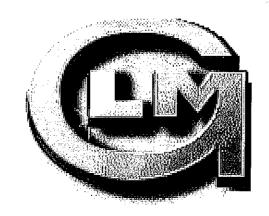


HUSKY ENERGY C/O EXCELSIOR ENGINEERING LTD

400 BBL SKIDDED WATER TANK

Tag# T-320 P.O. #8400261587

G.L.M. Job#: 10-797-1



INDEX

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SECTION "2" Calculation Package

SECTION "3" Material Test Reports

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SECTION "5" Quality Control

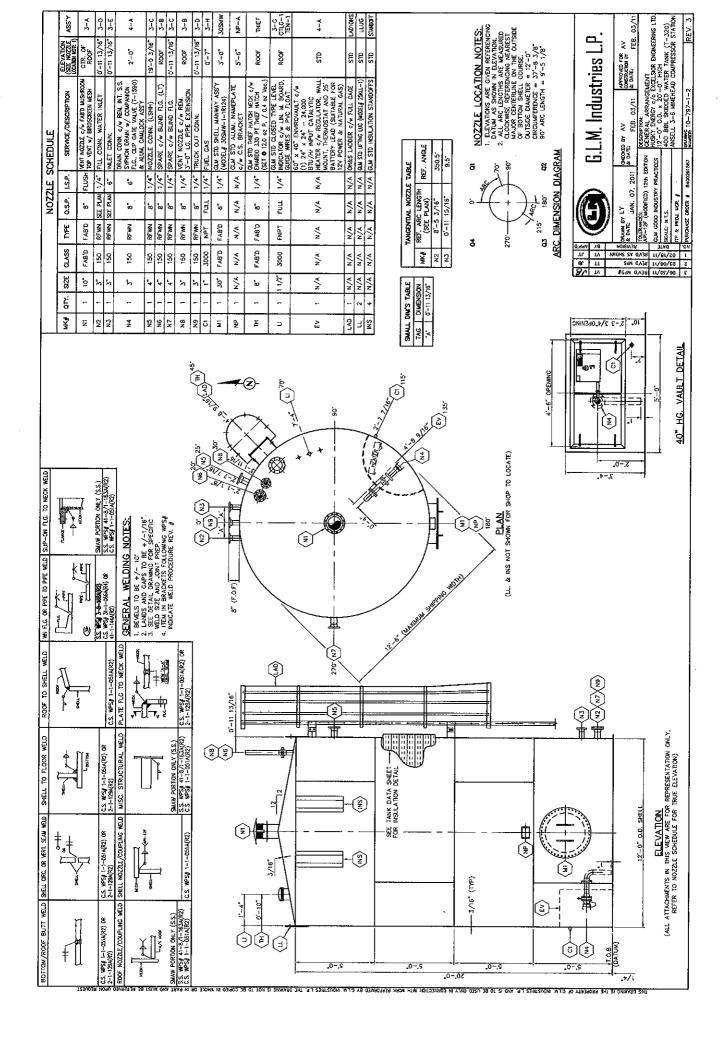
SECTION "6" Nameplate Facsimile

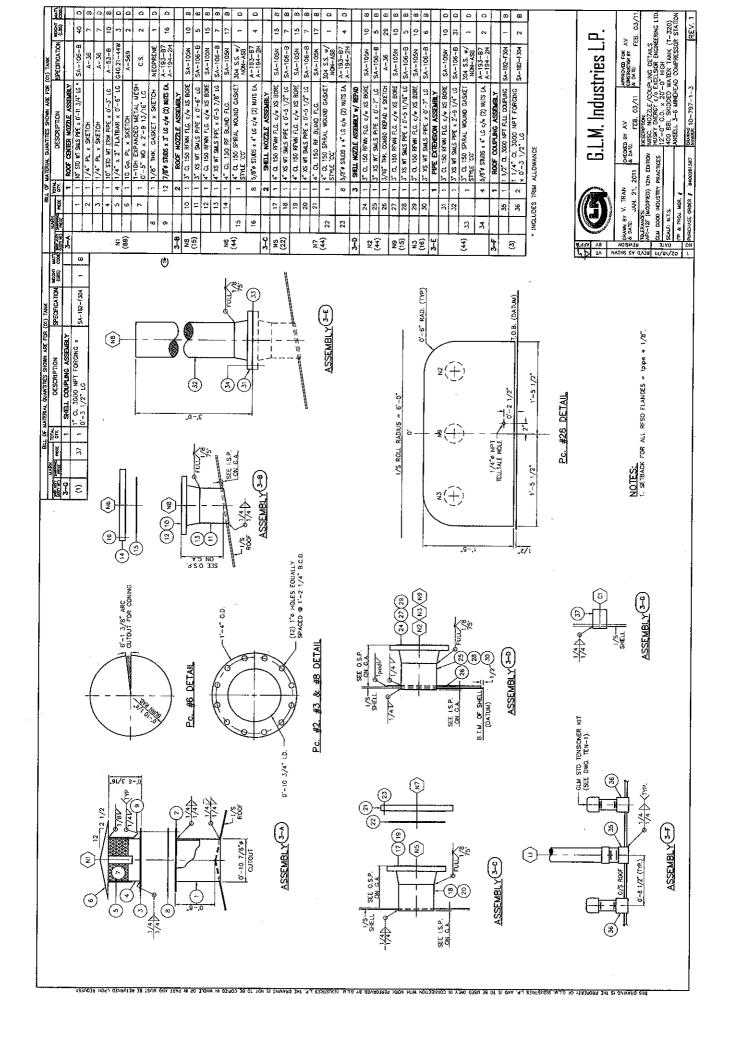


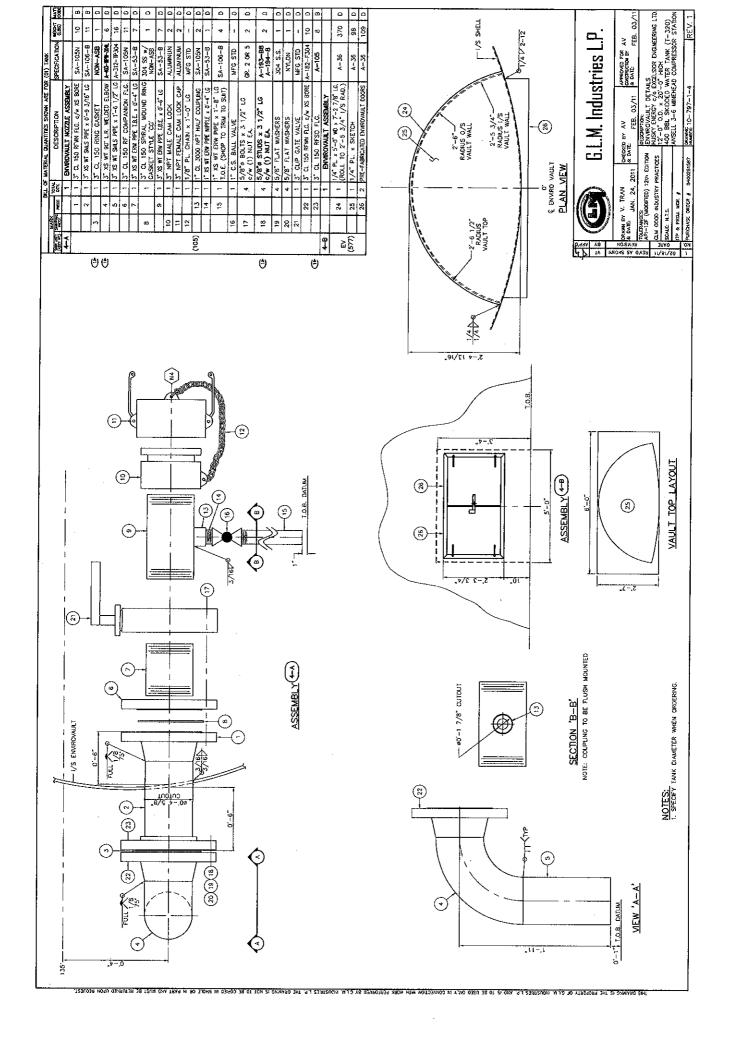
SECTION 1

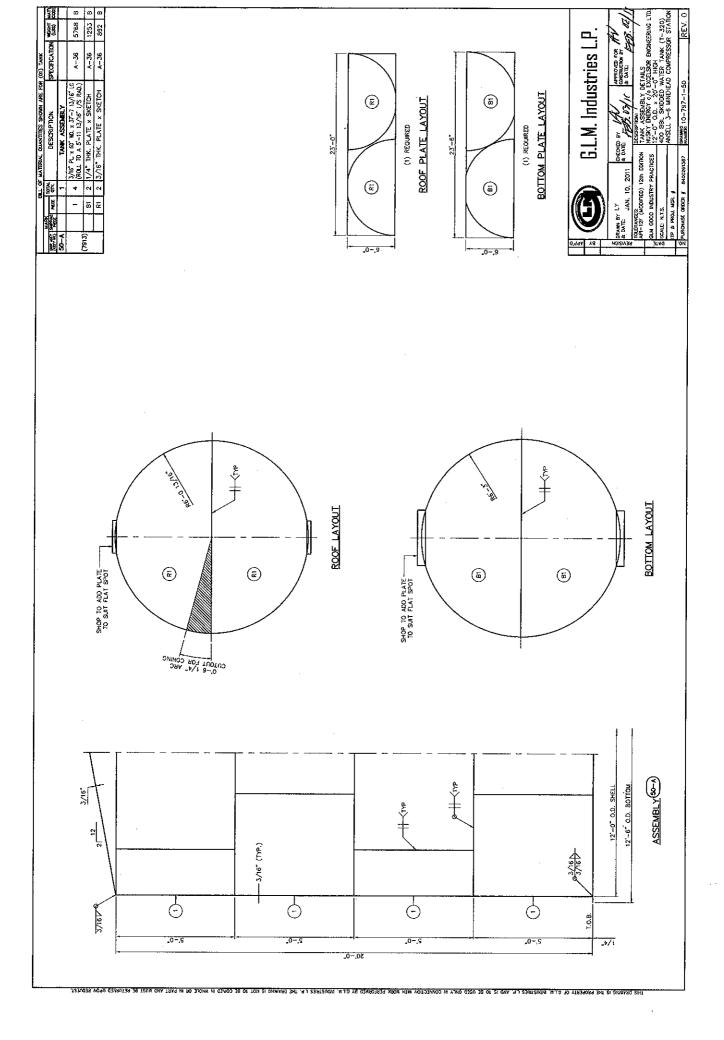
DRAWINGS

	SHE DESCRIPTION REW, REVISION REMERCE			G.L.M. INDUSTRIES L.P. API (12E)D (13A0D. APP. MOD. MOD.	SERVICE WATER NOW DIA 12.0 FT BTM THK 1.74 N. NOW HT 20.0 FT BTM TYPE FLAT NOW CAP 40.0 68.0 ROOF THK 3.16 N. NO 68.0 ROOF THK 3.16 N. NO ES. S.C. 1.0 DES. LOL LA 20.0 FT NOW TEMP 20.0 FT SHELL THICKNESS MATERIAL 20.0 FT 2.16" A - 3.6	O NAMEPLATE STAMPING DETAIL (STAMPING TO BE 1/4" MIN.)	B.L.M. Indus	2 2 2 2 2 2 2 2 2 2
TANK DATA SHEET	GENERAL NOTES. 1. TARS GRAINGS HAVE BEEN PENEWED FOR COMPLANCE WITH COOD INDUSTRY PRACTICES REFERENCING AP-12F AND THE APPLICABLE CONTRACT. 2. TARS DRAINGS HAVE BEEN PENEWED FOR COMPLANCE WITH COOD INDUSTRY PRACTICES REFERENCING AP-12F AND THE APPLICABLE CONTRACT. 3. LADDERS ARE IN COMPLANCE WITH OHES SPECIFICATIONS.	DESIGN NOTES 1. THIS TANK HAS BEEN BEEN DESIGNED FOR SIMULTANEDUS INTERNAL DESIGN PRESSURE AND WIND OVERTURNING. 2. THIS TANK MEETS THE VENING REQUIREMENTS OF APP-2000 WHEN EQUIPPED WITH THE VENTS SPECIFED ON THE GENERALARRANGEMENT DRAWING. 3. LITTING AND TALLING LUGS ARE FOR LIFTING EMPTY TANKS ONLY.	MATERIAL NOTES. 1. WIR REQUIRED FOR MAIN STEEL, PIPES AND FLANCES WILL BE ISSUED TO CUSTOMER FOR RECORDS UPON PROJECT COMPLETION. 2. THIEF HATCH NOZZLE IS FABRICATED AND CONSEQUENTLY IS NOT RAIDD AT CLASS 150.	EABRICATION NOTES 1. ALL SHELD STRUDGE VERTOAL CENTERLINES. 2. ALL ROOF NOZZES TO STRUDGE TANK RADIAL CENTERLINES UNLESS OTHERWSE SHOWN ON GENERAL ARRANGEMENT. 3. SHOP TO LOCATE LIFT LUCS, INSULATION STANDOFFS. 4. SHOP TRAL BIT ALL APPURTEMANCES PRIOR TO PAINTING OR COATING.	PAINTING & COATING NOTES **AL INTERNAL MERCHANT TO GREAT THEORESS READINGS AND RECORD SAME, ARE AS PER SSPC-PA2. **INTERNAL COATING HOLDAY DETECTION TO BE CONDUCTED IN ACCORDANCE WITH MACE RPO 188-90. **S. FLANGE FACES MAY RECEIVE INTERNAL COATING BUT ARE EXCLUDED FROM SPECIFIC BLAST AND MILS DET REQUIREMENTS.	G.A. NOTES CUSTOMER TO SPECIFY COMPANY CUSTOMER TO SPECIFY PROVE. BUS. CUSTOMER TO SPECIFY CUSTOMER TO SPECIFY EMAL: CUSTOMER TO SPECIFY CUSTOMER TO SPECIFY MSPECION DETAILS: CUSTOMER TO SPECIFY CUSTOMER TO SPECIFY	1. TANK ROOF & SHELL SHALL RECEIVE ARK/SCAP LEAK TEST TO 15,125 IN OF H ₂ O. 2. TANK FLOOR SHALL RECEIVE VACUUM BOX LEAK TEST TO 3.0 PSIG. 3. TANK SHELL—FLOOR WELD TO RECEIVE 100% MPL.	SHIPPING NOTES. 1. open commections shall be blanked with temporary shipping covers.
	Mo. REQUIRED 12-0° 0.0 x 20-0° HIGH	CESCH INT, PRESS & TEAP 16.0 cs./sq.in. @ 2007	SELIA SELIA ROOF	TITINGS OR FORGINGS A-234-WP3 A-403-WP3-304	EXTERNAL PREDABATION AND COATING 1. EXTERNAL PREDABATION AND COATING 3. EXTERNOR OF STRUCTURAL, SKO, 4. FITTINGS TO RECENCE. - BRUSH BLAST (SSPC SP7) - (1) COAT OF SHOP PRIMER - BRUSH BLAST (SSPC SP7) - (1) COAT OF SHOP PRIMER - BRUSH BLAST (SSPC SP7) - (1) COAT OF SHOP PRIMER MITERNAL PREPARATION AND COATING	O 1. INTERIOR OF PLOOR, SHELL ROOF, & FITHINGS TO RECEIVE. TO RECEIVE. - (16.0 TO 20.0 MILS DFT) OF DEVOE COATINGS. 100 EPCXY 2. REMOVABLE TANK INTERNALS TO RECEIVE. - (16.0 TO 20.0 MILS OFT) OF DEVOE - (16.0 TO 20.0 MILS OFT) OFT - (16.0 TO 20.0 MILS OFT) O	1. EXTERIOR OF SHELL & ROOF TO RECEIVE 2. Z. THK, SPRAY FOAM INSULATION C/W BLACK 2. SEALER & SELF PRIMING BLACK PANT ON ALL PROTRUSIONS	SPECIAL NIL





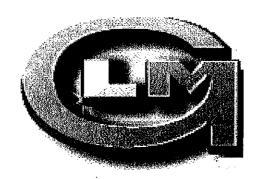






SECTION 2

CALCULATIONS



TANK DESIGN CALCULATION PACKAGE

V 2.6 FOR Husky Oil Operations Ltd. 12 ft - 0 in OD x 20 ft - 0 in Height Tag # TBD P.O. # 8400261587 GLM Job# 10-797-1/2 MADE BY: J. Brunton January 4, 2011

CHECKED BY:	 DATE:		
APPROVED BY:	DATE:		

Rev#	Date	By	Comments
0	1/4/2011	J. Brunton	Created Calculation Package
	·	<u> </u>	
···		ļ	
	<u> </u>		

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DESIGN CALCULATIONS

GLM Job# 10-797-1/2 Rev 0

MADE BY: J. Brunton DATE: 4-Jan-11

Tank Calculation Summary Sheet

V 2.6



API-650 11th E	Ed. Modified		•				1	GLM INDUS	TRIES L.P.
Size:									
Outside	Diameter =	12 ft - 0 in	App	rox Capacity =	402 BBL			Tag # TBD	
	Height =	20 ft	',,'	,		_		lag # ! DD	
•	-		_						
Design:	Pressure	1 psi	Vacuum	0.025 psi	@ Temp.	. 200 F		MDMT:	11 F

Service:	Water/S	lop Tanks	_	Product spe	cific gravity:	1.000		Floor CA	Nil
			_		- ,		_	_	
	Roof Load:	48.1 psf	_ Wind :	92 MPH	Seismic:	Nil		Roof C.A.:	Nil
		(2.3 kPa)		(147.1 Km/h)	-				···
ABC 2006 E	Invironment	al loads use	d for Edson						
Materials:									
	Roof		-36	Shell	A-	36	Bottom	A-3	6
	Pipe		106-B	Flange	SA-1	105N	Structural	G40.21-	-44W
	Bolting	A-193-B	7 A-194-2H	Gaskets	Manways - Ne	oprene	Other		
					Nozzles - S.S.	Flexitallic			
Roof	Slope:	2.25 : 12	Rafter Type	N/A		Bottom	Туре	Flat	t
	Thickness:		# Req'd	N/A			Thickness:	0.25	5
	Stiffener:	C3 x 4.1	_Ctr Column _	N/A			Anchors:	4	
	Radius:	N/A	_			1/2	Apex Angle:	N/A	\
0111							Stiffener:	N/A	<u> </u>
Shell	385 10 563						Skirt:	N/A	<u> </u>
Course	Width [ft]	Thkns [in]	CA			•			
1	5	3/16	0				Panel with Stee	Cladding	
2	5 .	3/16	0	Litting/	ailing Lugs:				
3	5	3/16	0		Venting:		np in Rate =		
4	5	3/16	0		N4 E		Out Rate =		l/hr
							Pressure =		
							Vent size requir		
							Free Vent size re		
							Tank Weights		
ĺ							12230 LB (55: 152999 LB (6:		
J	l						152999 LB (69		
·					Tankitu	ii oi vvatei.	125aaa FB (6	3545 Kg)	
Testing/Insp	ection:								
	test pressure:	15 -	1/8 in H2O						
									
Tank to be air/so	oap leak tested	1 .					-	*******	
Tank floor to be			IG				-		
Spot radiograph			· · · · · · · · · · · · · · · · · · ·				-		
All internal inspe	ections to obtai	n thickness rea	adings and record	same, are as pe	r SSPC-PA2				
Internal coating	holiday detecti	on to be condu	cted in accordan	ce with NACE RP	O 188-90				
				-					
Other Inform	nation:	-							
		··							
				····					
		. <u>-</u>	·						
					· · · · · · · · · · · · · · · · · · ·				
			· · · · · · · · · · · · · · · · · · ·						
									

GLM Job# 10-797-1/2 Rev 0

MADE BY: J. Brunton DATE: 4-Jan-11

Settings



Tank Calculations refe AISC ASD 9th Ed ABC 2006 / NBC 2006 API 650 11th Ed June	5	he following codes:			
Modified	V	See Notes:	Appendix J		Shop Built
Appendix A		Small Field Tanks	Appendix M		Elevated Temperature
Appendix E		Seismic	Appendix S		Stainless
Appendix F	V	Small Internal Pressure	Appendix V		External Pressure
Appendix I	1	Leak Detection	Appendix P		Nozzle Loads
Notes:					
1. Shell thickness determine	ed using th	e one foot method			
2. Snow loads determined r	eferencing	NBC 2005 / ABC 2006. The roof s	now load is determined	referenc	ing the
		ce factor and the snow load has a 1			, , , , , , , , , , , , , , , , , , , ,
	res from N	BC 2005 / ABC 2006 with a gust fac	tor of 2. Wind Analysis	s for over	turning
is based on API 650.					-
		······			
	***			····	

		· · · · · · · · · · · · · · · · · · ·			
Warnings	uro mor	ADI650 Ann D 2 io 6 4 or			

#REF!

GLM Job# 10-797-1/2 Rev 0

Page 5 of 30 MADE BY: J. Brunton
DATE: 4-Jan-11

Shell Thickness



GLM INDUSTRIES, L.P.

Tank Data:

Height

Nominal Diameter

11.984 ft

Sd =

23200

Specific Gravity

20 ft 1

Shell Joint Eff = E = 0.85

28,800,000 psi

St =

24900

psi

psi

Shell Thickness - Includes considerations for Apendices M, F and V as required

API 650 5.6.3.2

 $t_d = 2.6 * D * (H - 1) / (S_d * E) + CA$

H = Design Pressure plus liquid head at bottom of shell course under consideration

Course	Width	Minimum Design Thickness	Hydrotest Design Thickness	Actual Thickness
1 (Bottom)	5 ft	0.03367 in	0.0298 in	3/16 in
2	5 ft	0.02577 in	0.0225 in	3/16 in
3	5 ft	0.01787 in	0.0151 in	3/16 in
4	5 ft	0.00997 in	0.0077 in	3/16 in
5		İ		
6				
7				
8	•			·
9				
10				

Number of Intermediate Wind Girders Required

0

Number of Intermediate Vacuum RingsRequired

0

Bottom Thickness Required for external pressure

0.0880

in

GLM Job# 10-797-1/2

Rev 0

Page 6 of 30

MADE BY: J. Brunton DATE: 4-Jan-11

Shell Thickness API 650 5.6.3.2

```
Sd =
                                               23200
                                                          psi
 First Shell Course
                  t = 2.6 * D * (H_liquid + H_preshead - 1) * Spg / ( Sd_red * E ) + CA
                  t = 2.6 * 11.984 ft (20 ft + 1 psi * 27.7 / (12) - 1) * 1 / (23200 psi * 0.85) + 0 in
                                  0.0337
                  t, =
                               2.6 * d * ( H_liquid + H_preshead - 1 ) / St * E
                               2.6 * 12 ft * (20 ft + 1.26 ft - 1) / (24900 psi * 0.85)
                  t, =
                  t_t =
                                 0.0298
Note: Remaining shell courses calculated using same method.
Check Shell Thickness for external pressure per App V.8
CA excluded from shell stifness calculations
Elastic Buckling
                  (D / ts)^0.75 * (Hts / D) * (Fy / E)^0.5 > 0.19
                  ( 11.984 ft / 0.1875 in )^0.75 * ( 20ft / 11.984 ft ) * (36000 / 28800000psi )^0.5
                     1.334
                                                   0.19
                  Elastic Buckling will occur
(See wind overturning analysis for wind speed and pressure calculations)
                  Ps =
                              Max(Pe_{+}P_{H} + 0.4*Pe)
                  Ps =
                              Max(3.6 psf, 10.4 psf + 0.4 * 3.6 psf)
                  Ps =
                              Max( 3.6 psf, 11.9 psf)
                  Ps =
                                  11.88
                                           psf
Transformed Height of Shell
                  Hts = transformed width of shell
                                                                       t top =
                                                                                          0.1875
                                                                                                     in
                  Hts = \Sigma Wi * (t_top / ti)^2.5 / (# stiffeners + 1)
                  Hts = (5 * (0.1875 / 0.1875)^2.5 + 5 * (0.1875 / 0.1875)^2.5 + ...) / 1
                  Hts =
                                20.0000 ft
Minimum Shell Thickness on unsitffened shell (for stiffened shell use Hts between stiffeners)
                 t_{min} =
                              1.903 * ( Hts * Ps )^0.4 * D^0.6 / ( E^0.4 )
                              1.903 * ( 20 * 11.88 )^0.4 * 11.984^0.6 / ( 28800000^0.4 )
                 t<sub>min</sub> =
                  t_{min} =
                                 0.078
                                         in
                 t min applies to all shell courses
                 tsmin =
                                0.1875 in
Max External Pressure for an unstiffened Shell
                 Pmax =
                              0.2 * E / ( (Hts / D ) * ( D / tsmin )^ 2.5
                 Pmax =
                              0.2 * 28800000 psi / ( 20 ft / 11.984 ft ) * (11.984 ft / 0.1875 in )^2.5 )
                 Pmax =
                                105.680 psf
                 Pmax =
                                 0.734
                                           psi
```

Intermediate Stiffening Rings



GLM INDUSTRIES, L.P.

Intermediate Wind Girders

Maximum Height of Unstiffened Shell - API 650 3.9.7.1

 $Hu = 600,000 * t^2.5 / D^1.5 * (120 mph / V)^2$

 $Hu = 600,000 * (0.1875 in)^2.5 / (11.98 ft)^1.5 * (120mph / 91.41 mph)^2$

Hu = 379.435 ft

Number of intermediate wind girders Required

N = Hts / Hu

N = 20 ft / 379.44 ft

N =

0

Vacuum Stiffening Rings Per Appendix V (External Pressure must be greater then 0.0361 psi)

Hsafe = 0.2 *tsmin^2.5 * E / (D^1.5 * Ps)

Hsafe = N/A

Hsafe =

N/A

Ns =

Hts / Hsafe -1

Ns =

N/A

Ns=

0 -

0 Intermediate Girders Required

GLM Job# 10-797-1/2 Rev 0

Page 8 of 30 DATE:

MADE BY: J. Brunton DATE: 4-Jan-11

Bottom Thickness



Bottom Thickness

API 650 5.4.1

 $t_{bot1} = 1/4" + CA$

 $t_{bot1} = 0.25$ in

API 650 App V

If weight of bottom plate exceeds vacuum no further calculation is required

PE_{max} = density x thickness

 $PE_{max} = 0.284 \text{ lb in}^3 * 0.25 \text{ in}$

PE_{max} =

0.071 psi

 $t_{min2} = P_{ext} / density$

 $t_{mln2} = 0.025 \text{ psi / } 0.284 \text{ lb/in}^3$

 $t_{min2} = 0.0880$ in

Grillage Spacing - (If Required)

Grillage spacing = 28.76 in

Number of Supports = 6

tmin 4 = 0.2408 in

 $t_{bot} = Max(tmin1, tmin2, tmin4)$

 $t_{bot} = 0.2500$ in

MADE BY: J. Brunton DATE: 4-Jan-11

Self Supported Roof



psi

Tank Data:

Nominal Diameter = 11.984 ft

Height = 20 ft Sd = 23200

psf 48.13

Shell Joint Eff = 0.85

Roof Corrosion Allowance

E = 28,800,000 psi

Sts = 16000 psi

Consider CA for External Pressure? No

Conical Roof

API 650 3.10.5.1

θ= 10.62 Roof Slope = 2.25 in 12

Dead Load = 9.52 psf Roof Live Load = 37.18 psf Insulation Pressure = 1.85 psf External Pressure = 3.60 psf Additional Live Load = 0 psf

Load Combinations API 650 App R e)1 and 2

Roof Load 48.1 psf e) 1 e) 2 28 psf

in including corrosion allowance Minimum Roof Thickness = 0.1681

Min Compression Ring Area = -0.2421

in^2

C3 x 4.1 is sufficient for use as a top compression ring

NBC 2005 Snow Load

Design Snow Load = 0.8 * Ground Snow Load + Rain Load

Design Snow Load = 0.8 * 2.1 kPa + 0.1 kPa

Design Snow Load = 1.78 kPa Design Snow Load = 37.18 psf

Roof Load Combinations API 650 App R e)1 and 2

e)1

Roof Load = Dead Load + Snow and Live Load + 0.4 * External Pressure

Roof Load = 10psf + 37.18 psf + 0.4 * 3.6 psf

Roof Load = 48.13 psf

e)2

Roof Load = Dead Load + External Pressure + 0.4 * Snow and Live Load

Roof Load = 10 psf + 3.6 psf + 0.4 *37.18 psf

Roof Load = 27.99 psf

Dead Load

DL = ρ_plate * t_roof + P_insul + Additional Weight / A roof

DL = $(0.284 \text{ lb/in}^3 * 0.1875 \text{ in}) * 144 + 1.85 \text{ psf} + 0 \text{ lbs} / 113 \text{ ft}^2$

DL = 9.52 psf

Design Roof Load

T = Max(e.1, e.2)

T = Max(48.13 psf, 27.99 psf)

T = 48.13 psf

Roof Minimum Thickness

Appendix M 5.1 If Applicable

Temp Factor = E / E@temp

TF = 28800000 psi / 28800000 psi

TF = 1.0000

API 650 5.10.5.1

 $t_{roof1} = D / (400 * sin(\Theta)) * (T / 45)^0.5 * (TF) + CA$

 $t_{roof1} = 11.984 \text{ ft / (400 * sin(10.62))} * (48.13 \text{ psf / 45})^0.5 * 10 \text{ in}$

 $t_{roof1} = 0.1681$

App V - If External Pressure > 1inH 20

 $t_{roof2} = (D / sin(theta) * (T / (0.248 * E))^0.5 * TF / JEr$

 $t_{roof2} =$

 $t_{roof2} =$

 $t_{roof} = Max(t_{roof1}, t_{roof2}, t_{roof3})$

 $t_{roof} = 0.1681$ in

Roof to Shell Junction

API 650 5.10.5.2 - for self supported roofs only

$$A1_{req} = D^2 * T / (3000 * sin(theta) * 45) * TF$$

$$A1_{req} = (11.98 \text{ ft})^2 * 48.13 \text{ psf} / (3000 * 45 * \sin(10.62)) * 1$$

$$A1_{req} = 0.2779 \text{ in}^2$$

API 650 App F 5.1 - corroded condition

$$A2_{req} = (P - 8 * t - roof) * D^2 / (30800 * tan(theta))$$

$$A2_{req} = (27.7 - 8 * 0.1875) * 11.984^2 / (30800 * tan(10.62))$$

$$A2_{reg} = 0.6516 \text{ in}^2$$

$$A_{req} = Max(A1_{req}, A2_{req}, A4_{req}, A_{5req})$$

$$A_{reo} = 0.652 in^2$$

Roof to Shell Joint compression ring area Fig F-2

$$W_c = 0.6 * (Rc * (ts))^0.5$$

$$W_c = 0.6 * (71.81 * (0.1875))^0.5$$

$$w_c = 2.2016$$
 in (Corroded Condition)

R2 = Rc /
$$sin(\Theta)$$
 =
0.3 * (R₂ * (t_{h1})^0.5 < 12

$$W_h = 2.564$$
 in (Corroded Condition)

$$A_{roof joint} = W_h * t_r + W_c * t_s$$

$$A_{\text{roof-joint}} = 2.56 \text{ in * } 0.1875 \text{ in + } 2.202 \text{ in * } 0.1875 \text{ in}$$

$$A_{roof joint} = 0.894$$
 in 2 (Corroded Condition)

Required Compression ring Area

$$A_{C.R.} = A_{reg} - A_{roof joint}$$

$$A_{C.R'} = 0.652 \text{ in}^2 - 0.894 \text{ in}^2$$

$$A_{C.R.} = -0.2421 \text{ in}^2$$

$$A_{Actual} = 2.104 \text{ in}^2$$

C3 x 4.1 is sufficient for use as a top compression ring

389.662059 in



```
Roof to Shell Junction
Appendix V.7.2 - corrosion not included in design for external pressure
                    Xroof = 1.47 * ( D * tcone / sin( theta ))^0.5
                                  1.47 * ( 11.984 ft * 0.1875 in / sin( 10.62 ) )^0.5
                    Xroof =
                                     5.1330
                                                 in
top
                    X<sub>shell</sub> =
                                  1.47 * ( D * t_top )^0.5
                    X<sub>shell</sub> =
                                  1.47 * ( 11.984 ft * 0.1875 ) ^0.5
                    X<sub>shell</sub> =
                                      2.20
                                                 in
                    A4_{req} =
                                  Pr * D^2 / (8 * f * tan(theta))
                    A4_{red} =
                                  48.13 psf * 11.984^2 / (8 * 23200 * tan(10.62))
                                     0.0000
                    A4<sub>reo</sub> =
                                                 in²
Top Stiffener
                    A1<sub>stiff</sub> =
                                  (A_req - JE_s * t_top * X_{shell} - JE_r * tr * X_{cone}) / JE_{st}
                    A1_{stiff} =
                                  (0 in<sup>2</sup> - 0.85 * 0.1875 in * 2.2 in - 0.7 * 0.1875 in * 5.13 in ) / 0.7
                                                 in²
                    A1<sub>stiff</sub> =
                                     -1.464
                    A<sub>stiff</sub> =
                                  Max(0.5 * A4req, A1stiff)
                    A<sub>stiff</sub> =
                                  Max(0.5 * 0, -1.464)
                                              0 in2
                   A<sub>stiff</sub> =
For Anchored Tanks Only
API 620 -5.12.4
                                  0.6 * (R<sub>2</sub> * (t<sub>h</sub>))^0.5
                   W_h =
                                  0.6 * ( 389.662 * ( 0.1875 ) )^0.5
                   W_h =
                   W_h =
                                     5.1286 in (Corroded Condition)
                                 0.6 * (R<sub>c</sub> * (t<sub>c</sub>))^0.5
                   W_c =
                   W_c =
                                 0.6 * (71.81 * (0.1875))^0.5
                   W_c =
                                    2.2016 in (Corroded Condition)
                   R3 =
                                   71.81025 in
                   F≔
                                                                - additional downward force on Roof
                                        0
                   T_1 =
                                 (R3/(2*sin(theta))*(DL+(W+F)/A)
                   T_1 =
                                 (71.81 \text{ in } / (2 * \sin(10.62)) * (1 \text{ psi} + (-0.066 \text{ psi} + 0))
                   T_1 =
                                   181.9532 lb/in
                   T_2 =
                                 DP * R3 / sin(theta)
                   T_2 =
                                 1 psi * 71.81 in / sin( 10.62 )
                   T_2 =
                                   389.6621 In/in
```

API 620 5.10.3

```
T_{2S} =
             Pg * Rc
T<sub>28</sub> =
             1 * 71.81
T_{2S} =
                 71.81
                            lb/in
             T_2 * W_h + T_{2s} * W_c - T_1 * R_c * cos(th)
Q =
Q =
             389.66 * 5.13 + 71.81 * 2.2 - 181.95 * 71.81 * cos( 10.62 )
Q =
             -10685.81 lb
A5_{req} =
             Q/20000
A5_{req} =
             -10685.8 / 20000
A5_{req} =
                 0.53
                            in²
             Max(T1, T2)/(Sts * E) + RCA
t<sub>roof3</sub> =
             389.66 / (16000 * 0.7) + 0
t_{roof3} =
               0.03479 in
t_{roof3} =
```

Wind Overturning and Pmax



<u>Tank Data:</u>				Notes:		
Diameter	D	11.984	ft	1. Simultaneous wind	and pressure l	loading must be
Height	Н	20	ft	applied unless specific	cally waived by	the purchaser.
Roof plate thickness,corroded	th	0.1875	in	Roof weight	878	lb (Corroded)
Overturning resistance	D _{LS} =	8,022 lb	Excluding	g CA		
Design pressure	P	27.7	in H20 :	= 16.00 oz/i	$n^2 = .$	1.0000 psi

Wind Code:

See NBC2005 / ABC 2006 4.1.7 for de	finitions		
1/50 Hourly Wind Pressure, q =	0.46 kPa		
Gust factor, C _g =	2.00		
Exposure Factor, C _e =	0.91		
External Pres Coefficent, C _p =	1.0		
Force Coefficient, C _f =	0.600	(Cylindrical Surfaces)	
Importance factor, I _w =	1.0		
Design Shell Wind Pressure, ps =	0.5 kPa	=	10.44 psf
Design Roof Wind Pressure, p _r =	0.83 kPa	=	17.4 psf
Design Wind Speed, V =	91.41	mph	

