Government of the Northwest Territories
867-873-0117

Fax:

FAX COVER SHEET

FAX NUMBER TRANSMITTED TO: [ ] 780 458 3983
To: WARREN KMIECIK
Of:: WEK & ASSOCIATES
From: STEVE DONOVAN
Government of the Northwest Territories
Date: [ ] JAN 08/07

DOCUMENTS	NUMBER OF PAGES* 1
Information you requested.	1

COMMENTS: FOR YOUR INFO

Hi!

Our Web Site is up and running to answer any questions concerning the regulating of electrical, gas, boiler and elevator installations . Call if you require additional information. I will be glad to assist you.

Go to : http://www. pws.gov.nt.ca/inspect.htm

Click on safety, then to questions and answers.

Respectively,

Steve Donovan (Chief Boiler Inspector)
Ph # 867-920-3257
Fax # 867-872-0117
E-Mail: stephen_donovan@gov.nt.ca

* NOT COUNTING COVER SHEET. IF YOU DO NOT RECEIVE ALL PAGES, PLEASE TELEPHONE US IMMEDIATELY AT. 867-873-7473

Northwest Territories Public Works and Services

January 5, 2007

James Kozlowski
Paramount Resources Ltd
4700,888 – 3 ST.SW
Calgary, Alberta T2P 5C5

Dear: Sir/Madam

Design Review & Registration

Please be advised that your request for design registration has been approved for use in the Northwest Territories under the following Canadian Registration Number (CRN): R2052.2T

Design: Horizontal Inlet Separator – V 100

Drawing#(s) V – 100 Repair Rev 0 (02 – 179 – A Rev 1)

Catalogue #(s) N/A

CRN #(s): R2052.2T

Fee: $300.00

Reviewed by: Steve Donovan

In accordance with Section 4.6 of CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code, a Manufacturer's Data Report shall be completed and copied to the jurisdictional authorities advising of the location of installation.

Enclosed are stamped copies of the approved documents. Your company will be invoiced for the review and registration at a later date.

Sincerely,

Steve Donovan
Chief Boiler Inspector
Electrical/Mechanical Safety

Enclosure

FORM U-1A MANUFACTURERS DATA REPORT FOR PRESSURE VESSELS

(Alternative F [illegible] Single Chamber, Completely Shop-Fabricated V [illegible] Is Only)
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

A

1. Manufactured and certified by Orban Industries Ltd. 5550-55th Street S.E. Calgary, Alberta T2C 3G9
(Name and Address of Manufacturer)

2. Manufactured for PARAMOUNT RESOURCES LTD. 4700, 888-3 ST.S.W. CALGARY, AB T2P 5C5
(Name and address of purchaser)

3. Location of installation H03 GRID 60° 10MIN. N. 117° 30MIN. W.
(Name and address)

4. Type HORIZONTAL (Horz. or vert., tank) | 02-179 HS (Mfgr's serial No.) | R2052.21T (CRN) | 02-179-A REV.3 (Drawing No.) | N/A (Nat'l Bd. No.) | 2003 (Year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII, Division 1 2001 (Year)

to 2002 (Addenda (Date)) | N/A (Code case Nos.) | N/A (Special Service per UG-120(d))

6. Shell SA-516-70N (Matl. (Spec. No., Grade)) | 1.375" (Nom. Thk. (in.)) | 0.125" (Corr. Allow. (in.)) | 5'-3 ¼" (Diam. I.D. (ft. & in.)) | 18'-0" (Length (overall) (ft. & in.))

7. Seams: TYPE 1 (Long (Welded, Dbl., Sngl., Lap, Butt)) | FULL (R. T. (Spot or Full)) | 100% (Eff. (%)) | 1150 F (H.T. Temp. (° F)) | 1HR 23MIN (Time (hr)) | TYPE 1 (Girth (Welded, Dbl., Sngl., Lap, Butt)) | FULL (R.T. (Spot, Partial, or Full)) | 2 (No. of Courses)

8. Heads: (a) Matl. SA-516-70N (Spec. No., Grade) (b) Matl. SA-516-70N (Spec. No., Grade)

	Location (Top Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	END	1.3125"	0.125"			2:1				CONCAVE
(b)	END	1.3125"	0.125"			2:1				CONCAVE

If removable, bolts used (describe other fastenings) NA
(Matl., Spec. No., Gr., Size, No.)

9. MAWP 740 psi at max. temp. 100 F
Min. design metal temp. -20 °F at 740 psi. Hydro., pneu., or comb. test pressure 962 psi.

10. Nozzles, inspection and safety valve openings:

Purpose (Inlet, Outlet, Drain)	No.	Diam. or Size	Type	Matl.	Nom. Thk.	Reinforcement Matl.	How Attached	Location
				SEE ATTACHED	FORM	U-4		

11. Supports: Skirt NO (Yes or no) Lugs YES (No.) Legs NO (No.) Other SADDLES (Describe) Attached BTM / WELDED (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report:
(Name of part, Item number, Mfgr's. name and identifying stamp)

VOL- 416.77 CU. FT. (11.80 CU. M.) HORIZONTAL SEPARATOR RADIOGRAPHY AS PER PARA UW-11(a)
IMPACT TEST EXEMPT AS PER UCS-66 & UCS-67 SOUR SERVICE
MANUFACTURE DRAWING# 02-179-A REV.3 PSV PROVIDED BY CUSTOMER ON PIPING AS PER UG-125

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1. "U" Certificate of Authorization No. 32685 U expires JULY 11 2004

Date MAR 7 03 Co. name Orban Industries Ltd. Signed
(Manufacturer) (Representative)

CERTIFICATE OF SHOP INSPECTION

Vessel constructed by Orban Industries Ltd. at 5550-55th Street S.E. Calgary Alberta T2C 3G9

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and / or the State or Province of Alberta and employed by Alberta Boiler Safety Association have inspected the component described in this Manufacturer's Data Report on MAR - 7 2003, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date MAR - 7 2003 Signed (Authorized Inspector) Commissions AB # 11 (Nat'l Board (incl. endorsements), State, Prov. and No.)

FORM U-4 MANUFACTURER'S DATA REPORT SUPPLEMENTARY SHEET
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by Orban Industries Ltd 5550-55 street SE Calgary AB. T2C 3G9
(Name and address of Manufacturer)

2. Manufactured for PARAMOUNT RESOURCES LTD. 4700, 888-3 ST.S.W. CALGARY, AB T2P 5C5
(Name and address of Purchaser)

3. Location of installation H03 GRID 60° 10MIN N 117° 30MIN W
(Name and address)

4. Type: HORIZONTAL (Horiz., vert., or sphere) SEPARATOR (Tank, separator, heat exh., etc.) 02-179 HS (Mfg's. serial No.)

R2052.21T (CRN) 02-179-A REV.3 (Drawing No.) N/A (Nat'l Bd. No.) 2003 (Year Built)

Data Report Item Number 10 Continued from Form U1a

Remarks

Purpose (Inlet, Outlet, Drain)	No.	Diam. or Size	Type	Mat'l	Nom. Thk.	Reinforcement Mat'l	How Attached	Location
INLET	1	6"300#	RF'HB'	SA-105N	1.81"	INHERENT	UW-16.1(c)	SHELL
GAS OUTLET	1	2"300#	RFWN	SA-105N,SA-106-B	0.344"	INHERENT	UW-16.1(c)	SHELL
DRAIN	1	2"300#	RFWN	SA-105N,SA-106-B	0.344"	INHERENT	UW-16.1(c)	SHELL
OIL OUT	1	4"300#	RF'HB'	SA-105N	1.40"	INHERENT	UW-16.1(c)	SHELL
WATER OUT	1	3"300#	RF'HB'	SA-105N	1.24"	INHERENT	UW-16.1(c)	SHELL
LSHH	1	3"300#	RFLWN	SA-105N	0.81"	INHERENT	UW-16.1(c)	SHELL
LC OIL	1	4"300#	RFWN	SA-105N,SA-106-B	0.674"	SA-516-70N	UW-16.1(c)	SHELL
LC WATER	1	4"300#	RFWN	SA-105N,SA-106-B	0.674"	SA-516-70N	UW-16.1(c)	SHELL
PSV	1	1"6000#	T.O.L.	SA-105N		INHERENT	UW-16.1(a)	SHELL
TI	1	¼"6000#	T.O.L.	SA-105N		INHERENT	UW-16.1(a)	SHELL
PI	1	½" 6000#	T.O.L.	SA-105N		INHERENT	UW-16.1(a)	SHELL
LG OIL	1	¾" 6000#	CPLG	SA-105N		INHERENT	UW-16.1(c)	SHELL
LG OIL	1	¾" 6000#	T.O.L.	SA-105N		INHERENT	UW-16.1(a)	SHELL
LG WATER	1	¾" 6000#	CPLG	SA-105N		INHERENT	UW-16.1(c)	SHELL
LG WATER	1	¾" 6000#	T.O.L.	SA-105N		INHERENT	UW-16.1(a)	SHELL
MW c/w DAVIT	1	20" 300#	RF'HB'	SA-105N	2.50"	INHERENT	UW-16.1(c)	END

Certificate of Authorization: Type U No. 32685 Expires JULY 31 2004

Date Mar 6/03 Name Orban Industries Ltd Signed (Manufacturer) (Representative)

Date MAR 7 2003 Name (Authorized Inspector) Commission AB #1 (Nat'l Board Incl. Endorsement, State, Province and No.)

WEK ***& ASSOCIATES ENGINEERING INC.*** **#13 Heath Place St. Albert, Alberta T6N 6B3**
PH/FAX# (780) 458-3983, E-mail; 'wekeng@shaw.ca'

December 12, 2006

Electrical/Mechanical Safety
Public Works & Services
Government of the NWT
Box 1320
Yellowknife NWT X1A 2L9
Canada

Attention: Mr. Steve Donovan
Chief Boiler Inspector
PH#(867) 920-3257

Ref: Paramount Resources – Cameron Hills Battery
Repair/Alteration to Sour Inlet Separator Vessel
Originally manufactured by Orban Industries Dwg# 02-179-A Rev 1
66"OD X 18'-0" S/S x 740 psig DP, -20/100 F, 1/8"CA
Replacement of existing nozzles, addition of new nozzles and corrosion repairs

Dear Sir:

I am submitting the attached vessel repair/alteration documents for registration in Nothwest Territories, on behalf of my clients Paramount Resources and TG Engineering.

The vessel is 66"OD X 18'-0" S/S x 740 psig DP, -20/100 F, 1/8"CA and was manufactured by Orban Industries in 2003.

Scope of Repairs;(See attached Drawing V-100 Repair Rev 0)

1. The existing NPS 2(N2) gas outlet nozzle will be replaced with a NPS 8-300# RF HB Bore Nozzle to improve the operation of the separator. A new mist extractor section will also be added to handle the larger outlet nozzle.
2. The existing NPS 2(N3) drain nozzle will be replaced due to excessive corrosion.
3. Two(2) New NPS 4(N9A,N9B) 300#RFHB Bore forged anode nozzles will be added.
4. Several areas of the shell have been inspected and have corrosion present that will be repaired by the addition of weld metal. See attached U/T inspection report.

All areas of the vessel that will be repaired, will be preheated to 200F minimum before welding.

The areas of the shell that are corroded will be repaired as follows;
- all corroded material in the areas that will be repaired, will be removed by grinding
- the vessel shell will be preheated to 200F minimum prior to starting welding.
- weld metal will be applied to the vessel shell until the original base metal thickness is restored.
- the finished surface of the weld metal surface will be ground smooth and will be inspected by dye penetrant or MPI inspection to locate any surface defects that may be present. All defects located will be removed and repaired.

WEK ***& ASSOCIATES ENGINEERING INC.*** **#13 Heath Place St. Albert, Alberta T6N 6B3**
PH/FAX# (780) 458-3983, E-mail; 'wekeng@shaw.ca'

The vessel will not be re-stress relieved and **will become an 'as welded' vessel** as it would be extremely difficult to stress relieve the vessel on site and the stress relief is not required for the process conditions.

The addition of the new nozzles and the weld repairs will be done by;

Pillar Resource Services
Calgary, Alberta,

Pillar Resource Services is licensed to provide repair services to pressure vessels under Alberta Quality Control Program AQP-1102 and NWT AQP018.T
Pillar Resource Services will be providing all registered welding procedures for this vessel.

The following documents are attached to verify the design of the new nozzle in this vessel;

1. Three copies of the original fabrication drawing from Orban Industries
   Dwg# 02-179-A Rev 1, 66"OD X 18'-0" S/S x 740 psig DP, -20/100 F, 1/8"CA

2. Three copies of the drawing #V-100 Repair Rev 0, which details the planned repairs;

3. One set of calculations for this vessel to verify the design of the new nozzles in the existing pressure shell. The calculations are in accordance with the ASME code Sec VIII Div 1 2002 Ed. 2002 Add. To maintain the original Code of Manufacture.

4. Three copies of the U/T inspection report of the vessel.

Please register and return two copies of the stamped design to:

Paramount Resources Ltd.
4700, 888-3 St. SW
Calgary, Alberta
T2P 5C5

Attention: Mr. James Kozlowski
PH# (403)290-3671, FAX# (403)266-6032

Invoicing for registration of this design is to be sent directly to **Paramount Resources Ltd.**

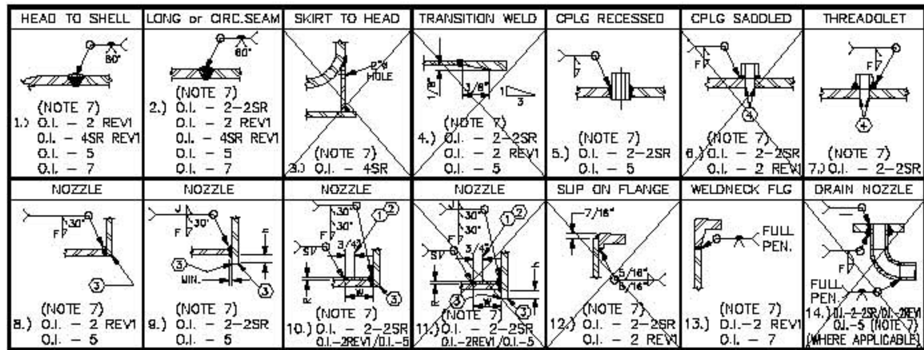
Please direct all technical inquiries to Warren Kmicik @ 780-458-3983

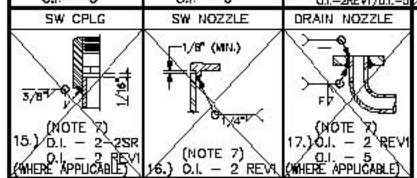
Your attention to the above registration is greatly appreciated, as my customer is very anxious to start the repairs to this vessel.

Yours truly;

Warren Kmicik P.Eng.

c/c **TG Engineering,**
Paramount Resources Ltd.





