Marine Safety Center Vapor Control System (VCS) Plan Review Information Sheet (PRIS)

Vessel Name	E2MS 105	**Shipyard**	Arcosa Caruthersville, MO
Official Number	1294900	**Hull Number**	6082-1 thru 6082-10

1. This sheet consolidates critical VCS parameters for MSC Staff Engineers and CG Field Inspectors dealing with Vapor Control Systems. CG Inspectors should verify the vessel's VCS design is consistent with the information listed in boxes 2, 6, 7 & 8 prior to updating the vapor control endorsement on the vessel's Certificate of Inspection. For cases where the information in the VCS PRIS does not reflect the vessel's design the CG Inspector should contact the MSC's Cargo Authority branch.

2. Tank Maximum Design Working Pressure 3.00 psig — **Raised Trunk** [X] **Flush Deck** [ ]

3. Authorized Maximum Cargo Transfer Rate(s) 3,500 bbl/hr loading (max 2 tanks simultaneously); 3,500 bbl/hr discharging

4. Authorized Maximum Vapor-Air Mixture Density 0.368 lbm/ft^3

5. Authorized VCS Categories 1 Through 7

6. Cargoes with the highest vapor density and/or pressure drop:

a. Cargo Name **Pentane (all isomers) [PTY]**

b. Cargo Name **Pentane (all isomers) [PTY]**

7. Pressure Vacuum Valve:

Manufacturer	**ERL**
Size	**EQUATE**
CG Approval	**162.017/167/4**

Settings in psig:

Pressure-side	**2.5**
Vacuum-side	**0.5**

8. VCS Pipe Sizes:

Approx. Inside Diameter

Longitudinal Header (inches)	**8**
Transverse Header (Inches)	**8**

Required Venting Capacity of Pressure-Side of P/V valve	**9337**	**bbl/hr (air)**
Required Venting Capacity of Vacuum-Side of P/V valve	**3500**	**bbl/hr (air)**

9. Tank Overfill Protection System (check appropriate box or boxes)

a. High Level/Tank Overfill Alarm	[X]	Type	ERL		
b. Overfill Control Shutdown	[X]	Type	ERL		**Setting in psig**
c. Spill Valve	[ ]	Type	N/A	Meets ASTM F1271	**N/A**
d. Rupture Disk	[ ]	Type	N/A		

10. Closed Gauging Verify the vessel has closed gauging that satisfies 46 CFR 39.2003 and 151.15-10(c).

11. Instructions/Guidelines for the OCMI:

11a. The following is the Marine Safety Center's recommended COI endorsement:

In accordance with 46 CFR Part 39, excluding part 39.4000, this vessel's vapor collection system has been inspected to the plans approved by MSC Letter C1-1902216 dated July 8, 2019 and has been found acceptable for the collection of bulk liquid cargo vapors annotated with "Yes" in the CAA's VCS column of the vessel's Cargo Authority Attachment. The VCS system has been approved with a pressure side 2.5 psig P/V valve with Coast Guard Approval 162.017/167/4. The cargo tank top is suitable for a maximum allowable working pressure (MAWP) of 3 psi. When the vessel is carrying cargoes containing greater than 0.5% benzene, the person in charge is responsible for ensuring the provisions of 46 US Code of Federal Regulations Part 197, Subpart C are applied.

In accordance with 46 CFR Part 39.1017 and 39.5000(e) this vessel's VCS has been evaluated and approved for multi-breasted tandem loading with other vessels specifically approved to tandem load with this vessel.

11b. The MSC approval letter/s must be available at the OCMI's request.

11c. Verify isolation valve at the vapor connection flange is manually operable and designed in a way it is "clearly" open or closed.

VCS Approval Letter	MSC Letter C1-1902216 dated July 8, 2019	MSC Plan Reviewer	LT A. L. Mohnke