Overturning Moments API650 5.11.2

4.4			
Mw	Mpi :	Mdl	Mf
(ft lbs)	(ft lbs)	(ft lbs)	(ft lbs)
36,790	97,326	53,325	223,342

Anchors Required

Anchors:
Number of anchors Anchor diameter

12.734

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```
API 650 5.11.2 - Corroded Condition
                              Mw = (arm * area * P_{H}) + (area * arm * P_{V})
Wind Moment
                              Mw = H/2 * OD * H * P_H + OD^3 / * 8 * 3.14 * P_V
                              Mw = 20 \text{ ft} / 2 * 11.984 \text{ ft} * 20 \text{ ft} * 10.44 \text{ psf} + (11.984 \text{ ft})^3 / 8 * 3.14 * 17.4 \text{ psf}
                              Mw =
                                                     36,790 ft lbs
Pressure Moment
                              Mpi = Pint * area * OD / 2
                              Mpi = 144 psf * 3.142 * (11.984 ft)^2 / 4 * 11.984 ft / 2
                              Mpi =
                                                     97,326 ft lbs
                              Mdl = (D_{LS} + Roof supported by Shell) * OD / 2
Resisting Moment
                              Mdl = (8899 lbs) * 11.984 ft/2
from tank weight
                              MdI =
                                                     53,325 ft lbs
Weight of fluid that resists overturning
                                             7.9 * t<sub>b</sub> * ( F<sub>y</sub> * H<sub>1/2</sub> * 0.7 )^0.5
API 650 5.11.2
                              W_a =
                              W_a =
                                             7.9 * 0.25 in * ( 36000 psi * 10 ft * 0.7 ) ^ 0.5
                              W_a =
                                                        991 lb/ft
Customer Specified Max
                              w =
                                             7.9 * tb * ( Fy * HLLL * SPG )^0.5
                                                        990 lb/ft
                              w =
                              W_{r} =
                                             w<sub>a</sub> * pi * D
                              W_1 =
                                             990 lb/ft * 3.14 * 11.98 ft
                              W_L =
                                                 37,273
                                                              Ιb
                              Mf =
                                             WI * D/2
Liquid Resisting
                              Mf =
                                             37273 lb * 11.98 ft / 2
Moment
                              Mf =
                                                   223,342 ft lbs
If Internal pressure exceeds the following limits then Anchors are required
5.11.2.1
                              P_{\text{max1}} =
                                             (MdI / 1.5 - 0.6 * Mw ) / (pi / 8 * D^3)
(Check empty Tank)
                              P_{max1} =
                                             (53325 ftlbs / 1.5 - 0.6 * 36790 ftlbs ) / (pi/8 * 11.98 ft ^3) * 0.111
                              P<sub>max1</sub> =
                                                  2.215
                              P<sub>mex2</sub> =
5.11.2.2
                                             [(Mdl + Mf)/2 - Mw]/(0.4 * pi/8 * D^3)
(Check half full tank)
                              P_{\text{max2}} =
                                             [( 53325 ftlbs + 223342 ftlbs ) / 2 - 36790 ftlbs ] / ( 0.4*pi/8 * 11.98 ft ^3 ) * 0.111
                              P_{\text{max2}} =
                                                 41.729
                              P_{max3} =
                                             0.245 * (D<sub>LS</sub>) / OD^2 + 8 * t_roof - 0.817 * Mw / OD^3
F4.2
(Check full tank)
                              P<sub>max3</sub> =
                                             0.245 * 8021 lbs / 11.984^2 ft^2 + 8 * ( 0.1875 in ) - 0.817 * 36790 ft lbs / 11.984^3 ft^3
                              P_{\text{max3}} =
                                                 -1.317
                                                                                                  -2.28
                                                                                                             inH2O
                                                              ΟZ
                              P<sub>max</sub> =
                                                 -1.317
                                                              ΟZ
                   Design Pressure =
                                                   16
                                                              οz
                              Anchors Required
Anchor Spacing (If Required)
             Min Number of Anchors = circumference / 10
             Min # Anchors = 11.984 ft * 3.14 / 10ft
             Min # Anchors =
```

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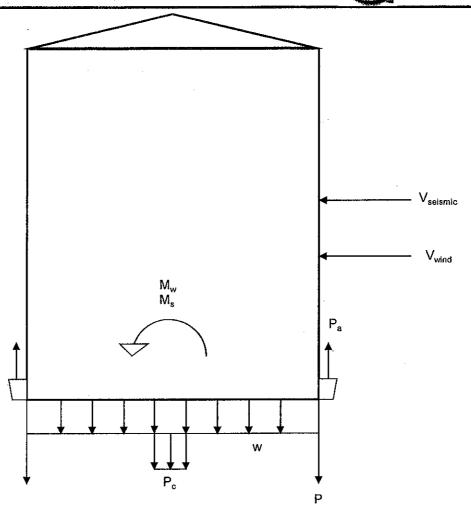


Estimated Tank Weights

Item	Uncorre	oded	Corre	oded
Roof	878	lb	878	lb
Top Angle	154	lb	154	lb*
Rafters	0	lb	0	`lb*
Columns	0	lb	0	lb*
Sheil	5,760	lb	5,760	lb
Secondary Shell	0	lb	0	lb
Cone Bottom	0	lb	0	lb
Cone Stiffener	34 4 50 to	lb	0	ib*
Skirt	0	lb	0	lb
Legs	0134	lb	0	lb*
Floor	1,249	lb	1,249	lb
Secondary Floor	0	lb	0	lb
Fittings	498	lb	498	lb*
Internals		lb	0	lb*
Attachments (skid)	1,500	lb	1,500	lb*
Insulation - Roof	216	lb	216	lb
Insulation - Shell	1,393	lb	1,393	lb*
Est Total, Empty	12,230	lb	12,230	lb
Total, Full of Product	153,000	lb	153,000	lb
Total, Full of Test Water	153,000	lb	153,000	lb

^{* -} corrosion not considered

^{* -} fittings weight is an approximation



Load	imperial		Metric
Perimeter Load, P (Includes Weight of tank minus weight of floor)	413.86 lb/ft	=	6. kN/m
Distributed load, w (Includes weight of bottom, liquid and internal pressure)	9.7 psi	=	67.16 kPa
Max Anchor Load, Pa (See anchor chair summary for list of anchor loads)	4,918 lb	=	2,235 kg
Column Load, Pc (Weight of column and roof supported by column)	N/A	Ξ	N/A
Seismic Shear, V _{seismic}	N/A	E	N/A
Wind Shear, V _{wind}	2,503 lb	=	1,138 kg
Wind Moment, Mw Seismic Moment, Ms	36,790 N/A ft lbs	=	49,881 N/A N m

Tank Data:				
Tank diameter	D =	11.98 ft	W1 =	7,950 lbf
Shell thickness (corroded)	ts =	.1875 in	W2 =	8,535 lbf
Bottom Thickness (corroded)	tb =	.25 in	W3 =	7,950 lbf
Roof Thickness (corroded)	th =	.1875 in	Pt =	15.13 inH2O
• ,			Pf =	. inH2O

Pf is only applicable to tanks with

API 650 - Table 5.21b - Uplift Loads (US Cu	stoman	/ Units)

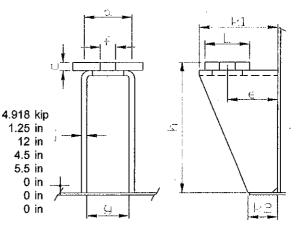
API 650 - Tabi	le 5.21b - Uplift Loads (US Customary U	frangible roofs			
Uplift Load	Net Uplift Formula (lbf) and calculated result - U	Allowable Anchor Bolt Stess	Total Anchor Bolt Load	Allowable Shell Stress	Shell Stress (no Repad)
Design Pressure	[(P-8*th)D^2 * 4.08] - W1 7,391 lbf	15,000 psi	7,391 lbf	20,000 psi	4,826 psi
Test Pressure	[(Pt-8*th)D^2 *4.08] - W1 34 lbf	20,000 psi	34 lbf	25,000 psi	22 psi
Failure Pressure	[(1.5 * Pf - 8*th)D^2 *4.08] - W3 -8,828 lbf	. Fy	0	36,000 psi	psi
Wind Load	[4 * Mw / D] - W2 3,745 lbf	0.8 x Fy	3,745 lbf	25,000 psi	2,446 psi
Seismic Load	[4 * Ms / D] - W2 N/A	0.8 x Fy	N/A	25,000 psi	psi
Design Presssure + Wind	[(P-8*th)D^2 *4.08] +[4 Mw / D] - W1 19,671 lbf	20,000 psi	19,671 lbf	25,000 psi	12,846 psi
Design Pressure + Seismic	[(P-8*lh)D^2 *4.08] +[4 Ms/ D] - W1 N/A	0.8 x Fy	N/A	25,000 psi	psi

Note: API 650 Formulas for Failure based solely on roof / shell failure - subject to future improvement

Worst Case, U =

19,671 lbf

of Anchors, N =



Max Anchor chair load (bolt load) Anchor bolt diameter Anchor chair height

h Anchor bolt eccentricity е Top plate width along shell Repad Height Н Repad Width Α Repad Thickness tr

> 7 in k1 k2 2.625 in j

đ

Vertical Side Plates: Plate width - top Plate width - bottom

Anchor Chair Data:

Plate thickness 0.5 in Washer Plate Data:

Distance between vertical plates 4.5 in g Washer Bolt Hole Diameter 1.375 in Washer plate thickness 1 in ¢ 4 in Washer plate length L

Sw 9.44 ksi 25 ksi Washer plate stress max = **ACCEPTABLE**

Welds:

Allowable weld stress across throat 9.6 ksi f Minimum weld size 0.0625 in

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Calculations

Washer Plate Stress - AISI T-192 Volume II Part VII (Anchor Bolt Chairs)

$$S_w = 1.5 * P * L/(c^2 * (g - f))$$

$$S_w = 1.5 * 4.918 \text{ kip} * 4 / (1^2 * (4.5 - 1.375))$$

$$S_{w} = 9.442$$

Reduction Factor

$$Z = 1.0 / (0.177 * a * m / (R * t)^0.5 * (m / t)^2 + 1.0)$$

 $Z = 1.0 / (0.177 * 5.5 in * 0.25 in / (71.904 in * 0.1875 in)^0.5 * (0.25 in / 0.1875 in)^2 + 1.0)$
 $Z = 0.8946$

Tank Shell Stress - for highest anchor load, remaining shell stresses calculated using same method

$$S = \frac{P \cdot e}{t^2} \left[\frac{1.32 \cdot Z}{\frac{1.43 \cdot \alpha \cdot h^2}{R \cdot t} + \left(4 \cdot \alpha \cdot h^2\right)^{0.333}} + \frac{0.031}{\sqrt{R \cdot t}} \right]$$

$$S = \frac{4.91 \text{ kip} * 4.5 \text{ in} * 1.32 * 0.89}{0.1875 ^{\circ}2} \frac{+ 0.031 / (71.904 \text{ in} * 0.1875 \text{ in})}{1.43 * 5.5 \text{ in} * 12^{\circ}2 \text{ in}^{\circ}2 + (4 * 5.5 \text{ in} * 12^{\circ}2 \text{ in}^{\circ}2)^{\circ}0.33} \frac{+ 0.031 / (71.904 \text{ in} * 0.1875 \text{ in})}{(71.904 \text{ in} * 0.1875 \text{ in})}$$

Shear in Weld

Max bending

Weld Stress

$$W = (Wv^2 + Wh^2)^0.5$$

$$W = (0.175^2 + 0.153)^0.5$$

$$W = 0.2334 kip / in weld$$

Min Weld Size

$$j_{min}$$
 = Max(1/2", 0.04*(h-c))
 j_{min} = Max(1/2, 0.04*(12-1))
 j_{min} = 0.5

check

Nozzle Design Data: (see table below)

D_o = outside diameter of nozzle [in]

t_n = nominal nozzle wall thickness [in]

 t_{min} = minimum nozzle wall thickness = (0.875 t_n - CA) [in]

 $D_{c.o.} = cutout$ opening in shell for nozzle [in]

Notes:

- 1. Based on corroded condition.
- 2. Nozzle wall thickness based on XS pipe.

Opening Reinforcement per Para. 5.7.2: (see table below)

 A_1 = area of excess metal in shell available for reinforcement = $(t_s - t_d)D_{c.o.}$ [in²]

 A_2 = area removed from cutout = $(t_{d-CA})D_{c.o.}[in^2]$

 A_3 = portion of nozzle projecting outward = 2 * 4(t_{min})² [in²]

 \dot{A}_4 = shell to nozzle cross-sectional area = 2 * $t_s t_{min}$ [in²]

Repad Requirement: (see table below)

If $A_1 + A_3 + A_4 < A_2$, Repad is Required

Sample Results for First Shell Course

	NOZZLE	DATA			REINFORC		REPAD REQ'D?	
$[D_o]$	[t _n]	$[t_{min}]$	[D _{c.o.}]	$[A_2]$	[A ₁]	$[A_3 + A_4]$	$[A_1 + A_3 + A_4]$	
3.500	0.3000	0.2625	3.625	0.1221	0.5576	0.6497	1.2073	no
4.500	0.3370	0.2949	4.625	0.1557	0.7115	0.8062	1.5176	no .
6.625	0.4320	0.3780	6.750	0.2273	1.0383	1.2848	2.3232	no
8.625	0.5	0.4375	8.750	0.2946	1.3460	1.6953	3.0413	. no
10.75	0.5	0.4375	10.875	0.3662	1.6729	1.6953	3.3682	no
12.75	0.5	0.4375	12.875	0.4335	1.9806	1.6953	3.6759	no
24.5 *	0.250	0.2188	24.625	0.8291	3.7880	0.4648	4.2529	no
THER:								
48.000	0.2500	0.2500	48.125	1.6204	7.4030	0.5938	7.9968	no

Nozzle Size	Repads Required for Shell Course:								
NPS	1	2	3	4	5	6	7	8	
3	No	No	No	No					
4	No	No	No	No					
6	No	No	No	No					
8	No	No	No	No					
10	No	No	No	No					
12	No	No	No	No					
24*	No	No	No	No					
48	No	No	No	No					

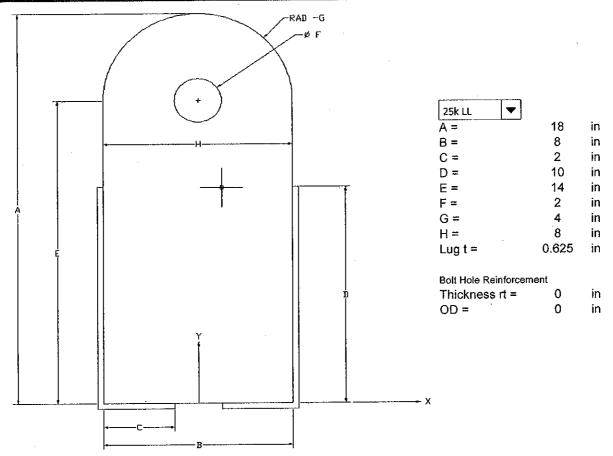
* - API 650 Shell Manway

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API 650 APP J3.8.3: Lifting lugs are to be designed to carry their share of twice the weight of the tank with a safety factor of 4.

5.85 OK

2.25 OK

Weld $\sigma_{\text{T.S}}$.:	70,000 psi	E70XX			
Weld Size	3/16 in		Tank Weight =	13,000	dl
Material: SA	516 Gr 70		Tank Height =	20	ft
σ _{τ.s.} =	70,000		Center of Gravity =	10	ft
σ _{Y.S.} =	38,000		Tailing lug height =	4.5	in
- 1.3.	•		radial distance to TL =	6.37	ft
Failure Modes	S		Tank OD =	11.984	ft
Tension Failur	·e	5.05 OK	LL Load =	13,000	1b
Hoop Tension	Failure	2.52 OK	Min Pin Diameter =	1.75	in
Bearing Stress	s Failure	2.88 OK			

Double Shear Failure

Weld Failure Governs Design

Weld Failure

Lifting Lug Design/Lift Analysis



Allowable Stresses API 650 APP J: Safety factor of 4 when lifting twice the tank weight

Tension Failure

$$\sigma_{AII} = \sigma_{T.S.} / 4$$

= 70000 psi / 4

$$\sigma_{AII}$$
 = 17,500 psi

Bearing Stress

Weld Failure

$$\sigma_{AII} = 0.9 * \sigma_{Y.S}.$$

= 0.9 * 38000 psi

Allowable stress is from AISC (J8-1)

Shear Failure

$$\sigma_{AII} = 0.4 * \sigma_{Y.S}.$$
= 0.40 *38000 psi

$$\sigma_{AII}$$
 = 15,200 psi

$$\sigma_{AII} = 0.25 * \sigma_{T.S.weld}$$

= 0.25 * 70000 psi
 $\sigma_{AII} = 17500$

17500 psi

psi

AISC F4 used for allowable Shear because it is more conservative than API 650 APP J

Critical Stresses

Lug stresses whenused on a tank

Tension Failure

$$\sigma = P / (t * (H - F))$$

 $\sigma = 13000 / (0.63 * (8 - 2))$
 $\sigma = 3,467$ psi

Hoop Tension Failure

5.05

2.52

 $\sigma = P/((G - F/2) * t + (OD/2 - F/2) * rt)$

$$\sigma = 13000 / ((4 - 2/2) * 0.625) + (-1) * 0$$

 $\sigma = 6.933$ psi

OK

FS =

Bearing Stress

 $\sigma = P / (t * Shackle Pin Diameter)$ $\sigma = 13000 / (0.625 * 1.75)$

σ= 11,886

OK

FS = 2.88

Double Shear Failure

 $\sigma = P/(2*t*g)$

 $\sigma = 13000 / (2 * 0.625 * 4)$ 2,600

OK

FS = 5.85

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Center of gravity of weld



Weld Check

x-bar = 0 in
y-bar =
$$D^2/(2C + 2D)$$

y-bar = $10^2/(2 * 10 + 2 * 2)$
y-bar = 4.167 in

$$J = 2 * J1 + 2 * J2$$

$$J1 = (D^3 * t/12) + D * t * [(B/2)^2 + (D/2 - y-bar)^2]$$

$$J1 = (10^3 * 0.133/12) + 10 * 0.133 * [(8/2)^2 + (10/2 - 4.167)^2]$$

$$J1 = 33.287 in^4$$

$$J2 = (C^3 * t/12) + C * t * [(y-bar)^2 + ((B-C)/2)^2]$$

$$J2 = (2^3 * 0.133/12) + 2 * 0.133 * [(4.167)^2 + ((8-2)/2)^2]$$

$$J2 = 7.101 in^4$$

$$J = 80.78 in^4$$

Lifting Lug Weld Stresses

$$\tau_x = P * \sin \Theta * (E - ybar) * (D-ybar) / J + P * \sin \Theta / ((D + C)*2 *t)$$

$$\tau_y = P * \sin \Theta * (E - ybar) * (B/2) / J + P * \cos \Theta / ((D + C)*2 *t)$$

$$\tau_{total} = (\tau_y^2 + \tau_x^2)^{1/2}$$

Table 1. Lifting Lug Stress (Twice tank Weight)
Distance Distance

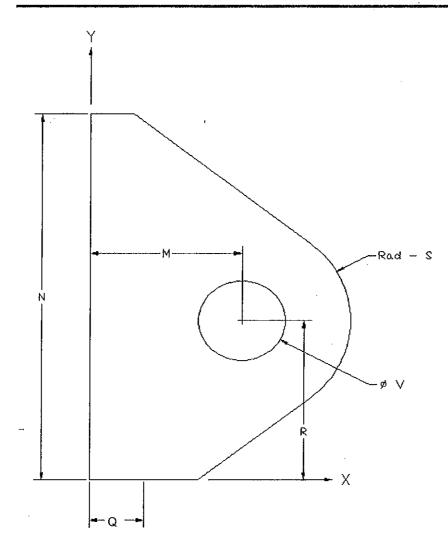
	LL from	TL from			Lifting Lug Weld
Angle	CG	CG	LL Load	TL Load	Stress (psi)
0	124	116	6,269	13,461	7,105
5	124	122	6,452	13,096	7,362
10	122	127	6,628	12,744	7,560
15	120	131	6,800	12,401	7,697
20	117	135	6,970	12,060	7,773
25	112	137	7,141	11,717	7,788
30	107	138	7,317	11,367	7,743
35	102	138	7,499	11,003	7,638
40	95	138	7,691	10,618	7,475
45	88	136	7,898	10,204	7,255
50	80	133	8,124	9,752	6,982
55	71	129	8,377	9,247	6,658
60	62	124	8,665	8,669	6,290
65	52	118	9,004	7,992	5,883
70	42	111	9,414	7,172	5,449
75	32	104	9,928	6,144	5,003
80	22	95	10,605	4,790	4,575
85	11	86	11,552	2,896	4,223
90	0	76	13,000	0	4,073

Max lifting Lug Shear Stress =

7,788 psi

ок





Lifting Lug	25 kTL	~
M =	4.5	in
N =	9	in
R =	4.5	in
S =	3.375	in
V =	2	in
Q =	2	in
Tail thickness =	0.75	in
Weld size	0.25	in
Shackle Pin =	1.75	

Max Tank Weight

13,000 lbs

T	L	0	n	T	а	n	k
---	---	---	---	---	---	---	---

Hoop Failure Governs Design						
Weld Failure	3.77					
Bearing Failure	3.33					
Double Shear Failure	5.72					
Hoop Failure	2.32					
Tension Failure	4.63					

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Critical Stresses

Bearing Stress Tension Failure $\sigma = P/(t*(2*S-V))$. $\sigma = P / (t * Shackle Pin D)$ $\sigma = 13461 / (0.75 * 1.75)$ $\sigma = 13461 / (0.75 * (2 * 3.375 - 2))$ σ= 10256 psi 3,779 psi OK OK Tank FS = 3.33 Tank FS = 4.63 **Double Shear Failure** Hoop Tension Failure $\sigma = P/(2*t*S)$ $\sigma = P/((S-V/2)*t)$ $\sigma = 13461 / (2 * 0.75 * 3.375)$ $\sigma = 13461 / ((3.375 - 2/2) * 0.75)$ σ= 2,659 σ≂ 7,557 psi

OK

Tank FS =

5.72

Weld Check

OK

Tank FS =

Weld Center of Gravity

2.32

```
X_bar = 0.5 * Q^2 / (N + Q)
X_bar = 0.5 * 2^2 / (9 + 2)
X_bar = 0.182 in
Y_bar = 0.5*N^2 / (N + Q)
Y_bar = 0.5 *9^2 / (9 + 2)
Y bar =
             3.682 in
J1 = t * N^3 / 12 + N * t * (X^2 + (N/2 - Y)^2)
J1 = 0.177 * 9^3 / 12 + 9 * 0.177 (0.182^2 + (9/2 - 3.682)^2)
J1 =
            11.871 in^4
J2 = t * Q^3 / 12 + Q * t * (Y^2 + (Q/2 - X)^2)
J2 = 0.177 * 2^3 + 0.177 * 2 * (3.682^2 + (2/2 - 0.182)^2)
J2 =
             5.154 in^4
J = 2 * (J1 + J2)
                                - Welded on both sides
J = 2 * (11.87 + 5.15)
             34.05 in^4
```

Lifting Lug Weld Stresses