DESIGN DATA

20 01 ASME CODE SEC: VIII DIV: 1
PARA: UW-11(a)
HEAD MATERIAL: SA-516-70N 1.375" NOM WALL (1.3125" MIN)
SHELL MATERIAL: SA-516-70N 1.375" NOM. WALL
MDMT: -20°F @ 740 PSIG
NOZZLE: SA-106-B/SA-105N FLANGES: SA-105N
MAX. W.P.: 740 PSIG (5102 kPa) TEMP.: 100°F (38°C)
HYDROTEST: 962 PSIG (6633 kPa) RADIOGRAPHY: RT-1 (FULL INCL. ALL NOZZ. BW)
STRESS RELIEVE: 83 MIN. @ 1150°F
CORR. ALLOW.: 0.125" (3.2 mm) JOINT EFF.: 100%
VOLUME: 416.77 CU. FT (11.80 CU. M)
EMPTY WT: 30,000 LBS (13,636 KGS) FULL WT: 56,006 LBS (25,457 KGS)
YEAR BUILT: 2003 SERIAL No.:
CRN No.:
W.P.R. No.: 1752.2
SURFACE PREP.: SSPC-SP6
PRIME: SEE PIPING
PAINT: SEE PIPING
INSULATION: VESSEL O/S BLDG. TO BE INSULATED WITH 2" FIBERGLASS C/W ALUMINUM JACKET

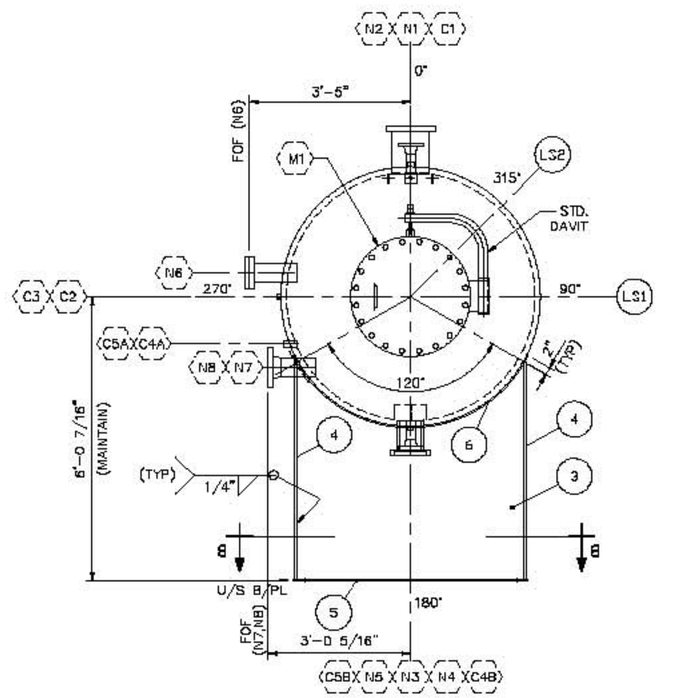
MARK NO.	NO. REQ'D	SIZE	SCH.	RATING AND FACING	SERVICE	PROJECTION INSIDE(min)	PROJECTION OUTSIDE	FILLET "F"	FILLET "J"	REPAD "W"	REPAD "R"	REPAD "S"	WELD#
N1	1	6"	160	300# RF 'HB'	INLET	0	10 1/4"	3/8"	–	–	–	–	8
N2	1	2"	160	300# RFWN	GAS OUTLET	0	6"	3/8"	–	–	–	–	8,13
N3	1	2"	160	300# RFWN	DRAIN	FLUSH	6"	3/8"	–	–	–	–	8,13
N4	1	4"	160	300# RF 'HB'	OIL OUT	FLUSH	7 7/16"	3/8"	–	–	–	–	8
N5	1	3"	XXH	300# RF 'HB'	WATER OUT	FLUSH	7 1/2"	3/8"	–	–	–	–	8
N6	1	3"	XXH	300# RFLWN	LSHH	1 1/2"	AS SHOWN	3/8"	3/8"	–	–	–	9
N7	1	4"	XXH	300# RFWN	LC OIL	0	AS SHOWN	3/8"	–	2"	1"	5/8"	10,13
N8	1	4"	XXH	300# RFWN	LC WATER	0	AS SHOWN	3/8"	–	2"	1"	5/8"	10,13
C1	1	1"	–	6000# NPT	PSV	–	–	3/8"	–	–	–	–	7
C2	1	3/4"	–	6000# NPT	TI	–	–	3/8"	–	–	–	–	7
C3	1	1/2"	–	6000# NPT	PI	–	–	3/8"	–	–	–	–	7
C4A	1	3/4"	–	6000# CPLG	LG OIL	–	–	3/8"	–	–	–	–	5
C4B	1	3/4"	–	6000# NPT	LG OIL	–	–	3/8"	–	–	–	–	7
C5A	1	3/4"	–	6000# CPLG	LG WATER	–	–	3/8"	–	–	–	–	5
C5B	1	3/4"	–	6000# NPT	LG WATER	–	–	3/8"	–	–	–	–	7
M1	1	20" ID	–	300# RF"HB"	MW c/w DAVIT	1-7/8"	AS SHOWN	3/8"	3/8"	–	–	–	8

BILL OF MATERIAL

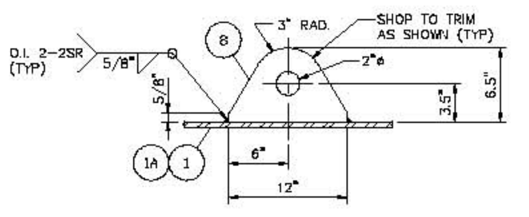
ITEM	QTY	DESCRIPTION	MAT'L
1	1	SHELL – 66" OD X 10'-0" S/S X 1.375" THK.	SA-516-70N
1A	1	SHELL – 66" OD X 8'-0" S/S X 1.375" THK.	SA-516-70N
2	2	HEADS – 66" OD 2:1 S.E. X 1.375" NOM. (1.3125" MIN) WITH 2" S.F.	SA-516-70N
3	2 PCS	WEB PL – 3/8" PL X 4'-9 13/16" WD X 4'-7 1/4" H	SA-36
4	4 PCS	SIDE PL – 1/2" PL X 10" WD X 4'-7 1/4" H	SA-36
5	2 PCS	BASE PL – 1/2" PL X 11" WD X 4'-11 13/16" LG	SA-36
6	2 PCS	WEAR PL – 3/8" PL X 12" WD X 6'-1 1/2" LG (ROLLED TO 66" ID SHELL)	SA-516-70N
7	3 PCS	INLET DEFLECTOR – 1/4" PL (CUT PER DWG DET'L)	SA-36
8	2	LIFTING LUG – 1" PL (CUT PER DWG DET'L)	SA-516-70N
9	1	NAME PLATE C/W MOUNTING BRACKET	SS/SA-36
10	1	VORTEX BREAKER – 1/4" PL X 4" WD X 8" LG	SA-36
11	2	VORTEX BREAKER – 1/4" PL X 4" WD X 3 7/8" LG	SA-36
12	1	VORTEX BREAKER – 1/4" PL X 2" WD X 8" LG	SA-36
13	4	MISTEX CLIPS – 3/8" PL X 3" WD X 3" LG	SA-516-70N
14	1	BAFFLE PL – 3/8" THK. (CUT PER DWG DET'L)	SA-36
15	1	WEIR PL – 3/8" THK. (CUT PER DWG DET'L)	SA-36
16	1	DAVIT SLEEVE – 2 1/2" SCH. STD SMLS PIPE X CTS	SA-106-B
17	1	RING – 2 1/2" SCH. STD. SMLS PIPE X 1" LG	SA-106-B
18	1	DAVIT ARM – 2" SCH. XXH SMLS PIPE X CTS	SA-106-B
19	1	PLATE – 3/4" THK. X 2" WD X 8" LG	SA-36
20	1	U BAR – 3/4"ø ROUND BAR (BEND AS SHOWN)	SA-36
21	1	EYE BOLT – 3/4"ø ROUND BAR (BEND AS SHOWN)	SA-36
22	1	WASHER – 3/4"ø	S.S.
23	2	NUTS – 3/4"ø	2H
24	1	HANDLE – 3/4"ø ROUND BAR (BEND AS SHOWN)	SA-36
25	1	BLIND END – 1/4" PL X 2 7/8" OD	SA-36
			SA-36
N1	1	FLANGE – 6" 300# RF 'HB' SCH. 160 BORE x 12" LG.	SA-105N
N2,N3	2	FLANGE – 2" 300# RFWN SCH. 160 BORE	SA-105N
	2	NECK – 2" SCH. 160 SMLS PIPE X 4 5/8" LG	SA-106-B
N4	1	FLANGE – 4" 300# RF 'HB' SCH. 160 BORE x 9" LG.	SA-105N
N5	1	FLANGE – 3" 300# RF 'HB' SCH. XXH BORE x 9" LG.	SA-105N
N6	1	FLANGE – 3" 300# RFLWN SCH. XXH BORE x 12" LG.	SA-105N
	1	HUB FLANGE – 3" 300# RF C/W 2" NPT D/T	SA-105N
	1	GASKET – 3" 300# RF, 1/8" THK., FLEX	316 SS
	8	STUD – 3/4"ø X 4 1/4" LG C/W 2 NUTS EA.	B7M/2HM
N7,N8	2	FLANGE – 4" 300# RFWN SCH. XXH BORE	SA-105N
	2	NECK – 4" SCH. XXH SMLS PIPE X 8 5/8" LG	SA-106-B
	2	REPAD – 1" PL x 2" ALL AROUND	SA-516-70N
	2	HUB FLANGE – 4" 300# RF C/W 2" NPT D/T	SA-105N
	2	GASKET – 4" 300# RF, 1/8" THK., FLEX	316 SS
	16	STUD – 3/4"ø X 4 1/4" LG C/W 2 NUTS EA.	B7M/2HM
C1	1	TOL – 1" 6000# NPT (ON 66" RUN)	SA-105N
C2	1	TOL – 3/4" 6000# NPT (ON 66" RUN)	SA-105N
C3	1	TOL – 1/2" 6000# NPT (ON 66" RUN)	SA-105N
C4A,C5A	2	LONG CPLG – 3/4" 6000# NPT X 3 1/2" LG	SA-105N
C4B,C5B	2	TOL – 3/4" 6000# NPT (ON 66" RUN)	SA-105N
M1	1	FLANGE – 20" 300# RF"HB" (2.50" WT) X 14" LG	SA-105N
	1	BLIND FLANGE – 20" 300# RF	SA-105N
	1	GASKET – 20" 300# RF, 1/8" THK, FLEX.	316 SS
	24	STUDS – 1 1/4"ø X 8 3/4" LG C/W 2 NUTS EA.	B7M/2HM

NOTES:

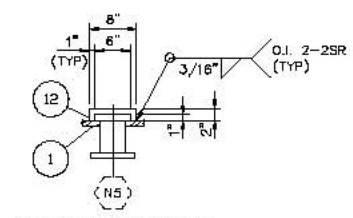
1. 2 WEEPHOLES REQUIRED WHEN PAD IS SPLIT.
2. WEEPHOLES 1/8" NPT UNLESS NOTED ON VESSEL DWG.
3. R=1/8" MIN/C=1/16" MIN ALL NOZZLES & R=1/4" MIN ALL MANWAYS UNLESS NOTED ON VESSEL DWG.
4. R=1/8" MIN UNLESS NOTED ON VESSEL DWG.
5. WPS O.I. 2-2SR & O.I.-2 ARE ACCEPTABLE FOR ALL TACK WELDS.



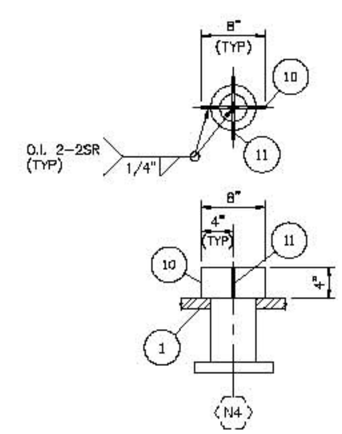
VIEW 'A-A'



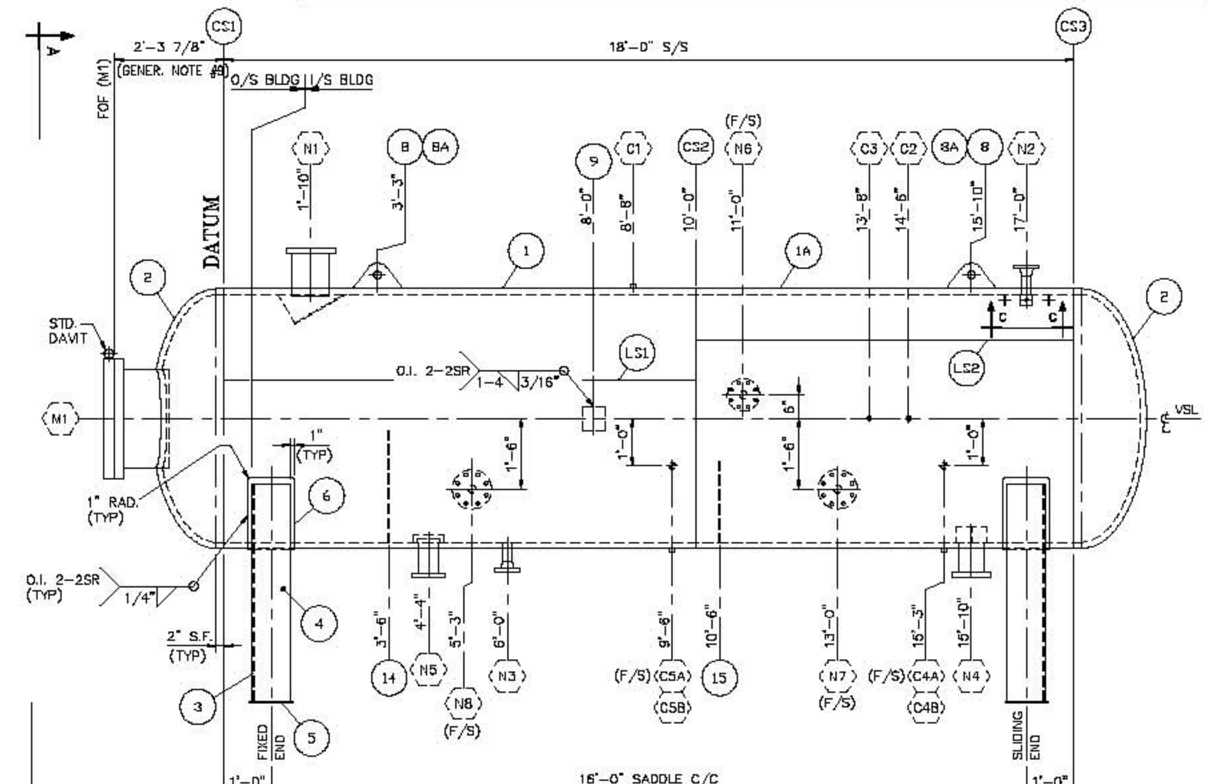
LIFT LUG DET'L
(2) REQ'D – N.T.S.



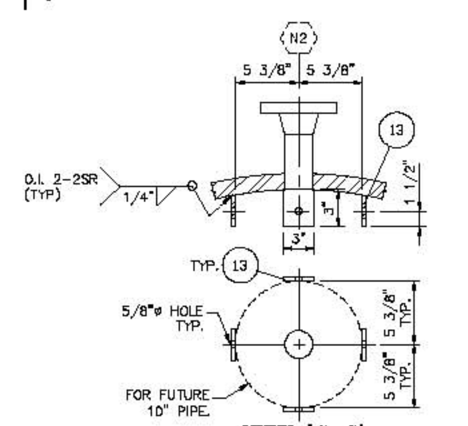
VORTEX BREAKER DET'L FOR N5
N.T.S.



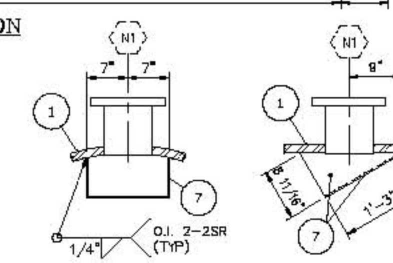
VORTEX BREAKER DET'L FOR N4
N.T.S.



ELEVATION



VIEW 'C-C'
MISTEX CLIPS DET'L
N.T.S.



INLET DEFLECTOR DET'L
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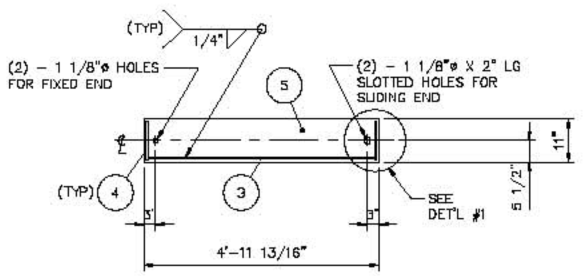
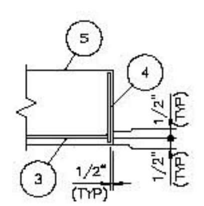
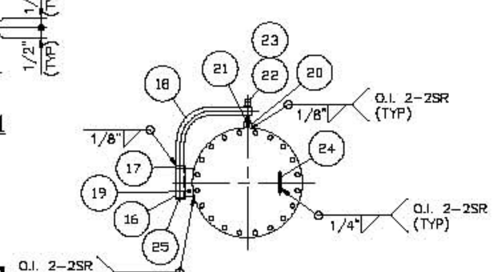


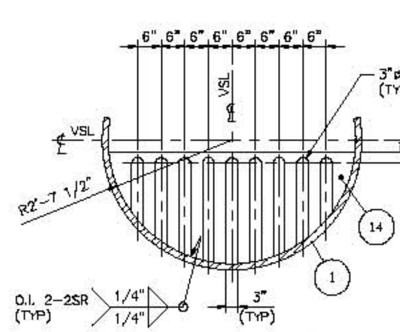
VIEW 'B-B'



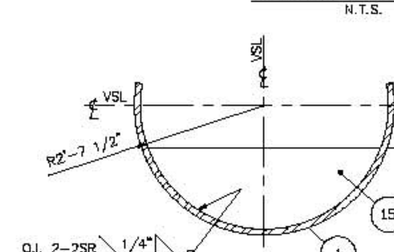
DET'L #1
N.T.S.