OWNER: American Inland Marine, LLC **CONTRACT: 75422**

DESCRIPTION: Double Skin Trunked Deck, Single Rake Tank Barge **BY: MEC**

SIZE: 200'-0"x35'-0"x12'-6" **DATE: 20-May-2019**

HULL/NAME: 6082-1 THRU 10/DBL 134, DBL 135, DBL 136, DBL 137, DBL 138, DBL 139, E2MS 104, E2MS 105, FMT 1400, FMT 1402

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	0.086	1.007	3523	3642	0.011	0.023
2	ACN	Acrylonitrile	15	O	C	II	4	.50-70(a), .55-1(e)	0.810	5.000	1.800	0.100	1.100	3850	4278	0.015	0.032
3	ADN	Adiponitrile	37	O	E	II	1	No	0.950	0.010	3.730	0.081	1.000	3501	3506	0.010	0.021
4	AEE	Aminoethylethanolamine	8	O	E	III	1	.55-1(b)	1.030	0.010	3.590	0.081	1.000	3501	3506	0.010	0.021
5	AHO	Anthracene oil (Coal tar fraction)	33	O	NA	II	N/A	No	1.030	0.010	3.590	0.081	1.000	3501	3506	0.010	0.021
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	0.163	1.212	4242	6020	0.031	0.063
7	ATN	Acetonitrile	37	O	C	III	3	No	0.780	0.030	1.410	0.081	1.001	3502	3506	0.010	0.021
8	BAE	Butyraldehyde (all isomers)	19	O	C	III	1	.55-1(h)	0.790	8.000	2.480	0.136	1.160	4060	5280	0.024	0.048
9	BAR	Butyl acrylate (all isomers)	14	O	D	III	2	.50-70(a), .50-81(a), (b)	0.880	0.600	4.420	0.090	1.012	3542	3750	0.012	0.024
10	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	0.092	1.250	4375	4674	0.018	0.038
11	BHB	Benzene or hydrocarbon mixtures (having 10% Benzene or more)	32	O	NA	III	1	.50-60	0.880	0.800	4.000	0.092	1.250	4375	4674	0.018	0.038
12	BMN	Butyl Methacrylate	14	O	D	III	2	.50-70(a), .50-81(a), (b)	0.880	0.290	4.900	0.086	1.006	3520	3637	0.011	0.023
13	BNZ	Benzene	32	O	C	III	1	.50-60	0.880	4.500	2.800	0.119	1.250	4375	5310	0.024	0.049
14	BTX	Benzene, Toluene, Xylene mixtures (10% Benzene or more)	32	O	B/C	III	1	.50-60	0.840	7.300	2.800	0.143	1.250	4375	5815	0.029	0.059
15	CBT	Carbon tetrachloride	36	O	NA	III	N/A	No	1.590	5.400	5.490	0.195	1.108	3878	6025	0.031	0.063
16	CCH	Cyclohexanone	18	O	D	III	1	.56-1(a), (b)	0.950	0.200	3.400	0.083	1.004	3514	3565	0.011	0.022
17	CCW	Creosote	21	O	E	III	1	No	0.950	0.200	3.400	0.083	1.004	3514	3565	0.011	0.022
18	CHA	Cyclohexylamine	7	O	D	III	1	.56-1(a), (b), (c), (g)	0.870	0.620	3.420	0.088	1.012	3543	3698	0.012	0.024
19	CSS	Caustic soda solution	5	O	NA	III		.50-73, .55-1(j)	1.540	0.029	1.330	0.081	1.001	3502	3506	0.010	0.021
20	DCM	Dichloromethane	36	O	NA	III	5	No	1.340	19.000	3.000	0.313	1.250	4375	8622	0.063	0.129
21	DEE	2,2'-Dichloroethyl ether	41	O	D	II	1	.55-1(f)	1.220	0.040	4.900	0.082	1.001	3503	3521	0.010	0.021
22	DEN	Diethylamine	7	O	C	III	3	.55-1(c)	0.710	1.000	2.500	0.088	1.020	3570	3725	0.012	0.024
23	DET	Diethylenetriamine	7	O	E	III	1	.55-1(c)	0.950	0.040	3.480	0.081	1.001	3503	3516	0.010	0.021
24	DIA	Diisopropylamine	7	O	C	II	3	.55-1(c)	0.720	3.700	3.500	0.124	1.074	3759	4665	0.018	0.038
25	DIP	Diisopropanolamine	8	O	E	III	1	.55-1(c)	0.980	0.010	4.590	0.081	1.000	3501	3507	0.010	0.021
26	DMB	Dimethylethanolamine	8	O	D	III	1	.56-1(b), (c)	0.890	0.516	3.030	0.086	1.010	3536	3645	0.011	0.023
27	DMF	Dimethylformamide	10	O	D	III	1	.55-1(e)	0.950	0.300	2.510	0.083	1.006	3521	3570	0.011	0.022
28	DMX	Dichloropropene, Dichloropropane mixtures.	15	O	NA	II	1	No	0.892	9.200	1.550	0.105	1.184	4144	4718	0.019	0.039
29	DNA	Di-n-propylamine	7	O	C	II	3	.55-1(c)	0.740	1.450	3.500	0.098	1.029	3602	3966	0.013	0.027
30	DOL	Dodecyl phenol	21	O	E	I		.50-73	0.930	0.000	9.040	0.081	1.000	3500	3503	0.010	0.021
31	DOT	Dodecyldimethylamine, Tetradecyldimethylamine mixture	7	O	E	III	N/A	.56-1(b)	0.990	0.010	13.450	0.081	1.000	3501	3516	0.010	0.021
32	DPB	1,1-Dichloropropane	36	O	C	III	3	No	1.040	1.800	3.000	0.098	1.036	3626	3991	0.013	0.028
33	DPC	1,3-Dichloropropane	36	O	C	III	3	No	1.040	1.800	3.000	0.098	1.036	3626	3991	0.013	0.028
34	DPP	1,2-Dichloropropane	36	O	C	III	3	No	1.160	2.500	3.890	0.115	1.050	3675	4383	0.016	0.033
35	DPU	1,3-Dichloropropene	15	O	D	II	4	No	1.230	5.500	3.840	0.154	1.110	3885	5371	0.024	0.050
36	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	0.081	1.000	3501	3508	0.010	0.021
37	EAC	Ethyl acrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.930	2.000	3.500	0.104	1.040	3640	4139	0.015	0.030
38	EAI	2-Ethylhexyl acrylate	14	O	E	III	2	.50-70(a), .50-81(a), (b)	0.890	0.015	6.350	0.081	1.000	3501	3512	0.010	0.021
39	EAN	Ethylamine solution (72% or less)	7	O	A	II	6	.55-1(b)	0.800	15.500	1.560	0.133	1.250	4375	5616	0.027	0.055
40	EBA	N-Ethylbutylamine	7	O	D	III	3	.55-1(b)	0.719	1.598	0.286	0.075	1.032	3612	3493	0.010	0.021
41	ECC	N-Ethylcyclohexylamine	7	O	D	III	1	.55-1(b)	0.850	0.585	4.400	0.090	1.012	3541	3743	0.012	0.024
42	EDA	Ethylenediamine	7	O	D	III	1	.55-1(c)	0.910	0.900	2.100	0.085	1.018	3563	3667	0.011	0.023
43	EDC	Ethylene dichloride	36	O	C	III	1	No	1.260	4.000	3.420	0.126	1.080	3780	4729	0.019	0.039
44	EGC	Ethylene glycol monoalkyl ethers	40	O	D/E	III	1	No	0.970	0.200	4.720	0.084	1.004	3514	3592	0.011	0.022
45	EGH	Ethylene glycol hexyl ether	40	O	E	III	N/A	No	0.930	0.170	3.100	0.083	1.003	3512	3551	0.011	0.022
46	EGP	Ethylene glycol propyl ether	40	O	E	III	1	No	0.908	0.025	3.600	0.081	1.001	3502	3511	0.010	0.021
47	EPA	2-Ethyl-3-propylacrolein	19	O	E	III	1	No	0.850	0.120	4.350	0.083	1.002	3508	3552	0.011	0.022
48	ETC	Ethylene cyanohydrin	20	O	E	III	1	No	1.040	0.010	2.450	0.081	1.000	3501	3505	0.010	0.021
49	ETM	Ethyl methacrylate	14	O	D/E	III	2	.50-70(a)	0.920	1.000	3.940	0.095	1.020	3570	3866	0.013	0.026
50	FFA	Furfural	19	O	E	III	1	.55-1(h)	1.200	0.150	3.310	0.082	1.003	3511	3548	0.011	0.022

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DESCRIPTION: Double Skin Trunked Deck, Single Rake Tank Barge **BY: MEC**