```
T = P * cos(theta) * (R-Ybar) - P * sin(theta) * (M-Xbar)
\tau_x = T * Ybar / J + P * cos(theta) / (t * (N + Q))
\tau_y = T * Xbar / J + P * sin(theta) / (t * (N + Q))
```



 $T_{\text{total}} = (T_y^2 + T_x^2)^{1/2}$

Table 2. Tailing Lug Stress (Twice tank Weight)

		Weld			Weld
	TL Load	Torque	T _x	τ_{y}	Stress
Angle	(lbs)	(lb in)	(psi)	(psi)	(psi)
0	13,461	11,011	4,648	59	4,648
5	12,963	5,685	3,931	321	3,944
10	12,464	695	3,227	560	3,276
15	11,966	-3,918	2,544	774	2,660
20	11,467	-8,121	1,889	964	2,121
25	10,969	-11,884	1,268	1,127	1,696
30	10,470	-15,188	686	1,263	1,438
35	9,971	-18,015	150	1,372	1,381
40	9,473	-20,356	-338	1,455	1,494
45	8,974	-22,210	-772	1,511	1,697
50	8,476	-23,579	-1,151	1,541	1,923
55	7,977	-24,473	-1,471	1,547	2,135
60	7,479	-24,907	-1,733	1,530	2,312
65	6,980	-24,903	-1,935	1,491	2,443
70	6,481	-24,486	-2,078	1,433	2,525
75	5,983	-23,687	-2,164	1,357	2,554
80	5,484	-22,542	-2,193	1,267	2,532
85	4,986	-21,091	-2,169	1,163	2,461
90	4,487	-19,375	-2,095	1,049	2,343

Max Stress =

4,648 psi

F.S. =

3.765 On Tank

API-650 App I: Grillage Requirements



Liquid Height H = 20 ft

Specific Gravity G = 1

Design Pressure $P_d = 27.700$ in H20 = 1 psi

Hydrostatic Pressure at tank bottom P = 9.74 psi

Bottom Plate Thickness $t_g = 0.25$ in

Bottom Plate Corrosion Allowance CA = 0 in

Bottom Plate Material $F_y = A-36$ psi

Bottom Plate Yield Strength $F_y = 58000$ psi

Center-Center Grillage Spacing: b = 28.762 in

Grillage width: w = 6 in

Number of Supports: N = 6

Calculations

$$t_{bottom} = ((b - w)^2 * P / (1.5 * Fy))^0.5 + CA$$

$$t_{bottom}$$
 = ((28.76 in - 6 in)^2 * 9.74 psi / (1.5 * 58000 psi))^0.5 + 0 in

 $t_{bottom} = 0.2408$ in

Check floor deflection

$$d_{max} = 0.0284 * p * (b - w)^4 / (E * (tg - CA)^3)$$

$$d_{max} = 0.0284 * 9.74 * (28.76 - 6)^4 / (28800000 * (0.25 - 0)^3)$$

 $d_{max} = 0.16$ in

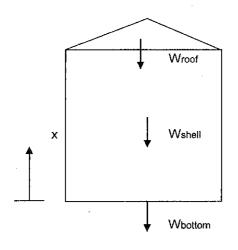
 $d_{limit} = (tg)/2$

 $d_{limit} = 0.125$ in

Page 28 of 30

MADE BY: J. Brunton

DATE: 4-Jan-11



Weight of Roof	878	lb
Centroid of roof, x	244.49	in
Weight of Shell	5,760	lb
Centroid of shell, x	120	in
Weight of Bottom	1,249	lb
Centroid of Bot, x	0.125	in
Weight of Insulation	1,393	lb
Centroid of In, x	120	in
Weight of top angle Centroid of T.A., x for C3 x 4.1 3/8" fror Weight of Product Centroid, x	154 238.125 n top of shell 132,196.63 120	lb in lb ft
Other Weight Centroid, x	,1500 3	

Approx Center of Gravity $Sum(x_iW_i)$ (Empty) Sum(Wi)

= (877 lbs * 244 in + 5760 lbs * 120 in + 1248 lbs * 0.125 in + 1393 lbs * 120 in + 154 lbs * 238.125 in + 1500 lbs * 3 in) (877 lbs + 5760 lbs + 1248 lbs + 1393 lbs + 154 lbs + 1500 lbs)

101.92 in

8.49 ft

Approx Center of Gravity

 $Sum(x_iW_i)$ Sum(Wi)

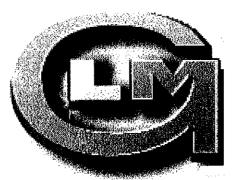
(Full)

= (877 lbs * 244 in + 5760 lbs * 120 in + 1248 lbs * 0.125 in + 1393 lbs * 120 in + 154 lbs * 238.125 in + 1500 lbs * 3 in + 132196 lbs * 120 in) (877 lbs + 5760 lbs + 1248 lbs + 1393 lbs + 154 lbs + 1500 lbs + 132196 lbs)

118.62 in

9.88 ft

NOTE: The above approximation does not include the effects from nozzles and attachments. Therefore it is to used as a guide only.



G.L.M. INDUSTRIES L.P.

Appendix Contents Supporting Calculations

Title	Number of Pages
Base Skid Analysis	3
	· · · · · · · · · · · · · · · · · · ·
	<u> </u>

APPENDIX 1: BASE SKID ANALYSIS



G.L.M. TANKS & EQUIPMENT LTD.

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Toll Free (866) 672-0777

Toll Free (800) 661-9828

Toll Free (800) 661-9446

BASE SKID ANALYSII:

ASSUME (6) MAIN BEAMS TAKE THE ENTIRE WEIGHT

RESULTANT LOADING, L. WEIGHT =
$$\frac{172486}{2(2)(35)+(2)(28)} = 24516/in$$



NOTE: LENGTH 'L' ASSUMED AS DISTANCE ON OUTER MEMBERS OF SKID BETWEEN PILE LOCATIONS.

Visit us at the GLM web site www.glmtanks.com

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Toll Free (800) 663-7785

Toll Free (866) 672-0777

Toll Free (800) 661-9446

$$R = \frac{WL}{2} = \frac{(245)(56.5)}{2} = 692/16.$$

$$M = \frac{1}{8} = \frac{(245)(56.5)^2}{8} = 97.763$$
 Ibin

$$A_{REOD} = \frac{R}{\sigma_{V_{ALL}}} = \frac{6921}{17400} = 0.40 \text{ in}^2$$

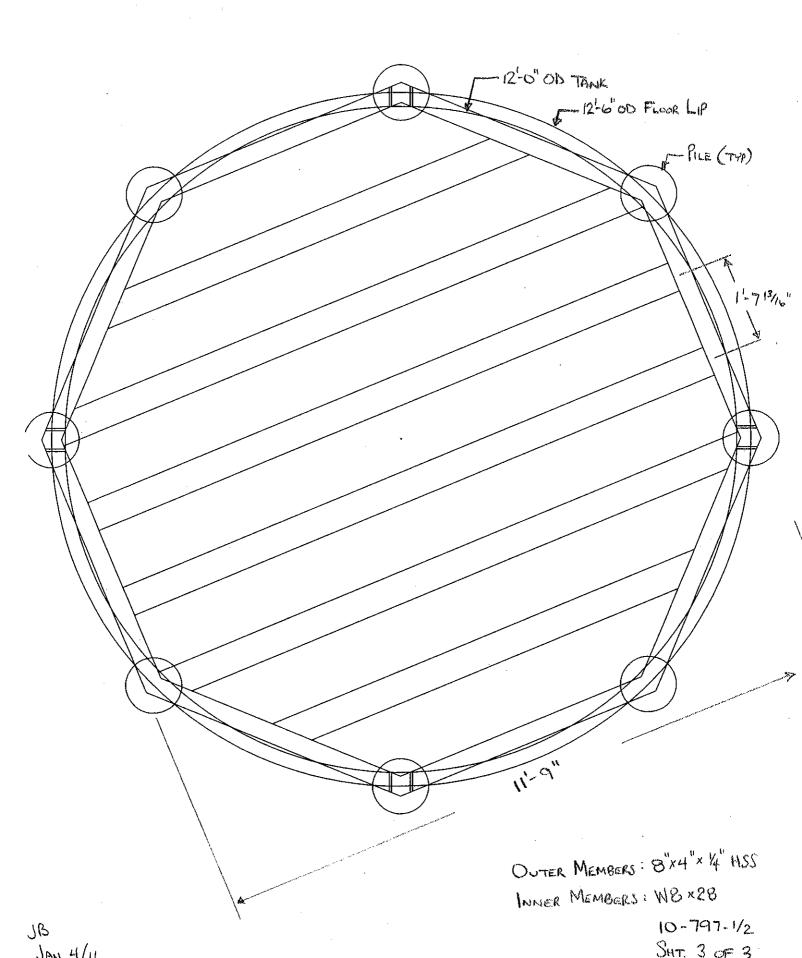
CHECK LAMER BEAMS!

$$A_{REGO} = \frac{R}{\sigma_{Vall}} = \frac{WL}{2\sigma_{Vall}} = \frac{(245)(135)}{2(17400)} = 0.95 \text{ in}^2$$

$$S_{Regio} = M = \frac{ML^2}{865_{ML}} = \frac{(245)(135)^2}{8(26100)} = 21.4 in^3$$

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G.L.M. INDUSTRIES L.P.

SECTION 3 MATERIAL TEST REPORTS



MATERIAL IDENTIFICATION SHEET

GLM JOB #	t:	DESCRIPTI	ON:	CUSTOMER:			FAB. FACILITY: Nisku
10-797-1). X 20'-0" HIGH 400 BBL Vater Tank (T-320)	Husky Energy	c/o Excelsior Engi	neering Ltd	Date: June 30'11
DWG#	PC#	QTY	DESCRIPTION		MATERIAL	DWG MARK	HEAT#
3	2	1	1/4" PLATE X SKE	TCH	A36	N1	A0P0896
3	4	1	10" STD ERW P	IPE	A-53-B	N1	58142
3	10	1	3" XS RFWN 15	0#	SA-105N	N8	70225
3	11	1	3" XS SMLS PII	PE	SA-106-B	N8	965485
3	12	1	4" XS RFWN 15	0#	SA-105N	N6	80407
3	13	1	4" XS SMLS PII	PE	SA-106-B	N6	24137
3	14	1	4" RFBL 150#	*	SA-105N	N6	10/31380
3	17	1	4" XS RFWN 15	0#	SA-105N	N5	80407
3	18	1	4" XS SMLS PII	PE	SA-106-B	N5	24137
3	19	1	4" XS RFWN 15	0#	SA-105N	N7	80407
3	20	1	4" XS SMLS PI	PE	SA-106-B	N7	24137
3	21	1	4" RFBL 150#	<i>t</i>	SA-105N	N7	10/31380
3	24	1	3" XS RFWN 15	0#	SA-105N	N2	70225
3	25	1	3" XS SMLS PI	PE	SA-106-B	N2	965485
3	26	1	3/16" THK REPAD X	SKETCH	A36	N2	1457V
3	27	1	3" XS RFWN 15	0#	SA-105N	N9	70225
3	28	1	3" XS SMLS PI	PE	SA-106-B	N9	965485
3	29	1	3" XS RFWN 15	0#	SA-105N	N3	70225
3	30	1	3" XS SMLS PI	PE	SA-106-B	N3	965485
3	35	1	1 1/2" NPT FULL COUPL	ING 3000#	SA-182-F304		Q268
3	36	2	1 1/4" NPT COUPLING	G 3000#	SA-182-F304	_	87B1
3	37	1	1" NPT COUPLING 3000#		SA-182-F304		N936
4	1	1	3" XS RFWN 150#		SA-105N		70225
4	2	1	3" XS SMLS PI	PE	SA-106-B		965485
4	23	1	3" RFSO 150#	#	A-105		RVC-232
50	1	4	3/16" PLATE		A36		1457V
50	B1	2	1/4" THK PLATE X S	KETCH	A36		NT8184
50	R1	2	3/16" THK REPAD X	SKETCH	A36		NT7748

Page #:1 of 1

Tusca loosa, AL 35404-1000 800-827-8872 1700 HOLT NO N.E.

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We hereby certify that the product described above passed all of the tests required by the speci

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DATE: AUG 18 2010 REVIEW BY: CONFORMS TO ASMES II A 를 Tenaris

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INSPECTION CERTIFICATE

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

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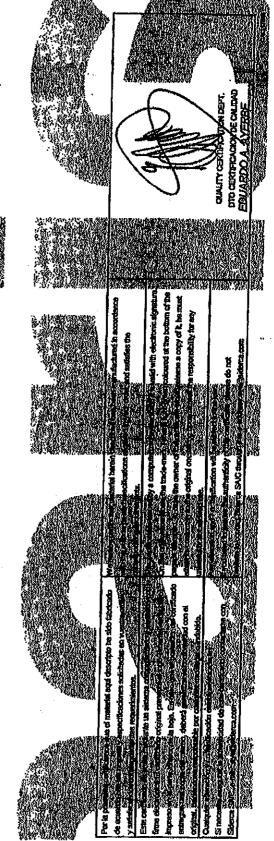
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CERTIFICATO DI COLLAUDO SECONDO EN 10204-3.1 INSPECTION CERTIFICATE

DesiDated 28.06.2010 DesiDated 28.05.2010 DesiDated 28.05.2010 DesiDated Certif. N. 2570 Fathers / Invoice N. 1921 DOT / Del Mote H. 3523 NS.Ond / Our 195. N. Unit 1E, Block 71, The Plaza Mangor Road DUBLIN 12 GLOBAL GAEL SERVICE LTD

W

Pag.3 - 9

VISIND E DIMENS, VIS. & DIMENS, SATISFACTORY	PARTE OTRIGINE / OFFICIA EUROPE	VISWO E DIMERIS. VIS. & DIMERIS. SÁTISFACTORY	MARKE ORIGINE / ORIGIN EUROPE	VSIVO E DIMENS. VIS. & DMENS. SATISFACTORY	ORIGNE / DRIGH
DHALIN ACC., A DHAL ACCORDANCE TO ASMIE/ANSI B18.5 M26 N% A/% C.E.% B.013 D.000 D.005 A.005	TEST - LOSE FRANCE ST. 28 P.	DIM IN ACC. A DIM IN ACCORDANCE TO ASMEEANS! B16.5 Nb% N% AW CE% 0,003 9,009 9,005 0,407	7.154 - JOHNSONS 1 2 3 30 FORMO FORMO ELECT	DM.IN ACC. A DM. ACCOPDANCE TO VIS. & DM. ASMEJANSI B16.5 SATISFA NDS. NS. A.S. C.E.S. 0.002 0.003 0.029 0.339	TTEST - JOHNSOne 20 ST 30 FORMO
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DESCRIPTION WIN 150 RF 4" STD P% G% 1 0,014 0,140 0	ALEMENTER CONTRACTOR ELONCATION REDUCTION OF AREA 31,0 59,0 TRATTAN NORMA	DESCRIPTION DESCRIPTION WIN 150 RE 4" STD P% C% 1	SENCTRONION SENCTRONION SENTRONION SENTRONIO	DESCRETIONE DESCRETION WIN 150 RF 3" XS P% CP% BM12 B,100	CONTRICTONE RESULTIVING FAREA 'S-8.0 TRATTAM NORMAN
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MARCHO PRODUZIONE MANUFACTURERS SYMBOL	(M)
ENTE UFFICIALE DI COLLADO RISPECTIOR AUTHORATY	
UFFICE CONTROLLO QUALITATO CUALITATO CUALITY CONTROL DEPARTEMENT	Int Longicol
NOTE BATERAL IN ACCREMENT WAS INFORMED SO 19156 NOTES BATERAL IN ACCREMENT MACE INFORMATION STATEMENTS OF STATEMEN	DATE: SEP 07.2010 REVIEW BY: 48 CONFORMS TO ASMES! 19 EDITION / ADDENDA: 20096

vam france
TUBERIS SAINT SAULV
SAINT SAULVE
ZONE INDUSTRIELLE
59880 SAINT SAULVE



VALLOUREC & MANNESMANN TUBES

Valicures Group

MATERIAL TEST	REPORT.
3.1 EN 10204 ; 20	104

No. : 110705v10 Page: 1/5 Date: 19.11.2010

(A03)

3 XH A106

angle 30° (+57-0), root face 1.6 mm (± 0.8) Inside without rust protection Outside dry vernish As rolled API spac. 5 L, PSL.1, 10.2007 ASTM A 106 M - 08 / ASTM A 530 M - 04 A ASME 5A 106, Edition 2007 / ASME 9A 530 M, Edition 2007 ASME Boiler and Pressure Vessel Code, Section II, Partie A, Edition 2007, Addends 2009b OSA Z 245.1:2009 Nace MR 0175 / ISO 15156-2:2003 / COR.1:2006 / EN ISO 15156-2:2003, Annexe A.2.1.2 Nace MR 0103-2005, Paragraphe 2.1 X 42 Grade B acc. to API spac. 6 L	(A)) V&M FRANCE		(A08.1) V&M-Order-No. LA1989
Customer CCTF CORPORATION 5407 -53RD AVENUE EDMONTON AB T6B 3G2 T6B 3G2 (x05.2) Crdersr VALLQUREC TUBES CANADA INC. / BURLINGTON, ONTARIO L7L 6G4 (x07.3) Crder-No. VM2454 Date 20.07.2010 (x07.4) Crder-No. 4688381-00 (x07.4) Crder-No. 4688381-00 (x07.5) Crder-No. 4688381-00 (x07.6) Crder-No. 4688381-			
Order-No. VM2454 VALLOUREC TUBES CANADA INC. / BURLINGTON, ONTARIO L7L 664 (A7.3) Creir-No. 4888381-00 Hot finished seamless line pips Ends bevelled, angle 30° (+5 f -0), not face 1.6 mm (± 0.8) Inside without rust protection Outside dry varnish As rolled API spac, 5 L, PSL1, 10.2007 ASTM A 106 M - 08 / ASTM A 530 M - 04 A ASME 5A 106, Edition 2007 / ASME 9A 530 M, Edition 2007 ASME Boller and Pressure Vessel Code, Section II, Partie A, Edition 2007, Addenda 2009b OSA Z 245, 1;2009 Nace MR 0175 / ISO 15156-2;2003 / COR.1;2005 / EN ISO 15156-2;2003, Annexe A.2.1.2 Nace MR 0103-2005, Paragraphe 2.1 X 42 Grade 8 acc. to API spac. 6 L	Customer CCTF CORPORATION 5407 -53RD AVENUE	392	
(801, 802, 804) Description of the product Ends bevelled, angle 30° (+57 -0), root face 1.6 mm (± 0.8) Inside without rust protection Outside dry vamish As rolled API spec, 5 L, PSL1, 10.2007 ASTM A 108 M - 08 / ASTM A 530 M - 04 A ASTM SA 106, Edition 2007 / ASME SA 530 M, Edition 2007 ASME Boller and Pressure Vessel Code, Section III, Partile A, Edition 2007, Addenda 2009b OSA Z 245.1:2009 Nace MR 0175 / ISO 15156-2:2003 / COR.1:2005 / EN ISO 15158-2:2003, Annexe A.2.1.2 Nace MR 0103-2005, Paragraphe 2.1 X 42 Grade B acc, to API spec, 5 L	Ordens VALLOUREC TUBES CANADA	inc./Burlington, Ontario L7L	Order-No. VM2454
Ends beveiled, angle 30° (+5 / -0), root face 1.6 mm (± 0.8) Inside without rust protection Outside dry varnish As rolled API spec, 5 L., PSL 1, 10,2007 ASTM A 106 M - 08 / ASTM A 530 M - 04 A ASME SA 106, Edition 2007 / ASME SA 530 M, Edition 2007 ASME Boiler and Pressure Vessel Code, Section II, Partie A, Edition 2007, Addende 2009b OSA Z 245.1:2009 Nace MR 0175 / ISO 15156-2:2003 / COR.1:2006 / EN ISO 15156-2:2003, Annexe A.2.1.2 Nace MR 0103-2005, Paragraphe 2.1 X 42 Grade B acc. to API spec. 6 L			1 7
Grade 290 acc. to CSA Z 245.1, Cet. I	Description of the product	Ends beveiled, angle 30° (+5 / -0), mot face 1.6 mm (Inside without rust protection Outside dry vernish As rolled API spac, 5 L, PSL 1, 10.2007 ASTM A 106 M - 08 / ASTM A 530 M ASME SA 106, Edition 2007 / ASME: ASME Boiler and Pressure Vessel Co Edition 2007, Addenda 2009b OSA Z 245.1;2009 Nace MR 0175 / ISO 15156-2;2003 / 0 EN ISO 15156-2;2003, Annexe A.2.1. Nace MR 0103-2005, Paragraphe 2.1 X 42 Grade B acc. to API spac. 6 L Grade B scc. to ASTM A 106 M / ASM	- 04 A BA 530 M, Editlon 2007 de, Saction II, Parlle A, COR,1:2005 / 2

(A15)	(109)	(814)	(809)	(810)
V&M Item	Cust Item	itom text	Dimensions	Single length
14		8KŲ No 2520419	NPS 3 SCH 8D	Fixed length 20 Ft + 4 in - 0 in
ĺ		<u>-</u>	OD-Telerance + 0.76 % - 0.76 %	
		·	WT-Tolerance + 15 % - 12.5 %	

سينجن زهمه والتراجي وأجنانا والم		
Carran	VERIFICATION	STAWP
(4) 3 6 4	A Paris and Contract	

REVIEW BY:

V&M FRANCE
TUBERIE SAINT SAULVE
SAINT SAULVE
ZONE INDUSTRIELLE
59860 SAINT SAULVE

(A01)



VALLOUREC & MANNESMANN TUBES

Valloureo Group

MATERIAL TEST REPORT - INSPECTION CERTIFICATE

3.1 EN 10204 : 2004

No.: 110705v10

(A03)

(A02)

Page: 2 / 5 Date: 19.11.2010

(A13)	(A09)	(807.1)	(864)	(911)	(B13)
V&M Item	Cust item	Heat	Quantity	Total langth	Weight
				ft	1b
14		985485	253	5.102,030	51.831

(C71)

HEAT CHEMICAL ANALYSIS

For each reduction of 0,01% cerbon below 0.30 %, an increase of 0,05% manganese above 1.06 % would be parmitted to a maximum of 1,35% manganese.

(B07.1)	(918)										
Heat	Process	C	81	Mn	P	\$	Cr	Mo	NI	Cu	ΤI
		%	%	%	%	%	%	%	%	%	%
min	•	•	0,10	0,29	•		٠	-	•	•	•
mex		0,28	0,60	1,08	0,030	0,030	0,40	0.15	0,40	0,40	6,11
965485	Elactric (EAF)	0,15	0,19	0,74	0,016	0,002	0,23	80,0	0,08	0,16	0,00

(607.4) Heat	Nb/Cb %	٧ %	B %	0002 %	2528	0014 %	1003 %	1099 %		
min		٠	-	•	3,00	•	·	•		
max	0,11	0,08	0,001	0,15	<u> </u>	1,00	0,40	0,40		
985485	0,00	0,00	0,000	0,00	4,84	0,52	0,35	0,33		

0002	V+NB+TI
2528	MN/C
0014	CR+CU+MO+NI+V
1003	CE = G+MN8+(CR+MO+Vy5+(NI+CUy15
1099	C+F(MN/8+81/24+CU/15+N1/20+((CR+MO+V+NB)/5)+5*B)

Heats fully killed

(C73)

PRODUCT CHEMICAL ANALYSIS

For each reduction of 0,01% carbon below 0.30 %, an increase of 0,05% mangenese above 1.06 % would be permitted to a maximum of 1,36% mangenese.

VSM FRANCE
TUBERIE SAINT SAULVE
SAINT SAULVE
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59860 SAINT SAULVE

(A01)

VM

VALLOUREC & MANNESMANN TUBES

Valloures Group

MATERIAL TEST REPORT -INSPECTION CERTIFICATE

3.1 EN 10204 : 2004

No.: 110708v10

(403)

(402)

Page: 3/ 5

Date: 19.11.2010

(673)

PRODUCT CHEMICAL ANALYSIS

(807.1)	(000.1)										1
Heat	Test Place	C .	Si	Mn	P	8	Cr	Mo	NI	Cu	n
		%	%	%	%	%	%	%	%	96	%
mln		•	0,10	0,29		•	-	•	•		-
max	<u> </u>	0,28	0,60	1,06	0,030	0,030	0,40	0,15	0,40	0.40	0,11
965486	01DL276	0,18	0,19	0,75	0,018	0,002	0,23	0,06	80,0	0,16	0,00
985485	02DL276	0,18	0,19	0,78	0,017	0,002	0,23	0,08	0,08	0,16	0,00

(807.1)	(C00.1)										
Heat	Test Place	Nb/Cb	٧	B	0002	2528	0014	1003	1099	l	
	İ	%	%	%	%	•	%	%	%		
wla		•	•	•	•	3,00	•	•	•		
max		0,11	0,08	0,001	0,15	•	1,00	0,40	0,40		
965485	01DL276	0,00	0,00	0,000	0,60	4,70	0,53	0,36	0,35		
985486	02DL276	0,00	0,00	0,000	0,00	4,61	0,53	0,36	0,35		

0002	V+NB+TI
2528	MN/C
0014	CR+CU+MO+NI+V
1003	CE = C+MN/8+(CR+MO+V)/6+(NI+CU)/16
1099	C+F(MN/8+91/24+CU/15+N1/20+((CR+MO+V+NB)/5)+5*B)

(804)

HEAT TREATMENT

NORMALIZED CONDITION MIN 920°C (1688 F) COOLING AIR

TENSILE TEST RESULTS

Type (c10.1)
Tube strip specimen
Test temperature (c03)
Room temperature
Direction (c02)
iongitudinal

DOUBLE LENGTH

VAM FRANCE
TUBERIE SAINT SAULVE
SAINT SAULVE
ZONE INDUSTRIELLE
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JA01)



VALLOUREC & MANNESMANN TUBES

Vallouree Group

MATERIAL TEST REPORT -INSPECTION CERTIFICATE

3.1 EN 10204 : 2004

No.: 110708v10

(403)

(A02)

Page: 4 / 5 Date: 19.11.2010

TENSILE TEST RESULTS

(807.1) Heat	(coo.s) Test Piece	(C10.2) Dimension	(011) YS	(C12) TS	(C13.2) Elong,				
		in/eqin	R _{p0,2} pal	R _m pgi	2° %				
m!n		•	42000	60000	24,0	 1	1		
max		•	•	-	-	<u> </u>		 	
965465	01DL276	0,74x0,30 0,22	47296	72975	33,8				

(C10.2)

Dimension

Test place dimensions

Test place area

HARONESS TEST RESULTS

99 HRB EQUIVALENT TO 22 HRC

Mathed	of to	et i	6361

Rockwell B

(807.1) Host	(coo.1) Test Place	(031.1) HRB	(C31.1) HRB	(011.1) HRB	(C32.1) Mean		 		
min		,	•	•	.			1	
max		99,0	99,0	99,0	•		 		
965485	0101.276	81,0	81,0	81,0	81,0				

(CBC)

TECHNOLOGICAL AND OTHER TESTS ON SPECIMENS

1	Test		Test rate	Result	
ł	Flattening test	Flattening tost (specific)		Salisfactory	

(054)

OTHER TESTS ON PIPE

CHER TESTS ON PIPE	Conditions	Test rate	Result
Test Hydrostatic test	2973 PSI	100% each lot	Satisfactory -
Appearance & Dimensions	Aspect & Dimensions (spécifique)	100% each tot	Satisfactory
Eddy Current test	CBA 2248-1	100% each lot	Selisfectory
Residual magnetism	30 GAUSS MAX	100% each tol	Sellefactory

(A04, BM)

14

MARKING, IDENTIFICATION

Paint elencifed on one side



VAM FRANCE
TUBERIE SAINT SAULVE
SAINT SAULVE
ZONE INDUSTRIELLE
59860 SAINT SAULVE

(IOA)



VALLOUREC & MANNESMANN TUBES

Valloured Group

MATERIAL TEST REPORT -INSPECTION CERTIFICATE

3.1 EN 10204 : 2004

No.: 110705v10

Page: 5 / 6

Oate: 19.11.2010

(A03)

(A02)

(201)

The supplied products are in compliance with the requirements of the order

(AOS, 202, 203)

Date	19.11.2010
Validated by	Inspection Representative
	Velérie DELACROIX
a	+ (33) 3 27 23 14 56
a	+ (33) 3 27 23 15 25
@	valene.delacroix@vmhubes.fr
Stamp	

Indication in parentheses correspond to elitibules according to EN 10168

This traditional and certification respectively may neither be modified not used for other products. Offences are regarded as fishification of documents and will be subject to criminal profequition.

311, Jen Fisin Road, Jen Wu Hsiang Kachtung Helen, Talwan, R.O.C. TEL: 07: 4724249; FAX.07: 3712923 URL: www.aaneng.com.lw e-mali: saneng@ksts.aeed.net.tw SAN ENG STEEL FORGING COLTD

MILL TEST CERTIFICATE

Customer: WE. FEITTINGS & FLANGES (CANADA) EN10204-3.1.B(DIN50049/3.1.B)

Order No.: \$200200/S759086553

Date: 01/17/2011 Certificate No.: SE100555

Page: 10F1

BEWARKS
BEOUXSHRS
CONFORMS WITH NACE MR0103-07 AND NACE
MR0175RSO15156.2
CONFORMS WITH 225.12 CAT I GR.248 SOUR
SERVICE-05
TEST & PECIMEN ORIENTATION. TRANSVERSE 3 0.396 0.416 0.416 0.396 DIMENSIONAL SPECIFICATIONS 0.00 0.008 0.008 ASME B16.5-09 CSA 2245.12 9.00.0 20.00.0 90.00 20.00 HEAT TREATMENT("2) 0.020 ₽ 0.00 0.031 5,080 0.005 0.120 0.013 0.013 0.005 20 욽 Z 0.050 0.050 0.050 0.028 0.050 0.300 0.400 0.041 0.044 000 Շ Material Supplier WEI CHIM STEEL 0.130 6.012 0.130 0.015 0.010 0.010 XXX 000 XXLX 0.013 0.013 0.035 6000 MATERIAL SPECIFICATIONS 1.100 Impact Test Temp: Minimum: Joule ASTM A105-09/ASME SA105-09 <u>5</u> 0210 0.250 0.210 0.100 0.350 N=Normalized, A=Annealed, Q=Quenched, T=Tempered, S.T=Solution Treated, S.R=Strass Relieved, A.C=Air Cooled, F.C=Furance Cooled, W.C=Water Cooled, O.C=Oil Cooled. 0.200 0339 ≣ š 40 PCE 1,935 PCE 15 PCE 5 PCE QUANTITY 1: T.S. = Tentile Strength, Y.S.=Yield Strength, E.L.=Elongation, R.A.=Reduction of Area. £ \$€8 \$ 69.5 69.5 69.5 68.6 rdness (HB) 萨瑟拉拉吞 8 2 2 8 2 4 4 5 DESCRIPTION 300 SWRF XS 1" A105N 150 WRRF STD 4" A105N 150 WRRF XS 4" A105N 600 WRRF XS 6" A105N (,S,(*1) (MPA) 250.0 379.5 395.2 395.2 335.4 FORGED CARBON STEEL, FLANGES 517.8 533.5 538.6 538.6 1.S.(*1) (MPA) 485.0 PRODUCT * CUSTOMER P/N Heat No. 21383 80407 80407 -24 60 S G £ ₹

WITR VERIFICATION STAMP

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

73: C.E. Value = C + (Mn KB) + (Cr + Mo +V) / 5 + (Ni + Cu) / 15

Manager of Quality Assurance Dept

AN ASSERTION Y

EDITION / ADDENDA: 2009 CONFORMS TO ASME § 11 14

REVIEW BY: 48. 24. H DATE

Single
2000

MILL TEST CERTIFICATE

Page / Página: 117 Number / Número: 00030169

Po= 7423

Alyana Tadas Inc. 547 Walling Tembos Gadl Shi-Mann, ON CANADA 900: 118 (705) 940-8130 ac (705) 940-8131 fiz.

Oastomer's Order Nem / Orden Cliente - Incer; CERTIFICADO DE PRUEBAS EN FABRICA DOMEN I CLEMES: MC JUNKIN RED MAN TUBULAR

Date / Dia: Docomber 28, 2610 Customor's Reference / Ref. del Ciento: CO12 728237 400

Amelactural's Works Dider N' / Corfe kuface / Superficie VARMISHED 307103/03 PO # C012 726237 400

mación de Ventar

82228.987 LB 37752.000 KG Quantity / Consisted 262 PostPz Sleel Grade / Grado de apeno: 1687,316 MTS 5535.814 FT B/290 SS Product Type / Tipo de Producto: L'INE PIPE SEAM ESS CONDUCCION SIN COSTURA

SISELADO NORMAL Vortinal Weight / Pedo No

15.00 LB/FT 22.32 KGM

NORMAL BEVEL Ends / Extremes:

BARNIZADO

TENSILE TEST MENSAY O DE TENSION

18.01 / 21.98 FT 5.49 / 6.70 MTS

Bogth / Longitud

Schedule / Céduta

nensions / Dimensiones 15 X 0.237 INCH 14.3 X 8.55 MM

88

245.1 APRILZ007, ASMEJASTIK SAJA106 BI2006

AMINADO EN CALIENTE SIN COSTURA Pandand or Specification / Normus o Especificacione

ndechaing Process / Proceso do Manufactura;

EAMLESS HOT ROLLED

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Req. Mac Required markman / Maximo requents RT: Room temperature / Temperatura Oft Orbestation / Odentación Rest Required / Requesto La: Location of semple / Ubicación do la emestra Obt. Obtained / Obtanido Marc Martingen / Médies Mrc Minimum / Minimo AM: As mamifactured / Según proceso de fabricación Loc intical langth / Longth of inical : Longhadost / Longhados

B: Body / Cuerpo

Sc. Specimen condition / Condiction de la peobeta

U.T.S. Utimate tensile strength / Resistencia

Y.S: Yield strongth (Fluorida

Sc: Sutp spectmen / Muestre rectangular

REVIEW BY: N BIR VERFICATION STAMP

CONFORMS TO ASME § II

EDITION / ADDENDA: 20091 DATE SEN ZR'11

The contacts is same by a computated system and it went with executive, by the original configuration the trade-mank green various Franch is stamped. In case the careful of confidure would release, copy of it has find similar to the first of the confiduration

Esto cerulizados emas procesas satémia computaçãos y es vinándo um fama encinação. El teraformo engual possos ampresos el tapo Teramit esto vertos. En caso de que el possendor del certificado estregas esa cepa, doberá paramitar in contermidad con el estimas haciendos responsados por exclusões eso Depalo e Indefecto. Centrafar altrandes you harifector estrata supisa e ta lay.

FOR03171

	Algorita Tanca Inc. 50 Nather Terrace Said She, Marte, ON CANAGA	FdC 11.9	(705) 945-3131 (12	Manabehner a Works Order Nr / Conference A. V.	TOTAL ACTIVATION OF THE PROPERTY OF THE PROPER	portraie:	A .	Q	Mag:	EVE.	MORMAL	Montant Weight / Poso Nominal:	•									
	Page / Págine:	217	28, 2010	Г	007103/03	Surface / Superficie	VARMENED	HARMIZADO	Ends/Endangs	WUNNING BEVE	BISELADO NORMAL	Nominal Weign	22.32 KGRA	II								
	Number / Número:	801.0000	Date / Dia: December 28, 2010	Ousbaner a Raterence / Ref. del Citante:	CO12 126237 4D6			P P			effe.	83228.981 LB	37752.000 KG		ICION QUIMICA		ſ	a × ×		1		8
	CERTIFICADO DE PRUEBAS EN FABRICA		Cistomer's Order from 100		ucto;	MESS	SON COSTURA	Steel Grade / Grado de acero.	BZ29 SS		Quantity / Canetral 262 Brests	5535.814 FT	TIST 316 MTS	Alecoupacian	CALLY COMPOSICION QUIMICA	Composition % / Composition %.	- - -	V Ca A Sa As No 11 Ca B			-	01 - 101 110 - 1 10
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			Customer / Clenter MC.P.R.KIN RED MAN TUBULAR	Worshockeing Process / Process do 44	SEAMLESS HOT ROLLED	LAMINADO EN CALIENTE SIN COSTURA	Standard of Specification / Remuse o Especificaciones	2245.1 APRIL/2007, ASME/ASTNI SA/A106 B/2006		Dimensions / Denensiones: Schedule / Cohile	4.5 x 8.337 INCH	114.3 X 8.55 MM					Ľ	77 E	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		ध्या द्र स्था	Wester Marstan Mars - 29 10

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Mac Maximum / Mástrao Min: Minimum / Minimo

P. Product / Products

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Customer / Ctests: MCJUNKIN RED MAN TUBULAR

MILL TEST CERTIFICATE

Page / Página: 317 Number / Número: 00030169

Agonts Tobes he. SAT Walter Totato SACSos, Mann, ON CARADA PBC 11.9 (705) 940-8130 tel (705) 946-8131 fax

CERTIFICADO DE PRUEBAS EN FABRICA

Ents/Extremos BARNIZADO VARMISHED 20/20170 Customer's Reference / Ref. del Ciente: CO12 726237 450 83228.981 LB 37752.008 KG Quantity / Cantidact 262 Pcs/Pz Stool Grade / Grado de acent Cestomes's Order frem / Ordon Charts - hem: 1687,316 MTS 5535.814 FT B/290 SS PO # CO12 726237 4DB CONDUCCION SIN COSTURA noduct Typo / Tipo de Productor. LINE PIPE SEAMLESS Length / Longtod: 18.01 / 21.98 FT 5.49 / 6.70 MTS Schedule / Cédula: 245.1 APRILIZO07, ASMEJASTIN SAJA105 BIZO06 AMINADO EN CALIENTE SIN COSTURA Jurdad er Speditablen / Normas o Espeditabionas nufactoring Process / Proceso do Manufactura; EAMLESS HOT ROLLED orreions / Dimensiones:

45 X 0.337 BNCH 114.3 X 8.56 MM

Manufactures's Works Order N' / Confirmación do Venta; NORMAL BEVEL BISELADO NORMAL Nominal Weight / Peco Nominat Surface / Superfici-15.00 LB/FT 22 22 KGM Date / Dia: December 28, 2010

SURERFICIAL HARDNESS ADUREZA SUPERFICIA

Req. Mar. - Req. Mar. 237

3 ã

Scale / Escalar HBI

External / Extend

Ls: Location of sample / Ubicaction de la muestra

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影響的			-	Feet N	•		24137	24139	24139	24151		AM: As manufactured / Senin process de fabricante.
$\mathcal{J}_{\mathcal{L}}$		_		١.,		1					L	₹

Lit Location of sample / Unicación de la muestra D: friemed diameter / Diámetro inferno Mac Madham / Math W. As manufactured / Segun proceso de fabricación Vrg: Average / Promedo B: Body / Cumpo

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Sc. Specimen condition / Condición de la probeta

Var. Variation / Variacitia

OD: Outside diameter / Diametro externo

MAY: Middle was / Centro Mar. Madazan / Maismo

Oract Quadrant / Creditanto

FOR03171

MILL TEST CERTIFICATE

Agona Tubes inc.
SAT Visities Terrace
SAT SAS Marke, ON CANADA
PIC 119.
(725) 946-8130 tet
(705) 946-8131 fax.

fantacturer's Works Order Nº / Conferención de Verta BISELADO NORMAL Naminal Weight / Pedo No. 007103103 Surface / Superficie: VARNISHED NORMAL BEVEL BARNIZADO Page / Página: 417 Date / Dia: Decomber 28, 2010 Customer's Reference / Ref. del Chenter C012 726237 4D0 Number / Número: 00030169 Juantity / Contidat 262 PostPa Sheet Grade / Grado de secro: Customer's Order Hem / Orden Cilente - Bens; CERTIFICADO DE PRUEBAS EN FABRICA B/290 SS Product Type / Tipo de Producto: LINE PIPE SEAMLESS CONDUCCION SIN COSTURA ength / Londay Schodude / Coduta: 245.1 APRILZ007, ASMEASTH SAIA106 B/2086 Customer! Clease: MCAUNKIN RED MAN TUBULAR LAMINADO EN CALIENTE SIN COSTURA Standard or Specification / Natures o Expeditacione danafacturing Process / Process de Masarlactura; EAMLESS HOT ROLLED

ALECANIENINGAESTERENSAYODDEAPLEASTEANIENTO

15.00 LB/FT 22.32 KG/M

83228.981 LB 37752.000 KG

5535.814 FT 1687.316 MTS

18.01 / 21.98 FT 5.49 / 6.70 MTS

nensions / Dimensiones: L5 X 0.337 INCH 14.3 X 8,56 MM

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			Southern Company

HEAN REALINENE FRANKAMENTO TERMICO

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Serollod 8 B

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CERTIFICADO DE PRUEBAS EN FABRICA MILL TEST CERTIFICATE

Page / Página: 517 Number / Número; 00030169

Alguma Tebes Inc.
547 Minister Tenzon
Szork Ste. Mane. On CANAGA
PPC: 11.9
(705) 404-4130 tol
(705) 405-4130 tol

7.28, 2016 (705) WG-6131 Ex	L'Esente: Manufacturar's Works Order N° / Confermoción de Vanta:	Surbos / Superficie: VARWSHED	BARNIZADO	WORMAL BEVEL	BISELADO NORMAL	Nominal Weight Fleso Naminal: 15.00 LB/FT	22.32 KGM
	C012 726237 4D0		Steel Grade / Grade de acent	SS		5535.514 FT 83228.981 LB	10-37,315 MIS 37752,000 KG
Custance's Corber than J Carber Cleans, 185	PO # C012 726237 4D0	LINE PIPE SEAM ESS CONDUCCION SIN COSTURA		SS 06278	Length / Lengthet:	18.01 / 21.98 FT 5535 5.49 / 6.70 MTC	2
Ossigner / Clerks: MCJUNKIN RED MAN TUBULAR	Manufactoring Process / Process de Manufactoring	SEAMLESS HOT ROLLED LAWMADO EN CALIENTE SIN COSTURA	Western of Specimenson's Normes o Especiment	60029 SAMONS IN SAMONS BIZOUS	Amensions / Dimensiones: Schedule / Cédule:	4.5 K 0.357 INCH 114.3 X 8.56 MM	

SUPPLEMENTARY INFORMATION INFORMACION SUPLEMENTARIA

BJU & UT NOTCH SK OD LAT, 16% ID LATUT LAUNNITON CONTROLWALL THEXNESS VERFICATION BJU & UT. Maishid meets requements of NACE MRVIG-2007, MRVITS-2003, CAT 15S, EVIOZO4 21, 22, 3,1 OCTIZO04, CSA ZZ46,1 APRILZBOT ASTM A106 BIZO06 ASME SA105 BIZO06. loano de Atoo Efectico-Itomo de Afosción-Aláquina de Colado Confenza. zforisi libre do controninsción de Mercurio Jontral no destructivo. Satisfactorio Aricado por ALGOMA TUBES DE-UT-WALL-PLYI-MEPE cero colmedo con abuminio lo repatado por soldadura escapation de inspecation étodo de Inspección abricoción del acoro: Supplementary Information Información Suplementaria EM & UT NOTCHEN, OD LAT, 10%, DLATUT LAMBNATION CONTROLMALL THEXNESS VERFICATION EM & UT. Material mode requirements of NACE MR0103-2007, MR0175-2003, CAT 155, EN12204, 2.1, 2.2, 3.1 OCTROOM, CSAZZAS, 1 APRILZOOF ASTM A116 B2006 ASME SA106 B2006. actic Arc Furnace-Ladio Furnace-Continuous Casting Machine. lateried froe from Mercury contamin Mufactured by ALGOMA TUBES ion destructive test. Satisfactory WE-UT-WALL - FLW - MPI tot repaired by welding Red making process: specton Description Appending members Hay Kaled Stad

MARKING MARCACION

ALGOMA Ret 039854

LGOMA Ref (139854

MASCARILLA DE TUBO ESTARCIDO. Martación Martación PIPESTENCIL

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FOR03171

Alyona Tubes te. 547 Walthe Ferson Sout So Blanc, ON CANADA PSC 119 (705) 946-8130 tel	(105) act co 31 km	Manatachara's Works Order N° / Confirmación de Venta: 097163103	postobe: 3D	2001	SEVEL SPORMA	Norther Weight / Poso Nominat 15.00 LB/FT	
Page / Pághar. 6 / 7	2010		Surface / Superficie: VARNESHED	BARNIZADO Ends / Edemog	RESELADO SODERA	Nombal Weign 15.00 LB/FT	A TOTAL LINE
Number / Nimero. 00030169	Date / Dia: December 28, 2010	Customer's Reference / Ref. dol Cliente; CO12 726237 4D0		Detra:		PestPz 83228.981 LB 37752.808 KG	No
MILL TEST CERTIFICATE CERTIFICADO DE PRUEBAS EN FABRICA	ı	PO # C042 726237 4D0 Product Ives / Tracks Product Product Ives / Tracks Product Ives /	LINE PIPE SEAMLESS COMDUCCION SIN COSTURA	Sheat Grade / Gradu de Boorno. B/7290 SS	Samuel (1 section)	18.01 / 21.98 FT 5535.814 FT 5535.814 FT 1687.316 MTS 1687.316 MTS	MARKING/HAREACION
enaris	Customer / Cleade: HCJUNKIN RED MAN TUBULAR	Manufacturing Process / Process de Manufactura.	SEAMLESS HOT ROLLED LAMINADO EN CALENTE SIN COSTURA	7245.1 APRILZOOT, ASMEASTM SAIA106 B2006	Dimensions / Dimensiones: Schedulo / Cédula:	45 X 0.337 BKCH 080 114.3 X 0.56 RM	

