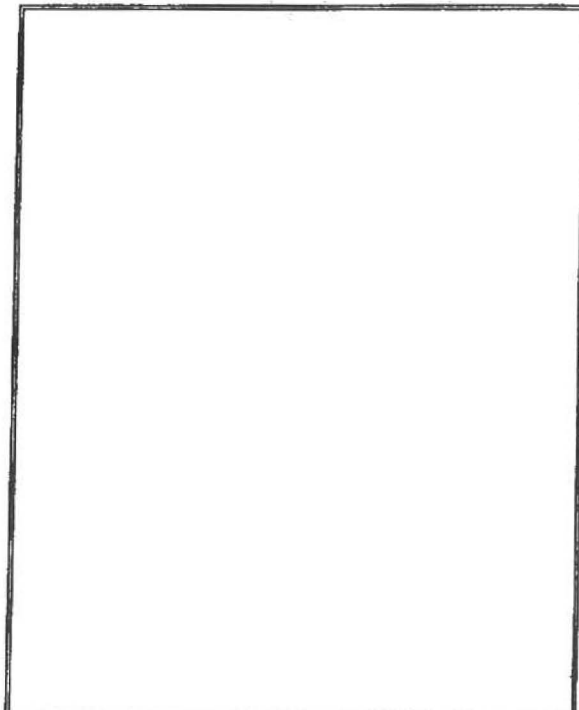
\_\_\_\_\_ 3.2 to 203 mm (0.125 to 8.00 in.) inclusive

COMBINED DEPOSITED WELD METAL THICKNESS

|                        |                                   |
|------------------------|-----------------------------------|
| ASME B31.1             | _____ 19.1 mm (0.750 in.) maximum |
| ASME B31.3             | _____ 19.1 mm (0.750 in.) maximum |
| ASME SECT. VIII, DIV.1 | _____ 38.1 mm (1.50 in.) maximum  |

|   |                       |
|---|-----------------------|
| ALBERTA BOILERS SAFETY ASSOCIATION        |                       |
| PROVINCE OF ALBERTA                       |                       |
| SAFETY CODES ACT                          |                       |
| WELDING PROCEDURE                         |                       |
| Reg. No. WP                               | 2380.2                |
| Spec No.                                  | CX-2N (REV.1)         |
| Weld Process                              | SMAW                  |
| Matl. Gr. P No.                           | 1 Gr. 1.2             |
| P No.                                     | 1 Gr. 1.2             |
| Elec. Gr. F No.                           | 3+4                   |
| A No.                                     | 1                     |
| Th. Qual. For                             | 3.2 to 203 mm PWHT NO |
|   | CVN - 46°C            |
| Y05. M09. Day 01 Signed _____             |                       |
| R. ROSEBERG, P.ENG.<br>WELDING SPECIALIST |                       |

PROVINCIAL REGISTRATION



**Calhex Industries**

**Ltd.**

**Welding Procedures**

**Welding Procedure:**

**CX-3N**

**Rev. 1**



the pressure equipment safety authority

9410 - 20 Ave N.W.

Edmonton, Alberta, Canada T6N 0A4

Tel: (780) 437-9100 / Fax: (780) 437-7787

February 22, 2008

Sheldon Alcock  
CALHEX INDUSTRIES LTD  
9515-48 STREET SE  
CALGARY, AB T2C 2R1

Dear Sheldon Alcock,

The welding procedures received on February 21, 2008 are accepted for registration as follows:

Reg. No. : WP-2380.2

Accepted on: February 22, 2008

Tracking No. : 2008-01121

Reg Type : Revision To Acc. Design

Spec. No. : CX-3N REV 1

Registered under owner / manufacturer name CALHEX INDUSTRIES LTD

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

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

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

Enclosed is a stamped welding procedure for your reference.

Sincerely,

ROSEBERG, BOB, P. Eng.  
Design Survey Engineer

WELDING PROCEDURE SPECIFICATION NO.: CX-3N (Rev. 1)

WELDING PROCEDURE QUALIFICATION RECORD NO.(S): PQ6, PQ7, PQ8,  
PQ11, PQ29, PQ30

QUALIFIED FOR

Base Metal (Typical): P1 Groups 1 & 2 to P1 Groups 1 & 2  
(SA 333 Gr.6, SA 350 Gr.LF2, SA 420 WPL6, SA 516 Gr.70, etc.)  
Process(es): GMAW / SMAW Weld Types: GROOVE & FILLET  
Position: ALL POSITIONS Diameter: ALL DIAMETERS  
Filler Metal: GMAW: ER70S-2 or 6 SMAW: E7018-1

BASE METAL CONDITIONS & THICKNESS RANGE QUALIFIED:

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

BASE METAL THICKNESS RANGE 3.0 to 203 mm (0.119 to 8.00 in.) inclusive.

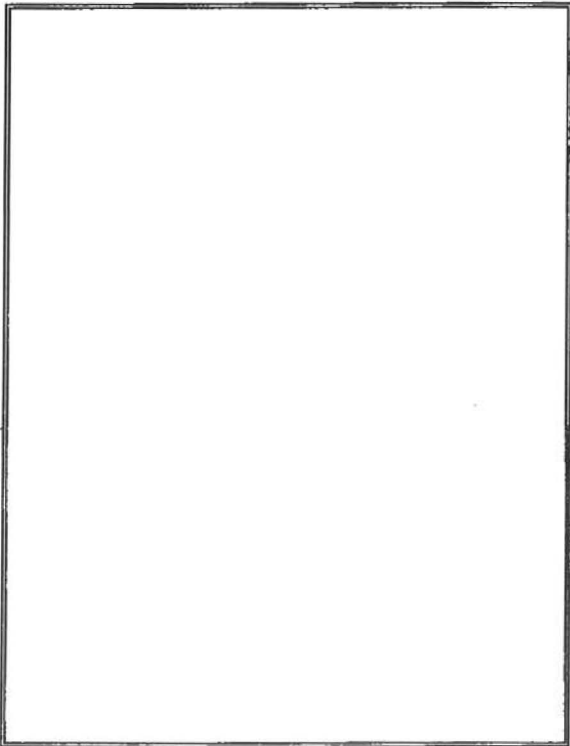
COMBINED DEPOSITED WELD METAL THICKNESS  
ASME B31.1 203 mm (8.00 in.) maximum  
ASME B31.3 203 mm (8.00 in.) maximum  
ASME SECT. VIII, DIV.1 203 mm (8.00 in.) maximum

ALBERTA BOILERS SAFETY ASSOCIATION  
PROVINCE OF ALBERTA  
SAFETY CODES ACT  
WELDING PROCEDURE

Reg. No. WP 2380.2  
Spec No. CX-3N (REV.1)  
Weld Process GMAW/SMAW  
Mater. Gr. P No. Gr. 1/2 to P No. Gr. 1/2  
Elec. Gr. F No. 6+4 A No. 1  
Th. Qual. For 3 to 203 mm PWHT YES  
CVN - 46°C

Yr. 8, Mo. 2, Day 27 Signed [Signature]  
R. ROSEBERG, P.ENG.  
WELDING SPECIALIST

PROVINCIAL REGISTRATION





Alberta

LABOUR

Grade "B" Pressure Welder's  
Certificate of Competency

Form No. CB-43 (90/07)

Glen D. Hansen

This is to Certify that  
having complied with provisions of the Boilers and Pressure Vessels Act is  
hereby granted a Grade "B" Pressure Welder's Certificate of Competency, and  
is authorized to engage in pressure welding in accordance with the prescribed  
Regulations.



W- 12138  
ABB File No.