SIZE: 200'-0"x35'-0"x12'-6" **DATE: 20-May-2019**

HULL/NAME: 6082-1 THRU 10/DBL 134, DBL 135, DBL 136, DBL 137, DBL 138, DBL 139, E2MS 104, E2MS 105, FMT 1400, FMT 1402

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)
51	FMS	Formaldehyde solution (37% to 50%)	19	O	D/E	III	1	.55-1(h)	1.130	0.150	1.030	0.081	1.003	3511	3514	0.010	0.021
52	GTA	Glutaraldehyde solution (50% or less)	19	O	NA	III	N/A	No	1.124	0.010	3.400	0.081	1.000	3501	3506	0.010	0.021
53	HMC	Hexamethylenediamine solution	7	O	E	III	1	.55-1(c)	1.210	10.500	1.260	0.094	1.210	4235	4562	0.018	0.036
54	HMI	Hexamethyleneimine	7	O	C	II	1	.56-1(b), (c)	0.880	5.600	0.104	0.057	1.112	3892	3278	0.009	0.019
55	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	0.081	1.000	3501	3510	0.010	0.021
56	IPP	iso-Propylamine	7	O	A	II	5	.55-1(c)	0.690	23.100	2.030	0.258	1.250	4375	7820	0.052	0.106
57	IPR	Isoprene	30	O	A	III	7	.50-70(a), .50-81(a), (b)	0.672	11.300	1.772	0.122	1.226	4291	5272	0.024	0.048
58	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	0.174	1.201	4204	6164	0.032	0.066
59	MAM	Methyl acrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.950	4.100	3.000	0.119	1.082	3787	4606	0.018	0.037
60	MCK	Methylcyclopentadiene dimer	30	O	C	III	1	No	0.941	0.040	0.930	0.081	1.001	3503	3505	0.010	0.021
61	MDE	Methyl diethanolamine	8	O	E	III	1	.56-1(b), (c)	1.043	0.000	4.120	0.081	1.000	3500	3503	0.010	0.021
62	MEA	Ethanolamine	8	O	E	III	1	.55-1(c)	1.020	0.030	2.100	0.081	1.001	3502	3508	0.010	0.021
63	MEP	2-Methyl-5-ethylpyridine	9	O	E	III	1	.55-1(e)	0.920	0.160	4.180	0.083	1.003	3511	3566	0.011	0.022
64	MMM	Methyl methacrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.940	2.020	3.450	0.104	1.040	3641	4135	0.014	0.030
65	MPA	iso-Propanolamine	8	O	E	III	1	.55-1(c)	0.960	0.080	2.590	0.081	1.002	3506	3521	0.010	0.021
66	MPL	Morpholine	7	O	D	III	1	.55-1(c)	1.000	0.800	3.000	0.088	1.016	3556	3721	0.012	0.024
67	MPR	2-Methylpyridine	9	O	D	III	3	.55-1(c)	0.940	2.065	3.200	0.102	1.041	3645	4101	0.014	0.029
68	MSO	Mesityl oxide	18	O	D	III	1	No	0.860	0.670	3.500	0.089	1.013	3547	3719	0.012	0.024
69	MSR	alpha-Methylstyrene	30	O	D	III	2	.50-70(a), .50-81(a), (b)	0.890	0.400	4.080	0.087	1.008	3528	3655	0.011	0.023
70	NCT	Coal tar naphtha solvent	33	O	D	III	1	.50-73	1.410	3.600	2.170	0.101	1.072	3752	4190	0.015	0.030
71	NPM	1- or 2-Nitropropane	42	O	D	III	1	.50-81	0.990	1.050	3.060	0.091	1.021	3574	3795	0.012	0.025
72	PAX	Propanolamine (iso-, n-)	8	O	E	III	1	.56-1(b), (c)	0.870	1.900	3.520	0.103	1.038	3633	4111	0.014	0.029
73	PDE	1,3-Pentadiene	30	O	A	III	7	.50-70(a), .50-81	0.680	17.060	2.360	0.221	1.250	4375	7246	0.044	0.091
74	PEB	Polyethylene polyamines	7	O	E	III	1	.55-1(e)	0.994	8.300	4.550	0.219	1.166	4081	6727	0.038	0.078
75	PER	Perchloroethylene	36	O	NA	III	N/A	No	1.620	1.230	5.830	0.109	1.025	3586	4163	0.015	0.030
76	PRD	Pyridine	9	O	C	III	1	.55-1(e)	0.980	1.300	2.720	0.091	1.026	3591	3820	0.012	0.025
77	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	0.081	1.000	3501	3502	0.010	0.021
78	SDD	Sodium chlorate solution (50% or less)	0	O	NA	III	N/A	.50-73	0.850	0.010	0.010	0.081	1.000	3501	3502	0.010	0.021
79	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	0.082	1.030	3606	3635	0.011	0.023
80	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	0.082	1.030	3606	3635	0.011	0.023
81	SSJ	Sodium sulfide, hydrosulfidesolutions (H2S greater than200ppm)	0	O	NA	II	N/A	.50-73, .55-1(b)	1.280	1.510	1.170	0.082	1.030	3606	3635	0.011	0.023
82	STY	Styrene monomer	30	O	D	III	2	.50-70(a), .50-81(a), (b)	0.920	0.400	3.600	0.086	1.008	3528	3636	0.011	0.023
83	TCB	1,2,4-Trichlorobenzene	36	O	E	III	1	No	1.450	0.010	6.260	0.081	1.000	3501	3509	0.010	0.021
84	TCL	Trichloroethylene	36	O	NA	III	1	No	1.470	3.500	4.540	0.139	1.070	3745	4916	0.020	0.042
85	TCM	1,1,2-Trichloroethane	36	O	NA	III	1	.50-73, .56-1(a)	1.430	0.010	4.550	0.081	1.000	3501	3507	0.010	0.021
86	TCN	1,2,3-Trichloropropane	36	O	E	II	3	.50-73, .56-1(a)	1.390	0.150	5.600	0.084	1.003	3511	3583	0.011	0.022
87	TEA	Triethanolamine	8	O	E	III	1	.55-1(b)	1.130	0.010	5.140	0.081	1.000	3501	3508	0.010	0.021
88	TEC	1,1,2,2-Tetrachloroethane	36	O	NA	III	N/A	No	1.600	1.000	5.800	0.103	1.020	3570	4041	0.014	0.028
89	TEN	Triethylamine	7	O	C	II	3	.55-1(e)	0.730	2.500	3.490	0.110	1.050	3675	4292	0.016	0.032
90	TET	Triethylenetetramine	7	O	E	III	1	.55-1(b)	0.980	0.010	5.040	0.081	1.000	3501	3508	0.010	0.021
91	THF	Tetrahydrofuran	41	O	C	III	1	.50-70(b)	0.890	8.500	1.350	0.095	1.170	4095	4439	0.017	0.034
92	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	0.096	1.030	3605	3930	0.013	0.027
93	TTP	Tetraethylenepentamine	1	O	E	III		.55-1(c)	0.998	0.000	6.530	0.081	1.000	3500	3503	0.010	0.021
94	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	0.081	1.000	3501	3509	0.010	0.021
95	VAM	Vinyl acetate	13	O	C	III	2	.50-70(a), .50-81(a), (b)	0.940	5.800	2.970	0.135	1.116	3906	5043	0.022	0.044
96	VNT	Vinyltoluene	13	O	D	III	2	.50-70(a), .50-81, .56-1(a), (b), (c), (g)	0.900	0.120	4.080	0.083	1.002	3508	3549	0.011	0.022

