TRINITY MARINE PRODUCTS, INC.

ASHLAND CITY, TN - MADISONVILLE, LA
CARUTHERSVILLE, MO – PORT ALLEN, LA

VAPOR CONTROL SYSTEM (VCS) CALCULATIONS

FOR

TANDEM LOADING AND DISCHARGE

OF

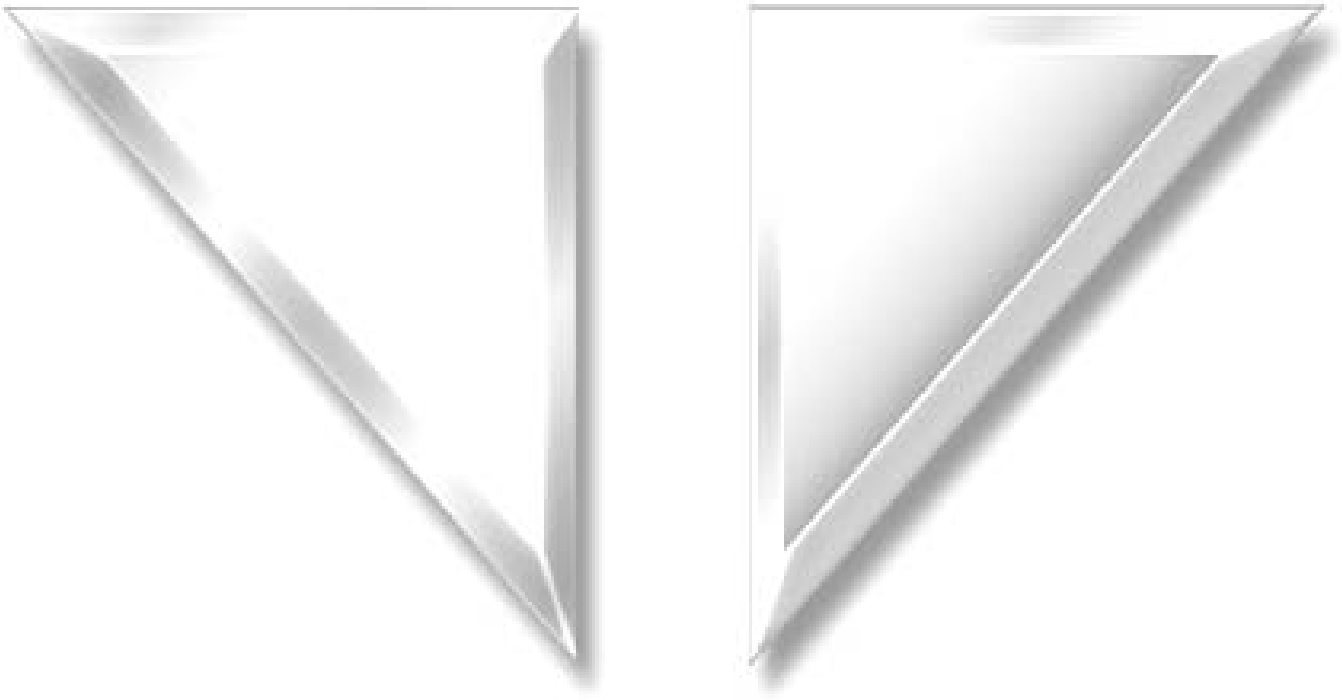
SUBCHAPTER "D" & "O" PRODUCTS

FOR

BLESSEY MARINE SERVICES, INC

TRINITY MARINE PRODUCTS TAG No.: 96234
TRINITY - ASHLAND CITY HULL No.: 5054 -5055
USCG MSC PROJECT No.: Pending

October 1, 2014



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OWNER: Blessey Marine Services, Inc
DESCRIPTION: Double Skin Single Rake Inland Tank Barge
SIZE: 297'-6"x54'-0"x13'-0"
HULL/NAME: 5054 -5055/WEB 352 & WEB 353

CONTRACT: 96234
BY: MEC
DATE: 1-Oct-14

VCS SYSTEM INFORMATION

1. GENERAL DESCRIPTION OF VESSEL:

A. TMP HULL NUMBERS	5054 -5055		
B. NAME (S):	WEB 352 & WEB 353		
C. OFFICIAL NUMBER:	1255462 & 1255463		
D. USCG MSC FILE NUMBER:	Pending		
E. DIMENSIONS:	297'-6"x54'-0"x13'-0"		
F. SERVICE:	Rivers, Lakes, Bays and Sounds, Subchapter "D" and "O"		
G. MAX. ALLOWABLE WORKING PRESSURE:	6.00	psig	
H. PV VALVE PRESSURE SETTING:	5.50	psig	
I. PV VALVE VACUUM SETTING:	2.00	psi	
J. MAX. DISCHARGE RATE:	4000	bbl/hr	374cuft/min
K. MAX. LIQUID LOADING RATE:	4000	bbl/hr	374cuft/min

2. VAPOR CONTROL SYSTEM

A. PIPE DIAMETER:	7.981	in
B. PIPE LENGTHS:	See Trinity Drawing 96234P-06	

C. P/V VALVE ERL SUPERAC PV-6 II

COMP	MAX FLOW @ PRESSURE SETTING	MAX PRESSURE DROP ACROSS VALVE @ MAX TRANSFER
ERL SUPERAC PV-6 II	18350bbl/hr @ 5.5psi	4.744psi @ 10680bbl/hr Air
ERL SUPERAC PV-6 II	8381bbl/hr @ 2.0psi	2.032psi @ 4000bbl/hr Air

D. MAX. VAPOR-AIR MIXTURE DENSITY: 0.432 lbs/ft^3

F. VCS CARGOES: SEE TABLE 1

G. SPILL VALVE None Installed

H. ADDITIONAL INFORMATION:

46CFR39.20-1(a)(4)	SYSTEM IS DESIGNED WITH SEVERAL LOW POINT CONDENSATE DRAINS.
46CFR39.20-1(a)(5)	SYSTEM IS ELECTRICALLY BONDED TO THE VESSEL DUE TO WELDED STEEL CONSTRUCTION
46CFR39.20-1(c)	SYSTEM INCLUDES AN ISOLATION VALVE, MANUALLY OPERATED VALVE, AT EACH FACILITY CONNECTION
46CFR39.20-1(d)	VAPOR HEADER MARKED AS SHOWN IN TRINITY DWG P-6 (SUBMITTED SEPARATELY)
46CFR39.20-1(e)	FACILITY CONNECTION FLANGE FITTED WITH 1/2" STUD 1" LONG AT LOCATION OUTLINED IN REGULATION
	SYSTEM IS DESIGNED TO ACCOMMODATE INTERNAL VISUAL INSPECTION AS REQUIRED FOR CARRIAGE OF POLYMERIZING CARGOES.

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VCS CALCULATIONS

1. CARGO AUTHORITY:

The vapor collection system installed on this vessel is designed to carry the cargoes listed in Table 1. These Cargoes are to be listed on the vessel's Certificate of Inspection.

2. DETERMINING VAPOR AIR MIXTURE DENSITY AND VAPOR GROWTH RATE:

iso-Pentane has the heaviest vapor-air mixture density. iso-Pentane has the highest vapor growth rate (see Table 1 for Calculations)

3. THE MAXIMUM LIQUID TRANSFER RATE AS IMPOSED BY THE CAPACITY OF THE CARGO VENTING SYSTEM 46CFR39.30-1:

A: PRESSURE DROP FROM TANK TO PV VALVE

Tank 4 is the farthest tank from the P/V valve. Using Crane's Technical Paper No. 410, the total equivalent length (L) for the path is shown in Table 2.

TABLE 2

PIPE/FITTINGS	QUANTITY	K	D (in)	UNIT EQ. LENGTH (FT)	TOTAL EQ. LENGTH (FT)	
Entrance, Projecting	1.00	0.78	7.981	37.05	37.05	
90° Long Radius Elbow	1.00	0.20	7.981	9.31	9.31	
Tee Branch Con	1.00	1.10	7.981	52.26	52.26	Tank Drop
Straight Pipe	3.67		7.981	1.00	3.67	102.29
Tee Run Con	2.00	0.55	7.981	26.13	52.26	
Tee 8x6 Full Flow Branch Div	1.00	2.40	7.981	113.92	113.92	
Straight Pipe	145.15		7.981	1.00	145.15	
				Total	413.62	

Using Darcy's Equation, with a 0.014 friction factor and the maximum liquid transfer rate, the pressure drop along the VCS piping between the #4 cargo tank and the P/V valve for each cargo is shown in Table 1.

Using a 4000 bbl/h liquid transfer rate, the vapor-air mixture and air-equivalent volumetric flow rate for each cargo are given in Table 1. At a setting of 5.5 psig, the ERL SUPERAC PV-6 II has an adequate pressure relieving capacity of air for each cargo listed in Table 1. The maximum pressure in the tank, 5.6 psi, based on a pressure drop of 0.0 psig in piping and 4.7 psig across the PV Valve at 1049 bbl air equivalant, does not exceed the cargo tank maximum design working pressure of 6.0 psi.

Pressure Drop of Air Flow Into Tanks During Discharge

NAME	ρ @ 115°f (LBS/CUFT)	f	PIPE DIA (FT)	TOTAL EQ. LENGTH (FT)	FLOW RATE (CUFT/SEC	V (FT/SEC)	PRESSURE DROP (PSI)
Air	0.069	0.014	0.665	413.62	6.24	17.96	0.021

Using a 4000 bbl/h liquid transfer rate as the air flow rate. At a setting of 2.0 psig, the ERL SUPERAC PV-6 II has an adequate pressure relieving capacity of air. The maximum vacuum in the tank, 2.1 psi based on a pressure drop of 0.0 psig in piping and 2.0 psig across the PV Valve at 4000 bbl air, does not exceed the cargo tank maximum design working pressure of 6.0 psi.

