7035

TRINITY MARINE PRODUCTS, INC.

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

VAPOR CONTROL SYSTEM (VCS) CALCULATIONS

FOR

SINGLE LOADING AND DISCHARGE

OF

SUBCHAPTER "D" & "O" PRODUCTS

FOR

CANAL BARGE COMPANY

TRINITY MARINE PRODUCTS TAG No.: 30174

TRINITY - MADISONVILLE HULL No.: 2180-3 thru 5

USCG MSC PROJECT No.: P014745

REVISED

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OWNER: CANAL BARGE COMPANY **CONTRACT: 38174**
DESCRIPTION: Double Skin Tank Barge, Rivers, Lakes, Bays and Sounds **BY: MEC**
SIZE: 297'-6"x54'-0"x12'-0" **DATE: 20-Oct-09**
HULL/NAME: 2180-3 thru 5/CBC 7034 - CBC 7036

VCS SYSTEM INFORMATION

1. GENERAL DESCRIPTION OF VESSEL:

A. TMP HULL NUMBERS	2180-3 thru 5	
B. NAME (S):	CBC 7034 - CBC 7036	
C. OFFICIAL NUMBER:	1221251 - 1221253	
D. USCG MSC FILE NUMBER:	P014745	
E. DIMENSIONS:	297'-6"x54'-0"x12'-0"	
F. SERVICE:	Rivers, Lakes, Bays and Sounds, Subchapter "D" & "O"	
G. MAX. ALLOWABLE WORKING PRESSURE:	3.00 psig	
H. PV VALVE PRESSURE SETTING:	1.00 psig	
I. PV VALVE VACUUM SETTING:	0.50 psi	
J. MAX. DISCHARGE RATE:	7500 bbl/hr	702cuft/min
K. MAX. LIQUID LOADING RATE:	7500 bbl/hr	702cuft/min

2. VAPOR CONTROL SYSTEM

A. PIPE DIAMETER: 7.981 in
B. PIPE LENGTHS: See Figure 1
C. P/V VALVE I.C. BERGEN KLPH-6 PV

COMP	MAX FLOW	MAX PRESSURE DROP
I.C. BERGEN KLPH-6 PV	21700bbl/hr @ 1.0psi	0.762psi @ 18456bbl/hr Air
I.C. BERGEN KLPH-6 PV	26000bbl/hr @ 0.5psi	0.619psi @ 7500bbl/hr Air

D. MAX. VAPOR-AIR MIXTURE DENSITY: 0.286 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(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:

Dichloromethane has the heaviest vapor-air mixture density. Dichloromethane 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 1 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	
Straight Pipe	14.13		7.981	1.00	14.13	
Tee Branch	2.00	0.84	7.981	39.91	79.81	Tank Drop
Tee Run	1.00	0.28	7.981	13.30	13.30	144.29
Straight Pipe	96.25		7.981	1.00	96.25	
Tee Run	1.00	0.28	7.981	13.30	13.30	
Tee Branch	1.00	0.84	6.065	30.33	30.33	
				Total	284.17	

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 #1 cargo tank and the P/V valve for each cargo is shown in Table 1.

Using a 7500 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 1 psig, the I.C. BERGEN KLPH-6 PV has an adequate pressure relieving capacity of air for each cargo listed in Table 1. The maximum pressure in the tank, 1.1 psi based on a pressure drop of 0.3 psig in piping and 0.8 psig across the PV Valve at 18456 bbl air equivalant, does not exceed the cargo tank maximum design working pressure of 3 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	284.17	11.70	33.67	0.051

Using a 7500 bbl/h liquid transfer rate as the air flow rate. At a setting of 0.5 psig, the I.C. BERGEN KLPH-6 PV has an adequate pressure relieving capacity of air. The maximum vacuum in the tank, 0.7 psi based on a pressure drop of 0.1 psig in piping and 0.6 psig across the PV Valve at 7500 bbl air, does not exceed the cargo tank maximum design working pressure of 3.0 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)
Tank Drop	144.29		7.981	1.00	144.29 (From Prev. Page)
Straight Pipe	243.75		7.981	1.00	243.75
Tee Run	4.00	0.280	7.981	13.30	53.21
Tee Branch	2.00	0.840	7.981	39.91	79.81
45° Long Radius Elbow	2.00	0.224	7.981	10.64	21.28
8" Gate Valve	1.00	0.112	7.981	5.32	5.32
				Total	547.661

Pressure drop at the maximum liquid loading rate of 7500bbl/h from Tank 1 to the Vapor Header Connection for each cargo is given in Table 1.

The largest pressure drop (0.6psi) does not exceed 80 percent of the P/V valve pressure setting (0.8psig).

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

SMALLEST TANK:	Tank No. 3
SET POINT OF OVERFILL SHUTDOWN:	11.28* IN ULLAGE FROM GAUGE FLANGE
REMAINING CAPACITY AT SHUTDOWN:	702 CUFT
MAX LOAD RATE:	702 CUFT/MIN
MAX LOAD RATE PER TANK:	7500 BBL/HR
TIME REMAINING FOR SHUTDOWN	1.0 MIN
TIME REQUIRED BY 46CFR39.20-9:	1.0 MIN
MARGIN:	0.0 MIN