OWNER: American Inland Marine, LLC **CONTRACT: 75422**

DESCRIPTION: Double Skin Trunked Deck, Single Rake Tank Barge **BY: MEC**

SIZE: 200'-0"x35'-0"x12'-6" **DATE: 20-May-2019**

HULL/NAME: 6082-1 THRU 10/DBL 134, DBL 135, DBL 136, DBL 137, DBL 138, DBL 139, E2MS 104, E2MS 105, FMT 1400, FMT 1402

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)
97	ACP	Acetophenone	18	D	E	NA	1	NA	1.030	0.600	4.140	0.090	1.012	3542	3734	0.012	0.024
98	ACT	Acetone	18	D	C	NA	1	NA	0.790	10.000	2.000	0.128	1.200	4200	5286	0.024	0.048
99	BAL	Benzyl alcohol	21	D	E	NA	1	NA	1.050	0.100	3.730	0.082	1.002	3507	3538	0.011	0.022
100	BAN	Butyl alcohol (n-)	0	D	D	NA	1	NA	0.810	0.500	2.600	0.085	1.010	3535	3619	0.011	0.023
101	BAS	Butyl alcohol (sec-)	0	D	C	NA	1	NA	0.810	1.300	2.600	0.091	1.026	3591	3805	0.012	0.025
102	BAT	Butyl alcohol (tert-)	0	D	C	NA	1	NA	0.780	2.800	2.600	0.102	1.056	3696	4153	0.015	0.030
103	BAX	Butyl acetate (all isomers)	34	D	D	NA	1	NA	0.870	0.600	4.000	0.089	1.012	3542	3726	0.012	0.024
104	BPH	Butyl benzyl phthalate	34	D	E	NA	1	NA	1.120	0.010	10.800	0.081	1.000	3501	3513	0.010	0.021
105	BUE	Butyl toluene	32	D	D	NA	1	NA	0.850	0.100	5.110	0.083	1.002	3507	3551	0.011	0.022
106	CHN	Cyclohexanol	20	D	E	NA	1	NA	0.940	0.200	3.500	0.083	1.004	3514	3568	0.011	0.022
107	CHX	Cyclohexane	31	D	C	NA	1	NA	0.780	4.500	2.900	0.121	1.090	3815	4672	0.018	0.038
108	CLS	Caprolactam solutions	22	D	E	NA	1	NA	1.060	0.700	3.900	0.090	1.014	3549	3756	0.012	0.024
109	CMP	p-Cymene	32	D	D	NA	1	NA	0.860	0.460	4.620	0.089	1.009	3532	3702	0.012	0.024
110	CPD	1,3-Cyclopentadiene dimer (molten)	30	D	D/E	NA	2	NA	0.690	0.250	4.550	0.085	1.005	3518	3610	0.011	0.023
111	DAA	Diacetone alcohol	20	D	E	NA	1	NA	0.940	0.100	4.000	0.082	1.002	3507	3540	0.011	0.022
112	DAX	Decyl alcohol (all isomers)	20	D	E	NA	1	NA	0.830	5.800	2.970	0.135	1.116	3906	5043	0.022	0.044
113	DBL	Diisobutylene	30	D	C	NA	1	NA	0.720	2.200	3.970	0.112	1.044	3654	4296	0.016	0.032
114	DCE	Decene	30	D	D	NA	1	NA	0.740	0.120	5.300	0.083	1.002	3508	3563	0.011	0.022
115	DDB	Dodecylbenzene, see Alkyl(C9+)benzenes	32	D	E	NA	1	NA	0.860	4.700	8.400	0.244	1.094	3829	6662	0.038	0.077
116	DDO	Diphenyl, Diphenyl ether mixtures	33	D	E	NA	1	NA	1.070	0.010	5.870	0.081	1.000	3501	3508	0.010	0.021
117	DEB	Diethylbenzene	32	D	D	NA	1	NA	0.870	0.080	4.620	0.082	1.002	3506	3538	0.011	0.022
118	DEG	Diethylene glycol	40	D	E	NA	1	NA	1.120	0.010	3.660	0.081	1.000	3501	3506	0.010	0.021
119	DIK	Diisobutyl ketone	18	D	D	NA	1	NA	0.810	0.480	4.900	0.090	1.010	3534	3724	0.012	0.024
120	DOP	Dioctyl phthalate	34	D	E	NA	1	NA	0.990	0.010	13.450	0.081	1.000	3501	3516	0.010	0.021
121	DPG	Dipropylene glycol	40	D	E	NA	1	NA	1.030	0.070	4.630	0.082	1.001	3505	3533	0.011	0.022