Dated at Edmonton, this Second  
day of April 19 91  
*[Signature]*  
Chief Inspector

No 7772



Alberta

ABSA

the pressure equipment safety authority

22967


Grade "W" Pressure Welder's  
Certificate of Competency

This is to certify that **Mike Taranov**  
having complied with provisions of the Safety Codes Act, is authorized to engage  
in pressure welding in accordance with the prescribed Regulations.

Dated at Edmonton  
June 03, 2005



W-22851  
File no.

  
Chief Inspector and Administrator



**Alberta**  
Municipal Affairs  
and Housing  
23142

**ABSA**  
the pressure equipment safety authority

Grade "B" Pressure Welder's  
Certificate of Competency

This is to certify that **James Crookes**  
having complied with provisions of the Safety Codes Act, is authorized to engage  
in pressure welding in accordance with the prescribed Regulations.

Dated at Edmonton  
September 24, 2009



W-27702  
File no.

*Lola*  
Chief Inspector and Administrator



012-01985145  01837140

### QUALIFICATION CERTIFICATE

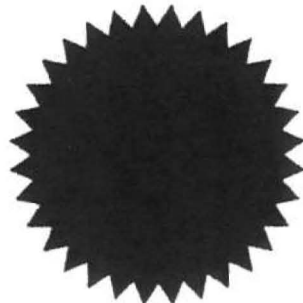
THIS IS TO CERTIFY THAT  
**SERGEY MUKHAMEDZYANOV**  
 HAS ACHIEVED THE STANDARDS ESTABLISHED  
 UNDER THE ALBERTA APPRENTICESHIP AND INDUSTRY TRAINING ACT  
 AND IS HEREBY AUTHORIZED TO WORK IN THE TRADE AS A JOURNEYMAN  
 AND TO USE THE TITLE CERTIFIED JOURNEYMAN



**WELDER**

EFFECTIVE DATE: July 23rd, 2013  
 ISSUE DATE: September 11th, 2013

HONOURABLE THOMAS LUKASZUK  
 MINISTER OF ENTERPRISE  
 AND ADVANCED EDUCATION

MARK DOUGLAS, EXECUTIVE  
 DIRECTOR OF APPRENTICESHIP  
 & INDUSTRY TRAINING




 


### WELDING PERFORMANCE QUALIFICATION

**SERGEY MUKHAMEDZYANOV**  
Name

is qualified as a Grade B Pressure Welder. This card is issued pursuant to the Safety Codes Act and Pressure Welders Regulation, subject to the limitations on the reverse side.

**NOV. 7/13**  
Date of Test

  
Signature of Welder

  
Safety Codes Officer

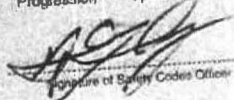
File W-30475

### PERFORMANCE QUALIFICATION

(In accordance with Section IX, A S.M.E. Code)  
 Form No. AB-118 Rev (10/2006)

|                          |      |       |                    |           |
|--------------------------|------|-------|--------------------|-----------|
| Process                  | SMAW | SMAW  | Material           | P1 to P1  |
| Max Deposited Weld Metal | 6 mm | 16 mm | Minimum Pipe Dia.  | NPS 2 1/2 |
| Filler Metal Group       | F3   | F4    | Position Qualified | ALL       |
| Backing                  | No   | Yes   | Progression        | Uptill    |

**NOV. 7/15**  
Date of Expiry

  
Signature of Safety Codes Officer

A 636695

**FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS** (2010)  
**As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1**

1. Manufactured and certified by CALHEX INDUSTRIES LTD. 9515 48<sup>TH</sup> STREET S.E., CALGARY, ALBERTA, CANADA T2C 2R1  
(Name and address of Manufacturer)

2. Manufactured for Encana Corporation 150 - 9<sup>th</sup> Avenue S.E., Calgary, AB T2P 2S5  
(Name and address of Purchaser)

3. Location of installation Encana Saturn Compressor Station, BC  
(Name and address)

4. Type Horizontal Heat Exchanger 13-0856-A  
(Horizontal, vertical, or sphere) (Tank, separator, jkt. vessel, heat exh., etc.) (Manufacturer's serial number)

W3145.21 13-0856-S Rev. 0 & T Rev. 0 - 2014  
(CRN) (Drawing No.) (National Board Number.) (Year Built)

5. ASME Code, Section VIII, Div. 1 2010 & 2011 - -  
[Edition and Addenda (date)] (Code Case Number) [Special Service per UG-120(d)]

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multi-chamber vessels.

6. Shell (a) Number of course(s): 1 (b) Overall length (ft & in.): 27' - 9.125"

| Course(s) |               |                   | Material            | Thickness |         | Long. Joint (Cat. A) |                  |      | Circum. Joint (Cat. A, B, & C) |                  |      | Heat Treatment |      |
|-----------|---------------|-------------------|---------------------|-----------|---------|----------------------|------------------|------|--------------------------------|------------------|------|----------------|------|
| No.       | Diameter, in. | Length (ft & in.) | Spec./Grade or Type | Nom.      | Corr.   | Type                 | Full, Spot, None | Eff. | Type                           | Full, Spot, None | Eff. | Temp.          | Time |
| 1         | 7.981"        | 27' - 9.125"      | SA106-B             | 0.322"    | 0.0625" | S                    | None             | 1.0  | 7                              | None             | n/a  | -              | -    |
|           |               |                   |                     |           |         |                      |                  |      |                                |                  |      |                |      |
|           |               |                   |                     |           |         |                      |                  |      |                                |                  |      |                |      |

7. Heads: (a) \_\_\_\_\_ (b) \_\_\_\_\_  
(Material spec. number, grade or type) (H.T. - time & temp.) (Material spec. number, grade or type) (H.T. - time & temp.)

|     | Location (Top, Bottom, Ends) | Thickness |       | Radius |         | Elliptical Ratio | Conical Apex Angle | Hemispherical Radius | Flat Diameter | Side to Pressure |         | Category A |                  |      |
|-----|------------------------------|-----------|-------|--------|---------|------------------|--------------------|----------------------|---------------|------------------|---------|------------|------------------|------|
|     |                              | Min.      | Corr. | Crown  | Knuckle |                  |                    |                      |               | Convex           | Concave | Type       | Full, Spot, None | Eff. |
| (a) |                              |           |       |        |         |                  |                    |                      |               |                  |         |            |                  |      |
| (b) |                              |           |       |        |         |                  |                    |                      |               |                  |         |            |                  |      |

removable, bolts used (describe other fastening) \_\_\_\_\_  
(Material spec. number, grade, size, number)

8. Type of jacket \_\_\_\_\_ Jacket closure \_\_\_\_\_  
(Describe as ogee and weld, bar, etc)

If bar, give dimensions \_\_\_\_\_ If bolted, describe or sketch.

9. MAWP 200 - psi at max. temp. 400 °F Min. design metal temp. -20 °F at 200 psi.  
(Internal) (External) (Internal) (External)

10. Impact test No. exempt per UG-20(f), UCS-66(a)(c)(d) & Fig. UCS-66 Note (e). at test temperature of - °F.  
(Indicate yes or no and the component(s) impact tested)

11. Hydro., pneu., or comb. test pressure 260 psi Proof test \_\_\_\_\_

Items 12 and 13 to be completed for tube sections.