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

The #3 port cargo tank has a set point for the overfill shutdown set at 0.94ft below the flange of the gauge. The tank capacity above this level is 702cuft. With a liquid transfer rate of 7500 bbl/h per tank based on loading into a single tank only, the person incharge 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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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	ADN	Adiponitrile	37	O	E	II	1	No	0.950	0.010	3.730	0.074	1.000	7502	7506	0.054	0.104
2	AHO	Anthracene oil (Coal tar fraction)	33	O	NA	II	N/A	No	1.030	0.010	3.590	0.074	1.000	7502	7506	0.054	0.104
3	ATN	Acetonitrile	37	O	C	III	3	No	0.780	0.030	1.410	0.074	1.001	7505	7505	0.054	0.104
4	BAE	Butyraldehyde (all isomers)	19	O	C	III	1	.55-1(h)	0.790	8.000	2.480	0.129	1.160	8700	11519	0.127	0.245
5	BAR	Butyl acrylate (all isomers)	14	O	D	III	2	.50-70(a), .50-81(a), (b)	0.880	0.600	4.420	0.083	1.012	7590	8069	0.062	0.120
6	BHB	Benzene or hydrocarbon mixtures (having 10% Benzene or more)	32	O	NA	III	1	.50-60	0.880	0.800	4.000	0.085	1.250	9375	10063	0.097	0.187
7	BMH	Butyl methacrylate	14	O	D	III	2	.50-70(a), .50-81(a), (b)	0.880	0.800	4.000	0.085	1.016	7620	8179	0.064	0.123
8	BNZ	Benzene	32	O	C	III	1	.50-60	0.880	4.500	2.800	0.112	1.250	9375	11540	0.128	0.246
9	BTX	Benzene, Toluene, Xylene mixtures (10% Benzene or more)	32	O	B/C	III	1	.50-60	0.840	7.300	2.800	0.135	1.250	9375	12703	0.155	0.298
10	CBT	Carbon tetrachloride	36	O	NA	III	N/A	No	1.590	5.400	5.490	0.187	1.108	8310	13252	0.168	0.324
11	CCW	Creosote	21	O	E	III	1	No	0.950	0.200	3.400	0.076	1.004	7530	7642	0.056	0.108
12	CHG	Crude hydrocarbon feedstock (containing Butyraldehydes and Ethylpropyl acrolein		O		III	N/A	No	0.870	0.620	3.420	0.081	1.012	7593	7945	0.060	0.117
13	COD	Chemical Oil (refined, containing phenolics)	21	O	E	II	N/A	.50-73	0.860	0.460	4.620	0.081	1.009	7569	7958	0.061	0.117
14	CPO	Camphor oil (light)	18	O	D	II	N/A	No	0.870	0.000	0.000	0.074	1.000	7500	7498	0.054	0.104
15	CRB	Chlorobenzene	36	O	D	III	1	No	1.110	0.800	3.880	0.084	1.016	7620	8158	0.064	0.123
16	CRF	Chloroform	36	O	E	III	3	No	1.480	9.000	4.250	0.211	1.180	8850	14971	0.215	0.414
17	CRS	Cresols (all isomers)	21	O	E	III	1	No	1.050	0.060	3.720	0.074	1.001	7509	7546	0.055	0.105
18	CTA	Crotonaldehyde	19	O	C	II	4	.55-1(h)	0.850	2.000	2.410	0.087	1.040	7800	8469	0.069	0.132
19	DCH	1,1-Dichloroethane	36	O	C	III	1	No	1.180	9.900	3.410	0.186	1.198	8985	14258	0.195	0.375
20	DCM	Dichloromethane	36	O	NA	III	N/A	No	1.340	19.000	3.000	0.286	1.250	9375	18456	0.326	0.629
21	DMX	Dichloropropene, Dichloropropane mixtures	15	O	NA	II	1	No	0.892	9.200	1.550	0.097	1.184	8880	10208	0.100	0.192
22	DPB	1,1-Dichloropropane	36	O	C	III	3	No	1.040	1.800	3.000	0.091	1.036	7770	8612	0.071	0.137
23	DPC	1,3-Dichloropropane	36	O	C	III	3	No	1.040	1.800	3.000	0.091	1.036	7770	8612	0.071	0.137
24	DPP	1,2-Dichloropropane	36	O	C	III	3	No	1.160	2.500	3.890	0.108	1.050	7875	9513	0.087	0.167
25	DPU	1,3-Dichloropropene	15	O	D	II	4	No	1.230	5.500	3.840	0.147	1.110	8325	11755	0.132	0.255
26	EAC	Ethyl acrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.930	2.000	3.500	0.097	1.040	7800	8954	0.077	0.148
27	EAI	2-Ethylhexyl acrylate	14	O	E	III	2	.50-70(a), .50-81(a), (b)	0.890	0.015	6.350	0.074	1.000	7502	7519	0.054	0.104
28	EDC	Ethylene dichloride	36	O	C	III	1	No	1.260	4.000	3.420	0.119	1.080	8100	10296	0.102	0.196
29	EGC	Ethylene glycol monoalkyl ethers	40	O	D/E	III	1	No	0.970	0.200	4.720	0.077	1.004	7530	7704	0.057	0.110
30	EGH	Ethylene glycol hexyl ether	40	O	E	III	N/A	No	0.930	0.170	3.100	0.075	1.003	7526	7608	0.055	0.105
31	EGP	Ethylene glycol propyl ether	40	O	E	III	1	No	0.908	0.025	3.600	0.074	1.001	7504	7517	0.054	0.104
32	EPA	2-Ethyl-3-propylacrolein	19	O	E	III	1	No	0.850	0.120	4.350	0.076	1.002	7518	7612	0.055	0.107
33	ETC	Ethylene cyanohydrin	20	O	E	III	1	No	1.040	0.010	2.450	0.074	1.000	7502	7503	0.054	0.104
34	ETM	Ethyl methacrylate	14	O	D/E	III	2	.50-70(a)	0.920	1.000	3.940	0.087	1.020	7650	8333	0.067	0.128
35	FFA	Furfural	19	O	E	III	1	.55-1(h)	1.200	0.150	3.310	0.075	1.003	7523	7603	0.055	0.107
36	FMS	Formaldehyde solution (37% to 50%)	19	O	D/E	III	1	.55-1(h)	1.130	0.150	1.030	0.074	1.003	7523	7521	0.054	0.104
37	GTA	Glutaraldehyde solution (50% or less)	19	O	NA	III	N/A	No	1.124	0.010	3.400	0.074	1.000	7502	7505	0.054	0.104
38	HFN	Hydrocarbon 5-9		O		III	1	.50-70(a), .50-81(a), (b)	1.210	10.500	1.260	0.086	1.210	9075	9830	0.093	0.178
39	IPR	Isoprene	30	O	A	III	N/A	.50-70(a), .50-81(a), (b)	0.672	11.300	1.772	0.115	1.226	9195	11465	0.126	0.243
40	MAM	Methyl acrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.950	4.100	3.000	0.112	1.082	8115	10010	0.096	0.185
41	MCK	Methylcyclopentadiene dimer	30	O	C	III	1	No	0.740	0.040	3.100	0.074	1.001	7506	7524	0.054	0.104
42	MMM	Methyl methacrylate	14	O	C	III	2	.50-70(a), .50-81(a), (b)	0.940	2.020	3.450	0.097	1.040	7803	8946	0.077	0.148
43	MSO	Mesityl oxide	18	O	D	III	1	No	0.860	0.670	3.500	0.081	1.013	7601	7993	0.061	0.118
44	MSR	alpha-Methylstyrene	30	O	D	III	2	.50-70(a), .50-81(a), (b)	0.890	0.400	4.080	0.079	1.008	7560	7849	0.059	0.114
45	NCT	Coal tar naphtha solvent	33	O	D	III	1	.50-73	1.410	3.600	2.170	0.093	1.072	8040	9052	0.078	0.151
46	NPM	1- or 2-Nitropropane	42	O	D	III	1	.50-81	0.990	1.050	3.060	0.084	1.021	7658	8166	0.064	0.123
47	PDE	1,3-Pentadiene	30	O	A	III	N/A	.50-70(a), .50-81	0.680	17.060	2.360	0.202	1.250	9375	15511	0.230	0.444
48	PER	Perchloroethylene	36	O	NA	III	N/A	No	1.620	1.230	5.830	0.101	1.025	7685	9020	0.078	0.150
49	SDD	Sodium chlorate solution (50% or less)	0	O	NA	III	N/A	.50-73	0.850	0.010	0.010	0.074	1.000	7502	7497	0.054	0.104
50	STX	Styrene (crude)		O	D	III	2	No	1.280	1.510	1.170	0.075	1.030	7727	7787	0.058	0.112