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Mer.	Marseda
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	#Com #Arm #Nrme #Km 22.32 KCM MADE IN CANADA
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Net weight of pipe in Kep merm.	Митего de coindo #Сет.
	Peso real de tubo en Kes #K****
Pipe rambes #h	Longitud del tubo en Mts #Mt***
	Número de Secuencia attento:
TOO BEAUTY OF THE SHARK DEBOTE	
	A KEPOK E RESUMEN

Mega	Peso (Tons) 12.126
undity Length	(ft) (m) 1,775,03 (541,023
Quantity	(Fieces)
Hoat N°	24151
Weight Perso	(Tons) 20,758 4.87
Length English	(m) 929.277 217.54
1 7	(2) 3,048.81 711.88
Quantity Cantistod	(Pecos) 144 34
Heat N° Colodo N°	24137 FP 24139 3

Nothing weight per pipe	Peso nominal por tubo	(ts/ts) (4cs/ts)	15.035 22.374	
Averago length per ploe	Longthal promedio por tudo	(12)	21,129 6.44	

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Customer / Cleme: MC. UNIKIN RED MAN TUBULAR

udacturing Process / Process de Monufecturaz

SEAMLESS HOT ROLLED

CERTIFICADO DE PRUEBAS EN FABRICA MILL TEST CERTIFICATE

Page / Página: 717 Number / Número: 00030169

Algoma Tubes Inc. 547 Watter Ferraco Sout Ste. Marie. On CactaDA PPC 119 (PE) 945-5130 tel (PE) 945-5131 tax

Date / Dia: December 28, 2010

ufacturar's Works Order Nº / Confirmación de Venter 007103403 Sertisce / Seperticle: VARNISHED Customer's Reference / Ref. del Clasto. CO12 726237 400 Osstomer's Order from / Orden Clonte - from:

PO # CO12 726237 4DB

Product Type / Tipo de Producto:

LINE PIPE SEAMLESS

37752.000 KG 83228.981 LB Quantity / Cantidad: 262 Pcs/P Steel Grade / Grade de sceno: 1687.316 MTS 5535,814 FT SS 062/6 lhs is to certly that the product described here has been manufactured, sampled, tested, and expected in accontance with purchaser order requirements. This conficate is not a declaration of origin. Insert it is a declaration of origin. CONDUCCION SIN COSTURA

18.DM / 21.98 FT 5.49 (6.70 MTS

ength / Longturt

Schedule / Cédule:

Actions / Dimensiones: L5 X 0.337 INCH 114.3 X 8.56 MM

2245.1 APRIL 2007, ASHEASTM SALATOS BIZODS

LAMBADO EN CALIENTE SIN COSTURA Sendard or Specification I Normas o Expediencion

BISELADO NORMAL Comfrad Worlght / Poso ?

15.00 LB/FT 22.32 KGM

NORMAL BEVEL BARNIZADO Ends / Extremo

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CUSTOMER. THIRD PARTY

COMPANIA DE DESPECCIÓN

DISPECTION COMPANY

Employee Name: N/A

Quality System Contined Nº 11095GU37 Ozeffy Management Syntom exchained The confliction covers the Tonada

NOT APPLY

DEPTO, DE CERTIFICACIÓN DE CALDAD CHALITY CERTIFICATION DEPT.

VAN BOERDONK Dave

RESPONSABLE DEL DEPTO. DE CERTIFICACIÓN DE CALIDAD CHEF OF CUMUTY CERTIFICATION DEPT. PEI Dunguo

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GLOBAL GAEL SERVICE LTD GLOBAL GAEL SERVICE LTD		V% ND% NYS 0,002 0,002 0,00 SALEKZA WAPACT TEST - JOUR	TRATTAMENTO TERMICO / HEAT TREATMEN! NORMALIZED AT 920 C - COOLED IN STILL AIR NORMALIZED AT 920 C - COOLED IN STILL AIR	V% Nb% 0,000	TRATTAMENTO TERMICO / HEAL IN STILL AIR NORMALIZED AT 920 C - COOLED IN STILL AIR ONE	TP% CU% V% ND% 0,018 0,190 0,000 0,000 TIPO 1 TYPE 18410 M 20 KN 20 HEAT TREATMENT	CONTROL LO QUALITÀ	OPPICIO CONTROL DEPARTEMENT QUALITY CONTROL DEPARTEMENT S. CONTROL DEPARTEMENT
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REVIEW BY: MTR VERIFICATION STAMP

DATE: INDENTALLE

EDITION / ADDENDA: 2009/b CONFORMS TO ASMES II A

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1457V	-344737 28748	MILL TEST REPORTS ALGOMA STEL INC. HEREN CENTIFIES THAT THE MATERIA, HEREN DESCRIBED WITH THE RULES OF THE SPECHFOATON	SHOWN, ALL RESULTS ARE RETAINED IN ACCORDANCE WITH THE COMPANY'S STANDARD RECORD KERING PRACTICES.	U. JOHNSTON MANAGING PETALLURGIST	THIS MILL TEST REPORT MAY NOT BE REPRODUCED EXCEPT IN FURL WITHOUT WRITTEN APPROVAL OF ALGOMA STEEL INC. IF YOU RECEIVETHIS DOCUMENT AND ARE	NOT THE INTENDED RECEIVER, PLEASE CALL (705)945-2624 COLLECT FOR INSTRUCTIONS ON METHOD OF DISPOSAL OF DOCLIMENT.		***		# 000 # 000	* * * * * * * * * * *	FICATION STANIP REVIEW BY: #		Φ.			E I OF I IS THE MINIMUM IRMENTS OF THER THAN THE
with		ALCO INC 7390	II. END			171 WS	/12/03 06:21	* * *		NO. WEIGHT 1 22230 1 22600 1 24940	* * * * * * * * * * * * * * * * * * * *	MITR VERII DATE: SAM 28 11	to House Man & Man Man Man Man Man Man Man Man Man Man	CB V	.002 .002	000. 000.	PAGE RIFICATE IS ISSUED MEETS RIMANCE WITH THE REQUIR FOR ANY SPECIFICATION OF
Canada, P6A 7B4	NUMBER CARRIER CP	DIVISION OF PREMETALCO INC. 7, FRASER STREET BRITTSH COLUMBIA \(\rangle 0 \tau \gamma 390 \)	(05) - STRL Q - RVD SHPZ - COLL		. •	2000	2007,	* * 0 % d d I	x COIL	HEAT 75716-05 75716-53 1457V-23	OPERTIE	% ELONG 29 (2") 32 (2")	PERTIES	MO AL	.01 .048 ·	.01 .036	THE TEST RESULTS AND VALUES REPORTED HEREIN INDICATE ONLY THAT (1) THE PARTICULAR STEEL FOR WHICH THIS CERTIFICATE IS ISSUED MEETS THE MINIMUM SPECIFIED YIELD STRENGTH AND (2) THE CHEMICAL ANALYSIS AND PHYSICAL PROPERTIES OF SUCH STEEL ARE IN CONFORMANCE WITH THE REQUIRMENTS OF THE SPECIFICATION INDICATED. THE RESULTS OF VALUES REPORTED. HEREIN CAN NOT BE USED TO QUALIFY THE STEEL, AND SPECIFICATION OTHER THAN THE ONE INDICATED.
Marie, Ontario, Canada, P	Z 051273	TEXTUSON A DIVER TATION A DIVER TATION 9777, FRANCOUVER, BRITTE	OF ASTM A36 (05) IT SURFCE IMPRVD		COUPON			UCT SH	96 X 881. SMOISN	COIL NUMBER 487105000 487107000 487130000	CALPR	KEI KSI 51.0 73.0 43.5 69.0	AL PRO	R NI CU	•	2 .01 .02	THAT (1) THE PARTICULAR PHYSICAL PROPERTIES OF D. BEREIN CAN NOT BE US
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STEEL INC	6 6 6 6 6 6	A DIVISION OF PREMETALCO RAST MARINE DRIVE BRITISH COLUMBIA	USTONIA PROLICED STEEL SHEET - RESTRICTED GAUGE 3/4 TOL TESTS ONE/HEAT FOR INFO		Tions 1: TEST	REPORTS		10204 3.1 * * * * * * *	EM 00003	HEAT 7571G-05 7571G-53 7571G-54 1457V-23	* * * * * *	TS: * SAMPLE SRCE 106"	* * * * *	TT TT	140 100 100	, 1000 1000	THE TEST RESULTS A SPECIFIED YIELD STR THE SPECIFICATION I
ALGUMA STEE	P71102DI006	WILKINSON 888 BOUTH VANCOVER V5X 2V3	CUSTOME SPECIFICATION ROT ROLLIED RESTRICTED TESTS ONE/F		SURPLEMENTARY INSTRUCTIONS TEST CERT 1:	TA TEST	RESA	*	CUSTOMER ITEM	COIL NUMBER 487104000 487106000 487131000	* * * * *	TENSILE TESTS HEAT 1457V 7571G	***	HEAT	1457V	75710	**WARNING**



BOTH-WELL STEEL FITTINGS CO., LTD. NO.303: JEN-HSIN ROAD JEN-WU HSIANG KAOHSIUNG HSIEN, TAIWAN R.O.C. (81406)

TEL: (07) 371-0497, 371-1536, 372-0260 FAX: (886-7) 371-3864, 371-3882 WEB SITE: http://www.bothwell.com.tw E-MAIL: bothwell@www.bothwell.com.tw or box@mell.bothwell.com.tw

TEST & INSPECTION CERTIFICATE

ACCORDING TO EN10204/DIN50049/3.1.B

CUSTOMER: UNIFIED ALLOYS

INVOICE NO: BW069509097

ORIGIN: TAIWAN

DATE: 12/30/00

		NO: 6287		rder No	: EP-5	7197			L/C N	D: BW069509 D:	0097		DATE PAGE	g: 1 <mark>2/30/</mark> 0 l: 3			
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8	115 116 117 118 119 120 121	9U078 9U105 9U067 YT060855 YT060864 FS-0174 U0807		FULL FULL FULL FULL	CPLG CPLG CPLG CPLG CPLG LBOW	3/4" 300 1" 3000# 1-1/4" 30 1-1/2" 30 2" 3000# 2-1/2" 30 3/4" 3000	NP7 4000 4000 NP7 4000	T H NPT H NPT C H NPT	A MARINE	S.	2	80 PC 20 PC	DIMENSION: ASME B16.11 SURFACE: BY VISUAL	- 2001			
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-	- [Tensile	Yield	Elo		R of A		Hardness	CONFORMS 1 STEEL MAKI	O NACE MER	0175-2003) 30 (4) 12(1)	Data ora				
	ļ	Strength (KSI)	Strengt1 (KSI)	h Gati (%)		(%)		(HIB)	MERCURY FR	EE	o : Elect	KIC PU	KINACE				
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BW-D0839 REV: 0

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MTR VERIFICATION STAMP DATE: Suly 4'11

Q.C. MANAGER

SHENG CHENG LEE

REVIEW BY:_

CONFORMS TO ASME \$ 11,

EDITION / ADDENDA:

INSPECTOR

CHUN CHIEH HUANG

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Phone (780) 466-4122 Fax (780) 463-5587

KS Manufacturing Enterprises Ltd.

5203-76 Avenue Edmonton Alberta T68 0A7

MATERIAL TEST REPORT 12117

Purchaser: UNIFIED ALLOYS, EDM

Purchaser Order No. EP60792

Date: 2007-03-13

Distributor:

Distributor Order No:

FOX (3066)

Products

Iter No		Product	Specification	Heat No	Description
1	8	1-1/4" X 3-1/2" LONG 3000 THRD COUPLING B16.11	A/SA182 F304/F304L	87B1	2-1/4" RD BAR ASTM A276-04, A479-04, A193-03 CL:1 GR
				A	B8, A320-03 CL 1 GR B8, ASME SA479 04 SA320-04 CL 1 GR B8, SA193-04 CL 1 GR
				7	B8, EN 10204 3.18

Chemical Properties

Heat No	. C	Mn	Р	S	SI	Cr	Ni	Мо	Cu	٧	Nb	Co	N	ΆΙ	Sn	Ti	
87B1	.023	1.601	.031	.021	.279	18.14	7 8.666	.416	.480	-	-	.166	.077	-	-	-	

Mechanical Properties

À.	item No.	Heat No	Yfeld	Tensile	Elong % in 2"RA	B.H.N. Impac FT	LB Remarks	
	1	87B1	41,000 PSI	81,000 PSI	62 70		OSION TEST: SOLUTIO	
						ASTM	A262-02a PR E ANNEALE	D I BREET

BOUR

8781 (14×31/2 3000 # CPLG) 304

DATE: 5.4.4 REVIEW BY: CONFORMS TO ASME \$ II A EDITION / ADDENDA: 20096

We hereby certify the above results to be correct as contained in the records of the company.

· 阿维克克克

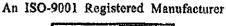
Kwang Y. Lee



柏雕鐵工股份有限公司

高維熙仁武鄉為林村仁心路 303 號 BOTH-WELL STEEL FITTINGS CO., LTD.

NO.303, JEN-HSIN ROAD JEN-WU HSIANG KAOHSIUNG HSIEN, TAIWAN R.O.C.(81460)





TEL: (07) 371-0497, 371-1536, 872-0260 FAX: (886-7) 371-3864, 371-3882 WEB SITE: http://www.bothwell.com.tw 6-MAIL: bothwell@www.bothwell.com.tw or box@meil.bothwell.com.tw

MILL TEST & INSPECTION CERTIFICATE

ACCORDING TO EN10204/DIN50049/3.1.B ORIGIN: TAIWAN CUSTOMER:UNIFIED ALLOYS INVOICE NO: BW079608013 DATE: 11/14/07 CERT NO:72746 ORDER NO: EP-63527 L/C NO: PAGE: 6 **BOTH** SPECIFICATION: ITEM RAW MATERIAL WELL DESCRIPTION QUANTITY HEAT NO. HT.CD. DIMENSION: 095 3₩356 N942 FULL CPLG 3/4" 3000# NPT 100 PC ASME BI6. 11 - 2005 19W177 096 N941 FULL CPLG 1" 3000# NPT 100 PC 097 3W278 N936 FULL CPLG 1"x3-1/2"L 3000# NPT 50 PC 50 PC SURFACE: 25 PC BY VISUAL...GOOD 098 9W151 N926 FULL CPLG 1-1/4" 3000# NPT 099 9W148 N923 FULL CPLG 1-1/2" 3000# NPT 100 PC 45D ELBOW 1/2" 3000# NPT 100 19W175 N939 10PC 101 FS-1488 45D ELBOW 3/4" 3000# NPT N904 10PC CHEMICAL COMPOSITION THEM C Si Mn P Cu Cr Ni Мо ٧ Cb(Nb) N 18,000 8.000 Min 0.030 1.000 2.000 0.045 0.030 20,000 Max 13,000 0.100 095 0.020 0.2901.770 0.028 0.028 18.120 8.180 0.100 096 0.030 0.230 1.850 0.029 0.028 18.150 8.180 0.100097 0.020 0,310 1.830 0.029 0.030 8.190 18,160 0.100 098 0.0200.2801.870 0.028 0.029 18,240 8,200 0.100 099 0.030 0.270 1.870 0.028 0.028 18,240 8.200 0.100 100 0.0300.260 1.840 0.025 0.028 18.140 8.120 0.100101 0.022 0.330 1.850 0.040 0.024 18.080 8.080 0.094MECHANICAL TEST Remark: TEM SOLUTION TREATED : 1040°C, W.Q. Tensile Yield Bion-CONFORMS TO NACE MR0175-2003 R of A Hardness Strength Strength STEEL MAKING PROCESS : ELECTRIC FURNACE Gation MERCURY FREE (KSI) (KSI) (%) (%) (HB) 75.0 30.0 Min 30.0 50.0 Max 235 095 89.0 44.0 59.4 75.7 170 WE CERTIFY THE ABOVE MENTIONED PITTINGS HAVE BEEN 096 84.2 35.5 64.6 75.8 156 MANUFACTURED AND TESTED IN ACCORDANCE WITH THE 097 88.2 43.6 SPECIFICATIONS SHOWN 58.8 74.9 171 098 82.1 37.8 67.0 72.7 155 099 83.2 39.7 66.2 76.2 152 100 83.3 36.1 65.4 76.3 161 O.C. MANAGER INSPECTOR 101 87.4 42.2 57.8 75.4 170 SHENG CHENG LEE CHUN CHIEH HUANG BW-D0839 REV:0

MOCSIQUE

DATE: \$15 /5 / REVIEW BY: \$2 CONFORMS TO ASME \$ II P EDITION / ADDENDA: 20076

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EVAZ ORGON STORT 1420 N REACTING NA GEGON 97203 EVAZ ORGON STORT 1420 N REACTING NA GEGON 97203 WITTHON GIVE ACCOUNTS PAYABLE SOO OF ACTINE ACCOUNTS PAYABLE	14	PORT OF CREMICAL/PHY	CHEMICAL/PHYSICAL TESTS SON COMPANY LID.	AYSICAL TYSICAL TY TY TY	TESTS		CERTIFICATE NO. 0ATE 1115395 SED 24, MICL GADER NO. 236102 CUSTOMER ORDGER NO.	2010 1
CANCOUVER, BC VSX 2V3	CANADA	vancouver, canada	DE 00	60#108	, 0g		NO. DATE DATE DATE DATE DATE DATE	24/2010
THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECFFCATIONS AND PURCHASE ORDER REQUIREMENTS STRUCTURAL QUALITY COIL FOR CONVERSION TO ASTM A36-08/ASME SA36 2007/08 ADD CSA G40.21-04 GRADE 44W PLATE CSA GRADE 38W. PHYSICAL PEOPERTIES	ECFICATIONS AND PUR BA36-08/ASME S. PHYSICAL PF	DPURCHASE ORDER E SA36 2007/0	O7/08	ADD C	its SA	,	CARRIER TS EXPRESS CARTRICK NO. 035A	
HEAT NO. SLAB	YIELD TENSILE PSTX 100 PSI X 100	SILE %EI	% ELONG 8 2 %	% FA	HARDNESS BY BHN TI	BSND TEST	IMPACTS	į
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certify the above to be correct as contained in the records of EVRAZ INC. NA	NC. NA By		7		Witting Support Co	CLIE OF K.	maths	

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-		EVKAZ INC. NA

NT 7748

09/09/2010 ERLSER BROS TRANSFER CO 2010 뛿 60 P00706ME001V 234921 CLSTOMER ORDER NO. CERTIFICATE NO. | DATE 1112251 MN1 ORDER NO. 1112251 SHIPPING NO. JOBPRED, NO. CABAIER L/PHYSICAL TESTS STRUCTURAL QUALITY COIL FOR CONVERSION TO ASTM A36-08/ASME SA36 2007/08 ADD CSA THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS V5X 2V3 WILKINSON COMPANY LTD. 888 SE MARINE DR VANCOUVER, BC CANADA WILKINSON STERL & METALS/DIV PREMET V5X 2V3 ATTM: ACCOUNTS PAYABLE eel 14406 N. Rivergate Bivd., Portland, Onegon 97203 888 SE MARINE DR G40.21-04 GRADE, 44W PLATE CSA 38W. VANCOUVER, BC S10114TH006-3

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	DESCRIPTION	E X	15180 LBS	21860 LBS	37040 LBS TOTALS	•	α.	.011	. 013	WI.
	DES	0.1880 X 96.000MB X COLL SCHEDULE B:7208.37.00.00		21	E .		Z.	89	35	HEATS INDICATED WITH
		96. B	<u>ک</u>	D _A	PCS		-	-	<u>.</u>	<u>_</u> E
		X	H H	р . П	N		ပ	14	ព	Ä
		188(TEE			ı		o			TA
		 St					CHEAT NO	748	WE7778	Ħ
	IBANO	8			04 3007740	# O #	出	E,	(TIE	1000/
7 7		**** ********************************	- 01-01-1	-11110	T-1-14 1-14 1-1-1-1-1-1-1-1-1-1-1-1-1-1-1				-	

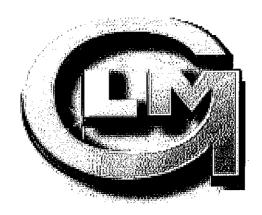
| certify the above to be correct as contained in the records of EVRAZ INC. NA

CONFORMS TO ASHE SH DATE: (2/2/2/2/2)

発すない面保用CATION STAND

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G.L.M. INDUSTRIES L.P.

SECTION 4 WELD PROCEDURES

WELDING PROCEDUR	E SPECIFICATION	N NO.:		1-1-051A (Re	v.2)
WELDING PROCEDUR	E QUALIFICATIO	N RECORI	O NO. (S):	1-1-051-2	
	QUALI	FIED FOR		-	
Restricted Applications: Base Metal (Typical):	API 12D, 12F, 62 P1 Groups 1 & 2	0 & 650 We	Ided Storage T	ank Fabricatio	n
	(SA 333 Gr.6. SA	350 Gr.I.F2	SA 420 MPL	SA 518 Gr 7	(O etc.)
Process(es):	SMAW		Weld Types:	GROOVE 8	FILLET
Position:	ALL POSITIONS		Diameter:	ALL DIAME	TERS
Filler Metal:	E6010, E7018-1				
BASE METAL CONDITION NOTCH TOUGHNESS APBASE METAL THICKNESS	PLICATIONS TO -4	6°C AS WEI			ıclusive
COMBINED DEPOSITED V ASME SECTION IX	VELD METAL THIC		12.7 mm (0.500	in.) maximun	1
DDOVINGIAL DEGIS	OTPATION.	"			
PROVINCIAL REGIS	STRATION				

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

	G.L.M. Indus	tries L.P.		
vveiding Procedure Specification	on No.	11A (Rev 2)	Date Fe	bruary 22, 2007
	a) - Pormat undate.	company name	a channa <i>(</i> for	mark 🔼 I NA
Tanks &	Equipment Ltd.), up denda, and PQR No	dated to ASME	Section IX-	2004 edition.
2006 add	denda, and PQR No	. 1-1-051 repla	ced with PQI	R No. 1-1-051-2
Supporting FGR 140, (8)	7_7_{11	11_2		
Welding Process(es)	SMAV	V	_ Type(s) _	Manual
·				
IOINTO (OM AGO)		•		
JOINTS (QW-402)	_			
Joint Design All ASME	groove & fillet, refe	rence construc	tion drawing	for joint details.
VVIICIE ILI	irir ixmixiis sira nnt ar	IOPITION PATAR 9/	A P ARKINAP	OF allegates at
Loor Obalility Wa Del St	tached typical drook	aas enniseh Al	figurae 1 to	15 attached
Backing With or w	(Ithout	_ Rétainers	Not r	<u>required</u>
		•		,
BASE METALS (QW-403)	- 400'			
P-Number P1 Group Thickness Range: Groove	8182	_ To P-Number	r <u>P1 G</u>	roups 1 & 2
Cillot	See cover pag	<u>le for thickness</u>	qualified by	governing code
Pine Dismeter Panger: Greeke	All place metal	tnicknesses		
Fillet Pipe Diameter Ranges: Groove	All diameters	`		·
Deposited Weld Metal (Per Pas				·
	a)	o m.) maximum		
FILLER METALS (QW-404)	MAM		CRAALA/	•
Specification No. (SFA)	QEA 5 1		SMAW .	
AWS No. (Class)	E6010		SFA 9.1	
F-No.	F3		E/U10-1	
A-No.	A1		F4 A1	
Size	3/32 to 5/32 in.	inclusive	3/32 to 1/4 in	inclusive
Deposited Weld Metal Thickness	Range:	IIIO/IUOIVO	VIVE (V 114 III	. II ICIUSIVO
Groove	4.8 mm (0.188	in.) max.	7.9 mm (0.31	2 in 1 may
illet	All fillet sizes	1112 111221	All fillet sizes	£ 111.7 1119A.
			113-110-1-1-1-1-1-2-2-	
POSITION (QW-405)				
Position of GrooveAll	positions	Position of Fill	et All po	sitions
Veld Progression F3	Vertical down	F	4: Vertical o	lown
•		-		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
REHEAT (QW-406)				
reheat Temperature (Minimum)	10°C (50	O°F)		
reheat Temperature (Minimum) nterpass Temperature (Maximur	n) <u>260°C (</u>	500°F)		
reneat Maintenance <u>10°C (50</u>	'-) prior to welding.	_Preheat maini	lenance is no	t required if
<u>welding is</u>	<u>s interrubted or after</u>	the completion	of welding u	inless required
by the coa	de of construction.	-		

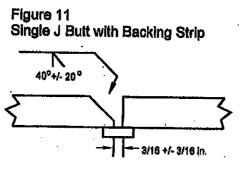
		WPS	No. <u>1-1-051A (Rev.2)</u>
POST WELD HEAT TREAT Temperature RangeN	MENT (QW-407) /A	Time Range	N/A
ELECTRICAL CHARACTER	RISTICS (QW-409)		
CurrentD	irect	Polarity	Reverse, electrode positive
AmpsS	ee Table #1	Volts	See Table #1
Maximum Heat Input		7-5160	COD TRIVIC #1
Base Metal Thickness Range	E6010 Elec	trode	E7018-1 Electrode
0.125 - 0.500 in.	17,770 J/		20,210 J/in.
TECHNIQUE (QW-410) String or WeaveE6010: Either Initial & Interpass Cleaning Method of Back Gouging Multiple or Single Pass Per Side Peening	Brushing, chipp	ing or grinding back-grind as	See Table #1

TABLE 1 - WELDING PARAMETERS

Process	Filler Metal	Diameter mm (in.)	Current Type & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min.(i.p.m.)
SMAW	E6010	2.4 (3/32)	DCRP	40 - 100	18 - 28	
SMAW	E6010	3.2 (1/8)	DCRP	60 - 140	19 - 30	62 - 300 (2.5 - 12
SMAW	E6010	4.0 (5/32)	DCRP	90 - 225	21 - 31	98 - 350 (3.9 - 14 162 - 400 (6.4 - 16
SMAW	E7018-1	2.4 (3/32)	DCRP	60 - 110	18 - 24	82 - 300 (3.2 - 12
SMAW	E7018-1	3.2 (1/8)	DCRP	90 - 160	18 - 26	123 - 350 (4.8 - 14
SMAW SMAW	E7018-1 E7018-1	4.0 (5/32)	DCRP	130 - 220	19 - 28	187 - 400 (7.4 - 16
SMAW	E7018-1	5.0 (3/16) 5.5 (7/32)	DCRP DCRP	200 - 300 240 - 340	20 - 30	302 - 500 (11.9 - 20
SMAW	E7018-1	6.4 (1/4)	DCRP	275 - 360	20 - 32 21 - 32	362 - 550 (14.3 - 2 436 - 550 (17.2 - 2

Note: Welding parameters shall be adjusted to insure that the maximum heat input value specified in QW-409 above is not exceeded. Heat input (J/in.) = Volts X Amps X 60

Travel Speed (ipm)



20° +/- 10°

Figure 2

Figure 5

Radius 1/8 in.

Figure 8

Radius 1/8 in.>

+/- 1/18 in.

Figure 14 Single Bevel Butt with Backing Strip

Figure 15 **Double Bevel Butt**

Double J Butt

40°+/- 20° Typical

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

Figure 1

Figure 4

Redius 1/8 in. >

Figure 7

Radius 1/8 in: +/- 1/16 in.

Figure 10

Figure 13

Single Bevel Butt

Single J Butt

40°+/- 20°

Single U Butt

20° +/- 10°

Single Vee Butt

Single Square Butt

3/16 +/- 3/16 in.

3/16 +/- 3/16 in.

3/16 +/- 3/16 in.

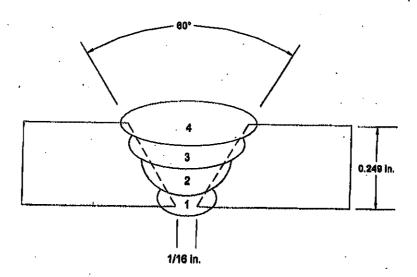
3/16 +/- 3/16 in.

606+) 15°

3/16 +/- 3/18 ln.

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

•	G.L.	<u>VI. Industries L.P. </u>		•
Procedure Qualification R	lecord No.	1-1-051-2	Date	December 15, 2006
vveiding Procedure Speci	iication No.	1-1-051A (Rev 2)	•	
Welding Process(es)		SMAW	Type(s) Manual
		_		
JOINTS (QW-402)			•	
Type	Butt joint, sir	igle vee groove, see	next page	
	•			
BASE METALS (QW-4	03)		•	
Material Spec. SA P-No. P1 Grp.1 To Diameter	516 to SA 516	Type or (Grade (er. 60 to Gr 70
P-No. P1 Grp.1 To	P-No. P1 G	rp.2 Thicknes	s 6	32 mm (0 249 in)
Diameter	N/A	Other _	F	late Product Form
		-		
FILLER METALS (QW-	404)			
Specification No. (SEA)	SFA !	5.1	SFA 5.1	
AWS No. (Class)	E601		F7018-1	
Filler Melai F-140.	F3		F4	
Filler Metal A-No.	A1	·····	Δ1	
Size of Electrode	See a	ttached sketch		
Deposited Weld Metal Thic	kness 2.39 r	nm (0 094 in)	3 04 mm	(0.155 in) .
		· ·		-131.133 11117
POSITION (QW-405)	٠			
Position of Groove	3G			•
Position of Groove Weld Progression	Vertic	al Down		
<u> </u>				
PREHEAT (QW-406)				
Preheat Temperature	10°C (50°F)	Interpass	Temp. (Max.)	232°C (450°F)
•			, and funda:	
DOSTINEI D LEAT TOE	ATRICALT (OL)	407)		••
POSTWELD HEAT TRE	MINIENI (WW	- 4 V/)		
Temperature	N/A	IIMe	N	<u> </u>
ELECTRICAL CUARAC		100 000		•
ELECTRICAL CHARAC	IERISTICS (Q		5 .	• • • •
Current	Direct	Polarity _		electrode positive
Amps	See next page	Volts	See next	
leat input	F3: 17.770 J/	in, maximum	F4: 20,21	0 J/in. maximum
FECUNIONE (ON 440)				
FECHNIQUE (QW-410)		· ·		
String or Weave	Both Both		ed <u>Se</u>	e next page
Multiple or Single Pass Per	Side <u>Multiple</u>	9		· · · · · · · · · · · · · · · · · · ·



Note: Pass #1 welded from backside followed by grinding out groove side to sound metal and depositing passes #2 to #4.

Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min (i.p.m.)
1	SMAW	E6010	4.0 (5/32)	DCRP	100 - 115	24 - 26	231 (9.1)
2	SMAW	E7018-1	3.2 (1/8)	DCRP	140 - 148	22 - 24	264 (10.4)
3	SMAW	E7018-1	3.2 (1/8)	DCRP	128 - 132	21 - 23	254 (10.0)
4	SMAW	E7018-1	3.2 (1/8)	DCRP	135 - 145	22 - 24	243 (9.6)

"WN NO1-1-001-2	PQR NO.	1-1-051-2
-----------------	---------	-----------

TENSILE TEST (QW-150)

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Uitimate Load N (ibs.)	Ullimate Stress MPa (psi)	Character & Fracture Location
T1	19.1	5.52	105	55 284	524	. Partial Cup & Cone
	(0.752)	(0.217)	(0.163)	(12,400)	(76,100)	Parent Metal (SA 516 Gr. 60)
T2	19.2	5.51	106	53 178	503	Partial Cup & Cone
	(0.756)	(0.217)	(0.164)	(12,000)	(72,900)	Weld Metal

GUIDED BEND TEST (QW-160)

Type & Figure No.			
	Resuit	Type & Figure No.	Result
QW-462.3a, TRB - R1	Pass	QW-462.3a, TFB - F1	
QW-462.3a, TRB - R2			Pass
444-402.38, TRD - RZ	Pass	QW-462.3a, TFB - F2	Pass

CHARPY IMPACT TOUGHNESS

t Tamparatura		Transverse
t Temperature48°C (-	<u>55°F) Specimen Size </u>	10 X 5 mm
Specimen No.	Notch Location	Investigation of the second
		Impact Values J (ft. lbs)
B2.1	Weld Metel	16.5 (12.2)
B2.2	Weld Metal	25.8 (19.0)
B2.3	Weld Metal	44.7 (33.0)
B3.1	P1 Grp.1 - HAZ	69.4 (51.2)
B3.2	P1 Grp.1 - HAZ	95.5 (70.4)
B3.3	P1 Grp.1 - HAZ	108 (79.4)
B4.1	P1 Grp.2 - HAZ	90.9 (67.0)
B4.2	P1 Grp.2 - HAZ	101 (74.2)
B4.3	P1 Grp.2 - HAZ	107 (79.0)

OTHER TESTS

Vict	cers Hardness - see attached la	boratory test repor	<u>t</u>
Welders Name Tests Conducted By Laboratory Test No.	Wilber Davie Ludwig & Associates Ltd. E06-1029,2	Stamp No	WD
Morden auth festen in SCCOI	in this record are correct and reduce with the requirements of	d that the test we Section IX of the A	lds were prepared, \SME Code.
Manufacturer	G.L.M. Industries L,P. 3 3 Signe	ed A	2



LABORATORY TEST REPORT

CUSTOMER:

G.L.M. Industries L.P.

1508 - 8 Street Nisku, AB **T9E 7S6**

Laboratory Test No.: E06-1029.2

Date: January 9, 2007

Attention:

Wilber Davie

POR No.:

1-1-051-2

Material:

SA 516 Gr. 60 to SA 516 Gr. 70

Thickness:

6.32 mm (0.249 In.)

Thermal Condition:

As Welded

TENSILE TEST QW-150

SAMPLE NUMBER	T1	QW-462.1(a)	T2	QW-462.1(a)
WIDTH mm (in.)	19.1	(0.752)	19.2	(0.756)
THICKNESS mm (in.)	5.52	(0.217)	5.51 ··	(0.217)
AREA sq. mm (sq. in.)	105	(0.163)	106	(0.164)
ULTIMATE LOAD N (lbs)	55 284	(12,400)	53 178	(12,000)
UTS MPa (psi)	524	(76,100)	503	(72,900)
FRACTURE TYPE	Partial C	up & Cone	•	up & Cone
FRACTURE LOCATION		letal (SA 516 Gr. 60)	Weld Me	

GUIDED-BEND TEST QW-160

SAMPLE WIDTH: 38.1 mm (1.50 in.) SAMPLE THICKNESS: 6.32 mm (0.249 ln.) **PLUNGER SIZE:** 22.2 mm (0.875 in.) YOKE SIZE: 41.1 mm (1.62 in.) QW-462.3(a) Face Bend Root Bend **Face Bend** Root Bend SAMPLE NUMBER(S) F1 R1 F2 R2

RESULTS **Pass** Pass Pass **Pass**

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX, 2004 edition and latest addenda. Material information has been provided by the Customer whose name appears on this report.

Samples associated with this report will be discarded in 30 days.

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

LABORATORY TEST REPORT

CUSTOMER:

G.L.M. Industries L.P.

1508 - 8 Street Nisku, AB

T9E 7S6

Attention:

Wilber Davie

PQR No.:

1-1-051-2

Material:

SA 516 Gr. 60 to SA 516 Gr. 70

Thickness:

6.32 mm (0.249 in.)

Thermal Condition:

As Welded

NOTCH-TOUGHNESS TEST

TYPE OF TEST: TEST TEMPERATURE: Charpy V-Notch

-48°C (-55°F)

ORIENTATION: SPECIMEN SIZE:

Transverse 10 x 5 mm

Laboratory Test No.: E06-1029.2

Date: January 2, 2007

Specimen	Notch	Impact	Values
Number	Location	Joules	(ft.lbs
B2.1	Weld Metal within 1/16" of root	16.5	(12.2)
B2.2	Weld Metal within 1/16" of root	25.8	(19.0)
B2.3	Weld Metal within 1/16" of root	44.7	(33.0)
B3.1	Gr. 60 - HAZ	69.4	(51.2)
B3.2	Gr. 60 - HAZ	95.5	(70.4)
B3.3	Gr. 60 - HAZ	108	(79.4)
B4.1	Gr. 70 - HAZ	90.9	(67.0)
B4,2	Gr. 70 - HAZ	101	(74.2)
B4.3	Gr. 70 - HAZ	107	(79.0)

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section Vill, Div. I, UG-84 - 2004 edition and latest addende. Meterial information has been provided by the Customer whose name appears on this report.

Samples associated with this report will/pe discarded in 30 days.

 H_{-1}

Laboratory Test Conducted By:

Natashua Collier, C.E.T.

LABORATORY TEST REPORT

CUSTOMER:

G.L.M. industries L.P.

1508 - 8 Street Nisku, AB T9E 7S6 Laboratory Test No.: E06-1029.2

Date: January 9, 2007

Attention:

Wilber Davie

PQR No.:

1-1-051-2

Material:

SA 516 Gr. 60 to SA 516 Gr. 70

Thickness:

6.32 mm (0.249 in.)

Thermal Condition:

As Welded

HARDNESS TEST

TYPE OF TEST:

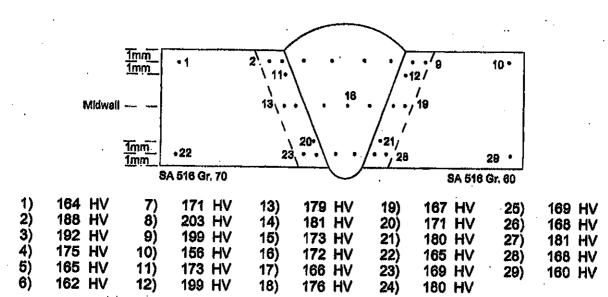
Vickers

LOAD:

10 kg

INSTRUMENT TYPE:

Leco V-100-C1



We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E92-82 (Reapproved 2003). The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the custofner whose name appears on this report.

Laboratory Test Conducted By:

Natashua Collier, C.E.T.

WELDING PROCEDURE	SPECIFICATIO	N NO.:		2-1-129A (Rev.2)
WELDING PROCEDURE	QUALIFICATIO	N RECORE) NO.(\$):	<u>2-1-129-1, 2-1-129-4</u> 2-1-129-3
	:			<u> </u>
	QUAL	IFIED FOR		
Restricted Applications: _	API 12D, 12F, 6	20 & 650 We	lded Storage Ta	ank Fabrication
Base Metal (Typical):	P1 Groups 1 & 2	to P1 Group	s 1 & 2	
***************************************		350 Gr.LF2		SA 516 Gr.70 etc.)
Process(es):	SAW			GROOVE & FILLET
Position:	FLAT & HORIZO	NTAL	Diameter:	ALL DIAMETERS
Filler Metal:	F7A2-EM12K			The same of the sa
BASE METAL CONDITIONOTCH TOUGHNESS APPIBASE METAL THICKNESS COMBINED DEPOSITED WASME SECTION IX	LICATIONS TO -2 RANGE	9°C AS WEL 4.8 to 3 KNESS	DED	to 1,50 in.) inclusive
SAFETY CODES ACT - PROVING WELDING PROCED Reg. No. WP SA3.2 Spec. No. 221-122A Weld Process SANN Matt. Gr. P.No. Gr. 1.72 to P.No. Eleo. Gr. F.No. A.No. Th. Qual. For 1.22 A. 22. ImmP.W.H.T. Ve.Q.S. Mo.R.S. Osy. 2. A. Signed R. R. WELL D.G. D. STUR ALE TANK F. P. R. R. WELL D.G. D. STUR ALE TANK F. R. R. R. WELL D.G. D. STUR ALE TANK F. R. R. R. R. R. R. R. R. R. R. R. R. R.	CREXZ			
PROVINCIAL REGIS	TRATION			

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Company Name		G.L.M. IN	DUSTRIES L.F	<u>', </u>	
Welding Procedure	Specification N	lo. 2-1-129A	(Rev.2) Da	ite	August 6, 2008
Revision(s) Rev	2: Essential - a	ddition of PC	R# 2-1-129-4.	deletion of	PQR# 2-1-129-2.
Rev.	2: Nonessentia	I - undated to	latest code re	auirements.	
	No. formerly 2				
Supporting PQR No	(g)	2-1-129-1	2-1-129-4, 2-1	-129-3	
Welding Process(es		SA	\\\	Type(s) Machine
vveiding i Tocoss(es	7	<u></u>	<u> </u>		O)
JOINTS (QW-402)	1				
Joint Design		nove & fillet	reference cons	truction dra	wing for joint details.
notific resign	\\/here ioint (iotalle are no	t enecified ref	er to figures	1 to 15 attached
Root Opening	As per etteck	and typical a	rove designs	eee figures	1 to 15 attached
Backing	\Alith or with	160 MADICAL AI	Detainer	soo ngaros	Not required
Dacking	VAILT OF VAILTO	, ut			TVOCTOGGICGG
DACE METAL Q //	'\\A/ AA2\				
BASE METALS (C	MAA.	0 0	To D Now	mhar	D4 Groups 1 & 2
P-Number	Pri Groups 1	0.2	name for shicks	noe evelifie	P1 Groups 1 & 2 d by governing code
i nickness Range:	Groove	See cover	page for injekt	<u>jess quame</u>	a by governing code
mi mi mana	FIRET	All base m	<u>etai thickhesse</u>	18	
Pipe Diameter Rang	es: Grool	/e	diameters		
m		All	diameters		
nebosited and inet	ai (Per Pass) _	12.	<u>/ mm (u.su in.</u>	<u>) maximum</u>	
	(mth. 4 m 4)	~ ^ ^)			
FILLER METALS		SAW			
Specification No. (SI	-A)	SFA 5.17		.,	
		<u> F7A2-EM1</u>	<u>2K</u>	a tree to the property of	
F-No		_F6			
A-No	********	AT			
Size		5/64 to 3/1	6 in. inclusive		
Supplemental Filler I	Vietal	Without		4.4.5.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4	
Wire Trade Name &	Designation	Lincoln Ele	ctric L61 wire		
Flux Trade Name & i	Designation	Lincoln Ele	ctric 860 flux		
Flux Type	······································	<u>Neutral</u>			
Recrushed Slag	Must be teste	d and meet	ASME Section	<u>II, Part C SI</u>	FA 5.17 requirements
Deposited Weld Meta	al Thickness Ra	ange:			
Groove		<u>38.1 mm (1</u>	.50 in.) max.		
Fillet		All fillet size	9 S		
POSITION (QW-40	15)				
Position of Groove		Horizontal	Position o	f FilletI	Flat & Horizontal
Weld Progression					
PREHEAT (QW-40	(6)				
Preheat Temperature		See attache	ed preheat she	et	
Interpass Temperatu			°C (450°F)		
Preheat Maintenance	See attache	d preheat sh		lding. Preh	eat maintenance is
	not required	if welding is	interrupted or	after the con	npletion of welding
	unless requir	red by the co	de of construc	tion.	
		- The St			

POST WELD HEAT TREATMENT (QW-407) Temperature Range N/A Time Range N/A ELECTRICAL CHARACTERISTICS (QW-409) Current Direct Polarity Reverse, electrode positive Volts See Table #1 Maximum Heat Input Base Metal Thickness Range SAW 0.188 - 0.374 in. 27,477 J/in. 0.375 - 0.624 in. 33,150 J/in. 0.625 - 1.50 in. 46,500 J/in. TECHNIQUE (QW-410) String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required Use of Thermal Process			WPS	NO. <u>2-1-129A (Rev.2)</u>