VCS CALCULATIONS (CONT)

B: PRESSURE DROP FROM TANK TO FACILITY VAPOR CONNECTION

The sum of the pressure drop along the longest path and the pressure at the facility vapor connection may not exceed 80 percent of the P/V valve setting. The total equivalent length from cargo tank #1 to the vapor connection is given in Table 3.

TABLE 3

	PIPE/FITTINGS	QUANTITY	K	D (in)	UNIT EQ. LENGTH (FT)	TOTAL EQ. LENGTH (FT)	
Outboard Barge	Tank Drop	102.29		7.981	1.00	102.29	(From Above)
	Tee Run Div	1.00	0.300	7.981	14.25	14.25	
	Tee Run Con	3.00	0.550	7.981	26.13	78.38	
	Tee Branch Div	1.00	1.040	7.981	49.41	49.41	
	Tee Branch Con	1.00	1.100	7.981	52.26	52.26	
	8" Gate Valve	1.00	0.112	7.981	5.32	5.32	
	Straight Pipe	232.50		7.981	1.00	232.50	
				Single Loading Subtotal		**534.41**	
Inboard Barge	Cargo Hose	20.00		7.981	1.00	20.00	
	8" Gate Valve	2.00	0.112	7.981	5.32	10.64	
	Tee Run Con	1.00	0.550	7.981	26.13	26.13	
	Straight Pipe	39.67		7.981	1.00	39.67	
					Total	**630.85**	

Pressure drop at the maximum liquid loading rate of 4000bbl/h from Tank 1 to the Vapor Header Connection for each cargo is given in Table 1.

The largest pressure drop (0.3psi) does not exceed 80 percent of the P/V valve pressure setting (4.4psig).

4. THE MAXIMUM LIQUID TRANSFER RATE AS IMPOSED BY THE RELIEVING CAPACITY OF THE CARGO TANK SPILL VALVE OR RUPTURE DISK.

MANUFACTURER / MODEL: None Installed

5. THE MAXIMUM LIQUID TRANSFER RATE AS IMPOSED BY THE SET POINT OF THE OVERFILL ALARM

CONTROLLING TANK:	Tank No. 4	
SET POINT OF OVERFILL SHUTDOWN:	13.56*	IN ULLAGE FROM GAUGE FLANGE
REMAINING CAPACITY AT SHUTDOWN:	545	CUFT
MAX LOAD RATE:	374	CUFT/MIN
MAX LOAD RATE PER TANK:	4000	BBL/HR
TIME REMAINING FOR SHUTDOWN	1.5	MIN
TIME REQUIRED BY 46CFR39.20-9:	1.0	MIN
MARGIN:	0.5	MIN

*Note: Setpoint is minimum required setpoint. Actual setting will be done by Owner prior to COI.

The #4 cargo tank has a set point for the overfill shutdown set at 1.13ft BELOW THE FLANGE OF THE GAUGE. The tank capacity above this level is 545cuft. With a liquid transfer rate of 4000 bbl/h per tank based on loading into a single tank only, the person in charge of transfer operations has at least 1 minute to stop the transfer operation before the tank overflows. Thus the VCS meets the requirements of 46CFR 39.20-9.

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SIZE: 297'-6"x54'-0"x13'-0" **DATE: 1-Oct-2014**

HULL/NAME: 5054 -5055/WEB 352 & WEB 353

TABLE 1 - VAPOR CONTROL SYSTEM CALCULATIONS

	CHRIS CODE	NAME	COMP GROUP	SUB CHAP	GRADE	HULL TYPE	VCS CAT	REST.	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR WEIGHT DENSITY	VAPOR GROWTH RATE	VAPOR FLOW RATE (bbl/h)	AIR EQUIV FLOW RATE (bbl/hr)	PRESSURE DROP TO PV VALVE IN VCS (LOADING) (psig)	PRESSURE DROP TO SHORE CONN IN VCS (LOADING)* (psig)
1	ABX	Ammonium bisulfite solution (70% or less)	43	O	NA	III	N/A	.50-73, .56-1(a), (b), (c)	0.880	0.330	4.480	0.100	1.007	4026	4143	0.031	0.047
2	ACN	Acrylonitrile	15	O	C	II	4	.50-70(a), .55-1(e)	0.810	5.000	1.800	0.114	1.100	4400	4820	0.042	0.064
3	ADN	Adiponitrile	37	O	E	II	1	No	0.950	0.010	3.730	0.095	1.000	4001	4007	0.029	0.044
4	AEE	Aminoethylethanolamine	8	O	E	III	1	.55-1(b)	1.030	0.010	3.590	0.095	1.000	4001	4007	0.029	0.044
5	AHO	Anthracene oil (Coal tar fraction)	33	O	NA	II	N/A	No	1.030	0.010	3.590	0.095	1.000	4001	4007	0.029	0.044
6	AMH	Ammonium hydroxide (28% or less NH3)	6	O	NA	III	N/A	.56-1(a), (b), (c), (f), (g)	0.940	10.600	2.640	0.177	1.212	4848	6618	0.079	0.120
7	ATN	Acetonitrile	37	O	C	III	3	No	0.780	0.030	1.410	0.095	1.001	4002	4007	0.029	0.044
8	BAR	Butyl acrylate (all isomers)	14	O	D	III	2	.50-70(a), .50-81(a), (b)	0.880	0.600	4.420	0.105	1.012	4048	4252	0.032	0.049
9	BHA	Benzene or hydrocarbon mixtures (containing Acetylene and 10% Benzene or more)	32	O	NA	III	1	.50-60, .56-1(b), (d), (f), (g)	0.880	0.800	4.000	0.106	1.250	5000	5293	0.050	0.077
10	BHB	Benzene or hydrocarbon mixtures (having 10% Benzene or more)	32	O	NA	III	1	.50-60	0.880	0.800	4.000	0.106	1.250	5000	5293	0.050	0.077
11	BMN	Butyl Methacrylate	14	O	D	III	2	.50-70(a), .50-81(a), (b)	0.880	0.290	4.900	0.100	1.006	4023	4138	0.031	0.047
12	BNZ	Benzene	32	O	C	III	1	.50-60	0.880	4.500	2.800	0.133	1.250	5000	5923	0.063	0.096
13	BTX	Benzene, Toluene, Xylene mixtures (10% Benzene or more)	32	O	B/C	III	1	.50-60	0.840	7.300	2.800	0.157	1.250	5000	6429	0.074	0.113
14	CBT	Carbon tetrachloride	36	O	NA	III	N/A	No	1.590	5.400	5.490	0.209	1.108	4432	6579	0.078	0.118
15	CCH	Cyclohexanone	18	O	D	III	1	.56-1(a), (b)	0.950	0.200	3.400	0.097	1.004	4016	4067	0.030	0.045
16	CCW	Creosote	21	O	E	III	1	No	0.950	0.200	3.400	0.097	1.004	4016	4067	0.030	0.045
17	CHA	Cyclohexylamine	7	O	D	III	1	.56-1(a), (b), (c), (g)	0.870	0.620	3.420	0.102	1.012	4050	4201	0.032	0.048
18	DCM	Dichloromethane	36	O	NA	III	5	No	1.340	19.000	3.000	0.368	1.250	5000	9853	0.174	0.266
19	DEE	2,2'-Dichloroethyl ether	41	O	D	II	1	.55-1(f)	1.220	0.040	4.900	0.096	1.001	4003	4022	0.029	0.044
20	DEN	Diethylamine	7	O	C	III	3	.55-1(c)	0.710	1.000	2.500	0.102	1.020	4080	4232	0.032	0.049
21	DET	Diethylenetriamine	7	O	E	III	1	.55-1(c)	0.950	0.040	3.480	0.095	1.001	4003	4016	0.029	0.044
22	DIA	Diisopropylamine	7	O	C	II	3	.55-1(c)	0.720	3.700	3.500	0.138	1.074	4296	5191	0.048	0.074
23	DIP	Diisopropanolamine	8	O	E	III	1	.55-1(c)	0.980	0.010	4.590	0.095	1.000	4001	4008	0.029	0.044
24	DMB	Dimethylethanolamine	8	O	D	III	1	.56-1(b), (c)	0.890	0.516	3.030	0.100	1.010	4041	4148	0.031	0.047
25	DMF	Dimethylformamide	10	O	D	III	1	.55-1(e)	0.950	0.300	2.510	0.097	1.006	4024	4072	0.030	0.045
26	DMX	Dichloropropene, Dichloropropane mixtures.	15	O	NA	II	1	No	0.892	9.200	1.550	0.119	1.184	4736	5300	0.050	0.077
27	DNA	Di-n-propylamine	7	O	C	II	3	.55-1(c)	0.740	1.450	3.500	0.112	1.029	4116	4474	0.036	0.055
28	DOT	Dodecyldimethylamine, Tetradecyldimethylamine mixture	7	O	E	III	N/A	.56-1(b)	0.990	0.010	13.450	0.096	1.000	4001	4016	0.029	0.044
29	DPB	1,1-Dichloropropane	36	O	C	III	3	No	1.040	1.800	3.000	0.112	1.036	4144	4502	0.036	0.055
30	DPC	1,3-Dichloropropane	36	O	C	III	3	No	1.040	1.800	3.000	0.112	1.036	4144	4502	0.036	0.055
31	DPP	1,2-Dichloropropane	36	O	C	III	3	No	1.160	2.500	3.890	0.129	1.050	4200	4898	0.043	0.066
32	DPU	1,3-Dichloropropene	15	O	D	II	4	No	1.230	5.500	3.840	0.168	1.110	4440	5917	0.063	0.096
33	DTI	2,4-Dichlorophenoxyacetic acid, triisopropanolamine salt solution.	43	O	NA	III	N/A	.56-1(a), (b), (c), (g)	1.180	0.010	5.300	0.095	1.000	4001	4008	0.029	0.044
34	EAC	Ethyl acrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.930	2.000	3.500	0.118	1.040	4160	4650	0.039	0.059
35	EAI	2-Ethylhexyl acrylate	14	O	E	III	2	.50-70(a), .50-81(a), (b)	0.890	0.015	6.350	0.095	1.000	4001	4012	0.029	0.044
36	EAN	Ethylamine solution (72% or less)	7	O	A	II	6	.55-1(b)	0.800	15.500	1.560	0.156	1.250	5000	6418	0.074	0.113
37	EBA	N-Ethylbutylamine	7	O	D	III	3	.55-1(b)	0.719	1.598	0.286	0.090	1.032	4128	4013	0.029	0.044
38	ECC	N-Ethylcyclohexylamine	7	O	D	III	1	.55-1(b)	0.850	0.585	4.400	0.104	1.012	4047	4245	0.032	0.049
39	EDA	Ethylenediamine	7	O	D	III	1	.55-1(c)	0.910	0.900	2.100	0.100	1.018	4072	4174	0.031	0.048
40	EDC	Ethylene dichloride	36	O	C	III	1	No	1.260	4.000	3.420	0.140	1.080	4320	5258	0.050	0.076
41	EGC	Ethylene glycol monoalkyl ethers	40	O	D/E	III	1	No	0.970	0.200	4.720	0.098	1.004	4016	4093	0.030	0.046
42	EGH	Ethylene glycol hexyl ether	40	O	E	III	N/A	No	0.930	0.170	3.100	0.097	1.003	4014	4052	0.029	0.045
43	EGP	Ethylene glycol propyl ether	40	O	E	III	1	No	0.908	0.025	3.600	0.095	1.001	4002	4012	0.029	0.044
44	EPA	2-Ethyl-3-propylacrolein	19	O	E	III	1	No	0.850	0.120	4.350	0.097	1.002	4010	4052	0.029	0.045
45	ETC	Ethylene cyanohydrin	20	O	E	III	1	No	1.040	0.010	2.450	0.095	1.000	4001	4005	0.029	0.044
46	ETM	Ethyl methacrylate	14	O	D/E	III	2	.50-70(a)	0.920	1.000	3.940	0.109	1.020	4080	4370	0.034	0.052
47	GTA	Glutaraldehyde solution (50% or less)	19	O	NA	III	N/A	No	1.124	0.010	3.400	0.095	1.000	4001	4006	0.029	0.044