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51	STY	Styrene monomer	30	O	D	III	2	.50-70(a), .50-81(a), (b)	0.920	0.400	3.600	0.079	1.008	7560	7804	0.058	0.112
52	TCB	1,2,4-Trichlorobenzene	36	O	E	III	1	No	1.450	0.010	6.260	0.074	1.000	7502	7512	0.054	0.104
53	TCL	Trichloroethylene	36	O	NA	III	1	No	1.470	3.500	4.540	0.132	1.070	8025	10731	0.110	0.213
54	TCM	1,1,2-Trichloroethane	36	O	NA	III	1	.50-73, .56-1(a)	1.430	0.010	4.550	0.074	1.000	7502	7508	0.054	0.104
55	TCN	1,2,3-Trichloropropane	36	O	E	II	3	.50-73, .56-1(a)	1.390	0.150	5.600	0.077	1.003	7523	7684	0.057	0.109
56	TEC	1,1,2,2-Tetrachloroethane	36	O	NA	III	N/A	No	1.600	1.000	5.800	0.096	1.020	7650	8739	0.073	0.141
57	THF	Tetrahydrofuran	41	O	C	III	1	.50-70(b)	0.890	8.500	1.350	0.088	1.170	8775	9568	0.088	0.169
58	VAM	Vinyl acetate	13	O	C	III	2	.50-70(a), .50-81(a), (b)	0.940	5.800	2.970	0.127	1.116	8370	10999	0.116	0.223
59	VND	Vinyl neodecanate	13	O	E	III	N/A	.50-70(a), .50-81(a), (b)	0.940	5.800	2.970	0.127	1.116	8370	10999	0.116	0.223
60	AAN	n-Amyl alcohol	20	D	D	NA	1	NA	0.791	0.304	0.063	0.072	1.006	7546	7475	0.054	0.103
61	ACP	Acetophenone	18	D	E	NA	1	NA	1.005	0.632	0.151	0.071	1.013	7595	7462	0.053	0.103
62	ACT	Acetone	18	D	C	NA	1	NA	0.761	10.340	1.410	0.093	1.207	9051	10196	0.100	0.192
63	AEC	Amyl acetate (all isomers)	34	D	D	NA	1	NA	0.876	0.329	0.101	0.072	1.007	7549	7476	0.054	0.103
64	BAL	Benzyl alcohol	21	D	E	NA	1	NA	1.037	0.102	0.023	0.073	1.002	7515	7489	0.054	0.104
65	BAN	Butyl alcohol (n-)	20	D	D	NA	1	NA	0.792	0.502	0.088	0.071	1.010	7575	7462	0.053	0.103
66	BAS	Butyl alcohol (sec-)	20	D	C	NA	1	NA	0.782	1.246	0.217	0.069	1.025	7687	7442	0.053	0.102
67	BAT	Butyl alcohol (tert-)	20	D	C	NA	1	NA	0.760	2.736	0.477	0.067	1.055	7910	7539	0.054	0.105
68	BAX	Butyl acetate (all isomers)	34	D	D	NA	1	NA	0.870	0.600	4.000	0.082	1.012	7590	8011	0.061	0.118
69	BPH	Butyl benzyl phthalate	4	D	E	NA	1	NA	1.110	0.005	0.003	0.074	1.000	7501	7497	0.054	0.104
70	BUE	Butyl toluene	32	D	D	NA	1	NA	0.850	0.100	5.110	0.076	1.002	7515	7611	0.055	0.107
71	CHN	Cyclohexanol	20	D	E	NA	1	NA	0.940	0.200	3.500	0.076	1.004	7530	7647	0.056	0.108
72	CHX	Cyclohexane	31	D	C	NA	1	NA	0.754	4.421	0.874	0.071	1.088	8163	8015	0.062	0.119
73	CLS	Caprolactam solutions	22	D	E	NA	1	NA	1.027	0.062	0.014	0.073	1.001	7509	7493	0.054	0.104
74	CMP	p-Cymene	32	D	D	NA	1	NA	0.843	0.107	0.034	0.073	1.002	7516	7489	0.054	0.104
75	CPD	1,3-Cyclopentadiene dimer (molten)	30	D	D/E	NA	2	NA	0.690	0.250	4.550	0.078	1.005	7538	7745	0.057	0.111
76	DAA	Diacetone alcohol	20	D	E	NA	1	NA	0.912	0.112	0.031	0.073	1.002	7517	7489	0.054	0.104