12. Tubesheet: SA516-70N 7.981" 1.375" 0.125" Welded  
[Stationary (material spec. no.)] [Diameter, (subject to press. )] (Nominal thickness) (Corr. Allow.) [Attachment (welded or bolted)]

- - - - -  
[Floating (material spec. no.)] (Diameter) (Nominal thickness) (Corr. Allow.) (Attachment)

13. Tubes SA179 \* 0.625" 16 BWG 68 Straight  
(Material spec. no., grade or type) (O.D.) (Nominal thickness) (Number) [Type (straight or U)]

Items 14-18 Incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell: (a) No. of course(s) 2 (b) Overall length (ft & in.): 1' - 4"

| Course(s) |          |         | Material            | Thickness |         | Long. Joint (Cat. A) |                  |      | Circum. Joint (Cat. A, B, & C) |                  |      | Heat Treatment |      |
|-----------|----------|---------|---------------------|-----------|---------|----------------------|------------------|------|--------------------------------|------------------|------|----------------|------|
| No.       | Diameter | Length  | Spec./Grade or Type | Nom.      | Corr.   | Type                 | Full, Spot, None | Eff. | Type                           | Full, Spot, None | Eff. | Temp.          | Time |
| 2         | 7.981"   | 0' - 8" | SA106-B             | 0.322"    | 0.0625" | S                    | None             | 1.0  | 1/7                            | Spot **          | 0.70 | -              | -    |
|           |          |         |                     |           |         |                      |                  |      |                                |                  |      |                |      |
|           |          |         |                     |           |         |                      |                  |      |                                |                  |      |                |      |

15. Heads: (a) SA105-N (b) SA105-N  
(Material spec. number, grade or type) (H.T. - Time & Temp.) (Material spec. number, grade or type) (H.T. - Time & Temp.)

|     | Location (Top, Bottom, Ends) | Thickness |         | Radius |         | Elliptical Ratio | Conical Apex Angle | Hemispherical Radius | Flat Diameter | Side to |         | Category A |                  |      |
|-----|------------------------------|-----------|---------|--------|---------|------------------|--------------------|----------------------|---------------|---------|---------|------------|------------------|------|
|     |                              | Min.      | Corr.   | Crown  | Knuckle |                  |                    |                      |               | Con     | Concave | Type       | Full, Spot, None | Eff. |
| (a) | End                          | 1.125"    | 0.0625" |        |         |                  |                    |                      | 13.50"        |         |         |            |                  |      |
| (b) | End                          | 1.125"    | 0.0625" |        |         |                  |                    |                      | 13.50"        |         |         |            |                  |      |

If removable, bolts used (describe other fastening) (16) 0.75" x 4.250" Lg. SA193-B7 UNC Studs / (32) 0.75" SA194-2H UNC Nuts  
(Material spec. number, grade, size, number)

**FORM U-1 (Back)**

16. MAWP 200 - psi at max. temp. 400 °F Min. design metal temp. -20 °F at 200 Psi

(Internal) (External) (Internal) (External)

17. Impact test No, exempt UG-20(f), UCS-66(a)(c)(d) & Fig. UCS-66 Note (e). at test temperature of - °F.

(Indicate yes or no and the component(s) impact tested)

18. Hydro., pneu., or comb. test press. 260 psi Proof test -

19. Nozzles, inspection, and safety valve openings:

| Purpose<br>(Inlet, Outlet, Drain, etc.) | No. | Diameter<br>or Size | Flange<br>Type | Material |         | Nozzle Thickness |         | Reinforcement<br>Material | Attachment Detail |        | Location<br>(Insp. Open.) |
|---|-----|---------------------|----------------|----------|---------|------------------|---------|---------------------------|-------------------|--------|---------------------------|
|   |     |                     |                | Nozzle   | Flange  | Nom.             | Corr.   |                           | Nozzle            | Flange |                           |
| Shellside Inlet                         | 1   | 3" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.300"           | 0.0625" | -                         | UW16.1c           | BW     | Shell Top                 |
| Shellside Outlet                        | 1   | 3" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.300"           | 0.0625" | -                         | UW16.1c           | BW     | Shell Bottom              |
| Tubeside Inlet                          | 1   | 2" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.344"           | 0.0625" | -                         | UW16.1c           | BW     | Channel Bottom            |
| Tubeside Outlet                         | 1   | 2" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.344"           | 0.0625" | -                         | UW16.1c           | BW     | Channel Top               |
| T.I.'s                                  | 2/2 | 1"                  | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Inlets / Outlets          |
| P.I.'s                                  | 2/2 | 3/4"                | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Inlets / Outlets          |
| Tubeside Vent                           | 1   | 1"                  | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Channel Top               |
| Tubeside Drain                          | 1   | 1"                  | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Channel Bottom            |
|   |     |                     |                |          |         |                  |         |                           |                   |        |                           |
|   |     |                     |                |          |         |                  |         |                           |                   |        |                           |

20. Supports: Skirt No Lugs 4 Legs n/a Other Saddles Attached Welded to Shell & Channel Covers

(Yes/no) (Number) (Number) (Describe) (Where and how)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report:

(list the name of part, item number, Manufacturer's name and identifying number):

22. Remarks: (2) 8" 150 CL RFWN End Flanges - SA105-N

SAFETY VALVES: P.S.V. on piping per UG-125 (g) to be installed by owner. CUBIC CAPACITY: 8.23 cu. ft.

SURFACE AREA: 1553.3 sq. ft.

SERVICE: Warm Lean / Rich Glycol Exchanger \* Tube Length - 28' - 0" Lg. \*\* RT2 - Spot per UW-11(a)<sup>F(b)</sup>.

ITEM #: E-322A1 Constructed to Drawing # 13-0856-S Rev. 2 & T Rev. 0.

**CERTIFICATE OF SHOP COMPLIANCE**

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1.

U Certificate of Authorization Number. 33238 Expires April 22, 2014

Date FEB 20 2014 Name Calhex Industries Ltd. Signed [Signature]  
(Manufacturer) (Representative)

**CERTIFICATE OF SHOP INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of ALBERTA and employed by ABSA of CALGARY, AB, CANADA have inspected the pressure vessel described in this Manufacturer's Data Report on FEB 20 2014, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date FEB 20 2014 Signed [Signature] Commissions AB 416 NB 14467 A  
(Authorized Inspector) (National Board (incl. endorsements), State, Province, and number)

**CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE**

We certify that the statements on this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1.

U Certificate of Authorization Number \_\_\_\_\_ Expires \_\_\_\_\_, 20\_\_\_\_

Date \_\_\_\_\_ Name \_\_\_\_\_ Signed \_\_\_\_\_  
(Assembler) (Representative)

**CERTIFICATE OF FIELD ASSEMBLY INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of \_\_\_\_\_ and employed by \_\_\_\_\_ of \_\_\_\_\_ have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of \_\_\_\_\_ psi. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date \_\_\_\_\_ Signed \_\_\_\_\_ Commissions \_\_\_\_\_  
(Authorized Inspector) (National Board (incl. endorsements), State, Province and number.)

**FORM U-1 MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS** (2010)  
 As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

① 636696

1. Manufactured and certified by CALHEX INDUSTRIES LTD. 9515 48<sup>TH</sup> STREET S.E., CALGARY, ALBERTA, CANADA T2C 2R1  
(Name and address of Manufacturer)

2. Manufactured for Encana Corporation 150 - 9<sup>th</sup> Avenue S.E., Calgary, AB T2P 2S5  
(Name and address of Purchaser)

3. Location of installation Encana Saturn Compressor Station, BC  
(Name and address)

4. Type Horizontal Heat Exchanger 13-0856-B  
(Horizontal, vertical, or sphere) (Tank, separator, jkt. vessel, heat exh., etc.) (Manufacturer's serial number)

W3145.21 13-0856-S Rev. 0 & T Rev. 0 - 2014  
(CRN) (Drawing No.) (National Board Number.) (Year Built)

5. ASME Code, Section VIII, Div. 1 2010 & 2011 - -  
[Edition and Addenda (date)] (Code Case Number) [Special Service per UG-120(d)]

Items 6-11 incl. to be completed for single wall vessels, jackets of jacketed vessels, shell of heat exchangers, or chamber of multi-chamber vessels.