DAVIT DET'L
N.T.S.



BAFFLE PL DET'L



WEIR PL DET'L

(1) REQ'D

TIME CARD
02-179-HS

GENERAL NOTES:

1. SHELL, HEADS AND PRODUCTION WELDS ARE IMPACT EXEMPTED AS PER UCS-66 AND UCS-67. MINIMUM DESIGN METAL TEMPERATURE IS -20°F @ 740 PSIG (5102 kPa).
2. MTR TO BE PROVIDED FOR ALL PRESSURE RETAINING MATERIAL.
3. EXTERNAL LOADINGS ARE NOT APPLICABLE (REF. UG-22).
4. DIMENSIONAL TOLERANCES AS PER ORBAN ENGR. SPEC. O.I.-004 REV. 0.
5. ALL BOLT HOLES TO STRADDLE CENTERLINES.
6. SUBSTITUTION OF MATERIAL OTHER THAN LISTED BELOW IS NOT ACCEPTABLE UNLESS ENGINEERING DEPARTMENT APPROVAL OBTAINED.
7. WELDING JOINT PREPARATION AND FIT-UP AS PER ORBAN ENGR. SPEC. O.I.-003 REV. 0.
8. VESSEL TO BE REGISTERED IN ALBERTA, B.C., AND N.W.T..
9. ADJUST O/S DIMENSION TO MAINTAIN I/S PROJECTION.

ALTERNATE NOTES:

1. ALL SA-106-B SEAMLESS PIPE CAN BE SUBSTITUTED WITH SA-333 GR. 6 SEAMLESS PIPE.
2. ALL SA-105N FLANGES CAN BE SUBSTITUTED WITH SA-350-LF2 FLANGES.
3. ALL SA-234-WPB BW FITTINGS CAN BE SUBSTITUTED WITH SA-420-WPL6 BW FITTINGS.
4. ALL SA-36 MATERIAL CAN BE SUBSTITUTED WITH 44W EXCEPT PRESSURE BOUNDARY COMPONENTS.

REV.	DESCRIPTION	APP'D	DATE	BY	DATE
1	ISSUED FOR CONSTRUCTION.			TT	03-01-22
0	ISSUED FOR APPROVAL			CG	03-01-20

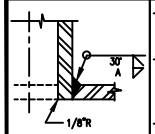
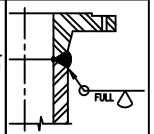
PROJECT CO-ORDINATOR CHECKED: DATE: BY:

ORBAN INDUSTRIES LTD.
CALGARY, ALBERTA

DRAWN BY: CG | DATE: 02-12-16
CHECKED BY: KS | SCALE: 1/2"=1'-0"

LSD:
66" OD X 18'-0" S/S X 740 PSIG X 100°F X 1/8" CA
HORIZONTAL INLET SEPARATOR – V-100
(SOUR SERVICE)

PARAMOUNT RESOURCES LTD. | 02-179-A | REV. 1

NOZZLE	WELDNECK FLG
	
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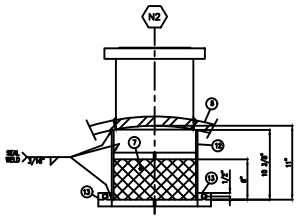
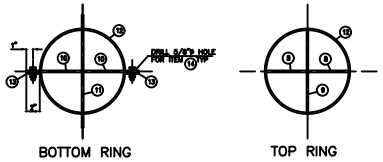




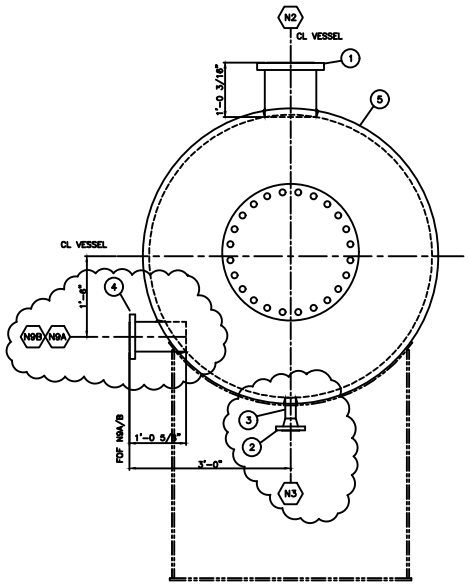
BOTTOM RING TOP RING

MISTEX DETAIL
SCALE: 1:1.5

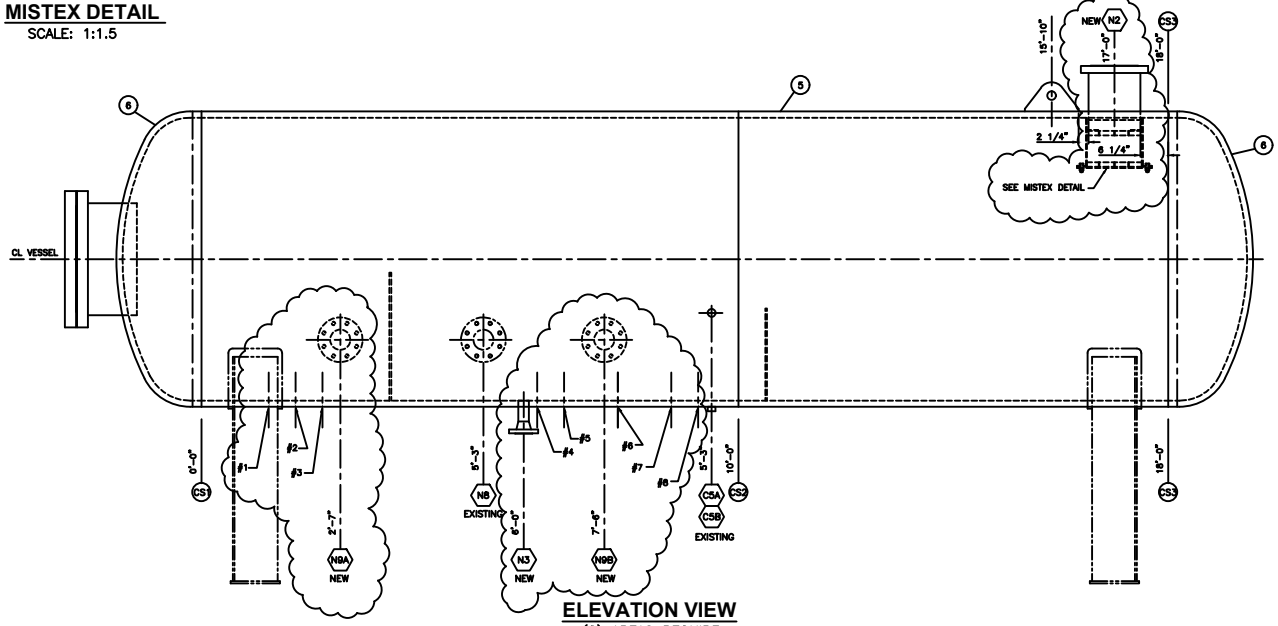
MARK#	QTY	SIZE	SCH.	RATING & FACING	SERVICE	PROJECTION		REINFORCING PAD		WELD SIZE			WD#	ITEM
						INSIDE(h)	OUTSIDE	SIZE	THK.	A	B	C		
N2	1	8"	1.97" THK	300#RFHB	GAS OUTLET	0"	10 1/4"	–	–	3/8"	–	–	1	1
N3	1	2"	S/160	300#RFWN	DRAIN	FLUSH	6"	–	–	3/8"	–	–	1,2	2,3
N9A/B	2	4"	1.40" THK	300#RFHB	ANODE	0"	AS SHOWN	–	–	3/8"	–	–	1	4

BILL OF MATERIALS

ITEM	QTY	DESCRIPTION	MAT'L
1	1	FLANGE – 8" CL 300 RF"HB" x 1.97" THK WALL x 13" LG	SA-350-LF2 CL1
2	1	FLANGE – 2" CL 300 RFWN SCH 160 BORE	SA-105N
3	1	NECK – 2" SCH 160 SMLS PIPE x 4 5/8" LG	SA-106-B
4	2	FLANGE – 4" CL 300 RF"HB" x 1.40" THK WALL x 13" LG	SA-350-LF2 CL1
		EXISTING:	
5	1	SHELL – 66" OD x 8'-0" S/S x 1.375" THK	SA-516-70N
6	2	HEAD – 66" OD 2:1 S.E. x 1.375" NOM. (1.3125" MIN.)	SA-516-70N
		WITH 2" S.F.	
		NEW DEMISTER	
7	1	6" THK DEMISTER @ 9 lba/cu ft x 12 1/4" OD	316L SS
8	2	1" x 1/4" THK FLAT BAR x 6" LG	SA-36
9	1	1" x 1/4" THK FLAT BAR x 12 1/4" LG	SA-36
10	2	1" x 1/4" THK FLAT BAR x 8 1/4" LG	SA-36
11	1	1" x 1/4" THK FLAT BAR x 16 3/4" LG	SA-36
12	1	12" SCH 10 (0.250") ERW PIPE x 11" LG	SA-53-B
13	2	2" x 1/4" THK FLAT BAR x 2" LG	SA-36
14	2	1/2"@ x 1 1/2" LG BOLT c/w (1) NUT	SS



END VIEW



ELEVATION VIEW
(8) AREAS REQUIRE WELD BUILD UP

SCOPE OF WORK

1. REPLACE N2 WITH AN NPS 8 CL 300# RF HB BORE NOZZLE AS SHOWN.
2. REPLACE N3 WITH AN NPS 2 CL 300# RFWN FLANGE AND NOZZLE AS SHOWN.
3. ADD (2) NPS 4 CL 300# RF HB BORE NOZZLES AS SHOWN AND TAG N9A AND N9B.

AREAS OF WELD REPAIR

1. ALL CORRODED MATERIAL TO BE REMOVED BY GRINDING TO CLEAN METAL.
2. PREHEAT AREA TO BE WELDED TO 200°F MINIMUM.
3. REPLACE BASE METAL WITH WELD MATERIAL AS REQUIRED TO A MINIMUM THICKNESS OF 1.375"
4. GRIND ALL NEW WELD MATERIAL SMOOTH.
5. INSPECT WELD MATERIAL WITH WFI OR LPI INSPECTION AND REPAIR ANY DEFECTS AS DETECTED.
6. STRESS RELIEF WILL NOT BE DONE ON ENTIRE VESSEL, VESSEL WILL BECOME "AS WELDED".

NOTES

1. IMPACT TESTING OF ALL COMPONENTS IS EXEMPT PER UCS-66.
   MINIMUM DESIGN METAL TEMPERATURE IS -20°F @ 740 PSIG.
2. MTR TO BE PROVIDED FOR ALL PRESSURE RETAINING MATERIAL.
3. EXTERNAL LOADINGS ARE NOT APPLICABLE (REF. UG-22).
4. ALL SHOWN DIMENSIONS ARE TO BE HELD TO 1/16".
5. WELDING JOINT PREPARATION AND FIT-UP AS PER ORBAN ENGR. SPEC. O.I.-003 REV. 0.
6. ALL BOLTS TO STRADDLE CENTER LINES UNLESS OTHERWISE NOTED.

DESIGN DATA

DESIGN AND REPAIR TO ASME CODE SECTION VIII DIV.1 2001 ED, 2001 ADD. PARAGRAPH UW-11(a)
DESIGN PRESSURE: 740 PSIG
DESIGN TEMPERATURE: 100°F
CORROSION ALLOWANCE: 1/8"
PWHT: N/R (VESSEL WILL BECOME "AS WELDED")
RADIOGRAPHY: RT-1 (NO ADDITIONAL RADIOGRAPHS WILL BE PERFORMED FOR THIS REPAIR)
HYDROSTATIC TEST PRESSURE: 962 PSIG MIN AFTER ALL REPAIRS
THIS VESSEL IS REGISTERED FOR USE IN NWT UNDER CRN# R2052.21T

REV.	DESCRIPTION	BY	APP.	DATE
0	ISSUED FOR APPROVAL	JB	WEK	12/12/06

PARAMOUNT RESOURCES
CAMERON HILLS PLANT SITE

CUSTOMER: ORIGINAL MANUFACTURER IS ORBAN INDUSTRIES LTD.

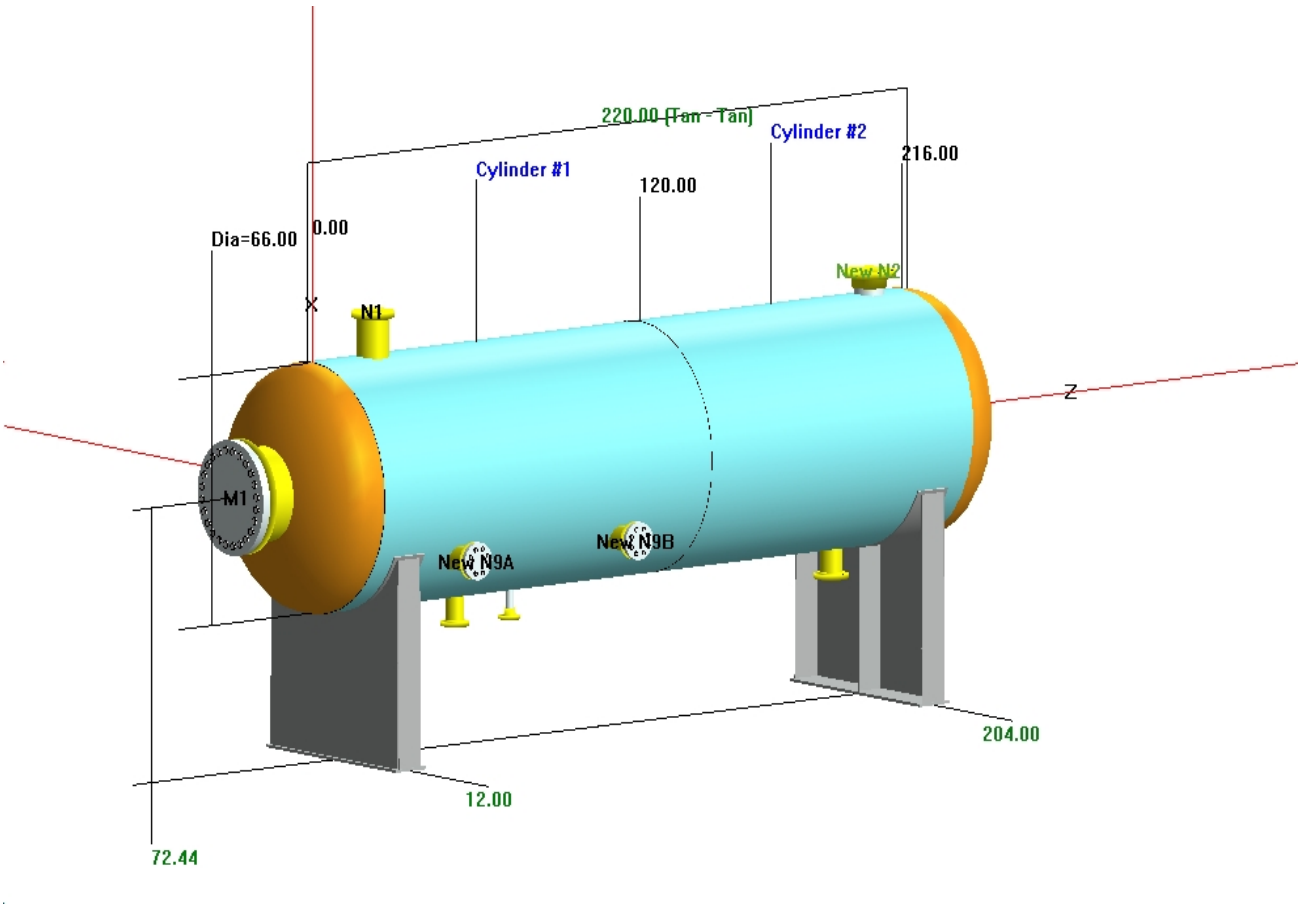
66" OD x 18'-0" S/S x 740 PSIG x 1/8" CA
HORIZONTAL INLET SEPARATOR
V-100

DWN.BY:	CHK'D.BY:	APP'D.BY:	DATE:	SCALE:	WEK#	DRAWING NO.:	REV.:
JB	WEK		12/12/06	1:1	1707	V-100 REPAIR	0

Paramount Resources

Cameron Hills Plant Site

NWT



COMPRESS Pressure Vessel Design Calculations

Contact: Warren Kmicik
Item: Inlet Separator V-100
Drawing No: Orban Dwg#02-179-A Rev 1 and V-100 Repair Rev 0
Customer: Paramount Resources
Size: 66"OD x 18'-0"S/S x 740 psig DP @ -20/450 F.
Date: Tuesday, January 16, 2007

Vessel is 66"OD x 18'-0"S/S x 740 psig DP @ -20/450 F.
THIS VESSEL IS REGISTERED UNDER CRN# R2052.21LT
SUBMITTED FOR DESIGN APPROVAL

Table Of Contents

Engineering Notes

Jan 16-2007

1. Nozzle N2 is revised from a NPS 8-300#HB Bore forged nozzle to a NPS 8 S/100 nozzle neck and a 1.25" thk repad.

Nozzle N2 will be fabricated with;
NPS 8 S/100(0.594"wt) SA-106 B nozzle neck
NPS 8 S/100 RFWN SA-105 N flange
Repad 16.625" OD x 8.75"ID x 1.25" Thick SA-516-70 N

The nozzle is fabricated with no internal projection.

