

METALFORMS, INC.

MANUFACTURER'S DATA REPORTS

CUSTOMER: Equistar Chemicals LP

PO# 4400839977

ITEM# E-1530

MANUFACTURER'S S/N: 17315

Metalforms, Inc.

**160 Garth Road
Beaumont, Texas 77705
(409) 842-1626**

DATA REPORT

CUSTOMER: Equistar Chemicals LP

PO#: 4400839977

ITEM#: E-1530

SERIAL/JOB#: 17315

METALFORMS, INC. DATA REPORT

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P.O. NUMBER: 4400839977 ITEM NUMBER: E-1530

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JOB # 17315

MANUFACTURER'S NAME: METALFORMS, INC., 160 GARTH ROAD
CHEEK, TEXAS 77705

ENGINEERING CONTRACTOR: METALFORMS, INC., P.O. BOX 20118
BEAUMONT, TEXAS 77702

AUTHORIZED INSPECTION AGENCY: HARTFORD STEAM BOILER
INSURANCE & INSPECTION
COMPANY

PURCHASE ORDER NUMBER: 4400839977

PLANT LOCATION: Equistar Chemicals, LP
3510 Gulf States Road, Beaumont, TX 77704

EQUIPMENT NAME: Glycol 1st Effect Reboiler

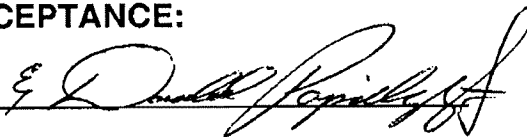
ITEM NUMBER: E-1530

FABRICATION SHOP ORDER/SERIAL NUMBER: 17315

NATIONAL BOARD NUMBER: 2565

CODE OF CONSTRUCTION: ASME SEC VIII DIV.1 2004/A06 & TEMA B

INSPECTOR'S SIGNATURE OF ACCEPTANCE:



METALFORMS, INC.

160 GARTH ROAD - GARTH INDUSTRIAL PARK - BEAUMONT, TEXAS 77705
(409) 842-1626 ANSWERED 24 HOURS
EMAIL ADDRESS: webmaster@metalformsinc.com

P.O. BOX 20118
BEAUMONT, TEXAS 77720



PRIMARY FAX (409) 842-1503
ENGINEERING FAX (409) 842-0207

HYDROSTATIC TEST REPORT

I, Randy Arnold, a representative of Metalforms, Inc., do hereby certify that a hydrostatic test was satisfactorily performed on the following:

Metalforms Job No: 17315

Test Date: Shell 12.30.07 Tube NA

Customer: Equistar Chemicals LP

Purchase Order No.: 4400839977

Item No.: E-1530

Pressure: Shell 480 psi Tube NA

Gauge No.: 156 NA

Calibration Date: 10.08.07 NA

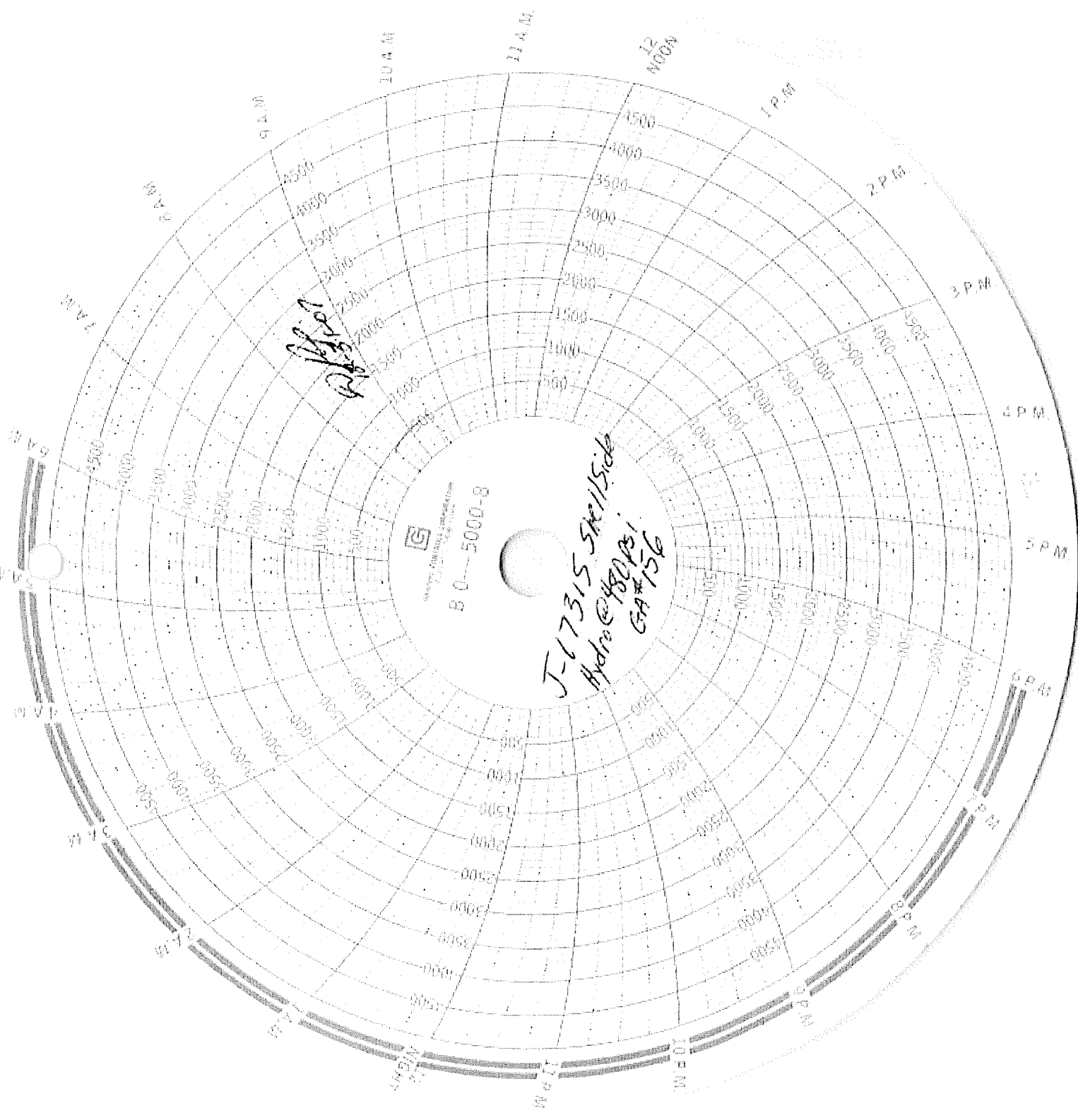
Test Duration: 2 hrs. _____

Signed: *R. Arnold*

Title: QC Inspector

Witnessed By: *[Signature]*

MS HSBCT 12-31-07



GAUGE NO.: 156

METALFORMS, INC.

160 GARTH ROAD — GARTH INDUSTRIAL PARK — BEAUMONT, TEXAS 77705
(409) 842-1626 ANSWERED 24 HOURS

P.O. BOX 20118
BEAUMONT, TEXAS 77720
PRIMARY FAX (409) 842-1503
ENGINEERING FAX (409) 842-0207



BRIDGE CITY
(409) 735-2851

CERTIFICATE OF CALIBRATION

This certifies the calibration of the following equipment using a dead weight tester as approved by the National Bureau of Standards.

NBS Test Report No.: 47238001

Instrument Type : pressure

Range: 0-1000

Manufacturer: Ashcroft

<u>% Scale</u>	<u>As Found</u>	<u>Left</u>
<u>0</u>		<u>0</u>
<u>25</u>		<u>250</u>
<u>50</u>		<u>500</u>
<u>75</u>		<u>750</u>
<u>100</u>		<u>1000</u>

Comments: cleaned and calibrated

Calibration Performed By Metalforms, Inc.

Date: 10-08-07

Signed: R. Arnold

METALFORMS, INC

P.O. BOX 20118
BEAUMONT, TX 77720

CUSTOMER

Equivstar Chemicals, LP

DATE 12-20-07

12-20-07

PART NO

RADIOGRAPHIC PROCEDURE NO.

V-81-1

SERIAL NO. 17315

17315

CODE SPEC.

ASME Sect. VIII Div. 1 : UW-52

SUBASSEMBLY	SERIAL NO	MATERIAL	THICK- NESS	TYPE WELD	TYPE EXPOSURE	NO OF EXPOSURES
Shell	17315	C/S	1/2"	Butt	Single Wall	3

RADIOGRAPHIC TECHNIQUE

[illegible]

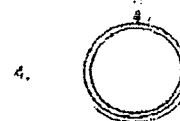
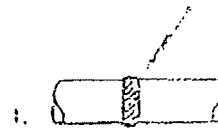
FILM USED

3-1/2 X 10

4-1/2 X 17

~~4-1/2 X 10~~[illegible]

SET UP



CUSTOMER INSPECTOR

AUTHORIZED INSPECTOR

METALFORMS RT-LEVEL II

DATE.

DATE 12/2/61

DATE 12-20-07

METALFORMS JOB ORDER 17315

METALFORMS, INC.

160 GARTH ROAD – GARTH INDUSTRIAL PARK – BEAUMONT, TEXAS 77705
(409) 842-1626 ANSWERED 24 HOURS
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P.O. BOX 20118
BEAUMONT, TEXAS 77720



PRIMARY FAX (409) 842-1503
ENGINEERING FAX (409) 842-0207

INSPECTION REPORT

Client : Equistar Chemicals L.P. Date : 12-29-07
Job# : 17315
PO# : 4400839977
Item# : E-1530

Soap & Air Test: 25 PSI

Specification: ASME Sec. VIII Div. 1 UW-15 Para. d

Examination of: Nozzle & Support Pads

RESULTS OF INSPECTION:

Examination of the described welds exhibited.
No recordable indication of discontinuities.

ACCEPTABLE

Customer Inspector: _____

Authorized Inspector: _____

Metalforms Inspector: *Donald Reynolds*

METALFORMS, INC.

160 GARTH ROAD - GARTH INDUSTRIAL PARK - BEAUMONT, TEXAS 77705
(409) 842-1626 ANSWERED 24 HOURS
EMAIL ADDRESS: webmaster@metalformsinc.com

P.O. BOX 20118
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PRIMARY FAX (409) 842-1503
ENGINEERING FAX (409) 842-0207

LIQUID PENETRANT TEST INSPECTION REPORT

Client : Equistar Chemicals LP Date : 12.29.07
Time : 1:30 PM
P.O.# 4400299977 Job# : 17315
M.F. NDE Procedure# LP-1-86.4 Item# : E-1530
Penetrant: SKL-WP Dwell Time: 15 minutes
Developer: SKD-S2 Dwell Time: 10 minutes
Material: SA-179 Thickness Surface Lighting: Dorsey LED

Ref. Code Std.: ASME Sec. VIII Div. 1 Appdx. 8 & Sec. V Art. 6, Art. 24 SE-165

Examination of: Tube to tubesheet welds second pass stationary and floater.

RESULTS OF INSPECTION:

ACCEPTABLE

Customer Inspector: _____

Authorized Inspector: _____

Metalforms PT-Level II: L. Desloer

METALFORMS, INC.

160 GARTH ROAD – GARTH INDUSTRIAL PARK – BEAUMONT, TEXAS 77705
(409) 842-1626 ANSWERED 24 HOURS
EMAIL ADDRESS: webmaster@metalformsinc.com

P.O. BOX 20118
BEAUMONT, TEXAS 77720



PRIMARY FAX (409) 842-1503
ENGINEERING FAX (409) 842-0207

LIQUID PENETRANT TEST INSPECTION REPORT

Client : EQUISTAR CHEMICALS, LP Date : 12-28-07
Time : 7:00 PM
P.O.# 4400839977 Job# : 17315
M.F. NDE Procedure# LP-1-86.4 Item# : E-1530
Penetrant: SKL-WP Dwell Time: 15 minutes
Developer: SKD-S2 Dwell Time: 10 minutes
Material: SA-179 Thickness SURFACE Lighting: Dorsey LED

Ref. Code Std.: ASME Sec. VIII Div. 1 Appdx. 8 & Sec. V Art. 6, Art. 24 SE-165

Examination of: TUBE TO TUBESHEET WELDS 1st PASS BOTH TUBESHEETS

RESULTS OF INSPECTION:

ACCEPTABLE

Customer Inspector: _____

Authorized Inspector: _____

Metalforms PT-Level II: Donald White

METALFORMS, INC.

160 GARTH ROAD — GARTH INDUSTRIAL PARK — BEAUMONT, TEXAS 77705
(409) 842-1626 ANSWERED 24 HOURS

E-MAIL ADDRESS: webmaster@metalfirmsinc.com

P. O. BOX 20118
BEAUMONT, TEXAS 77720



PRIMARY FAX (409) 842-1503
ENGINEERING FAX (409) 842-0207

BRINELL HARDNESS READINGS

DATE: 12.26.07

JOB NO.: 17315

CUSTOMER: Equistar Chem. LP

PERFORMED BY: John Hunsley

LOCATION		DIA. OF IMPRESSION IN BAR	DIA. OF IMPRESSION IN MATERIAL	BRINELL STANDARD USED	BRINELL HARDNESS OF MATERIAL
<u>Shell</u>					
<u>L-1</u>	<u>O.D.</u>	<u>2.9</u>	<u>3.0</u>	<u>176</u>	<u>165</u>
	<u>I.D.</u>	<u>2.9</u>	<u>2.9</u>		<u>176</u>
<u>L-2</u>	<u>O.D.</u>	<u>3.0</u>	<u>2.95</u>		<u>182</u>
	<u>I.D.</u>	<u>2.95</u>	<u>3.0</u>		<u>170</u>
<u>G-2</u>	<u>O.D.</u>	<u>3.0</u>	<u>3.05</u>		<u>170</u>
	<u>I.D.</u>	<u>2.9</u>	<u>3.0</u>		<u>165</u>
<u>N-1</u>	<u>O.D.</u>	<u>3.05</u>	<u>3.0</u>		<u>182</u>
	<u>I.D.</u>	<u>3.05</u>	<u>3.05</u>		<u>176</u>
	<u>BM</u>	<u>2.9</u>	<u>2.95</u>		<u>170</u>
<u>N-3</u>	<u>O.D.</u>	<u>2.95</u>	<u>2.95</u>		<u>176</u>
	<u>I.D.</u>	<u>3.0</u>	<u>2.95</u>		<u>182</u>
	<u>BM</u>	<u>3.0</u>	<u>3.0</u>		<u>176</u>
<u>N-5</u>	<u>O.D.</u>	<u>2.9</u>	<u>2.9</u>		<u>176</u>
	<u>I.D.</u>	<u>2.9</u>	<u>3.0</u>		<u>165</u>
	<u>BM</u>	<u>2.95</u>	<u>3.0</u>		<u>170</u>

TUBE WALL EXPANSION REPORT

17315
FLT. 7/5

$$\text{Reduction in wall thickness} = K$$

$$= [((d1-d)-c) \times 100\%]/2T$$

where d = inside diameter of tube before expansion
d1 = inside diameter of tube after expansion
D = tubesheet hole diameter
do = tube outside diameter
C = (D-do)
T = tube wall thickness = (do-d)/2

No	D	do	d	T	C	d1	X	Remarks
1	.761	.750	.565	.0925	.1011	.584	5	
2	.761		.565	.0925	.1011	.585	5 1/2	
3	.759		.565	.0925	.1009	.584	5	
4	.759		.565	.0925	.1009	.584	5	
5	.759		.565	.0925	.1009	.585	5 1/2	
6	.760		.565	.0925	.1010	.585	5 1/2	
7	.760		.565	.0925	.1010	.584	5	
8	.760		.565	.0925	.1010	.585	5 1/2	
9	.766		.565	.0925	.1010	.584	6	
10	.760		.565	.0925	.1010	.586	6	
11	.760		.565	.0925	.1010	.586	6	
12	.759		.565	.0925	.1009	.586	6	
13	.760		.565	.0925	.1010	.584	5	
14	.760		.565	.0925	.1010	.585	5 1/2	
15	.761		.563	.0935	.1011	.583	5 1/2	
16	.760		.565	.0925	.1010	.586	6	
17	.760		.565	.0925	.1010	.585	5 1/2	
18	.761		.565	.0925	.1011	.584	5	
19	.759		.565	.0925	.1009	.584	5	
20	.759		.565	.0925	.1009	.586	6	

TUBE WALL EXPANSION REPORT

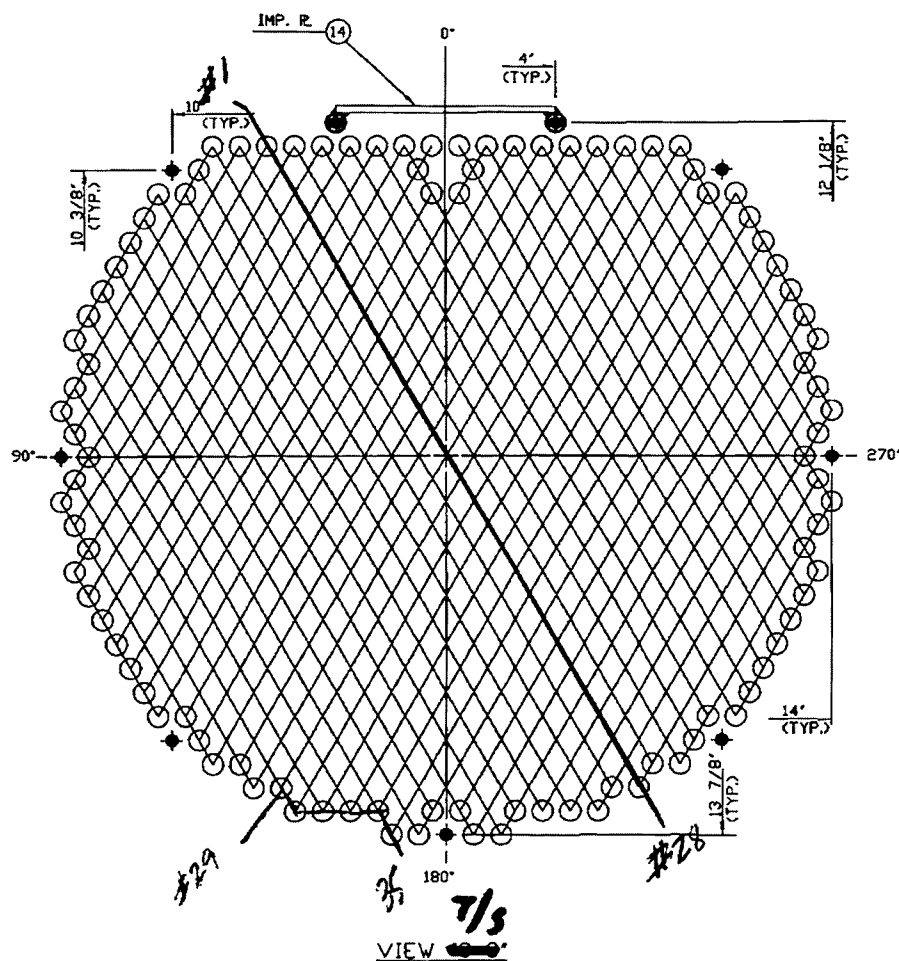
$$\text{Reduction in wall thickness} = K$$

$$= [((d1-d)-c) \times 100\%]/2T$$

where d = inside diameter of tube before expansion
d1 = inside diameter of tube after expansion
D = tubesheet hole diameter
do = tube outside diameter
C = (D-do)
T = tube wall thickness = (do-d)/2

No	D	do	d	T	C	d1	X	Remarks
21	.760	.750	.565	.0925	.1010	.586	6	
22	.760		.563	.0935	.1010	.584	6	
23	.761		.565	.0925	.1011	.584	5	
24	.759		.565	.0925	.1009	.585	5 1/2	
25	.759		.565	.0925	.1009	.584	5	
26	.759		.564	.093	.1009	.586	6 1/2	
27	.760		.565	.0925	.1010	.585	5 1/2	
28	.760		.565	.0925	.1010	.584	5	
29	.760		.565	.0925	.1010	.584	5	
30	.759		.563	.0935	.1009	.586	7	
31	.760		.565	.0925	.1010	.586	6	
32	.761		.565	.0925	.1011	.584	5	
33	.760		.565	.0925	.1010	.585	6	
34	.760		.565	.0925	.1010	.585	6	
35	.761		.565	.0925	.1011	.584	5	

SHOP INSPECTOR 12/18/2007



VIEW
(SEE BUNDLE DRAWING)
VIEW LOOKING AT SHELL SIDE OF TUBESHEET #9

NOTES:

1. 705 - 3/4" O.D. TUBES
2. 1" Δ TUBE PITCH
3. 28.4" Ø OF OUTERMOST TUBES
4. DRILL (9) TIE ROD HOLES 9/16" Ø IN BAFFLES.
5. DRILL TUBE HOLES IN BAFFLES 49/64" Ø
6. DRILL & TAP 5/8" DEEP FOR (9) - 1/2" Ø TIE RODS ON SHELL SIDE OF #9 TUBESHEET.

● DENOTES (9) - 1/2" Ø TIE RODS

CUSTOMER: EQUISTAR CHEMICALS, LP
PLANT: BMO (GLYCOLT)
ITEM NO.: E-1530
EQUIP TAG#: 2308021
P.O. NO.: 4400839977
EQUIP. SAPH: 10202805
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER



METALFORMS, INC.
P.O. BOX 20118
BEAUMONT, TEXAS 77720

TITLE: TUBE LAYOUT

OWN. DATE:	CHK. DATE:	CHK. DATE:	APPR. DATE:	DWG. NO.	SHT.
KL 12/14/07	VA 12/14/07	BK 12/18/07	BK 12/18/07	17315	5

© LAYST

TUBE WALL EXPANSION REPORT

17315

STA. T/3

$$\text{Reduction in wall thickness} = K$$

$$= [((d1-d)-c) \times 100\%]/2T$$

where d = inside diameter of tube before expansion
d1 = inside diameter of tube after expansion
D = tubesheet hole diameter
do = tube outside diameter
C = (D-do)
T = tube wall thickness = (do-d)/2

No	D	do	d	T	C	d1	X	Remarks
1	.760	.756	.565	.0925	.010	.584	5	
2	.760		.565	.0925	.010	.586	6	
3	.760		.565	.0925	.010	.586	6	
4	.761		.565	.0925	.011	.585	5 1/2	
5	.760		.565	.0925	.010	.585	5 1/2	
6	.761		.565	.0925	.011	.584	5	
7	.760		.565	.0925	.010	.584	5	
8	.760		.565	.0925	.010	.585	5 1/2	
9	.761		.563	.0935	.011	.583	5 1/2	
10	.760		.565	.0925	.010	.584	6	
11	.760		.565	.0925	.010	.584	6	
12	.761		.565	.0925	.011	.584	6	
13	.760		.565	.0925	.010	.585	5 1/2	
14	.761		.563	.0935	.011	.584	6	
15	.761		.565	.0925	.011	.585	5 1/2	
16	.761		.564	.093	.011	.585	6	
17	.760		.565	.0925	.010	.584	5	
18	.760		.565	.0925	.010	.584	5	
19	.760		.565	.0925	.010	.585	5 1/2	
20	.761		.563	.0935	.011	.584	6	

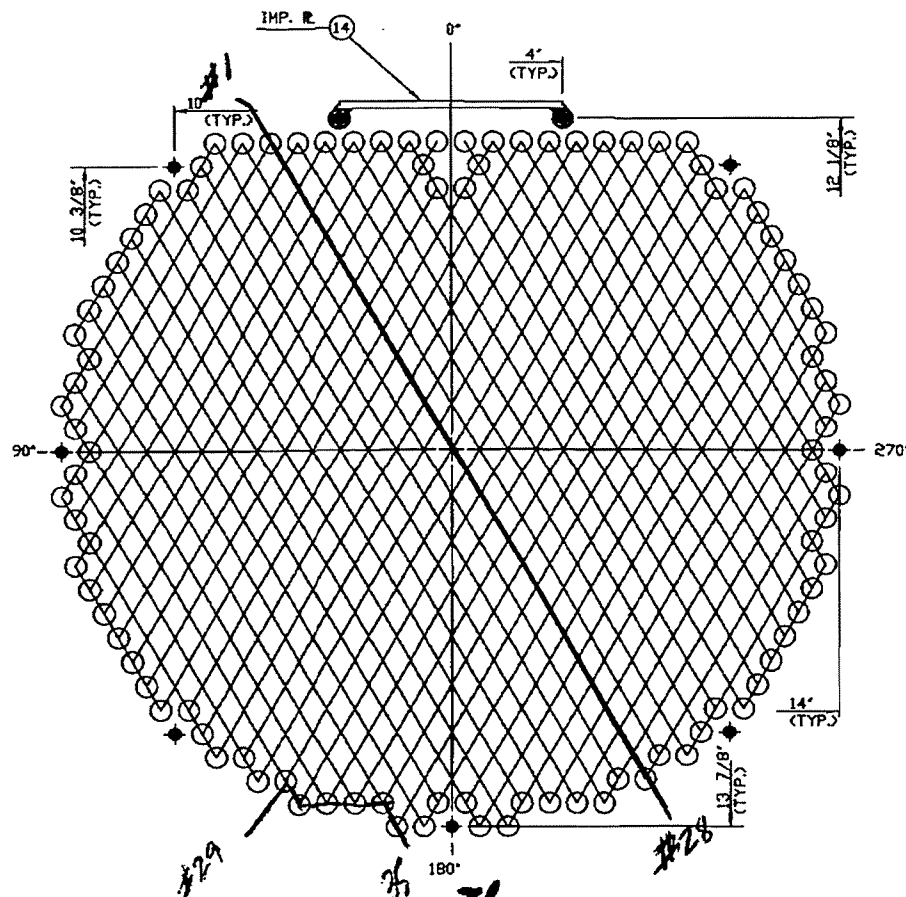
TUBE WALL EXPANSION REPORT

$$\begin{aligned} \text{Reduction in wall thickness} &= K \\ &= [((d1-d)-c) \times 100\%]/2T \end{aligned}$$

where d = inside diameter of tube before expansion
d1 = inside diameter of tube after expansion
D = tubesheet hole diameter
do = tube outside diameter
C = (D-do)
T = tube wall thickness = (do-d)/2

No	D	do	d	T	C	d1	X	Remarks
21	.760	.750	.565	.0925	1010	.584	5	
22	.760		.565	.0925	1010	.584	5	
23	.760		.565	.0925	1010	.584	6	
24	.761		.564	.093	1011	.585	6	
25	.760		.565	.0925	1010	.585	5 1/2	
26	.761		.565	.0925	1011	.585	5 1/2	
27	.762		.565	.0925	1012	.584	5	
28	.760		.565	.0925	1010	.585	5 1/2	
29	.760		.565	.0925	1010	.584	4	
30	.760		.564	.093	1010	.585	4	
31	.761		.565	.0925	1011	.584	4	
32	.760		.565	.0925	1010	.584	5	
33	.761		.565	.0925	1011	.584	5	
34	.761		.565	.0925	1011	.584	5	
35	.761		.565	.0925	1011	.586	6	

SHOP INSPECTOR 12/18/2007



VIEW **7/5**
(SEE BUNDLE DRAWING)
VIEW LOOKING AT SHELL SIDE OF TUBESHEET #9

NOTES:

1. 705 - 3/4" O.D. TUBES
2. 1' Δ TUBE PITCH
3. 28.4" ϕ OF OUTERMOST TUBES
4. DRILL (9) TIE ROD HOLES 9/16" ϕ IN BAFFLES.
5. DRILL TUBE HOLES IN BAFFLES 49/64" ϕ
6. DRILL & TAP 5/8" DEEP FOR (9) - 1/2" ϕ TIE RODS ON SHELL SIDE OF #9 TUBESHEET.