6. Shell (a) Number of course(s): 1 (b) Overall length (ft & in.): 27' - 9.125"

| Course(s) |               |                     | Material            | Thickness     |                | Long. Joint (Cat. A) |                  |            | Circum. Joint (Cat. A, B, & C) |                  |            | Heat Treatment |      |
|-----------|---------------|---------------------|---------------------|---------------|----------------|----------------------|------------------|------------|--------------------------------|------------------|------------|----------------|------|
| No.       | Diameter, in. | Length (ft & in.)   | Spec./Grade or Type | Nom.          | Corr.          | Type                 | Full, Spot, None | Eff.       | Type                           | Full, Spot, None | Eff.       | Temp.          | Time |
| <b>1</b>  | <b>7.981"</b> | <b>27' - 9.125"</b> | <b>SA106-B</b>      | <b>0.322"</b> | <b>0.0625"</b> | <b>S</b>             | <b>None</b>      | <b>1.0</b> | <b>7</b>                       | <b>None</b>      | <b>n/a</b> | -              | -    |
|           |               |                     |                     |               |                |                      |                  |            |                                |                  |            |                |      |
|           |               |                     |                     |               |                |                      |                  |            |                                |                  |            |                |      |

7. Heads: (a) \_\_\_\_\_ (b) \_\_\_\_\_  
(Material spec. number, grade or type) (H.T. - time & temp.) (Material spec. number, grade or type) (H.T. - time & temp.)

| Location (Top, Bottom, Ends) | Thickness |       | Radius |         | Elliptical Ratio | Conical Apex Angle | Hemispherical Radius | Flat Diameter | Side to Pressure |         | Category A |                  |      |  |
|------------------------------|-----------|-------|--------|---------|------------------|--------------------|----------------------|---------------|------------------|---------|------------|------------------|------|--|
|                              | Min       | Corr. | Crown  | Knuckle |                  |                    |                      |               | Convex           | Concave | Type       | Full, Spot, None | Eff. |  |
| (a)                          |           |       |        |         |                  |                    |                      |               |                  |         |            |                  |      |  |
| (b)                          |           |       |        |         |                  |                    |                      |               |                  |         |            |                  |      |  |

If removable, bolts used (describe other fastening) \_\_\_\_\_

8. Type of jacket \_\_\_\_\_ Jacket closure \_\_\_\_\_  
(Material spec. number, grade, size, number) (Describe as ogee and weld, bar, etc)

If bar, give dimensions \_\_\_\_\_ If bolted, describe or sketch \_\_\_\_\_

9. MAWP 200 - psi at max. temp. 400 - °F Min. design metal temp. -20 °F at 200 psi.  
(Internal) (External) (Internal) (External)

10. Impact test No. exempt per UG-20(f), UCS-66(a)(c)(d) & Fig. UCS-66 Note (e). at test temperature of - °F.  
(Indicate yes or no and the component(s) impact tested)

11. Hydro, pneu., or comb. test pressure 260 psi Proof test -

Items 12 and 13 to be completed for tube sections.

12. Tubesheet: SA516-70N 7.981" 1.375" 0.125" Welded  
[Stationary (material spec. no)] [Diameter, (subject to press.)] (Nominal thickness) (Corr. Allow.) [Attachment (welded or bolted)]

SA179 \* 0.625" 16 BWG 68 Straight  
(Material spec. no., grade or type) (O.D.) (Nominal thickness) (Number) [Type (straight or U)]

Items 14-18 incl. to be completed for inner chambers of jacketed vessels or channels of heat exchangers.

14. Shell: (a) No. of course(s) 2 (b) Overall length (ft & in.): 1' - 4"

| Course(s) |               |                | Material            | Thickness     |                | Long. Joint (Cat. A) |                  |            | Circum. Joint (Cat. A, B, & C) |                  |             | Heat Treatment |      |
|-----------|---------------|----------------|---------------------|---------------|----------------|----------------------|------------------|------------|--------------------------------|------------------|-------------|----------------|------|
| No.       | Diameter      | Length         | Spec./Grade or Type | Nom.          | Corr.          | Type                 | Full, Spot, None | Eff.       | Type                           | Full, Spot, None | Eff.        | Temp.          | Time |
| <b>2</b>  | <b>7.981"</b> | <b>0' - 8"</b> | <b>SA106-B</b>      | <b>0.322"</b> | <b>0.0625"</b> | <b>S</b>             | <b>None</b>      | <b>1.0</b> | <b>1/7</b>                     | <b>Spot **</b>   | <b>0.70</b> | -              | -    |
|           |               |                |                     |               |                |                      |                  |            |                                |                  |             |                |      |

15. Heads: (a) SA105-N (b) SA105-N  
(Material spec. number, grade or type) (H.T. - Time & Temp.) (Material spec. number, grade or type) (H.T. - Time & Temp.)

| Location (Top, Bottom, Ends) | Thickness     |                | Radius |         | Elliptical Ratio | Conical Apex Angle | Hemispherical Radius | Flat Diameter | Side to |         | Category A |                  |      |  |
|------------------------------|---------------|----------------|--------|---------|------------------|--------------------|----------------------|---------------|---------|---------|------------|------------------|------|--|
|                              | Min           | Corr.          | Crown  | Knuckle |                  |                    |                      |               | Con     | Concave | Type       | Full, Spot, None | Eff. |  |
| (a) <b>End</b>               | <b>1.125"</b> | <b>0.0625"</b> |        |         |                  |                    |                      | <b>13.50"</b> |         |         |            |                  |      |  |
| (b) <b>End</b>               | <b>1.125"</b> | <b>0.0625"</b> |        |         |                  |                    |                      | <b>13.50"</b> |         |         |            |                  |      |  |

If removable, bolts used (describe other fastening) \_\_\_\_\_

**(16) 0.75" x 4.250" Lg. SA193-B7 UNC Studs / (32) 0.75" SA194-2H UNC Nuts**  
(Material spec. number, grade, size, number)

**FORM U-1 (Back)**

16. MAWP 200 (Internal) - (External) psi at max temp 400 (Internal) - (External) °F Min. design metal temp -20 °F at 200 Psi

17. Impact test No, exempt UG-20(f), UCS-66(a)(c)(d) & Fig. UCS-66 Note (e). at test temperature of - °F.  
 (Indicate yes or no and the component(s) impact tested)

18. Hydro, pneu., or comb. test press. 260 psi Proof test -

19. Nozzles, inspection, and safety valve openings:

| Purpose<br>(Inlet, Outlet, Drain, etc.) | No. | Diameter<br>or Size | Flange<br>Type | Material |         | Nozzle Thickness |         | Reinforcement<br>Material | Attachment Detail |        | Location<br>(Insp. Open.) |
|---|-----|---------------------|----------------|----------|---------|------------------|---------|---------------------------|-------------------|--------|---------------------------|
|   |     |                     |                | Nozzle   | Flange  | Nom.             | Corr.   |                           | Nozzle            | Flange |                           |
| Shellside Inlet                         | 1   | 3" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.300"           | 0.0625" | -                         | UW16.1c           | BW     | Shell Top                 |
| Shellside Outlet                        | 1   | 3" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.300"           | 0.0625" | -                         | UW16.1c           | BW     | Shell Bottom              |
| Tubeside Inlet                          | 1   | 2" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.344"           | 0.0625" | -                         | UW16.1c           | BW     | Channel Bottom            |
| Tubeside Outlet                         | 1   | 2" 150 CL           | RFWN           | SA106-B  | SA105-N | 0.344"           | 0.0625" | -                         | UW16.1c           | BW     | Channel Top               |
| T.I.'s                                  | 1/1 | 1"                  | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Inlets / Outlets          |
| P.I.'s                                  | 1/1 | ¾"                  | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Inlets / Outlets          |
| Tubeside Vent                           | 1   | 1"                  | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Channel Top               |
| Tubeside Drain                          | 1   | 1"                  | CPLG           | SA105-N  | -       | 6000 CL          | 0.0625" | -                         | UW16.1a           | -      | Channel Bottom            |
|   |     |                     |                |          |         |                  |         |                           |                   |        |                           |
|   |     |                     |                |          |         |                  |         |                           |                   |        |                           |

20. Supports: Skirt No Lugs 4 Legs n/a Other Saddles Attached Welded to Shell & Channel Covers  
 (Yes/no) (Number) (Number) (Describe) (Where and how)

21. Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report:  
 (list the name of part, item number, Manufacturer's name and identifying number):

22. Remarks: (2) 8" 150 CL RFWN End Flanges - SA105-N

SAFETY VALVES: P.S.V. on piping per UG-125 (g) to be installed by owner. CUBIC CAPACITY: 8.23 cu. ft.