Current Direct Polarity Reverse, electrode positive Amps See Table #1 Volts See Table #1 Maximum Heat Input Base Metal Thickness Range SAW 0.188 - 0.374 in. 27,477 J/in. 0.375 - 0.624 in. 33,150 J/in. 0.625 - 1.50 in. 46,500 J/in. TECHNIQUE (QW-410) String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	POST WELD HEAT TREATME Temperature RangeN/A	NT (QW-407)	_ Time Range	N/A
Current Direct Polarity Reverse, electrode positive Amps See Table #1 Volts See Table #1 Maximum Heat Input Base Metal Thickness Range SAW 0.188 - 0.374 in. 27,477 J/in. 0.375 - 0.624 in. 33,150 J/in. 0.625 - 1.50 in. 46,500 J/in. TECHNIQUE (QW-410) String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	ELECTRICAL CHARACTERIS	TICS (QW-409)	
Base Metal Thickness Range 0.188 - 0.374 in. 0.375 - 0.624 in. 0.625 - 1.50 in. String or Weave Contact Tube to Work Distance Initial & Interpass Cleaning Method of Back Gouging Method of Back Gouging Closed to Out Chamber Multiple or Single Pass Per Side Multiple or Single Electrodes Moderate Input Say Say 27,477 J/in. 33,150 J/in. 133,150 J/in. 146,500 J/in. Travel Speed See Table #1 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Brushing, chipping or grinding as required Multiple or Single Pass Per Side Multiple Multiple	Current Direct	• • • • • •		Reverse, electrode positive
Base Metal Thickness Range 0.188 - 0.374 in. 0.375 - 0.624 in. 0.625 - 1.50 in. String or Weave Contact Tube to Work Distance Initial & Interpass Cleaning Method of Back Gouging Method of Back Gouging Closed to Out Chamber Multiple or Single Pass Per Side Multiple or Single Electrodes Moderate Input Say Say 27,477 J/in. 33,150 J/in. 133,150 J/in. 146,500 J/in. Travel Speed See Table #1 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Brushing, chipping or grinding as required Multiple or Single Pass Per Side Multiple Multiple	Amps See Table #	1	Volts	See Table #1
0.188 - 0.374 in. 0.375 - 0.624 in. 0.625 - 1.50 in. TECHNIQUE (QW-410) String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	Maximum Heat Input			
0.188 - 0.374 in. 0.375 - 0.624 in. 0.625 - 1.50 in. TECHNIQUE (QW-410) String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	Base Metal Thickness R	ange		SAW
0.375 - 0.624 in. 0.625 - 1.50 in. TECHNIQUE (QW-410) String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	0.188 - 0.374 in.			
TECHNIQUE (QW-410) String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	0.375 - 0,624 in.			33,150 J/in.
String or Weave String Travel Speed See Table #1 Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	0.625 - 1.50 in.			
Contact Tube to Work Distance Initial & Interpass Cleaning Method of Back Gouging Oscillation Closed to Out Chamber Multiple or Single Pass Per Side Multiple or Single Electrodes Peening 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Brushing, chipping or grinding as required Air carbon arc, back-grind as required N/A N/A Multiple Multiple Not required	TECHNIQUE (QW-410)			
Contact Tube to Work Distance 12.7 mm (0.50 in.) to 38.1 mm (1.50 in.) Initial & Interpass Cleaning Brushing, chipping or grinding as required Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	String or Weave	String	_ Travel Speed	See Table #1
Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	Contact Tube to Work Distance	<u> 12.7 mm (0.50</u>	in.) to 38.1 mn	n (1.50 in.)
Method of Back Gouging Air carbon arc, back-grind as required Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	Initial & Interpass Cleaning	Brushing, chip	<u>ping or grinding</u>	as required
Oscillation N/A Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	Method of Back Gouging	Air carbon arc,	back-grind as	required
Closed to Out Chamber N/A Multiple or Single Pass Per Side Multiple Multiple or Single Electrodes Single Peening Not required	Oscillation	N/A		
Multiple or Single Pass Per Side <u>Multiple</u> Multiple or Single Electrodes <u>Single</u> Peening Not required	Closed to Out Chamber			
Peening Not required		Multiple		
Peening Not required	Multiple or Single Electrodes	On MO		
Use of Thermal Process N/A	Peening	Not required		
	Use of Thermal Process	N/A		

TABLE 1 - WELDING PARAMETERS

Process	Filler Metal	Diameter mm (in.)	Current Type & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min (i.p.m.)
SAW	F7A2-EM12K	2.0 (5/64)	DCRP	200 - 450	25 - 32	164 - 750 (6.5 - 30)
SAW	F7A2-EM12K	2.4 (3/32)	DCRP	250 - 500	25 - 33	205 - 812 (8,1 - 32)
SAW	F7A2-EM12K	3.2 (1/8)	DCRP	300 - 600	26 - 34	256 - 890 (10.1 - 35)
SÁW	F7A2-EM12K	4.0 (5/32)	DCRP	400 - 700	26 - 34	341 - 1015 (13.5 - 40)
SAW	F7A2-EM12K	5.0 (3/16)	DCRP	500 - 1000	28 - 36	459 - 1270 (18.1 - 50)

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

Heat Input (joules per inch) = (Amperage X Voltage X 60) / Travel Speed (inches per minute)

TYPICAL JOINT DESIGNS -- 3/16 +/- 3/16 in. → 1/4 +/- 1/4 in. Figure 3 Figure 2 Figure 1 **Double Square Butt** Single Square Butt with Backing Strip Single Square Butt 80⁶+/- 15 ° 606+/- 150 Typical 3/16 +/- 3/16 in. 3/16 +/- 3/16 in. ^{4}--} 3/16 +/- 3/16 in. Figure 6 Figure 5 Figure 4 Single Vee Butt with Backing Strip Double Vee Butt Single Vee Butt Redius 1/8 in. Redius 1/8 In. Redius 1/8 In. +/- 1/16 In. +/- 1/16 in. +/- 1/18 in. 50° +/- 20 3/16 +/- 3/16 in. 3/16 +/- 3/16 in. 44-3/16 in. Figure 9 Figure 8 Figure 7 Double U Butt Single U Butt with Backing Strip Single U Butt Radius 1/8 in. +/- 1/16 ln. Redius 1/8 in: +/- 1/16 in. Radius 1/8 in. 20° +/- 10° 20° +/- 10° Typical 3/16 +/- 3/16 In. 3/16 +/- 3/16 in. 3/16 +/- 3/16 in. Figure 12 Figure 11 Figure 10 Double J Butt Single J Butt with Backing Strip Single J Butt 40°+/- 20° 40°+/- 20° Typical 40°+/- 20° --- 9/16 +/- 3/16 in. 3/16 +/- 3/16 in. -**₩** 3/16 +/- 3/16 in. Figure 15 Figure 14 Figure 13 Single Bevel Butt with Backing Strip **Double Bevel Butt** Single Bevel Butt

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

WPS No. 2-1-129A (Rev.2)

PREHEAT P-No. 1

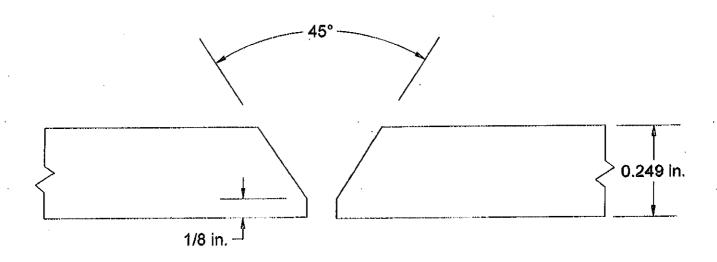
- 1. Welds joining pressure parts or attachments shall be preheated to not less than the minimum preheat temperatures stated in paragraph 5.
- 2. The preheat temperature shall be maintained during welding.
- 3. If welding is interrupted, the weld joint and adjacent areas shall be reheated to the minimum preheat temperature stated in paragraph 5, prior to the start of welding.
- 4. Preheat temperatures shall be checked by the welder or inspector, using temperature indicating crayons or other reputable methods.
- 5. Minimum preheating temperatures shall be as follows:

NOMINAL WALL THICKNESS	MINIMUM PREHEAT TEMPERATURE
0 to 32 mm (0 to 1,25 in)	10°C (50°F)
Over 32 mm (Over 1.25 in.)	95°C (200°F)

⁻ The preheat zone shall extend at least 76 mm (3.0 in.) beyond each edge of the weld.

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Company NameG.L.M. IND	DUSTRIES L.P.
Procedure Qualification Record No2-1	-129-1 Date August 22, 2000
welding Procedure Specification No. 2-1	-129A (Rev.2)
PQR Revision <u>Format update & Editorial</u>	update,
<u>WPS No. formerly 2-1-129</u>	9A (Rev.1), August 6, 2008
Welding Process(es)SA	N Type(s) Machine
JOINTS (QW-402)	
Type Butt joint, single vee groot	ve, see next page
BASE METALS (QW-403)	
Material Span SA 36 to SA 546	Tuno or Crodo NI/A to Co 70
Material Spec. SA 36 to SA 516 P-No. P1 Grp.1 To P-No. P1 Grp.2	Thickness 6.22 mm (0.240 in)
Diameter N/A	Other Plate Product Form m/s to 0.340 in
10/1	Other Flate Floudet Form III/C to 0.249 III.
FILLER METALS (QW-404)	
Specification No. (SFA) SFA 5.17	
AWS No. (Class) F7A2-EM12	PK
Filler Metal F-No. F6	
Filler Metal A-No. A1	,
Flux Type Neutral	
Flux Type Neutral Size of Electrode See attache Deposited Weld Metal Thickness 6.32 mm (0.	d sketch
Deposited Weld Metal Thickness <u>6.32 mm (0</u> .	249 in.)
POSITION (QW-405)	
Position of Groove1G	Weld Progression <u>N/A</u>
PREHEAT (QVV-406)	
PREHEAT (QW-406) Preheat Temperature 10°C (50°F)	Interpass Temp. (Max.)200°C (392°F)
•	
POSTWELD HEAT TREATMENT (QW-407)	
Temperature N/A	TimeN/A
	••
ELECTRICAL CHARACTERISTICS (QW-40)	
Direct Direct	Polarity Reverse, electrode positive
Amps <u>See next page</u> Heat Input <u>F6: 27,477 J/in. maximum</u>	Volts See next page
reat input	
ECHNIQUE (OW 440)	
ECHNIQUE (QW-410)	Taxani Orana I Orana
String or Weave String	Travel Speed See next page
Multiple or Single Pass Per Side Multiple or Single Floatenday	
fultiple or Single Electrodes Single	



Pass	Process	Filler Metal	Diameter mm (ln.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min (i.p.m.)
All	SAW	F7A2-EM12K	2.4 (3/32)	DCRP	325	31	559 (22)

PQR	NO	2.4.420.4
L Ofth	10 🕶 .	<u>2-1-129</u> -1

CHARPY IMPACT TOUGHNESS

Type of Test	Charpy V Notch	Orientation	Transverse
Test Temperature _	-54° C (-65° F)	Specimen Size	10 X 4 mm

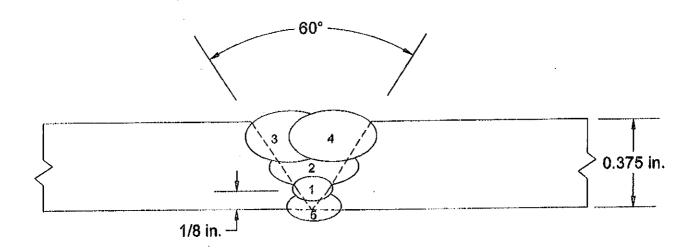
Specimen No.	Notch Location	Impact Values J (ft. lbs)
A2.1	Weld Metal within 1/16 in. of root	20.3 (15.0)
A2.2	Weld Metal within 1/16 in. of root	21.7 (16.0)
A2,3	Weld Metal within 1/16 in. of root	21.7 (16.0)
A3,1	SA 36 - HAZ	9.5 (7.0)
A3.2	SA 36 - HAZ	23.1 (17.0)
A3,3	SA 36 - HAZ	19.0 (14.0)
A4.1	Gr. 70 - HAZ	13.3 (9.8)
A4,2	Gr. 70 - HAZ	13.6 (10.0)
A4.3	Gr. 70 - HAZ	13.6 (10.0)

OTHER TESTS

•	VINE	. (E019						
Ro	Rockwell Hardness - see attached laboratory test report							
Welders Name	Cliff Debrule	Stamp No.	CD					
Tests Conducted By Laboratory Test No	Ludwig & Associa E00-598.1	tes Ltd.						
We hereby recertify that the Paragraph QW-200.2 and with the requirements of S	that the test welds we	ere prepared, welded	ised in accordance with and tested in accordance					
ManufacturerG.L	M INDUSTRIES L.P.		rryghteld yn dighlagydd y hawll dae'i Ellilli Gallandiai ellilligyydd y ddynno wyg gyfyrillia y y					
Date <u>08/19/08</u>	Differential Company of Charge	Signed Vo						

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Company Name		G.L.M. INDUS	STRIES L.P.		
Procedure Qualificat	ion Record No.	2-1-12	9-4 Date	Aug	ust 7, 2008
Welding Procedure S	Specification No	2-1-12	9A (Rev.2)		
Welding Procedure S Welding Process(es))	SAW		Type(s) _	Machine
• • • • • • • • • • • • • • • • • • • •					
JOINTS (QW-402)					
Туре	Butt joint, sing	le vee groove,	see next page		
BASE METALS (Q	(W-403)				
Material Spec.	SA 516 to SA	516	_ Type or Grad	e <u>Gr.6</u>	0 to Gr.70
Material Spec P-NoP1 Grp.1	To P-No	P1 Grp.2	_ Thickness	9.52	mm (0.375 in.)
Heat Number	297420 - 6519	6	_ Carbon Equiv	/alent <u>U.36</u>	%
Diameter	N/A	***	_ Other	<u>Plate</u>	e Product Form
FILLER METALS (QW-404)				
Specification No. (SF	A)	SFA 5.17	· · · · · · · · · · · · · · · · · · ·		
AWS No. (Class)		<u>F7A2-EM12K"</u>	i .		
Filler Metal F-No		F6	·		
Filler Metal A-No		A.L			
Supplemental Filler N	letal	Without			
Flux Type	····	<u>Neutral</u>	· · · · · · · · · · · · · · · · · · ·		
Flux Type Size of Electrode Deposited Weld Meta		See attached s	sketch		
Deposited Weld Meta	al Thickness	9.52 mm (0.37	<u>'5 in.)</u>		
Other		<u>* Lincoln Elect</u>	rlc L61 Wire		
·	Technological Printed	<u> * Lincoln Elect</u>	ric 860 Flux		· · · · · · · · · · · · · · · · · · ·
POSITION (QW-40)	5)				
Position of Groove	ender og samtifer og syndeligtet for det endeligt ville som sin hall ser	<u>1G</u>	. Weld Progres	sion <u>NA</u>	
PREHEAT (QW-40)	6}				
Preheat Temperature	<u>10°C (5</u>	0°F)	. Interpass Ten	ıр. (Мах.) 🔔	200°C (392°F)
POSTWELD HEAT	TREATMENT	(QW-407)			
Temperature	N/A		Time	N/A	
•					
ELECTRICAL CHA	RACTERISTIC	S (QW-409)			
Current	Direct		PolarityI	<u>Reverse, ele</u>	ctrode positive
Amps	See next page		Volts	<u>See next pac</u>	<u> </u>
Heat Input	F6: 33,150 J/in	, maximum			
- 					
TECHNIQUE (QW-4					
String or Weave			Travel Speed	See next	page
Multiple or Single Pas	s Per Side	Both			
Multiple or Single Elec	trodes	Single			



Pass	Process	Filler Metal	Diameter	Current &	Amperage	Voltage	Travel Speed
, , ,			mm (in.)	Polarity	Range	Range	mm/min (i.p.m.)
1*	SAW	F7A2-EM12K	2.4 (3/32)	DCRP	300	29	523 (20.6)
2*	SAW	F7A2-EM12K	2.4 (3/32)	DCRP	300	29	523 (20.6)
3*	SAW	F7A2-EM12K	2.4 (3/32)	DCRP	340	30	469 (18.5)
4*	SAW	F7A2-EM12K	2.4 (3/32)	DCRP.	340	30	469 (18.5)
5*	SAW	F7A2-EM12K	2.4 (3/32)	DCRP	340	30	469 (18.5)

^{*} Recorded welding parameters provided by G.L.M. INDUSTRIES L.P.

PQR	NO.	2-1-129-4
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CHARPY IMPACT TOUGHNESS

Type of Test	Charpy V Notch	Orientation	Transverse
Test Temperature		Specimen Size	10 X 8 mm

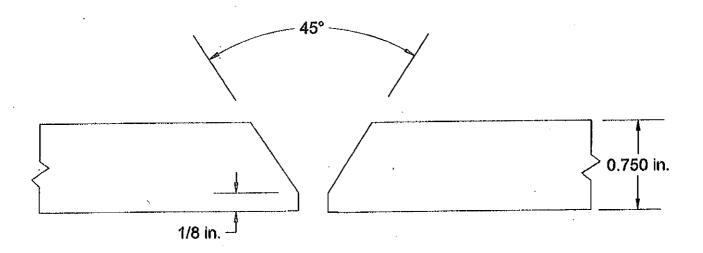
Specimen No.	Notch Location	Impact Values <u>J (ft. lbs</u>
L2.1	Weld Metal within 1/16 in, of surface	41.5 (30.6)
1.2.2	Weld Metal within 1/16 in. of surface	27.4 (20.2)
L2.3	Weld Metal within 1/16 in. of surface	29.0 (21.4)
L3.1	Gr. 60 - HAZ	93.8 (69.2)
L3.2	Gr. 60 - HAZ	87.9 (64.8)
L3.3	Gr. 60 - HAZ	83,8 (61.8)
N3.1	Gr. 70 - HAZ	160 (118)
N3,2	Gr. 70 - HAZ	>163 (>120)
N3.3	Gr. 70 - HAZ	>163 (>120)

OTHER TESTS

	Vickers Hardness - see attached laboratory test report				
Welders Name Tests Conducted By	Merlin Grabia Ludwig Associates Ltd.	Certificate File No.			
Laboratory Test No.	E08-617.2	And the second s	an ann an the state of the stat		
Manufacturer	G.L.M INDUSTRIES L.P.	सर्वे करानि है एक को त्रांत्र के प्राप्त के प्रेम प्राप्त को भी प्रेम के लिए के स्थाप प्राप्त का प्रमुक्त की का	an and an annual statement of the statem		
Date <u>8 / / / 9</u>	108	Signed			

QW-483 PROCEDURE QUALIFICATION RECORD (PQR)

Company Marie Galiani	7 1 \
Procedure Qualification Record No. 2-1-12	9-3 Date August 22, 2000
Welding Procedure Specification No. 2-1-12	9A (Rev.2)
POR Revision Format undate & Editorial upd	date.
PQR Revision Format update & Editorial update WPS No. formerly 2-1-129A (Rev.1). August 7, 2008
Welding Process(es) SAW	Type(s) Machine
Veiding (100055(05)	71
JOINTS (QW-402)	
Type Butt joint, single vee groove.	see next page
ype	
BASE METALS (QW-403)	
Material Spec. SA 36 to SA 516 P-No. P1 Grp.1 To P-No. P1 Grp.2	Type or Grade N/A to Gr.70
P.No. P1 Gro 1 To P-No. P1 Gro 2	Thickness 19.1 mm (0.750 in.)
Diameter N/A	Other Plate Product Form
Lifatiotei	
FILLER METALS (QW-404)	
Specification No. (SFA) SFA 5.17	•
ANAC No. (Close) E742-EM12K	
Filler Metal F-No. F6	
Filler Metal A-No. A1 Supplemental Filler Metal Without	the state of the s
Supplemental Filler Ividial Villiout	
Flux Type Neutral Size of Electrode See attached s	katch
Deposited Weld Metal Thickness 19.1 mm (0.75	n in \
Deposited Weld Metal Milokness 18.1 milit (0.79	V 1))./
MARITIMAL (AND ARE)	
POSITION (QW-405) Position of Groove 1G	Mold Progression M/A
Position of Groove 1G	Weld Progression TWA
managed the Art 1000 to 1000	
PREHEAT (QW-406) Preheat Temperature 10°C (50°F)	Internace Terms (May) 200°C (392°F)
Preheat Temperature 10°C (50°F)	interpass remp. (wax.)
POSTWELD HEAT TREATMENT (QW-407)	- NAMA
Temperature N/A	Time <u>IVA</u>
ELECTRICAL CHARACTERISTICS (QW-409)	
Current Direct	Polarity <u>Reverse, electrode positive</u>
Amps See next page	Volts See next page
Amps See next page Heat Input F6: 46,500 J/in, maximum	
TECHNIQUE (QW-410)	
String or WeaveString	Travel Speed See next page
TECHNIQUE (QW-410) String or Weave String Multiple or Single Pass Per Side Multiple Multiple or Single Pass Per Side Single	
Multiple or Single Electrodes Single	
•	



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/mln (i.p.m.)
All	SAW	F7A2-EM12K	2.4 (3/32)	DCRP	425	31	432 (17)

PQR NO. <u>2-1-129-3</u>	
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TENSILE TEST (QW-150)

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. ln.)	Ultimate Load N (lbs.)	Ultimate Stress MPa (psi)	Character & Fracture Location
T 1	19.0	16.0	304	160 200	527	Partial Cup & Cone
	(0.748)	(0.630)	(0.471)	(36,020)	(76,400)	Parent Metal (SA 516 Gr. 70)
T2	19.0	16.0	. 304	15 500	525	Partial Cup & Cone
	(0.748)	(0.630)	(0.471)	(35,900)	(76,100)	Parent Metal (SA 36)

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Type & Figure No.	Result
QW-462.2, TSB - S1	Pass	QW-462.2, TSB - S3	Pass
QW-462.2, TSB - \$2	Pass	QW-462.2, TSB - S4	Pass

CHARPY IMPACT TOUGHNESS

ype of Test	Charpy V Notch	Orientation	Transvers	30
est Temperature	-46° C (-50° F)	Specimen Size	10 X 10 n	nm
Specimen N	O. 1	Notch Location	Impact Values	J (ft. lbs)
C2.1	Weld Meta	al within 1/16 in, of root	33.9 (25	.0)
C2.2		al within 1/16 in. of root	34.2 (25.	.2)
C2.3		al within 1/16 in. of root	41.0 (30.	2)
C3.1		SA 36 - HAZ	20,3 (15.	0)
C3.2		SA 36 - HAZ	38.2 (28.	2)
C3.3		SA 36 - HAZ	31.2 (23.	0)
C4.1		Gr. 70 - HAZ	155 (114)
C4.2		Gr. 70 - HAZ	121 (89.	0)
C4.3		Gr. 70 - HAZ	115 (85.	0)

OTHER TESTS

R(<u>ckwell Hardness - see a</u>	ittached laboratory	test report
Welders Name	Cliff Debrule	Stamp No	CD
Tests Conducted By	Ludwig & Associate	s Ltd.	
Laboratory Test No.	E00-598.3		
Paragraph QW-200.2 an with the requirements of	d that the test welds wer Section IX of the ASME	e prepared, welded Code.	i and tested in accordance
with the requirements of	Section IX of the ASME	e prepared, welded Code.	i and tested in accordance
with the requirements of	d that the test welds wer Section IX of the ASME L.M INDUSTRIES L.P.	e prepared, welded Code.	and tested in accordance
with the requirements of ManufacturerG.	Section IX of the ASME	e prepared, welded	and tested in accordance
with the requirements of	Section IX of the ASME	e prepared, welded	and tested in accordance

Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLW Tanks & Equipment

1508 – 8 Street Nisku, Alberta T9E 7S6

•

Attention:

.Wilber Davie

PQR Number:

2-1-129-1

Material:

SA 36 to SA 516 Gr. 70

Thickness:

6.32 mm (0.249 in.) As Welded

Thermal Condition: As

NOTCH-TOUGHNESS TEST

TYPE OF TEST: TEST TEMPERATURE: Charpy V-Notch -54°C (-65°F)

ORIENTATION:

Transverse

Laboratory Test No.: E00-598.1

Date: August 22, 2000

SPECIMEN SIZE:

10 x 4 mm

Orinalisana	Notch	Impact Values	
Specimen Number	Location	Joules	(ft.lbs)
A 42 J	Weld Metal within 1/16" of surface	20.3	(15.0)
A2.1	Weld Metal within 1/16" of surface	, 21.7	(16.0)
A2.2		21.7	(16.0)
A2.3	Weld Metal within 1/16" of surface	& 1 · f	(10.0)
A3.1	SA 36 - HAZ	9.5	(7.0)
	SA 36 - HAZ	23.1	(17.0)
A3.2	SA 36 - HAZ	19.0	(14.0)
A3.3	5A 30 - HAZ	10.0	(1)
A4.1	Gr. 70 HAZ	13.3	(9.8)
A4,2	Gr. 70 – HAZ	13.6	(10.0)
	Gr. 70 - HAZ	13.6	(10.0)
A4.3	GI. 10 " TAL	.0.0	()

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. I, UG-84, 1998 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:_

Karen Koens, C.E.T.



Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM Tanks & Equipment

1508 – 8 Street Nisku, Alberta T9E 7S6 Laboratory Test No.: E00-598.1

Date: August 22, 2000

Attention:

Wilber Davie

POR Number:

2-1-129-1

Material:

SA 36 to SA 516 Gr. 70

Thickness:

6.32 mm (0.249 ln.)

Thermal Condition: A

As Welded

HARDNESS TEST

TYPE OF TEST:

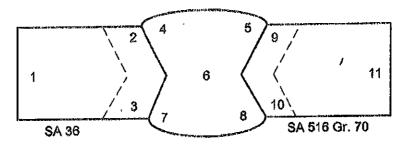
Rockwell

SCALE:

В

INSTRUMENT TYPE:

Wilson



1) 73 HRB

5) 85 HRB

9) 74 HRB

2) 74 HRB

6) 84 HRB

10) 87 HRB

3) 80 HRB

7) 82 HRB

11) 83 HRB

4) 82 HRB

8) 87 HRB

·

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E18 - 98. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Angela Sultanian/Karen Koens, C.E.T.



Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM Tanks.& Equipment

1508 – 8 Street Nisku, Alberta T9E 7S6

٠

Attention:

Wilber Davie

PQR Number:

2-1-129-2

Material:

SA 36 to SA 516 Gr. 70

Thickness:

9.52 mm (0.375 in.)

Thermal Condition:

As Welded

NOTCH-TOUGHNESS TEST

TYPE OF TEST:

Charpy V-Notch

ORIENTATION:

Transverse

TEST TEMPERATURE:

-50°C (-58°F)

SPECIMEN SIZE: 10 x 7 mm

Laboratory Test No.: E00-598.2

Date: August 22, 2000

Specimen	Notch	Impact	Values
Number	Location	Joules	(ft.lbs)
5 0.4	Weld Metal within 1/16" of surface	47.7	(35.2)
B2.1 B2.2	Weld Metal within 1/16" of surface	^{49.1}	(36.2)
B2.3	Weld Metal within 1/16" of surface	39.6	(29.2)
B 3.1	SA 36 - HAZ	33.9	(25.0)
B3.2	SA 36 - HAZ	1 6.3	(12.0)
B3.3	SA 36 - HAZ	31.2	(23.0)
В4.1	Gr. 70 – HAZ	15.2	(11.2)
B4.2	Gr. 70 - HAZ	1 3. 6	(10.0)
B4.3	Gr. 70 - HAZ	23.6	(17.4)

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. I, UG-84, 1998 edition and latest addende. The information regarding meterial identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Karen Koens, C.E.T



Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM Tanks & Equipment

1508 – 8 Street Nisku, Alberta T9E 7S6 Laboratory Test No.: E00-598.2

Date: August 22, 2000

Attention:

Wilber Davie

PQR Number:

2-1-129-2

Material:

SA 36 to SA 516 Gr. 70

Thickness:

9.52 mm (0.375 in.)

Thermal Condition:

As Welded

HARDNESS TEST

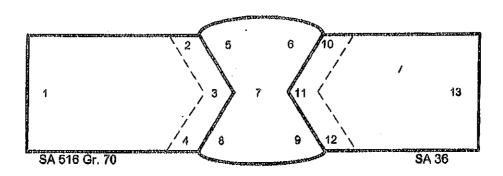
TYPE OF TEST:

Rockwell

SCALE:

B

INSTRUMENT TYPE:



1) 80 HRB

6) 90 HRB

11) 84 HRB

2) 88 HRB

7) 88 HRB

12) 85 HRB

3) 90 HRB

8) 90 HRB

13) 73 HRB

4) 89 HRB

9) 86 HRB

5) 90 HRB

10) 85 HRB

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E18 - 98. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

nducted By: Jaren Jaren Koens C.E.T.

4027 - 14 Street S.E., CALGARY, ALBERTA T2C JRB PHONE: (403) 262-7672 FAX: (403) 266-3163.



Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM Tanks & Equipment

1508 -- 8 Street Nisku, Alberta **T9E 7S6**

Attention:

Wilber Davie

PQR Number:

2-1-129-3

Material:

SA 36 to SA 516 Gr. 70

Thickness:

19.1 mm (0.750 in.)

Thermal Condition:

As Welded

TENSILE TEST QW-150

SAMPLE NUMBER	T 1	QW-462.1(a)	Т2	QW-462.1(a)
WIDTH mm (in)	19.0	(0.748)	19.0	(0.748)
THICKNESS mm (in)	16.0	(0.630)	16.0	(0.630)
AREA sq.mm (sq in)	304	(0.471)	304	(0.471)
ULTIMATE LOAD N (lbs)	160 200	(36,020)	15 500	(35,900)
UTS MPa (psl)	527	(76,400)	525	(76,100)
FRACTURE TYPE	Partial Cu	ıp & Cone	Partial C	up & Cone
FRACTURE LOCATION		etal (SA 516 Gr. 70)	Parent M	letal (SA 36)

GUIDED-BEND TEST QW-160

SAMPLE WIDTH:

9.52 mm (0.375 ln.)

SAMPLE THICKNESS:

19.1 mm (0.750 in.)

PLUNGER SIZE:

38.1 mm (1.50 in.)

YOKE SIZE: Side Bend 60.3 mm (2.375 in.)

QW-462.2

Side Bend

Side Bend

Side Bend

S1

S2

S3

S4

SAMPLE NUMBER(S) RESULTS

Pass:

Pass

Pass

Pass

Laboratory Test No.: E00-598.3

Date: August 22, 2000

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX - 98. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:_



Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM Tanks & Equipment

1508 – 8 Street Nisku, Alberta T9E 786

Attention:

Wilber Davie

PQR Number:

2-1-129-3

Material:

SA 36 to SA 516 Gr. 70

Thickness:

19.1 mm (0.750 in.)

Thermal Condition:

As Welded

NOTCH-TOUGHNESS TEST

TYPE OF TEST:
TEST TEMPERATURE:

Charpy V-Notch

-46°C (-50°F)

ORIENTATION:

Transverse

Laboratory Test No.: E00-598.3

Date: August 22, 2000

SPECIMEN SIZE:

10 x 10 mm

Specimen	Notch	Impact	Values
Number	l.ocation	Joules	(ft.lbs)
C2.1	Weld Metal within 1/16" of surface Weld Metal within 1/16" of surface	33.9 ′ 34.2	(25.0) (25.2)
C2.2 C2.3	Weld Metal within 1/16" of surface	41.0	(30.2)
C3.1	SA 36 - HAZ	20.3	(15.0)
C3.2	SA 36 - HAZ	38.2	(28.2)
C3.3	SA 36 - HAZ	31.2	(23.0)
C4.1	Gr. 70 - HAZ	155	(114)
C4.2 C4.3	Gr. 70 - HAZ Gr. 70 - HAZ	121 115	(89.0) (85.0)

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. I, UG-84, 1998 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By: Karen Koens, C.E.T.

Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM Tanks & Equipment

1508 - 8 Street Nisku. Alberta **T9E 7S6**

Laboratory Test No.: E00-598.3

Date: August 22, 2000

Attention:

Wilber Davie

PQR Number:

2-1-129-3

Materiai:

SA 36 to SA 516 Gr. 70

Thickness:

19.1 mm (0.750 ln.)

Thermal Condition: As Welded

MARDNESS TEST

TYPE OF TEST:

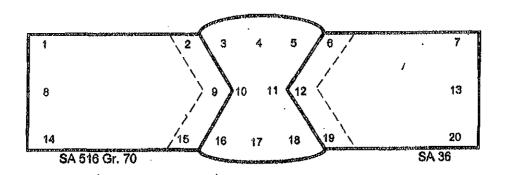
Rockwell

SCALE:

В

INSTRUMENT TYPE:

Wilson



1) **82 HRB** 6) **92 HRB** 11) 85 HRB 16) 90 HRB

2) **98 HRB** 7) 80 HRB 12) **87 HRB**

86 HRB 17)

3) **89 HRB** 8) **78 HRB** 13) **79 HRB** 18) 91 HRB

4) **85 HRB** 9) **89 HRB** 14) **84 HRB** 19) **93 HRB**

89 HRB 5)

10) 86 HRB

89 HRB 15)

20) **82 HRB**

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E18 - 98. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:_

Angela Sultanian/Karen Koens, C.E.T..



WELDING PROCEDURE SPECIFICATI	ION NO.:		3-8-168A (Rev.2)
WELDING PROCEDURE QUALIFICAT	ION RECORD	NO. (S):	3-8-168
QUA	ALIFIED FOR		
Base Metal (Typical): P8 to P8 (SA			
Process(es): GMAW (Surface-Tension-Tra			ALL DIAMETERS
Filler Metal: GMAW - STT:			7 towns or 11 11/1000 1 00 1
GMAW; ER3)			
BASE METAL CONDITIONS & GROOV	'E THICKNESS	RANGE QU	ALIFIED:
STANDARD APPLICATIONS AS WELDED BASE METAL THICKNESS RANGE	1.6 to 9.4	42 mm (0.062	to 0.371 in.) inclusive
COMBINED DEPOSITED WELD METAL TH ASME B31.1 ASME B31.3 ASME SECT. VIII, DIV.1	IICKNESS 9,42 mm 9,42 mm 9,42 mm	(0.371 ln.) ma (0.371 ln.) ma (0.371 ln.) ma	iximum iximum iximum
ALBERTA BOILERS SAFETY ASSOCIATION PROVINCE OF ALBERTA SAFETY CODES ACT WELDING PROCEDURE Reg. No. WP. 863.7 Spec No. 3-8-168.4 (REV.2) Weld Process Weld Process Mail. Gr. P No. 8 to P No. 8 Eleo. Gr. F No. 9 to P No. 8 Th. Qual. For. 9 to P No.			
PROVINCIAL REGISTRATION			

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

		G.L.M. Industries L.P.	
Welding Procedure	Specification	1 No 3-8-1684 (Pay 2	2) Date <u>September 26, 20</u>
Revision Rev. 2	(Nonessenti:	2) Corporate name change	(formerly GLM Tanks &
- 1101011 <u>- 11011 x</u>	. 11101100001161	Faultment Ltd \ M/PS No	o. formerly 3-8-168A (Rev.1)
Supporting POR N	o (s)	3-8-168	5. 1011116117 3-0-(00A (Nev. 1)
Welding Process/e	(s) GN	AAM (STT) / GMAM	Type(s) <u>Semi-automatic</u>
770iding (100035(0	.5/	MAW (STITT GIVIAVV	Type(s) <u>Serm-automatic</u>
JOINTS (QW-402			
Joint Design	All ASME	<u>groove & fillet, reference con</u>	struction drawing for joint details
	Where join	<u>nt details are not specified, re</u>	fer to figures 1 to 15 attached
Root Opening	As per atta	<u>iched typical groove designs.</u>	_see figures 1 to 15 attached
Backing	With or wit	hout Retainer	s <u>Not required</u>
BASE METALS (OW-403)		
P.Number	D8	To P-Nui	mhor D0
Thickness Range:	Groove	See cover page for thick	ness qualified by governing cod
THICKHOSS Harryo.	GIOOVE	All hase motel thinknesses	ness qualified by governing cod
Dine Diemoter Ranc	Liner	All diameters	es es es es es es es es es es es es es e
Lihe Digitieter valif	jes: Gro	All diameters	
Deposited Mind Man	FIIIE Canadan Danas	All diameters	70.440
Debosited Meid Me	tai (Per Pass)	GMAVV (STT): 2.	79 mm (0,110 in.) maximum
		GMAVV: 6.63 mn	n (0.261 in.) maximum
FILLER METALS	(QW-404)	GMAW (STT)	GMAW
Specification No. (S	FA)	SFA 5.9 ER308LSI, ER316LSI F6	SFA 5.9
AWS No. (Class) _		ER308LSJ, ER316LSJ	ER3XX(L)(Si)*
-No,		F6	F6
\-No	· · · · · · · · · · · · · · · · · · ·	A8	F6 A8
Size		.030 to .045 in. inclusive	
	Form	Solid wire	Solid wire
Supplemental Filler i	Vetal	Without	Without
eposited Weld Met	al Thickness	Range:	Tranout
Proove	W. 11119101000	2 79 mm (0 110 in \ may *	* 6.63 mm (0.261 in.) max.**
illet		All fillet sizes	All fillet sizes
ther * Metch fille	r metal chem	ical composition to base met	al heing welded
** Combined	denosited w	All fillet sizes lical composition to base met	exceed 9.42 mm (0.371 in.)
		and for ASME Section VIII, I	
	<u> </u>	CANGIOL ADMIL DECION VIII, I	OIV. I
OSITION (QW-40	E\		
colling of Overve	∧#	nalilana Destile d	6 PULL A 16 747
osition of Groove	All DO	ositions Position of	Fillet All positions
eld Progression	GIVIA	W (STT): Vertical down	GMAW: Vertical up
DELICAT (OM 40)	6)		
REHEAT (QW-40		(a a d d m a a a a a	
and the company of th	/A /I I		
terpass Temperatur	re (Maximum)	177°C (350°F)	
terpass Temperatur	re (Maximum) 10°C prior t	177°C (350°F) o welding. Preheat maintena	ance is not required if welding is
reheat Temperature terpass Temperatur reheat Maintenance	re (Maximum) 10°C prior t	177°C (350°F) o welding. Preheat maintena or after the completion of we	ance is not required if welding is Iding unless required by the

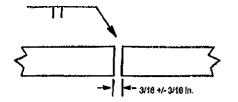
		WPS	NO	3-8-168A (Rev.2)
POST WELD HEAT TREAT	'MENIT (ON) 407\			·
Temperature Range	INENA (CAAA-401)	_ Time Range		NI/A
Tomporaturo rango	074	_ Hura Lyanga	<u> </u>	IN/M
GAS (QW-408)				
Specification No. (SFA) Shelding 90% Helium, 7.5% A	FA 5.32	AWS No. (Cli	ass)	SG-HeAC-7.5/2.5
Shielding 90% Helium, 7.5% A	rgon, 2.5% Carbon	Dioxide, 10-25	liters pe	r minute (20-50 cfph)
Backing N	ot Required	Trailing		Not Required
ELECTRICAL CHARACTER	HSTICS (QW-409)	1		
Current Direct Amps See Tabl		Polarity	Reverse	e, electrode positive
Amps See Tabl	e #1	Volts	See Tat	le #1
Mode of Metal TransferG	MAW (STT); Short	circuiting	1	
Mode of Metal TransferG	MAW: Pulsating Ar	C (SPRAY)		
TECHNIQUE (QW-410)				
String or Weave	<u>Either</u>	Travel Speed	8	ee Table #1
Orifice or Gas Cup Size	9,52 mm (0.37	<u>5 ln.) to 19.1 mi</u>	n (0.750) in.)
Initial & Interpass Cleaning	Brushing, chipi	oing or grinding	as requ	ired with equipment
·	that will not con	ntaminate		
Method of Back Gouging	Air carbon arc.	back-grind as r	equired	with equipment
	that will not cor	ntaminate		
Oscillation	N/A			
Contact Tube to Work Distance	GMAW (STT):	6.35 mm (0.250) in.) to	(9.1 mm (0.750 in.)
Contact Tube to Work Distance	GMAW: 12,7 r	nm (0.500 in.) to	25.4 m	ım (1.00 in.)
Multiple or Single Pass Per Side	GMAW (STT):	Single, root pas	s only	GMAW: Either
Multiple or Single Electrodes				
Electrode Spacing			·	
Peening	Not permitted			· · · · · · · · · · · · · · · · · · ·
-			***************************************	

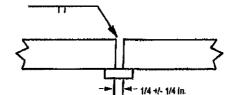
TABLE 1 - WELDING PARAMETERS

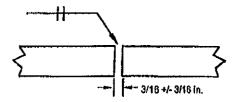
Process	Filler Metal	Diameter mm (ln.)	Current Type & Polarity	Amperage Range	Vollage Range	Travel Speed mm/min. (l.p.m.)
GMAW - STT	ER308LSI	0.8 (0.030)	DCRP	70 - 130	12 - 21	38 - 250 (1.5 - 10)
GMAW - STT	òr	0.9 (0.035)	DCRP	80 - 200	13 - 22	50 - 600 (2.0 - 25)
GMAW - STT	ER316LSI	1.1 (0.045)	DCRP	100 - 250	14 - 23	75 - 900 (3.0 - 35)