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48	HMC	Hexamethylenediamine solution	7	O	E	III	1	.55-1(c)	1.210	10.500	1.260	0.108	1.210	4840	5161	0.048	0.073
49	HMI	Hexamethyleneimine	7	O	C	II	1	.56-1(b), (c)	0.880	5.600	0.104	0.071	1.112	4448	3859	0.027	0.041
50	IAI	iso-Decyl acrylate	14	O	E	III	2	.50-70(a), .50-81(a), (b), .55-1(c)	0.890	0.010	7.300	0.095	1.000	4001	4010	0.029	0.044
51	IPP	iso-Propylamine	7	O	A	II	5	.55-1(c)	0.690	23.100	2.030	0.303	1.250	5000	8937	0.143	0.218
52	IPR	Isoprene	30	O	A	III	7	.50-70(a), .50-81(a), (b)	0.672	11.300	1.772	0.136	1.226	4904	5873	0.062	0.094
53	KPL	Kraft pulping liquors (free alkali content 3% or more) (including: Black, Green, or White liquor)	5	O	NA	III	N/A	.50-73, .56-1(a), (c), (g)	0.800	10.060	2.960	0.188	1.201	4805	6760	0.082	0.125
54	MAM	Methyl acrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.950	4.100	3.000	0.133	1.082	4328	5136	0.047	0.072
55	MCK	Methylcyclopentadiene dimer	30	O	C	III	1	No	0.941	0.040	0.930	0.095	1.001	4003	4006	0.029	0.044
56	MEA	Ethanolamine	8	O	E	III	1	.55-1(c)	1.020	0.030	2.100	0.095	1.001	4002	4009	0.029	0.044
57	MEP	2-Methyl-5-ethylpyridine	9	O	E	III	1	.55-1(e)	0.920	0.160	4.180	0.097	1.003	4013	4066	0.030	0.045
58	MMM	Methyl methacrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.940	2.020	3.450	0.118	1.040	4162	4647	0.039	0.059
59	MPA	iso-Propanolamine	8	O	E	III	1	.55-1(c)	0.960	0.080	2.590	0.096	1.002	4006	4022	0.029	0.044
60	MPL	Morpholine	7	O	D	III	1	.55-1(c)	1.000	0.800	3.000	0.102	1.016	4064	4225	0.032	0.049
61	MPR	2-Methylpyridine	9	O	D	III	3	.55-1(c)	0.940	2.065	3.200	0.116	1.041	4165	4613	0.038	0.058
62	MSO	Mesityl oxide	18	O	D	III	1	No	0.860	0.670	3.500	0.103	1.013	4054	4222	0.032	0.049
63	MSR	alpha-Methylstyrene	30	O	D	III	2	.50-70(a), .50-81(a), (b)	0.890	0.400	4.080	0.101	1.008	4032	4156	0.031	0.047
64	NCT	Coal tar naphtha solvent	33	O	D	III	1	.50-73	1.410	3.600	2.170	0.115	1.072	4288	4718	0.040	0.061
65	NPM	1- or 2-Nitropropane	42	O	D	III	1	.50-81	0.990	1.050	3.060	0.105	1.021	4084	4300	0.033	0.051
66	PAX	Propanolamine (iso-, n-)	8	O	E	III	1	.56-1(b), (c)	0.870	1.900	3.520	0.117	1.038	4152	4622	0.038	0.058
67	PDE	1,3-Pentadiene	30	O	A	III	7	.50-70(a), .50-81	0.680	17.060	2.360	0.260	1.250	5000	8281	0.123	0.188
68	PEB	Polyethylene polyamines	7	O	E	III	1	.55-1(e)	0.994	8.300	4.550	0.233	1.166	4664	7319	0.096	0.147
69	PER	Perchloroethylene	36	O	NA	III	N/A	No	1.620	1.230	5.830	0.123	1.025	4098	4666	0.039	0.060
70	PRD	Pyridine	9	O	C	III	1	.55-1(e)	0.980	1.300	2.720	0.105	1.026	4104	4329	0.034	0.051
71	SAU	Sodium aluminate solution (45% or less)	5	O	NA	III	N/A	.50-73, .56-1(a), (b), (c)	0.850	0.010	0.010	0.095	1.000	4001	4003	0.029	0.044
72	SDD	Sodium chlorate solution (50% or less)	0	O	NA	III	N/A	.50-73	0.850	0.010	0.010	0.095	1.000	4001	4003	0.029	0.044
73	SSH	Sodium sulfide, hydrosulfide solution (H2S 15 ppm or less)	0	O	NA	III	1	.50-73, .55-1(b)	1.280	1.510	1.170	0.096	1.030	4121	4150	0.031	0.047
74	SSI	Sodium sulfide, hydrosulfide solution (H2S greater than 15 ppm but less than 200 ppm)	0	O	NA	III	N/A	.50-73, .55-1(b)	1.280	1.510	1.170	0.096	1.030	4121	4150	0.031	0.047
75	SSJ	Sodium sulfide, hydrosulfidesolutions (H2S greater than200ppm)	0	O	NA	II	N/A	.50-73, .55-1(b)	1.280	1.510	1.170	0.096	1.030	4121	4150	0.031	0.047
76	STY	Styrene monomer	30	O	D	III	2	.50-70(a), .50-81(a), (b)	0.920	0.400	3.600	0.100	1.008	4032	4138	0.031	0.047
77	TCB	1,2,4-Trichlorobenzene	36	O	E	III	1	No	1.450	0.010	6.260	0.095	1.000	4001	4009	0.029	0.044
78	TCL	Trichloroethylene	36	O	NA	III	1	No	1.470	3.500	4.540	0.153	1.070	4280	5441	0.053	0.081
79	TCM	1,1,2-Trichloroethane	36	O	NA	III	1	.50-73, .56-1(a)	1.430	0.010	4.550	0.095	1.000	4001	4007	0.029	0.044
80	TCN	1,2,3-Trichloropropane	36	O	E	II	3	.50-73, .56-1(a)	1.390	0.150	5.600	0.098	1.003	4012	4083	0.030	0.046
81	TEA	Triethanolamine	8	O	E	III	1	.55-1(b)	1.130	0.010	5.140	0.095	1.000	4001	4008	0.029	0.044
82	TEC	1,1,2,2-Tetrachloroethane	36	O	NA	III	N/A	No	1.600	1.000	5.800	0.118	1.020	4080	4543	0.037	0.056
83	TEN	Triethylamine	7	O	C	II	3	.55-1(e)	0.730	2.500	3.490	0.124	1.050	4200	4808	0.041	0.063
84	TET	Triethylenetetramine	7	O	E	III	1	.55-1(b)	0.980	0.010	5.040	0.095	1.000	4001	4008	0.029	0.044
85	THF	Tetrahydrofuran	41	O	C	III	1	.50-70(b)	0.890	8.500	1.350	0.109	1.170	4680	5017	0.045	0.069
86	TPB	Triphenylborane (10% or less), caustic soda solution	5	O	NA	III	N/A	.56-1(a), (b), (c)	0.870	1.500	3.140	0.110	1.030	4120	4439	0.035	0.054
87	UAS	Urea, Ammonium nitrate solution (containing more than 2% NH3)	6	O	NA	III	N/A	.56-1(b)	1.000	0.010	6.800	0.095	1.000	4001	4010	0.029	0.044
88	VAM	Vinyl acetate	13	O	C	III	2	.50-70(a), .50-81(a), (b)	0.940	5.800	2.970	0.149	1.116	4464	5590	0.056	0.085
89	VNT	Vinyltoluene	13	O	D	III	2	.50-70(a), .50-81, .56-1(a), (b), (c), (g)	0.900	0.120	4.080	0.097	1.002	4010	4049	0.029	0.045
90	ACP	Acetophenone	18	D	E	NA	1	NA	1.030	0.600	4.140	0.104	1.012	4048	4236	0.032	0.049
91	ACT	Acetone	18	D	C	NA	1	NA	0.790	10.000	2.000	0.142	1.200	4800	5874	0.062	0.094
92	BAL	Benzyl alcohol	21	D	E	NA	1	NA	1.050	0.100	3.730	0.096	1.002	4008	4038	0.029	0.045
93	BAN	Butyl alcohol (n-)	0	D	D	NA	1	NA	0.810	0.500	2.600	0.099	1.010	4040	4122	0.030	0.046