SURFACE AREA: 1553.3 sq. ft.

SERVICE: Warm Lean / Rich Glycol Exchanger \* Tube Length - 28' - 0" Lg. \*\* RT2 - Spot per UW-11(a)5(b).

ITEM #: E-322A2 Constructed to Drawing # 13-0856-S Rev. 2 & T Rev. 0.

**CERTIFICATE OF SHOP COMPLIANCE**

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1.

U Certificate of Authorization Number: 33238 Expires April 22, 2014

Date FEB 20 2014 Name Calhex Industries Ltd. Signed [Signature]  
 (Manufacturer) (Representative)

**CERTIFICATE OF SHOP INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of ALBERTA and employed by ABSA of CALGARY, AB, CANADA have inspected the pressure vessel described in this Manufacturer's Data Report on FEB 20 2014, 2014, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date FEB 20 2014 Signed [Signature] Commissions AB 416 NB 14467 A  
 (Authorized Inspector) (National Board (incl. endorsements), State, Province, and number)

**CERTIFICATE OF FIELD ASSEMBLY COMPLIANCE**

We certify that the statements on this report are correct and that the field assembly construction of all parts of this vessel conforms with the requirements of ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1.

U Certificate of Authorization Number \_\_\_\_\_ Expires \_\_\_\_\_, 20\_\_\_\_

Date \_\_\_\_\_ Name \_\_\_\_\_ Signed \_\_\_\_\_  
 (Assembler) (Representative)

**CERTIFICATE OF FIELD ASSEMBLY INSPECTION**

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of \_\_\_\_\_ and employed by \_\_\_\_\_ have compared the statements in this Manufacturer's Data Report with the described pressure vessel and state that parts referred to as data items \_\_\_\_\_ not included in the certificate of shop inspection, have been inspected by me and to the best of my knowledge and belief, the Manufacturer has constructed and assembled this pressure vessel in accordance with ASME BOILER AND PRESSURE VESSEL CODE, Section VIII, Division 1. The described vessel was inspected and subjected to a hydrostatic test of \_\_\_\_\_ psi. By signing this certificate neither the Inspector nor his/her employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his/her employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date \_\_\_\_\_ Signed \_\_\_\_\_ Commissions \_\_\_\_\_  
 (Authorized Inspector) (National Board (incl. endorsements), State, Province and number)