GMAW	ER3XX(L)(SI)	0.8 (0.030)	DCRP	60 - 130	14 - 29	38 - 250 (1.5 - 10)
GMAW	ER3XX(L)(SI)	0.9 (0.035)	DCRP	70 - 200	15 - 30	50 - 600 (2.0 - 25)
GMAW	ER3XX(L)(Si)	1.1 (0.045)	DCRP	70 - 250	16 - 30	75 - 900 (3.0 - 35)

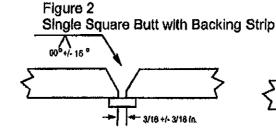
Note: Size of electrode, filler metal, number of passes, voltage, amperage, and travel speed will vary with position, joint thickness, joint type etc. Match filler metal chemical composition to base metal being welded.

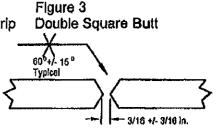
TYPICAL JOINT DESIGNS

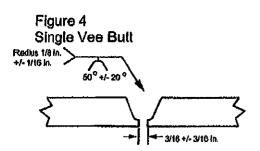


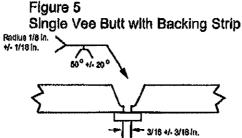


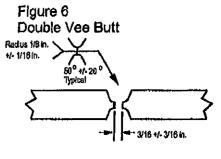


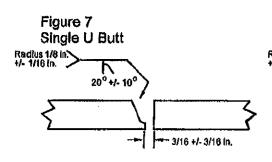












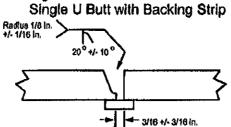
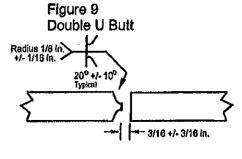
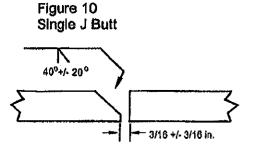
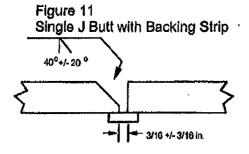


Figure 8







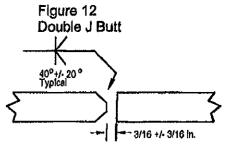


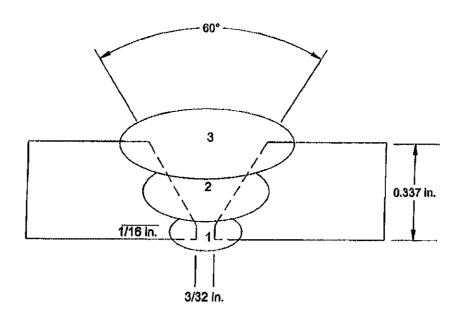
Figure 13 Single Bevel Butt

Figure 14 Single Bevel Butt with Backing Strip

Figure 15 Double Bevel Butt

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

· · · · · · · · · · · · · · · · · · ·	<u> </u>	/l. Industries L.P.	
Dropoduro Ouglification De-	ord No	2.0.460	- Danamhau C 2002
Procedure Qualification Rec	ord IVO.	<u>3-8-168</u> Dat	December 9, 2003
run kevision	Corporate na September 2	me change (formerly	GLM Tanks & Equipment Ltd.)
Welding Procedure Specific	ation No.	3-8-168A (Rev.2)	
Welding Process(es)	GMAW - STT	/GMAW Typ	e(s) <u>Seml-automatic</u>
	OWN CT	/ Oldiviva	S(S) OCITI-ACIOITIANC
JOINTS (QW-402)			
Гуре	Butt joint, sind	ale vee groove, see no	ext page
BASE METALS (QW-403)		Thurs 0	da "# 004)
viateriai Spec, SA 317	<u>/</u>	Type or Gra	de <u>Type 304L</u> 8.56 mm (0.337 in.)
-No	No. PB	Thickness .	8,56 mm (0.337 in.)
lameter <u>114.3 mm (4.5</u>	0 in.) O.D.	Other	Schedule 80
ILLER METALS (QW-40	4 \	GMAW - STT	GMAW
Inecification No. (SEA)	*/		SEVEO
MS No (Clase)		EDSUS SI	SFA 5.9 ER308LSI
iller Metal E-No	· · · · · · · · · · · · · · · · · · ·	EK	ENOVOLOI
lilor Motal A No		TU AG	F6
iller Metal A-No.		Mo	A8
ize of Electrode		See attached sketch	6.02 mm (0.237 in.)
eposited vveid Metal Thickn	ess	2.54 mm (0.100 in.)	6.02 mm (0.237 in.)
OSITION (QW-405)			
osition of Groove	5 G		
osition of Groove	6G GMAW - STT:	Vertical down	GMAW: Vertical up
osition of Groove leid Progression	5G GMAW - STT:	Vertical down	GMAW: Vertical up
osition of Groove			
osition of Groove			GMAW: Vertical up
reheat Temperature	10°C (50°F)	Interpass Te	
osition of Groove	10°C (50°F) MENT (QW-4	Interpass Te	mp. (Max.) <u>177°C (350°F)</u>
reheat Temperature	10°C (50°F) MENT (QW-4	Interpass Te	
relicion of Groove Feld Progression	10°C (50°F) MENT (QW-4	Interpass Te	пр. (Мах.) <u>177°С (350°F)</u>
relicion of Groove Teld Progression REHEAT (QW-406) Teheat Temperature DSTWELD HEAT TREAT Temperature I AS (QW-408)	10°C (50°F) MENT (QW-4 VA	Interpass Te	mp. (Max.) <u>177°C (350°F)</u> N/A
relicion of Groove Teld Progression REHEAT (QW-406) Teheat Temperature DSTWELD HEAT TREAT Temperature I AS (QW-408)	10°C (50°F) MENT (QW-4 VA	Interpass Te	mp. (Max.) <u>177°C (350°F)</u> N/A
relicition of Groove relicition of Groove relicition of Groove relicition (QW-406) relicition No. (SFA) relicition No. (SFA) relicition No. (SFA) relicition No. (SFA) relicition No. (SFA)	10°C (50°F) MENT (QW-4 VA	Interpass Te	mp. (Max.) <u>177°C (350°F)</u>
relicion of Groove Teld Progression REHEAT (QW-406) Teheat Temperature DSTWELD HEAT TREAT Temperature I AS (QW-408)	10°C (50°F) MENT (QW-4 VA	Interpass Te	mp. (Max.) <u>177°C (350°F)</u> N/A
relation of Groove relation of Groove relation (QW-406) reheat Temperature OSTWELD HEAT TREAT remperature AS (QW-408) recification No. (SFA) reciting 90% Helium, 7.	10°C (50°F) MENT (QW-4 VA SFA 5,32 5% Argon, 2.5°	Interpass Tele (07) Time AWS No. (Cla (Carbon Dioxide, 17)	mp. (Max.) <u>177°C (350°F)</u> N/A
relication of Groove relication of Groove relication (QW-406) reheat Temperature OSTWELD HEAT TREAT remperature AS (QW-408) recification No. (SFA) relication No. (SFA) relication No. (SFA) recking N/A LECTRICAL CHARACTER	10°C (50°F) MENT (QW-4 VA SFA 5,32 5% Argon, 2.5° RISTICS (QW	Interpass Teal Interpass Teal	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph)
rent	10°C (50°F) MENT (QW-4 NA SFA 5,32 5% Argon, 2.5° RISTICS (QW	Interpass Teal O7) Time AWS No. (Clay Carbon Dioxide, 17	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive
rent	10°C (50°F) MENT (QW-4 VA SFA 5,32 5% Argon, 2.5° RISTICS (QW	Interpass Teal O7) Time AWS No. (Cla Carbon Dioxide, 17 -409) Polarity Volts	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page
reheat Temperature OSTWELD HEAT TREAT OSTWELD HEAT	MENT (QW-4 WA SFA 5,32 5% Argon, 2,5° RISTICS (QW	Interpass Tele O7) Time AWS No. (Cla Carbon Dioxide, 17 -409) Polarity Volts Short circuiting arc	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page
reheat Temperature OSTWELD HEAT TREAT OSTWELD HEAT	MENT (QW-4 WA SFA 5,32 5% Argon, 2,5° RISTICS (QW	Interpass Tele O7) Time AWS No. (Cla Carbon Dioxide, 17 -409) Polarity Volts Short circuiting arc	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page
reheat Temperature OSTWELD HEAT TREAT OSTWEL	MENT (QW-4 WA SFA 5,32 5% Argon, 2,5° RISTICS (QW	Interpass Tele O7) Time AWS No. (Cla Carbon Dioxide, 17 -409) Polarity Volts Short circuiting arc	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page
reheat Temperature OSTWELD HEAT TREAT OSTWEL	MENT (QW-4 NA SFA 5,32 5% Argon, 2,5° RISTICS (QW t page SMAW - STT:	Interpass Teal IO7) Time AWS No. (Clare of the content of the c	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page
reheat Temperature OSTWELD HEAT TREAT OSTWELD HEAT	MENT (QW-4 WA SFA 5,32 5% Argon, 2.59 RISTICS (QW t page SMAW - STT: SMAW: Pulsati	Interpass Teal 107) Time AWS No. (Cla 409) Polarity Volts Short circuiting arc Ing Arc STT: Weave	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page
reheat Temperature OSTWELD HEAT TREAT OSTWELD HEAT	MENT (QW-4 WA SFA 5,32 5% Argon, 2.59 RISTICS (QW Dage SMAW - STT: SMAW: Pulsati	AWS No. (Claws and Control of the Co	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page GMAW: Weave
reheat Temperature OSTWELD HEAT TREAT OSTWELD HEAT	MENT (QW-4 WA SFA 5,32 5% Argon, 2.5° RISTICS (QW Dage SMAW - STT: SMAW: Pulsati	AWS No. (Claws and Control of the Co	np. (Max.)177°C (350°F) N/A ass)SG-HeAC-7.5/2.5 .5 liters per minute (35 cfph) Reverse, electrode positive See next page



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
1	GMAW	ER308LSi	1.1 (0.045)	DCRP	95 - 100	16 - 18	167 (6.6)
2	GMAW	ER308LSI	1.1 (0,045)	DCRP	85 - 90	23 - 26	79 (3,1)
3	GMAW	ER308LSI	1.1 (0.045)	DCRP	80 - 85	23 - 26	56 (2.2)

TENSILE TEST (QW-150)

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Ultimate Load N (ibs.)	Ultimate Stress MPa (psi)	Character & Fracture Location
T1	18.7	7.15	134	72 800	544	Partial Cup & Cone
	(0.736)	(0.281)	(0.207)	(16,400)	(79,000)	Parent Metal
T2	18.9	6.69	126	68 000	538	Partlal Cup & Cone
	(0.744)	(0.263)	(0.196)	(15,300)	(78,000)	Parent Metal

GUIDED BEND TEST (QW-160)

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

OTHER TESTS

	w 111-11		
Vickers H	ardness - see attached	laboratory test report	
Welders Name	Dwayne Huber	Certificate File No.	W-17511
Tests Conducted By	Ludwig & Associate	es Ltd.	
Laboratory Test No.			
	d that the test welds we	record have been revised ere prepared, welded and te Code.	
Manufacturer	G.L.M. INDU	JSTRIES L.P.	
Date Ort 5	106	Signed	·

Laboratory Test No.: E03-1087.1

Date: December 11, 2003

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6

Attention:

Wilber Davie

POR No.:

3-8-168

Material:

SA 312 Type 304L

Size:

114.3 mm (4.50 ln.) O.D. x 8.56 mm (0.337 ln.) w.t.

Thermal Condition: As

TENSILE TEST QW-150

SAMPLE NUMBER	T 1	QW-462.1(b)	T2	QW-462.1(b)
WIDTH mm (in.)	18.7	(0.736)	18.9	(0.744)
THICKNESS mm (in.)	7.15	(0.281)	6.69	(0.263)
AREA sq. mm (sq. in.)	134	(0.207)	126	(0.196)
ULTIMATE LOAD N (lbs)	72 800	(16,400)	68 000	(15,300)
UTS MPa (psl)	544	(79,000)	538	(78,000)
FRACTURE TYPE	Partial Cu	up & Cone	Partial Cu	up & Cone
FRACTURE LOCATION	Parent M	etal	Parent M	etal

GUIDED-BEND TEST QW-160

SAMPLE WIDTH: 19.1 mm (0.750 in.) SAMPLE THICKNESS: 8.56 mm (0.337 in.) PLUNGER SIZE: 31.8 mm (1.25 in.) YOKE SIZE: 54.5 mm (2.15 in.) QW-462.3 (a) Face Bend Root Bend Face Bend Root Bend SAMPLE NUMBER(\$) F1 R1 F2 R2 RESULTS **Pass** Pass Pass **Pass**

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX, 2001 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:	10d-
Laboratory Tost Conducted by.	TO THE STATE OF TH
	Natashua Collier, C.F.T

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6

Attention:

Wilber Davie

PQR No.:

3-8-168

Material:

SA 312 Type 304L

Size:

114.3 mm (4.50 in.) O.D. x 8.56 mm (0.337 in.) w.t.

Thermal Condition:

As Welded

HARDNESS TEST

TYPE OF TEST:

Vickers

LOAD:

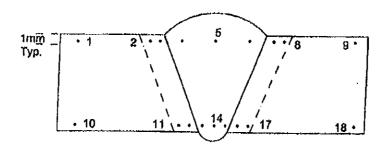
500g

Laboratory Test No.: E03-1087.1

Date: December 11, 2003

INSTRUMENT TYPE:

Leco V-100-C1



1)	189 HV	6)	202 HV	11)	212 HV	16)	210 HV
2)	173 HV	7)	208 HV	12)	194 HV	17)	203 HV
3)	196 HV	8)	203 HV	13)	215 HV	18)	174 HV
4)	192 HV	9)	187 HV	14)	202 HV	,	.,,
5)	213 HV	10)	204 HV	15)	207 HV		

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E384 – 99. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears of this report.

Laboratory Test Conducted By:

Natashua Collier, C.E.T.

WELDING PROCEDUR	E SPECIFICATION	NO.:	31-1-066A (Rev.4)
WELDING PROCEDURI	E QUALIFICATION	RECORD NO.(S): 31-	1- 066-1, 31-1-66-2,
			1-066-3
	QUALIFI	ED FOR	
Base Metal (Typical):	P1 Groups 1 & 2 to) P1 Groups 1 & 2 350 Gr.LF2, SA 420 WPL	6 SA 516 Cr 70 oto)
Proceedes):	CMAN/ SMAN/	Wald Tynes:	GROOVE & FILLET
Process(es):	ALL POSITIONS	Diameter:	ALL DIAMETERS
Filler Metal:	ER70S-6, E7018-1		
BASE METAL CONDITIONOTCH TOUGHNESS APPRASE METAL THICKNESS	PLICATIONS TO -46°	C AS WELDED	
COMBINED DEPOSITED V	VELD METAL THICK	NESS	
ASME B31.1		19.1 mm (0.750 in.) m	aximum
ASME B31.3		19.1 mm (0,750 in.) m	aximum
ASME SECTION VI	II, DIVISION I	23.1 mm (0.910 in.) m	axiiiuiii
SAFETY CODES ACT - PROVING PROCES Reg. No. WP 863 Spec. No. 31-1-066 Weld Process G. MAN Mail. Gr. P. No. 1 Gr. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2 to P. No. 1+2	NCE OF ALBERTA DURE		
PROVINCIAL RÉGIS	STRATION		

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

Company Name	<u> </u>	<u>3.L.M. INDUS</u> 1	RIES L.P.	
Maldina Procedure S	Shecification No	. 31-1U	DOM (1787, 4)	Date <u>July 7, 2008</u>
Revision(s) Rev.4:	Essential - addit	ion of PQR#3	1-1-066-3,	
Supporting PQR No.	(s)	31-1-066-1, 3	1-1-066-2, 31-1	1-066-3
Welding Process(es)	GMAV	//SMAW	Туре	I-066-3 (s) Seml-automatic / Manual
Troiding (Todada(To)	* <u>1917-1916-1916-1916-1916-1916-1916-1916-</u>			•
JOINTS (QW-402)				
Joint Design	All ASME groo	ove & fillet, refe	erence construc	ction drawing for joint details.
	- Mhere inint de	atalis are not s	pecifiea, refer t	O liquies I to 15 attached
Pool Opening	As per attache	ed typical groo	ve designs, sec	figures 1 to 15 attached
Rooking	With or withou	:t	Retainers	Not required
Dacking	VVICION WIGHTS	<u> </u>	was	
DAGE METALS /	W_403\			
BASE METALS (Q	D4 Orauma 1 9	2. 9	To P-Numbe	r P1 Groups 1 & 2
P-Number	FI Gloups I o	See cover ne	ge for thickness	qualified by governing code
Thickness Range: C	NOOVE	All hase meta	l thicknesses	qualified by governing code
۳ سمح کا مسلم میں انگل میں انگل	IIIBI	All diameters	i dijokijoogoo	
Pipe Diameter Range	es: Groove	All diameters		
	Fillet	42 7mm (0.50	in) maximum	
Deposited Weld Meta	ai (Per Pass) _	12.7(1111) (0.00	/ III) Maximum	
م عد و و مشکور اسال داده		CHANNA		SMAW
FILLER METALS (GMAW		SFA 5.1
Specification No. (SF	,	SFA 5.18		E7018-1
AWS No. (Class)		ER70S-6		E/U10-1
F-No.	· · · · · · · · · · · · · · · · · · ·	F6		F4
A-No		*	.	MI
Size		0.030 to 0.049	5 in. inclusive	3/32 to 1/4 in. inclusive
Filler Metal Product F	form	Solid wire		N/A
Supplemental Filler N	/letal	Without		N/A
Paris in add and health belonger	al Thiakaaaa Da	nde.		
Groove		2.8 mm (0.11)	0 in.) max.**	20.3 mm (0.80 in.) max.** All fillet sizes
Fillet	-	All fillet sizes		All fillet sizes
Other *Chemical co	mposition shall	<u>meet the requi</u>	rements of AS	ME Section II, Part C
SEA 5 18 fc	r FR70S-6			
** Combined	deposited weld	<u>metal thickne</u>	ss shall not exc	eed 19.1 mm (0,750 in.)
for ASM	E B31.1 & B31.	<u>3 and 23.1 mn</u>	n (0,910 in.) for	ASME Section VIII, Div.1
POSITION (QW-40	5)			
Position of Groove _		Horizontal	Position of F	illet <u>Flat & Horizontal</u>
Weld Progression			N/A	

PREHEAT (QW-40	ሐ)			
Preheat Temperature	› (Minimum)	10 °C	(50°F)	
Informana Tomparatu	ra (Mavimum)	260°C	(500°F)	
Drahaat Maintenance	、 4ሰ የሶ /ደበ°Fነ	prior to welding	ng. Preheat ma	aintenance is not required if
LIGHEST MISH TOHISHO	wolding is inte	rrunted or afte	r the completio	n of welding unless required
	by the code of	construction	· ************************************	
	DA ILIG COOR OF	COLIGI GOUGH		<u></u>

		WPS NO). <u>31-1066A (Rev. 4)</u>
POST WELD HEAT TREATM Temperature RangeN/		Time Range	N/A
GAS (QW-408)			
Specification No. (SFA)SFA	A 5.32	AWS No. (Clas	s) <u>SG-AC-25</u>
Specification No. (SFA) SF/Shielding 75% Argor	, 25% CO ₂ , 10 - 2	25 liters per minute	9 (20 - 50 ft³/hr)
Backing Not Requir	ed	_ Trailing	Not Required
Current Direct Amps See Table Mode of Metal Transfer GM Maximum Heat Input	#1	_ PolarityRe	everse, electrode positive See Table #1
Base Metal Thickness Range	GM,	AW	SMAW
0.125 - 0.499 in.	21,70	0 J/in.	40,650 J/in.
0.50 -1.0 in.	27,440	0 J/in.	46,190 J/in.
TECHNIQUE (QW-410) String or Weave	Either	Travel Speed	See Table #1

9.52 mm (0.375 in.) to 19.1 mm (0.750 in.)

Brushing, chipping or grinding as required

6.35 mm (0.250 in.) to 19.1 mm (0.750 in.)

SMAW: Multiple

Air carbon arc, back-grind as required

GMAW: Single, root pass only

TABLE 1 - WELDING PARAMETERS

Single

N/A

Not permitted

Process	Filler Metal	Diameter mm (in.)	Current Type & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
GMAW	ER70S-6	0.8 (0.030)	DCRP	70 - 130	14 - 20	54 - 250 (2.1 - 10)
GMAW	ER70\$-6	0.9 (0.035)	DCRP	80 - 180	15 - 22	67 - 600 (2.6 - 25)
GMAW	ER70S-6	1.1 (0.045)	DCRP	100 - 225	16 - 23	89 - 900 (3.5 - 35)
SMAW	E7018-1	2.4 (3/32)	DCRP	60 - 110	18 - 24	36 - 300 (1.4 - 12)
SMAW	E7018-1	3.2 (1/8)	DCRP	90 - 160	18 - 26	53 - 350 (2.1 - 14)
SMAW	E7018-1	4.0 (5/32)	DCRP	110 - 220	19 - 28	69 - 400 (2.7 - 16)
SMAW	E7018-1	5.0 (3/16)	DCRP	160 - 300	20 - 30	106 - 500 (4.2 - 20)
SMAW	E7018-1	5.5 (7/32)	DCRP	240 - 340	20 - 32	158 - 550 (6.2 - 22)
SMAW	E7018-1	6.4 (1/4)	DCRP	275 - 360	21 - 32	191 - 550 (7.5 - 22)

Heat Input (joules per inch) = (Amperage X Voltage X 60) / Travel Speed (inches per minute)

Page 3 of 13

Orifice or Gas Cup Size

Method of Back Gouging

Use of Thermal Process

Peening

Initial & Interpass Cleaning

Contact Tube to Work Distance

Multiple or Single Electrodes _

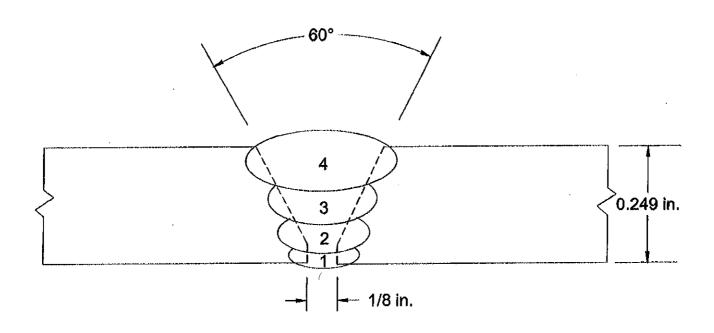
Multiple or Single Pass Per Side

QW-409 above is not exceeded.

TYPICAL JOINT DESIGNS 3/16 +/- 3/16 in. →- 1/4 +/- 1/4 In. 3/16 +/- 3/16 in. Figure 3 Figure 2 Figure 1 **Double Square Butt** Single Square Butt with Backing Strip Single Square Butt 60 +/- 150 606+/- 150 606+)- 150 Typ!cal 3/18 +/- 3/16 In. 3/16 +/- 3/16 in. Figure 6 Figure 5 Figure 4 Single Vee Butt with Backing Strip **Double Vee Butt** Single Vee Butt Radius 1/8 in. Radius 1/8 in. +/- 1/16 in. '+/- 1/16 in. +/- 1/16 ln. 50^b +/- 20 Typical 50° +/- 20° 3/16 +/- 3/16 ln. 3/16 +/- 3/16 ln. 3/16 +/- 3/16 In. Figure 9 Figure 8 Figure 7 Single U Butt with Backing Strip Double U Butt Single U Butt Radius 1/8 In.> Radius 1/8 In: +/- 1/16 in. Radius 1/8 in. +/- 1/16 in. 200 +/- 100 200 +/- 100 20° +/- 10° Typical 3/16 +/- 3/16 In. 3/16 +/- 3/16 in. •~ 3/16 +/- 3/18 in. Figure 12 Figure 10 Figure 11 Single J Butt with Backing Strip **Double J Butt** Single J Butt 40°+/- 20° 40°+/- 20° Typical 40°+/- 20° · 3/16 +/- 3/16 in. 3/16 +/- 3/16 In. 3/16 +/- 3/16 ln. Figure 15 Figure 14 Figure 13 **Double Bevel Butt** Single Bevel Butt with Backing Strip Single Bevel Butt

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

Company Name G.L.M Procedure Qualification Record No. Welding Procedure Specification No. PQR Revision Format update, WI	<u>, INDUSTRIES L.I</u>	Р.
Procedure Qualification Record No.	31-1-066-1	Date <u>May 3, 1993</u>
Welding Procedure Specification No.	31-1-066A (Re	v.4)
POR Revision Format update, WI	S No. formerly 31	I-1-066A (Rev.3), July 7, 2008
Welding Process(es) GM/	W/SMAW	Type(s) Semi-automatic / Manu
77 Olding (100000(00)		
JOINTS (QW-402)		
Type Butt joint, si	nale vee aroove, s	see next page
Type	INIO TOO STOOTS	
DACE METALS (OM 402)		
BASE METALS (QW-403)	Type	or Grade Gr. 6 to Gr. 70
Material Spec. SA 333 to SA 516 P-No. P1 Grp.1 To P-No. P1	Orn ? Thickn	6 32 mm (0 249 in)
P-No. P1 Grp.1 10 P-No. F1	SID,Z IIIGKII	1000 0.02 11111 10.2-10 113.11
	CNANA/	SMAW
FILLER METALS (QW-404)	GMAW	
Specification No. (SFA)	SFA 5.18 ER70S-6	E7018-1
AWS No. (Class)	ER70S-6	<u> </u>
Filler Metal F-No.	<u> </u>	F4 A1 N/A
Filler Metal A-No.		<u> </u>
Filler Metal Product Form	Solid wire	N/A
Suplemental Filler Metal	vvitnout	N / A
Size of Electrode Deposited Weld Metal Thickness	See attached s	<u>ketch</u>
Deposited Weld Metal Thickness	2.54 mm (0.10	in.) 3.78 mm (0.149 in.)
Other * Chemical composition m	eets the requireme	ents of ASME Section II, Part C
Other * Chemical composition m SFA 5.18 for ER70S-6		
POSITION (QW-405)		
Position of Groove	1G	
Weld Progression		
TYOIG T TO GIOCOGIOTI		
DDEHEAT (OWLAGE)		
PREHEAT (QW-406) Preheat Temperature 21°C (70°F)	Interna	ass Temp. (Max.) 204°C (400°l
Preneat remperature		Total Control
POSTWELD HEAT TREATMENT (QV	V-407)	
Temperature N/A	Time	NI /A
TemperatureN/A		
GAS (QW-408)	414/O h	I- (Olama) 00 A0 05
Specification No. (SFA) SFA 5.32	AWSIN	No. (Class) <u>SG-AC-25</u>
Shielding 75% Argon, 25% Co	D2, 10 liters per mi	INUTE (20 TC/NT)
Backing Without	Trailing	Without
•		
ELECTRICAL CHARACTERISTICS (C	QW-409)	
Current Direct	Polarity	
Amps See next page	Volts	See next page
Current Direct Amps See next page Heat Input F6: 21,700 J/in, ma	ximum	F4: 40,650 J/in. maximum
Mode of Metal Transfer Short	circuiting arc	
INOCO OF INOCOL FRANCISCO.		
TECHNIQUE (OW-440)		
TECHNIQUE (QW-410)		
	ro Traval	Speed See next page
	ve Travel	Speed See next page SMAW: Multiple
String or Weave	W: Single	Speed <u>See next page</u> SMAW: Multiple



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (l.p.m.)
1	GMAW	ER70S-6	0.9 (0.035)	DCRP	70 - 85	15 - 17	93 (3.7)
2	SMAW	E7018-1	3.2 (1/8)	DCRP	116 - 125	21 - 23	107 (4.5)
3 & 4	SMAW	E7018-1	4.0 (6/32)	DCRP	175 - 185	22 - 24	150 - 208 (6.0 - 8.2)

CHARPY IMPACT TOUGHNESS

Type of Test	Charpy V Notch	Orientation	Transverse
Test Temperature	-46° C (-50° F)	Specimen Size	10 X 6 mm

Specimen No.	Notch Location	Impact Values J (ft. lbs
B2.1	Weld Metal	34.6 (25.5)
B2.2	Weld Metal	42.0 (31.0)
B2.3	Weld Metal	59,6 (44.0)
B3.1 .	P1 Grp.1 - HAZ	75.2 (55.5)
B3.2	P1 Grp.1 - HAZ	98.9 (73.0)
B3.3	P1 Grp.1 - HAZ	55.6 (41.0)
B4.1	P1 Grp.2 - HAZ	23.7 (17.5)
B4.2	P1 Grp.2 - HAZ	12.2 (9.0)
B4.3	P1 Grp.2 - HAZ	33.9 (25.0)

OTHER TESTS

Welders Name	Brad Ludwig	Certificate File No.	N/A
Tests Conducted By Laboratory Test No.	Ludwig & Associat		
·		record have been revised	in accordance with

We hereby recertify that the statements in this record have been revised in accordance with Paragraph QW-200.2 and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer		G.L.M. IN	OUSTRIES L.P.	-,	
Date	4	14/2008		_ Signed	The second secon



Welding Consulting and Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM TANKS & EQUIPMENT LTD.

PO-Box 24

Nisku, AB TOC 2G0

Attention:

Mr. Wiber Davie

Material: SA 333 Gr. 6 to SA 516-70

Thickness: 6,35 mm (0,249 in.) Thermal Condition: As Welded. Laboratory Test No.: E93-146.2

Date: May 4, 1993

Size: 323.9 mm (12.75 in.)

Process: GMAW/SMAW

PQR No.: 31-1-066-1

TOUGHNESS TEST

Type of Test Orientation

Charpy V-Notch Transverse

Test Temperature Specimen Size

-46°C (-50°F) 10mm x 6mm

SPECIMEN NO.	NOTCH LOCATION	IMPACT VALUES J (ft.lbs.)	SHEAR %
B2.1		34.6 (25.5)	19
B2.2	Weld	42.0 (31.0)	26
B2.3	Weld	59.6 (44.0)	38
B3.1	Grp.1 HAZ	75.2 (55.5)	54
B3.2	Grp.1 HAZ	98.9 (73.0)	. 88
B3.3	Grp.1 HAZ	55.6 (41.0)	48
B4.1	Grp.2 HAZ	23.7 (17.5)	17
B4.2	Grp.2 HAZ	12.2 (9.0)	8
B4.3	Grp.2 HAZ	33.9 (25.0)	22

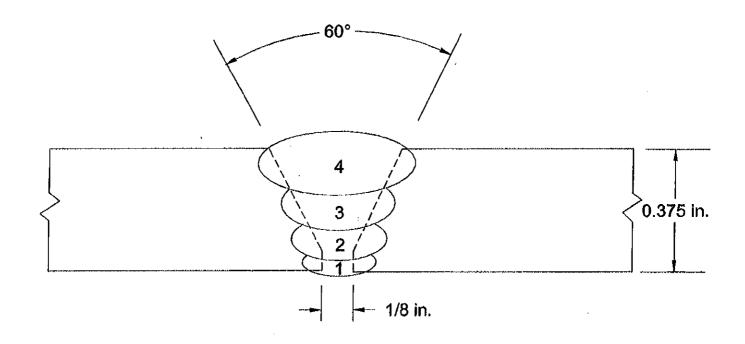
Hammer Velocity at Impact 5.18 m/sec. Energy at Impact 406.7 Joules (300 ft. lb.)

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div.I, UG-84 - 1992 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the Customer whose name appears on this report.

Laboratory Test Conducted By

GEORGE TAILLEUR, C.E.T.

Company Name	G.L	<u>M. INDUSTF</u>	RIES L.P.	······································		
Company Name Procedure Qualification Welding Procedure Sp	n Record No	31-1-06	6-2 Dat	te <u>D</u> e	cember 11.	1994
Welding Procedure St	pecification No.	31-1-06	6A (Rev.4)			
POR Revision	Format update. \	WPS No. torn	neriv 31-1-0	66A (Rev.3).	July 7. 2008	5
Welding Process(es)	G	MAW / SMAV	<u>V</u> Тур	e(s) <u>Seml-a</u>	iutomatic / N	/lanual
IOINTS (OM 403)				•		
JOINTS (QW-402)	Duff laint	ologio voe g		ovt paga		
Туре	Bull Joint,	siriqie vee q	oova' 299 II	ext page		
BASE METALS (QV	/_403\					
Material Spec.		A	Type or Gr	ada Gr	70	
P-No. P1	To D No D'	1	Thickness	0.5	2 mm (0 37)	5 in \
F-IVO. FI	10 F=140,F	<u> </u>	11110/11022	9.0	<u> </u>	7 115-1
FILLER METALS (Q	W-404)	GMAW		SM	IAW	
Specification No. (SFA)	SFA 5 1	8	SF/	A 5.1	
AWS No. (Class)	/	ER70S-	6	F-7(018-1	
Filler Metal F-No.		FA	<u> </u>	F4	/ I V . I	
Filler Metal A-No.		***		Δ1		
Filler Metal A-No. Filler Metal Product Fo		Solid wit	е	N /	Ą	
Suplemental Filler Met	· · · · · · · · · · · · · · · · · · ·	Without	<u> </u>	N /	A	
Size of Flactrode	21	See atte	ched sketch		<u> </u>	
Size of Electrode	Thickness	2 54 mm	(0.10 in)	6 9/	3 mm (0.275	in \
Other * Chem	ical composition	meets the re-	nulrements	of ASME Sec	tion II Part	C.
SEA 5	.18 for ER70S-6	mooto the fo	danomonto.	OI /3O VIL OOD	HOTE IN TOKE	<u> </u>
OIAU	, 10 101 LISTOO-0				·	*********
POSITION (QW-405))					
Position of Groove		1	G			
Weld Progression		N	1/A			
PREHEAT (QW-406)						
PREHEAT (QW-406) Preheat Temperature	21°C (70°	<u>F)</u>	Interpass To	emp. (Max.) ˌ	204°C (4	100°F)
POSTWELD HEAT T Temperature	NEATIVIENT (C	444-4U7)	Time	N//	Δ	
Tettihetarare	N.A.				· · · · · · · · · · · · · · · · · · ·	
GAS (QW-408)						
•	SEA 5.32		AWS No. (C	lass) SG-	AC-25	
Shielding 7	5% Argon 25%	CO2 10 liters	ner minute	(20 ft³/hr)		
Specification No. (SFA) Shielding7 BackingV	/Ithout	<u> </u>	Trailing	With	out	******
Daoking	Huroat			7,710	1000	
ELECTRICAL CHAR	ACTERISTICS	(QW-409)				
CurrentD			Polarity	Reverse, el	ectrode posi	itive
Amps <u>S</u>	ee next page	,	Volts			
Mode of Metal Transfer	Sho	ort circulting a				
			····			
FECHNIQUE (QW-41	0)					
String or Weave	We	ave				
Multiple or Single Pass						
Multiple or Single Electr		Single				



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i,p.m.)
1	GMAW	ER70S-6	0.9 (0.035)	DCRP	70 - 85	15 - 17	90 (3.5)
2	SMAW	E7018-1	3.2 (1/8)	DCRP	115 - 125	21 - 23	100 (4.0)
3 & 4	SMAW	E7018-1	5.0 (3/16)	DCRP	210 - 225	22 - 24	125 - 190 (5.0 - 7.5)

TENSILE TEST (QW-150)

	Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. In.)	Ultimate Load N (lbs.)	Ultimate Stress MPa (psi)	Character & Fracture Location
ı	T1	18.9	8.43	159	76,900	483	Partial Cup & Cone
Ì	····	(0.744)	(0.332)	(0.247)	(17,300)	(69,990)	Parent Metal
ľ	T2	19.0	8.37	159	76,600	482	Partial Cup & Cone
ľ		(0.748)	(0.330)	(0.247)	(17,240)	(69,840)	Parent Metal

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Type & Figure No.	Result
QW-462.2, TSB - S1	Pass	QW-462.2, TSB - S3	Pass
QW-462.2, TSB - S2	Pass	QW-462.2, TSB - S4	Pass

OTHER TESTS

Vic	<u>:kers Hardness - see a</u>	ittached laboratory test repor	<u> </u>
Welders Name	Brad Ludwig	Certificate File No	N/A
Tests Conducted By	Ludwig & Associa		
Laboratory Test No.	E94-490.1		
with the requirements of	Section IX of the ASM		sted in accordance
ManufacturerG.i	M, INDUSTRIES L.P	<u> </u>	
Date <u>faly 14/200</u>	<u> </u>	Signed	Market of the State of the Stat
//			

CUSTOMER:

GLM Tanks & Equipment Ltd.

Laboratory Test No.: E94-49(Date: December 13, 1994

P.O. Box 24 Nisku, AB

T0C 2G0

Attention:

Wilber Davie

Material: SA 516 Gr.70 PQR No.: 31-1-066-2

Process: GMAW / SMAW Thickness: 9.53mm (0.375 in.)

Thermal Condition: As Welded

TENSILE TEST (QW-150)

OAAADI E AU MADED	T1	•	T'O'	
SAMPLE NUMBER	1.1		T2	
WIDTH mm (in)	18.9	(0.744)	19.0	(0.748)
THICKNESS mm (in)	8.43 ·	(0.332)	8.37	(0.330)
AREA sq mm (sq in)	159	(0.247)	159	(0.247)
ULT, LOAD N (lbs)	76 900	(17,300)	76 600	(17,240)
UTS MPa (psi)	483	(69,990)	482	(69,840)
FRACTURE TYPE	Partial Cup & Cone		Partial C	up & Cone
FRACTURE LOCATION	Parent Metal		Parent M	etal

GUIDED-BEND TEST (QW-160)

SAMPLE WIDTH	9,53 mm	(0.375 in.)		
SAMPLE THICKNESS	9.53 mm	(0.375 in.)		
PLUNGER SIZE	38.1 mm	(1.50 in.)		
YOKE SIZE	60.3 mm	(2.375 ln.)		
SAMPLE TYPE	Side Bend	Side Bend	Side Bend	Side Bend
SAMPLE NUMBER(S)	S1	S2	S3	\$4
RESULTS	Pass	Pass	Pass	Pass

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of <u>ASME Section IX, 1992</u> edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the Customer whose name appears on this report.

Laboratory Test Conducted By

Kelly Frey, C.E.T.

CUSTOMER:

GLM Tanks & Equipment Ltd.

Laboratory Test No.: E94-49

P.O. Box 24

Date: December 12, 1994

Nisku, AB TOC 2G0

Attention:

Wilber Davie

Material: SA 516 Gr.70

Process: GMAW / SMAW

Thermal Condition: As Welded

PQR No.: 31-1-066-2

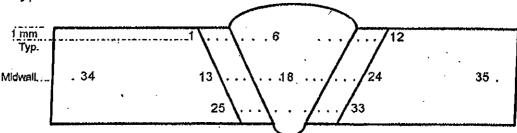
Thickness: 9.53mm (0.375 in.)

HARDNESS TEST

Test Method: Vickers

Load: 500 g.

Machine Type: Buehler Micromet



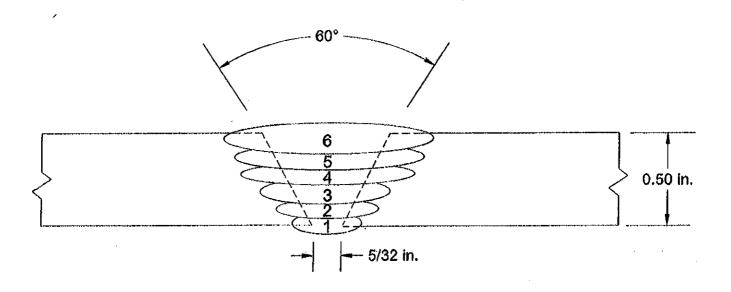
1)	173 HV	10)	199 HV	19)	181 HV	28)	169 HV
2)	170 HV	11)	191 HV	20)	174 HV	29)	174 HV
3)	186 HV	12)	182 HV	21)	173 HV	30)	169 HV
4)	180 HV	13)	178 HV	22)	191 HV	31)	182 HV
5)	196 HV	14)	168 HV	23)	192 HV	32)	181 HV
6)	191 HV	15)	177 HV	24)	189 HV	33)	177 HV
7)	181 HV	16)	181 HV	25)	158 HV	34)	174 HV
8)	187 HV	17)	187 HV	26)	173 HV	35)	183 HV
9)	190 HV	18)	182 HV	27)	159 HV	•	_

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of <u>ASTM E384-1993</u> edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the Customer whose name appears on this report.

Laboratory Test Conducted By

Kelly Frey, C.E.T.

Company Name G.L.M	<u>II. INDUSTR</u>	(IES L.P.	
Procedure Qualification Record No.	<u>31-1-06</u>	<u>6-3</u> Date	June 9, 2008
Molding Propodure Chariffestion No.	21 1 06/	ልለ /መልህ <i>ለ</i> ነ	
Welding Process(es) GM/	<u>AW / SMAV</u>	V Type	(s) <u>Semi-automatic / Ma</u>
JOINTS (QW-402)			
Type Butt joint, si	<u>ıngle vee gr</u>	<u>oove, see ne</u>	kt page
BASE METALS (QW-403)			
Material Spec. SA 516 to SA 516		Type or Gred	le Gr 60 to Gr 70
P-No. <u>P1 Grp.1</u> To P-No. <u>P1 (</u>	Grn 2	Thickness	12.7 mm (0.50 in
Heat Number <u>288533-99787</u>	<u> </u>	Carbon Faul	(alent 0.30
Diameter N/A		Other	Ploto Product Form
Diameter N/A		O(1)61	mate moddot roim
FILLER METALS (QW-404)	GMAW		SMAW
Specification No. (SFA)			
AMS No (Class)	EP709-6	?	E7018-1
AWS No. (Class)	E6	<u></u>	E/
Filler Metal F-No.	<u>FU</u>		F4
Filler Metal A-No.	On list code		A1
Filler Metal Product Form	Solid Wire	9	<u> </u>
Suplemental Filler Metal	vvitnout		N/A
Size of Electrode Deposited Weld Metal Thickness	See attac	ched sketch	
Deposited Weld Metal Thickness	<u>25.4 mm</u>	(0.10 ln.)	10.2 mm (0.40 in.
Other * Chemical composition me SFA 5.18 for ER70S-6	eets the req	<u>luirements of</u>	ASME Section II, Part C
Position of Groove 3G Weld Progression GMA	W: Vertical	down	SMAW: Vertical I
PREHEAT (QW-406)			
Preheat Temperature 10°C (50°F)		nterpass Ten	ip. (Max.) <u>260°C (50</u>
POSTWELD HEAT TREATMENT (QW	/- 407)		
Temperature N/A		Time	N/A
CAS (OM 408)			
GAS (QW-408) Specification No. (SFA) SFA 5.32		WS No (Cla	ss) SG-AC-25
Shielding 75% Argon, 25% CC	2 13 litere	ner minute (2	8 (f ³ /br)
Backing Without	<u>72, 10 11(0) 3</u> T	rallina	Without
backing <u>willout</u>		raining	vvinout
ELECTRICAL CHARACTERISTICS (Q	W-409)		
Current <u>Direct</u> Amps <u>See next page</u>		PolarityI	Reverse, electrode positiv
Amps See next page	V	olts	See next page
Heat Input F6: 27,440 J/in. max	ximum		4: 46,190 J/in. maximu
Mode of Metal Transfer Short		rc	
TECHNIQUE (QW-410)			
String or Weave <u>Weav</u>	<u>/e</u> T	ravel Speed	See next page
Multiple or Single Pass Per SideGMÄV	W: Single		MAW: Multiple
Multiple or Single Electrodes	Single		
By Ludwig Associates Ltd.			



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
1	GMAW	ER70S-6	1.1 (0.045)	DCRP	167-169	17-18	163 (6.4)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	98-100	22-23	133 (5.3)
3	SMAW	E7018-1	2.4 (3/32)	DCRP	103-104	22-23	129 (5.1)
4	SMAW	E7018-1	2.4 (3/32)	DÇRP	103-104	22-23	77 (3,0)
5	SMAW	E7018-1	2.4 (3/32)	DCRP	102-103	22-23	120 (4.7)
6	SMAW	E7018-1	2.4 (3/32)	DCRP	97-98	22-23	89 (3,5)

TENSILE TEST (QW-150)

	Specimen No.	Width mm (ln.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Ultimate Load N (lbs.)	Ultimate Stress MPa (psi)	Character & Fracture Location
ı	T1	19.0	11.3	215	112 020	522	Partial Cup & Cone
ľ		(0.748)	(0.445)	(0.333)	(25,200)	(75,700)	Parent Metal (SA 516 Gr. 60)
ſ	T2	19.1	11.5	220	113 618	529	Partial Cup & Cone
r		(0.752)	(0.453)	(0.340)	(25,500)	(76,800)	Parent Metal (SA 516 Gr. 70)

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Туре & Figure No.	Result
QW-462.2, TSB - S1	Pass	QW-462.2, TSB - S3	Pass
QW-462.2, T\$B - \$2	Pass	QW-462.2, TSB - S4	Pass

CHARPY IMPACT TOUGHNESS