OWNER: Blessey Marine Services, Inc **CONTRACT: 96234**

DESCRIPTION: Double Skin Single Rake Inland Tank Barge **BY: MEC**

SIZE: 297'-6"x54'-0"x13'-0" **DATE: 1-Oct-2014**

HULL/NAME: 5054 -5055/WEB 352 & WEB 353

TABLE 1 - VAPOR CONTROL SYSTEM CALCULATIONS

	CHRIS CODE	NAME	COMP GROUP	SUB CHAP	GRADE	HULL TYPE	VCS CAT	REST.	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR WEIGHT DENSITY	VAPOR GROWTH RATE	VAPOR FLOW RATE (bbl/h)	AIR EQUIV FLOW RATE (bbl/hr)	PRESSURE DROP TO PV VALVE IN VCS (LOADING) (psig)	PRESSURE DROP TO SHORE CONN IN VCS (LOADING)* (psig)
94	BAS	Butyl alcohol (sec-)	0	D	C	NA	1	NA	0.810	1.300	2.600	0.105	1.026	4104	4314	0.033	0.051
95	BAT	Butyl alcohol (tert-)	0	D	C	NA	1	NA	0.780	2.800	2.600	0.116	1.056	4224	4673	0.039	0.060
96	BAX	Butyl acetate (all isomers)	34	D	D	NA	1	NA	0.870	0.600	4.000	0.103	1.012	4048	4228	0.032	0.049
97	BPH	Butyl benzyl phthalate	34	D	E	NA	1	NA	1.120	0.010	10.800	0.095	1.000	4001	4014	0.029	0.044
98	BUE	Butyl toluene	32	D	D	NA	1	NA	0.850	0.100	5.110	0.097	1.002	4008	4052	0.029	0.045
99	CHN	Cyclohexanol	20	D	E	NA	1	NA	0.940	0.200	3.500	0.097	1.004	4016	4069	0.030	0.045
100	CHX	Cyclohexane	31	D	C	NA	1	NA	0.780	4.500	2.900	0.135	1.090	4360	5206	0.049	0.074
101	CLS	Caprolactam solutions	22	D	E	NA	1	NA	1.060	0.700	3.900	0.104	1.014	4056	4258	0.033	0.050
102	CMP	p-Cymene	32	D	D	NA	1	NA	0.860	0.460	4.620	0.103	1.009	4037	4203	0.032	0.048
103	CPD	1,3-Cyclopentadiene dimer (molten)	30	D	D/E	NA	2	NA	0.690	0.250	4.550	0.099	1.005	4020	4111	0.030	0.046
104	DAA	Diacetone alcohol	20	D	E	NA	1	NA	0.940	0.100	4.000	0.096	1.002	4008	4041	0.029	0.045
105	DAX	Decyl alcohol (all isomers)	20	D	E	NA	1	NA	0.830	5.800	2.970	0.149	1.116	4464	5590	0.056	0.085
106	DBL	Diisobutylene	30	D	C	NA	1	NA	0.720	2.200	3.970	0.126	1.044	4176	4808	0.041	0.063
107	DCE	Decene	30	D	D	NA	1	NA	0.740	0.120	5.300	0.097	1.002	4010	4064	0.030	0.045
108	DDB	Dodecylbenzene, see Alkyl(C9+)benzenes	32	D	E	NA	1	NA	0.860	4.700	8.400	0.258	1.094	4376	7225	0.094	0.143
109	DDO	Diphenyl, Diphenyl ether mixtures	33	D	E	NA	1	NA	1.070	0.010	5.870	0.095	1.000	4001	4009	0.029	0.044
110	DEB	Diethylbenzene	32	D	D	NA	1	NA	0.870	0.080	4.620	0.096	1.002	4006	4038	0.029	0.045
111	DEG	Diethylene glycol	40	D	E	NA	1	NA	1.120	0.010	3.660	0.095	1.000	4001	4007	0.029	0.044
112	DIK	Diisobutyl ketone	18	D	D	NA	1	NA	0.810	0.480	4.900	0.104	1.010	4038	4225	0.032	0.049
113	DOP	Dioctyl phthalate	34	D	E	NA	1	NA	0.990	0.010	13.450	0.096	1.000	4001	4016	0.029	0.044
114	DPG	Dipropylene glycol	40	D	E	NA	1	NA	1.030	0.070	4.630	0.096	1.001	4006	4034	0.029	0.045
115	EAL	Ethyl alcohol	20	D	C	NA	1	NA	0.790	3.500	1.600	0.105	1.070	4280	4501	0.036	0.055
116	EBT	Ethyl butanol	20	D	D	NA	1	NA	0.830	0.140	3.400	0.097	1.003	4011	4048	0.029	0.045
117	EGL	Ethylene glycol	20	D	E	NA	1	NA	1.130	0.010	2.210	0.095	1.000	4001	4005	0.029	0.044
118	EGY	Ethylene glycol diacetate	34	D	E	NA	1	NA	1.130	0.010	1.000	0.095	1.000	4001	4004	0.029	0.044
119	EHX	2-Ethylhexanol	20	D	E	NA	1	NA	0.830	0.015	4.500	0.095	1.000	4001	4010	0.029	0.044
120	ETA	Ethyl acetate	34	D	C	NA	1	NA	0.900	4.500	3.040	0.138	1.090	4360	5262	0.050	0.076
121	ETB	Ethylbenzene	32	D	C	NA	1	NA	0.870	0.600	3.660	0.102	1.012	4048	4208	0.032	0.048
122	ETG	Ethoxy triglycol (crude)	40	D	E	NA	1	NA	1.020	0.010	6.140	0.095	1.000	4001	4009	0.029	0.044
123	FAL	Furfuryl alcohol	20	D	E	NA	1	NA	1.290	0.100	3.370	0.096	1.002	4008	4035	0.029	0.045
124	GAT	Gasolines: Automotive (containing not over 4.23 grams lead per gallon)	33	D	C	NA	1	NA	0.760	12.500	3.400	0.236	1.250	5000	7888	0.112	0.170
125	GCR	Glycerine	20	D	E	NA	1	NA	1.260	0.010	3.170	0.095	1.000	4001	4006	0.029	0.044
126	HMX	Heptane (all isomers), see Alkanes (C6-C9) (all isomers)	31	D	C	NA	1	NA	0.680	2.500	3.450	0.124	1.050	4200	4798	0.041	0.063
127	HPX	Heptene (all isomers)	30	D	C	NA	2	NA	0.700	2.900	3.400	0.128	1.058	4232	4911	0.043	0.066
128	HXG	Hexylene glycol	20	D	E	NA	1	NA	0.920	0.010	4.000	0.095	1.000	4001	4007	0.029	0.044
129	HXN	Hexanol	20	D	D	NA	1	NA	0.820	1.000	3.520	0.107	1.020	4080	4330	0.034	0.051
130	IAC	iso-Propyl acetate	34	D	C	NA	1	NA	0.880	3.100	3.520	0.132	1.062	4248	5006	0.045	0.069
131	IAL	Butyl alcohol (iso-)	20	D	D	NA	1	NA	0.810	0.900	2.600	0.102	1.018	4072	4218	0.032	0.049
132	IDA	iso-Decaldehyde	19	D	E	NA	1	NA	0.830	0.060	5.380	0.096	1.001	4005	4034	0.029	0.045
133	IPA	iso-Propyl alcohol	20	D	C	NA	1	NA	0.790	3.000	2.070	0.110	1.060	4240	4568	0.037	0.057
134	IPH	Isophorone	18	D	E	NA	1	NA	0.930	0.010	4.750	0.095	1.000	4001	4008	0.029	0.044
135	KRS	Kerosene	33	D	D	NA	1	NA	0.810	0.150	4.500	0.097	1.003	4012	4067	0.030	0.045
136	MAC	Methylamyl acetate	34	D	D	NA	1	NA	0.860	0.340	5.000	0.101	1.007	4027	4164	0.031	0.047
137	MAL	Methyl alcohol	20	D	C	NA	1	NA	0.790	7.000	1.100	0.098	1.140	4560	4642	0.039	0.059
138	MBE	Methyl tert-butyl ether	41	D	C	NA	1	NA	0.740	0.040	3.100	0.095	1.001	4003	4015	0.029	0.044
139	MEK	Methyl ethyl ketone	18	D	C	NA	1	NA	0.800	4.500	2.500	0.127	1.090	4360	5040	0.046	0.069
140	MIK	Methyl isobutyl ketone	18	D	C	NA	1	NA	0.800	1.200	3.450	0.109	1.024	4096	4387	0.035	0.053
141	MNS	Mineral spirits	33	D	D	NA	1	NA	0.750	0.200	4.300	0.098	1.004	4016	4084	0.030	0.046
142	MTT	Methyl acetate	34	D	D	NA	1	NA	0.920	6.100	2.600	0.141	1.122	4488	5470	0.054	0.082
143	NNP	Nonyl phenol	21	D	E	NA	1	NA	0.940	0.010	7.590	0.095	1.000	4001	4010	0.029	0.044
144	NSS	Naphtha: Stoddard solvent	33	D	D	NA	1	NA	0.780	0.200	0.010	0.094	1.004	4016	3999	0.029	0.044
145	NSV	Naphtha: Solvent	33	D	D	NA	1	NA	0.870	0.200	3.500	0.097	1.004	4016	4069	0.030	0.045