**CALHEX INDUSTRIES LTD.**

9515 - 48 th. Street S.E., Calgary, Alberta, T2C 2R1

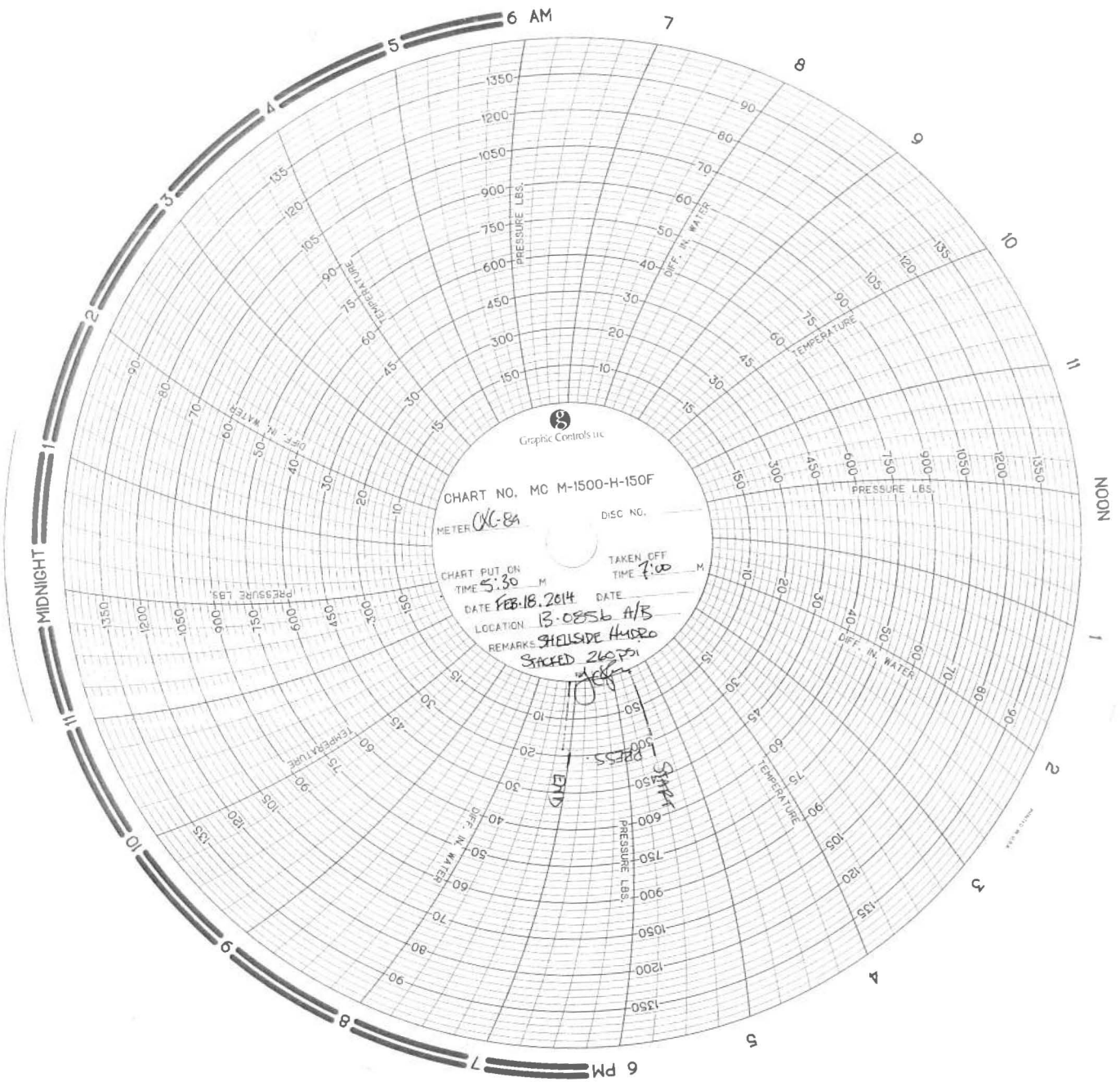
Bus: (403) 225 - 4395

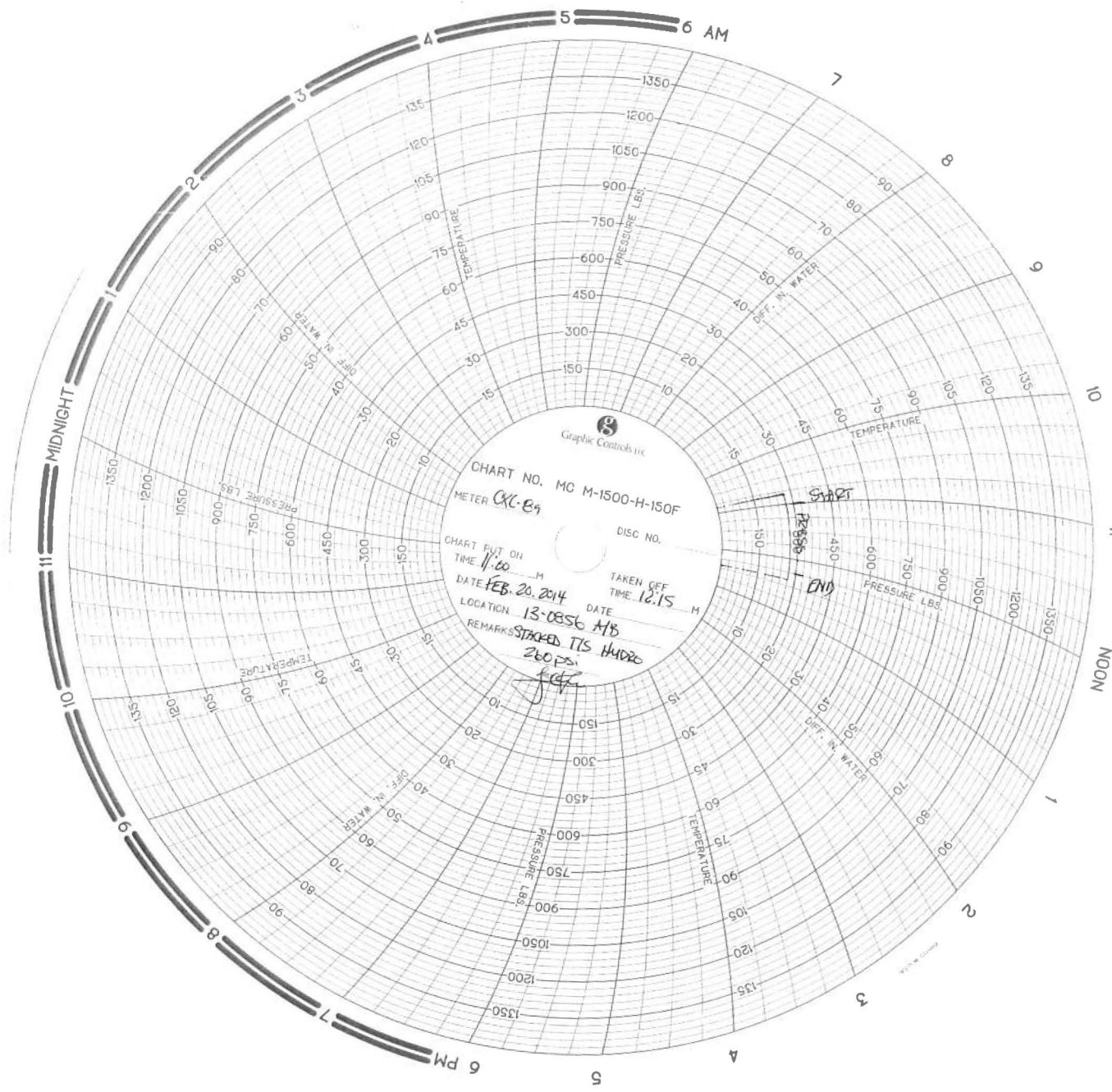
{ CALHEX5 }

Fax: (403) 261 - 2761

HYDROSTATIC TEST REPORT

|  |              |  |                          |
|--|--------------|--|--------------------------|
| <b>CUSTOMER:</b>                                   |              | <b>Spectrum Process Systems</b>                    |                          |
| <b>OWNER:</b>                                      |              | <b>Encana Corp.</b>                                |                          |
| <b>ITEM #:</b>                                     |              | <b>E-322 A1/A2</b>                                 |                          |
| <b>JOB #:</b>                                      |              | <b>13-0856-A/B</b>                                 |                          |
|  |              | STACKED SHELLSIDE                                  | STACKED TUBESIDE         |
| <b>DESIGN PRESSURE:</b>                            |              | <b>200 psi</b>                                     | <b>200 PSI</b>           |
| <b>HYDROSTATIC TEST PRESSURE:</b>                  |              | <b>260 PSI</b>                                     | <b>260 PSI</b>           |
|  | <b>DATE:</b> | FEB 10 2014  | <b>DATE:</b> FEB 20 2014 |
| <b>Calhex Representative:</b> <i>[Signature]</i>   |              | <b>Calhex Representative:</b> <i>[Signature]</i>   |                          |
| <b>Customer Representative:</b> <i>[Signature]</i> |              | <b>Customer Representative:</b> <i>[Signature]</i> |                          |
| <b>DATE:</b> 2/10/14                               |              | <b>Date:</b> 2/20/14                               |                          |
| <b>Gauges - CXG-16 &amp; CXG-17</b>                |              | <b>Gauges - CXG-17 &amp; CXG-46</b>                |                          |
| <b>Remarks:</b>                                    |              |  |                          |
| Hydro-tested min. 1 hour. No leaks detected.       |              |  |                          |





Graphic Controls Inc

CHART NO. MC M-1500-H-150F  
METER CXC-B9

CHART PUT ON TIME 11:00 M  
DATE FEB. 20, 2014

LOCATION 13-0856 A/B  
REMARKS STAKED TIS HYDRO 260 PS

DISC NO.  
TAKEN OFF TIME 12:15 M

START

END

MIDNIGHT

6 AM

NOON

6 PM



**CALHEX INDUSTRIES LTD.**

9515- 48 th. Street S.E., Calgary, Alberta, T2C 2R1

Bus: (403) 225 - 4395

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Fax: (403) 261 - 2761

**TRAVEL SHEET (FRONT)**

**DO NOT START CONSTRUCTION WITHOUT AI REVIEW** TRAVEL SHEET REVISION NO.: 0

AI REVIEW: *L. Bodard*

REVIEW DATE: *December 23, 2013*

CUSTOMER: Spectrum Process Systems OWNER: Encana, Solaris PROJECT: Saturn Compressor Station PO#: 002359

SERIAL NO.: 13-0856-A JOB NO.: 13-0856-S & T VESSEL TYPE: Warm Lean / Rich Glycol Exchanger Tag#: E-322A1