All welds are full penetration.

Nozzle to repad fillet weld size is 3/8".
Repad to shell fillet weld size is 1".

See nozzle attachment details in calculations

Deficiencies Summary

No deficiencies found.

Nozzle Schedule

Nozzle mark	Service	Size	Materials								
			Nozzle	Impact	Norm	Fine Grain	Pad	Impact	Norm	Fine Grain	Flange
M1	Existing M1 NPS 20 Manway	20.00 IDx2.50	SA-105	Yes	Yes	No	N/A	N/A	N/A	N/A	HB A105 Class 300
N1	Existing N1 NPS 6 Gas Inlet Nozzle	5.76 IDx1.81	SA-105	Yes	Yes	No	N/A	N/A	N/A	N/A	HB A105 Class 300
N4	Existing N4 NPS 4 Oil Out Nozzle	3.83 IDx1.39	SA-105	Yes	Yes	No	N/A	N/A	N/A	N/A	HB A105 Class 300
N5	Existing N5 NPS 3 Water Out Nozzle	2.90 IDx1.24	SA-105	No	No	No	N/A	N/A	N/A	N/A	HB A105 Class 300
N6	Existing N6 NPS 3 LSHH Nozzle	2.90 IDx1.24	SA-105	No	No	No	N/A	N/A	N/A	N/A	HB A105 Class 300
N7	Existing N7 NPS 4 Oil LLC Nozzle	4" XX Heavy	SA-106 B Smls pipe	No	No	No	SA-516 70	No	Yes	No	WN A105 Class 300
N8	Existing N8 NPS 4 Water LLC Nozzle	4" XX Heavy	SA-106 B Smls pipe	No	No	No	SA-516 70	No	Yes	No	WN A105 Class 300
New N2	New N2 NPS 8 Gas Outlet Nozzle #1	8" Sch 100	SA-106 B Smls pipe	No	No	No	SA-516 70	No	Yes	No	WN A105 Class 300
New N3	New N3 NPS 2 Drain Nozzle	2" Sch 160	SA-106 B Smls pipe	No	No	No	N/A	N/A	N/A	N/A	WN A105 Class 300
New N9A	New N9A NPS 4 Anode Nozzle	3.83 IDx1.39	SA-350 LF2 Cl 1	No	No	No	N/A	N/A	N/A	N/A	HB A350 LF2 Cl.1 Class 300
New N9B	New N9B NPS 4 Anode Nozzle	3.83 IDx1.39	SA-350 LF2 Cl 1	No	No	No	N/A	N/A	N/A	N/A	HB A350 LF2 Cl.1 Class 300

Nozzle Summary

Nozzle mark	OD (in)	t_n (in)	Req t_n (in)	A_1?	A_2?	Shell			Reinforcement Pad		Corr (in)	A_a/A_r (%)
						Nom t (in)	Design t (in)	User t (in)	Width (in)	t_{pad} (in)		
M1	25.00	2.5000	0.5081	Yes	Yes	1.3125*	1.2079		N/A	N/A	0.1250	100.3
N1	9.38	1.8100	0.4444	Yes	Yes	1.3750	1.3282		N/A	N/A	0.1250	141.6
N4	6.62	1.3950	0.3700	Yes	Yes	1.3750	1.3282		N/A	N/A	0.1250	159.5
N5	5.38	1.2400	0.3507	Yes	Yes	1.3750	1.3282		N/A	N/A	0.1250	164.8
N6	5.38	1.2400	0.3507	Yes	Yes	1.3750	1.3282		N/A	N/A	0.1250	237.6
N7	4.50	0.6740	0.3799	Yes	Yes	1.3750	1.3282		2.0000	1.0000	0.1250	100.3
N8	4.50	0.6740	0.3799	Yes	Yes	1.3750	1.3282		2.0000	1.0000	0.1250	100.3
New N2	8.63	0.5940	0.4649	Yes	Yes	1.3750	1.3282		4.0000	1.2500	0.1250	107.8
New N3	2.38	0.3440	0.2969	Yes	Yes	1.3750	N/A		N/A	N/A	0.1250	Exempt
New N9A	6.62	1.3950	0.3700	Yes	Yes	1.3750	1.3282		N/A	N/A	0.1250	159.5
New N9B	6.62	1.3950	0.3700	Yes	Yes	1.3750	1.3282		N/A	N/A	0.1250	159.5

t_n: Nozzle thickness

Req t_n: Nozzle thickness required per UG-45/UG-16

Nom t: Vessel wall thickness

Design t: Required vessel wall thickness due to pressure + corrosion allowance per UG-37

User t: Local vessel wall thickness (near opening)

A_a: Area available per UG-37, governing condition

A_r: Area required per UG-37, governing condition

Corr: Corrosion allowance on nozzle wall

***** Head minimum thickness after forming

Pressure Summary

Pressure Summary for Chamber bounded by Ellipsoidal Head #2 and Left Ellipsoidal Head #1

Identifier	P Design (psi)	T Design (°F)	MAWP (psi)	MAP (psi)	MDMT (°F)	MDMT Exemption	Total Corrosion Allowance (in)	Impact Test
Left Ellipsoidal Head #1	740.0	100.0	747.67	824.99	-21.7	Note 1	0.125	No
Straight Flange on Left Ellipsoidal Head #1	740.0	100.0	769.23	847.46	-21.7	Note 2	0.125	No
Cylinder #1	740.0	100.0	769.23	847.46	-21.7	Note 2	0.125	No
Cylinder #2	740.0	100.0	769.23	847.46	-21.7	Note 2	0.125	No
Straight Flange on Ellipsoidal Head #2	740.0	100.0	769.23	847.46	-21.7	Note 2	0.125	No
Ellipsoidal Head #2	740.0	100.0	747.67	824.99	-21.7	Note 3	0.125	No
Saddle #1	740.0	100.0	740.00	N/A	N/A	N/A	N/A	N/A
Existing M1 NPS 20 Manway (M1)	740.0	100.0	740.00	740.00	-20.0	Note 4	0.125	Yes
Existing N1 NPS 6 Gas Inlet Nozzle (N1)	740.0	100.0	740.00	740.00	-20.0	Note 4	0.125	Yes
Existing N4 NPS 4 Oil Out Nozzle (N4)	740.0	100.0	740.00	740.00	-20.0	Note 4	0.125	Yes
Existing N5 NPS 3 Water Out Nozzle (N5)	740.0	100.0	740.00	740.00	-20.0	Note 5	0.125	No
Existing N6 NPS 3 LSHH Nozzle (N6)	740.0	100.0	740.00	740.00	-20.0	Note 5	0.125	No
Existing N7 NPS 4 Oil LLC Nozzle (N7)	740.0	100.0	740.00	740.00	-20.0	Nozzle Note 5; Pad note 6	0.125	No
Existing N8 NPS 4 Water LLC Nozzle (N8)	740.0	100.0	740.00	740.00	-20.0	Nozzle Note 5; Pad note 6	0.125	No
New N2 NPS 8 Gas Outlet Nozzle #1 (New N2)	740.0	100.0	740.00	740.00	-20.0	Nozzle Note 5; Pad note 7	0.125	No
New N3 NPS 2 Drain Nozzle (New N3)	740.0	100.0	740.00	740.00	-20.0	Note 5	0.125	No
New N9A NPS 4 Anode Nozzle (New N9A)	740.0	100.0	740.00	740.00	-55.0	Note 8	0.125	No
New N9B NPS 4 Anode Nozzle (New N9B)	740.0	100.0	740.00	740.00	-55.0	Note 8	0.125	No

Chamber design MDMT is -20.00°F
Chamber rated MDMT is -20.00°F @ 740.00 psi

Chamber MAWP hot & corroded is 740.00 psi @ 100.0°F

Chamber MAP cold & new is 740.00 psi @ 45.0°F

This pressure chamber is not designed for external pressure.

Notes for MDMT Rating:

Note #	Exemption	Details
1.	Straight Flange governs MDMT	
2.	Material impact test exemption temperature from Fig UCS-66 Curve D = -18 °F Fig UCS-66.1 MDMT reduction = 3.7 °F, (coincident ratio = 0.9625542)	UCS-66 governing thickness = 1.375 in
3.	Straight Flange governs MDMT	
4.	Flange rating governs: Flange impact tested to -20.00°F	UCS-66(i) reduction of 0 °F applied (ratio = 1).
5.	Flange rating governs:	UCS-66(b)(1)(b)
6.	Pad impact test exemption temperature from Fig UCS-66 Curve D = -30 °F Fig UCS-66.1 MDMT reduction = 3.7 °F, (coincident ratio = 0.96255)	UCS-66 governing thickness = 1 in.
7.	Pad impact test exemption temperature from Fig UCS-66 Curve D = -21 °F Fig UCS-66.1 MDMT reduction = 3.7 °F, (coincident ratio = 0.96255)	UCS-66 governing thickness = 1.25 in.
8.	Nozzle is impact tested to -55 °F (UCS-66(g))	UCS-66 governing thickness = 1.375 in.

Design notes are available on the Settings Summary page.

Thickness Summary

Component Identifier	Material	Diameter (in)	Length (in)	Nominal t (in)	Design t (in)	Joint E	Load
Left Ellipsoidal Head #1	SA-516 70	66.00 OD	17.16	1.3125*	1.3008	1.0000	Internal
Straight Flange on Left Ellipsoidal Head #1	SA-516 70	66.00 OD	2.00	1.3750	1.3282	1.0000	Internal
Cylinder #1	SA-516 70	66.00 OD	120.00	1.3750	1.3282	1.0000	Internal
Cylinder #2	SA-516 70	66.00 OD	96.00	1.3750	1.3282	1.0000	Internal
Straight Flange on Ellipsoidal Head #2	SA-516 70	66.00 OD	2.00	1.3750	1.3282	1.0000	Internal
Ellipsoidal Head #2	SA-516 70	66.00 OD	17.16	1.3125*	1.3008	1.0000	Internal

Nominal t: Vessel wall nominal thickness
Design t: Required vessel thickness due to governing loading + corrosion
Joint E: Longitudinal seam joint efficiency
***** Head minimum thickness after forming

Load
internal: Circumferential stress due to internal pressure governs
external: External pressure governs
Wind: Combined longitudinal stress of pressure + weight + wind governs
Seismic: Combined longitudinal stress of pressure + weight + seismic governs

Weight Summary

Component	Weight (lb) Contributed by Vessel Elements						
	Metal New*	Metal Corroded*	Insulation & Supports	Lining	Piping + Liquid	Operating Liquid	Test Liquid
Left Ellipsoidal Head #1	1,784.60	1,623.40	0.00	0.00	0.00	0.00	1,491.57
Cylinder #1	9,409.84	8,571.07	0.00	0.00	0.00	0.00	13,627.60
Cylinder #2	7,533.05	6,861.57	0.00	0.00	0.00	0.00	10,896.44
Ellipsoidal Head #2	1,966.93	1,788.37	0.00	0.00	0.00	0.00	1,429.56
Saddle #1	1,290.00	1,290.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	21,984.41	20,134.41	0.00	0.00	0.00	0.00	27,445.17

*** Shells with attached nozzles have weight reduced by material cut out for opening.**

Component	Weight (lb) Contributed by Attachments							
	Body Flanges		Nozzles & Flanges		Packed Beds	Trays & Supports	Rings & Clips	Vertical Loads
	New	Corroded	New	Corroded				
Left Ellipsoidal Head #1	0.00	0.00	1,427.84	1,391.83	0.00	0.00	0.00	0.00
Cylinder #1	0.00	0.00	514.00	489.37	0.00	0.00	0.00	0.00
Cylinder #2	0.00	0.00	322.33	307.31	0.00	0.00	0.00	0.00
Ellipsoidal Head #2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	0.00	0.00	2,264.18	2,188.51	0.00	0.00	0.00	0.00

Vessel operating weight, Corroded: 22,323 lb
Vessel operating weight, New: 24,249 lb
Vessel empty weight, Corroded: 22,323 lb
Vessel empty weight, New: 24,249 lb
Vessel test weight, New: 51,694 lb

Vessel center of gravity location - from datum - lift condition

Vessel Lift Weight, New: 24,249 lb
Center of Gravity: 101.05"

Vessel Capacity

Vessel Capacity (New): 3,281 US gal**
Vessel Capacity (Corroded): 3,309 US gal**
****The vessel capacity does not include volume of nozzle, piping or other attachments.**

Hydrostatic Test

Shop test pressure determination for Chamber bounded by Ellipsoidal Head #2 and Left Ellipsoidal Head #1 based on MAWP per UG-99(b)

Shop hydrostatic test gauge pressure is 962.000 psi at 45.00 °F (the chamber MAWP = 740.000 psi)

The shop test is performed with the vessel in the horizontal position.

Identifier	Local test pressure psi	Test liquid static head psi	UG-99 stress ratio	UG-99 pressure factor	Stress during test psi	Allowable test stress psi	Stress excessive?
Left Ellipsoidal Head #1 (1)	964.755	2.755	1.0000	1.30	20,963	34,200	No
Straight Flange on Left Ellipsoidal Head #1	964.752	2.752	1.0000	1.30	22,668	34,200	No
Cylinder #1	964.752	2.752	1.0000	1.30	22,668	34,200	No
Cylinder #2	964.752	2.752	1.0000	1.30	22,668	34,200	No
Straight Flange on Ellipsoidal Head #2	964.752	2.752	1.0000	1.30	22,668	34,200	No
Ellipsoidal Head #2	964.755	2.755	1.0000	1.30	20,963	34,200	No
Existing M1 NPS 20 Manway (M1)	963.972	1.972	1.0000	1.30	23,747	48,600	No
Existing N1 NPS 6 Gas Inlet Nozzle (N1)	962.420	0.420	1.0000	1.30	23,689	48,600	No
Existing N4 NPS 4 Oil Out Nozzle (N4)	965.091	3.091	1.0000	1.30	24,089	48,600	No
Existing N5 NPS 3 Water Out Nozzle (N5)	965.091	3.091	1.0000	1.30	23,748	48,600	No
Existing N6 NPS 3 LSHH Nozzle (N6)	963.447	1.447	1.0000	1.30	22,159	48,600	No
Existing N7 NPS 4 Oil LLC Nozzle (N7)	964.317	2.318	1.0000	1.30	19,043	47,250	No
Existing N8 NPS 4 Water LLC Nozzle (N8)	964.317	2.318	1.0000	1.30	19,043	47,250	No
New N2 NPS 8 Gas Outlet Nozzle #1 (New N2)	962.420	0.420	1.0000	1.30	19,744	47,250	No
New N3 NPS 2 Drain Nozzle (New N3)	965.091	3.091	1.0000	1.30	25,202	46,701	No
New N9A NPS 4 Anode Nozzle (New N9A)	964.330	2.330	1.0000	1.30	23,672	48,600	No
New N9B NPS 4 Anode Nozzle (New N9B)	964.330	2.330	1.0000	1.30	23,672	48,600	No

Notes:
(1) Left Ellipsoidal Head #1 limits the UG-99 stress ratio.
(2) P_L stresses at nozzle openings have been estimated using the method described in PVP-Vol. 399, pages 77-82.
(3) VIII-2, AD-151.1(b) used as the basis for nozzle allowable test stress.
(4) The zero degree angular position is assumed to be up, and the test liquid height is assumed to the top-most flange.