OWNER: Blessey Marine Services, Inc **CONTRACT: 96234**

DESCRIPTION: Double Skin Single Rake Inland Tank Barge **BY: MEC**

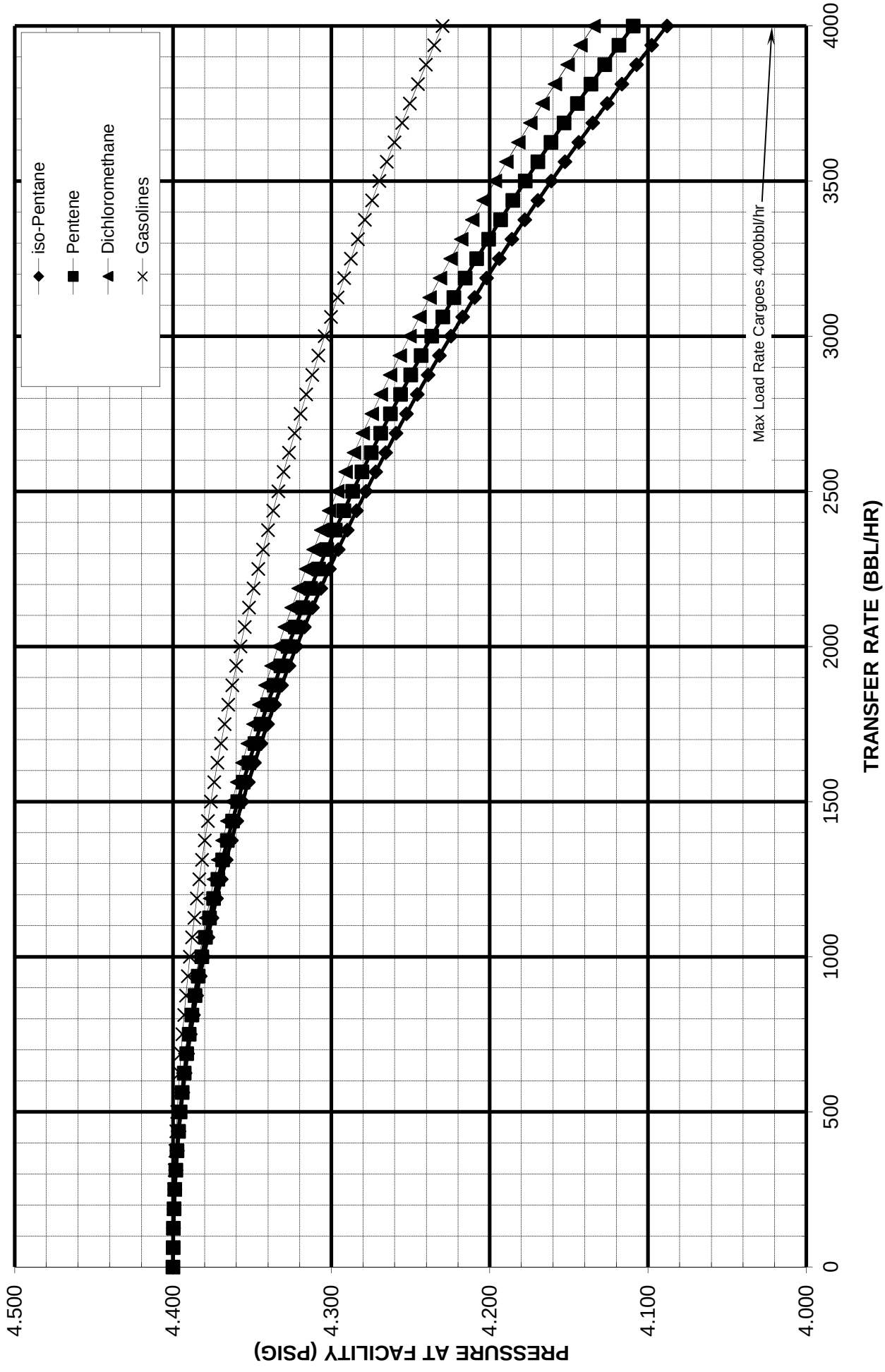
SIZE: 297'-6"x54'-0"x13'-0" **DATE: 1-Oct-2014**

HULL/NAME: 5054 -5055/WEB 352 & WEB 353

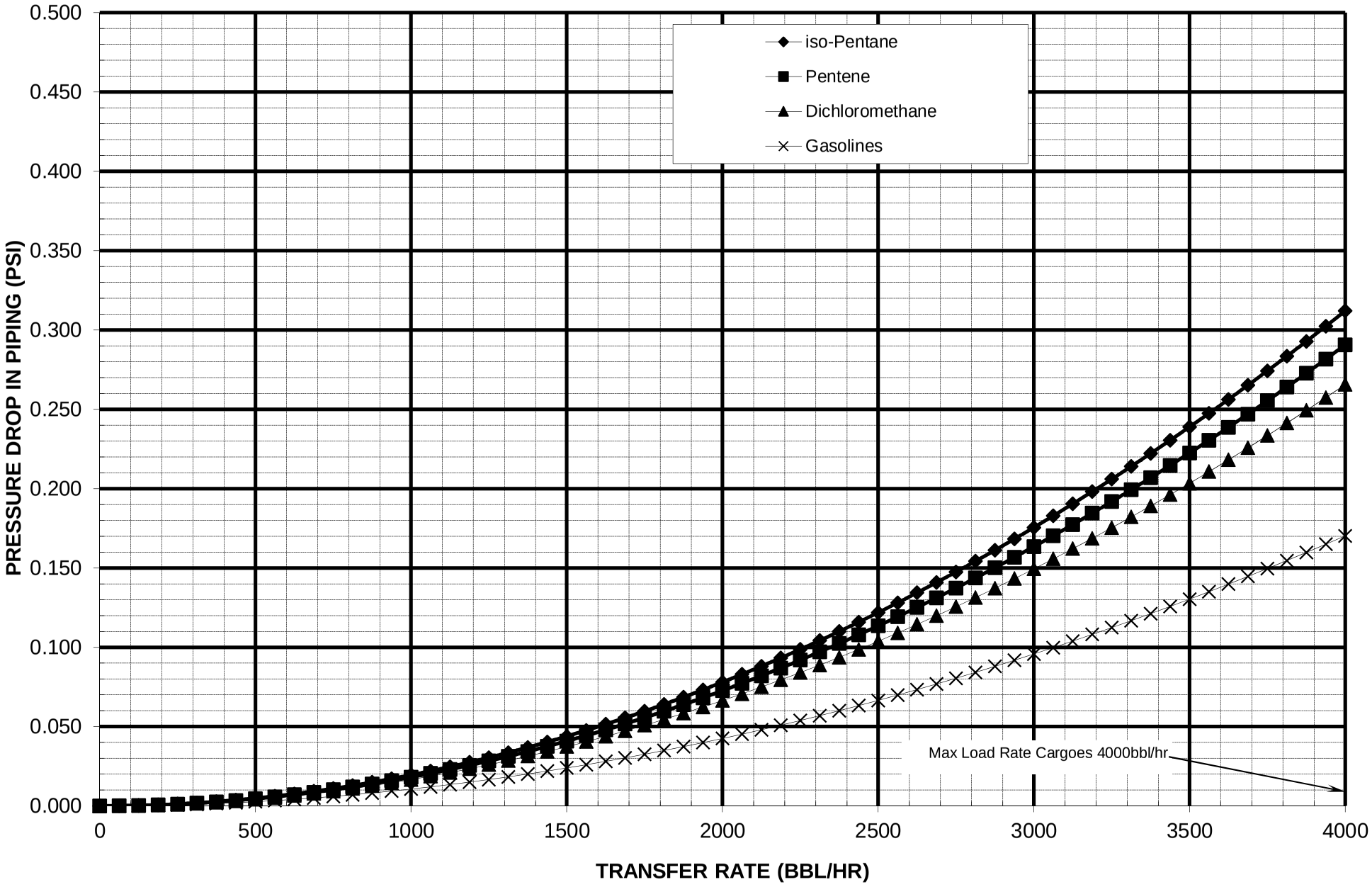
TABLE 1 - VAPOR CONTROL SYSTEM CALCULATIONS