DRAWING NO.: 13-0856-S& T DWG. REVISION NO.: 2 & 0 TRAVEL SHEET INITIATION BY: *DR* DEC 22 2013

| Seq. | Item   | Comments  | Q.C.I.     | Date               | A.I. Hold Points | A.I.       | Date             | Owner / Customer Rep. | Date           |
|------|--|---|------------|--------------------|------------------|------------|------------------|-----------------------|----------------|
| 1.   | Calculations in File   | Approved by Customer and ABSA                                   | <i>DR</i>  | <i>FEB 19 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| 2.   | Release of App'd Dwg   | Approved by Customer and ABSA                                   | <i>DR</i>  | <i>DEC 22 2013</i> | <i>R</i>         | <i>LGB</i> | <i>Dec 23/13</i> |                       |                |
| 3.   | Heat Numbers Recorded  | 2010 Edition 2011 Addenda                                       | <i>DR</i>  | <i>FEB 18 2014</i> | <i>W</i>         | <i>LGB</i> | <i>Feb 19/14</i> |                       |                |
| 4.   | MTRs Checked   |   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| 5.   | Examination of Material (UG-93)                              |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| 6.   | WPS(s) Checked   | (-20 °F) Carbon   | <i>DR</i>  | <i>DEC 22 2013</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> | <i>DR</i>             |                |
| 7.   | Welder(s) Qualified  |   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> | <i>DR</i>             |                |
| 8.   | Thicknesses Verified & Recorded                              |   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| 9.   | Shell(s) & Head(s) Fit-up Inspection                         |   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>W</i>         | <i>LGB</i> | <i>Feb 19/14</i> |                       |                |
| 10.  | Nozzles & Fittings Fit-up Inspection                         |   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>n/a</i>       |            |                  |                       |                |
| 11.  | Nozzle Orientation   |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| 12.  | Nozzle & Flange Rating Checked                               |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  | <i>DR</i>             |                |
| 13.  | Impact Testing   | No. exampt per UG-30(f), UCS-66(a)(c)(d) & Fig. UCS-66 Note (a) | <i>n/a</i> |                    |                  |            |                  |                       |                |
| 14.  | Internals Checked  |   | <i>DR</i>  | <i>FEB 19 2014</i> |                  |            |                  |                       |                |
| 15.  | Final Internal Inspection                                    | Shellside -   | <i>DR</i>  | <i>FEB 03 2014</i> | <i>W</i>         | <i>DR</i>  | <i>Feb 03/14</i> | <i>DR</i>             | <i>2/3/14</i>  |
|      |  | Tubeside -  | <i>DR</i>  | <i>FEB 19 2014</i> | <i>W</i>         | <i>LGB</i> | <i>Feb 19/14</i> | <i>DR</i>             | <i>2/19/14</i> |
| 16.  | Bundle Insertion   |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| 17.  | Weld Size Checked  | 3/8"  | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| 18.  | Welder I.D Checked   |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| 19.  | Final External Inspection                                    | 3-N/P   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>W</i>         | <i>LGB</i> | <i>Feb 19/14</i> |                       |                |
| 20.  | Radiography  | Shellside-  | <i>n/a</i> |                    |                  |            |                  |                       |                |
| a)   | Radiography  | Tubeside- RTD - Spot per UW-11(a)(5)(b)                         | <i>DR</i>  | <i>FEB 18 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| 21.  | MPI-Bevelled Edges - Tubesheets A & B before welding         |   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| a)   | MPI-Exposed Edges - Tubesheets A & B after welding           |   | <i>DR</i>  | <i>FEB 18 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| b)   | MPI-Cut outs - N1a/N2a/N3b/N4b/C1a/b/c/d/C2a/b/c/d/C3a/b     |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| c)   | UT- Cat. D's - N1a, N2a, N3b, N4b                            |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| d)   | MPI-S/S Temp's / Fillet Welds-Cat. D's - Saddle to Shell-N/P |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| e)   | MPI-T/S- Temp's / Fillet Welds- Lift lugs                    |   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| f)   | HT -   |   | <i>n/a</i> |                    |                  |            |                  |                       |                |
| 22.  | Final Ext. Prior to P.W.H.T.                                 |   | <i>n/a</i> |                    |                  |            |                  |                       |                |
| 23.  | PWHT Chart Checked -   |   | <i>n/a</i> |                    |                  |            |                  |                       |                |
| 24.  | Hydrostatic Test - 1 Hr Report & Chart                       | Shellside: Gauge: 260 psi CXG- 16 & CXG- 17                     | <i>DR</i>  | <i>FEB 19 2014</i> | <i>W</i>         | <i>LGB</i> | <i>Feb 19/14</i> | <i>DR</i>             | <i>2/19/14</i> |
| 24.a | Hydrostatic Test - 1 Hr Report & Chart                       | Tubeside: Gauge: 260 psi CXG- 17 & CXG- 46                      | <i>DR</i>  | <i>FEB 20 2014</i> | <i>W</i>         | <i>LGB</i> | <i>Feb 20/14</i> | <i>DR</i>             | <i>2/20/14</i> |
| 25.  | CRN Drawing: (AB)(BC)  | CRN# <i>W3145-21</i>  | <i>DR</i>  | <i>FEB 18 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| 26.  | N.C.R  | Approved:   | <i>DR</i>  | <i>FEB 18 2014</i> |                  |            |                  |                       |                |
| 27.  | Nameplate Stamping   | Imp.  | <i>DR</i>  | <i>FEB 19 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> |                       |                |
| 28.  | Manuf. Data Report Completed & Verified                      | U1  | <i>DR</i>  | <i>FEB 19 2014</i> | <i>R</i>         | <i>LGB</i> | <i>Feb 20/14</i> | <i>DR</i>             |                |
| 29.  | Nameplate Installation                                       | Imp. / Met. / Cau   | <i>DR</i>  | <i>FEB 25 2014</i> |                  |            |                  |                       |                |
| 30.  | Final Paint  |   | <i>DR</i>  | <i>FEB 25 2014</i> |                  |            |                  |                       |                |
| 31.  | Shipping and Release   |   | <i>DR</i>  | <i>FEB 25 2014</i> |                  |            |                  | <i>DR</i>             |                |
| 32.  | Final Documentation  | Manufacturer's Data Book  | <i>DR</i>  | <i>FEB 25 2014</i> |                  |            |                  |                       |                |

*WPS listing under Design Data  
-to match weld details  
AI LGB date Feb 20/14*

The Authorized Inspector shall be present with the Travel Sheet prior to construction so that he can designate additional inspection points and/or Hold Points. Any revisions shall be marked with a delta symbol with revision number and described at the bottom of this page.  
\* Denotes an A.I. Inspection Point \*\* Denotes an A.I. Hold Point