77	DAL	n-Decaldehyde	19	D	E	NA	1	NA	0.808	0.013	0.004	0.074	1.000	7502	7497	0.054	0.104
78	DAX	Decyl alcohol (all isomers)	20	D	E	NA	1	NA	0.830	5.800	2.970	0.127	1.116	8370	10999	0.116	0.223
79	DBL	Diisobutylene	30	D	C	NA	1	NA	0.699	1.555	0.421	0.069	1.031	7733	7506	0.054	0.104
80	DBZ	n-Decylbenzene, see Alkyl(C9+)benzenes	32	D	E	NA	1	NA	0.854	1.268	0.434	0.070	1.025	7690	7510	0.054	0.104
81	DCE	Decene	30	D	D	NA	1	NA	0.720	0.125	0.041	0.073	1.003	7519	7488	0.054	0.103
82	DDO	Diphenyl, Diphenyl ether mixtures	33	D	E	NA	1	NA	1.070	0.010	5.870	0.074	1.000	7502	7511	0.054	0.104
83	DEB	Diethylbenzene	32	D	D	NA	1	NA	0.855	0.081	0.025	0.073	1.002	7512	7491	0.054	0.103
84	DEG	Diethylene glycol	40	D	E	NA	1	NA	1.091	0.001	0.000	0.074	1.000	7500	7498	0.054	0.103
85	DIK	Diisobutyl ketone	18	D	D	NA	1	NA	0.792	0.152	0.051	0.073	1.003	7523	7486	0.054	0.103
86	DOP	Dioctyl phthalate	34	D	E	NA	1	NA	0.971	0.006	0.038	0.074	1.000	7501	7497	0.054	0.104
87	DPA	ortho-Dibutyl phthalate	34	D	E	NA	1	NA	1.028	0.001	0.000	0.074	1.000	7500	7498	0.054	0.104
88	DPE	Diphenyl ether	NA	D	E	NA	1	NA	1.059	0.887	0.265	0.071	1.018	7633	7471	0.053	0.103
89	DPG	Dipropylene glycol	40	D	E	NA	1	NA	1.005	0.014	0.002	0.074	1.000	7502	7497	0.054	0.104
90	DPN	Dipentene	NA	D	D	III	1	NA	0.833	0.066	0.022	0.073	1.001	7510	7492	0.054	0.104
91	EAA	Ethyl acetoacetate	NA	D	E	NA	1	NA	1.020	0.208	0.062	0.073	1.004	7531	7482	0.054	0.103
92	EAL	Ethyl alcohol	20	D	C	NA	1	NA	0.767	3.477	0.376	0.063	1.070	8021	7445	0.053	0.102
93	EBR	Ethyl butyrate	NA	D	D	NA	1	NA	0.875	0.989	0.270	0.070	1.020	7648	7468	0.053	0.103
94	EBT	Ethyl butanol	20	D	D	NA	1	NA	0.825	0.119	0.029	0.073	1.002	7518	7488	0.054	0.103
95	EEA	2-Ethoxyethyl acetate	34	D	D	NA	1	NA	0.130	0.023	0.008	0.074	1.000	7503	7496	0.054	0.104
96	EGL	Ethylene glycol	20	D	E	NA	1	NA	1.094	0.010	0.001	0.074	1.000	7502	7497	0.054	0.104
97	EGY	Ethylene glycol diacetate	NA	D	E	NA	1	NA	1.076	0.135	0.043	0.073	1.003	7520	7487	0.054	0.103
98	EHX	2-Ethylhexanol	20	D	E	NA	1	NA	0.813	0.025	0.008	0.074	1.001	7504	7496	0.054	0.104
99	EMA	Ethylene glycol butyl ether acetate	34	D	E	NA	1	NA	0.933	0.126	0.042	0.073	1.003	7519	7488	0.054	0.103
100	ETA	Ethyl acetate	34	D	C	NA	1	NA	0.877	4.575	0.947	0.072	1.092	8186	8121	0.063	0.122
101	ETB	Ethylbenzene	32	D	C	NA	1	NA	0.844	0.534	0.133	0.071	1.011	7580	7465	0.053	0.103
102	ETG	Ethoxy triglycol (crude)	40	D	E	NA	1	NA	1.012	0.002	0.870	0.074	1.000	7500	7498	0.054	0.104
103	FAL	Furfuryl alcohol	20	D	E	NA	1	NA	1.121	0.053	0.012	0.073	1.001	7508	7493	0.054	0.104
104	FAM	Formamide	10	D	E	NA	1	NA	1.133	0.574	0.043	0.071	1.011	7586	7450	0.053	0.102