122	EAL	Ethyl alcohol	20	D	C	NA	1	NA	0.790	3.500	1.600	0.091	1.070	3745	3970	0.013	0.027
123	EBT	Ethyl butanol	20	D	D	NA	1	NA	0.830	0.140	3.400	0.082	1.003	3510	3547	0.011	0.022
124	EGL	Ethylene glycol	20	D	E	NA	1	NA	1.130	0.010	2.210	0.081	1.000	3501	3505	0.010	0.021
125	EGY	Ethylene glycol diacetate	34	D	E	NA	1	NA	1.130	0.010	1.000	0.081	1.000	3501	3503	0.010	0.021
126	EHX	2-Ethylhexanol	20	D	E	NA	1	NA	0.830	0.015	4.500	0.081	1.000	3501	3509	0.010	0.021
127	ETA	Ethyl acetate	34	D	C	NA	1	NA	0.900	4.500	3.040	0.124	1.090	3815	4728	0.019	0.039
128	ETB	Ethylbenzene	32	D	C	NA	1	NA	0.870	0.600	3.660	0.088	1.012	3542	3706	0.012	0.024
129	ETG	Ethoxy triglycol (crude)	40	D	E	NA	1	NA	1.020	0.010	6.140	0.081	1.000	3501	3509	0.010	0.021
130	FAL	Furfuryl alcohol	20	D	E	NA	1	NA	1.290	0.100	3.370	0.082	1.002	3507	3534	0.011	0.022
131	GAT	Gasolines: Automotive (containing not over 4.23 grams lead per gallon)	33	D	C	NA	1	NA	0.760	12.500	3.400	0.222	1.250	4375	7253	0.045	0.091
132	GCR	Glycerine	20	D	E	NA	1	NA	1.260	0.010	3.170	0.081	1.000	3501	3506	0.010	0.021
133	HMX	Heptane (all isomers), see Alkanes (C6-C9) (all isomers)	31	D	C	NA	1	NA	0.680	2.500	3.450	0.110	1.050	3675	4283	0.016	0.032
134	HPX	Heptene (all isomers)	30	D	C	NA	2	NA	0.700	2.900	3.400	0.114	1.058	3703	4392	0.016	0.033
135	HXG	Hexylene glycol	20	D	E	NA	1	NA	0.920	0.010	4.000	0.081	1.000	3501	3507	0.010	0.021
136	HXN	Hexanol	20	D	D	NA	1	NA	0.820	1.000	3.520	0.093	1.020	3570	3826	0.012	0.025
137	IAC	iso-Propyl acetate	34	D	C	NA	1	NA	0.880	3.100	3.520	0.118	1.062	3717	4486	0.017	0.035
138	IAL	Butyl alcohol (iso-)	20	D	D	NA	1	NA	0.810	0.900	2.600	0.088	1.018	3563	3712	0.012	0.024
139	IDA	iso-Decaldehyde	19	D	E	NA	1	NA	0.830	0.060	5.380	0.082	1.001	3504	3534	0.011	0.022
140	IPA	iso-Propyl alcohol	20	D	C	NA	1	NA	0.790	3.000	2.070	0.096	1.060	3710	4045	0.014	0.028
141	IPH	Isophorone	18	D	E	NA	1	NA	0.930	0.010	4.750	0.081	1.000	3501	3507	0.010	0.021
142	KRS	Kerosene	33	D	D	NA	1	NA	0.810	0.150	4.500	0.083	1.003	3511	3566	0.011	0.022
143	MAC	Methylamyl acetate	34	D	D	NA	1	NA	0.860	0.340	5.000	0.087	1.007	3524	3663	0.011	0.023
144	MAL	Methyl alcohol	20	D	C	NA	1	NA	0.790	7.000	1.100	0.084	1.140	3990	4074	0.014	0.029
145	MBE	Methyl tert-butyl ether	41	D	C	NA	1	NA	0.740	0.040	3.100	0.081	1.001	3503	3514	0.010	0.021
146	MEK	Methyl ethyl ketone	18	D	C	NA	1	NA	0.800	4.500	2.500	0.113	1.090	3815	4505	0.017	0.035
147	MIK	Methyl isobutyl ketone	18	D	C	NA	1	NA	0.800	1.200	3.450	0.095	1.024	3584	3881	0.013	0.026
148	MNS	Mineral spirits	33	D	D	NA	1	NA	0.750	0.200	4.300	0.084	1.004	3514	3584	0.011	0.022
149	MTT	Methyl acetate	34	D	D	NA	1	NA	0.920	6.100	2.600	0.127	1.122	3927	4920	0.020	0.042