● DENOTES (9) - 1/2" ϕ TIE RODS

CUSTOMER: EQUSTAR CHEMICALS, LP
PLANT: BMO (GLYCOL 1)
ITEM NO.: E-1530
EQUIP TAG#: 2308021
P.O. NO.: 4400839977
EQUIP. SAPH: 10202806
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER



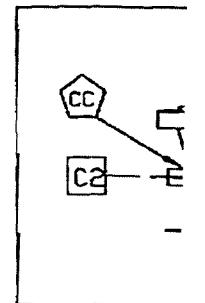
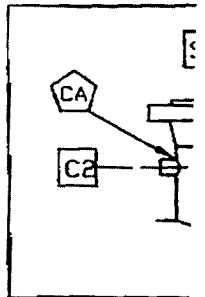
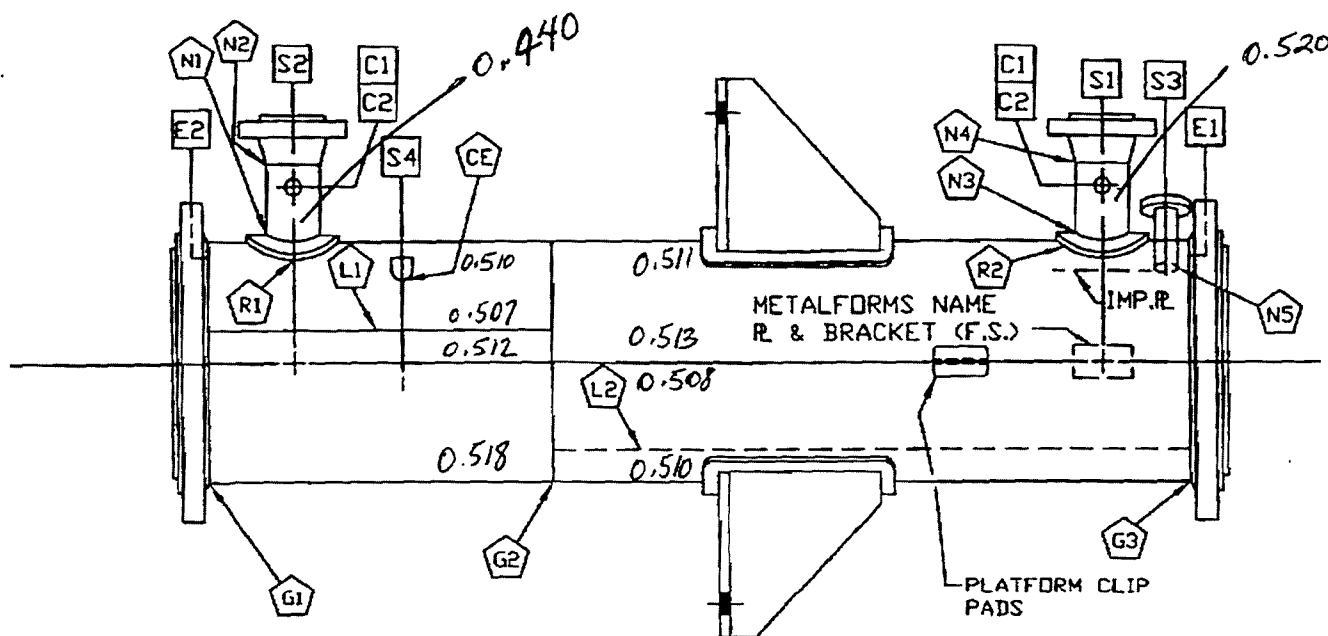
METALFORMS, INC.
P.O. BOX 20118
BEAUMONT, TEXAS 77720

TITLE: TUBE LAYOUT
DWG. DATE: 12/14/07 CHK. DATE: 12/14/07 BK. DATE: 12/18/07 APRV. DATE: 12/18/07 DWG. NO.: 17315 SHY.: 5

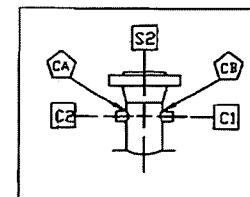
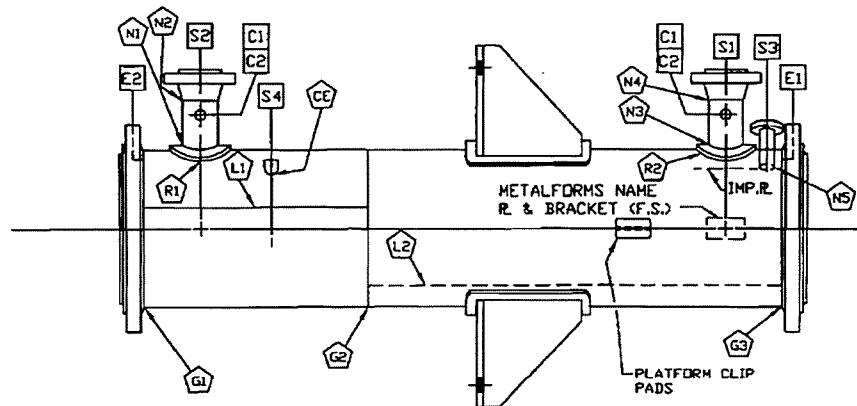
LATST

"AS Built U Thickness Readings"

SHOP 1



<u>NDE LEGENDS</u>	
NO:	DESCRIPTION
A	RT -3
B	100% ULTRASONIC TEST
C	MT TEST
D	PT TEST
E	BHN
F	VISUAL EXAMINATION
G	WFMP TEST
H	AFTER STRESS NDE
I	SOAP & AIR TEST
J	HELIUM TEST
K	
L	
M	
N	
O	
P	



REV.	REVISION DESCRIPTION	BY	CHK	DATE
	METALFORMS, INC. P.O. BOX 20118 BEAUMONT, TEXAS 77720			

TITLE: SHELLSIDE NDE MAP

DWN. DATE:	CHK:	DATE:	CHK:	DATE:	APRV. DATE:	BVG. NO.:	SCH. SK.
KI 12/14/07	VA	12/14/07	BK	12/18/07	SK 12/18/07	12315	SK

METALFORMS, INC.		INSPECTION & TESTING PLAN FRONT SHEET			
PLAN LIST No. QCP-2001		Sheet No. 0 OF 1		Revision No. 0	
Requisition No.		P/ORDER No. 4400839977 JOB No. 17315			
VENDOR: Metalforms, Inc., Beaumont, TX SUBCONTRACTOR:					
PROJECT/ITEM DETAILS: GLYCOL 1 FIRST EFFECT REBOILER					
JOB DESCRIPTION/SCOPE: Fabricate -E- exchanger, shell and bundle only. in accordance with ASME Code Section VIII, Div.1, latest edition, TEMA Standards, Class B, latest edition, and Equistar Engineering Specification and Metalforms, Inc. Quality Assurance Manual, and Equistar Purchase Order # 4400839977 requirements. Perform shop inspection and examinations throughout all phases of shop fabrication in accordance with Lyondell/Equistar requirements, and Engineering Standards 200, 220, 223, 322, 340, 360, API-660, QAP070. IS123, & IS601. Customer: EQUISTAR CHEMICALS, LP Location: BEAUMONT, TX PLANT: BMO Equip. SAP#: 10202806 Equip. TAG#: 2308021 Item #: E-1530 P.O. #: 4400839977 Service: GLYCOL 1 FIRST EFFECT REBOILER MI Job #: 17315 MASS SPECTROMETER HELIUM LEAK TEST REQ'D PER ASME SECTION V, ARTICLE 10, APPENDIX IV.					
DRAWINGS:					
KEY: S = SURVEILLANCE		A POINT WHERE THOSE SPECIFIED MUST CARRY OUT THE REQUIRED ACTIVITY.			
V = VERIFY BY INSPECTION		A RANDOM MONITORING OF THE QUALITY CHARACTERISTICS BY THOSE SPECIFIED TO VERIFY CONFORMANCE.			
W = WITNESS		A POINT WHERE THOSE SPECIFIED CARRY OUT AN ACTUAL INSPECTION TO VERIFY CONFORMANCE.			
H = HOLD		A POINT BEYOND WHICH WORK MAY NOT PROCEED WITHOUT COMPLETION OF THE ACTION.			
R = REVIEW		A REVIEW OF DOCUMENTATION BY THOSE SPECIFIED TO VERIFY CONFORMANCE.			
REV.	REMARKS	DATE	Initiated by	Complete	Distributed
0	INITIAL ISSUE	12/18/2007	KL		

METALFORMS INC.	INSPECTION & TESTING QCP-2001	PROJECT: 10202806 JOB No. 17315						Item # E-1530 P/ORDER No. 4400839977	
ACTIVITY		RELEVANT PROCEDURES/SPECIFICATIONS	VENDOR Metalforms, Inc.	SIGN	CUST. REP.	SIGN	VERIFYING DOCUMENT		
2.0 General Requirements									
2.1	Check materials against certified material test reports and design requirements.	1, 3, 4 (3.3)(d)(e), 6 (3.6.2.7), 8 (3.0), 14, UG4, UG77, UG90, UG93, UG94	H,R	<i>DP</i>					
2.2	Check material test reports for all materials.	1, 4 (3.3)(d) (7.1.5)(e), 6 (3.6.2.7)	H,R	<i>DP</i>	<i>AA</i>				
2.3	Check welding procedure specifications and supporting procedure qualification records prior to fabrication for approval.	1, 4 (3.2.3), 5 (3.2.3) (4.6.2.6)(b)(c), 10	H	<i>DP</i>	<i>AS</i>				
2.4	Check welder performance qualification records for approval prior to fabrication start.	1, 4(7.1.5)(a), 5 (3.2.3) (4.6.2.6)(b)(c), 10	H,R	<i>DP</i>					
2.5	Check N.D.E. procedures and technician qualification documentation.	1, 3, 5 (4.6.2.6)(c), 6 (7.4.2) (7.4.17), 10 (11.3-4) (12.1-2), 11 (5.2.1-2) (5.2.4-5) (5.3.3-5) (5.4.1-4), UG90 (B)(15)	H,R	<i>DP</i>					
2.6	Check hydrostatic pressure gauge calibration and certification documentation.	1, 3, 6 (3.6.2.6), 11 (4.4) (5.3.3-5), UG102	H,R	<i>DP</i>	<i>AA</i>				
3.0 Shell Fabrication									
3.1	Check shell plate heat number stenciling for traceability.	1, 3, 4 (3.3)(d), 6 (3.6.2.7), 8(3.5.5) UG77, UG93, UG94	H,R	<i>DP</i>	<i>AA</i>				
3.2	Check shell cylinder for roundness and dimensional tolerance after rolling and before welding.	2 ___, 3, 6 (6.1.1), UG80	H						
	MK 'L1' (Bottom Can long. weld)		H	<i>DP</i>	<i>AS</i>				
	MK 'L2' (Top Can long. weld)		H	<i>DP</i>	<i>AA</i>				
3.3	Check shell cylinder longitudinal weld joint preparations, fit ups and alignment.	1, 2 ___, 3, 4(9), 10 (7.1-2) (7.5), UW9, UW31, UW32, UW37	H						
	MK 'L1' (Bottom shell Can long. weld)		H	<i>DP</i>	<i>AS</i>				
	MK 'L2' (Top shell Can long. weld)		H	<i>DP</i>	<i>AA</i>				
3.4	Check welding consumables.	1, 3, 10 (6.16) (6.16.1-3), UG9, __	H,R	<i>DP</i>					
3.5	Surveillance during welding.	1, 5 (4.6.2.6)(c), 6 (7.4.5-7) (7.4.11) (7.4.17) (7.4.20-21) (7.6), 8 (3.0), 11 (5.2.1-4) (5.5.1), 12 (5.2.1) (5.3.1), WPS __	S	<i>DP</i>					
3.6	Check completed longitudinal weld joint for overall workmanship quality and welder I.D. stamping.	1, 3, 11 (5.5.1), UW29(C), UW35, UW37(F)	S	<i>DP</i>	<i>AS</i>				
JOB SCOPE: FABRICATE -E- EXCHANGER		PLAN No. QCP-2001	SRT No.	1/7	17315				

METALFORMS INC.	INSPECTION & TESTING QCP-2001	PROJECT: 10202806 JOB No. 17315					
		Item # E-1530 P/ORDER No. 4400839977					
ACTIVITY		RELEVANT PROCEDURES/SPECIFICATIONS	VENDOR Metaforms, Inc.	SIGN	CUST. REP.	SIGN	VERIFYING DOCUMENT
3.7	Check NDE results for completed and repaired shell section longitudinal weld seam.	1, 2 __, 3, 4 (7), 5 (4.6.2.6)(c), 6 (7.4.5-7) (7.4.11) (7.4.17) (7.4.20-21) (7.6), 10 (10.1), 11 (5.2.1-4) (5.5.1), 12 (5.2.1) (5.3.1), UW__	H,R				
3.8	Check shell heat number stenciling for traceability.	1, 3, 4 (3.3)(d), 6 (3.6.2.7), UG77, UG93, UG94	H,R				
3.9	Check shell for roundness and dimensional tolerance after welding.	2 __, 3, 6 (6.1.1), UG80	H				
3.10	Check shell circumferential weld joint preparations and alignment.	1, 2 __, 3, 10 (7.1) (7.2) (7.5), WPS __, UW9, UW31, UW32, UW37	H				
3.11	Check welding consumables.	1, 2 __, 3, 10 (6.16) (6.16.1-3), WPS, UG9	H,R				
3.12	Surveillance during welding.	1, 2 __, 5 (4.6.2.6)(c), 6 (7.4.5-7) (7.4.11) (7.4.17) (7.4.20-21) (7.6), 8 (3.0), 11 (5.2.1-4) (5.5.1), 12 (5.2.1) (5.3.1), WPS__	S				
3.13	Check completed circumferential weld joint for overall workmanship quality.	1, 3, 11 (5.5.1), UW35	S				
3.14	Check completed circumferential welds for welder I.D. stamping.	1, 3, 11 (5.5.1), UW29 (C), UW37 (F)			/		
	MK '1' (Shell cyl.-to-tubesheet #10 weld)		W				
	MK '2' (Shell cyl.-to-Shell cyl. welds)		H,R				
	MK '3' (Shell cyl.-to-tubesheet # 9 weld)		W				
3.15	Check shell cylinder for roundness and dimensional tolerances after completion of circumferential weld seam.	1, 2 __, 3, 6 (6.1.1), UG80	H				
3.16	Check NDE results for completed and repaired circumferential weld seam.	1, 2 __, 3, 4 (7.2), 5 (4.6.2.6)(c), 6 (7.4.5-7) (7.4.11) (7.4.17) (7.4.20-21) (7.6), 11 (5.2.1-4) (5.5.1), 12 (5.2.1) (5.3.1), UW5__	H,R				
	MK '1' (Shell cyl.-to-tubesheet #10 weld)		H,R				
	MK '2' (Shell cyl.-to-Shell cyl. welds)		H,R				
	MK '3' (Shell cyl.-to-tubesheet # 9 weld)		H,R				
JOB SCOPE: FABRICATE -E- EXCHANGER		PLAN No. QCP-2001		SHT No.	2/7	17315	

METALFORMS INC.		INSPECTION & TESTING QCP-2001		PROJECT: 10202806 JOB No. 17315		Item # E-1530 P/ORDER No. 4400839977	
ACTIVITY		RELEVANT PROCEDURES/SPECIFICATIONS	VENDOR Metalforms, Inc.	SIGN	CUST. REP.	SIGN	VERIFYING DOCUMENT
3.17	Check shell body flange flatness dimensional tolerance after machining.	2 __, 4 (6.8.2-3), 6 (6.8.3), 9, TEMA	H				
4.0 Shell Nozzle Installations							
4.1	Check nozzle orientation layout markings prior to cutting out shell openings.	1, 2 __, details, 6 (6.1.1)					
	Nozzle <u>51</u> <u>13</u>		H	<i>[Signature]</i>			
	Nozzle <u>52</u> <u>13</u>		H	<i>[Signature]</i>			
	Nozzle <u>53</u> <u>15</u>		H	<i>[Signature]</i>			
	Nozzle <u>54</u> ()		H	<i>[Signature]</i>			
	Nozzle ' ' ()		H				
	Nozzle ' ' ()		H				
	Cplg <u>C1</u> (coupling)		H	<i>[Signature]</i>			
	Cplg <u>C1</u> (coupling)		H	<i>[Signature]</i>			
	Cplg <u>C2</u> (coupling)		H	<i>[Signature]</i>			
	Cplg <u>C2</u> (coupling)		H	<i>[Signature]</i>			
4.2	Check shell nozzle opening weld bevel preparations and fit ups of nozzle to shell.	1, 2 __, 4(6), 6(fig 1), 10 (7.1-2) (7.5)					
	Nozzle <u>51</u> <u>13</u>		H	<i>[Signature]</i>			
	Nozzle <u>52</u> <u>13</u>		H	<i>[Signature]</i>			
	Nozzle <u>53</u> <u>15</u>		H	<i>[Signature]</i>			
	Nozzle <u>54</u> ()		H	<i>[Signature]</i>			
	Nozzle ' ' ()		H				
	Nozzle ' ' ()		H				
	Cplg <u>C1</u> (coupling)		H	<i>[Signature]</i>			
	Cplg <u>C1</u> (coupling)		H	<i>[Signature]</i>			
	Cplg <u>C2</u> (coupling)		H	<i>[Signature]</i>			
	Cplg <u>C2</u> (coupling)		H	<i>[Signature]</i>			
4.4	Surveillance during welding.	1, 5 (4.6.2.6)(c), 6 (7.4.5-7) (7.4.11) (7.4.17) (7.4.20-21) (7.6), 8 (3.0), 11 (5.2.1-4) (5.5.1), 12 (5.2.1) (5.3.1), ____	S	<i>[Signature]</i>			
JOB SCOPE: FABRICATE -E- EXCHANGER		PLAN No. QCP-2001		SHT No.	3/7	17315	

METALFORMS INC.		INSPECTION & TESTING QCP-2001		PROJECT: 10202806		Item # E-1530	
		JOB No. 17315		PI/ORDER No. 4400839977			
ACTIVITY		RELEVANT PROCEDURES/SPECIFICATIONS	VENDOR Metalforms, Inc.	SIGN	CUST. REP.	SIGN	VERIFYING DOCUMENT
4.5	Check completed nozzle-to-shell welds for overall workmanship quality and welder I.D. stamping.	1, 3, 4(6), 11 (5.5.1), UW29(C), UW37(F)					
	Nozzle <u>51' (113)</u>		H	<i>DP</i>	<u>14</u>		
	Nozzle <u>52' (113)</u>		H	<i>DP</i>	<u>14</u>		
	Nozzle <u>53' (115)</u>		H	<i>DP</i>	<u>15</u>		
	Nozzle <u>54' ()</u>		H	<i>DP</i>	<u>14</u>		
	Nozzle ' ' ()		H				
	Nozzle ' ' ()		H				
	Cplg <u>C1'</u> (coupling)		H	<i>DP</i>	<u>14</u>		
	Cplg <u>C1'</u> (coupling)		H	<i>DP</i>	<u>15</u>		
	Cplg <u>C2</u> (coupling)		H	<i>DP</i>	<u>14</u>		
	Cplg <u>C2</u> (coupling)		H	<i>DP</i>	<u>14</u>		
5.0	Shell attachments						
5.1	Check saddle plate heat number stenciling for traceability.	1, 3, 4 (6.3)(d) (7.3.2), 6 (3.6.2.7), UG77, UG90, UG93, UG94	H,R	<i>DP</i>	<u>14</u>		
5.2	Check saddle pad plate, gusset plate, base plate details.	2 __, 4 (7.3.2), 6 (6.1.1)					
	Assembly 'X'		H,R	<i>DP</i>			
	Assembly 'Y'		H,R	<i>DP</i>			
5.3	Check welding consumables.	1, 3, 10 (6.16) (6.16.1-3), UG9, WPS __	H,R	<i>DP</i>			
5.4	Check complete welded assembly prior to attachment to shell.	2 __, 4(9), 6 (6.1.1)					
	Assembly 'X'		H	<i>DP</i>			
	Assembly 'Y'		H	<i>DP</i>			
5.5	Check fit up and orientation of shell weld seams prior to attachment welding.	2 __, 3, 10 (7.1-2) (7.5), UG54, UG55	H	<i>DP</i>			
5.6	Check welding consumables.	1, 3, 10 (6.16) (6.16.1-3), WPS, UG9	H,R	<i>DP</i>			
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METALFORMS INC.		INSPECTION & TESTING QCP-2001		PROJECT: 10202806		Item # E-1530	
		JOB No. 17315		P/ORDER No. 4400839977			
ACTIVITY		RELEVANT PROCEDURES/SPECIFICATIONS	VENDOR Metalforms, Inc.	SIGN	CUST. REP.	SIGN	VERIFYING DOCUMENT
5.7	Check completed shell support assembly attachment to shell for overall workmanship quality.	1, 2 ___, details, 4(9), 10 (5.5.1)	H	<i>DP</i>	<i>A</i>		
6.0 Miscellaneous Shell Attachments							
6.1	Check nameplate bracket orientation prior to weld attachment.	2 ___ and ___, 6 (6.1.1)	H	<i>DP</i>	<i>A</i>		
6.2	Check welding consumables used for attachment of the nameplate to the shell.	1, 3, 10 (6.16) (6.16.1-3), WPS, BP, UG9	H,R	<i>DP</i>			
6.3	Check nameplate weld attachment for overall workmanship quality.	1, 2 ___, WPS, 11 (5.5.1)	H	<i>DP</i>	<i>A</i>		
6.4	Check platform pad orientation prior to weld attachment.	2 ___ and ___, 6 (6.1.1)	H	<i>DP</i>			
6.5	Check platform pad weld attachment for overall workmanship quality.	1, 2 ___, WPS, 11 (5.5.1)	H	<i>DP</i>	<i>A</i>		
7.0 Tubesheet Manufacture							
7.1	Check machined tubesheet for flatness before drilling.	2 ___, 4 (9.8.2), 5, 6 (6.8.3)	H	<i>DP</i>			
7.2	Check tube hole and tie rod layout prior to drilling.	2 ___, 5 (7.6.1.8) (7.6.3.3)	H	<i>DP</i>			
7.3	Check drilled and reamed tubesheet tube hole dimensional tolerances and chamfer.	2 ___, 4 (9.9.3), 5 (9.9.4), TEMA Spec.	H	<i>DP</i>			
7.4	Check final machined tubesheet dimensional details.	2 ___, 4 (9.8.2), 6 (6.8.3)	H	<i>DP</i>			
7.5	Check drilled and tapped tie rod supports.	2 ___, 5 (7.6.3.3)	H	<i>DP</i>			
8.0 Tube Bundle Assembly							
8.1	Check bundle skeleton dimensional details: General tolerance on baffle spacing is $\pm 1/4"$.	2 ___, 4 (7.6.3), 5 (7.6.3.1), TEMA					
	Baffle dimensions		H	<i>DP</i>	<i>A</i>		
	Baffle spacing		H	<i>DP</i>	<i>A</i>		
	Baffle tube hole dimensions		H	<i>DP</i>			
	Baffle tube hole deburring		H	<i>DP</i>			
JOB SCOPE: FABRICATE -E- EXCHANGER			PLAN No. QCP-2001		SHT No.	5/7	17315