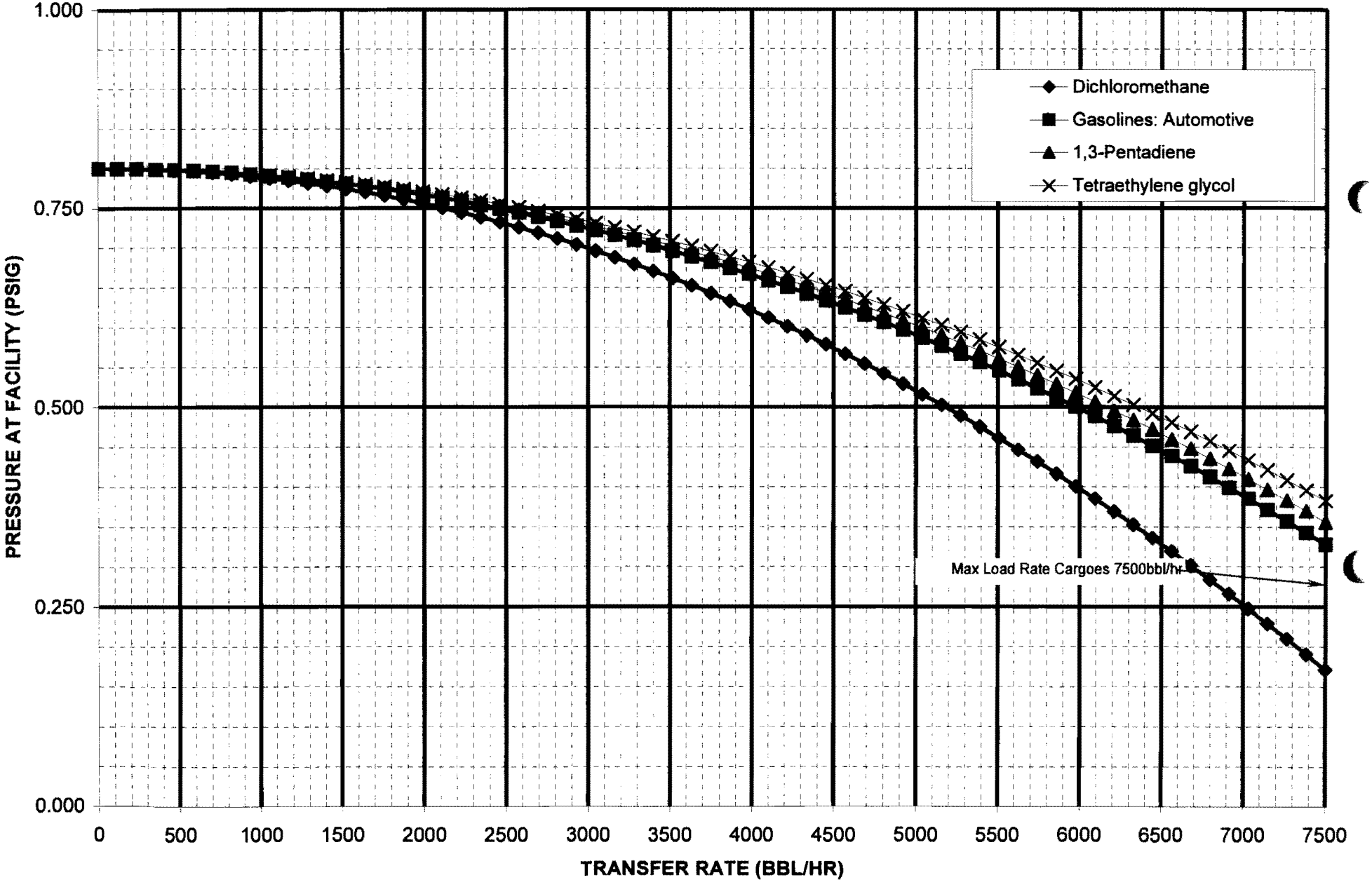
OWNER: CANAL BARGE COMPANY
DESCRIPTION: Double Skin Tank Barge, Rivers, Lakes, Bays and Sounds
SIZE: 297'-6"x54'-0"x12'-0"
HULL/NAME: 2180-3 thru 5/CBC 7034 - CBC 7036