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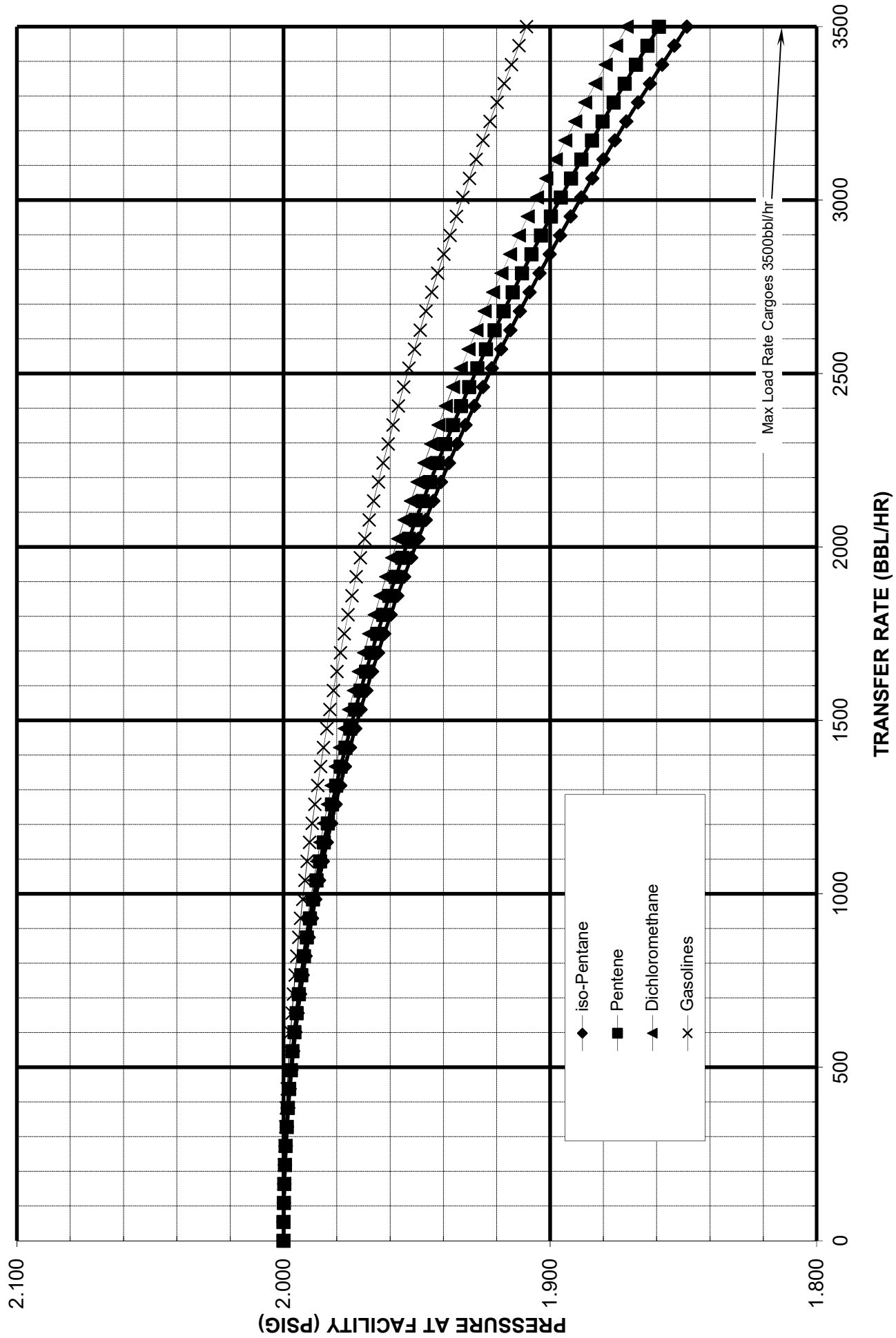
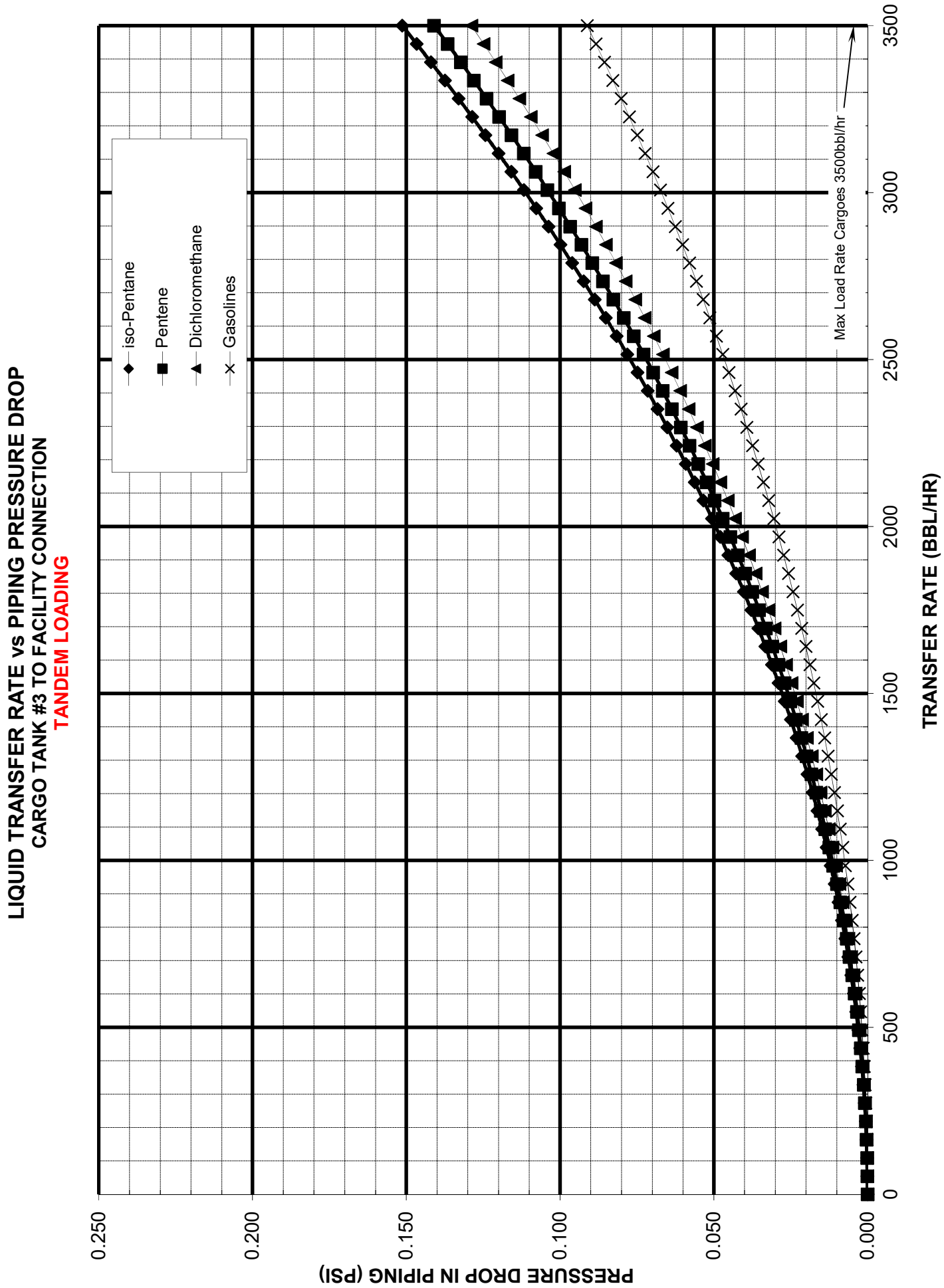
TABLE 1 - VAPOR CONTROL SYSTEM CALCULATIONS