METALFORMS INC.		INSPECTION & TESTING QCP-2001		PROJECT: 10202806		Item # E-1530	
		JOB No. 17315		P/ORDER No. 4400839977			
ACTIVITY		RELEVANT PROCEDURES/SPECIFICATIONS	VENDOR Metalforms, Inc.	SIGN	CUST. REP.	SIGN	VERIFYING DOCUMENT
8.2	Check tube projections.	2 __, 5 (7.6.1.6)	H	DP			
8.2.1	Check tube to tubesheet & weld joints for cleanliness, preparation fit up & alignment.	5, relevant procedures/specs		DP			
8.2.2	Check welding consumables	2 __, 5, relevant procedures/specs		DP			
8.2.3	Surveillance during welding	5, WPS __, relevant procedures/specs		DP			
8.2.4	Check completed tube end welds for overall workmanship quality.	5, relevant procedures/specs		DP			
8.2.5	Check PT results on tube end welds.	5, relevant procedures/specs		DP			
8.2.6	Check Helium Leak Test results on tube end welds.	5, relevant procedures/specs		NA CUST. WITHD.			
8.3	Check tube I.D.'s for tube expansion tolerances. (Random)	2 __, 5 (6.2.4.1 & 6.3m), 9.5.6.1-6 TEMA tolerances / customer specs	S	DP			
8.4	Check tube bundle insertion for clearance.	2 __, Metalforms, Std. Practice	H	DP			
9.0 Final Inspection							
9.1	Check vessel for overall workmanship quality and cleanliness prior to final closure of exchanger and hydrostatic pressure testing.	1, 3, 7, 8 (3.0), UG97	H	DP			
10.0 Hydrostatic Pressure Testing							
10.1	Check test water purity. Alloys only - Chloride content not to exceed 50 ppm.	1, 4 (10.3.4), 5 (10.3.4), 6 (7.7.5)	H	N/A			
10.2	Check test water temperature.	1, 6 (7.7.2), Hydrostatic Test Pressure	H				
10.3	Tube bundle air under water bubble test.	2 __, Eng. Spec.	H	N/A			
10.4	Check hydrostatic test pressure and charting.	1, 3, 4(10.3), 5 (10.3.3)(10.3.5)					
	Shell Side - psig 480	UG99	H	DP			
	Tube Side - psig		H	N/A			
10.5	Verify pressure gauge test range and calibration. Range 1.5 - 4.0 times press. calibration - annually.	1, 3, 6 (3.6.2.6), 11 (4.4) (5.3.3-5), UG102 (B) (C)	H	DP			
JOB SCOPE: FABRICATE -E- EXCHANGER			PLAN No. QCP-2001		SHT No. 6/7	17315	

METALFORMS INC.	INSPECTION & TESTING QCP-2001	PROJECT: 10202806						Item # E-1530	
		JOB No. 17315						P/ORDER No. 4400839977	
ACTIVITY		RELEVANT PROCEDURES/SPECIFICATIONS	VENDOR Metalforms, Inc.	SIGN	CUST. REP.	SIGN	VERIFYING DOCUMENT		
11.0 Nameplate Stamping and Reports									
11.1	Verify nameplate stamping and manufacturer's data report for conformance.	1, 3, 6 (1.3), 6 (3.2.10.8), UG115 through UG120	H	TD					
12.0 Sandblasting and Painting									
12.1	Check external shell and surfaces for cleanliness and preparation after sandblasting and before painting.	9, SSPC Std's, NACE	H	N/A Waived BY ED					
12.2	Check paint coats for conformance.	9	H	11					
13.0 Equipment Stenciling									
13.1	Check purchase order number, plant record number, and weight stenciling check approximate center of gravity.	2 ___ notes, 4 (11.2)(11), 6 (9.1-3)	H	DP					
14.0 Shipping Preparations									
14.1	Check shipping preparations for conformance.	2 ___ notes, 4(11.0), 5(11.0), 6 (8.0) (9.0), 8 (3.7), 13 (7.0)	H	DP					
15.0 Inspection Release									
15.1	Inspection Release	Per PO# 4400839977	H	DP					
JOB SCOPE: FABRICATE -E- EXCHANGER		PLAN No. QCP-2001			SHT No. 7/7		REV. 0		



QTY	PART	ONE (1) REQUIRED DESCRIPTION OF (1)	NOTE	MATERIAL	VENDOR	P.O.
705	1 TUBES	3/4" O.D. X 14 (MW) X 20'-0" LG.	1,2,5	SA-179	✓	
2	2 TUBESHEETS	3" TK. X 35 1/2" B.O.D.	1,5	SA-516-70N	✓	
7	3 BAFFLES	1/2" TK. X 30 3/16" B.O.D.		SA-36	✓	
1	4 SHELL CYLINDER	R & W CYL. 30" I.D. X 1/2" TK. X 19'-7 1/4" LG. (1) 1/2" PL. X 95 15/16" X 119 1/2" [153 1/4"] (BOS/BOS) (1) 1/2" PL. X 95 15/16" X 115 3/4" [150 3/8"] (BOS/BOS)	1,5	SA-516-70	✓	
1	5 NOZZLE S1 PIPE	8" X-HVY (0.5") PIPE X 5 3/4" LG. (BOS/SQ)	1,5	SA-106-B	✓	
1	6 NOZZLE S2 PIPE	6" X-HVY (0.432") PIPE X 6" LG. (BOS/SQ)	1,5	SA-106-B	✓	
1	7 NOZZLE S3	1 1/2" - 300# RF-LWN (12" LG.)	1,5	SA-105	✓	
1	8 NOZZLE S1 FLANGE	8" - 300# RF-WN W/ X-HVY BORE	1,5	SA-105	✓	
1	9 NOZZLE S2 FLANGE	6" - 300# RF-WN W/ X-HVY BORE	1,5	SA-105	✓	
1	10 NAME PL.	METALFORMS INC.		SA-240-302	✓	
1	11 BRKT	1/4" TK. X 4" X 6 3/4"		SA-36	✓	
1	12 BRKT	1/4" TK. X 6 3/4" X 6 1/2"		SA-36	✓	
2	13 PAINT	GAL'S. OF CARBOZINC #11	5		✓	
1	14 IMP. PLATE	1/4" TK. X 8" O.D.		SA-36	✓	
1	15 S1 NZ. PAD	1/2" TK. X 11 5/8" O.D. X 8 3/4" I.D. (ROLL TO 15 9/16" I.S.R.) [START FROM 11 5/8" WIDE X 24" LG. PLATE]	1,5	SA-516-70	✓	
1	16 S2 NZ. PAD	1/2" TK. X 9 5/8" O.D. X 6 3/4" I.D. (ROLL TO 15 9/16" I.S.R.) [START FROM 9 5/8" WIDE X 24" LG. PLATE]	1,5	SA-516-70	✓	
4	17 CPLG.	3/4" -6000# BLIND CPLG. W/ PLUG.	1,5	SA-105	✓	
1	18 S4 CPLG.	3/4" -6000# FULL CPLG. W/ PLUG.	1,5	SA-105	✓	
2	19 N.P.T. PLUG	1/4" N.P.T. PLUG	1,5	SA-105	✓	
2	20 SUPPORT PAD	3/8" TK. X 1'-4" X 14 1/4" ARC LGTH. [ROLL TO 15 9/16" I.S.R.]	1,5	SA-516-70	✓	
2	21 SUPT. BASE	3/4" TK. X 1'-0" X 1'-2 3/16"		SA-36	✓	
4	22 SUPT. GUSSET	3/4" TK. X 1'-1 1/4" X 1'-1 9/16"		SA-36	✓	
9	23 TIE-ROD	1/2" DIA. X 18'-0" LG. W/ 2-HH NUTS (EA.)		SA-36	✓	
9	24 SPACERS	3/4" O.D. X 14 OR 16 GA. X 18'-0" LG. (R/L)		SA-214	✓	
5	25 PAD (@ PLATFORM CLIP)	1/2" TK. X 1'-0" X 6" ARC. LGTH. [ROLL TO 15 9/16" I.S.R.]	1,5	SA-516-70	✓	
5	26 PLATFORM CLIP	1/2" TK. X 5" X 10" LG.	3,4	SA-516-70	✓	
1	27 MI SPECIAL TAG	MI STD. TAG		SA-240-302	✓	

NOTES	1. MTR'S REQ'D.	JOB #	17315	SHEET	12			
	2. EDDY CURRENT TEST PER SA-450.	CUST.	EQUISTAR CHEMICALS, LP					
	3. CLIPS ARE TO BE GALVANIZED.	ITEM #	E-1530					
	4. CLIPS TO BE SHIPPED LOOSE.	PO NO.	4400839977					
	5. FROM LYONDELL AML ONLY.	EQUIP	SAP # 10202806; TAG# 2308021					
		PLANT	BMO (GLYCOL 1)	RV		DESCRIPTION	DATE	BY



MATERIAL TEST REPORT

Page 1 of 1

Sold To: 7280000
METALFORMS
160 GARTH ROAD
CHEEK TX 77705 US

Ship To: 7280000
METALFORMS
160 GARTH ROAD
CHEEK TX 77705 US

Purchase Order: 87851-17315
Sales Order: 100898
Material: TA32007500830 A/SA179 0.750" OD x .083" MW
Delivery: 80149840

Description: ASTM/ASME A/SA 179-90A(05) SMLS

Test: NDT ELECTRIC TESTED TO ASTM A450 OR A1016 & APPLICABLE TEST METHOD E309 OR E426.
FLANGE TEST PASSED. FLARE TEST PASSED. FLATTENING TEST PASSED.

Heat Number:	TR771644	TR771645
--------------	----------	----------

CARBON	Idl 0.080	0.070
MANGANESE	Idl 0.380	0.400
PHOSPHORUS	Idl 0.012	0.010
SULFUR	Idl 0.007	0.008
SILICON	Idl 0.130	0.130
NICKEL	Idl	
CHROMIUM	Idl	
MOLYBDENUM	Idl	
COPPER	Idl	
ALUMINUM	Idl	

Ultimate (PSI)		
Yield (PSI)		
Elongation (%)		
Hardness (RB)	63 / 63	63 / 63
Manufactured in	Romania	Romania

Webco Industries, Inc. certifies that the material described was manufactured and tested and/or inspected in accordance with the specification and fulfills requirements in such respect.
This document was prepared by means of electronic processing and is valid without signature.

Date: 12/21/2007

Buck Hernandez
Quality Manager

MTR-UKDP
12-21-07
PO# 87851
J-17315

Tubos



SHIPPING TALLY

Page 1 of 1

Sold To: 7280000
METALFORMS
160 GARTH ROAD
CHEEK TX 77705
US

Ship To: 7280000
METALFORMS
160 GARTH ROAD
CHEEK TX 77705
US

Purchase Order: 87851-17315
Sales Order: 100898
Material: TA32007500830 A/SA179 0.750" OD x .083" MW
Delivery: 80149840
Date: 12/21/2007
Description: ASTM/ASME A/SA 179-90A(05) SMLS

Batch	Length	Heat	Pieces	Tot Length	UOM	Weight	UOM
1002404806	20' 0.000"	TR771644	127	2,540.000	FT	1633	LB
		TR771645					
Tagging Information:		17315					
1002404807	20' 0.000"	TR771644	127	2,540.000	FT	1633	LB
		TR771645					
Tagging Information:		17315					
1002404808	20' 0.000"	TR771644	127	2,540.000	FT	1633	LB
		TR771645					
Tagging Information:		17315					
1002404809	20' 0.000"	TR771644	127	2,540.000	FT	1633	LB
		TR771645					
Tagging Information:		17315					
1002404810	20' 0.000"	TR771644	127	2,540.000	FT	1633	LB
		TR771645					
Tagging Information:		17315					
1002404811	20' 0.000"	TR771644	49	980.000	FT	630	LB
Tagging Information:		17315					
1002404812	20' 0.000"	TR771644	23	460.000	FT	296	LB
Tagging Information:		17315					
Length Summary							
	Max Length	Pieces	Tot Length	UOM	Weight	UOM	Lots
	20' 0.000"	707	14,140.000	FT	9091	LB	7
TOTALS							
		707	14,140.000	FT	9091	LB	7

QUALITY ASSURANCE REPORT OF TEST AND ANALYSES

Q 1 E	SERIAL NUMBER	PAT NO.	HEAT NUMBER	NO. PCS.	DIMENSIONS				WEIGHT	YIELD POINT	TENSILE STRENGTH	E.LONG	REL.
					THICKNESS	WIDTH OR DIA.	LENGTH						
					INCHES	INCHES	INCHES	POUNDS	PSI	PSI	IN	%	

NO WELD REPAIR WAS PERFORMED ON BELOW PLATE(S)

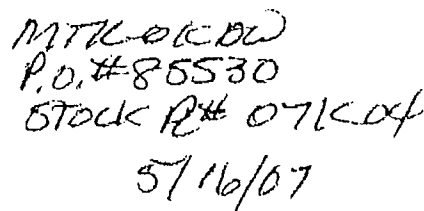
ABNORMAL 2F TEMPERATURE

NOTARY PUBLIC JAMES L. KEEL
LAPOINTE COUNTY INDIANA
MY COMMISSION EXPIRES DECEMBER 20, 2009
COUNTY OF RESIDENCE, LAPORTE

I certify that the above results are a true and correct copy of actual results contained in records maintained by AHA Steel Inc. and are in full compliance with the requirements of the specification cited above. This test report cannot be altered and must be treated as having impact with any subsequent third party test reports. Furthermore, this report is provided under a certificate of confidentiality as required by AHA-QC-CERT #30477.

DISPATCH TO: SUPPLY QUALITY ASSURANCE

D. W. ELWOOD



AC#2 Tubersheet

V & M STAR
Seamless Tubular Products

Certified Test Report
06/26/2007

29371

CUSTOMER: DIXIE PIPE SALES	DESC: SEAMLESS HOT ROLLED	CUSTOMER ORDER NUMBER: 3890
SLN: W50399	GRADE: API 5L X42/B PSL 2 Rev. October 4, 2004	MILL ORDER NO: 81929
OD: 8.625	WALL: 0.500	LBS/FT: 43.43
PEB	DRL	LP
COMMENT: Melted and Manufactured in the USA		W/O NO:
This pipe is also manufactured to: ASTM A106B/C Rev.06 ASTM A53B Rev.06 ASME SA106B/C Rev.04 ASME SA53B Rev.04 V&M Star's QA program meets the requirements of DIN EN 10204/Rev.2004 Type 3.1. Satisfies NACE MR0103-2005.		LOT NO:

MECHANICAL PROPERTIES:			LONGITUDINAL						SUPPLEMENTAL REQUIREMENT	
SPECIMEN CROSS SECTION			STRENGTH KSI		GAGE LENGTH	ELONGATION	%ELONG	HARDNESS: 80 HRBW AVG		
WIDTH(IN)	THICK(IN)	AREA(SQIN)	YIELD	TENSILE				FLATTENING: PASSED		
1)	1.520	0.535	0.8181	50.7	71.9	2	36.5	NACE TEST: MRO175/ISO 15156-2 Clause A.2.1.1		
2)	0.000	0.000	0.0000	0.0	0.0	0	0.0	GRAIN SIZE:		
3)	0.000	0.000	0.0000	0.0	0.0	0	0.0	OTHER:		
4)	0.000	0.000	0.0000	0.0	0.0	0	0.0	COLLAPSE:		
5)	0.000	0.000	0.0000	0.0	0.0	0	0.0	8D MIN:		

INSPECTION:

HYDROSTATIC TEST (psi): 3650 for a 5 second minimum

Q/T:

AP: 0

TF: 0

DRIFT PLUG SIZE: INCHES

Required CE Max of 0.43

CHEMICAL ANALYSIS: 61 Ultrasonic Inspection. Reference Standard was a test joint with 10% ID and OD Longitudinal and Transverse notches.																			
	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Nb	V	Al	Ca	B	Ti	N	CE	
HEAT	0.20	0.76	0.007	0.003	0.22	0.16	0.07	0.07	0.01	0.008	0.001	0.001	0.039	0.0025	0.0001	0.001	0.0070	0.35	
PRODUCT 1)	0.20	0.76	0.007	0.003	0.22	0.15	0.06	0.07	0.01	0.008	0.001	0.001	0.038	0.0021	0.0001	0.001	0.0067	0.36	
PRODUCT 2)	0.21	0.76	0.007	0.003	0.22	0.15	0.06	0.07	0.01	0.007	0.001	0.001	0.039	0.0023	0.0001	0.001	0.0066	0.37	
PRODUCT 3)	0.00	0.00	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	0.0000	0.00	
PRODUCT 4)	0.00	0.00	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	0.0000	0.00	

CHARPY IMPACT TESTING Notch: V

	DIRECTION	SIZE	TEMP(Deg.F)	FTLBS 1	FTLBS 2	FTLBS 3	AVG	SHEAR 1	SHEAR 2	SHEAR 3	AVG
TEST #1	TRANS	FULL	32	36	44	56	45.00	30	30	30	30
TEST #2				0	0	0	0.00	0	0	0	0
TEST #3				0	0	0	0.00	0	0	0	0

This material has been produced and tested in accordance with the requirements of applicable specifications unless otherwise listed below. We hereby certify that the above test results are representative of those contained in the records of the company. Any modification to this certification as provided by V & M STAR without the expressed written consent of V & M STAR negates the validity of the test report. V & M STAR is not responsible for the inability of the material to meet specific applications.

SIGNED:

Name: JOE DOLAK Title: PRODUCT
DATE APPROVED: 06/26/2007

MTR-OK DW PIPE CODE
P.O.# 87275 XX31
Stock
11/6/07

MILL TEST REPORTS
FOR PO#
DIXIE PIPE SALES, L.P

PC#5 11/6/07



V & M Star
Seamless Tubular Products

CERTIFIED TEST REPORT

Wednesday, December 20, 2006

28987
Pg. 1

PRODUCT DESCRIPTION:

SLN U70293
OD: 6.625 WALL 0.432 LBS / FT 28.60 PEB DRL LP

SEAMLESS HOT ROLLED

GRADE: API 5L X42/B PSL 2 Rev. October 4, 2004

CUSTOMER:

DIXIE PIPE SALES

MILL ORDER NO:

79641

CUSTOMER ORDER NUMBER:

3286

COMMENT

Melted and Manufactured in the U.S.A.

This pipe is also manufactured to:

ASTM A106B/C Rev.06

ASTM A53B Rev.06

ASME SA106B/C Rev.04

ASME SA53B Rev.04

V&M Star's QA program meets the requirements of DIN EN 10204/Rev.2004 Type 3.1. Satisfies NACE MR0103-2005

MECHANICAL PROPERTIES: LONGITUDINAL

SPECIMEN CROSS SECTION			STRENGTH KSI		ELONGATION	
WIDTH (IN)	THICK (IN)	AREA (SQIN)	YIELD	TENSILE	GAGE LENGTH	% ELONG
1) 1.512	0.432	0.6599	48.0	73.6	2	41.5
2)						
3)						
4)						

HYDROSTATIC TEST (PSI): 4110 for a 5 second minimum DRIFT PLUG SIZE: INCHES

SUPPLEMENTAL REQUIREMENTS:

HARDNESS 78 HRBW AVG

FLATTENING PASSED

NACE TEST SATISFIES NACE MR-01-75

GRAIN SIZE

OTHER

COLLAPSE

8D MIN

CHEMICAL ANALYSIS: 61M Electromagnetic Inspected. Reference Standard was a test joint with 10% ID and OD Longitudinal and Transverse notches.

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Nb	V	Al	Ca	B	Ti	N	CE
HEAT	0.21	0.69	0.007	0.006	0.19	0.18	0.08	0.13	0.02	0.017	0.001	0.001	0.018	0.0021	0.0001	0.001	0.0073	0.37
PRODUCT 1)	0.21	0.68	0.007	0.004	0.19	0.18	0.08	0.12	0.02	0.012	0.001	0.001	0.016	0.0016	0.0001	0.001	0.0077	0.37
PRODUCT 2)	0.21	0.68	0.007	0.004	0.20	0.17	0.08	0.12	0.02	0.011	0.001	0.001	0.016	0.0016	0.0001	0.001	0.0074	0.37
PRODUCT 3)																		
PRODUCT 4)																		

CHARPY IMPACT TESTING:

DIRECTION:	TEST #1	TEST #2	TEST #3
TRANS	FILE: 24		
SIZE:	23		
2/3	27		
TEMP:	AVG: 25		
32 (°F)	SHEAR: 30		
NOTCH:	30		
V	30		
	AVG: 30		

This material has been produced and tested in accordance with the requirements of applicable specifications unless otherwise listed below. We hereby certify that the above test results are representative of those contained in the records of the company. Any modification to this certification as provided by V & M Star without the expressed written consent of V & M Star negates the validity of this test report. V & M Star is not responsible for the inability of this material to meet specific applications.

SIGNED:

DATE:

J. J. Schmitz
12/20/06

"The following clause is a condition of this contract and must be passed on verbatim in each subsequent sale: 'These commodities, technology, or software, were exported from the United States in accordance with the export administration regulation. Diversion contrary to U.S. law is prohibited.' Buyer acknowledges his understanding that the sanction of denial of trading privileges in USA exports may be imposed for violation of this export regulation."

MTL-OKDW
P.O. # 86395
STOCK
8/1/07

PIPE CODE
XX07

THIS CERTIFICATE IS NOTORIZED ONLY WHEN REQUESTED

PC#6 10g. Pipe S2



A DIVISION OF AMERI-FORGE GROUP INC.

MATERIAL TEST REPORT

Forged Vessel Connections
2525 De Soto St. (77091)
P.O. Box 38421 (77238-8421)
Houston, Texas

MTR # A170933

http://www.fvc.cc
QA@fvc.cc

TEL: (713) 688-9705 FAX: (713) 688-7954

S.O. No: 7-03928 Date: 12/04/2007 REV #
Purchaser: Lynco Flange & Fitting Distributor:
P.O. No.: H-112607-S Distributor's Order No: Page 1

ITEM NO	QTY	DESCRIPTION	SPEC	HEAT #	HEAT TREAT
10	6	LWN,SA105, 300#,1.5 x 12",RF&D STK	SA105 ✓ 2007 Edition	C763AF ✓	As-Forged

$(C + (Mn / 6)) + ((Cr + Mo + V) / 5) + ((Ni + Cu) / 15) = .407$

CHEMICAL ANALYSIS AND MECHANICAL PROPERTIES

Heat #: C763AF

T2186

Chemical values below represent percentage of weight

C (Carbon) .19 ✓ *CAS # 7349-96-5	Mn (Manganese) 1.18 *CAS # 7349-96-5	P (Phosphorus) .006 *CAS # 7723-14-0	S (Sulphur) .002	Si (Silicon) .23	Cr (Chromium) .03 *CAS # 7440-47-3	Ni (Nickel) .05 *CAS # 7440-02-0	Mo (Molybdenum) .02 *CAS # 1313-27-5
Cu (Copper) .10 ✓ *CAS # 7440-50-8	Al (Aluminum) .026	V (Vanadium) .002 *CAS # 7440-62-2	As (Arsenic) .004 *CAS # 7440-38-2	Sb (Antimony) .0010 *CAS # 7440-36-0	Sn (Tin) .006	Co (Cobalt)	N (Nitrogen) .00680
Ti (Titanium) .001	Ta (Tantalum)	Cb (Columbium) .001	O (Oxygen) .00100	H (Hydrogen)	Boron .0005		

TENSILE (PSI)	YIELD (PSI)	ELONG (IN 2")	R.A. (%)	CHARPYS (FT - LBS)	TEMP ° F
77200	58100	32.0	71.0		

SHEAR %	LATERAL EXPANSION (MILS)	BHN
		< 187 ✓

FVC STANDARD MANUFACTURING PRACTICES:

- 1) FLANGE DIMENSIONS & BOLTING COMPLY - ASME B16.5 ✓
- 2) SELF-REINFORCING NOZZLES COMPLY WITH SPECIFICATION OF SECT. VIII DIV. 1 OR DIV.2 PER CUSTOMER DESIGN/FVC DESIGN. ✓
- 3) MATERIAL SPECIFICATION COMPLIES WITH ASME SECT. II, PART A. ✓
- 4) ALL FVC MATERIAL MANUFACTURED PER FINE GRAIN PRACTICE. ✓
- 5) ALL FVC MATERIAL CERTIFIED PER EN 10204, 3.1.B UNLESS OTHERWISE SPECIFIED
- 6) CERTIFICATE OF INSURANCE AVAILABLE UPON REQUEST.