CONTRACT: 38174
BY: MEC
DATE: 20-Oct-2009

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)
105	GAT	Gasolines: Automotive	33	D	C	NA	1	NA	0.706	12.500	3.400	0.214	1.250	9375	15990	0.245	0.472
106	GCR	Glycerine	20	D	E	NA	1	NA	1.246	0.001	3.170	0.074	1.000	7500	7499	0.054	0.104
107	HPT	Heptane (all isomers), see Alkanes (C6-C9) (all isomers)	31	D	C	NA	1	NA	0.661	2.342	0.551	0.069	1.047	7851	7582	0.055	0.106
108	HTE	Heptene (all isomers)	30	D	C	NA	2	NA	0.675	2.810	0.648	0.069	1.056	7922	7665	0.056	0.108
109	HTN	Heptanol (all isomers)	20	D	D/E	NA	1	NA	0.801	0.038	0.010	0.073	1.001	7506	7495	0.054	0.104
110	HXA	Hexane (all isomers), see Alkanes (C6-C9)	31	D	B/C	NA	1	NA	0.634	6.841	1.384	0.086	1.137	8526	9209	0.081	0.157
111	HXG	Hexylene glycol	20	D	E	NA	1	NA	0.901	0.012	0.003	0.074	1.000	7502	7497	0.054	0.104
112	HXN	Hexanol	20	D	D	NA	1	NA	0.818	0.974	0.234	0.070	1.019	7646	7460	0.053	0.103
113	IAA	iso-Amyl alcohol	20	D	D	NA	1	NA	0.789	0.267	0.055	0.072	1.005	7540	7477	0.054	0.10
114	IAC	iso-Propyl acetate	34	D	C	NA	1	NA	0.866	3.520	0.708	0.069	1.070	8028	7759	0.058	0.11
115	IAL	Butyl alcohol (iso-)	20	D	D	NA	1	NA	0.783	0.860	0.150	0.070	1.017	7629	7447	0.053	0.102
116	IDA	iso-Decaldehyde	19	D	E	NA	1	NA	0.830	0.223	0.074	0.073	1.004	7533	7482	0.054	0.103
117	IPA	iso-Propyl alcohol	20	D	C	NA	1	NA	0.778	2.833	0.399	0.066	1.057	7925	7481	0.054	0.103
118	IPH	Isophorone	18	D	E	NA	1	NA	0.904	0.065	0.020	0.073	1.001	7510	7492	0.054	0.104
119	KRS	Kerosene	33	D	D	NA	1	NA	0.810	0.150	4.500	0.076	1.003	7523	7645	0.056	0.108
120	MAA	Methylamyl alcohol	20	D	D	NA	1	NA	0.775	0.434	0.104	0.072	1.009	7565	7469	0.053	0.103
121	MAC	Methylamyl acetate	34	D	D	NA	1	NA	0.835	0.327	0.111	0.072	1.007	7549	7477	0.054	0.103
122	MAL	Methyl alcohol	20	D	C	NA	1	NA	0.775	6.623	0.498	0.058	1.132	8493	7539	0.054	0.105
123	MBE	Methyl tert-butyl ether	41	D	C	NA	1	NA	0.741	0.038	3.100	0.074	1.001	7506	7522	0.054	0.104
124	MBK	Methyl butyl ketone	18	D	C	NA	1	NA	0.788	0.969	0.228	0.070	1.019	7645	7459	0.053	0.103
125	MEK	Methyl ethyl ketone	18	D	C	NA	1	NA	0.780	4.477	0.758	0.069	1.090	8172	7882	0.060	0.115
126	MIK	Methyl isobutyl ketone	18	D	C	NA	1	NA	0.778	1.216	0.285	0.070	1.024	7682	7464	0.053	0.103
127	MNS	Mineral spirits	33	D	D	NA	1	NA	0.780	0.187	4.300	0.077	1.004	7528	7672	0.056	0.109
128	MTT	Methyl acetate	34	D	D	NA	1	NA	0.891	9.617	1.674	0.104	1.192	8943	10626	0.108	0.208
129	NNP	Nonylphenol	21	D	E	NA	1	NA	0.933	0.255	0.095	0.073	1.005	7538	7481	0.054	0.103
130	NON	Nonene (all isomers)	30	D	D	NA	2	NA	0.733	0.346	0.102	0.072	1.007	7552	7475	0.054	0.103
131	NSS	Naphtha: Stoddard solvent	33	D	D	NA	1	NA	0.780	0.187	0.010	0.073	1.004	7528	7481	0.054	0.103
132	NSV	Naphtha: Solvent	33	D	D	NA	1	NA	0.850	0.187	3.500	0.076	1.004	7528	7637	0.056	0.108
133	NVM	Naphtha: Varnish makers and painters (75%)	33	D	C	NA	1	NA	0.750	0.187	0.010	0.073	1.004	7528	7481	0.054	0.103
134	ODS	Oil, misc: Diesel	33	D	D/E	NA	1	NA	0.840	0.149	2.970	0.075	1.003	7522	7590	0.055	0.106
135	OIL	Oil, misc: Crude	33	D	C/D	NA	1	NA	0.700	0.149	2.970	0.075	1.003	7522	7590	0.055	0.106
136	OSX	Oil, fuel: No. 6	33	D	E	NA	1	NA	0.966	0.149	2.970	0.075	1.003	7522	7590	0.055	0.10
137	OTW	Oil, fuel: No. 2	33	D	D/E	NA	1	NA	0.877	0.558	8.000	0.092	1.011	7584	8472	0.069	0.13
138	PAL	n-Propyl alcohol	20	D	C	NA	1	NA	0.783	1.180	0.167	0.069	1.024	7677	7431	0.053	0.102
139	PAT	n-Propyl acetate	34	D	C	NA	1	NA	0.858	1.840	0.441	0.069	1.037	7776	7515	0.054	0.104
140	PBY	Propylbenzene (all isomers)	32	D	D	NA	1	NA	0.860	0.600	4.200	0.083	1.012	7590	8038	0.062	0.119
141	PGN	Propylene glycol methyl ether acetate	34	D	D	NA	1	NA	0.130	0.072	0.024	0.073	1.001	7511	7492	0.054	0.104
142	PLB	Polybutene	30	D	E	NA	1	NA	0.810	0.088	0.168	0.073	1.002	7513	7494	0.054	0.104
143	PPG	Propylene glycol	20	D	E	NA	1	NA	1.019	0.012	0.002	0.074	1.000	7502	7497	0.054	0.104
144	PTT	Propylene tetramer	30	D	D	NA	1	NA	0.754	0.022	0.009	0.074	1.000	7503	7496	0.054	0.104
145	SFL	Sulfolane	39	D	E	NA	1	NA	1.252	0.038	0.009	0.073	1.001	7506	7495	0.054	0.104
146	TCP	Tricresyl phosphate (less than 1% of the ortho isomer)	34	D	E	NA	1	NA	1.156	0.019	0.012	0.074	1.000	7503	7496	0.054	0.104
147	TEB	Triethylbenzene	32	D	E	NA	1	NA	0.841	0.023	0.009	0.074	1.000	7503	7496	0.054	0.104
148	TEG	Triethylene glycol	40	D	E	NA	1	NA	1.108	0.141	0.037	0.073	1.003	7521	7486	0.054	0.103
149	THN	Tetrahydronaphthalene	32	D	E	NA	1	NA	0.962	0.041	0.013	0.073	1.001	7506	7494	0.054	0.104
150	TOL	Toluene	32	D	C	NA	1	NA	0.844	1.516	0.328	0.069	1.030	7727	7470	0.053	0.103
151	TTG	Tetraethylene glycol	40	D	E	NA	1	NA	1.112	12.130	3.075	0.192	1.243	9320	15033	0.216	0.417
152	UND	Undecanol	20	D	E	NA	1	NA	0.821	0.144	0.047	0.073	1.003	7522	7487	0.054	0.103
153	XLP	Xylenes (ortho-, meta-, para-)	32	D	D	NA	1	NA	0.840	0.528	0.131	0.071	1.011	7579	7466	0.053	0.103
Max Vapor Density Cargo		DCM Dichloromethane	36	O	NA	III	N/A	No	1.340	19.000	3.000	0.286	1.250	9375	18456	0.326	0.629
Max Pressure Drop Cargo		DCM Dichloromethane	36	O	NA	III	N/A	No	1.340	19.000	3.000	0.286	1.250	9375	18456	0.326	0.629