Type of Test	Charpy V Notch	Orientation		verse
	-46° C (-50° F)	Specimen Size	10 X	10 mm
Specimen No.	, <u>N</u>	lotch Location		es J (ft. lbs)
B2.1		Weld Metal		(96.4)
B2.2		Weld Metal	>163	(>120)
B2.3		Weld Metal	118	(86.8)
B3.1	Р	1 Grp.1 - HAZ	>163	(>120)
B3.2	P	1 Grp.1 - HAZ	145	(107)
B3.3	Р	1 Grp.1 - HAZ	114	(84.4)
B4.1	p	1 Grp.2 - HAZ	>163	(>120)
B4.2		1 Grp.2 - HAZ	122	(89.8)
B4.3	P'	1 Grp.2 - HAZ	113	(83.0)

OTHER TESTS

Vic	ckers Hardness - see at	tached laboratory test report	
Welders Name	John Langoz	Certificate File No	W-23997
Tests Conducted By	Ludwig Associates	Ltd.	
Laboratory Test No.	E08-522.1		
welded and tested in acc ManufacturerG.i	ordance with the require	orrect and that the test we ements of Section IX of the /	ASME Code.
Date <u> </u>	υ <u>β.</u>	Signed	

Laboratory Test No.: E08-522.1

288533-99787

Date: June 19, 2008

Heat No.:

Customer:

G.L.M. Industries L.P.

1508 - 8 Street Nisku, AB T9E 7S6

Attention:

Wilber Davie

PQR No.:

31-1-066-3

Material: Thickness: SA 516 Gr. 60 to SA 516 Gr. 70

Thermal Condition:

12.7 mm (0.500 in.) As Welded

TENSILE TEST QW-150

SAMPLE NUMBER	T1 /	QW-462.1(a)	T2	QW-462.1(a)	
WIDTH mm (in.)	19.0	(0.748)	19.1	(0.752)	
THICKNESS mm (in.)	11.3	(0.445)	11.5	(0.453)	
AREA sq. mm (sq. in.)	215	(0.333)	220	(0.340)	
ULTIMATE LOAD N (lbs)	112 020	(25,200)	113 618	(25,500)	
UTS MPa (psi)	522	(75,700)	529	(76,800)	
FRACTURE TYPE	Partial Cu	ıp & Cone	Partial Cu	ıp & Cone	
FRACTURE LOCATION	Parent Me	etal (SA 516 Gr. 60)	Parent Me	etal (SA 516 Gr. 70)

GUIDED-BEND TEST QW-160

SAMPLE WIDTH: 9.52 mm (0.375 ln.) SAMPLE THICKNESS: 12.7 mm (0.500 in.) PLUNGER SIZE: (1.50 in.) 38.1 mm YOKE SIZE: 60.3 mm (2.375 ln.) QW-462.2 Side Bend Side Bend Side Bend Side Bend SAMPLE NUMBER(S) **S1** S2 **S**3 **S4** RESULTS Pass ' Pass. Pass Pass

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX, 2007 edition and latest addenda. Material information has been provided by the Customer whose name appears on this report.

Samples associated with this report will be discarded in 30 days.

Laboratory Test Conducted By:

Eric Dacyk, T.T. / Karen Koens, R.E.T.

Customer:

G.L.M. Industries L.P.

1508 - 8 Street Nisku, AB **T9E 7S6**

Attention:

Wilber Davle

PQR No.:

31-1-066-3

Material:

SA 516 Gr. 60 to SA 516 Gr. 70

Thickness:

12.7 mm (0.500 in.)

Thermal Condition:

As Welded

NOTCH-TOUGHNESS TEST

TYPE OF TEST: TEST TEMPERATURE: Charpy V-Notch

-46°C (-50°F)

ORIENTATION:

Heat No.:

Transverse

10 x 10 mm SPECIMEN SIZE:

Laboratory Test No.: E08-522.1

288533-99787

Date: June 19, 2008

Specimen	Notch	Impact Values			
Number	Location	Joules	(ft.lbs)		
B2.1	Weld Metal within 1/16" of root	131	(96.4)		
B2.2	Weld Metal within 1/16" of root Weld Metal within 1/16" of root	>163	(>120)		
B2.3		118	(86.8)		
B3.1	Gr. 60 HAZ	>163	(>120)		
B3.2	Gr. 60 HAZ	145	(107)		
B3.3	Gr. 60 HAZ	114	(84.4)		
B4.1	Gr. 70 HAZ	>163	(>120)		
B4.2	Gr. 70 HAZ	122	(89.8)		
B4.3	Gr. 70 HAZ	113	(83.0)		

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. I, UG-84 - 2007 edition and latest addenda. Material information has been provided by the Customer whose name appears on this report.

Samples associated with this report will be discarded in 30 days.

Laboratory Test Conducted By:

Customer:

G.L.M. Industries L.P.

1508 - 8 Street Nisku, AB T9E 7S6

Attention:

Wilber Davie -

PQR No.:

31-1-066-3

Material:

SA 516 Gr. 60 to SA 516 Gr. 70

Thickness:

12.7 mm (0.500 in.)

Thermal Condition:

As Welded

HARDNESS TEST

Type of Test: Vickers 10kg (HV10).

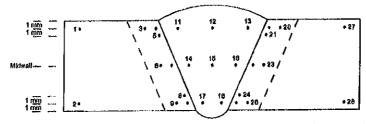
Instrument: Leco V-100-C1

Laboratory Test No.: E08-522.1

288533-99787

Date: July 4, 2008

Heat No.:



				, in	eld Metai				
Pa	rent Metal		HAZ.				all Marie salle		renivivietal
1	149	3	169	11	196	19	203	27	152
2	156	4	197	12	187	20	180	28	156
		5	200	13	195	21	199]	
		6	170	14	181	22	182		
		7	180	15	185	23	172	1	
1 1		8	175	16	179	24	173		
]		9	166	17	165	25	172		
		10	170	18	163	26	170		

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E92-82 (Reapproved 2003). Material information has been provided by the Customer whose name appears on this report.

Samples associated with this report will be discarded in 30 days

Laboratory Test Conducted By:

Eric Dacyk, T.T. / Karen Koens, R.E.T.



WELDING PROCEDUR	RE SPECIFICATION N	0.:	41-1-144A (Rev.2)
WELDING PROCEDUR	RE QUALIFICATION R	ECORD NO.(S):	41-1-134, 41-1-134-2
	QUALIFIED	FOR	
Base Metal (Typical):	P1 Groups 1 & 2 to P	1 Groups 1 & 2	0.00.540.0.70
Process(es): Position: Filler Metal:	GTAW / SMAW ALL POSITIONS	Weld Types: Diameter:	6, SA 516 Gr.70, etc.) GROOVE & FILLET ALL DIAMETERS
BASE METAL CONDITI	ONS & GROOVE THIC	KNESS RANGE QU	JALIFIED:
NOTCH TOUGHNESS AF BASE METAL THICKNESS	PPLICATIONS TO -46°C	AS WELDED 3.2 to 25.4 mm (0.125	to 1.00 in.) inclusive
COMBINED DEPOSITED		SS	
ALBERTA BOILERS SAFE PROVINCE OF SAFETY CODE WELDING PROC Reg. No. WP 86.3 Spec No. LI - I - I 44 Weld Process G. TAV Matl. Gr. P No. LG 1.1.2 to F Elec. Gr. F No. LG 1.1.2 to F Elec. Gr. F No. LG 1.1.2 to F CV M-46 Yr. C. Mo. Q. Dayl. 9. Signed Fi. WE	ALBERTA ES ACT EDURE .2 A(REV3) A(REV3) No. 1 G(1+2) No. 1 C(1+2) VHT. NO.		
PROVINCIAL REGIS	STRATION		

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

	G.L.M. Industries L.P.	
Welding Procedure Specification	No. 41-1-1444 (Rev 2) Date Sentember 12 2006
Revision Rev. 2 (Nonessential)	Corporate name change (f	formerly GLM Tanks &
	Fallinment Ltd) M/DC NA	formanic Ad d AAAA (P) A)
Supporting PQR No.(s) Welding Process(cs)	47-7-134 41-1-134-2	
Welding Process(es)	GTAW / SMAW	Type(s) Manual
		Typo(o) Wajtuai
JOINTS (QW-402)		
Joint Design All ASME g	roove & fillet reference const	rijotlan duminima kan tatat 11.1.11.
VVIIERE IOITI	CIRIBIIS BIO DOLODONIIDA PAFA	was finimas das de sa . a
Not obening As her arra	CDRO IVOICAL OLOGVA Abaiana - a	on fineman 4 to 40° M.
Backing With or with	Out Retainers	Not required
	- Iveramers	Ivot required
BASE METALS (QW-403)		
P-Number P1 Groups	1.8.2 To D.M	
Thickness Range: Grove	Soc south name for Milde	perP1 Groups 1 & 2
P-Number P1 Groups Thickness Range: Groove Fillet	All base model thirt inickne	ss qualified by governing code
Pipe Diameter Ranges: Groot	Ve All diameters	
Deposited Weld Metal (Per Pass)	GIAVV: 4.78 mm (C).188 in.) maximum
	SMAW: 12.7 mm (0	0.500 in.) maximum
FILLED METALS (OW. 404)	OT4141	
FILLER METALS (QW-404)	GTAW	SMAW
Specification No. (SFA)	SFA 5.18	SFA 5,1
AWS No. (Class)	<u> </u>	E/018-1
F-No.	<u>F6</u>	F4
/\-(\v)		
CIZE	1/16 to 5/32 in. inclusive	3/32 to 1/4 in inclusive
Consumable Inserts	Not required Salid wire	N/A
Filler Metal Product Form	Solid wire	18/75
Flux	Without the addition of flux	N/A
Deposited Weld Metal Thickness Ra	ange:	
Groove	4.78 mm (0.188 in.) max.*	20.6 mm (0.812 in.) max.*
Chief Collinglied deboated Mel	i Meiai inickness shall not evo	200d 10 1 mm /0 750 in \
for ASME B31.1 & B31.3	and 25.4 mm (1.00 in.) for AS	ME Section VIII, Div.1
POSITION (QW-405)		
Position of Groove All pos		illet All positions
Weld Progression GTAW	: Vertical up or vertical down	SMAW: Vertical up
PREHEAT (QW-406)		
Preheat Temperature (Minimum)	See attached preheat	sheet
Interpass Temperature (Maximum)	260°C (500°E)	
Preheat Maintenance See attached	preheat sheet prior to welding	g. Preheat maintenance is
not required i	welding is interrupted or afte	r the completion of welding
unless require	ed by the code of construction	T WAS ASSUMPTION OF MEIGHIN
		·

seek one and phone accepts (2) appear

	WPS	NO. 41-1-144A (Rev. 2)
POST WELD HEAT TREATM	MENT (OW-407)	
Temperature RangeN/		N/A
GAS (QW-408)	•	
Specification No. (SFA) Spinishing 400%	A 5.32 AWS No. (C	ass) <u>SG-A</u>
	ZV IIIMIS DAL MIDLIA ("III - AN MAAA)	
Backing Not required	Trailing	Not required
ELECTRICAL CHARACTERI	STICS (QW-409)	
Current Direct Amps See Table Maximum Heat Input	Polarity GTA	W: Straight SMAW: Reverse
Amps See Table	#1 Volte	See Table 44
Maximum Heat Input	Volts	See Table #1
Base Metal Thickness Range 0.125 - 0.499 in. 0.500 - 1.0 in. Pulsing Current GTA Tungsten Electrode 1/16	GTAW	SMAM
0.125 - 0.499 in.	30,000 J/in.	30 130 J/in
0.500 - 1.0 in.	52,570 J/in.	69 990 Vin
Pulsing CurrentGTA	W: With or without	33,000 0,117.
Tungsten Classification <u>EW</u>	<u> Th-1, EWTh-2, EWCe-2, EWLa-1</u>	, EWLa-1.5, EWLa-2
TECHNIQUE (QW-410)		,
String or Weave	Fither Travel Canad	One Weble H4
Ormoc or Gas Cup Size	9 52 to 14 1 mm (0 376 to 0 78	(A)
		no required
monios of Dack Goldmin	AIF COIDON ATA BOOK ANIMA AS II.	as required
Oscillation	N/A	soured
Oscillation Closed or Out of Chamber	N/A	
viultiple of Single Pass Per Side	GTAM: Fither C	MANA: Multiple
	Sitigle	
=lectrode Spacing	N/A	
Peening	Not permitted	1

TABLE 1 - WELDING PARAMETERS

Process	Filler Metal	Diameter mm (in.)	Current Type & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
GTAW	ER70S-2	1.6 (1/16)	DCSP	50 - 140	6 - 14	
GTAW	ER70S-2	2.4 (3/32)	DCSP	70 - 200	8 - 18	9 - 300 (0.4 - 12)
GTAW	ER70S-2	3.2 (1/8)	DCSP	100 - 285	9 - 20	17 - 350 (0.7 - 14)
GTAW	ER70S-2	4.0 (5/32)	DCSP	120 - 350	10 - 21	27 - 400 (1.1 - 16) 35 - 450 (1.4 - 18)
SMAW	E7018-1	2.4 (3/32)	DCRP	60 - 110	18 - 24	
SMAW	E7018-1	3.2 (1/8)	DCRP	90 - 160	18 - 26	24 - 300 (1.0 - 12) 36 - 350 (1.4 - 14)
SMAW	E7018-1	4.0 (5/32)	DCRP	130 - 220	19 - 28	
SMAW	E7018-1	5.0 (3/16)	DCRP	200 - 300	20 - 30	
SMAW	E7018-1	5.5 (7/32)	DCRP	240 - 340	20 - 32	88 - 500 (3.5 - 20)
SMAW	E7018-1	6.4 (1/4)	DCRP	275 - 360	21 - 32	105 - 550 (4.2 - 22) 126 - 550 (5.0 - 22)

Note: Welding parameters shall be adjusted to insure that the maximum heat input value specified in QW-409 above is not exceeded. Heat Input (J/in.) = Voits X Amps X 60
Travel Speed (ipm)

TYPICAL JOINT DESIGNS П -- 3/16+/- 3/16 in. ---- |--- 1/4 +/- 1/4 in. •~ 3/16 +/- 3/16 in. Figure 1 Figure 2 Figure 3 Single Square Butt Single Square Butt with Backing Strip **Double Square Butt** 60°+/- 15° Typical 3/16 +/- 3/16 in. *** 3/16 +/- 3/16 in. 3/16 +/- 3/16 In. Figure 4 Figure 5 Figure 6 Single Vee Butt Single Vee Butt with Backing Strip Double Vee Butt Redius 1/8 In. Redius 1/8 in. +/- 1/16 in. Radius 1/8 in. +/- 1/18 ln. +/- 1/16 in, 50° +1, 20 Typical 7 3/16 +/- 3/16 in. Figure 7 Figure 8 Figure 9 Single U Butt Single U Butt with Backing Strip **Double U Butt** Radius 1/8 in: +/- 1/16 in. Radius 1/8 in. > Radius 1/8 in. +/- 1/16 in. 20° +/- 10° 20° +/- 10° 20° +/- 10° Typical - 3/16 +/- 3/16 in. ~ 3/16 +/- 3/18 (n. 3/16 +/- 3/16 in. Figure 10 Figure 11 Figure 12 Single J Butt Single J Butt with Backing Strip **Double J Butt** 40°+/- 20° 40°+/- 20° 40°+/- 20° Typical 3/16 +/- 3/16 in. ⁻⁻ 3/16 +/• 3/16 in, ⊶- 3/16 +/- 3/16 in. Figure 13 Figure 14 Figure 15 Single Bevel Butt Single Bevel Butt with Backing Strip Double Bevel Butt

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

PREHEAT P-No. 1

- 1. Welds joining pressure parts or attachments shall be preheated to not less than the minimum preheat temperatures stated in paragraph 5.
- 2. The preheat temperature shall be maintained during welding.
- 3. If welding is interrupted, the weld joint and adjacent areas shall be reheated to the minimum preheat temperature stated in paragraph 5, prior to the start of welding.
- 4. Preheat temperatures shall be checked by the welder or inspector, using temperature indicating crayons or other reputable methods.
- 5. Minimum preheating temperatures shall be as follows:

PRESSURE VESSELS IN ACCORDANCE WITH ASME SECTION VIII, DIV. 1

NOMINAL WALL THICKNESS	MINIMUM PREHEAT TEMPERATURE
0 to 32 mm (0 to 1.25 in)	10°C (50°F)
Over 32 mm (Over 1.25 in.)	95°C (200°F)
Over 25 mm (1.0 in.) & specified maximum carbon content in excess of 0.30%.	79°C (175°F)

⁻ The conditions of UW-30 shall apply for base metal temperatures below 0°C (32°F).

PROCESS PIPING IN ACCORDANCE WITH ASME B31.3

NOMINAL WALL THICKNESS	MINIMUM SPECIFIED BASE METAL TENSILE STRENGTH	MINIMUM PREHEAT TEMPERATURE
< 25 mm (1.0 in.)	≤ 490 MPa (71 ksi)	10°C (50°F)
≥ 25 mm (1.0 in.)	All	79°C (175°F)
All	> 490 MPa (71 ksi)	79°C (175°F)

⁻ The preheat zone shall extend at least 25 mm (1.0 in.) beyond each edge of the weld.

POWER PIPING IN ACCORDANCE WITH ASME B31.1

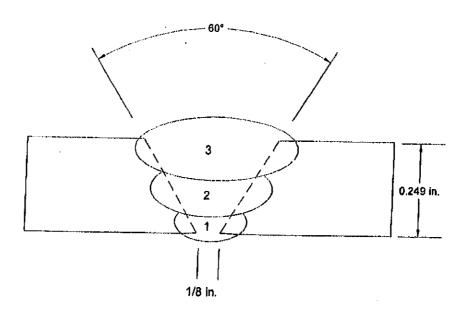
NOMINAL WALL THICKNESS	MINIMUM PREHEAT TEMPERATURE
Over 25 mm (1.0 in.) & specified maximum carbon content in excess of 0.30%.	80°C (175°F)
All others	10°C (50°F)

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

⁻ The preheat zone shall extend at least 50 mm (2.0 in.) beyond each edge of the weld.

⁻ The interruption of welding shall be subject to the requirements of paragraph 330.2.4.

	M. Industries L.P.
Procedure Qualification Record No.	41-1-134 Data April 22 2004
COLDOLATE US	ame change (formerly CLM Topke 9 Equipment Ltd.
aeniemer i	17 711/16
vveiding modedure Specification No	41-1-1444 (Rev 2)
Welding Process(es)	GTAW / SMAW Type(s) Manual
	Typo(o) Inditidal
JOINTS (QW-402)	
Type Butt joint, sin	igle vee groove, see next hage
	SAS YOU SHOOKS, OCC HEAR PAGE
BASE METALS (QW-403)	
Material Spec. SA 333 to SA 350	Type or Grade <u>Gr. 6 to Gr. LF2</u> Thickness <u>6.32 mm (0.249 in.)</u>
P-No. P1 Grp.1 To P-No. P1 G	Thickness 6.22 mm (0.240 in)
Diameter 114.3 mm (4.50 in) O.D.	Other Schedule 80 m/c to 0.249 in.
	Schedule 80 m/c to 0.249 in.
FILLER METALS (QW-404)	CTAIA!
Specification No. (SEA)	GTAW SMAW
AWS No. (Class)	SFA 5.18 SFA 5.1
Filler Metal A-No	F6 F4
Filler Metal A-No.	<u>A1</u>
Denosited World Motel Thister	See attached sketch
Deposited Weld Metal Trickness	See attached sketch 2.38 mm (0.094 in.) 3.94 mm (0.155 in.)
POSITION (QW-405)	
Position of Groove 5G	
vield Progression	lup
PREHEAT (QW-406)	
Preneat Temperature 10°C (50°F)	Interpass Temp. (Max.) 232°C (450°F)
POSTWELD HEAT TREATMENT (QW-4	\$07)
Temperature <u>N/A</u>	Time N/A
GAS (QW-408)	
Specification No. (SFA) SFA 5.32	AWS No. (Class) SG-A
Shielding 100% Argon 13 liters p	per minute (27 cfnh)
Shielding 100% Argon 13 liters p Backing Without	Trailing \\//ithout
	- Framing <u>- VyitiTout</u>
ELECTRICAL CHARACTERISTICS (QW	/_400\
Current Direct	
Amps See next page	Polarity GTAW; Straight SMAW: Reverse
Heat Input F6: 30,000 J/in. maxim	Volts See next page
Other 3/32 in, diameter 2% th	num F4: 52,570 J/in. maximum
0/32 tri. diameter 276 tri	oriated tungsten electrode, EWTh-2
TECHNIQUE (OW 440)	
TECHNIQUE (QW-410)	
String or Weave Both	Travel Speed See next page
Multiple or Single Pass Per Side GTAW:	
Multiple or Single Electrodes	Single



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min (i.p.m.)
1	GTAW	ER70S-2	2.4 (3/32)	DCSP	100 - 110	9 - 10	56 (2.2)
2 - 3	SMAW	E7018-1	2.4 (3/32)	DCRP	72 - 75	20	53 - 127 (2.1 - 5.0)

TENSILE TEST (QW-150)

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Ultimate Load N (lbs.)	Ultimate Stress MPa (psi)	Character & Fracture Location
T1	19.0	4.06	77.1	40 000	519	Partial Cup & Cone
	(0.748)	(0.160)	(0.120)	(8,990)	(75,200)	Parent Metal (SA 333 Gr. 6)
T2	19.2	4.15	79,7	40 900	513	Partial Cup & Cone
	(0.756)	(0.163)	(0.123)	(9,190)	(74,400)	Parent Metal (SA 333 Gr. 6)

GUIDED BEND TEST (QW-160)

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

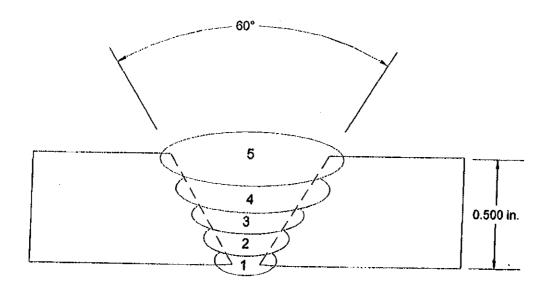
CHARPY IMPACT TOUGHNESS

	<u>py V Notch</u> Orientation C (-55°F) Specimen Size	Transverse
	2 (303) Specimen 3120	9 <u>10 x 5 mm</u>
Specimen No.	Notch Location	impact Values J (ft. lbs)
A2.1	Weld Metal with 1/16" of roo	31.5 (23,2)
A2.2	Weld Metal with 1/16" of root	39.3 (29.0)
- A2.3	Weld Metal with 1/16" of root	41.0 (30.2)
A3.1	P1 Grp.1 - HAZ	55.6 (41.0)
A3.2	P1 Grp.1 - HAZ	96.5 (71.2)
A3.3	P1 Grp.1 - HAZ	83,3 (61.4)
A4.1	P1 Grp.2 - HAZ	44.7 (33.0)
A4.2	P1 Grp.2 - HAZ	25,8 (19,0)
A4.3	P1 Grp.2 - HAZ	50.2 (37.0)

OTHER TESTS

Vio	<u> ckers Hardness - see attac</u>	ned laboratory test repor	t
Welders Name Tests Conducted By Laboratory Test No.	Robert Gottschlich Ludwig & Associates L E01-283,1	Certificate File No .td.	W-13480
Paragraph Qvv-200.2 an	the statements in this red d that the test welds were Section IX of the ASME Co	prepared, welded and te	in accordance with ested in accordance
Manufacturer		NDUSTRIES L.P.	7
Date Sept 1	5/06	Signed	thelles

	<u>G.L</u>	.ivi. Indus	stries L.P.	
Procedure Qualific	cation Record No.	41-1-	134-2	Date February 25, 2002
PQR Revision	Corporate r	name cha	nge (formerly GI	M Tanks & Equipment Ltd.),
	September	12, 2006		
Welding Procedure	e Specification No.	41-1-	144A (Rev 2)	
Welding Process(e	es)	GTAV	V / SMAW	Type(s) Manual
•	· · / · · · · · · · · · · · · · · · · ·	<u> </u>	V O O O O O O O O O O O O O O O O O O O	Type(s)wanuar
JOINTS (QW-40)	21			
Type	Butt joint, si	nala voa	areauc coc nord	
. Me	<u> </u>	ildie vee	groove, see next	page
BASE METALS (OW-403)			
Material Spon	CA 222 to CA 250			
Heat No	94040 to 20400		Type or Grade	Gr. 6 to Gr. LF2
P.No. D1 Cra 4	0 1042 to 38493		_ CE:	0.27 to 0.39
Diameter 240	10 P-NO. P1 (srp,2	_ Inickness	12.7 mm (0,500 in.)
Diameter 219.	1 mm (8,625 in.) Q.D.		Other	N/A
CH FD 4FT 4	/O14/ 45 ()			
FILLER METALS	(QW-404)		/	SMAW
Specification No. (S	SFA)	<u>SFA 5.</u>	18	SFA 5.1
AVVS No. (Class)		ER709	:-2*	F7018-1**
Filler Metal F-No.		F6		F4
Filler Metal A-No.		<u>A1</u>		A1
Size of Electrode _		See at	ached sketch	
Deposited Weld Me	tal Thickness	2.38 m	m (0.094 in.)	10.3 mm (0.406 in.)
Other	"Linc	oin Fiect	ric Co · Lincoln 🖼	R70S-2
	**Linc	oln Elect	ric Co.: Excalibur	E7018-1
POSITION (QW-4)	05)			
Position of Groove	. 5G			
Neld Progression	Vertic	al up	<u>"</u>	
		**************************************	······································	**************************************
PREHEAT (QW-40)6)			
reheat Temperatur	e 10°C (50°F)		Internace Temp	(Max.) <u>232°C (450°F)</u>
· · · · · · · · · · · · · · · · · · ·			interpass remp.	(Max.) 232 C (430 F)
OSTWELD HEAT	TTREATMENT (QW-	407)		
emperature	N/A	407)	Time	N/A
omperature	INA		ııme	N/A
AC (014) 400)				
AS (QW-408)	74) 00, 50			
pecification No. (SF	A) <u>SFA 5,32</u>		AWS No. (Class)) <u>SG-A</u>
nielaing	<u>100% Argon 13 liters</u>	per minu		
acking	Without		TrailingWit	hout
LECTRICAL CHA	RACTERISTICS (Q)	N-409)		
urrent	Direct		Polarity GTAW:	Straight SMAW: Reverse
mps	See next page			next page
eat Input	See next page F6: 63,820 J/in. maxi	mum	F4:	69.990 J/in maximum
ther	3/32 in. dlameter 2% t	lhoriated	tungsten electroc	le, EWTh-2
ECHNIQUE (QW-	410)			
ring or Weave	Both		Travel Speed	See next page
ultiple or Single Pas	ss Per SideGTAW:	Single	Travel Oheen	AW: Multiple
ultiple or Single Flac	ctrodes	Single		
But usus 9 Associate		Silidia		



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/mln (i,p,m,)
1	GTAW	ER70S-2	2.4 (3/32)	DCSP	110	10	26 (1.0)
2	SMAW	E7018-1	2.4 (3/32)	DCRP	80	20	84 (3.3)
3 - 5	SMAW	E7018-1	3,2 (1/8)	DCRP	110	20	48 - 74 (1.9 - 2.9)

and the first of the party

TENSILE TEST (QW-150)

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sg. in.)	Ultimate Load N (lbs.)	Ultimate Stress MPa (psi)	Character & Fracture Location
T1	18.9	11.6	219	94 400	431	Partial Cup & Cone
	(0.744)	(0.457)	(0,340)	(21,200)	(62,400)	Parent Metal (SA 333 Gr. 6)
T2	19.0	9.82	187	81 200	435	Partial Cup & Cone
Li	(0.748)	(0.387)	(0.289)	(18,300)	(63,100)	Parent Metal (SA 333 Gr. 6)

GUIDED BEND TEST (QW-160)

Type & Figure No.	Result	Type & Figure No.	Result
QW-462.2, TSB - S1	Pass	QW-462.2, TSB - S3	Pass
QW-462.2, TSB - S2	Pass	QW-462.2, TSB - S4	Pass

CHARPY IMPACT TOUGHNESS

Type of Test	Charpy V Notch	Orientation	Trans	verse
Test Temperature	-46°C (-50°F)	Specimen Size		0 mm
Specimen No	. N	lotch Location	Impact Valu	es J (ft. lbs)
R2.1	Weld Me	tal within 1/16" of root		(91.2)
R2.2	Weld Me	tal within 1/16" of root		(95.4)
R2.3		tal within 1/16" of root		(50.0)
R3.1	p-	1 Grp.1 - HAZ	>260	(>192)
R3.2		1 Grp.1 - HAZ	>260	
R3.3		Grp.1 - HAZ	>260	
R4.1	P1	I Grp.2 - HAZ	40,1	(29.6)
R4.2		Grp.2 - HAZ	44.5	
R4.3		Grp.2 - HAZ	41.2	

OTHER TESTS

Vickers Hardne	ness - see attached ass - see attached la as - see attached lab		
Tests Conducted By	Don Johnson Ludwig & Associates E02-150.15	Certificate File No.	N/A
We hereby recertify that the Paragraph QW-200.2 and tha with the requirements of Section	it the test welds wer	e prepared, welded and te	in accordance with sted in accordance
Manufacturer	G.L.M. INDUS	STRIES L.P.	
Date Sept 15/0	16	_ Signed	Statted

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB **T9E 7S6**

Attention:

Wilber Davie

POR No.:

41-1-134

Material:

SA 333 Gr. 6 to SA 350 Gr. LF2

Size:

114.3 mm (4.50 in.) O.D. x 6.32 mm (0.249 in.) w.t.

Thermal Condition:

As Welded

TENSILE TEST QW-150

SAMPLE NUMBER	T 1	QW-462,1(b)	T2	QW-462.1(b)
WIDTH mm (in)	19.0	(0.748)	19.2	(0.756)
THICKNESS mm (in)	4.06	(0.160)	4.15	(0.163)
AREA sq mm (sq in)	77.1	(0.120)	79.7	(0.123)
ULTIMATE LOAD N (lbs)	40 000	(8,990)	40 900	(9,190)
UTS MPa (psi)	519	(75,200)	513	(74,400)
FRACTURE TYPE	Partial Cup	& Cone	Partial Cu	ıp & Cone
FRACTURE LOCATION	Parent Met	al (SA 333 Gr. 6)	Parent M	etal (SA 333 Gr. 6)

GUIDED-BEND TEST QW-160

SAMPLE WIDTH:

19.1 mm (0.750 ln.)

SAMPLE THICKNESS:

6.32 mm (0.249 in.)

PLUNGER SIZE:

22.2 mm (0.875 in.)

YOKE SIZE: Face Bend 41.1 mm (1.619 in.)

QW-462.3(a)

Face Bend F1

Root Bend

Root Bend

SAMPLE NUMBER(S)

R1

F2

R2

RESULTS

Pass

Pass

Pass

Pass

Laboratory Test No.: E01-283.1

Date: April 23, 2001

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX, 1998 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Andrew Elash / Ron Peters, C.E.T.

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6 Laboratory Test No.: E01-283.1

Date: April 23, 2001

Attention:

Wilber Davie

PQR No.:

41-1-134

Material:

SA 333 Gr. 6 to SA 350 Gr. LF2

Size:

114.3 mm (4.50 in.) O.D. x 6.32 mm (0.249 in.) w.t.

Thermal Condition:

As Welded

NOTCH-TOUGHNESS TEST

TYPE OF TEST:

TEST TEMPERATURE:

Charpy V-Notch

-48°C (-55°F)

ORIENTATION:

Transverse

SPECIMEN SIZE: 10 x 5 mm

Specimen	Notch	Impac	Values
Number	Location	Joules	(ft.lbs)
A2.1	Weld Metal within 1/16" of root	31.5	(23.2)
A2.2	Weld Metal within 1/16" of root	39.3	(29.0)
A2.3	Weld Metal within 1/16" of root	41.0	(30.2)
A3.1	Gr. 6 - HAZ	55.6	(41.0)
A3.2	Gr. 6 - HAZ	96.5	(71.2)
A3.3	Gr. 6 - HAZ	83.3	(61.4)
A4.1	Gr. LF2 - HAZ	44.7	(33.0)
A4.2	Gr. LF2 - HAZ	25.8	(19.0)
A4.3	Gr. LF2 - HAZ	50.2	(37.0)

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. I, UG-84, 1998 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Andrew Elash / Ron Peters, C.E.T.

Materials and Welding Engineering

LABORATORY TEST REPORT

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 -- 8 Street

Nisku, AB T9E 7S6

Laboratory Test No.: E01-283.1

Date: April 23, 2001

Attention:

Wilber Davie

POR No.:

41-1-134

Material:

Size:

SA 333 Gr. 6 to SA 350 Gr. LF2

114.3 mm (4.50 in.) O.D. x 6.32 mm (0.249 in.) w.t.

Thermal Condition: As Welded

HARDNESS TEST

TYPE OF TEST:

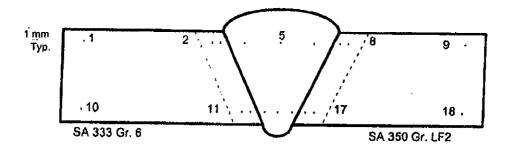
Vickers

LOAD:

500 g

INSTRUMENT TYPE:

Leco V-100-C1



1)	144 HV	6)	185 HV	11)	185 HV	16)	189 HV
2)	173 HV	7)	180 HV	12)	183 HV	17)	182 HV
3)	185 HV	8)	177 HV	13)	155 HV	18)	150 HV
4)	205 HV	9)	147 HV	14)	164 HV	•	
5)	193 HV	10)	150 HV	15)	157 HV		

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E384 - 99. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report?

Laboratory Test Conducted By:_

Andrew Elash / Ron Peters, C.E.T.

Laboratory Test No.: E02-150.15

Date: March 1, 2002

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB **T9E 7S6**

Attention:

Wilber Davie

PQR No.:

Material:

41-1-134-2

SA 333 Gr. 6 to SA 350 Gr. LF2

Size:

219.1 mm (8.625 in.) O.D. x 12.7 mm (0.500 in.) w.t.

Thermal Condition: As Welded

TENSILE TEST QW-150

SAMPLE NUMBER	T1	QW-462.1(b)	TO	Otto the colo
WIDTH mm (in)	• •	, ,	T2	QW-462.1(b)
	18.9	(0.744)	19.0	(0.748)
THICKNESS mm (in)	11.6	(0.457)	9.82	(0.387)
AREA sq mm (sq in)	219	(0.340)	187	(0.289)
ULT. LOAD N (lbs)	94 400	(21,200)		•
UTS MPa (psi)			81 200	(18,300)
	431	(62,400)	435	(63,100)
FRACTURE TYPE	Partial Çı	up & Cone	Partial Cu	ıp & Cone
FRACTURE LOCATION	Parent Metal (SA 333 Gr. 6)		Parent Metal (SA 333 Gr. 6)	

GUIDED-BEND TEST QW-160

SAMPLE WIDTH: 9.52 mm (0.375 in.) SAMPLE THICKNESS: 12.7 mm (0.500 in.) PLUNGER SIZE: 38.1 mm (1.50 in.) YOKE SIZE: 60.3 mm (2,375 in.) QW-462.2 Side Bend Side Bend Side Bend Side Bend SAMPLE NUMBER(S) S1 S2 **S3 S4** RESULTS Pass Pass Pass **Pass**

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX, 2001 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:	aren Boens
	Chris Lachuk / Karen Koens, C.F.T.

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB **T9E 7S6**

Wilber Davie

Attention:

PQR No.:

41-1-134-2

Material:

SA 333 Gr. 6 to SA 350 Gr. LF2

Size:

219.1 mm (8.625 in.) O.D. x 12.7 mm (0.500 in.) w.t.

Thermal Condition: As Welded

NOTCH-TOUGHNESS TEST

TYPE OF TEST:

Charpy V-Notch

ORIENTATION:

Transverse 10 x 10 mm

Laboratory Test No.: E02-150.15

Date: March 1, 2002

TEST TEMPERATURE: -46°C (-50°F) SPECIMEN SIZE:

Specimen	Notch	impact Values		
Number	Location	Joules	(ft.lbs)	
R2.1	Weld Metal within 1/16" of root	124	(91.2)	
R2.2	Weld Metal within 1/16" of root	129	(95.4)	
R2.3	Weld Metal within 1/16" of root	67.8	(50.0)	
R3.1	Gr. 6 - HAZ	>260	(>192)	
R3.2	Gr. 6 - HAZ	>260	(>192)	
R3.3	Gr. 6 - HAZ	>260	(>192)	
R4.1	Gr. LF2 - HAZ	40.1	(29.6)	
R4.2	Gr. LF2 - HAZ	44.5	(32.8)	
R4.3	Gr. LF2 - HAZ	41.2	(30.4)	

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. I, UG-84, 2001 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6

Attention:

Wilber Davie

PQR No.:

41-1-134-2

Material:

SA 333 Gr. 6 to SA 350 Gr. LF2

Size:

219.1 mm (8.625 in.) O.D. x 12.7 mm (0.500 in.) w.t.

Thermal Condition:

As Welded

HARDNESS TEST

TYPE OF TEST:

Rockwell

SCALE:

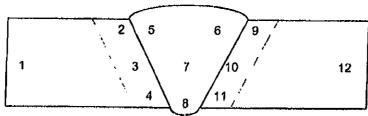
В

Laboratory Test No.: E02-150.15

Date: March 1, 2002

INSTRUMENT TYPE:

NewAge Digital Versitron



SA 350 Gr. LF2

SA 333 Gr. 6

1) **78 HRB** 5) 90 HRB 9) 84 HRB 2) 87 HRB 6) 89 HRB 10) **79 HRB** 3) 88 HRB 7) 84 HRB 11) **79 HRB** 4) 86 HRB 8) **78 HRB** 12) 71 HRB

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E18 - 98. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Chris Lachuk / Karen Koens, C.E.T.

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB **T9E 7S6**

Laboratory Test No.: E02-150.15

Date: March 1, 2002

Attention:

Wilber Davie

PQR No.:

41-1-134-2

Material:

SA 333 Gr. 6 to SA 350 Gr. LF2

Size:

219.1 mm (8.625 in.) O.D. x 12.7 mm (0.500 in.) w.t.

Thermal Condition: As Welded

HARDNESS TEST

TYPE OF TEST:

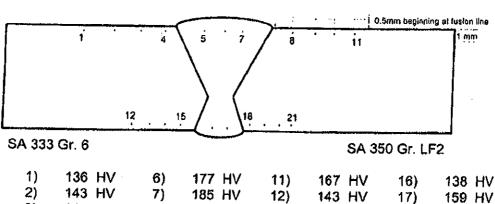
Vickers

LOAD:

10kg

INSTRUMENT TYPE:

Mitutoyo AVK-C1



1)	136 HV	6)	177 HV	11)	167 HV	16)	138 HV
2)	143 HV	7)	185 HV	12)	143 HV	17)	159 HV
3)	146 HV	8)	196 HV	13)	148 HV	18)	174 HV
4)	147 HV	9)	180 HV	14)	150 HV	19)	169 HV
5)	172 HV	10)	174 HV	15)	154 HV	20)	167 HV
						21)	160 HV

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E92-82 (Reapproved 1997). The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Chris Lachuk / Karen Koens, C.E.T.

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6 Laboratory Test No.: E02-150.15

Date: March 1, 2002

Attention:

Wilber Davie

PQR No.:

41-1-134-2

Material:

SA 333 Gr. 6 to SA 350 Gr. LF2

Size:

219.1 mm (8.625 in.) O.D. x 12.7 mm (0.500 in.) w.t.

Thermal Condition:

As Welded

HARDNESS TEST

TYPE OF TEST:

Brinell

LOAD:

3000kg., 10 mm ball

INSTRUMENT TYPE:

Brown Bayley

WELD CAP HARDNESS

174 BHN

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E10-00. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Chris Lachuk / Karen Koens, C.E.T.

4027 - 14 Street S.E., CALGARY, ALBERTA T2G 3K6 PHONE: (403) 262-7072 FAX: (403) 266-3169
7925 Davies Road, EDMONTON, ALBERTA T6E 4N1 PHONE: (780) 468-3030 FAX: (780) 468-3032



WELDING PROCEDUR	RE SPECIFICATION NO).:	41-8 / 1-163A (Rev.2)
WELDING PROCEDUR	RE QUALIFICATION RE	CORD NO.(S):	41-1 / 8-163-1
•	QUALIFIED	FOR	
Base Metal (Typical):	P1 Groups 1 & 2 to P8	Group 1	
	(SA 333 Gr.6, SA 350 C	Sr.LF2, SA 420 WPL6	, SA 516 Gr.70, etc. to
Processies):	SA 182, SA 240, SA 31	2, Types 304, 304L, 3	316, 316L, 321, etc.)
Process(es):	ALL POSITIONS	vveiu rypes:	ALL DIAMETERS
Filler Metal:	ER309L, E309L-15/16/1	7	ALL DIAMETERS
BASE METAL CONDITIONAL TOUGHNESS AF			UALIFIED:
BASE METAL THICKNESS	S RANGE 3	3.2 to 12.7 mm (0.125	to 0.500 in.) inclusive
COMBINED DEPOSITED N ASME B31.1 ASME B31.3 ASME SECT. VIII, [1	2.7 mm (0.500 in.) m 2.7 mm (0.500 in.) m 2.7 mm (0.500 in.) m	aximum aximum aximum
ALBERTA BOILERS SAFE PROVINCE OF A SAFETY CODE WELDING PROCE Rog. No. WP. 86.3 Spec No. 41 8 Weld Process G.7A.V Mail. Gr. P No. 1. Gr. 11.3 to P Eleo. Gr. F No. 4.1.5 A Th. Qual. For 3. 21.2.7 m PW CVN - 4.6 Yr. O. Mo. 10. Day 22. Signed R. F WE	ALBERTA S ACT EDURE 4.3A (R.EV.Z.) / S.M.A.W. No. B. G.M. No. B. G		

QW-482 WELDING PROCEDURE SPECIFICATION (WPS)

	G.L.M. Industries L.P.	
Welding Procedure Specificati	on No. 41-8 / 1-163A	(Rev.2) Date September 26, 2006
Revision <u>Rev. 2 (Nonessen</u>	<u>itial) Corporate name chang</u>	<u>ie (formerly GLM Tanks & </u>
	Equipment Ltd.) WPS N	No. formerly 41-8 / 1-163A (Rev.1)
Supporting PQR No.(s)	41-1 / 8-163-1	
Welding Process(es)	GTAW / SMAW	Type(s)Manual
JOINTS (QW-402)		
	E groove & fillet, reference co	onstruction drawing for joint details.
Where ic	pint details are not specified.	refer to figures 1 to 15 attached
Root Opening As per a	<u>ttached typical groove design</u>	s, see figures 1 to 15 attached
Backing With or v	<u>vithout</u> Retain	ers <u>Not required</u>
BASE METALS (QW-403)		
P-Number P1 Group	os 1 & 2 To P ₂ N	lumber P8 Group 1
Thickness Range: Groove	See cover page for thic	kness qualified by governing code
Fillet	All base metal thicknes	Ses
Pipe Diameter Ranges: G	roove All diameters	
Fi	llet All diameters	
Deposited Weld Metal (Per Pas	s) GTAW: 4.78 m/	m (0.188 in.) maximum
·	SMAW: 7.92 m	m (0.188 in.) maximum m (0.312 in.) maximum