COMMENTS

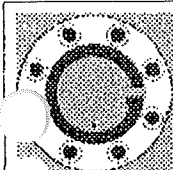
Test Bar: 170-170 BHN

MTR - OKP
12-21-07
PO # 87871
J-17315
#7
Nozzle "S3"

EPCRA Supplier Notification:

This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with an asterisk (*) under the chemical's name and percent-by-weight value, followed by a Chemical Abstract Service (CAS) registry number for that chemical. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Uma Robles

**GALPERT, INC.**

160 Southbelt Industrial Drive
Houston, Texas 77047
PH. 713-433-0700 - FAX 713-433-5580
Email: galpmail@galperti-am.com

LYNCO FLANGE & FITTING, INC.**P.O. BOX 926226****HOUSTON TX 77292-6226**

TEST/CERTIFICATE

EN 10204

INTERNAL JOB

3.1B**073841**

No. 1. CERTIFICATE N.

DATE

YOUR P.O.

DATE

009647/B

11/21/2007

H-111207-S-1

11/14/2007

ITEM	DESCRIPTION	QUANTITY	B/P	MATERIAL	HEAT N°	#
015/015	3" 300 WN RF STD A105 B1 F	40	B	ASTM A/SA105 03c	2649/02	A
016/016	6" 300 WN RF XS A105 B1 F	25	B	ASTM A/SA105 03c	4265/02	B
017/017	8" 300 WN RF XS A105 B1 F	10	B	ASTM A/SA105 03c ✓	UYX ✓	C
018/018	12" 300 WN RF STD A105 B1 F	7	B	ASTM A/SA105 03c	XXL	D

CHEMICAL ANALYSIS

#	C %	MN %	SI %	P %	S %	CR %	NI %	MO %	CU %	V %	SN %	AL %	NB %	TI %	N %	B %	O %	FL%
A	0.165	1.130	0.224	0.007	0.005	0.092	0.100	0.022	0.107	0.001			0.0001		0.007	0.0001	0.001	0.39
A C	0.155	1.150	0.204	0.010	0.008	0.102	0.110	0.032	0.117	0.001			0.0001		0.007	0.0001	0.001	0.38
B	0.160	1.100	0.180	0.004	0.010	0.110	0.180	0.050	0.190	0.001	0.009	0.020	0.0010		0.008			0.40
B C	0.150	1.120	0.200	0.007	0.007	0.100	0.190	0.060	0.200	0.001	0.009	0.030	0.0010		0.008			0.39
C	0.200	0.850	0.180	0.010	0.011	0.100	0.080	0.022	0.250	0.002								0.38
C C	0.190	0.870	0.200	0.007	0.014	0.110	0.070	0.032	0.240	0.002								0.38
D	0.180	0.890	0.200	0.012	0.015	0.110	0.070	0.025	0.240	0.036			0.0070					0.38
D C	0.170	0.910	0.180	0.015	0.018	0.120	0.080	0.015	0.230	0.031			0.0070					0.37

NOTES
FL=Carbon Equivalent Long Formula

C = CHECK ANALYSIS

MECHANICAL PROPERTIES

#	TYPE	TENSILE					CHARPY TEST				HB HARDNESS (AVERAGE)
		Ø DIAMETER mm.	AREA mm ²	LENGTH mm.	TEMP. F	TENSILE PSI	YIELD PSI	ELONG %	REDUCT. %	VALUES	
A	S	12.50	122.70	50.00	68	70,000	36,000	22.0	30.0		187
A	O	12.50	122.70	50.00	68	76,129	48,731	28.4	67.2		162
B	S	12.50	122.70	50.00	68	70,000	36,000	22.0	30.0		187
B	O	12.50	122.70	50.00	68	77,757	49,542	28.8	67.6		154
C	S	12.50	122.70	50.00	68	70,000	36,000	22.0	30.0		187
C	O	12.50	122.70	50.00	68	78,352	47,121	31.0	68.3		152
D	S	12.50	122.70	50.00	68	70,000	36,000	22.0	30.0		187
D	O	12.50	122.70	50.00	68	77,847	48,481	29.5	70.0		158

NOTES

O = OBTAINED
S = STANDARD

HEAT TREATMENTS**GENERAL NOTES**

A	Normalized at 900 dgr.C for 1.1/2 h.-Cooling from 900 dgr.C in still air	ROUGHNESS F - STOCK FINISH 125-250 microinch STANDARD B1 = ASME B16.5 ✓
A		
B	Normalized at 900 dgr.C for 1.1/2 h.-Cooling from 900 dgr.C in still air	
B		
C	Normalized at 900 dgr.C for 2 h.-Cooling from 900 dgr.C in still air	
C		
D	Normalized at 900 dgr.C for 2.1/2 h.-Cooling from 900 dgr.C in still air	
D		

NOTES
Material I.A.W. Nace MR-0175

PC#8
Note: "SI" FLANGE

MR-0175
B1 = ASME B16.5
J-17315

TRADE MARK



INT. INSPECT DATE

INT. INSPECTOR

11/21/2007

D.RUZICKA

INSPECTION AUTHORITY

Don Ruzicka





Material Test Report

Heat Code: YLL ✓

An Ameri-Forge Group Company

13770 Industrial Rd., Houston, TX 77015

ISO 9001:2000 Certified

Sales: (713) 868-4421 Fax: (713) 455-8366

Lynco Flange & Fitting P. O. Box 926226 Houston, TX 77292-6226 ✓	PO: H081107S	Sales Order: 60931	Line: 27
	Item Code: 0301600102-0020F		Qty Shipped: 73
	Item Desc: FLG 06.00 0300 WN RF XH A105 ✓ NHT COFFR		
	Supplier: CMC Supplier Heat: 256875		

Spec: ASTM A 105/A 105M-03/ASME SA 105/SA 105M-04, Melt Practice EF

Element	(%wt)	Ladle	Product	EPCRA	CAS#	Element	(%wt)	Ladle	Product	EPCRA	CAS#
C	Carbon	0.19	✓			Cr	Chromium	0.08	✓	✓	7440-47-3
Mn	Manganese	0.89	✓	✓	7439-96-5	Mo	Molybdenum	0.014	✓		
P	Phosphorus	0.011	✓			V	Vanadium	0.002	✓		
S	Sulphur	0.021	✓			Cb	Columbium	0.001			
Si	Silicon	0.18	✓			C.E.		0.379	✓		
Cu	Copper	0.25	✓	✓	7440-50-8	CuNiCrMo		0.41	✓		
Ni	Nickel	0.07	✓	✓	7440-02-0	CrMo		0.09	✓		

Mechanical		Other	
Test Lab	AFG	Country of Origin	USA (US)
Test Bar Size	SACRIFICIAL PIECE	EP	Y
HBW	156-156 ✓		
Elg (%)	36.0 ✓		
RA (%)	62.0 ✓		
Tensile Specimen Size (in)	0.500		
Tensile (ksi)	75.8 ✓		
Yield (ksi)	43.6 ✓		
Gauge Length	2.00		

*WTR OK'D 12-21-07
PO # 87871
J-17315
PC # 9
NOZZLE 52" FLANGE*

Product compliant with NACE MR0175, latest edition.

Product compliant with and meets all requirements of ASTM A105/ASME SA105-05.

No Weld repair performed. Chemical Analysis results shown are actual. Forgings are capable of passing hydrostatic test compatible with the appropriate rating. Elongation taken from a round specimen. All material supplied under this order is certified to be free of mercury contamination and no mercury bearing equipment was used in manufacturing, fabrication or testing. Yield strength was determined using the 0.2% offset method.

EPCRA Supplier Notification: This product may contain one or more toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) and 40 C.F.R. Part 372. Potentially reportable chemicals are indicated with a checkmark in the "EPCRA" column and a Chemical Abstract Services (CAS) registry number is provided for each such chemical in addition to the percent by weight of the chemical present in this product. It is your responsibility alone to determine whether your facility is required to submit a Toxic Release Inventory Report under EPCRA Section 313.

Certification No.: 124048

Certification Date: 8/22/2007

Kevin Papich - Tech. Svcs. Manager

NUCOR
PLATE MILL

P.O. Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

Page 3



Issuing Date: 06/15/2007

B/L No.: 165672

Load No.: 168723

Our Order No.: 53802/4

Cust. Order No.: 7831

Vehicle No: LW 62182

Sold To: RANGER STEEL SERVICES LP
1225 NORTH LOOP W. STE 650
HOUSTON, TX 77008

Ship To: RANGER STEEL
C/O KINDERMORTX
9640 CLINTON DRIVE
ZONE 23 TRACK 415
HOUSTON, TX 77245

Specification: 0.5000" x 120.000" x 480.000"

ASTM A516 70-00/ASME SA516 70-90 PVQ 2006 Normalized Tests at
1650 F 30 min. minimum

Marking:

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb	Ti	N	Ca	B	Sn	CEQ	PCM
7103939	0.21	1.03	0.014	0.003	0.19	0.27	0.08	0.11	0.01	0.026	0.006	0.001	0.001		0.0001	0.0001	0.011	0.43	0.28

Plate Serial No.	Tensile Test							Charpy Impacts											
	Pieces	Tons	Dir.	(psi)	(psi)	Elongation % in 2"	Elongation % in 8"	Dir.	1	(%)	2	(%)	3	(%)	Ave.	(%)	Size	Temp	Min Ave.
				Yield	Tensile					shear		shear		shear		shear			

7103939-03	6	24.50	T	61,300	80,700		24.1									
7103939-04	6	24.50	T	53,000	80,100		23.3									
7103939-03	6	24.50	T	50,100	75,400		26.3	N								
7103939-04	6	24.50	T	55,000	75,100		25.0	N								

MTR-01COL
P.O.# 86124

Stock R# 07GD03 07GD04
7/9/07 07GD05 07GD06
07GD07 07GD08

Normalized 30 minutes per inch of thickness at 1650 F ± 25 F. Hold 30 minutes minimum.

RANGER STEEL SUPPLY CORP.
Q.C. APPROVED

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast as-rolled discrete plate. Yield by 0.5EUL method unless otherwise specified. $CEQ = C + (Mn/5) + ((Cr + Mo + V)/5) + ((Cu + Ni)/15)$

$Pcm = C + (S/30) + (Mn/20) + (Cu/20) + (Ni/60) + (Cr/20) + (Mo/15) + (V/10) + B$

Melted and manufactured in the USA. ISO 9001-2000 certified (#12443-0) by SRI Quality System Registrar (#0885-08). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant. DIN 50849 3.1, EN 10204 3.1, B(2004) compliant. For ABS grades only. Quality Assurance certificate No. 03-MMPQA-182

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Depretis

T. A. Depretis, Metallurgist

06/18/2007 8:30:50 AM

PC #4
PC #15,16
PC #25

Shell Cylinders
SI, S2 NOZ. Pads
And @ Platform Clip



(773) 767-2430

800-447-3300

Fax (773) 767-2471

3900 West 74th Street • Chicago, IL 60629-4354

MATERIAL CERTIFICATION**DATE PRINTED 9/28/2006****ACCT# 5304**

SOLD TO: PROD. MFG. CO. INC.
5909 E. 13TH STREET
TULSA OK 74112

INVOICE#: SHIPMENT
38875 DATE: 8/14/2006 PO#: 01046

DESCRIPTION OF MATERIAL AND SPECIFICATIONS

ITEM#: 70370 1.750 HR RD A105 16'
DESCALED, MACHINE STRAIGHTENED & OILED

HEAT#: 602414 PRODUCER:

C: .21 ✓ MN: .98 ✓ P: .014 ✓ S: .021 ✓ SI: .23 ✓ NI: .079 ✓
CR: .139 ✓ MO: .019 ✓ CU: .23 ✓ AL: .007 PB: SN: .013
V: .023 ✓ CB: .011 ✓ CA: .0070 SE: FE: O:
N: H: GRAIN: 8 MISC: DI=0.89

**MISC.
INFORMATION**

U.T. TESTED OK
✓ TO ASTM A105 ASME SA 105

✓ This steel is 100% electric
arc furnace melted and
rolled in the USA

PHYSICALS

YIELD: 60300
TENSILE: 83200
ELONG: 24% IN 2"
RED/AREA: 47%
BHN: 153

MTR - OK DL

P.O. # 86201

Stock - 100

7/9/07

CUSTOMER Metal Form

P.O. # 86201

ITEM 3/4" - 6000 # Blind Cplg Bldg

HEAT CODE 64T

#17 3/4" Blind Cplg

CERTIFIED MILL TEST REPORT



**The Best Value
Price, Quality, Service
All The Time.**

LOG NO. 315307 PAGE 13
 BONNEY FORGE
 P.O. BOX 330 • 14496 CROGHAN PIKE • MOUNT UNION, PA 17066-0330
 (814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
 www.bonneyforge.com

CUSTOMER: LYNCO FLANGE AND FITTING, INC.

Date 11/05/07

CUSTOMER'S Order No.: H-102107-S

Bonney Order No. 000020206

SHIPPED TO: LYNCO FLANGE AND FITTING, INC.
 5114 STEADMONT DRIVE

HOUSTON, TX 77040 United States

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:			
			5A/A105			
028	25	3981 ✓	.75FRP 3/4 3M/6M A105 RDPL T ✓			
			C	.210 MN	1.030 P	.006 S .021 SI .220
			NI	.030 CU	.100 CO	.003 CR .040 MO .010
			V	.000 AL	.023 NB	.017
			CE(LONG FORMULA) = 0.40			
			T/S 79350 Y/S 49294 EL 31.00 RA 50.00			
			BRINELL HARDNESS1: 164 HARDNESS2: 161			
029	5	57059	36-4X11/2 XS A105 FLEX B			
			C	.200 MN	1.040 P	.006 S .019 SI .220
			NI	.020 CU	.080 CO	.002 CR .040 MO .010
			V	.000 AL	.017 NB	.010
			CE(LONG FORMULA) = 0.39			
			T/S 76913 Y/S 51276 EL 29.35 RA 63.47			
			BRINELL HARDNESS1: 144 HARDNESS2: 141			
030	25	57118	36-3/4X11/2 3M A105 FLEX S			
			C	.200 MN	1.020 P	.008 S .020 SI .210
			NI	.020 CU	.060 CR	.040 MO .010 V .000
			NB	.016		
			CE(LONG FORMULA) = 0.39			
			T/S 78875 Y/S 51125 EL 29.55 RA 63.75			
			BRINELL HARDNESS1: 150 HARDNESS2: 150			
031	30	57261	36-11/2X3/4 3M A105 FLEX S			
			C	.200 MN	1.010 P	.016 S .021 SI .140
			NI	.050 CU	.170 CO	.005 CR .110 MO .020
			V	.000 AL	.024 NB	.014
			CE(LONG FORMULA) = 0.41			
			T/S 81875 Y/S 52875 EL 29.75 RA 63.95			
			BRINELL HARDNESS1: 162 HARDNESS2: 159			

MTR-OK DW
 P.O.# 87533
 STOK
 11-20-07

***** CONTINUED ON NEXT PAGE *****

I certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks

stock 3/4" 3M/6M CRP.
 #18 "S4" CPLG

by
 Chris Boozer

CERTIFIED MILL TEST REPORT



The Best Value
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All The Time.

LOG NO. 315307

PAGE 21

BONNEY FORGE
P.O. BOX 330 • 14498 CROGHAN PIKE • MOUNT UNION, PA 17066-033
(814) 542-2545 • (800) 345-7546 • FAX (814) 542-4906
www.bonneyforge.com

CUSTOMER: LYNCO FLANGE AND FITTING, INC.

Date 11/05/07

CUSTOMER'S Order No.: H-102107-S

Bonney Order No. 000020206

SHIPPED TO: LYNCO FLANGE AND FITTING, INC.
5114 STEADMONT DRIVE

HOUSTON, TX 77040 United States

ITEM	QUANTITY	LOT NO.	GRADE OR SPECIFICATION NO. CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS:
------	----------	---------	--

1. THE FITTINGS SUPPLIED ARE IN ACCORDANCE WITH PURCHASE ORDER SPECIFICATIONS.
2. THE MATERIAL SUPPLIED IDENTIFIED AS A105GT WAS QUENCHED AND TEMPERED IN ACCORDANCE WITH ASTM A105 HEAT TREATING REQUIREMENTS.
3. CERTIFYING ASTM A105-05 / ASME SA105-04 EDITION.
4. ELONGATION TEST RESULTS ARE OBTAINED USING STANDARD ROUND SPECIMEN, 2 INCH OR 50 MM GAGE LENGTH.
5. THE PRODUCT SUPPLIED WAS INSPECTED IN ACCORDANCE WITH EN 10204:2004 EDITION TYPE 3.1 INSPECTION DOCUMENT. (EUROPEAN STANDARD)
6. THE MATERIAL SUPPLIED MEETS THE REQUIREMENTS OF BOTH NACE MR0103-2005 AND NACE MR0175-2002.

***** END OF CERTIFICATION *****

certify that the data on this sheet is a true copy taken from our records of material furnished us by the production mill, or as obtained by additional laboratory checks.

by

Cris Bodiel

**BONNEY FORGE**

U.S. ROUTE 522 SOUTH
P.O. BOX 330
MOUNT UNION, PA 17066
(814) 542-2545 (800) 345-7546
FAX (814) 542-9977 TELEX 910-240-9091

CERTIFIED MILL TEST REPORT

LYNCO FLANGE AND FITTING, INC.

12/19/07

LOT NO.	CHEMICAL ANALYSIS, PHYSICAL PROPERTIES, REMARKS																																																												
3964 ✓	1/4" 3M/6M A105 Hexagon Plug Threaded ✓																																																												
	<table border="1"><tr><td>C</td><td>0.180 ✓</td><td>MN</td><td>0.690 ✓</td><td>P</td><td>0.016 ✓</td><td>S</td><td>0.012 ✓</td><td>SI</td><td>0.210 ✓</td></tr><tr><td>NI</td><td>0.017 ✓</td><td>CR</td><td>0.035 ✓</td><td>MO</td><td>0.007 ✓</td><td>CU</td><td>0.031 ✓</td><td>V</td><td>0.000 ✓</td></tr><tr><td>CB</td><td>0.020 ✓</td><td colspan="8"></td></tr><tr><td colspan="10">CE(LONG FORMULA) = 0.307 ✓</td></tr><tr><td colspan="10">T/S 0 Y/S 0 EL 0.000 RA 0.000</td></tr><tr><td colspan="10">BRINELL HARDNESS: 156 ✓</td></tr></table>	C	0.180 ✓	MN	0.690 ✓	P	0.016 ✓	S	0.012 ✓	SI	0.210 ✓	NI	0.017 ✓	CR	0.035 ✓	MO	0.007 ✓	CU	0.031 ✓	V	0.000 ✓	CB	0.020 ✓									CE(LONG FORMULA) = 0.307 ✓										T/S 0 Y/S 0 EL 0.000 RA 0.000										BRINELL HARDNESS: 156 ✓									
C	0.180 ✓	MN	0.690 ✓	P	0.016 ✓	S	0.012 ✓	SI	0.210 ✓																																																				
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T/S 0 Y/S 0 EL 0.000 RA 0.000																																																													
BRINELL HARDNESS: 156 ✓																																																													

1. THE MATERIAL SUPPLIED MEETS THE REQUIREMENTS OF NACE MRO175-2002 AND MRO103-2005
2. THE MATERIAL SUPPLIED WAS INSPECTED AND MANUFACTURED IN ACCORDANCE WITH EN DIN 10204 3.1.B.
3. CERTIFYING ASTM A105-05 / ASME SA105-04 EDITION ✓

THIS DOCUMENT HAS BEEN ELECTRONICALLY SUBMITTED.

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MTR-OK DP
12-24-07
PO 87871
J-17315

PC# 19
1/4" NPT PLUG.

I hereby certify this is a true and exact
copy of the original Mill Test Report.

LYNCO FLANGE & FITTING
Coordinator

3/8" K. STOCK SA-516-70 HT. 103750 SN-02804

NUCOR P.O.Box 279
Winton, NC 27988
PLATE MILL (252) 356-3700

Mill Test Report Page 1



Issuing Date : 05/27/2007 B/L No. : 164743 Load No. : 166706 Our Order No. : 53074/3 Cust. Order No. : 7802
Vehicle No: LW 62083 Sold To : RANGER STEEL SERVICES LP Ship To : RANGER STEEL
Specification : 0.3750" x 120.000" x 480.000" 1225 NORTH LOOP W. STE 650
ASTM A516 70-06/ASME SA516 70-90 PVQ 2006 Normalized Tests at HOUSTON, TX 77008
1850 F 30 min. minimum

Marking :

Heat No	C	Mn	P	S	SI	Cu	NI	Cr	Mo	Alz	V	Nb	TI	N	Ca	B	Sn	CEQ	PCM
7103750	0.19	1.02	0.017	0.004	0.19	0.25	0.07	0.13	0.01	0.031	0.006	0.001	0.002		0.0008	0.0001	0.010	0.41	0.27

Tensile Test										Charpy Impacts									
Plate Serial No	Pieces	Tons	Dir.	(ksi) Yield	(ksi) Tensile	Elongation % in 2"	Elongation % in 8"	Dir.	1	(ft) shear	2	(ft) shear	3	(ft) shear	Ave.	(ft) shear	Size	Temp	Min Ave.
7103750-02	6	18.37	T	55,000	79,300		21.8												
7103750-03	6	18.37	T	56,400	80,700		23.1												
7103750-04	6	18.37	T	56,400	81,100		21.3												
7103750-05	3	9.18	T	55,200	80,100		20.9												
7103750-02	6	18.37	T	46,000	71,100		20.9	N											
7103750-03	6	18.37	T	47,500	72,400		17.5	N											
7103750-04	6	18.37	T	46,600	71,100		23.6	N											
7103750-05	3	9.18	T	46,000	70,600		23.8	N											

MTK-OK DW

P.O.# 86053

STOCK # 07GC01 07GC02

7/5/07 07GC03 07GC04

07GC05

Normalized 30 minutes per inch of thickness at 1650 F ± 25 F. Hold 30 minutes minimum.

RANGER STEEL SUPPLY CORP.
Q.C. APPROVED

Manufactured to fully killed fine grain practice by Electric Arc Furnace. Welding or weld repair was not performed on this material. Mercury has not been used in the direct manufacturing of this material. Produced as continuous cast as-rolled discrete plate.

Yield by 0.5EJL method unless otherwise specified. $Ceq = C + (Mn/5) + ((Cr+Mo+V)/5) + ((Cu+Ni)/15)$

$Pcm = C + (Si/30) + (Mn/20) + (Cu/20) + (Ni/60) + (Cr/20) + (Mo/15) + (V/10) + 5B$

Melted and manufactured in the USA. ISO 9001-2000 certified (#12443-0) by SRI Quality System Registrar (#0985-09). PED 97/23/EC 7/2 Annex 1, Para. 4.3 Compliant.