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**TRAVEL SHEET (FRONT)**

| DO NOT START CONSTRUCTION WITHOUT AI REVIEW |  |  |                 |  |                                   |           | TRAVEL SHEET REVISION NO.: 0 |                       |         |
|---|--|--|-----------------|--|-----------------------------------|-----------|------------------------------|-----------------------|---------|
| AI REVIEW: <u>L. Bodard</u>                 |  |  |                 | REVIEW DATE: <u>December 23, 2013</u>                    |                                   |           |                              |                       |         |
| CUSTOMER:                                   | Spectrum Process Systems                                     | OWNER:   | Encana, Solaris | PROJECT:   | Saturn Compressor Station         | PO#:      | 002358                       |                       |         |
| SERIAL NO.:                                 | 13-0856-B  | JOB NO.:   | 13-0856-S & T   | VESSEL TYPE:   | Warm Lean / Rich Glycol Exchanger | Tag#:     | E-322A2                      |                       |         |
| DRAWING NO.:                                | 13-0856-S&T  | DWG. REVISION NO.:   | 2 & 0           | TRAVEL SHEET INITIATION BY: <u>LR</u> <u>DEC 22 2013</u> |                                   |           |                              |                       |         |
| Seq.  | Item   | Comments   | Q.C.I.          | Date   | A.I. Hold Points                  | A.I.      | Date                         | Owner / Customer Rep. | Date    |
| 1.  | Calculations in File   | Approved by Customer and ABSA                                    | <u>LR</u>       | FEB 19 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| 2.  | Release of App'd Dwg   | Approved by Customer and ABSA                                    | <u>LR</u>       | DEC 22 2013  | R                                 | LGB       | Dec 23/13                    |                       |         |
| 3.  | Heat Numbers Recorded  | 2010 Edition 2011 Addenda  | <u>LR</u>       | FEB 18 2014  | W                                 | LGB       | Feb 19/14                    |                       |         |
| 4.  | MTRs Checked   |  | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| 5.  | Examination of Material (UG-93)                              |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| 6.  | WPS(s) Checked   | (-20 °F) Carbon  | <u>LR</u>       | DEC 22 2013  | R                                 | LGB       | Dec 23/13                    | <u>LR</u>             |         |
| 7.  | Welder(s) Qualified  |  | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    | <u>LR</u>             |         |
| 8.  | Thicknesses Verified & Recorded                              |  | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| 9.  | Shell(s) & Head(s) Fit-up Inspection                         |  | <u>LR</u>       | FEB 18 2014  | W                                 | LGB       | Feb 19/14                    |                       |         |
| 10.   | Nozzles & Fittings Fit-up Inspection                         |  | <u>LR</u>       | FEB 18 2014  | W/A                               |           |                              |                       |         |
| 11.   | Nozzle Orientation   |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| 12.   | Nozzle & Flange Rating Checked                               |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| 13.   | Impact Testing   | No, exempt per UG-20(f), UCS-66(a)(c)(d) & Fig. UCS-66 Note (e). | n/a             | -----  |                                   |           |                              |                       |         |
| 14.   | Internals Checked  |  | <u>LR</u>       | FEB 19 2014  |                                   |           |                              |                       |         |
| 15.   | Final Internal Inspection                                    | Shellside -  | <u>LR</u>       | FEB 03 2014  | W                                 | <u>LR</u> | Feb 3/14                     | <u>LR</u>             | 2/3/14  |
|   |  | Tubeside -   | <u>LR</u>       | FEB 13 2014  | W                                 | LGB       | Feb 17/14                    | <u>LR</u>             | 2/19/14 |
| 16.   | Bundle Insertion   |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| 17.   | Weld Size Checked  | 3/8"   | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| 18.   | Welder I.D. Checked  |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| 19.   | Final External Inspection                                    | 3-N/P  | <u>LR</u>       | FEB 18 2014  | W                                 | LGB       | Feb 19/14                    |                       |         |
| 20.   | Radiography  | Shellside-   | n/a             | -----  |                                   |           |                              |                       |         |
| a)  | Radiography  | Tubeside- RT3 - Spot per UW-11(a)(5)(b)                          | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| 21.   | MPI-Bevelled Edges - Tubesheets A & B before welding         |  | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| a)  | MPI-Exposed Edges - Tubesheets A & B after welding           |  | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| b)  | MPI-Cut outs - N1b/N2b/N3a/N4a/C1e/f/C2e/f/C3c/d             |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| c)  | UT- Cat. D's - N1b, N2b, N3a, N4a                            |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| d)  | MPI-S/S Temp's / Fillet Welds-Cat. D's - Saddle to Shell-N/P |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| e)  | MPI-T/S- Temp's / Fillet Welds- Lift lugs                    |  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| f)  | HT -   |  | n/a             | -----  |                                   |           |                              |                       |         |
| 22.   | Final Ext. Prior to P.W.H.T.                                 |  | n/a             | -----  |                                   |           |                              |                       |         |
| 23.   | PWHT Chart Checked -   |  | n/a             | -----  |                                   |           |                              |                       |         |
| 24.   | Hydrostatic Test - 1 Hr Report & Chart                       | Shellside: Gauge: 260 psi CXG- 16 & CXG- 17                      | <u>LR</u>       | FEB 19 2014  | W                                 | LGB       | Feb 19/14                    | <u>LR</u>             | 2/19/14 |
| 24.a  | Hydrostatic Test - 1 Hr Report & Chart                       | Tubeside: Gauge: 260 psi CXG- 17 & CXG- 46                       | <u>LR</u>       | FEB 28 2014  | W                                 | LGB       | Feb 20/14                    | <u>LR</u>             | 2/20/14 |
| 25.   | CRN Drawing: (AB)(BC)  | CRN# W3145-21  | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| 26.   | N.C.R.   | Approved:  | <u>LR</u>       | FEB 18 2014  |                                   |           |                              |                       |         |
| 27.   | Nameplate Stamping   | Imp.   | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    |                       |         |
| 28.   | Manuf. Data Report Completed & Verified                      | U1   | <u>LR</u>       | FEB 18 2014  | R                                 | LGB       | Feb 20/14                    | <u>LR</u>             |         |
| 29.   | Nameplate Installation                                       | Imp. / Met. / Cau  | <u>LR</u>       | FEB 25 2014  |                                   |           |                              |                       |         |
| 30.   | Final Paint  |  | <u>LR</u>       | FEB 25 2014  |                                   |           |                              |                       |         |
| 31.   | Shipping and Release   |  | <u>LR</u>       | FEB 25 2014  |                                   |           |                              | <u>LR</u>             |         |
| 32.   | Final Documentation  | Manufacturer's Data Book   | <u>LR</u>       | FEB 25 2014  |                                   |           |                              | <u>LR</u>             |         |

WPS listing under Design Data  
 to match weld details  
 AI LGB date Feb 20/14

The Authorized Inspector shall be presented with the Travel Sheet prior to construction so that he can designate additional inspection points and/or Hold Points. Any revisions shall be marked with a delta symbol with revision number and described at the bottom of this page.  
 \* Denotes an A.I. Inspection Point      \*\* Denotes an A.I. Hold Point





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SANDBLASTING & PROTECTIVE COATING SPECIALISTS

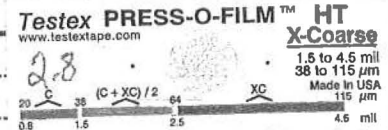
8715 - 40 Street SE  
Calgary, AB  
T2C 2P1  
Tel: 403 279 8171  
Fax: 403 279 1852

DATE: FEB 28 / 14 CUSTOMER: CALHEX  
ITEM: 1-VESSEL 13-0856 W/O: 14-0082 P/O: CX-11764

**SURFACE PREPARATION**

Medium Used:  
Ambient Temperature at the time  
Substrate Temperature:  
Wet Bulb:  
Relative Humidity:  
Dew Point:  
Moisture Traps used:  
Preparation meets SSPC:  
Peak to valley height:  
Coating Temperature:

| EXTERNAL |  |
|----------|--|
| Sil-4    |  |
| -16°C    |  |
| -17°C    |  |
| -17.5°C  |  |
| 55%      |  |
| -22.7°C  |  |
| YES      |  |
| SP-6     |  |
| 2.8      |  |
| 20°C     |  |



**COATING**

| Layer | Product Designation<br>Batch Number                          | Temperature |      | W.B   | R.H  | D.P     | D.F.T | Date           |
|-------|--|-------------|------|-------|------|---------|-------|----------------|
|       |  | AMB         | SUB  |       |      |         |       |                |
| #1    | INTER 228 WH. FV<br>PA 2899 UH<br>CAT - PK 4047 UH           | 25°C        | 25°C | 9.6°C | 5.2% | -16.8°C | 3.6   | MAR 04<br>2014 |
| #2    | INTER 228 GREY<br>PK 5136 UH, QA 6486 UH<br>CAT - P 54028 UH | 25°C        | 25°C | 9.9°C | 6.6% | -13.9°C | 8.2   | MAR 05<br>2014 |
| #3    |  |             |      |       |      |         |       |                |
| #4    |  |             |      |       |      |         |       |                |
| #5    |  |             |      |       |      |         |       |                |
| #6    |  |             |      |       |      |         |       |                |

Tests between layers: ✓ Visual Check: ✓ Total DFT: 8.2 AVERAGE

Touch up Surface Prep: ✓ Visual Check: ✓ How Applied: AIRLESS

Comments: SAND DEBRIS & TOUCH-UP & CONTACT POINTS  
FORCE CURE 3 HOURS @ 50°C

DATE: MAR 05 / 14 SIGNED: [Signature]

All painted items require time to cure. As per paint manufacturers data sheets, please note that after coating is complete all parts should be left to cure before being used. Sometimes this can be 5-7 days at 25C. Please ask for details.