FILLER METALS (QW-404)	GTAW	SMAW
Specification No. (SFA)	SFA 5.9	SFA 5.4
AWS No. (Class)	ER309L	E309L-15/16/17
F-No	F6	F5
M-140	A8	A8
0128	1/16 to 5/32 in. inclusive	
Consumable Inserts	Not Regulred	N/A
Filler Metal Product Form	Solid wire	N/A
Flux	Without the addition of fi	lux N/A
Deposited Weld Metal Thickness	s Range:	
Groove	4.78 mm (0.188 in.) max	c* 7.92 mm (0,312 in.) max.*
Fillet	All fillet sizes	7.92 mm (0.312 in.) max.* All fillet sizes
Jiher <u>Combined deposited</u>	<u>weid metai thickness shall no</u>	ot exceed 12.7 mm (0.500 in.)
for ASME B31.1 & B3	1.3 and for ASME Section VI	[i], Div.1
POSITION (QW-405)		
Position of GrooveAll	positions Position	of FilletAll positions
Veld ProgressionGT	AW: Vertical up or vertical de	own SMAW: Vertical up
PREHEAT (QW-406)		
Preheat Temperature (Minimum)	10°C (50°F)	·
nterpass Temperature (Maximun	n) 177°C (350°F)	
reheat Maintenance <u>10°C prior</u>	to welding. Preheat mainten	ance is not required if welding is
interrupte	d or after the completion of w	elding unless required by the
	onstruction.	

POST WELD HEAT TREAT	MENT (QW-407)		
Temperature Range	<u> </u>	_ Time Range	N/A
GAS (QW-408)			
Specification No. (SFA) Shielding 100% As	SFA 5.32	AWS No. (Class)	SG-A
	uun, o * zu mers ber	minute (10 - 40 ctnn	1
backing100% Ar	<u>gon, 3 - 10 liters per </u>	minute (6 - 20 cfph)	
Trailing Not Reg	uired		***************************************
ELECTRICAL CILLER			
ELECTRICAL CHARACTER	RISTICS (QW-409)		
Current Direct Amps See Tabl	Polarii	y GTAW: Strate	pht SMAW: Reverse
Amps See Tabl	e#1 Volts	See Table #1	
Maximum Heat Input Base Metal Thickness Range 0.125 - 0.500 In. Pulsing Current G Tungsten Floatrode			
Base Metal Thickness Range	GTAW		SMAW
0.125 - 0.500 ln.	51,830 J/	in.	21,920 J/in.
Pulsing Current G	TAW: With or withou	t	
A CHI CHACH OLD IV	10 to 5/32 inch diame	ater	
Tungsten ClassificationE	<u> </u>	Ce-2, EWLa-1, EWL	a-1.5, EWLa-2
TECHNIQUE (QW-410)			
String or Weave	Either	Travel Speed	See Table #1
Orifice or Gas Cup Size Initial & Interpass Cleaning Method of Back Coupling	9,52 to 19,1 mm	1 (0.375 to 0.750 in.)	
Method of Bank Organing	Brushing, chippi	<u>ng or grinding as rec</u>	ulred
Marrior of Dack Goughing	<u>Air carbon arc, i</u>	ack-grind as require	d
Oscillation	N/A	****	
Closed or Out of Chamber	N/A		
Multiple or Single Pass Per Side	GTAW: Either	SMAW: Multip	le
MURIDIO OF SINGLE ELECTRODES	Sinale		
Electrode Spacing	N/A		
Peening	Not permitted		

TABLE 1 - WELDING PARAMETERS

Process	Filler Metal	Diameter mm (ln.)	Current Type & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min. (i.p.m.)
GTAW	ER309L	1.6 (1/16)	DCSP	50 - 140	6 - 14	9 - 300 (0.4 - 12)
GTAW	ER309L	2.4 (3/32)		70 - 200	8 - 18	17 - 350 (0.7 - 14)
GTAW	ER309L	3.2 (1/8)	DCSP	100 - 285	9 - 20	27 - 400 (1.1 - 16)
GTAW	ER309L	4.0 (5/32)	DCSP	120 - 350	10 - 21	36 - 450 (1.4 - 18)
SMAW	E309L-15/16/17	2.4 (3/32)	DCRP	50 - 80	16 - 27	56 - 300 (2.2 - 12)
SMAW	E309L-15/16/17	3.2 (1/8)	DCRP	70 - 120	17- 28	83 - 350 (3.3 - 14)
SMAW	E309L-15/16/17	4.0 (5/32)	DCRP	100 - 170	18 - 29	126 - 400 (5,0 - 16
SMAW	E309L-15/16/17	5.0 (3/16)	DCRP	140 - 220	20 - 30	195 - 500 (7.7 - 20

Note: Welding parameters shall be adjusted to insure that the maximum heat input value specified in QW-409 above is not exceeded. Heat input (J/in.) = Volts X Amps X 60
Travel Speed (lpm)

of the data quite

TYPICAL JOINT DESIGNS 3/16 +/- 3/16 in. --- 1/4 +/+ 1/4 in. **→** 3/16 +/- 3/16 in. Figure 1 Figure 2 Figure 3 Single Square Butt Single Square Butt with Backing Strip Double Square Butt 606+). 150 600+ 150 606+1-150 Typical 3/16 +/- 3/16 in. -- 3/16 +/- 3/16 in. Figure 4 Figure 5 Figure 6 Single Vee Butt Single Vee Butt with Backing Strip **Double Vee Butt** Redius 1/8 in. > Redius 1/8 In. Redius 1/8 In. +/- 1/18 In. +/- 1/16 ln. 60° +/- 20 Typical > 3/10 +/- 3/10 in. 3/18 4/- 3/16 In. Figure 7 Figure 8 Figure 9 Single U Butt Single U Butt with Backing Strip Double U Butt Radius 1/8 in.> Radius 1/8 in. > Radius 1/8 in. +/- 1/16 in. 20°+/- 10° 20°+/- 10° 20° +/- 10° Typical 3/16 +/- 3/16 in. 3/16 +/- 3/16 in. ¬¬ 3/16 +/- 3/16 in. Figure 10 Figure 11 Figure 12 Single J Butt Single J Butt with Backing Strip Double J Butt 400+/- 200 40°+/- 20° 40°+/- 20° Typical 3/16 +/- 3/18 in. 3/16 +/- 3/16 in. •-- 3/16 +/- 3/16 ln. Figure 13 Figure 14 Figure 15 Single Bevel Butt Single Bevel Butt with Backing Strlp

Prepared By Ludwig & Associates Ltd.

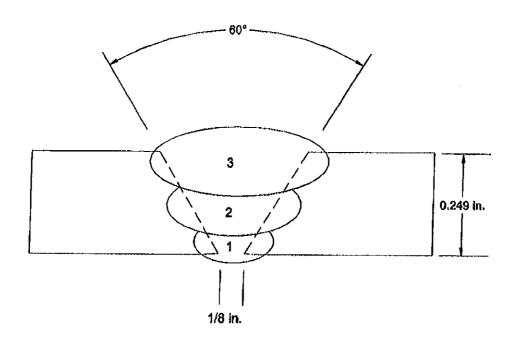
Or as per the joint design on the approved construction drawing.

Double Bevel Butt

QW-483 WELDING PROCEDURE RECORD (PQR)

	G.L.M.	industries L.P.		
Procedure Qualification Re	COZO NO 41	_1 / Q. 1QQ 1	Data 1	ine 11, 2002
PUR Revision	Corporate nam	e change (forme	rly GLM Tanks	& Equipment Ltd.
Wolding Describer Co. 16	September 26,	2006		
Wolding Procedure Specific	eation No.	<u>41-8 / 1-163A (F</u>	(ev.2)	
PQR Revision Welding Procedure Specific Welding Process(es)	GTAW /	SMAW	Type(s) <u>M</u>	anual
JOINTS (QW-402)				
Туре	Buttioint single	Vaa aroovo eo	a navt naga	
	Date Joint, Olligic	700 GIOOVE, 36	e next page	
BASE METALS (QW-403	3)			
Material Spec. SA 51	6 to SA 240	Type or	Grade Gr.60	/ 70 to Type 304t
F-140P1 G(p,1/2 10)	7-NO. P8 Grb. 1	i Thicknes	s 6.5	12 mm // 240 in \
Diameter N/A		Other	Pla	te Product Form
,				
FILLER METALS (QW-40	(4) G	TAW	SN	1AW
Specification No. (SFA)	S	FA 5.9	SF	A 5.4
AVVO IVO. (CIBSS)	l ĕ	R309L*	F3	<u>ሰር፤ _4 ም</u> **
Filler Metal F-No	F(6	F5	
Tine: Metal A-140,	A	8	AΑ	
Size of Electrode	S	ee attached sket	ch	
Size of Electrode Deposited Weld Metal Thick	1ess2.	38 mm (0.094 in	.) 3.9	4 mm (0.155 in.)
Other	*Avesta V	elding Products	: Avesta 309L	2 (1MI) (01 100 H1.)
Other	**Avesta W	elding Products	Avesta 309L-	7
POSITION (QW-405)				
Position of Groove	3G			
Position of Groove Weld Progression	Vertical U	D		***************************************
•		***************************************	· · · · · · · · · · · · · · · · · · ·	
PREHEAT (QW-406)				
Preheat Temperature	10°C (50°F)	Interpass	Temp. (Max.)	177°C (350°F)
			· - · · · · · · · · · · · · · · · · · ·	111 0 1000 1 1
POSTWELD HEAT TREAT	MENT (QW-407	7)		
Temperature	None .	Time	N/A	

3AS (QW-408)				
Specification No. (SFA)	SFA 5.32	AWS No. (Class)SG-/	4
Shielding 100% A	rgon, 12.5 liters p	er minute (25 cf	nh)	
Backing 100% A	rgon, 7.5 liters pe	r minute (15 cfpl	1)	
railing Without				
ELECTRICAL CHARACTE				
LECTRICAL CHARACTE				
Current <u>Direct</u>			<u> [AW; Straight</u>	SMAW: Reverse
mps See nex	t page	Volts	See next par	<u> </u>
leat Input F6: 51,8	130 J/In. maximun	1	F5: 21,920,	I/In. maximum
ther1/8 in. di	ameter 2% thoria	<u>ted tungsten ele</u>	<u>ctrode, EWTh-</u>	<u> </u>
ECHNIQUE (QW-410)				
tring or Weave Weave		Transact On a	۸ اس	
ultiple or Single Pass Per Sid	OTAMA DIS	Travel Spec		ext page
ultiple or Single Flass Per Sid ultiple or Single Electrodes	E GIAW; SIN	ule SMA\	V: Multiple	
minhip of purific Electrodes -	Sing	ie .		···



Pass	Process	Filler Metal	Diameter mm (in.)	Current & Polarity	Amperage Range	Voltage Range	Travel Speed mm/min (l.p.m.)
1	GTAW	ER309L	2.4 (3/32)	DCSP	80	10	24 (0.9)
2	SMAW	E309L-17	2.4 (3/32)	DCRP	50	22	76 (3.0)
3	SMAW	E309L-17	2.4 (3/32)	DCRP	50	22	79 (3.1)

PQR NO. 41-1 / 8-163-1	
------------------------	--

TENSILE TEST (QW-150)

Specimen No.	Width mm (in.)	Thickness mm (in.)	Area Sq. mm (Sq. in.)	Uitimate Load N (lbs.)	Uitimate Stress MPa (psi)	Character & Fracture Location
T1	19.1	4.90	93.6	51 500	550	Partial Cup & Cone
	(0.752)	(0.193)	(0.145)	(11,600)	(79,800)	Parent Metal (SA 516 Gr. 60/70)
T2	19.0	4.77	90.6	49 900	551	Partial Cup & Cone
	(0.748)	(0.188)	(0.140)	(11,200)	(79,900)	Parent Metal (SA 516 Gr. 60/70)

GUIDED BEND TEST (QW-160)

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

CHARPY IMPACT TOUGHNESS

Type of Test	Charpy V Notch	Orientation	Transverse
Test Temperature	-48°C (-55°F)	Specimen Size	10 x 5 mm
Specimen No.	Notch Location	Line and Volume 1 400 Bank	
		Impact Values J (ft. lbs)	Lateral Expansion (inches)
B2.1	Weld Metal	38.2 (28.2)	0.042
B2.2	Weld Metal	36.6 (27.0)	0.040
B2.3	Weld Metal	46.1 (34.0)	0.043
B3,1	P1 Grp.1 / 2 - HAZ	99.3 (73.2)	N/A
B3,2	P1 Gro.1 / 2 - HAZ	64.3 (47.4)	N/A

OTHER TESTS

94.9 (70.0)

P1 Grp.1/2 - HAZ

Vickers Ha	lardness - see attache rdness - see attached iness - see attached	ed laboratory test report laboratory test report aboratory test report	
Welders Name Tests Conducted By Laboratory Test No.	Don Johnson Ludwig & Associa E02-552.2	Certificate File No	N/A
We hereby recertify that	the statements in this	s record have been revised ere prepared, welded and te Code.	in accordance with ested in accordance
Manufacturer	G.L.M. IND	USTRIES L.P.	
Date	-	Signed	fue

B3.3

CUSTOMER:

GLM Tanks & Equipment Ltd.

Laboratory Test No.: E02-552.2

Date: June 21, 2002

1508 - 8 Street Nisku, AB

T9E 7S6

Attention:

Wilber Davie

PQR No.:

41-1/8-163-1

Material:

SA 516 Gr. 60/70 to SA 240 Type 304L

Thickness:

6.32 mm (0.249 in.)

Thermal Condition:

As Welded

TENSILE TEST QW-150

SAMPLE NUMBER	T1	QW-462.1(a)	T2	QW-462.1(a)
WIDTH mm (in)	19.1	(0.752)	19.0	(0.748)
THICKNESS mm (in)	4.90	(0.193)	4.77	(0.188)
AREA sq mm (sq in)	93.6	(0.145)	90.6	(0.140)
ULT. LOAD N (lbs)	51 500	(11,600)	49 900	(11,200)
UTS MPa (psi)	550	(79,800)	551	(79,900)
FRACTURE TYPE	Partial Cup	& Cone	Partial Cup	• • •
FRACTURE LOCATION	Parent Meta	Parent Metal (SA 516 Gr. 60/70)		al (SA 516 Gr. 60/70)

GUIDED-BEND TEST QW-160

SAMPLE WIDTH: 38.1 mm (1.50 in.) **SAMPLE THICKNESS:** 6.32 mm (0.249 in.) PLUNGER SIZE: 22.2 mm (0.875 in.) YOKE SIZE: 41.1 mm (1.62 ln.) QW-462.3 (a) Face Bend **Root Bend** Face Bend Root Bend SAMPLE NUMBER(S) F1 R1 F2 R₂ RESULTS Pass Pass Pass Pass

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section IX, 2001 edition and latest addenda. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:	// Call
	Natashua Collier, C.E.T.

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6 Laboratory Test No.: E02-552.2

Date: June 20, 2002

Attention:

Wilber Davie

POR No.:

41-1/8-163-1

Material:

SA 516 Gr. 60/70 to SA 240 Type 304L

Thickness:

6.32 mm (0.249 in.)

Thermal Condition:

As Welded

NOTCH-TOUGHNESS TEST

TYPE OF TEST:

TEST TEMPERATURE:

Charpy V-Notch -48°C (-55°F)

ORIENTATION:

Transverse

SPECIMEN SIZE:

10 x 5 mm

Specimen	Notch	•	Values	Lateral Expansion
Number	Location	Joules	(ft.lbs)	<u>in.</u>
B2.1	Weld Metal within 1/16" of root	38.2	(28.2)	0.042
B 2.2	Weld Metal within 1/16" of root	36.6	(27.0)	0.040
B2.3	Weld Metal within 1/16" of root	46.1	(34.0)	0.043
B3.1	Gr. 60/70 - HAZ	99,3	(73.2)	
B3.2	Gr. 60/70 - HAZ	64.3	(47.4)	
B3.3	Gr. 60/70 - HAZ	94.9	(70.0)	•

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASME Section VIII, Div. I, UG-84 - 2001. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

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

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street Nisku, AB

T9E 7S6

Attention:

Wilber Davie

PQR No.:

41-1/8-163-1

Material:

SA 516 Gr. 60/70 to SA 240 Type 304L

Thickness:

6.32 mm (0.249 in.)

Thermal Condition:

As Welded

HARDNESS TEST

TYPE OF TEST:

Vickers

LOAD:

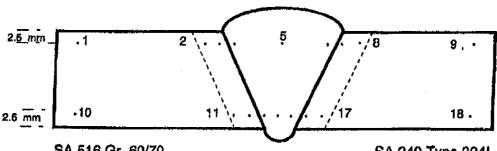
10 kg

Laboratory Test No.: E02-552.2

Date: June 24, 2002

INSTRUMENT TYPE:

Leco V-100-C1



SA 516 Gr. 60/70

SA 240 Type 304L

1)	164 HV	6)	197 HV	11)	206 HV	16)	179 HV
2)	186 HV	7)	186 HV	12)	223 HV	17)	184 HV
3)	198. HV	8)	187 HV	13)	177 HV	18)	164 HV
4)	197 HV	9)	171 HV	14)	165 HV	,	
5)	194 HV	10)	157 HV	15)	188 HV		

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E92 - 82 (Reapproved 1997). The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:

Natashua Collier, C.E.T.

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6

Attention:

Wilber Davie

POR No.:

41-1/8-163-1

Material:

SA 516 Gr. 60/70 to SA 240 Type 304L

Thickness:

6.32 mm (0.249 in.)

Thermal Condition:

As Welded

HARDNESS TEST

TYPE OF TEST:

Rockwell

SCALE:

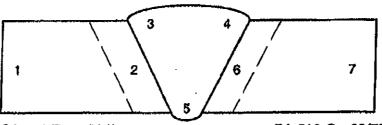
В

Laboratory Test No.: E02-552.2

Date: June 24, 2002

INSTRUMENT TYPE:

Wilson



SA 240 Type 304L

SA 516 Gr. 60/70

84 HRB

- 1) 81 HRB
- 4) 88 HRB

7)

- 2) 90 HRB
- 5) 84 HRB
- 3) 90 HRB
- 6) 92 HRB

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E18 - 98. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

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

CUSTOMER:

GLM Tanks & Equipment Ltd.

1508 - 8 Street

Nisku, AB T9E 7S6

Attention:

Wilber Davie

PQR No.:

41-1/8-163-1

Material:

SA 516 Gr. 60/70 to SA 240 Type 304L

Thickness:

6.32 mm (0.249 in.)

Thermal Condition:

As Weided

HARDNESS TEST

TYPE OF TEST:

Brinell

LOAD:

3000 kg., 10 mm ball

Laboratory Test No.: E02-552.2

Date: June 24, 2002

INSTRUMENT TYPE:

King

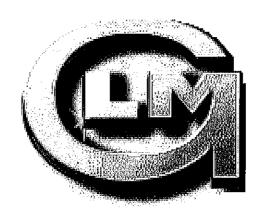
Location	Brinell Hardness (BHN)
Surface of Weld Cap	166
Surface of Weld Cap	170
Surface of Weld Cap	159

Average Brinell Hardness 165 BHN

We certify the test results in this report and that the specimen(s) were prepared and tested in accordance with the requirements of ASTM E10-00. The information regarding material identification (i.e. size, thickness, heat number, etc.) has been provided by the customer whose name appears on this report.

Laboratory Test Conducted By:____

Natashua Coller, C.E.T.



G.L.M. INDUSTRIES L.P.

SECTION 5

QUALITY CONTROL/INSPECTION DATA

	G.L.M. INDUSTRIES L.P. Fabrication T	Fabrication Traveler / 1.1 P # 3 - Checklist	Checklis	it.	Rev:	ō
	Ľ.		Hold/Witn	Hold/Witness/Review	Rev. 30-	30-Mar-11
Action By	Action By: Customer: 12'-0" OD x 20'-0" HG SKIDDED TANK HUSKY c/o EXCELSIOR ENGINEERING	Ref. Documents or Standards (Where applicable)	WP RP	Witness Point Review Point	Initial & Date of Completion/Acceptance	letion/Acceptance
lob Classiff	Job Classification - 3. GLM Standard Design / MTR Trace / 3" Party Involvement / No Amendments to traveler	veler	GLM	caR	GLM	COR
PRE	Material / Nozzle / Flange mapping MTR TRACE? YES	Q-826 / Q-827				
p	Material: Yard Selection / Rolling / Burning / Tacking / Marking	Drawings/BOM				
	Roof Fittings: Orientation	As per Drawings			11/08/8~1116	
	Roof Fittings: Alignment / Projection (ISP & OSP)	As per Drawings			11/18/2-14/5	
	Shell Fittings: Orientation	As per Drawings			149818-149	
1	Shell Fittings: Elevation	As per Drawings			11/3/2-MS	
<i>I</i> IFG	Shell Fittings: Alignment / Projection (ISP & OSP)	As per Drawings			514-3/3/11	
	Internal weld spatter / stray arcs and grinding suitable for internal coating		ΗP		11/2/17	
	External weld spatter / stray arcs and grinding suitable for external paint or primer		НР		1/4/1/2-Ne	
	Internals trial fit and verified.	As per Drawings			1/8/12-MS	
	All welds and fittings visually inspected & Welders ID Verified (Metal Marker)	As per Drawings			11/4/1/20	
	Double wall construction? NO	The best of the second of the				
	Complete floor vacuum / air tested	The second secon	Annual control to the Control		WECDEN SH	
	Repads air tested (15 psig)				11/2/11/11	
	Air/Soap Test	E-315 (API 650)			10-01/11	
Mi	-	NA			11/2	
-G	Heat Coil(s) (air/hydro test) (Non-Registered Coils ONLY)	N/A			-	
,i	IF Double Wall					
 	RT:	E-329 to E-340			1	
QC	MT: 100% REQUIRED SHELL TO FLOOR	As per Drawings PER API 650			WAIURD	
DAIMT	Release to Paint Shop	QCR WRITTEN?		1	2/1924/3/11	
SHOP	Painting / Coating / Insulation / Cladding	As per Drawings		\	* S.H.	
FIT OUT	Final Fit Out & Touch Up Painting	As per Drawings			1/8/4	
8	Final Inspection verification and release	As per Drawings			21 There 6/11	
OMMENTS		400-1-00	7	1	1	
WP-Now	HP - No work past this point until approved/accepted. WP - Witness of work - not to hold up production	i complete solves a	,	20011	TEMOSITURES	

HP - No work past this point until approved/accepted. WP - Witness of work - not to hold up production. RP - Items in this category will be reviewed during the process - does not stop work/progress.

G.L.M. INDUSTRIES L.P.

API-650 HYDROSTATIC & AIR-SOAP LEAK TEST

TANK DATA

* Vital instructions required to complete this test are given in the drawing package. Refer to the drawings prior to performing any hydrostatic or pressure test.

TESTING OF THE SHELL

- 1. FILL TANK WITH WATER TO THE SPECIFIED FILL LEVEL.
- 2. IF "AIR TEST" IS SPECIFIED, FILL LEVEL IS NIL, SKIP TO #4
 - 3. VISUALLY INSPECT ALL JOINTS FOR LEAKS.
- 4. JOINTS ABOVE SPECIFIED FILL LEVEL SHALL BE SUBJECTED TO AN AIR—SOAP LEAK TEST TO SPECIFIED IEST PRESSURE.

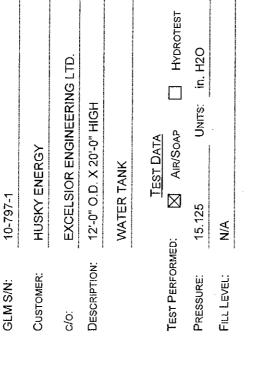
Position for Hydrotesting

VENT

TESTING OF THE ROOF

ROOFS SHALL BE TESTED IN ACCORDANCE WITH ONE OF THE FOLLOWING METHODS:

- 1. AIR-SOAP LEAK TEST TO THE SPECIFIED TEST PRESSURE.
- 2. VACUUM TESTING ALL JOINTS.



	FILE LEVEL: MIN. HOLD TIME:	30 min.	in.	OMIS: III, TZO	UZO	
	GAUGE TYPE:	\boxtimes	MANOMETER		PRESSURE	
Position for	PRESS. GAUGE NO.		N/A			
	CALIBRATION DUE:	·	N/A			

TEST REPORT

ACCEPTABLE:
TANK ROOF & SHELL RECEIVED

AN AIR/SQAP LEAK TEST

VALVE₁

WATER IN

DRAIN VALVE-

WITNESS: GLM (RATIFICESS CUSTOMER: (FF NECESS DATE:

API-650 STORAGE TANK HYDRO TEST LAYOUT



G.L.M. INDUSTRIES L.P.

Head Office & Manufacturing

1508 -- 8th Street Nisku AB T9E 7S6 P: (780) 955-2233 F: (780) 955-2241 TF: (800) 661-9828



Calgary Sales

#900, 706 - 7th Avenue SW Calgary AB T2P 0Z1 P: (403) 231-2730 F: (403) 234-8274 TF: (800) 661-9446

Grande Prairie Facility

9101 - 150th Avenue Grande Prairie AB T8X 0B1 P: (780) 830-1474 F: (780) 830-1478 TF: (888) 830-1474

Saskatchewan Facility

14th Street & 5th Avenue PO Box 1229 Battleford SK S0M 0E0 P: (306) 937-7785 F: (306) 937-7788 TF: (800) 663-7785

GLM Job#:

10-797-1 Date Tested: Mar 24/11

Customer:

Your Reference: Tag#:

RECORD OF VACUUM BOX TEST

This is to certify that the above project has been completed in compliance with all applicable drawings, engineering specifications provided, applicable regulatory bodies and jurisdictions. The following areas have been tested by vacuum box methods in accordance with API Standards.

Area Tested:	Floor seams @ 3.0 psig
Testing Medium:	Soap Film Solution
Ambient Temperature:	40 Deg. F minimun
Light Source Used:	Flashlight
Approximate Light Intensity:	N/A
Number of Defects Identified:	0
Retest Completed & Satisfactory:	yes

Merlin Grabia Newlin Dualia

SERIAL No. 10 - 747. DESCRIPTION: 47.0		<u> </u>
THICKNESS:	2:\ 	VERIFIED BY: UN
TEMPERATURE:	20F	•
SUBSTRATE TEMP:	705	• 175.
RELATIVE HUMIDITY:	406	
DEW POINT:	37 F	
INSULATION PRODUCT NAME:	BASE	PRICE: \$
RESIN NUMBER:	R2973	*
COUNTER READINGS: START		FINISH 794
LOT NUMBER:	200338248	
ISO NUMBER:	8000 4	
COUNTER READINGS: START	0	FINISH
LOT NUMBER:	2003450910	
SEALER:	Towerton I	PRICE: \$
CONSUMPTION (GALLONS)	20	ni (many macana
COATING NAME:	Towerton I	
COATING NUMBER:	20101 Blace	
LOT NUMBER:	310 K2502	
HEAT TAPE LOCATION:	NA	
SURFACE PREP:	For shop	proce
GLM ACCEPTANCE:	<u> </u>	

psi Date M/D Color Date M/D とられ Initials CLIENT REP Pressure pH Ref. No. TESTEX NEWARK, DE 19715 X COARSE (1.5 to 4.5 mils) or (40 to 115 µm) Gals. Used PRESS-O-FILM Made in U.S.A. Initials Max F G.L.M. AND ERNAL FATERNAL COATING TRAVEL SHEET SERIAL NO: 10-7911 <u>절</u>. ANCHOR Replicas or Min & Max Record PROFILES Av DFT before coating 60 Nozzle Size 3 Material Temp.°F Catalyst Batch No. Dewpoint 54894VV. extreen mix 423 Tip Size CUSTOMER: 4 Induction Time Pump Size NOTE LOCATION: Grade Application Method Base Batch 1587 mils Abrasive Mixing Method Date: 🤳 Date: Date: Dew Pt.°F ENVIRONMENT CONDITIONS Mag. Base (where req'd) Substrate Temp. 679A К.Н. % Batch # (Initial) Profile 28 Amb. °F Surface accepted for Lining (Applicator)_ Manufacturer & Product No. Thinning Agent Surf °F G.L.M. Final Substrate Inspection: Surface Preparation (substrate): CQR Final Substrate Inspection: Amount % Delive in Areas Coated APPLICATION (PART A)
Coat APPLICATION (PART B) Standard SSPC Type Ambient Temp. Coat No. Coat No. Date Н m 4

DESCRIPTION: TOO DO

FORMS.\Q-802.6

G.L.M. INTERNAL/EXTERNAL COATING TRAVEL SHEET (PART 2) INSPECTION & TESTING

INSPECTION:

1 1	Coll	5		10.1	DFT Min			DFT ZZ1es	Initials	Date M/D	Equipment	H.D.	Comments	ts	COR Initial
CADOS L	Bielly Low	Low Nother	Tel. Dale	K+ Mary		20	2		1 5	US 15-E					
CURE HISTORY:															
Temp Range	From		٥ ا		Tota	Total Time(hrs)	rs)		Ambient Air	Air	Forced Air	_	Cure Test	est	
Temp Range	From		10		Total	l Time(hrs)	rs)		Ambient Air	Nir	Forced Air_	_	Cure Test	est	
Temp Range	From		<u>p</u>		_ Total	Time(hrs)	rs)		Ambient Air_	Air	Forced Air	i.	Cure Test	est	
DISCONTINUITY TESTING:	Test by A		Date 04-16	91-	_ Area '	Tested Complete	o my le	ı l	Equip. I.D	1000	&	Discon. &	& Loc'n:	6	Į
Test std	_Test_by		Date		Area -	Tested		Д	Equip. I.D.		۵		& Loc'n:		
Test std.	Test by		Date		Area	Tested		<u>ш</u> 	Equip. I.D.		Ω		Loc'n:		:
Repair # Areas Coated	ed Repair Proc	# Jou	Manuf	Manufacturer & Product	& Produc	ct #		Base Batch	atch #	Ü	Catalyst Batch	*	Gals. Used		Color
MRABIES	765-5-4) Evere,	OKUBIE DIEU MA	81/	_	643	411711 80679	117	56	59699 Hui H	F.	1/4	GREY	\ \ \
		•			•										
Renair #	Thinning Agent		ā	Environment Conditions	nt Condi	tions	-	Application	uo	Cure History	story	و.۱	G.L.M.	Ç	<u>«</u>
Туре	Batch #	Amt. %	∃° JunS	Surf°F Amb.°F	к.н. %	Dew Pt.	H.	Method	<u></u> .	Time	Temp	Sign	Date	Sign	Date
}	J	1	72	74	29	36	181	BRUSH				14K	51-20		
							·								
FINAL INSPECTIONS: Visual by Wayne /	An Fener Ko	87		Date	Date 04	- 91-	-2011					N.			
اتما	mes hos	d		Date	e 04-	9/	-2011	š		d. E	G.L.M. Acceptance	ee			
Cure by Jime &	Temp			Date	04	-17 - 5	noe				CQR Acceptance	9		:	

10000 DS.I かが Date M/D Color おん Date M/D Warn Initials 3 S S CLIENT REP Pressure pH Ref. No. Gals. Used Initials べる S Max Ø mils Abrasive SHRUETT Grade Solo Nozzle size S WFT Dewpoint 1201 7 3 ANCHOR Replicas or Min & Max Record PROFILES Av DFT before coating Material Temp.°F 23 O 1 Catalyst Batch No. Tip Size Induction Time 60. Pump Síze NOTE LOCATION: SIIB3070 Application Method Base Batch Sprag Mixing Method Mech Date: Dew Pt.°F 79.52 12.6 S. S. S. C. ENVIRONMENT CONDITIONS (Initial) Mag. Base (where req'd) FREADE Amb. °F R.H. % 200 7.8.4 10.9 (Initial) Batch # Substrate Temp. 582 -loverdule Marked urface accepted for Lining (Applicator)_ Profile A Closerdala Industrial Manufacturer & Product No. Thinning Agent Surf °F 3.L.M. Final Substrate Inspection: (substrate): 10R Final Substrate Inspection: Amount % Con Dute Areas Coated Surface Preparation ((PPLICATION (PART A) PPLICATION (PART B) Type standard 52 Ambient Temp. 1 GL.M. Coat No. Coat No. Coat No. Jate

G.L.M. INTERNAL/EXTERNAL COATING TRAVEL SHEET (PART 2) INSPECTION & TESTING

INSPECTION:

Coat No.		Comments				DFT Min	DFT Max		DFT Nozzles	Initials	Date M/D	Equipment	I.D.	Comments	nts	COR Initial
н	PRin	PRIMER				2.0	3.7	8. Q	2.5-2.	u y	31-10	2000				
2	1-1015h	y _s				3.7	5.5	4,4	3-4.5	られ	91-10	700 M				
, m																
4																
CURE HISTORY:																
Temp Range	i	From		ဥ		Total	al Time(hrs)	(hrs)		Ambient Air	Air	Forced Air		Cure Test	rest	
Temp Range	ī	From		ا 2		Total	al Time(hrs)	(hrs)		Ambient Air	Air	Forced Air	Ŀ	Cure Test	rest	
Temp Range	Ĭ	From		<u>و</u>		Total		Time(hrs)		Ambient Air	Air	Forced Air	<u>.</u>	Cure Test	rest	
DISCONTINUITY TESTING:	TESTING:					٠										
Test std	Test by	by	ا	Date		Area	Tested_			Equip. I.D.	D.		Discon. &	& Loc'n:		
Test std	Test	Test by		.Date		Area	Tested			Equip. I.D.	D.		Discon. &	& Loc'n:		
Test std.	Test by	: by	اً	_Date		Area	Tested			Equip. I.	I.D.			& Loc'n:		Å.
Repair # Ar	Areas Coated	Repair Proc	# 00	Manuf	Manufacturer	& Product	uct #		Base	Batch.#	J	Catalyst Batch	*	Gals. Used		Color
r			-													
2																
m																
# * * * * * * * * * * * * * * * * * * *	Thinning Agent) Agent		100	Environment Conditions	nt Cond	itions		Applica	tion	Cure H	History	G.1	G.L.M.	ŭ	CQR
# Hepdan	Type Batc	Batch # Am	Amt. %	Surf °F Amb.	Amb.°F	R.H.	% Dew Pt.	۲. ۹	Method	<u>Г</u>	Time	Temp	Sign	Date	Sign	Date
1																
2																
ж.																
FINAL INSPECTIONS:	SNO	(- •	-		٠.		`	1		:
visual by WAYDE ADJONED 120	4YDE A.	Janen	100		Date_		·21-10	20 M				:			\mathbb{N}	
Discontinuity by_	12	4			Date	le.						G.L.M. Acceptance	≱ ′			
Cure by	Tine of T	Gni			Date_	o O	٠(ه	NO2.				CQR Acceptance	Ge			

G.L.M.	A. INTERNAL/EXTERNAL COATING	AL/EX	TERNA	N CO		TRAVEL SHEET	HEEL	SERIAL NO:	0: 70.	14/-		DESCRIPTION:	LION:	SPOR
Surface P Standard		rate): 2 Profile_		mil	ja 1	GARNET	CU Cu	CUSTOMER:	HUSKYC Nozzle size	Y 1 1	200	_ CLIENT REP: Pressure	10	S psi
Ambient	Temp. 7204	_ Substi		77	10/	R.H.	3729	79	Dewpoint_	18.	₹ 707	pH Ref. No.		
S.L.M. Final S	Final Substrate Inspection:	mag. pection:	Mag. base (where λ): $\lambda \lesssim \lambda$ (Initial)	(where red d)	Date:_	6/12	ANCHOR	i	as or Min & Max		Record PRESS-O-FILM™	F	 	
CQR Fina	CQR Final Substrate Inspection:	tion:	(Tnitial)		Date:				Saw.te		X-Coarse 1.5 to 4.5 m 38 to 115 µ	55 E		
""Surface	Surface accepted for Lining (Applicator)	ıg (Applica	tor)	(Initial)	45	Date: 6/	23		8 8 70 (% (C+XC)/2 6	8 %	Made in USA 115 µm 115 µm 4.5 mil	 	
APPLICAT	APPLICATION (PART A)					NOTE L	NOTE LOCATION:							
Coat No.		Manufacturer & Product No.	જ			Base Batch No.		98	Catalyst Batch No.		Gals.	. Used		Color
₩	DEVOE I	EVTA,	るら	7	DE	11/1/130	257	12	43 1	40016	V	7007	79	ACK
2					<u>.</u>		7			2	}			•
m														
4					,									
Coat	 	Thinning Agent	ent			Mixing	Induct	ijon	Mate	Material		- L		Date
No.	Type Amount %	%	Batch	# -		Method	Time	e e	Tem	Temp.°F	-	ر اها ک		M/D
		11 de 11 de	\		ME	7)2	15/	12.2	1\	300	1/J	g.	9	72
2											3			
m														
4				,										
APPLICAT	APPLICATION (PART B)	-			s:		 -					-		
Coat	Areas Coated	iii	ENVIRONMENT CONDITIONS	T CONDITI	ONS	Application	dund		Tip A	AV DFT before	WFT	Ä	Initials	Date
NO.		Surf °F	Amb. °F	R.H. %	Dew Pt.°F	метпоа	212				Min Max			U/M
1	HOOR	730%	7449	19/19/	Jr8.45	I dinhad	56.1	N.	17.	1	7	70	<i>H</i> .	6/22
2	•	·		\$	-			-						
3					:	·						-		
4														

FORMS.\Q-802.6

G.L.M. INTERNAL/EXTERNAL COATING TRAVEL SHEET (PART 2) **INSPECTION & TESTING**

INSPECTION:

Coat No.		Comments	ints			DFT Min	DFT Max	DFT Avg N	DFT Vozzles	DFT Initials	Date M/D	Equipment I.D.	I.D.	Comments	nts	COR
	Bollor	Botton Floor				13.4	18.3 1	16.1	4/0	Ka	06-25	7000				
2																
8																
4													-			
CURE HISTORY:	STORY:															-
Temp. Range	nge	From		- 10 - 1		_ Total	Time(hrs)	rs)		Ambient Air	\ir	Forced Air_	ir	Cure Test	Test	
Temp Range_	nge	From		- P		_ Total	l Time(hrs)	rs)		Ambient Air_	\ir	Forced Air_	ir	Cure Test	Test	
Temp Range_	nge	From		10 1		_ Total	l_Time(hrs)_	rs)		Ambient Air_	\ir	Forced Air	ir	Cure Test	Test	
DISCONT Test st	DISCONTINUITY TESTING: Test std. Kpo (&&	ING:	X	Date 06 - 25	-25	Area	Area Tested 1500A	12 (TO		Equip. I.E	Equip. I.D. 6.4 14 10 80	~	Discon. & Loc'n:		ϕ	
Test std.	q.			Date		Area	Area Tested			Equip. I.D.			Discon. & loc'n:	100,00		
Test std	d.	Test_by		Date		Area	Area Tested			Equip. I.D.			Discon. &	& Loc'n:		
Repair #		Areas Coated Repail	Repair Proc #	Manu	Manufacturer & Product	& Produc	ct #		Base	Batch #	, o	Catalyst Batch	#	Gals. Used		Color
F																
2																
m																
		Thursday Agent		"		1	1									
Repair #		,			יווא ויו פוווויבו	ור כסומו			Application Method	ijon	care History	Istory	او	و، د . M.	ט [CQR
	Type	Batch #	Amt. %	Surf °F Amb.	Amb. °F	ж.н.%	Dew Pt.	ц,		,	Time	Temp	Sign	Date	Sign	Date
н									;							
2																-
m																
FINAL I	FINAL INSPECTIONS:		,					<u> </u>								

G.L.M. Acceptance __ CQR Acceptance __

Date 66-25 - 2011
Date 66-25 - 2011
Date 66-23 - 2011

Row hyons

Visual by_

Discontinuity by Cliwi



FINAL FIT-OUT TRAVEL SHEET

DATE WRITTEN: April 31 / 11 REQUIRED BY:								
Cust	ОМЕР	e this	ku Goer	i u			·	
DESCRIPTION: 400 BBL.								
JOB NUMBER / SERIAL NUMBER:								
Ware	HOU:	SE ITEMS PULLED BY:			<u>.</u>	DATE:		
		ERIFIED ITEMS RECEIVED		•	-			•••
FROM	SHIP	PING/RECEIVING:				- .		
	<u></u>	Check for latest drawing re				1		
	}	Check all internals/lengths,	ids	ds ·			1	
	<u> </u>	Check internals for Teflon/nylon washers on coated flanges						ļ
5	1	Check external hardware (cages/ladders/hoops, gaskets, bolting, tape / dope & wired)					ed)]
O-	T E M	Check all openings are covered if required						nitials
<u> </u>		Check gauge system & decals						i i
		Check blind flanges/installed/painted, and external hardware Visual inspection for cleanliness prior to installing manway						
		2 copies of Nameplate attached – forward to QC Correct nameplate installed						
Fit-O	UT C	OMMENTS:		FINAL FIT-O	SHIP-LOOSE			
				QTY:	· , · · · · · · · ·	RIPTION:		
						· · · · · · · · · · · · · · · · · · ·		
								:
							Y	
		. *	`			<u>, , , , , , , , , , , , , , , , , , , </u>		<u> </u>
					ļ		·	
~							T-L	
in the same					ļ	<u> </u>	77	
21.64.5		Fit Out Income to Committee			<u> </u>	Т		
olivi r	mai	Fit-Out Inspect Complete:	Form received b	y QC: Date: /		Nameplate ph	noto copies received b	y QC
- -			12/1	Jane	6/2011	SH	Jane 4/	201
Released for loading, 3 rd party inspector to witness loading & tie down, 24 hours notice required				Ship loose items 3 rd party/inspection required , 24 hours notice required				
Released for loading, 3 rd party inspect after tie down, 24 hours notice required				Form received from QC by S & R:			Initial & Date:	
				Above items included for transport:			Initial:	
☐ Released for loading & shipping 3 rd party inspection				Accessories ready for shipping:			Initial:	
		uired	party mapection	Date:				
RANSPORTATION TO CONFIRM CORRECT NAMEPLATE IS INSTALLE				L		·	<u> </u>	-
/N: Transportation:					 -	Date:		
·				Transportation:		<u> </u>	Date:	
RANSPORTATION TO REVIEW PRODUCT LOAD FOR TIE-DOWN:				rransportation.			Date.	
	_							

YES

PICTURE:



G.L.M. INDUSTRIES L.P.

SECTION 6 NAMEPLATE FACSIMILE