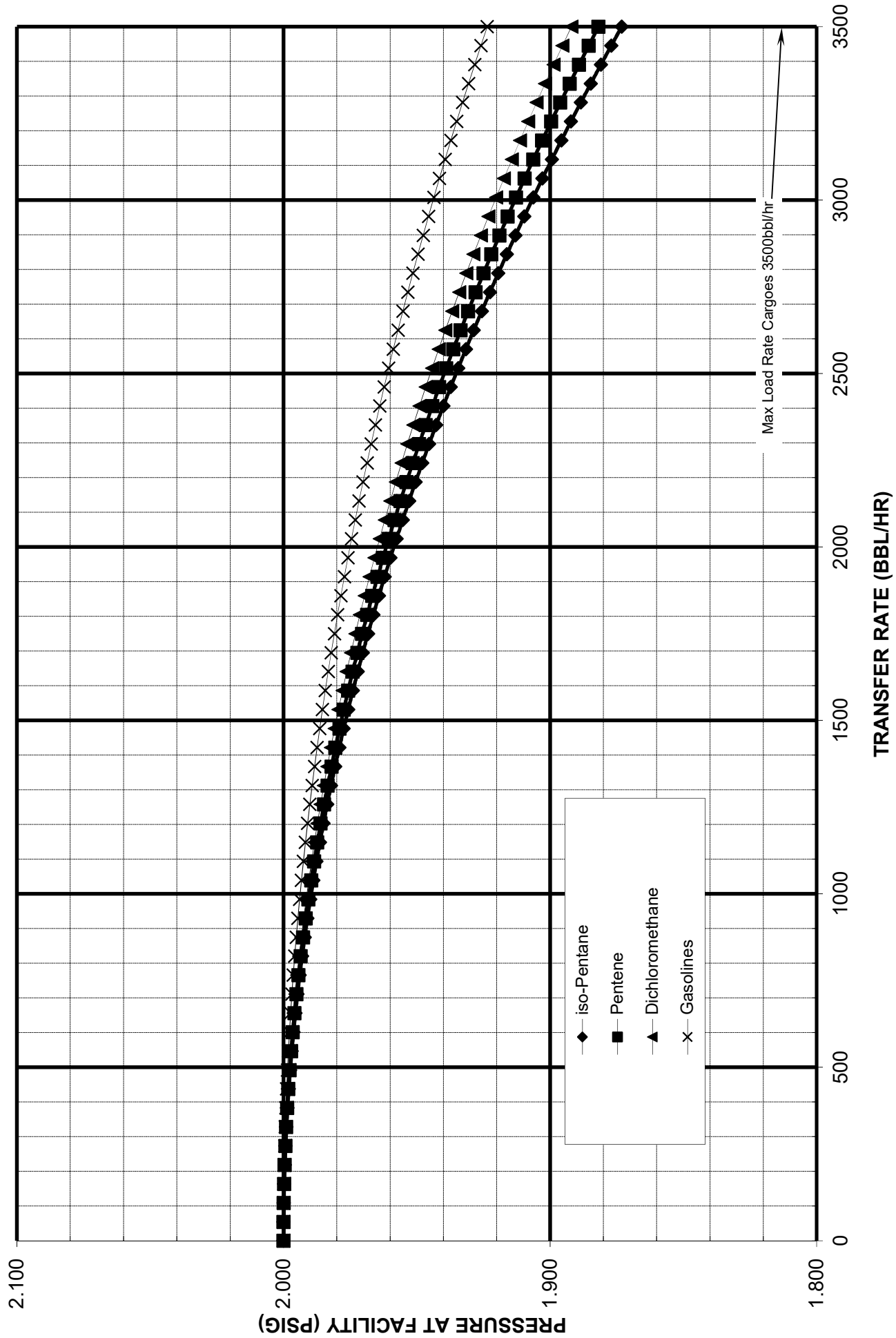
	CHRIS CODE	NAME	COMP GROUP	SUB CHAP	GRADE	HULL TYPE	VCS CAT	REST.	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR WEIGHT DENSITY	VAPOR GROWTH RATE	VAPOR FLOW RATE (bbl/h)	AIR EQUIV FLOW RATE (bbl/hr)	PRESSURE DROP TO PV VALVE IN VCS (LOADING) (psig)	PRESSURE DROP TO SHORE CONN IN VCS (LOADING)* (psig)
150	NNP	Nonyl phenol	21	D	E	NA	1	NA	0.940	0.010	7.590	0.081	1.000	3501	3510	0.010	0.021
151	NSS	Naphtha: Stoddard solvent	33	D	D	NA	1	NA	0.780	0.200	0.010	0.080	1.004	3514	3496	0.010	0.021
152	NSV	Naphtha: Solvent	33	D	D	NA	1	NA	0.870	0.200	3.500	0.083	1.004	3514	3568	0.011	0.022
153	NVM	Naphtha: Varnish makers and painters (75%)	33	D	C	NA	1	NA	0.770	0.190	0.010	0.080	1.004	3513	3497	0.010	0.021
154	ODS	Oil, misc: Diesel	33	D	D/E	NA	1	NA	0.900	5.800	2.970	0.135	1.116	3906	5043	0.022	0.044
155	OIL	Oil, misc: Crude	33	D	C/D	NA	1	NA	0.950	5.800	2.970	0.135	1.116	3906	5043	0.022	0.044
156	OSX	Oil, fuel: No. 6	33	D	E	NA	1	NA	0.950	0.149	2.970	0.082	1.003	3510	3543	0.011	0.022
157	OTW	Oil, fuel: No. 2	33	D	D/E	NA	1	NA	0.880	0.560	8.000	0.099	1.011	3539	3925	0.013	0.027
158	PAL	n-Propyl alcohol	20	D	C	NA	1	NA	0.800	1.200	2.070	0.087	1.024	3584	3718	0.012	0.024
159	PAT	n-Propyl acetate	34	D	C	NA	1	NA	0.870	1.900	3.520	0.103	1.038	3633	4111	0.014	0.029
160	PBY	Propylbenzene (all isomers)	32	D	D	NA	1	NA	0.860	0.600	4.200	0.090	1.012	3542	3737	0.012	0.024
161	PLB	Polybutene	30	D	E	NA	1	NA	0.910	0.010	0.010	0.081	1.000	3501	3502	0.010	0.021
163	PTE	Pentene (all isomers)	31	D	A	III	5	NA	0.637	24.945	2.500	0.343	1.250	4375	9018	0.069	0.141
162	PTY	iso-Pentane	30	D	A	III	5	NA	0.620	27.000	2.480	0.368	1.250	4375	9345	0.074	0.151
164	TCP	Tricresyl phosphate (less than 1% of the ortho isomer)	34	D	E	NA	1	NA	1.170	0.010	12.700	0.081	1.000	3501	3515	0.010	0.021
165	TEB	Triethylbenzene	32	D	E	NA	1	NA	0.860	0.050	5.600	0.082	1.001	3504	3530	0.011	0.022
166	TEG	Triethylene glycol	40	D	E	NA	1	NA	1.120	0.010	5.170	0.081	1.000	3501	3508	0.010	0.021
167	THN	Tetrahydronaphthalene	32	D	E	NA	1	NA	0.980	0.040	4.550	0.082	1.001	3503	3520	0.010	0.021
168	TOL	Toluene	32	D	C	NA	1	NA	0.870	1.500	3.140	0.096	1.030	3605	3930	0.013	0.027
169	TTG	Tetraethylene glycol	40	D	E	NA	1	NA	1.130	0.010	6.700	0.081	1.000	3501	3509	0.010	0.021
Max Vapor Density Cargo		PTY iso-Pentane	30	D	A	III	5	NA	0.620	27.000	2.480	0.368	1.250	4375	9345	0.074	0.151
Max Pressure Drop Cargo		PTY iso-Pentane	30	D	A	III	5	NA	0.620	27.000	2.480	0.368	1.250	4375	9345	0.074	0.151