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



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

1. Vessel Name	CBC 7035-CBC 7037	Shipyard	Trinity Marine Products, Madisonville, LA
Official Number	1221251-1221253	Hull #	2180-3 Thru 5

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: 3.00 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**

7,500	bbl/hr loading
7,500	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	DCM Dichloromethane	0.286	lbm/ft3
b. Cargo Name	DCM Dichloromethane	0.286	lbm/ft3

6. **VCS Categories Requested (list):** 1-4

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	0.326	0.326
b. Most Remote Cargo Tank to VCS Facility Connection	0.629	0.629
c. ΔP across P/V valve @ cargoes' Maximum Transfer Rate	0.762	0.762
d. ΔP across Vacuum P/V @ MTR or Max. Discharge Rate	0.619	
e. ΔP across Spill Valve for Max. Density Cargo at MTR	NA	

8. **Pressure Vacuum Valve:**

Manufacturer	Bergan
Model/Size	KLPH-6
CG Approval Number	162.017/144/2

Settings in psig:

Pressure-side	1.0
Vacuum-side	0.5

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]	Guard Level® 07324TWIN-2A	**Setting in psig**
b. Overfill Control Shutdown	[X]	Guard Level® 07324TWIN-2A w/ Shore Connector	
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:

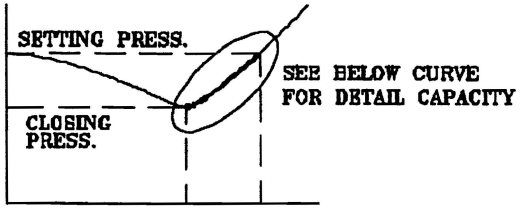
High Level / Overfill Alarm Setpoints - Canal Barge, TMP Hull 2180-3 thru 5

Load Rate 7500 bbl/hr

Flange Ht 12.82 ft

Tank	100% Tank Capacity			95% Tank Setting			98.5% Tank Setting			60s Tank Setting		
	Tank Capacity (cuft)	Tank Level (ft)	Distance to Flange (ft)	Tank Capacity (cuft)	Tank Level (ft)	Distance to Flange (ft)	Tank Capacity (cuft)	Tank Level (ft)	Distance to Flange (ft)	Tank Capacity (cuft)	Tank Level (ft)	Distance to Flange (ft)
1	25761	12.748	0.07	24473	11.80	**1.02**	25374	12.32	**0.50**	25059	12.11	**0.71**
2	25247	12.749	0.07	23985	11.80	**1.02**	24868	12.32	**0.50**	24545	12.10	**0.72**
3	24018	12.748	0.07	22817	11.49	**1.33**	23658	12.19	**0.63**	23316	11.88	**0.94**