DIN 50049 3.1.B/EN 10204 3.1.B(2004) compliant. For ABS grades only, Quality Assurance certificate No. 03-MMPQA-182

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Deprele

T. A. Deprele, Metallurgist

05/29/2007 3:23:18 PM

PC#20 Support Pad

REVISION



SHELL & TUBE HEAT EXCHANGER DATA SHEET

PROJECT NO.: MI JOB # 17315
P.O. NO.: 4400839977
INQUIRY NO.: BMT G-1 1ST EFFECT
MADE BY: KL 12/18/2007
REVISION: 0

ITEM NO.: E-1530
P.O. DATE: 12/12/2007
VENDOR: METALFORMS INC.
APPROVED:
REV. DATE: 12/18/2007

PLANT: BMO (GLYCOL 1)

PROJECT:

SERVICE DATA

1	SERVICE OF UNIT: GLYCOL 1 FIRST EFFECT REBOILER					NO. UNITS: 1							
2	SIZE: 30-140	TYPE: "-E-"	ARRANGEMENT: VERTICAL			CONNECTED IN: N/A							
3	SURF./UNIT: EFFECTIVE: N/A		SQ.FT.		SHELLS/UNIT: N/A		SURF./SHELL: EFFECTIVE: N/A		SQ. FT.				
4	USER: EQUSTAR CHEMICAL, LP			LOCATION: BEAUMONT, TX									
PERFORMANCE OF ONE UNIT													
5					SHELL SIDE				TUBE SIDE				
6	FLUID NAME				N/A				N/A				
7	FLUID FLOW RATE - TOTAL LB/HR				N/A				N/A				
8					IN		OUT		IN		OUT		
9	VAPOR LB/HR				N/A		N/A		N/A		N/A		
10	LIQUID LB/HR				N/A		N/A		N/A		N/A		
11	STEAM LB/HR				N/A		N/A		N/A		N/A		
12	WATER LB/HR				N/A		N/A		N/A		N/A		
13	NONCONDENSABLE LB/HR				N/A		N/A		N/A		N/A		
14	TEMPERATURE F				N/A		N/A		N/A		N/A		
15	MOLE WT.: VAPOR				N/A		N/A		N/A		N/A		
16	MOLE WT.: NONCONDENSABLE				N/A		N/A		N/A		N/A		
17	DENSITY LB/FT ³				LIQ.	N/A	VAP.	N/A	LIQ.	N/A	VAP.	N/A	
18	VISCOSITY Cp				LIQ.	N/A	VAP.	N/A	LIQ.	N/A	VAP.	N/A	
19	THERMAL CONDUCTIVITY BTU/HR-FT-F				LIQ.	N/A	VAP.	N/A	LIQ.	N/A	VAP.	N/A	
20	SPECIFIC HEAT BTU/LB-F				LIQ.	N/A	VAP.	N/A	LIQ.	N/A	VAP.	N/A	
21	LATENT HEAT BTU/LB				N/A				N/A				
22	SURFACE TENSION DYNE/CM				N/A				N/A				
23	VELOCITY FT/SEC				N/A				N/A				
24	OPERATING PRESSURE PSIA				N/A				N/A				
25	PRESSURE DROP PSI				ALLOW.	N/A		CALC.	N/A		ALLOW.	N/A	
26	FOULING RESISTANCE HR-(FT) ² -F/FTU				N/A				N/A				
27	FILM COEFFICIENT BTU/HR-(FT) ² -F				N/A				N/A				
28	HEAT EXCHANGED BTU/HR				N/A				MTD, F:		N/A (CORRECTED) (WEIGHTED)		
29	OVERALL HT. TRANS. COEFF. BTU/HR-(FT) ² -F				SERVICE: N/A		CLEAN: N/A						

CONSTRUCTION DATA

30		SHELL SIDE				TUBE SIDE				SKETCH (BUNDLE/NOZZLE ORIENTATION)						
31	PRESSURE, PSIO	DESIGN	320	TEST	400	DESIGN	133	TEST	NONE							
32	TEMPERATURE, F	DESIGN	470	ADMIT	-20	DESIGN	400	ADMIT	CODE							
33	NO. PASSES/SHELL	1				1										
34	CORR. ALLOW., IN.	1/16"				1/8"										
35	NOZZLES	NO.	N/A	RATING & TYPING		NO.	N/A	RATING & TYPING								
36	INLET	8"	300W	RFLWN		N/A	N/A	N/A								
37	OUTLET	6"	300W	RFLWN		N/A	N/A	N/A								
38	VENT	14"		NPT W/PLUG		N/A	N/A	N/A						MATERIALS: (MARK SR AND PERCENT NR)		
39	DRAIN	14"		NPT W/PLUG		N/A	N/A	N/A		TEMP						
40	INST. CONN.	3/4"	6000W	CPLG		N/A	N/A	N/A		ITEM		MATL	DEGT	SPECIFICATION		
40	TEMPERATURE CONN.	3/4"	6000W	CPLG		N/A	N/A	N/A		TUBES		CNTL		SA-179		
41	PRESSURE CONN.	3/4"	6000W	CPLG		N/A	N/A	N/A		SHELL		CSTL		SA-516-70		
42	CHEMICAL CLEAN	1 1/2"	300W	RFLWN		N/A	N/A	N/A		TUBESHEETS		CSTL		SA-516-70		
43	SPARE GASKETS REQUIRED:	(ND)								BAFFLES		CSTL		SA-36		
44	TEST RING REQ'D:	(NO)				STACKING: N/A HIGH				IMPACT PLATE		CSTL		SA-36		
45	INSULATION THICKNESS:	SHELL SIDE: N/A				TUBE SIDE: N/A IN.				TIE RODS		CSTL		SA-36		
46	CODE: ASME, SEC. VIII, Div. I	ES-200 & AP 660:				YES				TEMA: II		SPACERS		CNTL	SA-214	
47	SHELL DIA.	OD	31	ID	30	IN.										
48	TUBES: NO-SHELL	105	OD	0.75	IN.	THICK. 14 (MW)				IN.		LENGTH: 20'-0"		STR. LGTH	TUBE PITCH: 1	IN.
49	CROSS BAFFLES	TYPE	SSEG	HORIZ. 44.8		% CUT (DIAM.)				TUBE LAYOUT:		30	DEG.			
50		SPACING	INLET	20 15/16		IN.		CENTER		29 1/2	IN.		OUTLET	20 13/16		IN.
51	LONG BAFFLE TYPE	N/A				SEAL RODS / STRIPS				NO	QTY.:	N/A	SIZE:	N/A		
52	TIME TO TUBESHEET JOINTS:	(STRENGTH WELDED & THEN ROLLED)				IMPEDEMENT PROTECTION				YES	TYPE	CIRCULAT PLATE				
53	GASKETS: SHELL SIDE	N/A				TUBE SIDE				N/A	FLOATING HEAD		N/A			
54	SUPPORTS: TUBE	N/A				U-BEND				EXPANSION JOINT		NO*	TYPE			
55	PV2 LB-FT2-SEC2:	INLET NOZZLE: N/A				BUNDLE ENTRANCE				N/A	BUNDLE EXIT		N/A			
56	WEIGHT/SHELL - SHIPPING	14,000				FILLED WITH WATER				N/A		BUNDLE		N/A	LB	
57	SPECIAL SERVICE DESIGNATIONS:	HYDROGEN: SHELL SIDE / TUBE SIDE / NONE				HIGHLY LEAK SENSITIVE: YES				CYCLIC: YES / NO						

NOTES

58	NO THERMAL OR VIBRATIONAL EVALUATION PERFORMED.														
59	REPLACEMENT-IN-KIND (SHELL & BUNDLE ONLY) EQUIP. SAP#: 10202806 ; EQUIP. TAG#: 2300021														
60	*CAUTION: DO NOT START-UP OR RUN TUBE SIDE WITHOUT SHELL SIDE.														
61	MAINTAINING EXISTING TUBESHEET THICKNESS, EXISTING THREADED NPT CONNECTIONS ON TUBESHEETS, IMPACT PLATE, & EXISTING COUPLINGS.														

METALFORMS, INC.
CONSTRUCTION DETAIL SHEET

Page 1 of 1

CUST: <u>EQUISTAR CHEMICALS, LP</u>	P.O.: <u>4400839977</u>	MDES: <u>BK 12/18/2007</u>	M REV0: <u>12/11/2007</u>
ITEM: <u>E-1530</u>	JOB: <u>17315</u>	MCHK: <u>VA 12/18/2007</u>	M REV1: <u>12/18/2007</u>
SERV: <u>GLYCOL 1 FIRST EFFECT REBOILER</u>		MREV: <u>1</u>	M REV2: <u></u>
INQ: <u>BMT G-1 1ST EFFECT</u>	EQUIP. SAP#: <u>10202806</u>		M REV3: <u></u>
QUOTE: <u>Q-1224-2007-0 (A-1-0)</u>	EQUIP. TAG#: <u>2308021</u>		M REV4: <u></u>
	PLANT: <u>BMO (GLYCOL1)</u>		

PHYSICAL CHARACTERISTICS:

TEMA Size: <u>30-240</u>	TEMA Type: <u>-E-</u>	Shipping Weight: (approx.) (#): <u>14,000</u>
Tube Qty: <u>705</u>	Tube O.D.: <u>3/4"</u>	Tube Gauge: <u>14 (MW)</u>
Shell I.D.: <u>30"</u>	Channel I.D.: <u>N/A</u>	Kettle I.D.: <u>N/A</u>
Shell Thk.: <u>1/2"</u>	Channel Thk.: <u>N/A</u>	Kettle Thk.: <u>N/A</u>
Tube Length: <u>20' - 0"</u>	Pinned Tubes: <u>N/A</u>	F.P.I.: <u></u>

☒ SEAMLESS TUBES
☐ WELDED TUBES

METALLURGIES:

BUNDLE		SHELL		CHANNELS	
Tubes	SA-179	Shell Cylinder	SA-516-70	Channel Cylinders	N/A
Tubesheets	SA-516-70	Shell Body Flanges	N/A	Channel Covers	N/A
Tubesheet Overlay	N/A	Shell Body Flange Gaskets	N/A	Channel Body Flanges	N/A
Baffles	SA-36	Bolting @ Shell Body Flanges	N/A	Bolting @ Channel Body Flanges	N/A
Impact Plate	SA-36	Expansion Joint	NONE	Channel Body Flange Gaskets	N/A
Tie Rods	SA-36	Shell Cover	N/A	Floating Head Cover	N/A
Spacers	SA-214	Shell Cover Flange	N/A	Floating Head Cover Flange	N/A
Seal/Skid Bars	NONE	Eccentric Reducer	N/A	Floating Head Cover Gasket	N/A
		Kettle Cylinder	N/A	Pass Partition Plates	N/A

FEATURES:

TUBE-TO-TUBESHEET JOINT: <u>WELDED & THEN ROLLED</u>	PMI: <u>NO</u>
EXPANSION JOINT: <u>NONE</u>	STRESS RELIEVE U-BENDS: <u>N/A</u>
TUBE END WELDS PWHT: <u>NO</u>	SPARE SETS OF GASKETS: <u>NONE</u>

DESIGN CRITERIA:

Shell Side Design Conditions (Internal): <u>320 psi @ 470°F</u> (Press. & Temp.)	Tube Side Design Conditions (Internal): <u>133 psi @ 400°F</u> (Press. & Temp.)
Shell Side Design Conditions (External): <u>NONE</u> (Press. & Temp.)	Tube Side Design Conditions (External): <u>NONE</u> (Press. & Temp.)
SHELL SIDE MDMT: <u>-20°F @ 320 psi</u> (Temp. & Press.)	TUBE SIDE MDMT: <u>CODE</u> (Temp. & Press.)
SHELL SIDE RADIOGRAPHY: <u>RT-3</u>	TUBE SIDE RADIOGRAPHY: <u>NONE</u>
SHELL SIDE PWHT: <u>NO</u>	TUBE SIDE PWHT: <u>NO</u>
SHELL SIDE DESIGN FOR: <u>NORMAL SERVICE</u>	TUBE SIDE DESIGN FOR: <u>No Consideration for Any Service</u>
SHELL SIDE HYDROTEST: <u>CODE</u>	TUBE SIDE HYDROTEST: <u>NONE</u>

TEMA Class: R

CODE: ASME, SEC.VIII, DIV. 1

SCOPE:

FABRICATE ONE (1) 30-240 BEL (S/T) HEAT EXCHANGER. (LESS HEADS) (IDENTICAL TO METALFORMS OLD MI JOB # 12917)

PAINT: NEAR-WHITE SANDBLAST PER SSPC-SP10 & PRIME WITH ONE (1) COAT OF CARBOLINE CARBOZINC #11, 3-4 MILS D.F.T.

TUBES ARE STRENGTH WELDED & THEN ROLLED TO TUBESHEET.	NO TUBE-TO-TUBESHEET MOCK-UP INCLUDED.
HIGH SENSITIVITY HELIUM LEAK TEST INCLUDED.	NO BOLTS OR GASKETS INCLUDED.

CODE AS A PART WITH PROPER U-2 FORM.

EXPANSION JOINT EVALUATED FOR THESE CONDITIONS:	CASE	SS	TS	EXP. JT. REQ'D
	Normal	413°F	384°F	NO
	SS Start-Up	253°F	210°F	NO
	Winter Start-Up	409°F	360°F	NO
	TS Start-Up	76°F	324°F	YES *

*CAUTION: DO NOT START-UP OR RUN TUBE SIDE WITHOUT SHELL SIDE.

GROUNDING LUGS NOT INCLUDED.

NO INSULATION CLIPS OR RINGS INCLUDED.

EXCEPTIONS:

MAINTAINING EXISTING TUBESHEET THICKNESS, EXISTING THREADED NPT CONNECTIONS ON TUBESHEETS, IMPACT PLATE, & EXISTING COUPLINGS.

NO THERMAL OR VIBRATIONAL EVALUATION PERFORMED AT THIS TIME. ANY MODIFICATIONS RESULTING FROM FUTURE EVALUATIONS WOULD BE AT AN ADDED COST, PENDING CUSTOMER APPROVAL.

Metalfoms, Inc.
160 Garth Rd. Cheek, TX 77705
WELDING PROCEDURE SPECIFICATION (WPS)

WPS No.: M-1 Date: 01/05/89 Revision No.: 9 Date: 06/29/00
Supporting PQRs: M-1

BASE METAL (QW-403, QW-405)
P No. 1 to P No.: 1
Thickness range. 0.1875" to 1.5000"
Position(s) All positions (see note)
Progression Vertical Up
notes :Vertical down for root pass only

JOINT (QW-402)
Joint design Groove/Fillet (see pg 2)
Backing..... With backing only
Backing Matl Weld metal
Fillet Weld Size All (QW-451.4)
notes _____

PREHEAT (QW-406)
Minimum Temperature. 50 Degrees F.
Max. Interpass Temp. 300 Degrees F.
Preheat Maintenance. :note (n6) below

POSTWELD HEAT TREATMENT (QW-407)
Temperature range None
Time range None
notes _____

Process / type All pass(es)
Process thickness limit. SMAW / manual
1.5000" Max.

None
None

GAS (QW-408)
Shielding Gas / CFH..... N/A / -
Trailing Gas / CFH..... N/A / -
Backing Gas / CFH..... N/A / -

None / -
None / -
None / -

FILLER METAL (QW-404)
AWS classification..... E7018
SFA Spec. No. & F No.... SFA#: 5.1 F#: 4
A No. or Chem. Comp..... 1
Filler metal trade name. n/r
SAW flux trade name/type N/A / -
Elec./Wire size (in) ... 1/8 | 5/32 | -
ELECTRICAL (QW-409)
Welding amperage range.. 90-160 | 130-220 | -
Welding voltage range... 21-23 | 22-23 | -
Travel speed (ipm)..... 4-9 | 4-9 | -
Max. Heat Input (J/in).. None
Tungsten Type/Size..... N/A / -
Current & Polarity..... DCEP (reverse)

None
SFA#: None F#: -
None
None
None / -
- | - | -
- | - | -
- | - | -
None
N/A / -
N/A

TECHNIQUE (QW-410)
String / weave bead..... String Bead
Orifice / gas cup..... N/A
Contact tube to work.... N/A
Oscillation..... None
Mult./Single electrode.. Single Electrode
Other Technique Notes... _____

N/A
None
None
None
N/A
None

Multiple or Single Pass (per side).... Multiple Passes

(n1) No peening will be done with this procedure.

(n2) No pass greater than 1/2" will be used.

(n3) Preheat to 175 Deq.F if T>1" & C>0.30%; To 200 Deq.F if T> 1-1/4".

(n4) _____

(n5) No backing rings, strips, or retainers will be used.

(n6) No preheat maintenance required after welding.

(n7) Not used for group 2 materials with min. specified tensile > 70 ksi.

WELDING PROCEDURE SPECIFICATION (WPS)

Page 2 of 2

WPS No.: M-1 Date: 01/05/89 Revision No.: 9 Date: 06/29/00

JOINT (QW-402) : See detail drawings also.

Single-V groove

Backing : gouged & back welded
Root Opening: 0 - 5/32"
Groove Angle: 45 +/- 2 1/2 degrees
Root Face : 0 - 1/8"

Double-V groove

Backing : gouged & back welded
Root Opening: 0 - 5/32"
Groove Angle: 45 +/- 2 1/2 degrees
Root Face : 0 - 1/8"

Single/Double Fillet

Backing : with backing
Root Opening: n/a
Weld Size : as required

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL OF THOSE FOUND ON A JOB SITE. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial cleaning : See note (c) below.
Method of back gouging : See note (d) below.

- (a) Preheating shall be applied in the same manner during thermal cutting, tacking, gouging, & welding operations.
- (b) Welds shall be cleaned between each pass. When completed, remove all slag and projections.
- (c) Remove rust, scale, grease, oil, & other contaminants from both sides of weld bevel prior to welding.
- (d) Backside of the weld shall be gouged, ground, & then rewelded with SMAW (groove welds only)
- (e) Minimum preheat shall be maintained during welding.

We certify that the statements in this record are correct and in accordance with the requirements of Sections IX and VIII of the ASME Code.

Prepared By: Donald Papadopoulos (06/29/00) QC Manager

Metallforms, Inc.
160 Garth Rd. Cheek, TX 77705
Procedure Qualification Record (PQR)

PQR No.: M-1 Date: 01/06/75 WPS No.: M-1 Rev 9

JOINT DESIGN (QW-402)
WELD JOINT CONFIGURATION
Single-V groove
Back-gouged & back welded
Groove Angle : 60 Degrees
Root Opening : 1/16 Inches
Root Face : 1/16 Inches

note: _____

POSITION (QW-405)
Position of Joint : 5G - Mult.
Progression: Vertical Up
note: _____

BASE METAL (QW-403)
Material form. Pipe / Tube
Material Spec. SA-53-B
To SA-53-B
P No. 1 Gr. 1 to P No. 1 Gr. 1
Thickness (in) 0.8640 Dia. (in) 6.0000

HEAT TREATMENT (QW-406, QW-407)
Preheat Temperature: 50 Degrees F.
Preheat Maintenance: Note (n3) below.
Max. Interpass Temp.: - Degrees F.
PWHT temperature: None Degrees F.
PWHT Holding time (hr): None
note: _____

Weld Process / type	All pass(es)	None
GAS (QW-408)	SMAW / manual	
Shielding Gas / CFH.....	N/A / -	None / -
Trailing Gas / CFH.....	N/A / -	None / -
Backing Gas / CFH.....	N/A / -	None / -

Filler Metal (QW-404)	None
AWS Classification.....	None
SFA Spec. No. & F No.... SFA#: <u>5.1</u> F#: <u>4</u>	SFA#: <u>None</u> F#: <u>-</u>
A No. or Chem. Comp.....	None
Filler Metal Trade Name.....	None
SAW Flux Trade Name/Type.....	None / -
Weld Deposit 't' (in)....	None
Elec./Wire Size (in)....	- / - / -
ELECTRICAL (QW-409)	
Amperage USED.....	- / - / -
Voltage USED.....	- / - / -
Travel Speed (ipm).....	- / - / -
Max. Heat Input (J/in)...	None
Tungsten Type & Size....	N/A / -
Current Type/Polarity...	N/A

TECHNIQUE (QW-410)	None
String or Weave Bead....	N/A
Orifice/Gas Cup Size....	None
Contact Tube to Work....	None
Oscillation.....	N/A
Mult./Single Electrodes.....	N/A
Other Technique Notes....	None
Multiple or Single Pass (per side)....	Multiple Passes

- (n1) Peening was not used with this weld test.
(n2) No Pass > 1/2" was used.
(n3) No preheat maintenance after welding.
(n4) No retainer was used. No backing strips or rings used.
(n5) Removed scale, grease, oil, & other contaminants from edges of weld bevel.

Procedure Qualification Record (PQR)

PQR No.: M-1

Page 2 of 2

TENSILE TEST (QW-150)

Specimen No.	Width (in.)	Thick. (in.)	Area (sq.in.)	Ultimate total load (lb)	Ultimate stress (psi)	Type of failure and location
T-1	0.748	0.622	0.465	34700	74600	Ductile - BM
T-2	0.781	0.621	0.485	35400	73000	Ductile - BM

GUIDED BEND TEST (QW-160)

Figure No. and Type	Result	Figure No. and Type	Result
QW-462.2 Side bend	Satisfactory	QW-462.2 Side bend	Satisfactory
QW-462.2 Side bend	Satisfactory	QW-462.2 Side bend	Satisfactory

TOUGHNESS TEST (QW-170)

Spec. No.	Notch Location	Notch Type	Test Temp. (°F)	Impact Values (ft-lbs)	Lateral exp.		Drop weight break
					Shear %	Mils	
None							

HARDNESS TEST - Brinell hardness

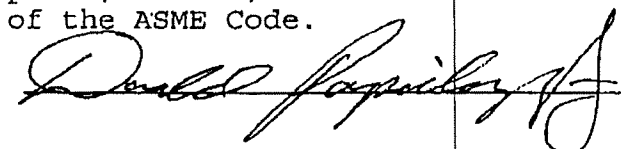
Base metal	-1-	-2-	-3-	HAZ	-1-	-2-	-3-	WM	-1	-2-	-3-
SA-53-B					174	174	174		191	186	168

(Heat Affected Zone=HAZ, Weld Metal=WM)

Notes: Editorial corrections only on October 02, 2000.

Stamp: - Welder's Name: RICKIE BROWN ID: 450-02-4083
 Tests conducted by: Southwestern Labs Laboratory Test No: 2445*
 PQR was done & welding of coupon was witnessed by : Metalforms, Inc.

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

Certified by:  (01/02/97) QC Manager



Metalforms, Inc.
160 Garth Road
Check, TX 77705

Welding Procedure Specification (WPS)

WPS No.: A-4

Date: 12/7/1982

Rev. No.: 5

Date: 2/27/2002

Page 1 of 2

Supporting PQR(s): A-4

Welding Process(es) / Type(s): (1) SMAW / Manual (2) SAW / Machine

Joint Design (QW-402)					
Weld Type: Groove and fillet welds					
Joint Type	Backing	Root Opening	Groove Angle	Root Face	Groove Radius
Single-V groove	gouged & back welded	0 - 5/32"	42.5 Deg. - 47.5 D	0 - 1/8"	
Fillet Welds: All (QW-451.4)					
Retainers: None					
See Detail Drawings.					
WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.					
Base Metals (QW-403)					
P-No. 1 Thickness Range: 0.1875 in. to 1.5000 in.					
to P-No. 1					
Flat position only with SAW					
Preheat (QW-406)			Postweld Heat Treatment (QW-407)		
Minimum Preheat Temperature: 60 °F			PWHT Type: No PWHT will be performed		
Maximum Interpass Temperature: 400 °F			PWHT Temperature: None °F		
Preheat Maintenance: None			PWHT Holding Time: None		
Initial and Interpass Cleaning: With wire-brush, clean 1" both sides of weld joint.					
Method of Back Gouging: When required, grind until all defects are removed.					
Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.					
Welds shall be cleaned between each pass. When completed, remove all slag and projections.					
Maximum heat input in case of impact: SMAW - 44850 J/in & SAW - 70714 J/in.					
No recrushed slag will be used.					

We certify that the statements in this specification are correct and in accordance with the requirements of Section IX of the ASME Code.

Prepared By:

[Signature]

2/27/2002

Date

QC MANAGER

Accepted By:

[Signature]

Date

QC Manager

Welding Procedure Specification (WPS)

WPS No.: A-4

Rev. No.: 5

Page 2 of 2

First Process:	SMAW	Type:	Manual
Filler Metal (QW-404)			
Weld Deposit Limits:	0.0000 in. to 0.2500 in.	No Pass Greater Than 1/2" Allowed	
AWS Classification:	E7018	SFA Specification:	5.1 F-No.: 4
A-No. or Chemical Composition:	1	Filler Metal Trade Name:	N/R
Position (QW-405)		Technique (QW-410)	
Position of Joint:	All Positions (see notes)	Stringer or Weave Bead:	Stringer bead
Weld Progression:	Vertical up	Peening:	None
Notes:	Flat position only with SAW		
Electrical Characteristics (QW-409)			
Current Type and Polarity:	DCEP (reverse)		
Max. Heat Input (J/in):	None		

No peening done with this procedure, No retainers will be used.

No pass greater than 1/2" allowed.

No supplementary filler metal will be used with this procedure.

Base metal thickness range in case of impact: 5/8" to 1-1/2".

Group 2 materials only in case of impact.

No vertical uphill progression in case of impact.

Preheat to 175F if "T" > 1" and C > 0.3%; To 200F if T > 1-1/4".