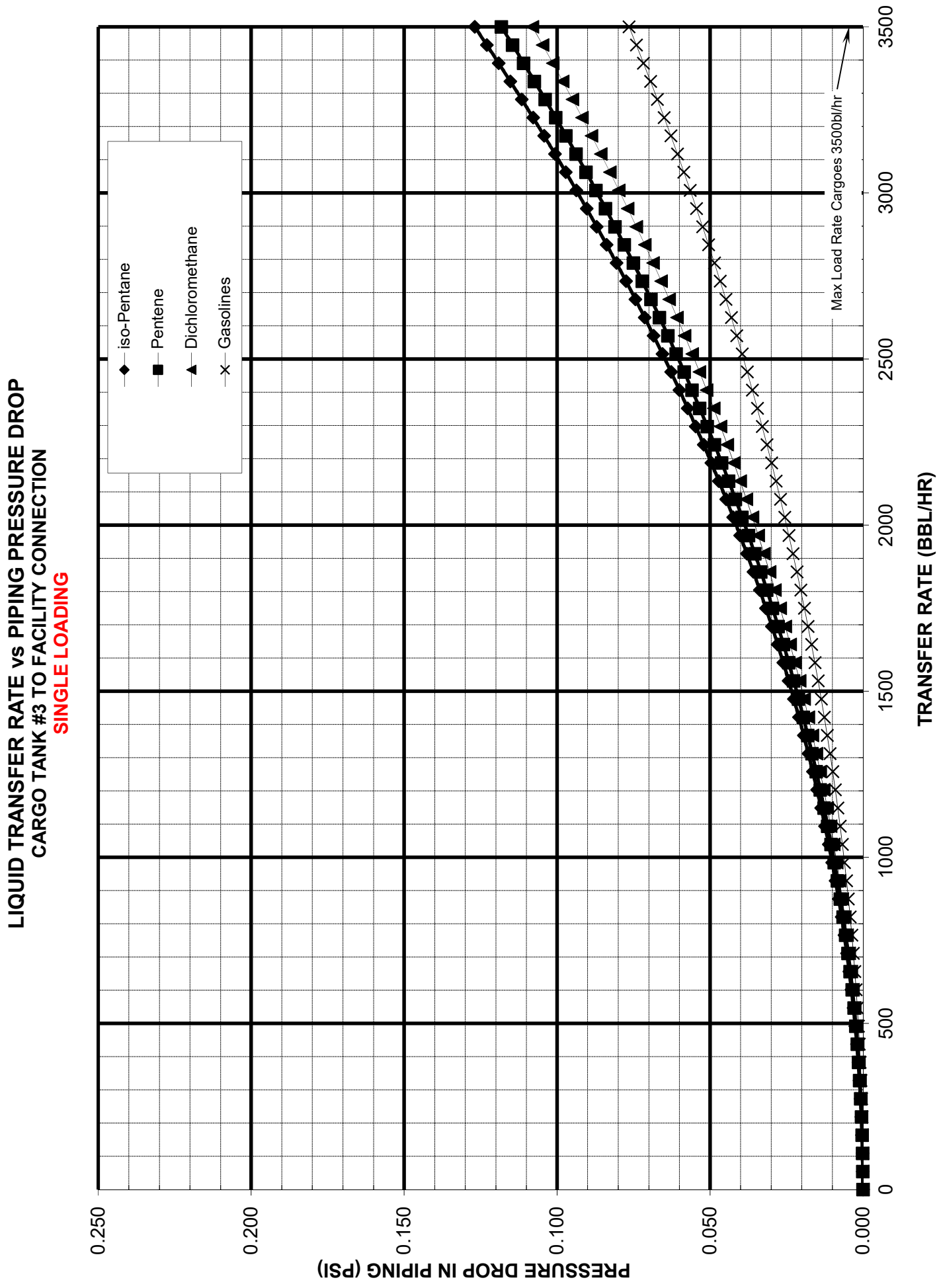
LIQUID TRANSFER RATE vs FACILITY PRESSURE FOR TANDEM LOADING
BASED ON PRESSURE DROP FROM CARGO TANK #3 TO FACILITY CONNECTION




LIQUID TRANSFER RATE vs PIPING PRESSURE DROP
CARGO TANK #3 TO FACILITY CONNECTION
TANDEM LOADING
iso-Pentane
Pentene
Dichloromethane
Gasolines
Max Load Rate Cargoes 3500bbl/hr
PRESSURE DROP IN PIPING (PSI)
0.000
0.050
0.100
0.150
0.200
0.250
TRANSFER RATE (BBL/HR)
0
500
1000
1500
2000
2500
3000
3500

LIQUID TRANSFER RATE vs FACILITY PRESSURE FOR SINGLE LOADING
BASED ON PRESSURE DROP FROM CARGO TANK #3 TO FACILITY CONNECTION




LIQUID TRANSFER RATE vs PIPING PRESSURE DROP
CARGO TANK #3 TO FACILITY CONNECTION
SINGLE LOADING
iso-Pentane
Pentene
Dichloromethane
Gasolines
Max Load Rate Cargoes 3500bl/hr
PRESSURE DROP IN PIPING (PSI)
0.250
0.200
0.150
0.100
0.050
0.000
0
500
1000
1500
2000
2500
3000
3500
TRANSFER RATE (BBL/HR)