	CHRIS CODE	NAME	COMP GROUP	SUB CHAP	GRADE	HULL TYPE	VCS CAT	REST.	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR WEIGHT DENSITY	VAPOR GROWTH RATE	VAPOR FLOW RATE (bbl/h)	AIR EQUIV FLOW RATE (bbl/hr)	PRESSURE DROP TO PV VALVE IN VCS (LOADING) (psig)	PRESSURE DROP TO SHORE CONN IN VCS (LOADING)* (psig)
146	NVM	Naphtha: Varnish makers and painters (75%)	33	D	C	NA	1	NA	0.770	0.190	0.010	0.094	1.004	4015	4000	0.029	0.044
147	ODS	Oil, misc: Diesel	33	D	D/E	NA	1	NA	0.900	5.800	2.970	0.149	1.116	4464	5590	0.056	0.085
148	OIL	Oil, misc: Crude	33	D	C/D	NA	1	NA	0.950	5.800	2.970	0.149	1.116	4464	5590	0.056	0.085
149	OSX	Oil, fuel: No. 6	33	D	E	NA	1	NA	0.950	0.149	2.970	0.096	1.003	4012	4044	0.029	0.045
150	OTW	Oil, fuel: No. 2	33	D	D/E	NA	1	NA	0.880	0.560	8.000	0.113	1.011	4045	4423	0.035	0.054
151	PAL	n-Propyl alcohol	20	D	C	NA	1	NA	0.800	1.200	2.070	0.101	1.024	4096	4227	0.032	0.049
152	PAT	n-Propyl acetate	34	D	C	NA	1	NA	0.870	1.900	3.520	0.117	1.038	4152	4622	0.038	0.058
153	PBY	Propylbenzene (all isomers)	32	D	D	NA	1	NA	0.860	0.600	4.200	0.104	1.012	4048	4239	0.032	0.049
154	PLB	Polybutene	30	D	E	NA	1	NA	0.910	0.010	0.010	0.095	1.000	4001	4003	0.029	0.044
156	PTE	Pentene (all isomers)	31	D	A	III	5	NA	0.637	24.945	2.500	0.403	1.250	5000	10307	0.191	0.291
155	PTY	iso-Pentane	30	D	A	III	5	NA	0.620	27.000	2.480	0.432	1.250	5000	10680	0.205	0.312
157	TCP	Tricresyl phosphate (less than 1% of the ortho isomer)	34	D	E	NA	1	NA	1.170	0.010	12.700	0.095	1.000	4001	4016	0.029	0.044
158	TEB	Triethylbenzene	32	D	E	NA	1	NA	0.860	0.050	5.600	0.096	1.001	4004	4030	0.029	0.044
159	TEG	Triethylene glycol	40	D	E	NA	1	NA	1.120	0.010	5.170	0.095	1.000	4001	4008	0.029	0.044
160	THN	Tetrahydronaphthalene	32	D	E	NA	1	NA	0.980	0.040	4.550	0.096	1.001	4003	4020	0.029	0.044
161	TOL	Toluene	32	D	C	NA	1	NA	0.870	1.500	3.140	0.110	1.030	4120	4439	0.035	0.054
162	TTG	Tetraethylene glycol	40	D	E	NA	1	NA	1.130	0.010	6.700	0.095	1.000	4001	4010	0.029	0.044
Max Vapor Density Cargo		PTY iso-Pentane	30	D	A	III	5	NA	0.620	27.000	2.480	0.432	1.250	5000	10680	0.205	0.312
Max Pressure Drop Cargo		PTY iso-Pentane	30	D	A	III	5	NA	0.620	27.000	2.480	0.432	1.250	5000	10680	0.205	0.312

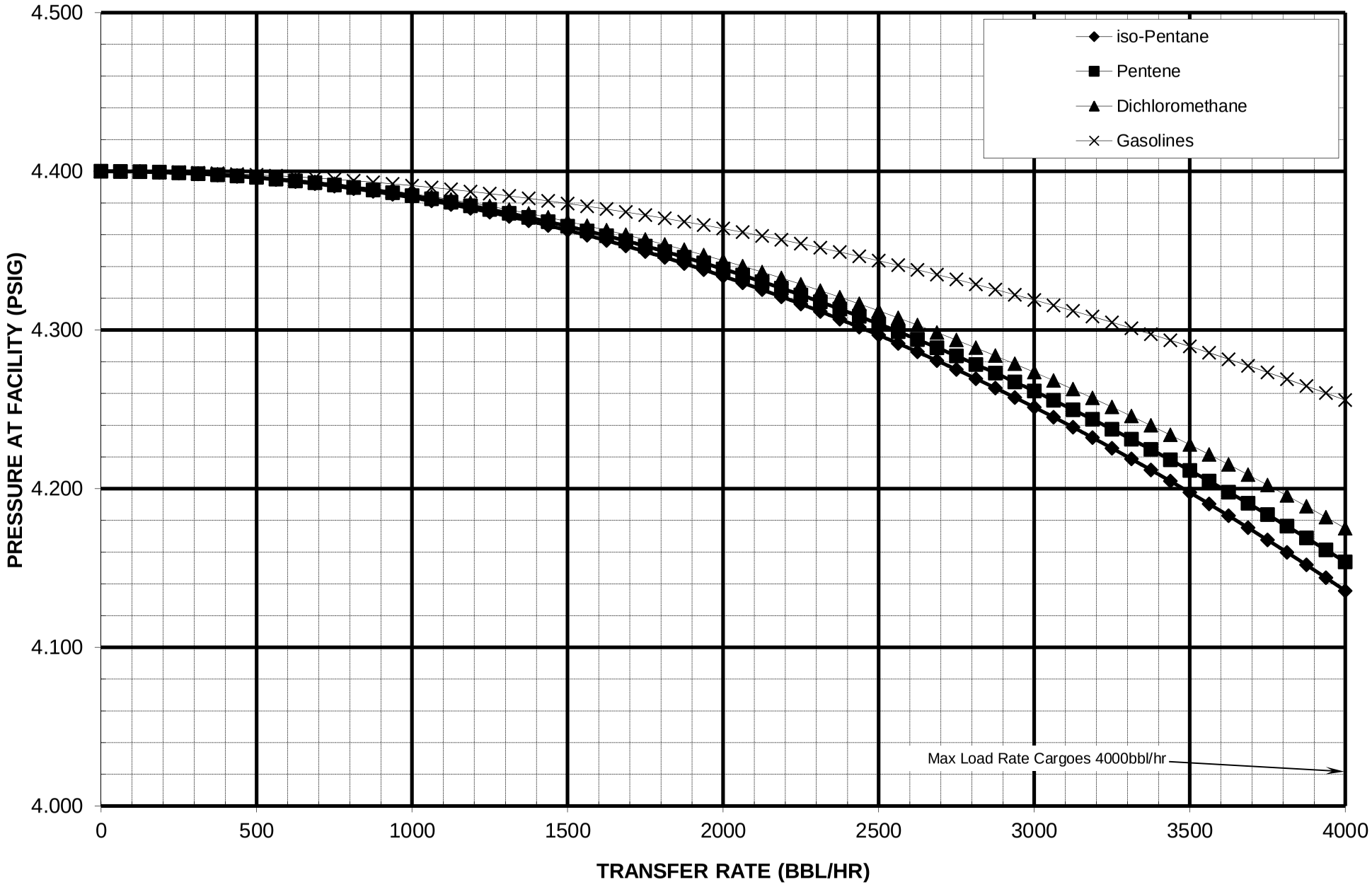
LIQUID TRANSFER RATE vs FACILITY PRESSURE FOR TANDEM LOADING
BASED ON PRESSURE DROP FROM CARGO TANK #1 TO FACILITY CONNECTION



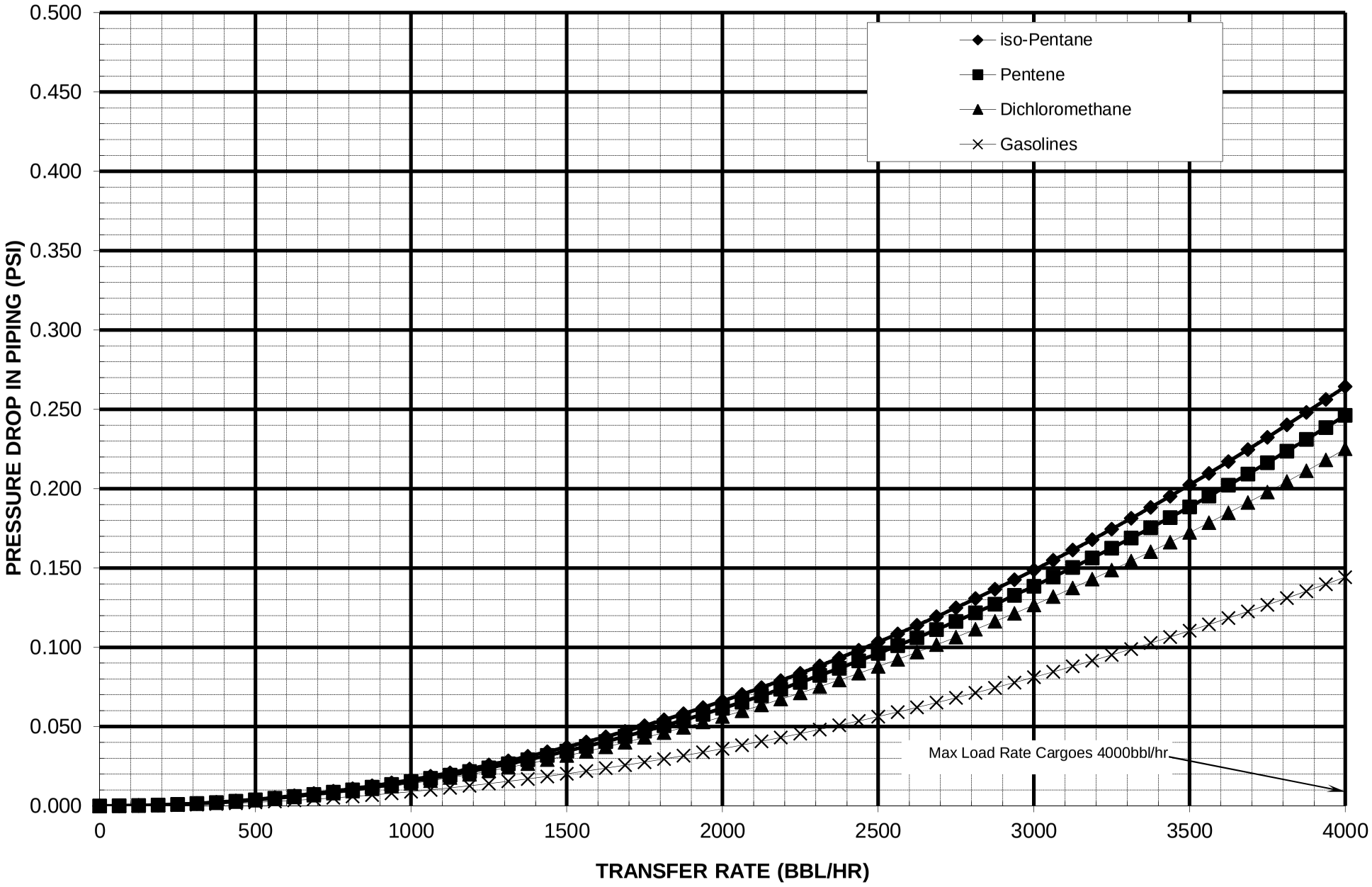
LIQUID TRANSFER RATE vs PIPING PRESSURE DROP
CARGO TANK #1 TO FACILITY CONNECTION
TANDEM LOADING