First Process Welding Parameters

Layer(s) and/or Pass(es)	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
	AWS Classification	Size (in.)	Type and Polarity	Amperage Range		
Any	E7018	1/8	DCEP (reverse)	130	23	4-8
Any	E7018	5/32	DCEP (reverse)	130-220	22-25	3-8

Second Process:	SAW	Type:	Machine
Filler Metal (QW-404)			
Weld Deposit Limits:	0.0000 in. to 1.2500 in.	No Pass Greater Than 1/2" Allowed	
AWS Classification:	EM12K	SFA Specification:	5.23 F-No.: 6
A-No. or Chemical Composition:	1	Flux Trade Name:	Lincoln 860
Flux Trade Name:	Lincoln 860	Flux Type:	Neutral
Supplemental Filler Metal:	None		
Flux from Recrushed Slag:	None		
Position (QW-405)		Technique (QW-410)	
Position of Joint:	Flat only	Stringer or Weave Bead:	Stringer bead
Notes:	Flat position only with SAW		
Electrical Characteristics (QW-409)		Oscillation:	None
Current Type and Polarity:	DCEP (reverse)	Peening:	None
Max. Heat Input (J/in):	None	Contact Tube to Work Distance:	1-1/4" B.S.O. - SAW
		Multiple or Single Electrode(s):	Single electrode
		Electrode Spacing:	N/A
		Multiple / Single Pass (per side):	Multipass

Second Process Welding Parameters

Layer(s) and/or Pass(es)	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
	AWS Classification	Size (in.)	Type and Polarity	Amperage Range		
Any	F7A2-EM12K	3/32	DCEP (reverse)	405-495	25-31	12-15
Any	F7A2-EM12K	5/32	DCEP (reverse)	495-505	32-34	12-15



Metalforms, Inc.
160 Garth Road
Cheek, TX 77705

Procedure Qualification Record (PQR)

PQR No.: A-4 WPS No.: _____ Date: 12/7/1982 Page: 1 of 2

Welding Process(es) / Type(s): (1) SMAW / Manual (2) SAW / Machine

Joints (QW-402) Weld Type: <u>Groove weld</u> <u>Single-V groove</u> Backing: <u>Back-gouged and back welded</u> Root Opening: <u>1/16</u> in. Root Face: <u>1/16</u> in. Groove Angle: <u>60</u> °	
Base Metals (QW-403) Material Spec., Type or Grade: <u>SA-515, Grade 70</u> to <u>SA-515, Grade 70</u> P-No.: <u>1</u> Group No.: <u>2</u> to P-No.: <u>1</u> Group No.: <u>2</u> Thickness of Test Coupon (in.): <u>0.7500</u>	Postweld Heat Treatment (QW-407) Type: <u>No PWHT performed</u> Temperature: <u>None</u> °F Time: <u>None</u> hr
Filler Metals (QW-404) SFA Specification: <u>(1) 5.1 (2) 5.17</u> AWS Classification: <u>(1) E7018 (2) F7A2-EM12K</u> Filler Metal F-No: <u>(1) 4 (2) 6</u> Weld Metal Analysis A-No: <u>(1 & 2) 1</u> Size of Filler Metal (in.): <u>(1) 0.1250 (2) 0.1563</u> Weld Deposit 't' (in.): <u>(1) 0.1250 (2) 0.6250</u> Pass Greater Than 1/2": <u>(1 & 2) No</u> Filler Metal Trade Name: <u>(2) Lincoln L-61 wire</u> Supplemental Filler Metal: <u>(2) None</u> Flux Trade Name / Type: <u>(2) Lincoln 860 / Neutral</u> Recrushed Slag: <u>(2) None</u>	Gas (QW-408) <u>Gas Composition / Flow Rate</u> Shielding: <u>(1 & 2) N/A</u> Trailing: <u>(1 & 2) N/A</u> Backing: <u>(1 & 2) N/A</u>
Positions (QW-405) Position of Joint: <u>(1 & 2) 1G - Flat</u> Weld Progression: <u>(1 & 2) N/A</u>	Electrical Characteristics (QW-409) Current / Polarity: <u>(1 & 2) DCEP (reverse)</u> Amps: <u>(1) 130 (2) 500</u> Volts: <u>(1) 23 (2) 33</u> Tungsten Type / Size: <u>(1 & 2) N/A</u> Heat Input: <u>(1) 44850 J/in (2) 70714 J/in</u>
Preheat (QW-406) Preheat Temp.: <u>60</u> °F Interpass Temp.: <u>400</u> °F Preheat Maintenance: <u>None</u>	Technique (QW-410) Travel Speed (in/min): <u>(1) 4-6 (2) 14</u> String/Weave Bead: <u>(1 & 2) Stringer bead</u> Oscillation: <u>(1) N/A (2) None</u> Mult./Single Pass (per side): <u>(2) Multipass</u> Mult./Single Electrode: <u>(1) N/A (2) Single electrode</u> Electrode Spacing: <u>(1 & 2) N/A</u> Contact Tube to Work Dist.: <u>(2) 1-1/4"</u>
(1) Peening was not used with this weld test. No Pass > 1/2" t.	

Metalforms, Inc.
Procedure Qualification Record (PQR)

PQR No. A-4

Page: 2 of 2

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in ²)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
T-1	1.0000	0.7610	0.7610	60000	78843	Base metal
T-2	1.0000	0.7630	0.7630	59500	77981	Base metal

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Satisfactory	QW-462.2 Side bend	Satisfactory
QW-462.2 Side bend	Satisfactory	QW-462.2 Side bend	Satisfactory
None		None	

Toughness Test (QW-170)

Specimen Number	Notch Location	Notch Type	Test Temp. (°F)	Impact Value (ft-lb)	Lateral Expansion		Drop Weight Break
					Shear %	Mils	
1	Weld metal	"V"	-20	38	20	23	-
2	Weld metal	"V"	-20	42	20	28	-
3	Weld metal	"V"	-20	65	30	47	-
1	HAZ	"V"	-20	23	50	17	-
2	HAZ	"V"	-20	18	40	11	-
3	HAZ	"V"	-20	23	50	15	-

Hardness Test - Brinell hardness

Location	Readings								
	1	2	3	4	5	6	7	8	9
SA-515-70 BM	169	172	168						
SA-515-70 HAZ	174	168	174						
Weld Metal	196	182	182						

** Laboratory test # for impact : 96518 - Je

Impact test specimen size, 10 mm. X 10 mm.

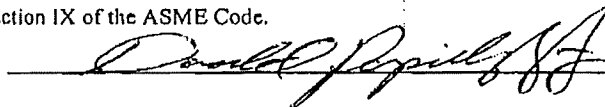
Editorial Corrections on Feb. 26,2002. Added BM BHN#'s on Aug 19,2005

Welder's Name: G.D.Droddy ID: - Stamp: "A"

PQR was done and welding of coupon was witnessed by: Metalforms, Inc.

Tests Conducted By: Southwestern Laboratories Test ID.: 2488Jn**

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

Prepared By:  2/26/2002 Date QC Manager

Metalforms, Inc.
160 Garth Rd. Cheek, TX 77705
WELDING PROCEDURE SPECIFICATION (WPS)

WPS No.: M-21-N Date: 11/15/00 Revision No.: 8 Date: 11/15/00
Supporting PQRs: M-21-N

BASE METAL (QW-403, QW-405) P No. <u>1</u> to P No.: <u>1</u> Thickness range. <u>0.1875"</u> to <u>1.0000"</u> Position(s). <u>Flat & Horizontal</u> Progression. <u>N/A</u> notes _____	JOINT (QW-402) Joint design <u>Groove/Fillet (see pg 2)</u> Backing..... <u>With backing only</u> Backing Matl <u>Weld metal</u> Fillet Weld Size <u>All (QW-451.4)</u> notes <u>See note (d) page 2</u>
PREHEAT (QW-406) Minimum Temperature. <u>50</u> Degrees F. Max. Interpass Temp. <u>400</u> Degrees F. Preheat Maintenance. <u>note (n6) below.</u>	POSTWELD HEAT TREATMENT (QW-407) Temperature range <u>None</u> Time range <u>None</u> notes _____

Process / type All pass(es) FCAW / semi-auto
 Process thickness limit. 1.0000" Max.

GAS (QW-408)
 Shielding Gas / CFH..... 75% Argon, 25% CO2/ 32-42
 Trailing Gas / CFH..... None / -
 Backing Gas / CFH..... None / -

FILLER METAL (QW-404)
 AWS classification..... E71T-1
 SFA Spec. No. & F No.... SFA#: 5.20 F#: 6
 A No. or Chem. Comp..... 1
 Filler metal trade name. n/r
 SAW flux trade name/type None / -
 Elec./Wire size (in) ... 0.045 | 0.045 | -
ELECTRICAL (QW-409)
 Welding amperage range.. 170-190 | 190-210 | -
 Welding voltage range... 18-20 | 23-27 | -
 Travel speed (ipm)..... 5-7 | 5-7 | -
 Max. Heat Input (J/in).. None
 Tungsten Type/Size..... N/A / -
 Current & Polarity..... DCEP (reverse)
 GMAW/FCAW transfer mode. Spray Arc

TECHNIQUE (QW-410)
 String / weave bead..... String Bead
 Orifice / gas cup..... 3/8" to 5/8"
 Contact tube to work.... None
 Oscillation..... None
 Mult./Single electrode.. Single Electrode
 Other Technique Notes... _____

Multiple or Single Pass (per side).... Multiple Passes

(n1) No peening done with this procedure.

(n2) No pass greater than 1/2" allowed.

(n3) No supplementary filler metal will be used with this procedure.

(n4) No retainers will be used.

(n5) Minimum preheat shall be maintained during welding.

(n6) No preheat maintenance required after welding.

(n7) No backing strips or rings will be used.

None

None

None / -

None / -

None / -

None

SFA#: None F#: -

None

None

None / -

- | - | -

- | - | -

- | - | -

None

N/A / -

N/A

N/A

N/A

None

None

None

None

N/A

None

Procedure Qualification Record (PQR)

R No.: M-21-N

Page 2 of 2

TENSILE TEST (QW-150)

Specimen No.	Width (in.)	Thick. (in.)	Area (sq.in.)	Ultimate total load (lb)	Ultimate stress (psi)	Type of failure and location
T-1	1.0580	0.5200	0.5501	50600	91973	Ductile P.M.
T-2	1.0820	0.5270	0.5702	51000	89442	Ductile P.M.

GUIDED BEND TEST (QW-160)

Figure No. and Type	Result	Figure No. and Type	Result
QW-462.2 Side bend	Satisfactory	QW-462.2 Side bend	Satisfactory
QW-462.2 Side bend	Satisfactory	QW-462.2 Side bend	Satisfactory

TOUGHNESS TEST (QW-170)

Spec. No.	Notch Location	Notch Type	Test Temp. (°F)	Impact Values (ft-lbs)	Lateral exp.		Drop weight break
					Shear %	Mils	
None							

HARDNESS TEST - Brinell hardness

Base metal	-1-	-2-	-3-	HAZ	-1-	-2-	-3-	WM	-1	-2-	-3-
SA-516-70	168				179				192		

(Heat Affected Zone=HAZ, Weld Metal=WM)

Notes: Editorial corrections only on June 30, 2000.

Stamp: "S" Welder's Name: David Sharp ID: -
 Tests conducted by: Southwestern Labs Laboratory Test No: 95083
 PQR was done & welding of coupon was witnessed by : Metalforms, Inc.

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

Certified by:

David Sharp

(08/28/96) QC Manager

Metalfoms, Inc.
160 Garth Rd. Cheek, TX 77705
Procedure Qualification Record (PQR)

PQR No.: M-21-N Date: 03/06/80 WPS No.: M-21-N Rev 8

JOINT DESIGN (QW-402)
WELD JOINT CONFIGURATION
Single-V groove
None
Groove Angle : 60 Degrees
Root Opening : 1/8 Inches
Root Face : 1/16 Inches

note: _____

POSITION (QW-405)
Position of Joint : 1G - Flat
Progression: N/A
note: _____

BASE METAL (QW-403)
Material form. Plate
Material Spec. SA-516, Grade 70
To SA-516, Grade 70
P No. 1 Gr. 2 to P No. 1 Gr. 2
Thickness (in) 0.5000

HEAT TREATMENT (QW-406, QW-407)
Preheat Temperature: 50 Degrees F.
Preheat Maintenance: Note (n2) below.
Max. Interpass Temp.: - Degrees F.
PWHT temperature: None Degrees F.
PWHT Holding time (hr): None
note: _____

	All pass(es)
Weld Process / type	FCAW / semi-auto
GAS (QW-408)	
Shielding Gas / CFH.....	75% Argon, 25% CO2/ 35
Trailing Gas / CFH.....	None / -
Backing Gas / CFH.....	None / -

	None
	None / -
	None / -
	None / -

FILLER METAL (QW-404)
3 Classification..... E70T-1
SFA Spec. No. & F No.... SFA#: 5.20 F#: 6
A No. or Chem. Comp..... 1
Filler Metal Trade Name. n/r
SAW Flux Trade Name/Type None / -
Weld Deposit 't' (in)... 0.5000
Elec./Wire Size (in).... 0.045 | - | -

	None
SFA#: <u>None</u> F#: <u>-</u>	
	None
	N/R
	None / -
	None
- - -	

ELECTRICAL (QW-409)
Amperage USED 180-200 | - | -
Voltage USED 18-27 | - | -
Travel Speed (ipm)..... 6 | - | -
Max. Heat Input (J/in).. None
Tungsten Type & Size.... N/A / -
Current Type/Polarity... DCEP (reverse)
GMAW/FCAW Transfer Mode. Spray Arc

	None
	N/A / -
	N/A
	N/A
	N/A
	N/A
	N/A

TECHNIQUE (QW-410)
String or Weave Bead.... String Bead
Orifice/Gas Cup Size.... 5/8" I.D.
Contact Tube to Work.... None
Oscillation..... N/A
Mult./Single Electrodes. Single Electrode
Other Technique Notes...
Multiple or Single Pass (per side).... Multiple Passes

	None
	N/A
	None
	None
	N/A
	N/A
	None

- (n1) Peening was not used with this weld test.
- (n2) No preheat maintenance after welding.
- (n3) No supplementary filler metal was used.
- (n4) No retainer was used. No backing strips or rings used.
- (n5) Removed scale, grease, oil, & other contaminants from edges of weld bevel.

W. No.: M-21-N Date: 11/15/00 Revision No.: 8 Date: 11/15/00

JOINT (QW-402)

Single-V groove

Backing : gouged & back welded
Root Opening: 0 - 1/8"
Groove Angle: 45 +/- 2 1/2°
Root Face : 0 - 1/8"

Double-Bevel groove

Backing : gouged & back welded
Root Opening: 0 - 1/8"
Groove Angle: 45 +/- 2 1/2°
Root Face : 0 - 1/8"

Single/Double Fillet

Backing : with backing
Root Opening: n/a
Weld Size : as required

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL OF THOSE FOUND ON A JOB SITE. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial cleaning See note (c) below.

Method of back gouging See note (d) below.

- (a) Preheating shall be applied in the same manner during thermal cutting, tacking, gouging, & welding operations.
- (b) Welds shall be cleaned between each pass. When completed, remove all slag and projections.
- (c) Remove rust, scale, grease, oil, & other contaminants from both sides of weld bevel prior to welding.
- (d) Backside of the weld shall be gouged, ground, & then rewelded with FCAW (groove welds only).
- (e) N/A for group 2 materials with min specified tensile strength > 70000 psi

We certify that the statements in this record are correct and in accordance with the requirements of Sections IX and VIII of the ASME Code.

Prepared By: Quill Papadopolis (11/15/00) QC Manager

Metalforms, Inc.
160 Garth Rd. Cheek, TX 77705
WELDING PROCEDURE SPECIFICATION (WPS)

WPS No.: SW-27 Date: 12/05/88 Revision No.: 1L1 Date: 12/21/05
Supporting PQRs: SW-27-1L

BASE METAL (QW-403, QW-405) P No. <u>1</u> to P No.: <u>1</u> Thickness range. <u>0.0765"</u> to <u>0.0935"</u> Position(s) <u>Flat Only</u> Progression. <u>N/A</u> notes <u>Progression - Upward & Downward.</u>	JOINT (QW-402) Joint design <u>Tube to tubesheet (pg 2)</u> Backing..... <u>With backing only</u> Backing Matl <u>Base metal only</u> notes _____
PREHEAT (QW-406) Minimum Temperature. <u>100</u> Degrees F. Max. Interpass Temp. <u>450</u> Degrees F. Preheat Maintenance. <u>None</u>	POSTWELD HEAT TREATMENT (QW-407) Temperature range <u>None</u> Time range <u>None</u> notes _____

Process / type <u>All pass(es)</u> Process thickness limit. <u>GTAW / automatic</u> <u>0.1406" Max.</u>	<u>None</u> <u>None</u>
GAS (QW-408) Shielding Gas / CFH..... <u>100% Argon</u> / <u>25-35</u> Trailing Gas / CFH..... <u>None</u> / <u>-</u> Backing Gas / CFH..... <u>None</u> / <u>-</u>	<u>None</u> / <u>-</u> <u>None</u> / <u>-</u> <u>None</u> / <u>-</u>
FILLER METAL (QW-404) AWS classification..... <u>ER70S-3</u> SFA Spec. No. & F No.... SFA#: <u>5.18</u> F#: <u>6</u> A No. or Chem. Comp..... <u>1</u> Filler metal trade name. <u>N/A</u> SAW flux trade name/type <u>N/A</u> / <u>-</u> Elec./Wire size (in) ... <u>0.035</u> <u>0.035</u> <u>-</u> ELECTRICAL (QW-409) Welding amperage range.. <u>140-150</u> <u>140-150</u> <u>-</u> Welding voltage range... <u>N/A</u> <u>N/A</u> <u>-</u> Travel speed (ipm)..... <u>Var</u> <u>Var</u> <u>-</u> Max. Heat Input (J/in).. <u>None</u> Tungsten Type/Size..... <u>EWTh-2</u> / <u>1/8"</u> Current & Polarity..... <u>DCEN (straight)</u>	<u>None</u> SFA#: <u>None</u> F#: <u>-</u> <u>None</u> <u>None</u> <u>None</u> / <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>-</u> <u>None</u> <u>N/A</u> / <u>-</u> <u>N/A</u>
TECHNIQUE (QW-410) String / weave bead..... <u>String Bead</u> Orifice / gas cup..... <u># 5 to # 10</u> Contact tube to work.... <u>N/A</u> Oscillation..... <u>None</u> Mult./Single electrode.. <u>Single Electrode</u> Other Technique Notes... <u>2 Pass Minimum</u> Multiple or Single Pass (per side).... <u>Multiple Passes</u> (n1) <u>No peening done with this procedure.</u> (n2) <u>No retainers will be used with this procedure.</u> (n3) <u>No consumable insert will be used with this procedure.</u> (n4) <u>Preheat to 200 °F for Tubesheet > 1" Thick & Carbon content >0.30%.</u> (n5) <u>See attached CyberTig set up sheet. {this wps for 3/4" OD tubes}</u> (n6) <u>Position(s): 5F-Pipe HZ; Progression: Vertical Up & Down</u> (n7) <u>Minimum ligament between Tubeholes = 0.16875".</u>	<u>N/A</u> <u>None</u> <u>None</u> <u>None</u> <u>N/A</u> <u>None</u>

WPS No.: SW-27 Date: 12/05/88 Revision No.: 1LL Date: 12/21/05

JOINT (QW-402) Also See Detail Drawings.
1/16" (+1/32"-0") X 45° Chamfer. 1/16" (+/-1/32") Tube Projection

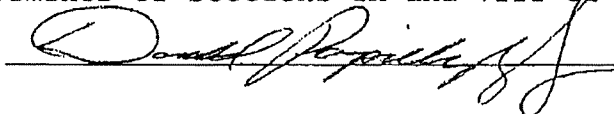
WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL OF THOSE FOUND ON A
JOB SITE. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR
DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Initial cleaning With wire brush clean 1" both sides of weld joint.
Method of back gouging No gouging or back-welding with this procedure.

- (a) Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.
- (b) Welds shall be cleaned between each pass. When completed, remove all slag and projections.
- (c) Edges or surfaces to be welded shall be prepared by machining. Tube ends & TS shall be thoroughly cleaned with Trichloroethylene (or equal).
- (d) Degrease & remove all other contaminants as rust, scale, oil, paint 1" both sides of weld joint prior to welding.
- (e) Dye Penetrant test after each pass.

We certify that the statements in this record are correct and in accordance with the requirements of Sections IX and VIII of the ASME Code.

CERTIFIED BY



(12/21/05) QC MANAGER

Metalforms, Inc.
160 Garth Rd. Cheek, TX 77705
Procedure Qualification Record (PQR)

PQR No.: SW-27-1L Date: 05/01/01 WPS No.: SW-27 Rev 1LL

JOINT DESIGN (QW-402)

WELD JOINT CONFIGURATION

Fillet weld
Fillet weld only
Dihedral Angle: 45 Degrees
Root Opening : N/A Inches
Root Face : N/A Inches

note: _____

POSITION (QW-405)

Position of Joint : 5F - Pipe HZ
Progression: Vert. Up & Down

note: _____

BASE METAL (QW-403)

Material form. Pipe to Plate
Material Spec. SA-179
To SA-516, Grade 70
P No. 1 Gr. 1 to P No. 1 Gr. 2
Thickness (in) 0.0850 Dia. (in) 0.7500

HEAT TREATMENT (QW-406, QW-407)

Preheat Temperature: 50 Degrees F.
Preheat Maintenance: None
Max. Interpass Temp.: 450 Degrees F.
PWHT temperature: None Degrees F.
PWHT Holding time (hr): None

note: _____

	All pass(es)
Weld Process / type	GTAW / automatic
GAS (QW-408).	
Shielding Gas / CFH.....	100% Argon / 25-35
Trailing Gas / CFH.....	None / -
Backing Gas / CFH.....	None / -

	None
	None / -
	None / -
	None / -

FILLER METAL (QW-404)

AWS Classification.....	ER70S-3	
SFA Spec. No. & F No....	SFA#: <u>5.18</u>	F#: <u>6</u>
A No. or Chem. Comp.....	1	
Filler Metal Trade Name.	N/A	
SAW Flux Trade Name/Type	N/A / -	
Weld Deposit 't' (in)...	0.0850	
Elec./Wire Size (in)....	0.035	0.035 / -
ELECTRICAL (QW-409)		
Amperage USED	145	145 / -
Voltage USED	N/A	N/A / -
Travel Speed (ipm).....	Var	Var / -
Max. Heat Input (J/in)...	None	
Tungsten Type & Size....	EWTh-2 / 1/8"	
Current Type/Polarity...	DCEN (straight)	

	None
SFA#: <u>None</u>	F#: <u>-</u>
	None
	None / -
	None
-	- / -
-	- / -
-	- / -
	None
N/A /	-
	N/A

TECHNIQUE (QW-410)

String or Weave Bead....	String Bead
Orifice/Gas Cup Size....	# 8
Contact Tube to Work....	N/A
Oscillation.....	None
Mult./Single Electrodes.	Single Electrode
Other Technique Notes...	
Multiple or Single Pass (per side)....	Multiple Passes

	N/A
	None
	None
	N/A
	N/A
	None

- (n1) Peening was not used with this weld test.
 (n2) No retainers used with this weld test.
 (n3) No consumable insert used with this weld test.
 (n4) See Attached Set-up Sheet. Tubesheet thickness on test piece = 2 3/8"
 (n5) Ligament between tube holes on test piece: 3/16"

Procedure Qualification Record (PQR)

PQR No.: SW-27-1L

Page 2 of 2

TENSILE TEST (QW-150)

Specimen No.	---	Diam. (in.)	Area (sq.in.)	Ultimate total load (lb)	Ultimate stress (psi)	Type of failure and location
T-1		0.75	0.1881	10190	54173	BM - Tube

GUIDED BEND TEST (QW-160)

Figure No. and Type	Result	Figure No. and Type	Result
None None		None None	

TOUGHNESS TEST (QW-170)

Spec. No.	Notch Location	Notch Type	Test Temp. (°F)	Impact Values (ft-lbs)	Lateral exp.		Drop weight break
					Shear %	Mils	
None							

HARDNESS TEST - No hardness test

Base metal	-1-	-2-	-3-	HAZ	-1-	-2-	-3-	WM	-1	-2-	-3-

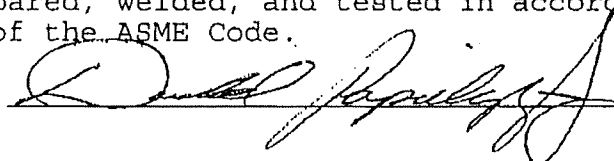
(Heat Affected Zone=HAZ, Weld Metal=WM)

Notes: See METCO Report No. 8-12799 & 8-12800 for minimum leakage path results
Liquid penetrant examination on test piece by Metalforms: acceptable

Stamp: "N&HH" Welder's Name: Marlon Freeman, Jason R. ID: -
Tests conducted by: Metco Laboratory Test No: 8-12799
PQR was done & welding of coupon was witnessed by : Metalforms, Inc.

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

CERTIFIED BY



(07/29/02) QC Manager

METCO Materials Evaluation & Technology Corporation

10980 Metronome
Houston, Texas 77043
(713) 465-4113 • Fax (713) 827-7854

21 Sawyer Street
Beaumont, Texas 77702
(409) 835-2600 • Fax (409) 835-1199

113 North Post Oak
Sulphur, Louisiana 70684
(337) 828-1806 • Fax (337) 828-1844

August 28, 2002

REPORT OF TESTS ON METAL SPECIMENS

Client Metalforms, Inc.

Report No 8-15677-1

Date 8/26/02

Project: Mechanical Testing

Purchase Order No.: 71531

Material: Tubes: SA-179, 3/4" OD x 14 (MW); Tubesheet: SA-516-70, 2-1/2" Thk

Identification: WPS# 27.1.1L, Welder: Wayne Hargraves, Stamp "W"

Spec. Reference: ASME Sec VIII Div I Para UW-20 (c) (1)

Mock-up was sectioned, polished, etched and examined under 10X magnification for weld height determinations:

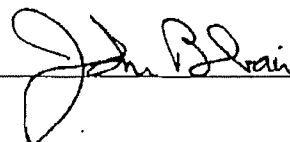
Tube No.	View			
	A	B	A	B
1	.100	.105	.095	.115
2	.120	.145	.140	.120
3	.095	.110	.120	.105
4	.125	.110	.125	.115
5	.125	.120	.110	.115
6	.120	.110	.130	.115
7	.135	.130	.130	.130
8	.120	.120	.110	.125
9	.105	.115	.100	.125
10	.135	.125	.135	.120
11	.125	.110	.130	.135

Note: No cracking was detected

Technician: Gary Robinson

METCO
Materials Evaluation & Technology Corporation

Distribution: Don Popielarczyk



METco Materials Evaluation & Technology Corporation

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August 28, 2002

REPORT OF TESTS ON METAL SPECIMENS

Client Metalforms, Inc.