The test temperature of 45.00 °F is warmer than the minimum recommended temperature of 10.00 °F so the brittle fracture provision of UG-99(h) has been met.

Field test pressure determination for Chamber bounded by Ellipsoidal Head #2 and Left Ellipsoidal Head #1 based on design P per UG-99(b)

Field hydrostatic test gauge pressure is 962.000 psi at 45.00 °F (the chamber design P = 740.000 psi)

Identifier	Local test pressure psi	Test liquid static head psi	UG-99 stress ratio	UG-99 pressure factor	Stress during test psi	Allowable test stress psi	Stress excessive?
Left Ellipsoidal Head #1 (1)	964.755	2.755	1.0000	1.30	20,963	34,200	No
Straight Flange on Left Ellipsoidal Head #1	964.752	2.752	1.0000	1.30	22,668	34,200	No
Cylinder #1	964.752	2.752	1.0000	1.30	22,668	34,200	No
Cylinder #2	964.752	2.752	1.0000	1.30	22,668	34,200	No
Straight Flange on Ellipsoidal Head #2	964.752	2.752	1.0000	1.30	22,668	34,200	No
Ellipsoidal Head #2	964.755	2.755	1.0000	1.30	20,963	34,200	No
Existing M1 NPS 20 Manway (M1)	963.972	1.972	1.0000	1.30	23,747	48,600	No
Existing N1 NPS 6 Gas Inlet Nozzle (N1)	962.420	0.420	1.0000	1.30	23,689	48,600	No
Existing N4 NPS 4 Oil Out Nozzle (N4)	965.091	3.091	1.0000	1.30	24,089	48,600	No
Existing N5 NPS 3 Water Out Nozzle (N5)	965.091	3.091	1.0000	1.30	23,748	48,600	No
Existing N6 NPS 3 LSHH Nozzle (N6)	963.447	1.447	1.0000	1.30	22,159	48,600	No
Existing N7 NPS 4 Oil LLC Nozzle (N7)	964.317	2.318	1.0000	1.30	19,043	47,250	No
Existing N8 NPS 4 Water LLC Nozzle (N8)	964.317	2.318	1.0000	1.30	19,043	47,250	No
New N2 NPS 8 Gas Outlet Nozzle #1 (New N2)	962.420	0.420	1.0000	1.30	19,744	47,250	No
New N3 NPS 2 Drain Nozzle (New N3)	965.091	3.091	1.0000	1.30	25,202	46,701	No
New N9A NPS 4 Anode Nozzle (New N9A)	964.330	2.330	1.0000	1.30	23,672	48,600	No
New N9B NPS 4 Anode Nozzle (New N9B)	964.330	2.330	1.0000	1.30	23,672	48,600	No

Notes:
(1) Left Ellipsoidal Head #1 limits the UG-99 stress ratio.
(2) P_L stresses at nozzle openings have been estimated using the method described in PVP-Vol. 399, pages 77-82.
(3) VIII-2, AD-151.1(b) used as the basis for nozzle allowable test stress.
(4) The zero degree angular position is assumed to be up, and the test liquid height is assumed to the top-most flange.

The test temperature of 45.00 °F is warmer than the minimum recommended temperature of 10.00 °F so the brittle fracture provision of UG-99(h) has been met.

Left Ellipsoidal Head #1

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Component:	**Ellipsoidal Head**
Material Specification:	**SA-516 70 (II-D p.14, ln. 30)**

Straight Flange governs MDMT

Internal design pressure: P = 740 psi @ 100 °F

Static liquid head:

P_s= 0 psi (SG=1, H_s=0" Operating head)
P_{th}= 2.7547 psi (SG=1, H_s=76.3125" Horizontal test head)

Corrosion allowance:	**Inner C = 0.125"**	**Outer C = 0"**

Design MDMT = -20°F	**No impact test performed**
Rated MDMT = -21.7°F	**Material is normalized**
	Material is not produced to fine grain practice
	PWHT is not performed
	Do not Optimize MDMT / Find MAWP

Radiography:	**Category A joints -**	**Seamless No RT**
	Head to shell seam -	**Full UW-11(a) Type 1**

Estimated weight*:	**new = 1,784.60 lb**	**corr = 1,623.40 lb**
Capacity*:	**new = 171.4 US gal**	**corr = 173.9 US gal**

*** includes straight flange**

Outer diameter	**=**	**66"**
Minimum head thickness	**=**	**1.3125"**
Head ratio D/2h	**=**	**2 (new)**
Head ratio D/2h	**=**	**1.9922 (corroded)**
Straight flange length L_{sf}	**=**	**2"**
Nominal straight flange thickness t_{sf}	**=**	**1.375"**

Insulation thk*:	**0"**	**density: 0 lb/ft^3**	**weight: 0 lb**
Insulation support ring spacing:	**0"**	**individual weight: 0 lb**	**total weight: 0 lb**
Lining/ref thk*:	**0"**	**density: 0 lb/ft^3**	**weight: 0 lb**

*** includes straight flange if applicable**

Results Summary

The governing condition is internal pressure.

Minimum thickness per UG-16	**=**	**0.0625" + 0.125" = 0.1875"**
Design thickness due to internal pressure (t)	**=**	**1.3008"**
Maximum allowable working pressure (MAWP)	**=**	**747.665 psi**
Maximum allowable pressure (MAP)	**=**	**824.9853 psi**

K (Corroded)

$$K = (1/6)*[2 + (D / (2*h))^2]$$
$$= (1/6)*[2 + (63.625 / (2*15.9688))^2]$$
$$= 0.994792$$

K (New)

$$K = (1/6)*[2 + (D / (2*h))^2]$$
$$= (1/6)*[2 + (63.375 / (2*15.8438))^2]$$
$$= 1$$

Design thickness for internal pressure, (Corroded at 100 °F) Appendix 1-4(c)

$$t = P*D_o*K / (2*S*E + 2*P*(K - 0.1)) + Corrosion$$
$$= 740*66*0.994792 / (2*20000*1 + 2*740*(0.994792 - 0.1)) + 0.125$$
$$= 1.3007"$$

The head internal pressure design thickness is 1.3008".

Maximum allowable working pressure, (Corroded at 100 °F) Appendix 1-4(c)

P = $2*S*E*t / (K*D_o - 2*t*(K - 0.1)) - P_s$
= 2*20000*1*1.1875 / (0.994792*66 - 2*1.1875*(0.994792 - 0.1)) - 0
= 747.665 psi

The maximum allowable working pressure (MAWP) is 747.665 psi.

Maximum allowable pressure, (New at 45 °F) Appendix 1-4(c)

P = $2*S*E*t / (K*D_o - 2*t*(K - 0.1)) - P_s$
= 2*20000*1*1.3125 / (1*66 - 2*1.3125*(1 - 0.1)) - 0
= 824.9853 psi

The maximum allowable pressure (MAP) is 824.9853 psi.

% Extreme fiber elongation - UCS-79(d)

= $(75*t / R_f)*(1 - R_f / R_o)$
= (75*1.375 / 11.4613)*(1 - 11.4613 / ∞)
= 8.9977%

The extreme fiber elongation exceeds 5 percent and the thickness exceeds 5/8 inch;. Heat treatment per UCS-56 is required if fabricated by cold forming.

Cylinder #1

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Component: **Cylinder**
Material specification: **SA-516 70 (II-D p. 14, ln. 30)**
Material impact test exemption temperature from Fig UCS-66 Curve D = -18 °F
Fig UCS-66.1 MDMT reduction = 3.7 °F, (coincident ratio = 0.9625542)
UCS-66 governing thickness = 1.375 in

Internal design pressure: P = 740 psi @ 100°F

Static liquid head:

P_{th}=2.7524 psi(SG=1.0000, H_s=76.2500", Horizontal test head)

Corrosion allowance: **Inner C = 0.1250"** **Outer C = 0.0000"**

Design MDMT = -20.00°F
Rated MDMT = -21.70°F

No impact test performed
Material is normalized
Material is not produced to Fine Grain Practice
PWHT is not performed

Radiography: **Longitudinal joint - Full UW-11(a) Type 1**
Left circumferential joint - Full UW-11(a) Type 1
Right circumferential joint - Full UW-11(a) Type 1

Estimated weight: New = 9480.2725 lb corr = 8635.0996 lb
Capacity: New = 1632.2258 gal corr = 1645.1542 gal

OD = 66.0000"
Length L_c = 120.0000"
t = 1.3750"

Design thickness, (at 100.00°F) Appendix 1-1

t = $P*R_0/(S*E + 0.40*P)$ + Corrosion
= 740.00*33.0000/(20000*1.00 + 0.40*740.00) + 0.1250
= 1.3282"

Maximum allowable working pressure, (at 100.00°F) Appendix 1-1

P = $S*E*t/(R_0 - 0.40*t) - P_s$
= 20000*1.00*1.2500 / (33.0000 - 0.40*1.2500) - 0.0000
= 769.2308 psi

Maximum allowable pressure, (at 45.00°F) Appendix 1-1

P = $S*E*t/(R_0 - 0.40*t)$
= 20000*1.00*1.3750 / (33.0000 - 0.40*1.3750)
= 847.4576 psi

% Extreme fiber elongation - UCS-79(d)

= $(50 * t / R_f) * (1 - R_f / R_0)$
= (50 * 1.3750 / 32.3125) * (1 - 32.3125 / ∞)
= 2.1277 %

Allowable Compressive Stress, Hot and Corroded- S_{cHC}, (table CS-2)

A = $0.125 / (R_0 / t)$
= 0.125 / (33.0000 / 1.2500)
= 0.004735
B = 17101.4570 psi

S = **20000.0000 / 1.0000**
= **20000.0000 psi**

S_{cHC} = **17101.4570 psi**

Allowable Compressive Stress, Hot and New- S_{cHN}, (table CS-2)

A = **0.125 / (R_o / t)**
= **0.125 / (33.0000 / 1.3750)**
= **0.005208**

B = **17210.0332 psi**

S = **20000.0000 / 1.0000**
= **20000.0000 psi**

S_{cHN} = **17210.0332 psi**

Allowable Compressive Stress, Cold and New- S_{cCN}, (table CS-2)

A = **0.125 / (R_o / t)**
= **0.125 / (33.0000 / 1.3750)**
= **0.005208**

B = **17210.0332 psi**

S = **20000.0000 / 1.0000**
= **20000.0000 psi**

S_{cCN} = **17210.0332 psi**

Allowable Compressive Stress, Cold and Corroded- S_{cCC}, (table CS-2)

A = **0.125 / (R_o / t)**
= **0.125 / (33.0000 / 1.2500)**
= **0.004735**

B = **17101.4570 psi**

S = **20000.0000 / 1.0000**
= **20000.0000 psi**

S_{cCC} = **17101.4570 psi**

Allowable Compressive Stress, Vacuum and Corroded- S_{cVC}, (table CS-2)

A = **0.125 / (R_o / t)**
= **0.125 / (33.0000 / 1.2500)**
= **0.004735**

B = **17101.4570 psi**

S = **20000.0000 / 1.0000**
= **20000.0000 psi**

S_{cVC} = **17101.4570 psi**

New N2 NPS 8 Gas Outlet Nozzle #1 (New N2)

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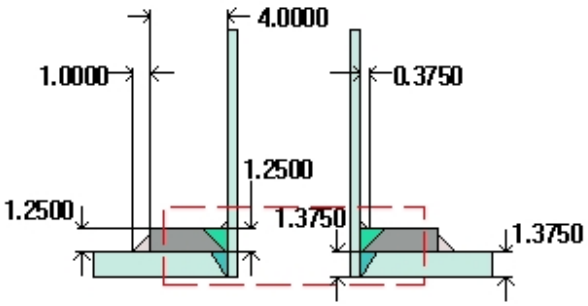

$t_{w(lower)}$ = 1.3750 in
Leg_{41} = 0.3750 in
$t_{w(upper)}$ = 1.2500 in
Leg_{42} = 1.0000 in
D_p = 16.6250 in
t_e = 1.2500 in

.

Note: round inside edges per UG-76(c)

Located on:	**Cylinder #2**
Liquid static head included:	**0 psi**
Nozzle material specification:	**SA-106 B Smls pipe (II-D p. 10, ln. 15)**
Nozzle longitudinal joint efficiency:	**1.00**
Nozzle description:	**8" Sch 100**
Pad material specification:	**SA-516 70 (II-D p. 14, ln. 30) (normalized)**
Pad diameter:	**16.625 in**
Flange description:	**8 inch Class 300 WN A105**
Bolt Material:	**SA-193 B7 Bolt <= 2 1/2 (II-D p. 382, ln. 37)**
Flange rated MDMT:	**-20°F**
(UCS-66(b)(1)(b))	
Liquid static head on flange:	**0 psi**
ASME B16.5 flange rating MAWP:	**740 psi @ 100°F**
ASME B16.5 flange rating MAP:	**740 psi @ 45°F**
ASME B16.5 flange hydro test:	**1125 psi @ 45°F**
Nozzle orientation:	**0°**
Local vessel minimum thickness:	**1.375 in**
Nozzle center line offset to datum line:	**204 in**
End of nozzle to shell center:	**39 in**
Nozzle inside diameter, new:	**7.437 in**
Nozzle nominal wall thickness:	**0.594 in**
Nozzle corrosion allowance:	**0.125 in**
Projection available outside vessel, Lpr:	**6 in**
Pad is split:	**no**

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2) For P = 740 psi @ 100 °F The opening is adequately reinforced							UG-45 Nozzle Wall Thickness Summary (in) The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
9.4126	10.1453	0.3535	1.2353	--	8.4363	0.1202	0.4068	0.5198

Weld Failure Path Analysis Summary (lb_f) All failure paths are stronger than the applicable weld loads						
Weld load W	Weld load W_{1-1}	Path 1-1 strength	Weld load W_{2-2}	Path 2-2 strength	Weld load W_{3-3}	Path 3-3 strength
181,932.17	195,835.02	327,844.38	47,159.75	543,850.25	215,884.77	506,562.19

UW-16 Weld Sizing Summary			
Weld description	Required weld size (in)	Actual weld size (in)	Status
Nozzle to pad fillet (Leg_{41})	0.2500	0.2625	weld size is adequate
Pad to shell fillet (Leg_{42})	0.3750	0.7000	weld size is adequate
Nozzle to pad groove (Upper)	0.3283	1.2500	weld size is adequate

Calculations for internal pressure 740 psi @ 100 °F

Fig UCS-66.2 general note (1) applies.

Nozzle impact test exemption temperature from Fig UCS-66 Curve B = -5.1 °F
Fig UCS-66.1 MDMT reduction = 86.3 °F, (coincident ratio = 0.43258)
Rated MDMT is governed by UCS-66(b)(2).

Pad impact test exemption temperature from Fig UCS-66 Curve D = -21 °F
Fig UCS-66.1 MDMT reduction = 3.7 °F, (coincident ratio = 0.96255).