LIQUID TRANSFER RATE vs FACILITY PRESSURE FOR SINGLE LOADING
BASED ON PRESSURE DROP FROM CARGO TANK #1 TO FACILITY CONNECTION



LIQUID TRANSFER RATE vs PIPING PRESSURE DROP
CARGO TANK #1 TO FACILITY CONNECTION
SINGLE LOADING



Marine Safety Center Form for Tank Vessels Installing a Vapor Control System

1. Vessel Name	WEB 352 & 353	Shipyard	Trinity Marine Products, Ashland City, TN
Official Number	1255462 & 1255463	Hull #	5054 & 5055

2. **Purpose:** This form consolidates the information required for VCS approval. Entering the requested information will expedite your approval and significantly decrease the probability the MSC will return the submission for revision.

3. **Tank Design:** Raised Trunk [X] Maximum Design Working Pressure: 6.00 psig

Flush Deck [ ] Existing Raised Trunk Barges need MSC approval letter serial number and date which approved its MDWP: [ ]

4. Requested Maximum Cargo Transfer Rates

4,000	bbl/hr loading
4,000	bbl/hr discharging

5. Requested Maximum Cargo-Air Mixture Vapor Density:

List the requested cargoes with the (a) highest vapor density and (b) highest pressure drop. They are not always the same cargo.

a. Cargo Name	iso-Pentane	0.432	lbm/ft3
b. Cargo Name	iso-Pentane	0.432	lbm/ft3

6. VCS Categories Requested (list): 1 - 7

7. Pressure Drop for the cargo(es) from Section 5 for the following scenarios:

	Cargo A psi	Cargo B psi
a. Most Remote Cargo Tank to P/V valve	0.205	0.205
b. Most Remote Cargo Tank to VCS Facility Connection	0.312	0.312
c. ΔP across P/V valve @ cargoes' Maximum Transfer Rate	4.744	4.744
d. ΔP across Vacuum P/V @ MTR or Max. Discharge Rate	2.032	
e. ΔP across Spill Valve for Max. Density Cargo at MTR	NA	

8. Pressure Vacuum Valve:

Manufacturer	ERL
Model/Size	SUPERAC MODEL II PV-6
CG Approval Number	162.017/167/4

Settings in psig:

Pressure-side	5.5
Vacuum-side	2.0

Include the Manufacturer's ΔP versus Flow for both parts of P/V & **Spill Valve:** [x]

9. VCS Pipe Sizes:

Longitudinal Header 8 **Inches** Transverse Headers 8 **Inches**

10. Closed Gauging [x]

Check the box to signify the vessel will have closed gauging meeting 46 CFR 151.151-10(c). MSC Electrical Branch and the OCMI will verify the closed gauging meets these requirements.

11. Tank Overfill Protection System (check appropriate box or boxes and list make/model)

a. High Level/Tank Overfill Alarm	[x]	ERL LEVEL ALERT MODEL II	**Setting in psig**
b. Overfill Control Shutdown	[x]	ERL LEVEL ALERT MODEL II	
c. Spill Valve	[ ]		Meets ASTM F1271 [ ]
d. Rupture Disk	[ ]		

If applicalble, Calculations demonstrate compliance with 39.20-9(b)(2). [x]

12. Submittal Includes a Graph or Table showing the ΔP through the VCS piping from the most remote cargo tank to the facility connection as a function of liquid transfer rate for **both** cargoes in Section 5. [X]

13. Submittal Includes a Graph or Table showing the Facility Pressure @ the vessel's vapor connect versus allowable transfer rate. This graph demonstrates the barge can satisfy 46 CFR 39.30-1(d)(3). See MSC "Guidelines" at www.msc.uscg\hq\msc for an example. [X]

14. Previous VCS approval letters**:**

#2 & #3 PORT TANKS SHOWN STBD TANK SIMILAR
******REFERENCE POINT IS GAUGE FLANGE FACE******

TANK LIST

Part	Type	Reference Point Long	Trans	Vert
CT1.C	INTACT TANK	62.83a	1.00p	18.35
CT2.P	INTACT TANK	126.13a	10.75p	18.11
CT3.P	INTACT TANK	193.88a	10.75p	18.11
CT4.C	INTACT TANK	261.59a	1.00s	18.35

Distances in FEET.

FULL LOAD TANKS AT 100%
TANK STATUS
Trim: zero, Heel: zero

Part	BBLs.	SpGr	Weight(ST)	LCG	TCG	VCG	RefHt
CT1.C	7239.8	1.050	1,332.24	61.64a	0.00	10.20	
CT2.P	4111.5	1.050	756.58	124.03a	11.62p	10.08	
CT3.P	4522.5	1.050	832.21	193.59a	11.62p	10.08	
CT4.C	6432.1	1.050	1,183.61	257.27a	0.00	9.31	
Total Tanks---------->			4,104.64	156.30a	4.50p	9.89	

Distances in FEET.

HIGH LEVEL SETPOINT AT 0.95 OF FULL LOAD 46CFR39.20-7(c)(1)
TANK STATUS
Trim: zero, Heel: zero

Part	BBLs.	SpGr	Weight(ST)	LCG	TCG	VCG	RefHt
CT1.C	6877.8	1.050	1,265.62	61.65a	0.00	9.83	1.52
CT2.P	3905.9	1.050	718.75	124.00a	11.70p	9.70	1.29
CT3.P	4296.3	1.050	790.60	193.57a	11.70p	9.70	1.30
CT4.C	6110.5	1.050	1,124.43	257.85a	0.00	8.90	1.96
Total Tanks---------->			3,899.40	156.46a	4.53p	9.51	

Distances in FEET.

OVERFILL SETPOINT BASED ON 0.985 OF FULL LOAD 46CFR39.30-1(e)(1)
TANK STATUS
Trim: zero, Heel: zero

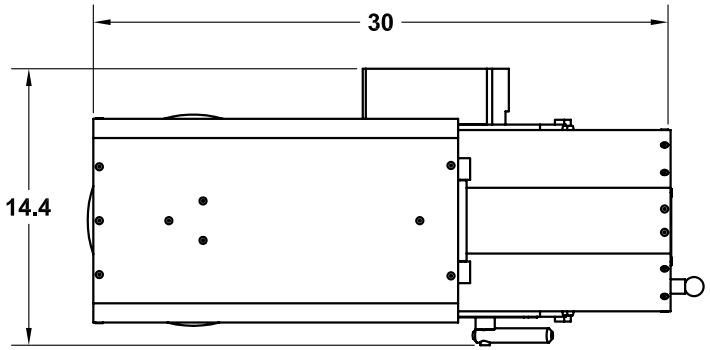
Part	BBLs.	SpGr	Weight(ST)	LCG	TCG	VCG	RefHt
CT1.C	7130.8	1.050	1,312.19	61.63a	0.00	10.08	1.00
CT2.P	4049.6	1.050	745.19	124.00a	11.70p	9.96	0.76
CT3.P	4454.4	1.050	819.68	193.57a	11.70p	9.96	0.76
CT4.C	6335.1	1.050	1,165.75	257.45a	0.00	9.18	1.13
Total Tanks---------->			4,042.81	156.34a	4.53p	9.78	

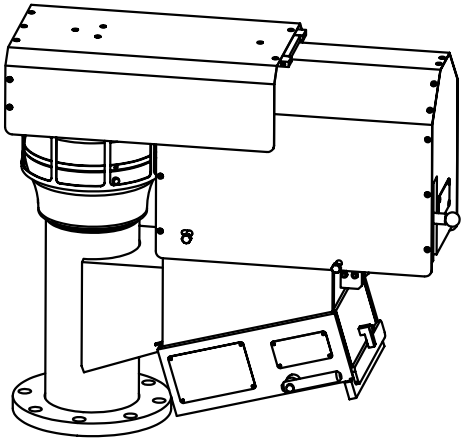
Distances in FEET.