Report No 8-15677

Date 8/26/02

Project: Mechanical Testing

Purchase Order No.: 71531

Material: Tubes: SA-179, 3/4" OD x 14 (MW); Tubesheet: SA-516-70, 2-1/2" Thk

Identification: WPS# 27.1.1L, Welder: Wayne Hargraves, Stamp "W"

Spec. Reference: ASME Sec VIII Div: II Art F-3

Mock-up was sectioned, polished, etched and examined under 10X magnification for leakage path determinations:

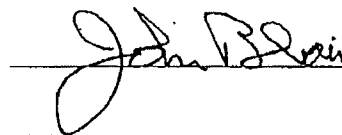
Tube No.	View			
	A	B	A	B
1	.100	.100	.085	.100
2	.105	.100	.100	.100
3	.090	.090	.085	.095
4	.110	.110	.095	.115
5	.105	.100	.095	.100
6	.100	.110	.100	.100
7	.115	.110	.100	.110
8	.120	.100	.100	.095
9	.100	.100	.100	.105
10	.105	.085	.100	.100
11	.095	.100	.085	.105

Note: No cracking was detected

METCO
Materials Evaluation & Technology Corporation

Technician: Gary Robinson

Contribution: Don Popielarczyk



METco Materials Evaluation & Technology Corporation

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113 North Post Oak
Sulphur, Louisiana 70664
(337) 626-1808 • Fax (337) 626-1844

August 28, 2002

REPORT OF TESTS ON METAL SPECIMENS

Client Metalforms, Inc.

Report No 8-15675

Date 8/26/02

Project: Mechanical Testing

Purchase Order No.: 71531

Material: Tubes: SA-179, 3/4" OD x 14 (MW); Tubesheet: SA-516-70, 2-1/2" Thk

Identification: WPS# 27.1.1L, Welder: Garber Reeves, Stamp "X"

Spec. Reference: ASME Sec VIII Div II Art F-3

Mock-up was sectioned, polished, etched and examined under 10X magnification for leakage path determinations:

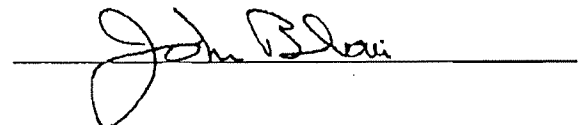
Tube No.	View			
	A	B	A	B
1	.100	.105	.095	.095
2	.095	.100	.095	.085
3	.105	.100	.095	.080
4	.095	.105	.075	.095
5	.105	.085	.110	.085
6	.090	.100	.100	.100
7	.100	.110	.110	.110
8	.090	.095	.105	.095
9	.085	.090	.085	.095
10	.100	.095	.105	.090
11	.105	.065	.090	.090

Note: No cracking was detected

Technician: Gary Robinson

METCO
Materials Evaluation & Technology Corporation

Distribution: Don Popielarczyk



METCO Materials Evaluation & Technology Corporation

10980 Metronome
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August 28, 2002

REPORT OF TESTS ON METAL SPECIMENS

Client Metalforms, Inc.

Report No 8-15675-1

Date 8/26/02

Project: Mechanical Testing

Purchase Order No.: 71531

Material: Tubes: SA-179, 3/4" OD x 14 (MW); Tubesheet: SA-516-70, 2-1/2" Thk

Identification: WPS# 27.1.1L, Welder: Garber Reeves, Stamp "X"

Spec. Reference: ASME Sec VIII Div. I, Para. UW-20 (c)(1)

Mock-up was sectioned, polished, etched and examined under 10X magnification for weld height determinations:

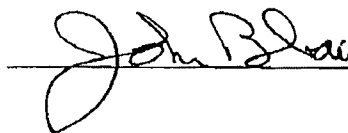
Tube No.	View			
	A	B	A	B
1	.120	.135	.105	.135
2	.130	.150	.140	.130
3	.130	.105	.125	.080
4	.105	.135	.100	.110
5	.150	.135	.145	.130
6	.145	.115	.150	.115
7	.130	.130	.130	.110
8	.125	.100	.130	.095
9	.105	.120	.085	.095
10	.125	.125	.135	.095
11	.125	.065	.110	.095

Note: No cracking was detected

Technician: Gary Robinson

METCO
Materials Evaluation & Technology Corporation

Contribution: Don Popielarczyk



SHOP INSPECTOR 12/18/2007

METALFORMS, INC.

JOB RELEASE

DP

JOB NO.: 17315 P.O. NO.: 4400839977 ITEM NO.: E-1530
CUSTOMER: EQUISTAR CHEMICALS, LP CONTACT: HUNG MAI PHONE: (409) 654-9189
DWG.: 1/12 RELEASE DATE: 12/18/2007 BY: BK SHIP DUE: 01/17/2008

JOB DESCRIPTION

1. FABRICATE ONE (1) 30-240 FIXED TUBESHEET EXCHANGER, LESS HEADS.
2. WELD PADS FOR PLATFORM CLIPS TO SHELL CYLINDER, BUT SHIP PLATFORM CLIPS LOOSE WITH THE UNIT (IN A BOX IDENTIFIED WITH THE P.O.# & ITEM#).

Mag-LS 4GS P.T. Nozz's
Cust - Busside Ins. & Hydro
CUST. INSP.: Verify Jay Telger
CODE STAMP: U-2 409-654-9202

TUBE WELD: Strength Weld SPARE GSKTS: N/A
PMI: N/A SB & PAINT: 1 Coat
STACKING: N/A NAT'L BOARD: Required

SHELL SIDE	X-RAY Spot	HEAT TREAT None	SERVICE Normal	HYDRO @ 480	psig
TUBE SIDE	X-RAY N/A	HEAT TREAT N/A	SERVICE N/A	HYDRO @ N/A	psig

Tubes: (705) 3/4" O.D. X 14 (MW) X 20'-0" LG. MAT'L: SA-179
Del. Date:

REVISION RECORD

Rev.	Date	By	Description
------	------	----	-------------

SHIP TO: EQUISTAR CHEMICALS, LP

3510 GULF STATES ROAD
BEAUMONT, TX USA 77704

GROSS DRY WT: 14000 (LBS)

LENGTH: 20'-0"

WIDTH: 4'-10"

HEIGHT: 4'-0"

PAGE 1 OF 1

11:04:09

12/18/2007



'TRUE ORIENTATION'

SEE VIEW 'A-A' FOR TRUE ORIENTATION

CUSTOMER: EQUISTAR CHEMICALS, LP
PLANT: BMO (GLYCOLI)
ITEM NO.: E-1530
EQUIP TAG#: 2308021
P.O. NO.: 4400839977
EQUIP. SAPH: 10202806
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER

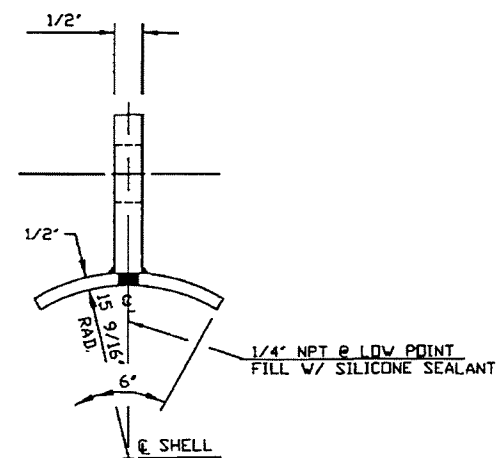
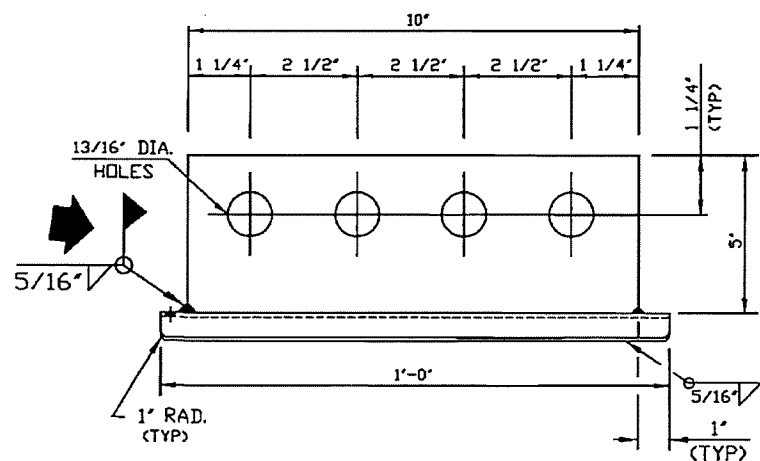
* USE E71T-9 WIRE



METALFORMS, INC.
P.O. BOX 20118
BEAUMONT, TEXAS 77720

TITLE: WELD MAP

DOWNLOADED:	CHK. DATE:	CHK. DATE:	APPRV. DATE:	DWG. NO.	SHT
KL 12/14/07	VA 12/14/07	BK 12/18/07	BK 12/18/07	17315	2



PLATFORM CLIPS
TOTAL REQ'D (5)
ALL PLATE 1/2" TK.
MAT'L: SA-516-70

NOTE: CLIPS TO BE GALVANIZED, PADS TO BE PAINTED

SHOP-NOTE: WELD PADS TO SHELL, BUT BRACKETS TO BE INSTALLED IN FIELD.

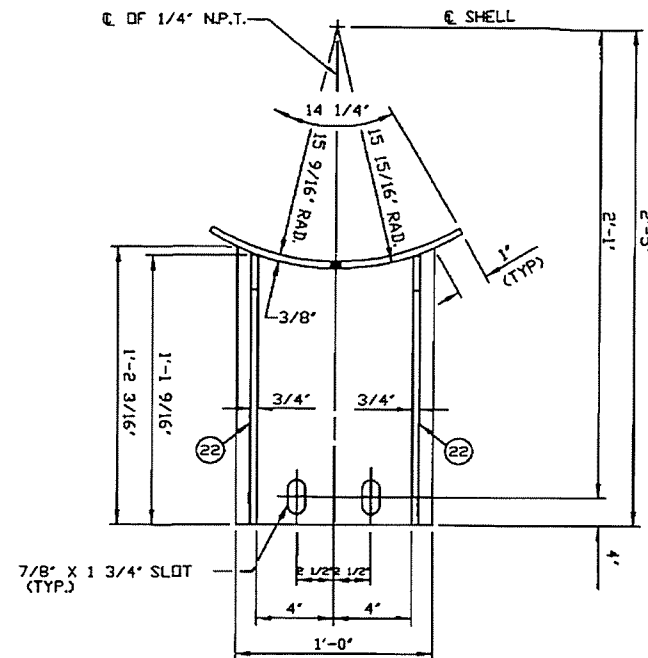
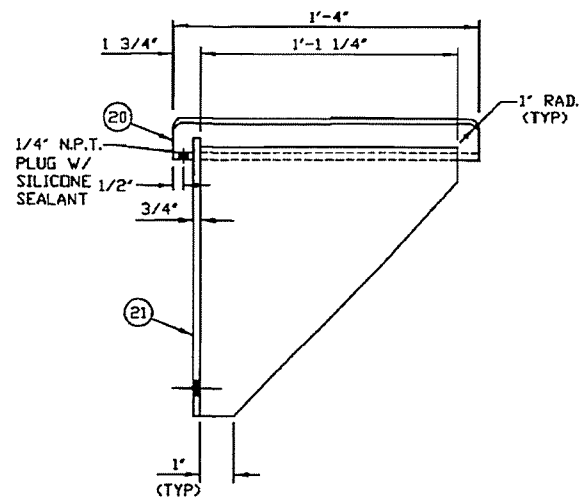
CUSTOMER: EQUISTAR CHEMICALS, LP
PLANT: BMO (GLYCOL1)
ITEM NO.: E-1530
EQUIP TAG#: 2308021
P.O. NO.: 4400839977
EQUIP. SAPH: 10202806
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER



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BEAUMONT, TEXAS 77720

												METALFORMS, INC.		
												P.O. BOX 20118		
												BEAUMONT, TEXAS 77720		
										TITLE:		PLATFORM CLIPS		
REV.	REVISION DESCRIPTION				BY	CHK	DATE	EVALUATE DATE: KL 12/14/07	CHK: VA 12/14/07	DATE: BK 12/18/07	CHK DATE: BK 12/18/07	APPR. DATE: BK 12/18/07	DWG. NO.: 17315	SHT: 3A

TOP



TOTAL (2) SUPPORTS REQ'D

ALL WELDS TO BE 1/2" CONTINUOUS, EXCEPT PAD WELDS TO BE 3/8" C.F.W.

NOTE: SEE WELD MAP DETAIL DWG. SHT.# 2 FOR WPS.

CUSTOMER: EQUISTAR CHEMICALS, LP
PLANT: BMO (GLYCOL1)
ITEM NO.: E-1530
EQUIP TAG#: 2308021
P.O. NO.: 4400839977
EQUIP. SAMP: 10202806
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER

REV.	REVISION DESCRIPTION	BY	CHK DATE



METALFORMS, INC.
P.O. BOX 20118
BEAUMONT, TEXAS 77720

TITLE: SUPPORT DETAIL

OWN.	DATE:	CHK.	DATE:	CHK.	DATE:	APRV.	DATE:	DWG. NO.	SHT.
KL	12/14/07	VA	12/14/07	BK	12/18/07	BK	12/18/07	17315	4

© suvp2

NOTES:

1. NOTIFY CUSTOMER'S INSPECTOR (S) WORKING DAYS PRIOR TO START OF FABRICATION.
2. NOTIFY CUSTOMER'S INSPECTOR OF THE DATE FOR REQ'D INSPECTION POINTS & FINAL INSPECTION.
3. BACKING STRIPS SHALL NOT BE USED.
4. LIQUID PENETRANT TEST OF THE PRODUCTION WELDS SHALL BE PERFORMED USING THE SAME METHOD AND CRITERIA USED FOR THE QUALIFICATION TESTING.

SHIPPING:

1. MACHINED SURFACES SHALL BE WELL GREASED.
2. THOROUGHLY CLEAN THE UNIT BEFORE SHIPMENT.
3. VESSELS SHALL BE CLEARLY IDENTIFIED BY PAINTING THE PO # AND ITEM # IN A CONSPICUOUS LOCATION ON THE SHELL HEAD, OR SUPPORT, ALSO INCLUDE WEIGHT.
4. ALL BOXES, CRATES, OR PACKAGES SHALL BE IDENTIFIED WITH THE PURCHASER'S ORDER # AND THE EQUIPMENT ITEM #.
5. UNIT SHALL NOT BE RELEASED FOR SHIPMENT WITHOUT CUSTOMER'S APPROVAL.
6. ALL NOZZLE OPENINGS SHALL BE COVERED FOR SHIPMENT.

INSPECTION:

1. HARDNESS OF BASE MATERIALS & WELDS IN THEIR FINAL CONDITION SHALL HAVE HARDNESS NOT EXCEEDING:

"235 BHN." FOR P1, P3, & P4 MATERIALS.

HARDNESS READINGS SHALL BE TAKEN AS FOLLOWS:

- a) ONE READING ON EACH GIRTH SEAM AND EACH LONG SEAM.
- b) ONE READING ON EACH NOZZLE WELD AND THE ADJACENT BASE METAL.
- c) ALL READING ON THE INSIDE & OUTSIDE OF THE VESSEL WHERE POSSIBLE.

2. SPOT RADIOGRAPHY SHALL BE PERFORMED AS FOLLOWS:

- a) AT LEAST ONE (1) SPOT X-RAY SHALL BE MADE OF EACH CATEGORY A & B JOINT AS DEFINED BY SECT. VIII, DIV. 1, OF ASME CODE (NOZ. WELDS EXCLUDED FROM THIS SPEC.).
- b) SPOT RADIOGRAPHS SHALL INCLUDE EACH START & STOP OF WELDS MADE BY THE AUTOMATIC SUBMERGED-ARC WELDING PROCESS.
- c) RADIOGRAPH THE JUNCTIONS OF LONG AND GIRTH SEAMS WELDED BY SUBMERGED ARC METHOD.
- d) SPOT RADIOGRAPHS SHALL BE AT LEAST 10 INCHES LONG OR SHALL BE FULL LENGTH WHERE THE WELD IS LESS THAN 10 INCHES LONG.
- e) SPOT RADIOGRAPHS NOT TO EXCEED POROSITY STANDARDS OF SECT. VIII, DIV. 1, ASME CODE FOR FULL RADIOGRAPHY.

3. (1) AN U.T. EXAMINATION SHALL BE DONE TO DETERMINE THE "NEW" AS BUILT THICKNESS OF THE MATERIALS:

- A) FOUR (4) READINGS DIVIDED BY 90° AROUND THE CIRCUMFERENCE ON EACH SHELL SECTION AND HEAD.
- B) ONE (1) READING ON EACH NOZZLE.

4. NDE REPORTS ARE REQ'D.

5. NDE SHALL BE PERFORMED IN ACCORDANCE WITH IS 601 AND ALL WRITTEN PROCEDURES SHALL BE SUBMITTED TO & APPROVED BY LYONDELL.

6. ALL NDE EXCEPT HARDNESS SHALL BE PERFORMED BY PERSONNEL CERTIFIED IN ACCORDANCE WITH ASNT SNT-TC-1A, LEVEL II OR EQUIVALENT.

7. DIMENSIONAL TOLERANCES SHALL BE USED PER: ES-220, FIG. 1&2.

8. MINIMUM HYDROTEST FOR (1) HOUR WITH MIN. 50°F WATER TEMP. (CHARTS REQ'D)

9. HYDROTEST WATER SHALL BE DRAINED IMMEDIATELY AFTER COMPLETION OF THE HYDROTEST, AND THE VESSEL THOROUGHLY DRIED & SEALED. HOT AIR DRYING IS NOT PERMITTED. IF COMPLETE DRAINING IS NOT POSSIBLE, THE AREA SHALL BE FLUSHED WITH LOW-CHLORIDE WATER. (K5 PPM CHLORIDE)

10. PT MATERIALS SHALL MEET THE REQUIREMENTS OF (ASME BOILER & PRESSURE VESSEL CODE, SECTION VIII, PARA. T-641) FOR SULFUR AND HALOGEN CONTENT AND FREE OF CHLORIDES REGARDLESS OF TYPE OF MATERIAL TO BE EXAMINED. (PROOF OF CERTIFICATION IS REQ'D).

11. THE FLATNESS TOLERANCE (MAX. DEVIATION FROM THE PLANE) ON PERIPHERAL GASKET SURFACE SHALL BE 1/32". FINAL MACHINING TO BE PERFORMED AFTER ALL WELDING AND DIALED IN.

12. PNEUMATIC TEST NOZZLE & SUPPORT REINFORCEMENT PADS @ 25 PSIG.

CUSTOMER: EQUISTAR CHEMICALS, LP
 PLANT: BMO (GLYCOL)
 ITEM NO.: E-1530
 EQUIP TAG#: 2308021
 P.O. NO.: 4400839977
 EQUIP. SAMP#: 10202806
 SERVICE: GLYCOL 1 FIRST EFFECT REBOILER

REV.	REVISION DESCRIPTION	BY	CHK	DATE



METALFORMS, INC.

P.O. BOX 20118

BEAUMONT, TEXAS 77720

TITLE:

OWN. DATE	CHK. DATE	CHK. DATE	APPR. DATE	DWG. NO.	SHT.
KL 12/14/07	VA 12/14/07	BK 12/18/07	BK 12/18/07	17315	11

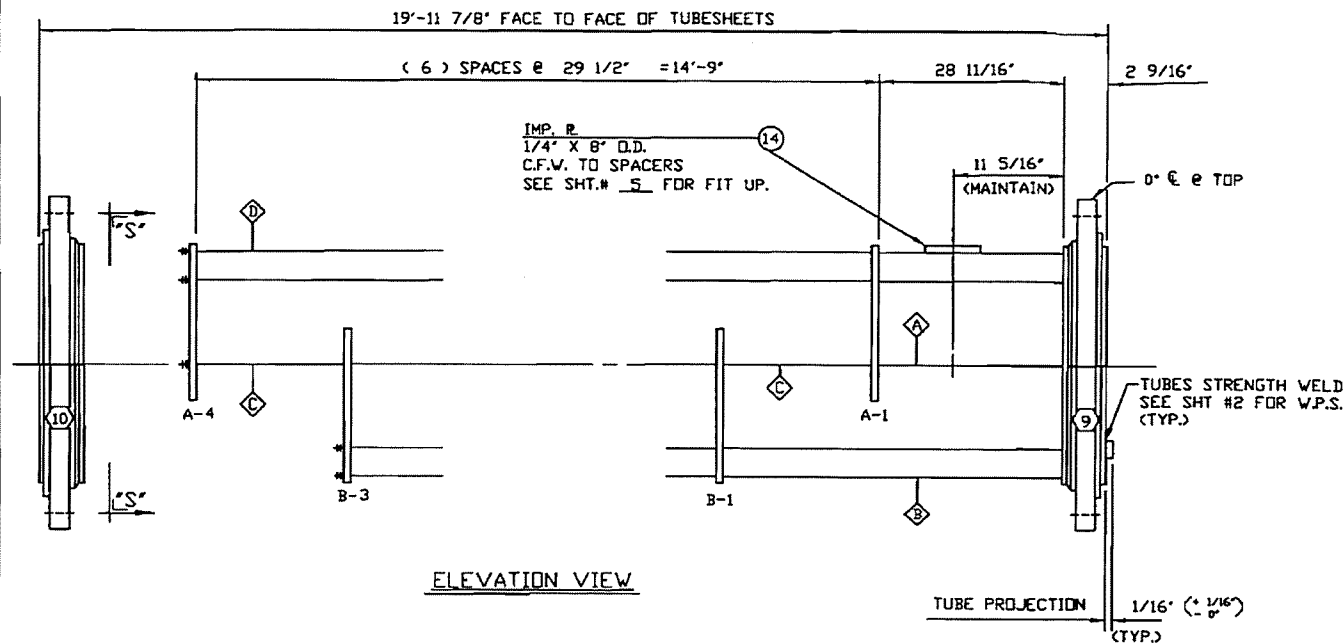
12/18/2007 09:10:45		BILL OF MATERIAL			ITEM 1 THROUGH 27		SHOP INSPECTOR 12/18/2007				
RV	MM	PART	QTY	ONE (1) REQUIRED DESCRIPTION OF ONE (1)	NOTE	MATERIAL	VENDOR	P.O. NO	RCV DT	DUE DATE	COST
	1	TUBES	705	3/4" O.D. X 14 (MW) X 20'-0" LG.	1,2,5	SA-179	✓				
	2	TUBESHEETS	2	3" TK. X 35 1/2" B.O.D.	1,5	SA-516-70N	✓				
	3	BAFFLES	7	1/2" TK. X 30 3/16" B.O.D.		SA-36	✓				
	4	SHELL CYLINDER	1	R & W CYL. 30" I.D. X 1/2" TK. X 19'-7 1/4" LG. (1) 1/2" PL. X 95 15/16" X 119 1/2" [153 1/4"] (BOS/HOS) (1) 1/2" PL. X 95 15/16" X 115 3/4" [150 3/8"] (BOS/HOS)	1,5	SA-516-70	✓				
	5	NOZZLE S1 PIPE	1	8" X-HVY (0.5") PIPE X 5 3/4" LG. (BOS/SQ)	1,5	SA-106-B	✓				
	6	NOZZLE S2 PIPE	1	6" X-HVY (0.432") PIPE X 6" LG. (BOS/SQ)	1,5	SA-106-B	✓				
	7	NOZZLE S3	1	1 1/2" - 300# RF-LWN (12" LG.)	1,5	SA-105	✓				
	8	NOZZLE S1 FLANGE	1	8" - 300# RF-WN W/ X-HVY BORE	1,5	SA-105	✓				
	9	NOZZLE S2 FLANGE	1	6" - 300# RF-WN W/ X-HVY BORE	1,5	SA-105	✓				
	10	NAME PL.	1	METALFORMS INC.		SA-240-302	✓				
	11	BRKT	1	1/4" TK. X 4" X 6 3/4"		SA-36	✓				
	12	BRKT	1	1/4" TK. X 6 3/4" X 6 1/2"		SA-36	✓				
	13	PAINT	2	GAL'S. OF CARBOZINC #11	5		✓				
	14	IMP. PLATE	1	1/4" TK. X 8" O.D.		SA-36	✓				
	15	S1 NZ. PAD	1	1/2" TK. X 11 5/8" O.D. X 8 3/4" I.D. (ROLL TO 15 9/16" I.S.R.) [START FROM 11 5/8" WIDE X 24" LG. PLATE]	1,5	SA-516-70	✓				
	16	S2 NZ. PAD	1	1/2" TK. X 9 5/8" O.D. X 6 3/4" I.D. (ROLL TO 15 9/16" I.S.R.) [START FROM 9 5/8" WIDE X 24" LG. PLATE]	1,5	SA-516-70	✓				
	17	CPLG.	4	3/4" -6000# BLIND CPLG. W/ PLUG.	1,5	SA-105	✓				
	18	S4 CPLG.	1	3/4" -6000# FULL CPLG. W/ PLUG.	1,5	SA-105	✓				
	19	N.P.T. PLUG	2	1/4" N.P.T. PLUG	1,5	SA-105	✓				
	20	SUPPORT PAD	2	3/8" TK. X 1'-4" X 14 1/4" ARC LGT. [ROLL TO 15 9/16" I.S.R.]	1,5	SA-516-70	✓				
	21	SUP'T. BASE	2	3/4" TK. X 1'-0" X 1'-2 3/16"		SA-36	✓				
	22	SUP'T. GUSSET	4	3/4" TK. X 1'-1 1/4" X 1'-1 9/16"		SA-36	✓				
	23	TIE-ROD	9	1/2" DIA. X 18'-0" LG. W/ 2-HI NUTS (EA.)		SA-36	✓				
	24	SPACERS	9	3/4" O.D. X 14 OR 16 GA. X 18'-0" LG. (R/L)		SA-214	✓				
	25	PAD (@ PLATFORM CLIP)	5	1/2" TK. X 1'-0" X 6" ARC. LGT. [ROLL TO 15 9/16" I.S.R.]	1,5	SA-516-70	✓				
	26	PLATFORM CLIP	5	1/2" TK. X 5" X 10" LG.	3,4	SA-516-70	✓				
	27	MI SPECIAL TAG	1	MI STD. TAG		SA-240-302	✓				