Nozzle UCS-66 governing thk:	**0.5198**	**in**
Nozzle rated MDMT:	**-55**	**°F**
Pad UCS-66 governing thickness:	**1.25**	**in**
Pad rated MDMT:	**-24.7**	**°F**

Limits of reinforcement per UG-40

Parallel to the vessel wall:	**d = 7.687 in**
Normal to the vessel wall outside:	**$2.5*(t_n - C_n) + t_e$ = 2.4225 in**

Nozzle required thickness per UG-27(c)(1)

t_{rn} = $P*R_n/(S_n*E - 0.6*P)$
= 740*3.8435/(17100*1 - 0.6*740)
= 0.1708 in

Required thickness t_r from UG-37(a)

t_r = $P*R_o/(S*E + 0.4*P)$
= 740*33/(20000*1 + 0.4*740)
= 1.2032 in

Area required per UG-37(c)

Allowable stresses: S_n = 17100, S_v = 20000, S_p = 20000 psi

f_{r1} = lesser of 1 or S_n/S_v = 0.855
f_{r2} = lesser of 1 or S_n/S_v = 0.855
f_{r3} = lesser of f_{r2} or S_p/S_v = 0.855

f_{r4} = lesser of 1 or S_p/S_v = 1

A = $d*t_r*F + 2*t_n*t_r*F*(1 - f_{r1})$
= $7.687*1.2032*1 + 2*0.469*1.2032*1*(1 - 0.855)$
= 9.4126 in^2

Area available from FIG. UG-37.1

A_1 = larger of the following= 0.3535 in^2

= $d*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
= $7.687*(1*1.25 - 1*1.2032) - 2*0.469*(1*1.25 - 1*1.2032)*(1 - 0.855)$
= 0.3535 in^2

= $2*(t + t_n)*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
= $2*(1.25 + 0.469)*(1*1.25 - 1*1.2032) - 2*0.469*(1*1.25 - 1*1.2032)*(1 - 0.855)$
= 0.1546 in^2

A_2 = smaller of the following= 1.2353 in^2

= $5*(t_n - t_{rn})*f_{r2}*t$
= $5*(0.469 - 0.1708)*0.855*1.25$
= 1.5935 in^2

= $2*(t_n - t_{rn})*(2.5*t_n + t_e)*f_{r2}$
= $2*(0.469 - 0.1708)*(2.5*0.469 + 1.25)*0.855$
= 1.2353 in^2

A_{41} = Leg^2*f_{r3}
= $0.375^2*0.855$
= 0.1202 in^2

A_{42} = Leg^2*f_{r4}
= 0^2*1
= 0 in^2

(Part of the weld is outside of the limits)
A_5 = $(D_p - d - 2*t_n)*t_e*f_{r4}$
= $(15.374 - 7.687 - 2*0.469)*1.25*1$
= 8.4363 in^2

Area = $A_1 + A_2 + A_{41} + A_{42} + A_5$
= 0.3535 + 1.2353 + 0.1202 + 0 + 8.4363
= 10.1453 in^2

As Area >= A the reinforcement is adequate.

UW-16(c)(2) Weld Check

Inner fillet: t_{min} = lesser of 0.75 or t_n or t_e = 0.469 in
$t_{c(min)}$ = lesser of 0.25 or $0.7*t_{min}$ = 0.25 in
$t_{c(actual)}$ = 0.7*Leg = 0.7*0.375 = 0.2625 in

Outer fillet: t_{min} = lesser of 0.75 or t_e or t = 0.75 in
$t_{w(min)}$ = $0.5*t_{min}$ = 0.375 in
$t_{w(actual)}$ = 0.7*Leg = 0.7*1 = 0.7 in

UG-45 Nozzle Neck Thickness Check

Wall thickness per UG-45(a): t_{r1} = 0.2958 in (E =1)
Wall thickness per UG-45(b)(1): t_{r2} = 1.3282 in
Wall thickness per UG-16(b): t_{r3} = 0.1875 in
Standard wall pipe per UG-45(b)(4): t_{r4} = 0.4068 in

The greater of t_{r2} or t_{r3}:	**t_{r5} = 1.3282 in**
The lesser of t_{r4} or t_{r5}:	**t_{r6} = 0.4068 in**

Required per UG-45 is the larger of t_{r1} or t_{r6} = 0.4068 in

Available nozzle wall thickness new, t_n = 0.8750*0.594 = 0.5198 in

The nozzle neck thickness is adequate.

Allowable stresses in joints UG-45(c) and UW-15(c)

Groove weld in tension:	**0.74*20000 = 14800 psi**
Nozzle wall in shear:	**0.7*17100 = 11970 psi**
Inner fillet weld in shear:	**0.49*17100 = 8379 psi**
Outer fillet weld in shear:	**0.49*20000 = 9800 psi**
Upper groove weld in tension:	**0.74*20000 = 14800 psi**

Strength of welded joints:

(1) Inner fillet weld in shear
$(\pi/2)$*Nozzle OD*Leg*S_i = $(\pi/2)$*8.625*0.375*8379 = 42569.88 lb_f

(2) Outer fillet weld in shear
$(\pi/2)$*Pad OD*Leg*S_o = $(\pi/2)$*16.625*1*9800 = 255922 lb_f

(3) Nozzle wall in shear
$(\pi/2)$*Mean nozzle dia*t_n*S_n = $(\pi/2)$*8.156*0.469*11970 = 71922.38 lb_f

(4) Groove weld in tension
$(\pi/2)$*Nozzle OD*t_w*S_g = $(\pi/2)$*8.625*1.25*14800 = 250640.2 lb_f

(6) Upper groove weld in tension
$(\pi/2)$*Nozzle OD*t_w*S_g = $(\pi/2)$*8.625*1.25*14800 = 250640.2 lb_f

Loading on welds per UG-41(b)(1)

W = $(A - A_1 + 2*t_n*f_{r1}*(E_1*t - F*t_r))*S_v$
= (9.4126 - 0.3535 + 2*0.469*0.855*(1*1.25 - 1*1.2032))*20000
= 181932.2 lb_f

W_{1-1} = $(A_2 + A_5 + A_{41} + A_{42})*S_v$
= (1.2353 + 8.4363 + 0.1202 + 0)*20000
= 195835 lb_f

W_{2-2} = $(A_2 + A_3 + A_{41} + A_{43} + 2*t_n*t*f_{r1})*S_v$
= (1.2353 + 0 + 0.1202 + 0 + 2*0.469*1.25*0.855)*20000
= 47159.75 lb_f

W_{3-3} = $(A_2 + A_3 + A_5 + A_{41} + A_{42} + A_{43} + 2*t_n*t*f_{r1})*S_v$
= (1.2353 + 0 + 8.4363 + 0.1202 + 0 + 0 + 2*0.469*1.25*0.855)*20000
= 215884.8 lb_f

Load for path 1-1 lesser of W or W_{1-1} = 181932.2 lb_f
Path 1-1 through (2) & (3) = 255922 + 71922.38 = 327844.4 lb_f
Path 1-1 is stronger than W so it is acceptable per UG-41(b)(2).

Load for path 2-2 lesser of W or W_{2-2} = 47159.75 lb_f
Path 2-2 through (1), (4), (6) = 42569.88 + 250640.2 + 250640.2 = 543850.3 lb_f
Path 2-2 is stronger than W_{2-2} so it is acceptable per UG-41(b)(1).

Load for path 3-3 lesser of W or W_{3-3} = 181932.2 lb_f
Path 3-3 through (2), (4) = 255922 + 250640.2 = 506562.2 lb_f
Path 3-3 is stronger than W so it is acceptable per UG-41(b)(2).

New N3 NPS 2 Drain Nozzle (New N3)

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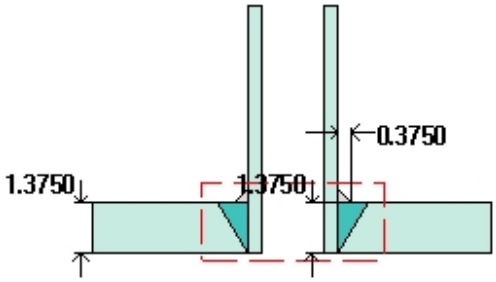
$t_{w(lower)}$ = 1.3750 in

Leg_{41} = 0.3750 in



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Note: round inside edges per UG-76(c)

Located on:	**Cylinder #1**
Liquid static head included:	**0 psi**
Nozzle material specification:	**SA-106 B Smls pipe (II-D p. 10, ln. 15)**
Nozzle longitudinal joint efficiency:	**1.00**
Nozzle description:	**2" Sch 160**
Flange description:	**2 inch Class 300 WN A105**
Bolt Material:	**SA-193 B7 Bolt <= 2 1/2 (II-D p. 382, ln. 37)**
Flange rated MDMT:	**-20°F**
(UCS-66(b)(1)(b))	
Liquid static head on flange:	**0 psi**
ASME B16.5 flange rating MAWP:	**740 psi @ 100°F**
ASME B16.5 flange rating MAP:	**740 psi @ 45°F**
ASME B16.5 flange hydro test:	**1125 psi @ 45°F**
Nozzle orientation:	**180°**
Local vessel minimum thickness:	**1.375 in**
Nozzle center line offset to datum line:	**72 in**
End of nozzle to shell center:	**41 in**
Nozzle inside diameter, new:	**1.687 in**
Nozzle nominal wall thickness:	**0.344 in**
Nozzle corrosion allowance:	**0.125 in**
Projection available outside vessel, Lpr:	**8 in**

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2) For P = 740 psi @ 100 °F							UG-45 Nozzle Wall Thickness Summary (in) The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
This nozzle is exempt from area calculations per UG-36(c)(3)(a)							0.2598	0.3010

Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(2)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.1533	0.2625	weld size is adequate

Calculations for internal pressure 740 psi @ 100 °F

Fig UCS-66.2 general note (1) applies.

Nozzle is impact test exempt to -155 °F per UCS-66(b)(3) (coincident ratio = 0.24448).

Nozzle UCS-66 governing thk: 0.301 in
Nozzle rated MDMT: -155 °F

Limits of reinforcement per UG-40

Parallel to the vessel wall: $(R_n + t_n + t) = 2.4375$ in
Normal to the vessel wall outside: $2.5*(t_n - C_n) + t_e = 0.5475$ in

Nozzle required thickness per UG-27(c)(1)

$t_{rn} = P*R_n/(S_n*E - 0.6*P)$
$= 740*0.9685/(17100*1 - 0.6*740)$
$= 0.043$ in

Required thickness t_r from UG-37(a)

$t_r = P*R_0/(S*E + 0.4*P)$
$= 740*33/(20000*1 + 0.4*740)$
$= 1.2032$ in

This opening does not require reinforcement per UG-36(c)(3)(a)

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.219 in
$t_{c(min)}$ = lesser of 0.25 or $0.7*t_{min}$ = 0.1533 in
$t_{c(actual)} = 0.7*Leg = 0.7*0.375 = 0.2625$ in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Wall thickness per UG-45(a): $t_{r1} = 0.168$ in (E =1)
Wall thickness per UG-45(b)(1): $t_{r2} = 1.3282$ in
Wall thickness per UG-16(b): $t_{r3} = 0.1875$ in
Standard wall pipe per UG-45(b)(4): $t_{r4} = 0.2598$ in

The greater of t_{r2} or t_{r3}: t_{r5} = 1.3282 in

The lesser of t_{r4} or t_{r5}: t_{r6} = 0.2598 in

Required per UG-45 is the larger of t_{r1} or t_{r6} = 0.2598 in

Available nozzle wall thickness new, t_n = 0.8750*0.344 = 0.301 in

The nozzle neck thickness is adequate.

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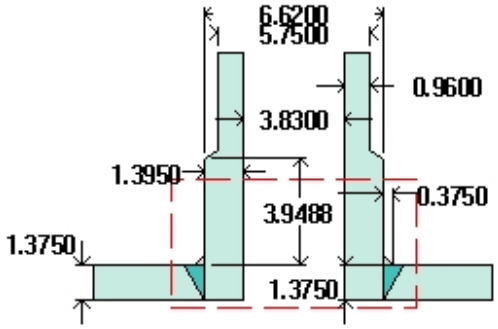

$t_{w(lower)}$ = 1.3750 in
Leg_{41} = 0.3750 in

.

Note: round inside edges per UG-76(c)

Located on:	**Cylinder #1**
Liquid static head included:	**0 psi**
Nozzle material specification:	**SA-350 LF2 Cl 1 (II-D p. 14, ln. 22)**
Nozzle longitudinal joint efficiency:	**1.00**
Flange description:	**4 inch Class 300 HB A350 LF2 Cl.1 (Nut Relief)**
Bolt Material:	**SA-193 B7 Bolt <= 2 1/2 (II-D p. 382, ln. 37)**
Flange rated MDMT:	**-55°F**
(UG-84 provisions apply)	
(Flange impact tested to -55.00°F (UCS-66(g)))	
Liquid static head on flange:	**0 psi**
ASME B16.5 flange rating MAWP:	**740 psi @ 100°F**
ASME B16.5 flange rating MAP:	**740 psi @ 45°F**
ASME B16.5 flange hydro test:	**1125 psi @ 45°F**
Nozzle orientation:	**90°**
Local vessel minimum thickness:	**1.375 in**
Nozzle center line offset to datum line:	**31 in**
End of nozzle to shell center:	**36 in**
Offset from center, Lo:	**18 in**
Nozzle inside diameter, new:	**3.83 in**
Nozzle wall thickness, t_n:	**1.395 in**
Nozzle minimum wall thickness:	**0.96 in**
Nozzle corrosion allowance:	**0.125 in**
Opening chord length:	**4.9166 in**
Projection available outside vessel, Lpr:	**6.45 in**

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2) For P = 740 psi @ 100 °F The opening is adequately reinforced							UG-45 Nozzle Wall Thickness Summary (in) The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
2.9578	10.8636	3.2680	7.4550	--	--	0.1406	0.3700	0.9600

Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(1)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.2500	0.2625	weld size is adequate

Calculations for internal pressure 740 psi @ 100 °F

Nozzle is impact tested to -55 °F (UCS-66(g)).

Nozzle UCS-66 governing thk: 1.375 in
Nozzle rated MDMT: -55 °F

Limits of reinforcement per UG-40

Parallel to the vessel wall: $(R_n + t_n + t) = 4.9783$ in
Normal to the vessel wall outside: $2.5*(t - C) = 3.125$ in

Nozzle required thickness per UG-27(c)(1)

$t_{rn} = P*R_n/(S_n*E - 0.6*P)$
$= 740*2.04/(20000*1 - 0.6*740)$
$= 0.0772$ in

Required thickness t_r from UG-37(a)

$t_r = P*R_0/(S*E + 0.4*P)$
$= 740*33/(20000*1 + 0.4*740)$
$= 1.2032$ in

Area required per UG-37(c)

Allowable stresses: $S_n = 20000$, $S_v = 20000$ psi

f_{r1} = lesser of 1 or $S_n/S_v = 1$
f_{r2} = lesser of 1 or $S_n/S_v = 1$

$A = d*t_r*F + 2*t_n*t_r*F*(1 - f_{r1})$
$= 4.9166*1.2032*0.5 + 2*1.27*1.2032*0.5*(1 - 1)$
$= 2.9578$ in^2

Area available from FIG. UG-37.1

A_1 = larger of the following= 3.268 in^2

$= d*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
$= 4.9166*(1*1.25 - 0.5*1.2032) - 2*1.27*(1*1.25 - 0.5*1.2032)*(1 - 1)$
$= 3.1879$ in^2

$= 2*(t + t_n)*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
$= 2*(1.25 + 1.27)*(1*1.25 - 0.5*1.2032) - 2*1.27*(1*1.25 - 0.5*1.2032)*(1 - 1)$

= 3.268 in^2

A_2 = smaller of the following= 7.455 in^2

= $5*(t_n - t_{rn})*f_{r2}*t$
= $5*(1.27 - 0.0772)*1*1.25$
= 7.455 in^2

= $5*(t_n - t_{rn})*f_{r2}*t_n$
= $5*(1.27 - 0.0772)*1*1.27$
= 7.5743 in^2

A_{41} = Leg^2*f_{r2}
= 0.375^2*1
= 0.1406 in^2

Area = $A_1 + A_2 + A_{41}$
= 3.268 + 7.455 + 0.1406
= 10.8636 in^2

As Area >= A the reinforcement is adequate.

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.75 in
$t_{c(min)}$ = lesser of 0.25 or $0.7*t_{min}$ = 0.25 in
$t_{c(actual)}$ = 0.7*Leg = 0.7*0.375 = 0.2625 in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Wall thickness per UG-45(a):	t_{r1} = 0.2022 in (E =1)
Wall thickness per UG-45(b)(1):	t_{r2} = 1.3282 in
Wall thickness per UG-16(b):	t_{r3} = 0.1875 in
Standard wall pipe per UG-45(b)(4):	t_{r4} = 0.37 in
The greater of t_{r2} or t_{r3}:	t_{r5} = 1.3282 in
The lesser of t_{r4} or t_{r5}:	t_{r6} = 0.37 in

Required per UG-45 is the larger of t_{r1} or t_{r6} = 0.37 in

Available nozzle wall thickness new, t_n = 0.96 in

The nozzle neck thickness is adequate.