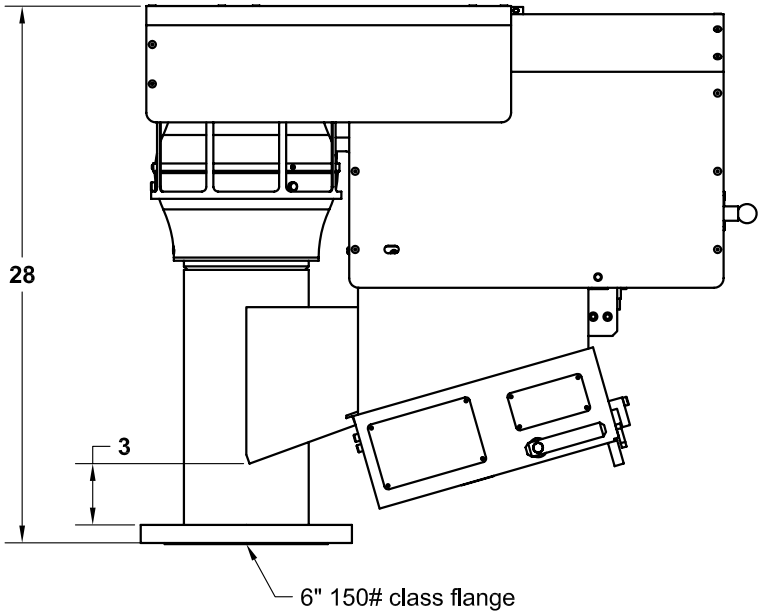
OVERFILL SETPOINT BASED ON 60SEC AT 4000BBL/HR 46CFR39.20-9(b)(2)
TANK STATUS
Trim: zero, Heel: zero

Part	BBLs.	SpGr	Weight(ST)	LCG	TCG	VCG	RefHt
CT1.C	7172.8	1.050	1,319.91	61.63a	0.00	10.13	0.89
CT2.P	4044.7	1.050	744.29	124.00a	11.70p	9.96	0.78
CT3.P	4455.5	1.050	819.89	193.57a	11.70p	9.97	0.76
CT4.C	6365.3	1.050	1,171.32	257.39a	0.00	9.22	1.02
Total Tanks---------->			4,055.41	156.29a	4.51p	9.80	

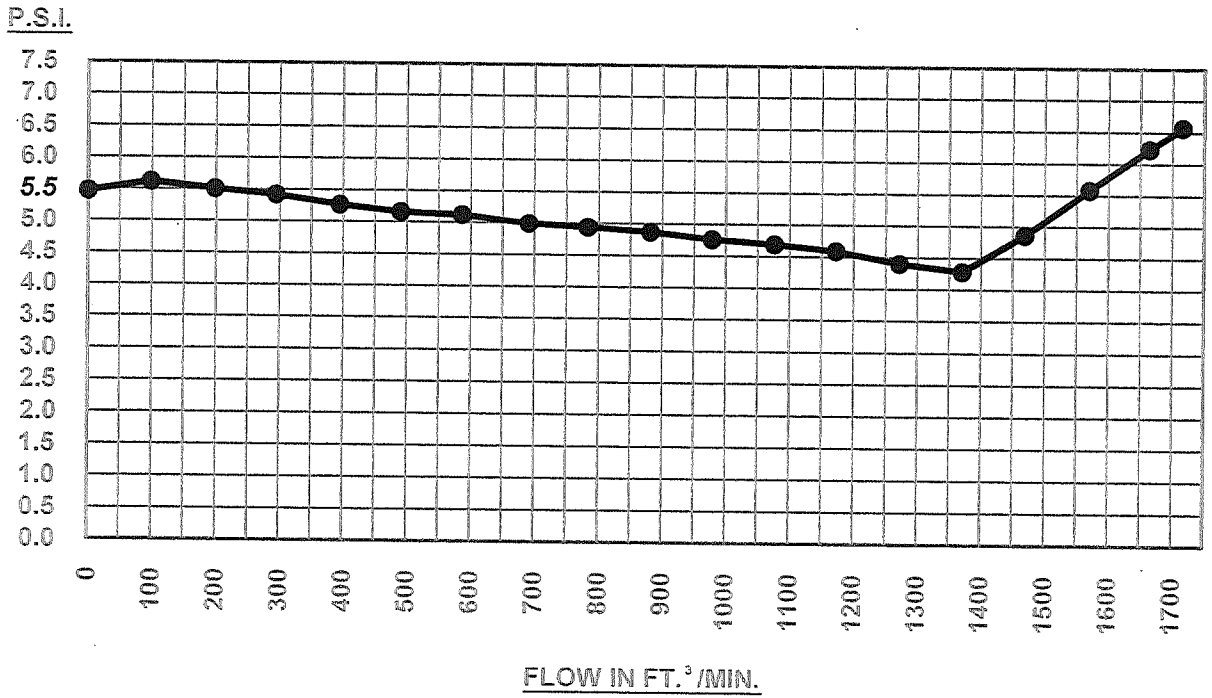
Distances in FEET.







ELECTROMECHANICAL RESEARCH LABORATORIES, INC. P.O. 1026 NEW ALBANY, IN 47150	DATE 3/22/00	DRAWN D. URBAN	PART NAME 6" PV Valve, MDII	
	TOLERANCES .0= +/- .030 .00= +/- .015 .000= +/- .005	APPROVED	UNIT NAME ERL Commercial Marine Inc.	
		SCALE 1/10 / JOB NO.	DRAWING NO. 269L144B-5	ITEM NO.



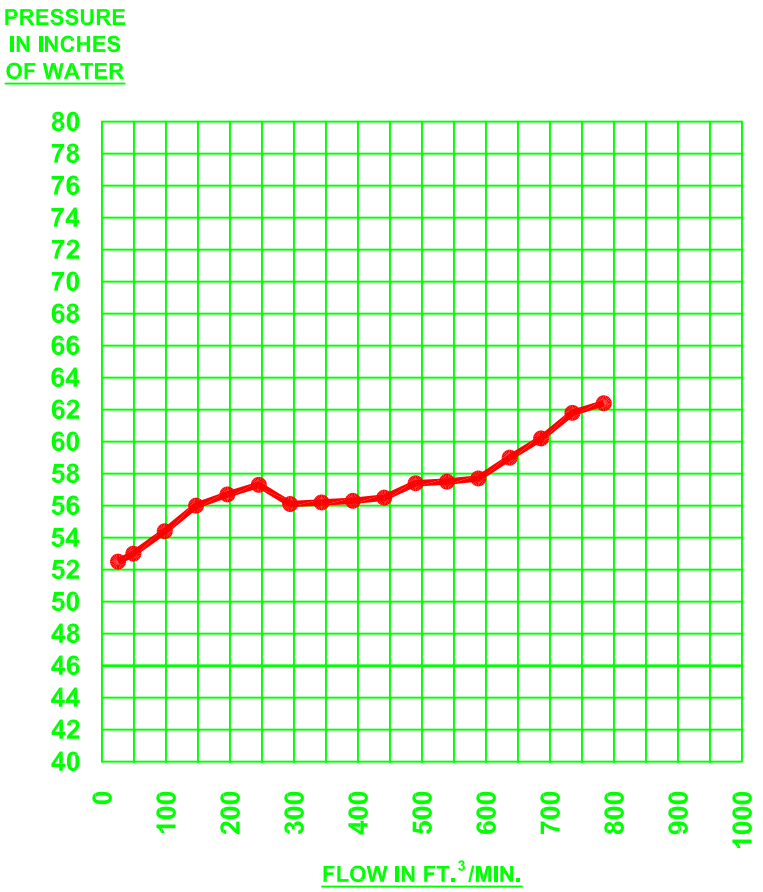
BARRELS PER HOUR	FLOW FT.³ per MIN.	P.S.I.
0	0	5.47
1049	98	5.62
2119	198	5.51
3146	294	5.42
4216	394	5.27
5243	490	5.16
6270	586	5.12
7394	691	4.99
8378	783	4.94
9427	881	4.87
10465	978	4.76
11513	1076	4.69
12540	1172	4.59
13600	1271	4.40
14659	1370	4.28
15708	1468	4.86
16788	1569	5.58
17794	1663	6.23
18350	1715	6.57

Curve for *PRESSURE* side of 6" PV Valve - *5.5 PSI*

CEESI - Colorado Engineering

data based on air flow

ELECTROMECHANICAL RESEARCH LABORATORIES, INC. P.O. 1026 NEW ALBANY, IN 47150	DATE 7/12/10	DRAWN D. URBAN	PART NAME Flow Curve 5.5 PSI Pressure
	TOLERANCES .0= +/- .030 .00= +/- .015 .000= +/- .005	APPROVED	UNIT NAME 6" PV Valve MDII
		SCALE / JOB NO.	DRAWING NO. 193V147B / ITEM NO.



BARRELS PER HOUR	FLOW $FT.^3$ / MIN.	PRESSURE IN. OF H_2O
262	25	52.5
524	49	53.0
1048	98	54.4
1571	147	56.0
2095	196	56.7
2619	245	57.3
3143	294	56.1
3667	343	56.2
4190	392	56.3
4714	441	56.5
5238	490	57.4
5762	539	57.5
6286	588	57.7
6810	637	59.0
7333	686	60.2
7857	735	61.8
8381	784	62.4

Curve for Vacuum Side of SUPERAC 6" PV Valve - 2.0 PSI

data based on air flow

ELECTROMECHANICAL RESEARCH LABORATORIES, INC.
P.O. 1026 NEW ALBANY, IN 47150

DATE	DRAWN	PART NAME
4/26/04	D. URBAN	2.0 Flow Curve, Vacuum
	APPROVED	UNIT NAME
		Marine 6" PV Valve
	SCALE / JOB NO.	DRAWING NO. / ITEM NO.
		113P155B