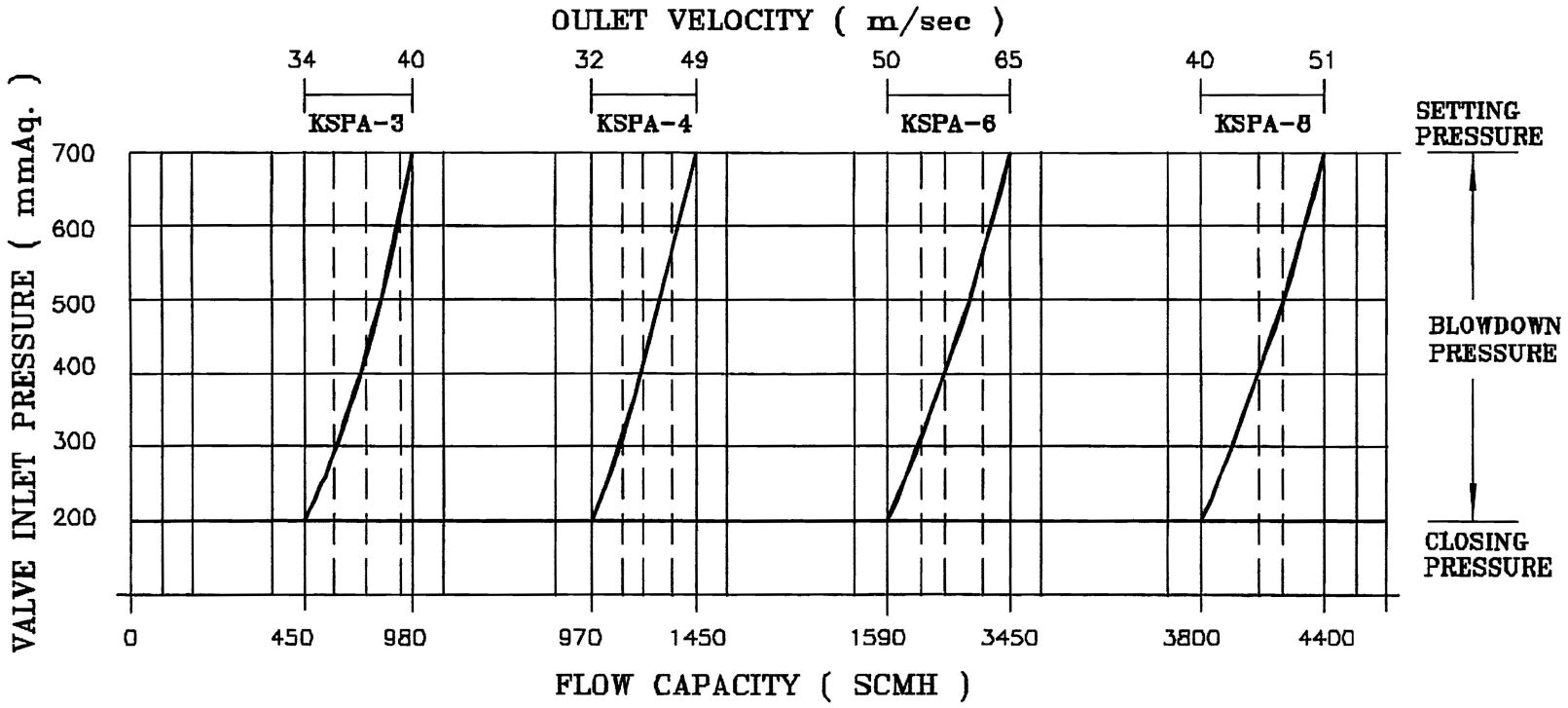
PROGRESS OF VALVE PRESSURE



TANKTECH HIGH VELOCITY VENT VALVES

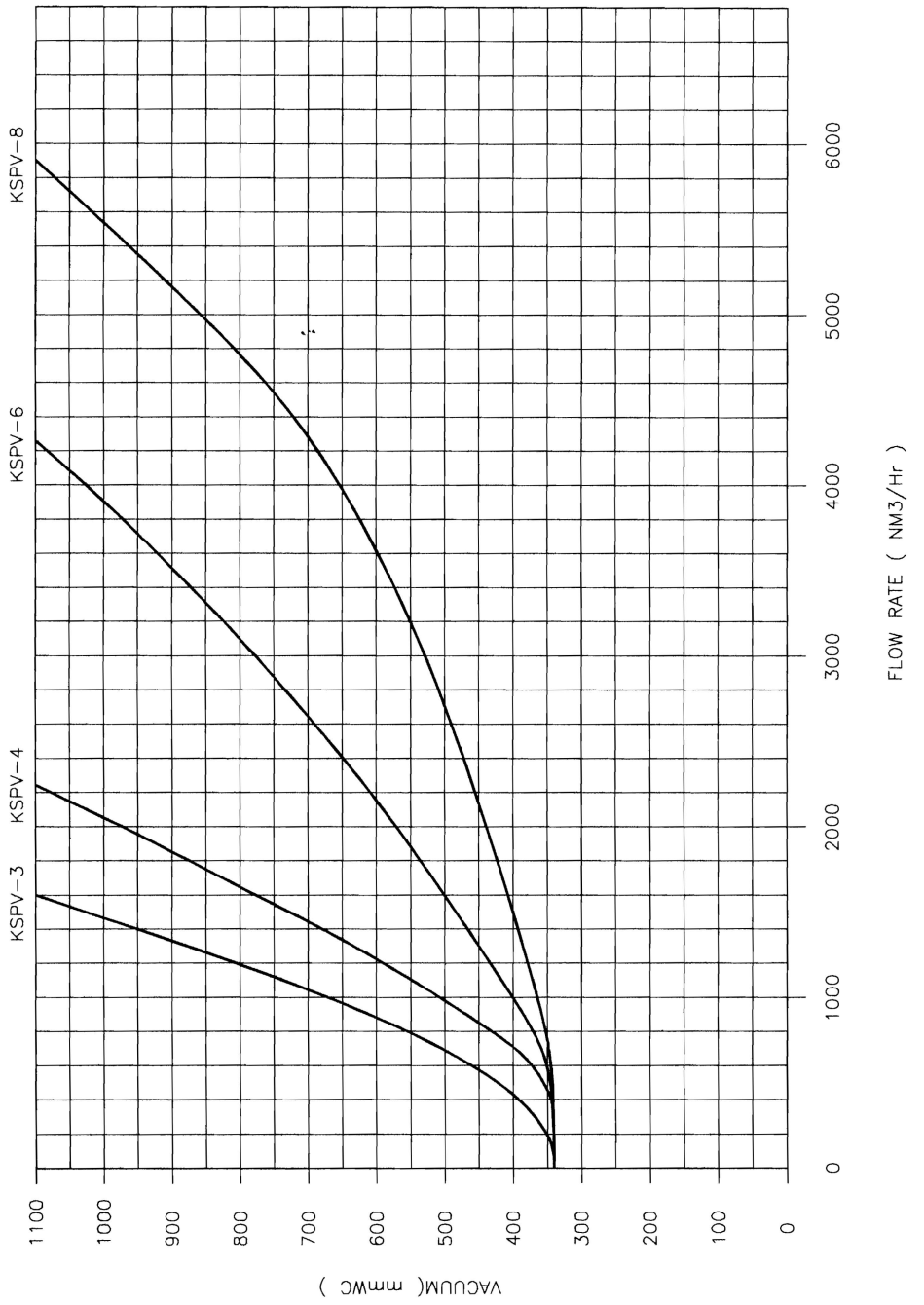
KSPA TYPE FLOW CAPACITY CURVE

700 mmAq. SETTING PRESSURE



FLOW CAPACITY CURVE GRAPH

FLOW TEST PERFORMED ON EQUIPMENT USING AIR, AT TEMP. T=15.6°C AND AMBIENT PRESSURE P=1.0332 KG/CM2.



TANKTECH	TITLE HIGH VELOCITY VACUUM RELIEF VALVE KSPV TYPE	