Reinforcement check in the plane parallel to the longitudinal axis

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2) For P = 740 psi @ 100 °F The opening is adequately reinforced							UG-45 Nozzle Wall Thickness Summary (in) The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
4.9090	7.8315	0.2359	7.4550	--	--	0.1406	0.3700	0.9600

Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(1)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.2500	0.2625	weld size is adequate

Limits of reinforcement per UG-40

Parallel to the vessel wall: $(R_n + t_n + t) = 4.56$ in
Normal to the vessel wall outside: $2.5*(t - C) = 3.125$ in

Nozzle required thickness per UG-27(c)(1)

t_{rn} = $P*R_n/(S_n*E - 0.6*P)$
= $740*2.04/(20000*1 - 0.6*740)$
= 0.0772 in

Required thickness t_r from UG-37(a)

t_r = $P*R_0/(S*E + 0.4*P)$
= $740*33/(20000*1 + 0.4*740)$
= 1.2032 in

Area required per UG-37(c)

Allowable stresses: S_n = 20000, S_v = 20000 psi

f_{r1} = lesser of 1 or S_n/S_v = 1
f_{r2} = lesser of 1 or S_n/S_v = 1

A = $d*t_r*F + 2*t_n*t_r*F*(1 - f_{r1})$
= $4.08*1.2032*1 + 2*1.27*1.2032*1*(1 - 1)$
= 4.909 in^2

Area available from FIG. UG-37.1

A_1 = larger of the following= 0.2359 in^2

= $d*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
= $4.08*(1*1.25 - 1*1.2032) - 2*1.27*(1*1.25 - 1*1.2032)*(1 - 1)$
= 0.191 in^2

= $2*(t + t_n)*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
= $2*(1.25 + 1.27)*(1*1.25 - 1*1.2032) - 2*1.27*(1*1.25 - 1*1.2032)*(1 - 1)$
= 0.2359 in^2

A_2 = smaller of the following= 7.455 in^2

= $5*(t_n - t_{rn})*f_{r2}*t$
= $5*(1.27 - 0.0772)*1*1.25$

= 7.455 in^2

= $5*(t_n - t_{rn})*f_{r2}*t_n$
= $5*(1.27 - 0.0772)*1*1.27$
= 7.5743 in^2

A_{41} = Leg^2*f_{r2}
= 0.375^2*1
= 0.1406 in^2

Area = $A_1 + A_2 + A_{41}$
= 0.2359 + 7.455 + 0.1406
= 7.8315 in^2

As Area >= A the reinforcement is adequate.

UG-45 Nozzle Neck Thickness Check

Wall thickness per UG-45(a):	t_{r1} = 0.2022 in (E =1)
Wall thickness per UG-45(b)(1):	t_{r2} = 1.3282 in
Wall thickness per UG-16(b):	t_{r3} = 0.1875 in
Standard wall pipe per UG-45(b)(4):	t_{r4} = 0.37 in
The greater of t_{r2} or t_{r3}:	t_{r5} = 1.3282 in
The lesser of t_{r4} or t_{r5}:	t_{r6} = 0.37 in

Required per UG-45 is the larger of t_{r1} or t_{r6} = 0.37 in

Available nozzle wall thickness new, t_n = 0.96 in

The nozzle neck thickness is adequate.

New N9B NPS 4 Anode Nozzle (New N9B)

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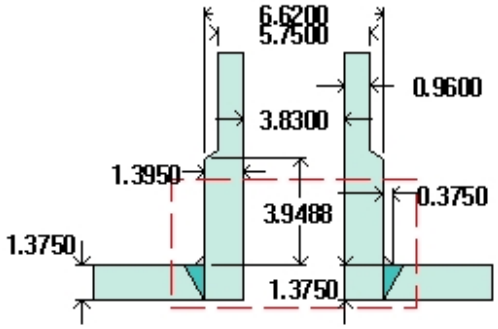


$t_{w(lower)}$ = 1.3750 in

Leg_{41} = 0.3750 in

.

Note: round inside edges per UG-76(c)

Located on:	**Cylinder #1**
Liquid static head included:	**0 psi**
Nozzle material specification:	**SA-350 LF2 Cl 1 (II-D p. 14, ln. 22)**
Nozzle longitudinal joint efficiency:	**1.00**
Flange description:	**4 inch Class 300 HB A350 LF2 Cl.1 (Nut Relief)**
Bolt Material:	**SA-193 B7 Bolt <= 2 1/2 (II-D p. 382, ln. 37)**
Flange rated MDMT:	**-55°F**
(UG-84 provisions apply)	
(Flange impact tested to -55.00°F (UCS-66(g)))	
Liquid static head on flange:	**0 psi**
ASME B16.5 flange rating MAWP:	**740 psi @ 100°F**
ASME B16.5 flange rating MAP:	**740 psi @ 45°F**
ASME B16.5 flange hydro test:	**1125 psi @ 45°F**
Nozzle orientation:	**90°**
Local vessel minimum thickness:	**1.375 in**
Nozzle center line offset to datum line:	**90 in**
End of nozzle to shell center:	**36 in**
Offset from center, Lo:	**18 in**
Nozzle inside diameter, new:	**3.83 in**
Nozzle wall thickness, t_n:	**1.395 in**
Nozzle minimum wall thickness:	**0.96 in**
Nozzle corrosion allowance:	**0.125 in**
Opening chord length:	**4.9166 in**
Projection available outside vessel, Lpr:	**6.45 in**

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2) For P = 740 psi @ 100 °F The opening is adequately reinforced							UG-45 Nozzle Wall Thickness Summary (in) The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
2.9578	10.8636	3.2680	7.4550	--	--	0.1406	0.3700	0.9600

Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(1)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.2500	0.2625	weld size is adequate

Calculations for internal pressure 740 psi @ 100 °F

Nozzle is impact tested to -55 °F (UCS-66(g)).

Nozzle UCS-66 governing thk: 1.375 in
Nozzle rated MDMT: -55 °F

Limits of reinforcement per UG-40

Parallel to the vessel wall: $(R_n + t_n + t) = 4.9783$ in
Normal to the vessel wall outside: $2.5*(t - C) = 3.125$ in

Nozzle required thickness per UG-27(c)(1)

$t_{rn} = P*R_n/(S_n*E - 0.6*P)$
$= 740*2.04/(20000*1 - 0.6*740)$
$= 0.0772$ in

Required thickness t_r from UG-37(a)

$t_r = P*R_0/(S*E + 0.4*P)$
$= 740*33/(20000*1 + 0.4*740)$
$= 1.2032$ in

Area required per UG-37(c)

Allowable stresses: $S_n = 20000$, $S_v = 20000$ psi

f_{r1} = lesser of 1 or $S_n/S_v = 1$
f_{r2} = lesser of 1 or $S_n/S_v = 1$

$A = d*t_r*F + 2*t_n*t_r*F*(1 - f_{r1})$
$= 4.9166*1.2032*0.5 + 2*1.27*1.2032*0.5*(1 - 1)$
$= 2.9578$ in^2

Area available from FIG. UG-37.1

A_1 = larger of the following= 3.268 in^2

$= d*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
$= 4.9166*(1*1.25 - 0.5*1.2032) - 2*1.27*(1*1.25 - 0.5*1.2032)*(1 - 1)$
$= 3.1879$ in^2

$= 2*(t + t_n)*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
$= 2*(1.25 + 1.27)*(1*1.25 - 0.5*1.2032) - 2*1.27*(1*1.25 - 0.5*1.2032)*(1 - 1)$

= 3.268 in^2

A_2 = smaller of the following= 7.455 in^2

= $5*(t_n - t_{rn})*f_{r2}*t$
= 5*(1.27 - 0.0772)*1*1.25
= 7.455 in^2

= $5*(t_n - t_{rn})*f_{r2}*t_n$
= 5*(1.27 - 0.0772)*1*1.27
= 7.5743 in^2

A_{41} = Leg^2*f_{r2}
= 0.375^2*1
= 0.1406 in^2

Area = $A_1 + A_2 + A_{41}$
= 3.268 + 7.455 + 0.1406
= 10.8636 in^2

As Area >= A the reinforcement is adequate.

UW-16(c) Weld Check

Fillet weld: t_{min} = lesser of 0.75 or t_n or t = 0.75 in
$t_{c(min)}$ = lesser of 0.25 or $0.7*t_{min}$ = 0.25 in
$t_{c(actual)}$ = 0.7*Leg = 0.7*0.375 = 0.2625 in

The fillet weld size is satisfactory.

Weld strength calculations are not required for this detail which conforms to Fig. UW-16.1, sketch (c-e).

UG-45 Nozzle Neck Thickness Check

Wall thickness per UG-45(a):	t_{r1} = 0.2022 in (E =1)
Wall thickness per UG-45(b)(1):	t_{r2} = 1.3282 in
Wall thickness per UG-16(b):	t_{r3} = 0.1875 in
Standard wall pipe per UG-45(b)(4):	t_{r4} = 0.37 in
The greater of t_{r2} or t_{r3}:	t_{r5} = 1.3282 in
The lesser of t_{r4} or t_{r5}:	t_{r6} = 0.37 in

Required per UG-45 is the larger of t_{r1} or t_{r6} = 0.37 in

Available nozzle wall thickness new, t_n = 0.96 in

The nozzle neck thickness is adequate.

Reinforcement check in the plane parallel to the longitudinal axis

Reinforcement Calculations for Internal Pressure

UG-37 Area Calculation Summary (in^2) For P = 740 psi @ 100 °F The opening is adequately reinforced							UG-45 Nozzle Wall Thickness Summary (in) The nozzle passes UG-45	
A required	A available	A_1	A_2	A_3	A_5	A welds	t_{req}	t_{min}
4.9090	7.8315	0.2359	7.4550	--	--	0.1406	0.3700	0.9600

Weld Failure Path Analysis Summary
The nozzle is exempt from weld strength calculations per UW-15(b)(1)

UW-16 Weld Sizing Summary			
Weld description	Required weld throat size (in)	Actual weld throat size (in)	Status
Nozzle to shell fillet (Leg_{41})	0.2500	0.2625	weld size is adequate

Limits of reinforcement per UG-40

Parallel to the vessel wall: $(R_n + t_n + t) = 4.56$ in
Normal to the vessel wall outside: $2.5*(t - C) = 3.125$ in

Nozzle required thickness per UG-27(c)(1)

$t_{rn} = P*R_n/(S_n*E - 0.6*P)$
$= 740*2.04/(20000*1 - 0.6*740)$
$= 0.0772$ in

Required thickness t_r from UG-37(a)

$t_r = P*R_o/(S*E + 0.4*P)$
$= 740*33/(20000*1 + 0.4*740)$
$= 1.2032$ in

Area required per UG-37(c)

Allowable stresses: $S_n = 20000$, $S_v = 20000$ psi

f_{r1} = lesser of 1 or $S_n/S_v = 1$
f_{r2} = lesser of 1 or $S_n/S_v = 1$

$A = d*t_r*F + 2*t_n*t_r*F*(1 - f_{r1})$
$= 4.08*1.2032*1 + 2*1.27*1.2032*1*(1 - 1)$
$= 4.909$ in^2

Area available from FIG. UG-37.1

A_1 = larger of the following= 0.2359 in^2

$= d*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
$= 4.08*(1*1.25 - 1*1.2032) - 2*1.27*(1*1.25 - 1*1.2032)*(1 - 1)$
$= 0.191$ in^2

$= 2*(t + t_n)*(E_1*t - F*t_r) - 2*t_n*(E_1*t - F*t_r)*(1 - f_{r1})$
$= 2*(1.25 + 1.27)*(1*1.25 - 1*1.2032) - 2*1.27*(1*1.25 - 1*1.2032)*(1 - 1)$
$= 0.2359$ in^2

A_2 = smaller of the following= 7.455 in^2

$= 5*(t_n - t_{rn})*f_{r2}*t$
$= 5*(1.27 - 0.0772)*1*1.25$

= 7.455 in^2

= 5*(t_n - t_{rn})*f_{r2}*t_n
= 5*(1.27 - 0.0772)*1*1.27
= 7.5743 in^2

A_{41} = Leg^2*f_{r2}
= 0.375^2*1
= 0.1406 in^2

Area = A_1 + A_2 + A_{41}
= 0.2359 + 7.455 + 0.1406
= 7.8315 in^2

As Area >= A the reinforcement is adequate.

UG-45 Nozzle Neck Thickness Check

Wall thickness per UG-45(a):	t_{r1} = 0.2022 in (E =1)
Wall thickness per UG-45(b)(1):	t_{r2} = 1.3282 in
Wall thickness per UG-16(b):	t_{r3} = 0.1875 in
Standard wall pipe per UG-45(b)(4):	t_{r4} = 0.37 in
The greater of t_{r2} or t_{r3}:	t_{r5} = 1.3282 in
The lesser of t_{r4} or t_{r5}:	t_{r6} = 0.37 in

Required per UG-45 is the larger of t_{r1} or t_{r6} = 0.37 in

Available nozzle wall thickness new, t_n = 0.96 in

The nozzle neck thickness is adequate.