NOTES	1. MTR'S REQ'D.		JOB #	17315	SHEET	12
	2. EDDY CURRENT TEST PER SA-450.		CUST.	EQUISTAR CHEMICALS, LP		
	3. CLIPS ARE TO BE GALVANIZED.		ITEM #	E-1530		
	4. CLIPS TO BE SHIPPED LOOSE.		PO NO.	4400839977		
	5. FROM LYONDELL AML ONLY.		EQUIP	SAP # 10202806; TAG# 2308021		
			PLANT	BMO (GLYCOL 1)		

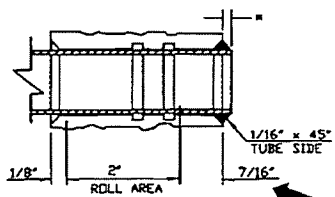
 METALFORMS, INC. P.O. BOX 20118 BEAUMONT, TEXAS 77720		BK	BK	VA	BK
12/14/07	12/14/07	12/14/07	12/18/07		
PREPARE	DESIGN	CHECK	APPROVE		

STRENGTH WELD STEPS:

- DEGREASE TUBE HOLES AND TUBE ENDS W/ A NON-RESIDUAL CHLORIDE FREE SOLVENT. THE LENGTH OF THE TUBE ENDS TO BE CLEANED SHALL BE 12" MINIMUM.
- IMMEDIATELY BEFORE INSERTING TUBE IN TUBE HOLE, CLEAN HOLE AND TUBE END INSIDE AND OUT. ENSURE THAT NO FOREIGN MATERIAL REMAINS BETWEEN TUBE AND TUBE HOLE AFTER FINAL POSITIONING.
- WELD FIRST PASS.
- DYE PENETRANT EXAMINE ALL INDICATIONS W/ MAJOR DIMENSIONING GREATER THAN 1/32" ARE UNACCEPTABLE (LYONDELL WITNESS POINT).
- WELD SECOND PASS.
- DYE PENETRANT EXAMINE ALL INDICATIONS W/ MAJOR DIMENSIONING GREATER THAN 1/32" ARE UNACCEPTABLE (LYONDELL WITNESS POINT).
- TUBE END WELDS ARE THEN HELIUM LEAK TESTED USING A MASS SPECTROMETER, PER ASME SECTION V, ARTICLE 10, APPENDIX IV. (LYONDELL WITNESS POINT).
- TUBES SHALL BE ROLLED (7% ± 2% WALL RED.) AFTER WELDING AND TESTING IS COMPLETE. TUBE END WELDS SHALL BE DYE PENETRANT EXAMINED. ALL INDICATIONS W/ MAJOR DIMENSIONING GREATER THAN 1/32" ARE UNACCEPTABLE (LYONDELL WITNESS POINT).
- PROVIDE TUBE EXPANSION CHARTS INDICATING THE TUBE NUMBER, THE MEASURED TUBE I.D. (EXPANDED AND UNEXPANDED) AND CALCULATED PERCENT WALL REDUCTION FOR A MINIMUM OF 5% RANDOM SAMPLE OF TUBES PER TUBESHEET.
- HYDRO-TEST (LYONDELL WITNESS POINT)



ELEVATION VIEW



TUBE TO I.S. WELD JT. DETAIL

CUSTOMER: EQUSTAR CHEMICALS, LP
PLANT: BNO (GLYCOL1)
ITEM NO.: E-1530
EQUIP TAG#: 2308021
P.O. NO.: 4400839977
EQUIP. SAPH: 10202806
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER

× 1/16" (MIN.) FILLET WELD HEIGHT.

3/4" O.D. SPACERS (24)

MARK	QTY	LENGTH	MARK	QTY	LENGTH
A	6	28 11/16"	G		
B	3	58 3/16"	H		
C	12	29"	I		
D	18	58 1/2"	J		

(23) 1/2" Ø TIE RODS

QTY	LENGTH
6	17'-5"
3	14'-11 1/2"

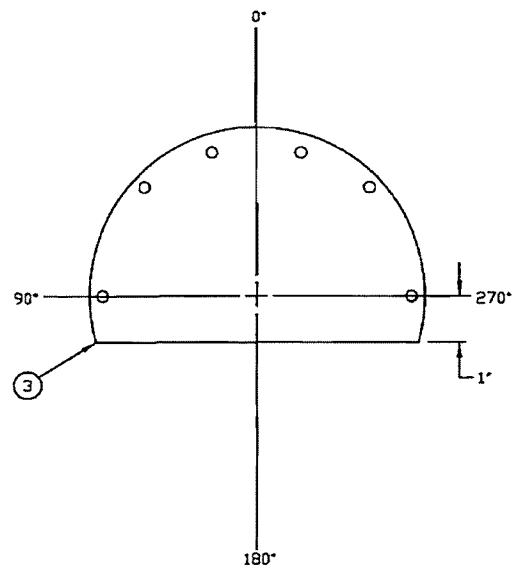


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BEAUMONT, TEXAS 77720

TITLE: BUNDLE DETAIL

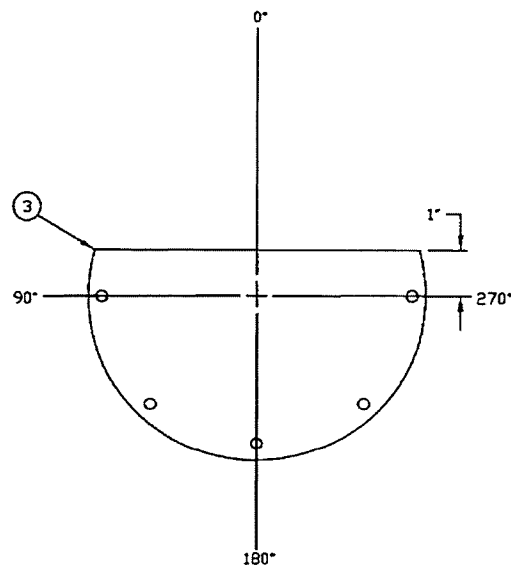
REV.	REVISION DESCRIPTION	BY	CHK	DATE	OWN. DATE	CHK. DATE	CHK. DATE	APPR. DATE	DWG. NO.	SHT.
					KL 12/14/07	VA 12/14/07	BK 12/18/07	BK 12/18/07	17315	6

BDEM114

SHOP INSPECTOR 12/18/2007

BAFFLE 'A'

(4) REQUIRED - 1/2' THK.

BAFFLE 'B'

(3) REQUIRED - 1/2" THK.

ALL BAFFLES 29 13/16" O.D.

NOTES:

1. ALL BAFFLES VIEWED FROM VIEW 'S-S'. (SEE BUNDLE DRAWING.)
2. 250 RMS (MIN.) FINISH REQ'D. ON BAFFLE O.D.

CUSTOMER:	EQUISTAR CHEMICALS, LP
PLANT:	BMO (GLYCOL1)
ITEM NO.:	E-1530
EQUIP TAG#:	2308021
P.O. NO.:	4400839977
EQUIP. SAPH:	10202806
SERVICE:	GLYCOL 1 FIRST EFFECT REBOILER



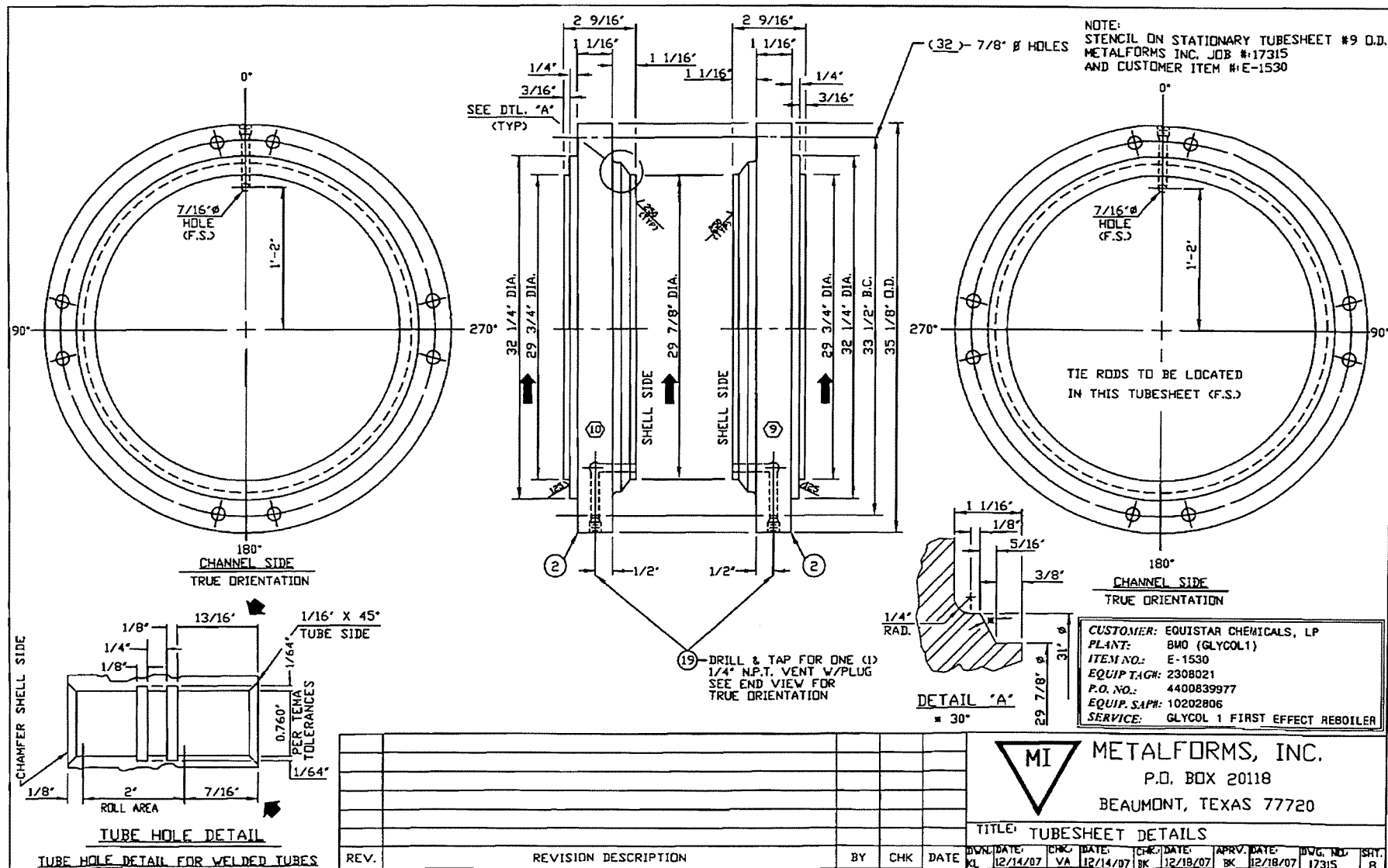
✓ METALFORMS, INC.

P.O. BOX 20118

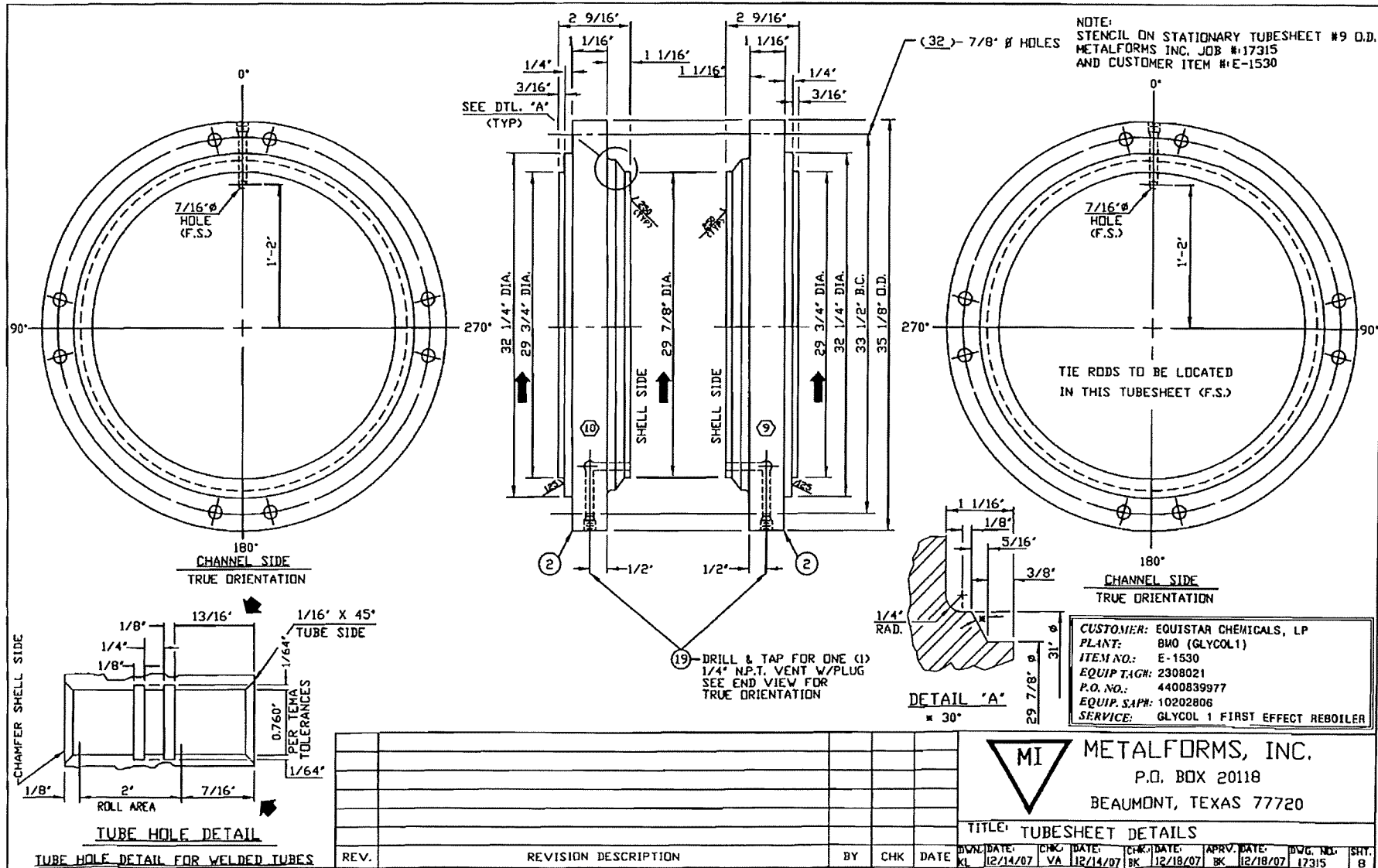
BEAUMONT, TEXAS 77720

TITLE: BAFFLE DETAILS

[illegible]

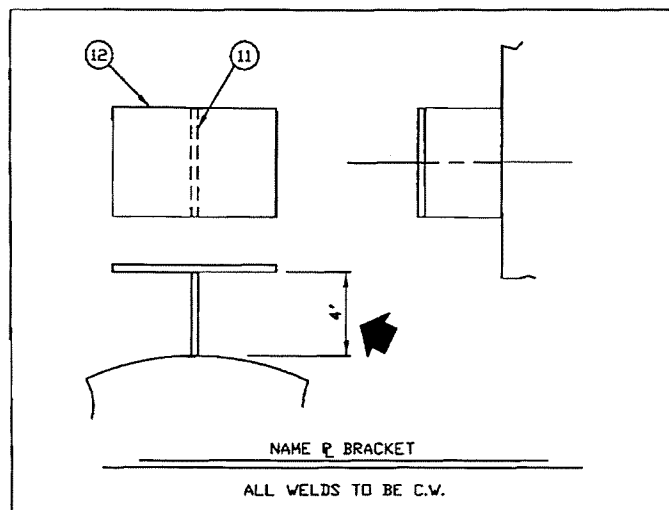


SHOP INSPECTOR 12/18/2007



© TBM1A2A

SHOP INSPECTOR 12/18/2007



U PART W	NB		MI METALFORMS, INC. CHEEK, TEXAS	
	CERTIFIED BY			
RT-3 S	SHELL SIDE		TUBE SIDE	
MAWP	320	PSI AT 470 °F	133	PSI AT 400 °F
INTERNAL	--	PSI AT -- °F	--	PSI AT -- °F
MAWP	--	PSI AT -- °F	--	PSI AT -- °F
EXTERNAL	--	PSI AT -- °F	--	PSI AT -- °F
MIN. DMT	-20	°F AT 320 PSI	--	°F AT -- PSI
TEST	480	PSI NEW	--	PSI NEW
MFG S.N.	17315	YEAR BUILT	2008	
P.O. NO.	4400839977	ITEM NO.	E-1530	
DO NOT START-UP OR RUN TUBESIDE W/O SHELLSIDE				
SHELL&BUNDLE: EQ. SAP/TAG#: 10202806/2308021				

Handwritten: HBCT 12-20-07

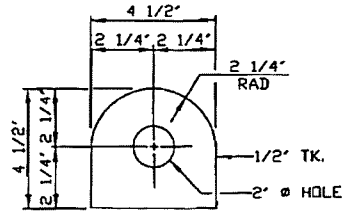
CAUTION:
THE CODE REQUIRED PRESSURES AND TEMPERATURES MARKED ON THE HEAT EXCHANGER RELATE TO THE BASIC DESIGN CONDITIONS. THE HEAT EXCHANGER DESIGN HAS BEEN EVALUATED FOR SPECIFIC OPERATING CONDITIONS AND SHALL BE RE-EVALUATED BEFORE IT IS OPERATED AT DIFFERENT CONDITIONS.

CUSTOMER: EQUSTAR CHEMICALS, LP
PLANT: BMO (GLYCOL1)
ITEM NO.: E-1530
EQUIP TAG: 2308021
P.O. NO.: 4400839977
EQUIP. SAP: 10202806
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER

REV.		REVISION DESCRIPTION		BY	CHK	DATE	MI METALFORMS, INC. P.O. BOX 20118 BEAUMONT, TEXAS 77720																					
<table border="1"> <tr> <td>TITLE:</td> <td colspan="2">NAME PLATE DETAIL</td> </tr> <tr> <td>CHK. DATE:</td> <td>CHK. DATE:</td> <td>CHK. DATE:</td> </tr> <tr> <td>KL 12/14/07</td> <td>VA 12/14/07</td> <td>BK 12/18/07</td> </tr> <tr> <td>APPR. DATE:</td> <td>APPR. DATE:</td> <td>APPR. DATE:</td> </tr> <tr> <td>BK 12/18/07</td> <td>BK 12/18/07</td> <td>BK 12/18/07</td> </tr> <tr> <td>DOC. NO.</td> <td>17315</td> <td>SH.</td> </tr> <tr> <td>9</td> <td></td> <td></td> </tr> </table>							TITLE:	NAME PLATE DETAIL		CHK. DATE:	CHK. DATE:	CHK. DATE:	KL 12/14/07	VA 12/14/07	BK 12/18/07	APPR. DATE:	APPR. DATE:	APPR. DATE:	BK 12/18/07	BK 12/18/07	BK 12/18/07	DOC. NO.	17315	SH.	9			NAME PLV
TITLE:	NAME PLATE DETAIL																											
CHK. DATE:	CHK. DATE:	CHK. DATE:																										
KL 12/14/07	VA 12/14/07	BK 12/18/07																										
APPR. DATE:	APPR. DATE:	APPR. DATE:																										
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9																												

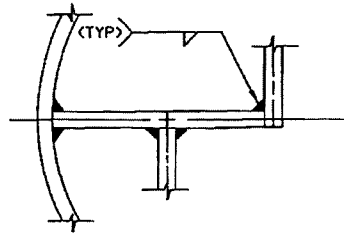
SHOP INSPECTOR 12/18/2007

ATTACH WITH 1/4"
MIN. CONT. F.W.

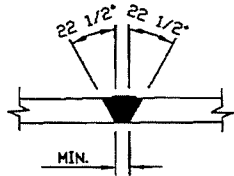


ASSEMBLY LUG DETAIL

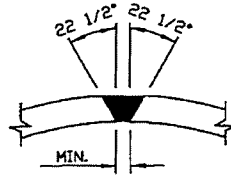
DO NOT LIFT ASSEMBLED EXCHANGER BY LIFTING LUGS. THEY ARE FOR FIT UP USE ONLY.



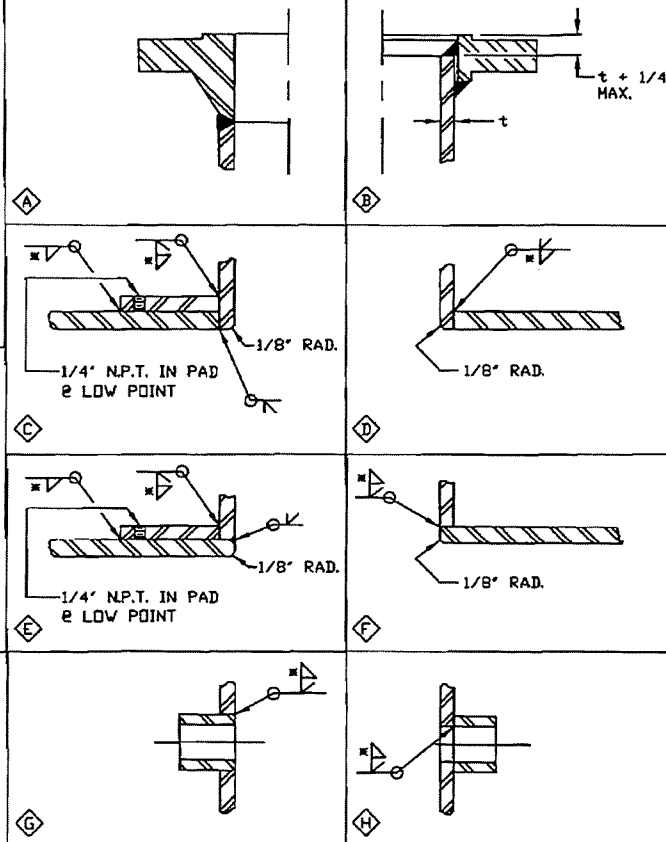
PASS PARTITION WELD DETAIL



TYP. ROUND SEAM
(DOUBLE WELD)



TYP. LONG SEAM
(DOUBLE WELD)



* USE FILLET WELD SIZE INDICATED ON WELD MAP.

NOZZLE & COUPLING WELD DETAIL

CUSTOMER: EQUISTAR CHEMICALS, LP
PLANT: BMO (GLYCOL 1)
ITEM NO.: E-1530
EQUIP TAG#: 2308021
P.O. NO.: 4400839977
EQUIP. SAPH: 10202806
SERVICE: GLYCOL 1 FIRST EFFECT REBOILER

GRINDING NOTES:

1. DO NOT GRIND WELDS FLUSH UNLESS INDICATED ON WELD MAP.

REV.	REVISION DESCRIPTION	BY	CHK	DATE



METALFORMS, INC.
P.O. BOX 20118
BEAUMONT, TEXAS 77720

TITLE: STANDARD DETAIL

OWN. DATE:	CHK. DATE:	CHK. DATE:	APPR. DATE:	DWG. NO.	SHT.
KL 12/14/07	VA 12/14/07	BK 12/18/07	BK 12/18/07	17315	10

HISCDET

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