SOUTH HEAD

BOTTOM DEAD CENTER

CIRC

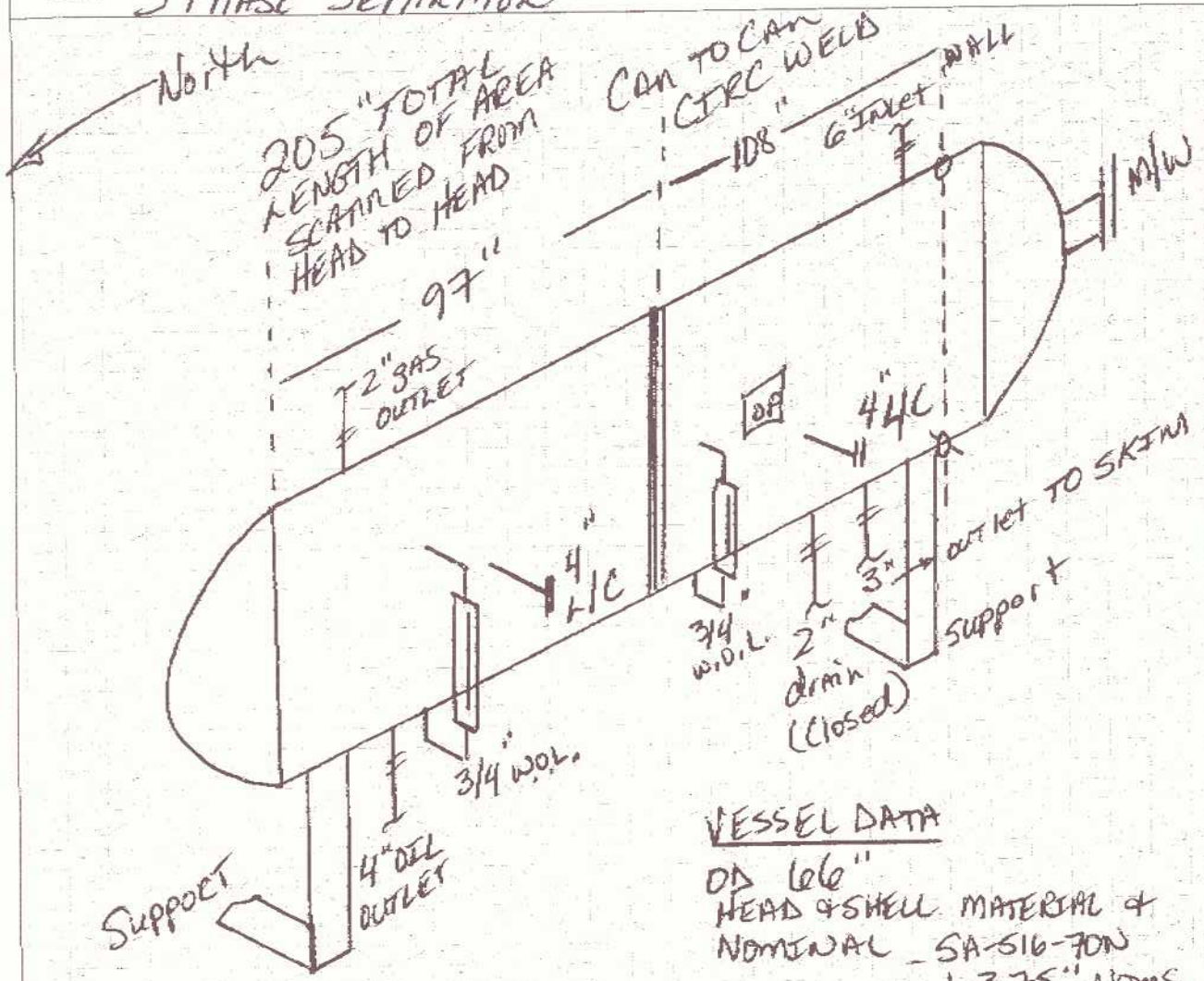
H01	1.405in	G01	1.407in	F01	1.408in	E01	1.332in	D01	1.240in	C01	1.410in	B01	1.413in	A01	1.417in	
H02	1.408in	G02	1.408in	F02	1.407in	E02	1.160in	D02	1.160in	C02	1.316in	B02	1.415in	A02	1.419in	
H03	1.409in	G03	1.410in	F03	1.410in	E03	1.147in	D03	1.161in	C03	1.417in	B03	1.415in	A03	1.419in	
H04	1.406in	G04	1.411in	F04	1.412in	E04	1.410in	D04	1.408in	C04	1.416in	B04	1.416in	A04	1.419in	
H05	1.409in	G05	1.416in	F05	1.414in	E05	1.405in	D05	1.402in	C05	1.416in	B05	1.422in	A05	1.419in	
H06	1.405in	G06	1.412in	F06	1.412in	E06	1.391in	D06	1.394in	C06	1.419in	B06	1.420in	A06	1.419in	
H07	1.410in	G07	1.412in	F07	1.414in	E07	1.408in	D07	1.406in	C07	1.415in	B07	1.417in	A07	1.423in	
H08	1.410in	G08	1.411in	F08	1.408in	E08	1.405in	D08	1.345in	C08	1.400in	B08	1.416in	A08	1.416in	
H09	1.406in	G09	1.410in	F09	1.392in	E09	1.357in	D09	1.394in	C09	1.409in	B09	1.417in	A09	1.422in	
H10	1.409in	G10	1.407in	F10	1.226in	E10	1.357in	D10	1.409in	C10	1.411in	B10	1.417in	A10	1.419in	
H11	1.408in	G11	1.410in	F11	1.244in	E11	1.351in	D11	1.407in	C11	1.413in	B11	1.419in	A11	1.419in	
H12	1.406in	G12	1.409in	F12	1.385in	E12	1.386in	D12	1.406in	C12	1.396in	B12	1.418in	A12	1.420in	
H13	1.400in	G13	1.409in	F13	1.195in	E13	1.389in	D13	1.411in	C13	1.412in	B13	1.416in	A13	1.421in	
H14	1.407in	G14	1.402in	F14	1.323in	E14	1.360in	D14	1.407in	C14	1.414in	B14	1.418in	A14	1.419in	
H15	1.407in	G15	1.402in	F15	1.259in	E15	1.224in	D15	1.397in	C15	1.179in	B15	1.415in	A15	1.415in	
H16	1.398in	G16	1.409in	F16	1.281in	E16	1.151in	D16	1.371in	C16	1.277in	B16	1.417in	A16	1.406in	
H17	1.398in	G17	1.399in	F17	1.257in	E17	1.378in	D17	1.369in	C17	1.392in	B17	1.416in	A17	1.418in	LONGSEAM
H18	1.384in	G18	1.385in	F18	1.385in	E18	1.332in	D18	1.398in	C18	1.388in	B18	1.396in	A18	1.392in	
H19	1.386in	G19	1.387in	F19	1.388in	E19	1.389in	D19	1.392in	C19	1.396in	B19	1.396in	A19	1.399in	
H20	1.375in	G20	1.389in	F20	1.389in	E20	1.392in	D20	1.393in	C20	1.397in	B20	1.399in	A20	1.402in	
H21	1.391in	G21	1.389in	F21	1.391in	E21	1.392in	D21	1.389in	C21	1.399in	B21	1.397in	A21	1.399in	
H22	1.391in	G22	1.391in	F22	1.394in	E22	1.396in	D22	1.389in	C22	1.401in	B22	1.402in	A22	1.403in	
H23	1.390in	G23	1.392in	F23	1.393in	E23	1.395in	D23	1.399in	C23	1.401in	B23	1.403in	A23	1.399in	
H24	1.391in	G24	1.391in	F24	1.394in	E24	1.395in	D24	1.399in	C24	1.401in	B24	1.405in	A24	1.398in	
H25	1.390in	G25	1.391in	F25	1.392in	E25	1.388in	D25	1.390in	C25	1.400in	B25	1.404in	A25	1.402in	
H26	1.389in	G26	1.392in	F26	1.391in	E26	1.395in	D26	1.390in	C26	1.400in	B26	1.403in	A26	1.401in	
H27	1.389in	G27	1.390in	F27	1.393in	E27	1.393in	D27	1.394in	C27	1.391in	B27	1.396in	A27	1.401in	
H28	1.385in	G28	1.390in	F28	1.392in	E28	1.386in	D28	1.394in	C28	1.397in	B28	1.402in	A28	1.400in	
H29	1.384in	G29	1.388in	F29	1.393in	E29	1.371in	D29	1.397in	C29	1.394in	B29	1.399in	A29	1.395in	
H30	1.386in	G30	1.386in	F30	1.388in	E30	1.390in	D30	1.397in	C30	1.394in	B30	1.395in	A30	1.393in	
H31	1.374in	G31	1.370in	F31	1.378in	E31	1.377in	D31	1.379in	C31	1.397in	B31	1.391in	A31	1.388in	CIRC

BOTTOM DEAD CENTER

NORTH HEAD

ZZ1	1.384in	BOTTOM NORTH HEAD	3" WATER OUTLET NOZZLE	1.225in	LONG NECK FORGED FITTING
ZZ2	1.386in	BOTTOM NORTH HEAD	2" DRAIN NOZZLE, CLOSED	0.273in	2" SCH. 160, 0.343" NOM. SMALL ID PITTING
ZZ3	1.385in	BOTTOM NORTH HEAD	4" LEVEL CONTROL NOZZLE	0.673in	4" XXS NOM. 0.674"
XX1	1.382in	BOTTOM SOUTH HEAD	3" HLSD NOZZLE	0.836in	
XX2	1.381in	BOTTOM SOUTH HEAD	4" LEVEL CONTROL NOZZLE	0.667in	4" XXS NOM. 0.674"
XX3	1.382in	BOTTOM SOUTH HEAD	4" OIL OUTLET NOZZLE	1.367in	LONG NECK FORGED FITTING
QQ1	1.397in	BOTTOM SHELL BELOW MANWAY			
QQ2	1.392in	BOTTOM SHELL BELOW MANWAY			
QQ3	1.395in	BOTTOM SHELL BELOW MANWAY			
QQ4	1.397in	BOTTOM SHELL BELOW MANWAY			
QQ5	1.398in	BOTTOM SHELL BELOW MANWAY			

ITEM: 3 Phase Separator



VESSEL DATA

OD 66"
HEAD & SHELL MATERIAL & NOMINAL _ SA-516-70N 1.375" NOMS
No Corrosion ALLOWANCE STATED ON NAMEPLATE.

BOTTOM OF VESSEL WAS SCANNED CONTINUOUSLY 100%. BOTTOM SHELL WAS DIVIDED INTO 6"x6" SQUARES, 48" WIDE BY 205" IN LENGTH PLEASE REFER TO PAGE 2 FOR DWG OF EXAMINED AREAS & PAGE 3 FOR THICKNESS MEASUREMENTS.

Comments:

HUNT INSPECTION LTD. SNT

Stettler, AB (403) 742-4868
Lacombe, AB (403) 782-7855
Brooks, AB (403) 501-8029
Grande Prairie, AB (866) 422-9732

TECHNICIAN: Glenn Aiken CGSB Level II UT/MT/RT CGSB # 973B

DATE: 11/20/2006 PAGES # 1 OF 3

CLIENT: Paramount Resources
LSD: H-03
INSPECTOR: Warren Kmiecik
LOCATION: Cameron Hills Battery
DISTRICT UNIT: Cameron Hills
BUILDING / SKID: PKG0335
PROCESS: Sour Emulsion
CODE: ASME VIII DIV. 1
SPECIFICATION: As per ASTM SE 797
TECHNIQUE: UT-1-1, Rev. 1
METHOD: A-Scan / Continuous
SURFACE CONDITION: Painted
~~LIGHTING~~: Operating Temp. 104°F

INFORMATION

VESSEL#: POU 2082
CRN#: R-2052.21T
SERIAL#: 02-179HS
MANUFACTURER: ORBAN Ind.
DATE BUILT: 2003
CLIENT ID / TAG: V-100
M.A.W.P: 740 PSI
M.A.W.T: 100°F
JOINT EFFICIENCY / RT: (1)
STRESS RELIEVED: Yes
INSULATED: EXTERNAL HEAD
MAN WAY: Yes

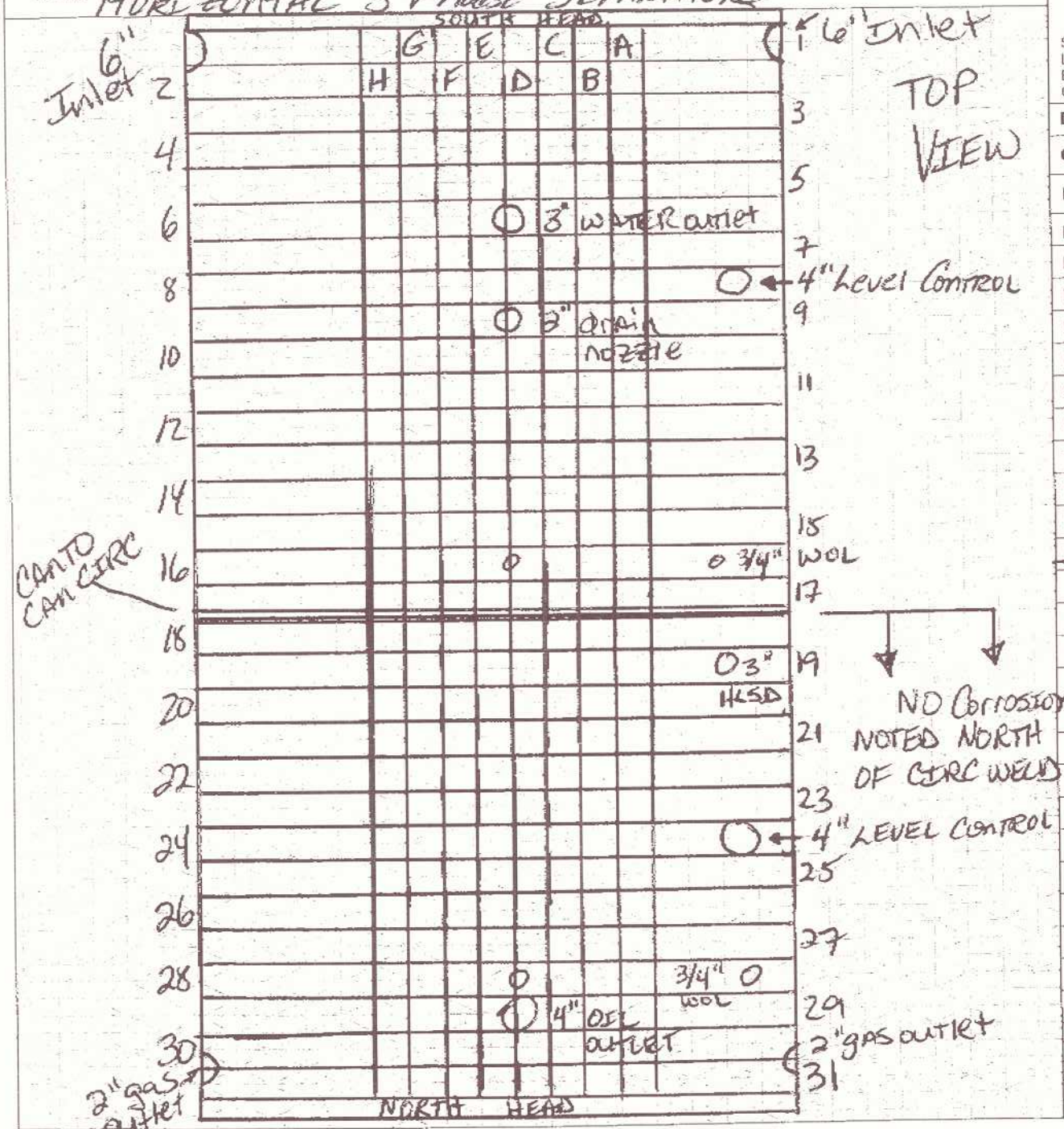
EQUIPMENT USED

PANAMETRICS S/N 050313402 MODEL # EPOCH IV
STRESSTEL .375" S/N 01 BATCH # S/N 0168FA
BATCH #
MODEL #
MODEL #

PROJECT # C10079

Printed by The Stettler Independent

ITEM: HORIZONTAL 3 PHASE SEPARATOR



HUNT INSPECTION LTD.

Stettler, AB (403) 742-4868
Lacombe, AB (403) 782-7855
Brooks, AB (403) 501-8029
Grande Prairie, AB (866) 422-9732

TECHNICIAN: Glenn Allen SNT/CGSB Level III UT/MT CGSB #9738

DATE: 11/20/06 PAGES # 2 OF 3

CLIENT: PARAMOUNT RESOURCES

LSD: H-03

INSPECTOR: Warren Kmicik

LOCATION: Cameron Hills Battery

DISTRICT UNIT: Cameron Hills

BUILDING / SKID: PKG 0335

PROCESS: Sour Emulsion

CODE: ASME VIII DIV. 1

SPECIFICATION: ASTM SE 797

TECHNIQUE: UT-1-1, REV. 1

METHOD: A-SCAN / CONTINUOUS

SURFACE CONDITION: PAINTED

~~LIGHTING:~~ OPERATING TEMP. + 105 °F

INFORMATION

VESSEL#: POU 2082

CRN#: R-2052.21T

SERIAL#: 02-179HS

MANUFACTURER: ORBAN Ind.

DATE BUILT: 2003

CLIENT ID / TAG: V-100

M.A.W.P: 740 PSI

M.A.W.T: 100°F

JOINT EFFICIENCY / RT: 1

STRESS RELIEVED: Yes

INSULATED: External Head

MAN WAY: Yes

EQUIPMENT USED

PANAMETRICS S/N D0534309 MODEL # EPOCH IV

STRESSTEL .375" 5MHZ BATCH # S/N 01685

BATCH #

MODEL #

MODEL #

PROJECT # C10099

Comments:

Government of the Northwest Territories
867-873-0117

Fax:

FAX COVER SHEET

FAX NUMBER TRANSMITTED TO: [ ] 780 458 3983
To: WARREN KMIECIK
Of:: WEK & ASSOCIATES
From: STEVE DONOVAN
Government of the Northwest Territories
Date: [ ] JAN 08/07

DOCUMENTS	NUMBER OF PAGES* 1
Information you requested.	1

COMMENTS: FOR YOUR INFO

Hi!

Our Web Site is up and running to answer any questions concerning the regulating of electrical, gas, boiler and elevator installations . Call if you require additional information. I will be glad to assist you.

Go to : http://www. pws.gov.nt.ca/inspect.htm

Click on safety, then to questions and answers.

Respectively,

Steve Donovan (Chief Boiler Inspector)
Ph # 867-920-3257
Fax # 867-872-0117
E-Mail: stephen_donovan@gov.nt.ca

* NOT COUNTING COVER SHEET. IF YOU DO NOT RECEIVE ALL PAGES, PLEASE TELEPHONE US IMMEDIATELY AT. 867-873-7473

Northwest Territories Public Works and Services

January 5, 2007

James Kozlowski
Paramount Resources Ltd
4700,888 – 3 ST.SW
Calgary, Alberta T2P 5C5

Dear: Sir/Madam

Design Review & Registration

Please be advised that your request for design registration has been approved for use in the Northwest Territories under the following Canadian Registration Number (CRN): R2052.2T

Design: Horizontal Inlet Separator – V 100

Drawing#(s) V – 100 Repair Rev 0 (02 – 179 – A Rev 1)

Catalogue #(s) N/A

CRN #(s): R2052.2T

Fee: $300.00

Reviewed by: Steve Donovan

In accordance with Section 4.6 of CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code, a Manufacturer's Data Report shall be completed and copied to the jurisdictional authorities advising of the location of installation.

Enclosed are stamped copies of the approved documents. Your company will be invoiced for the review and registration at a later date.

Sincerely,

Steve Donovan
Chief Boiler Inspector
Electrical/Mechanical Safety

Enclosure