



MARINE SOLUTIONS, Inc.

www.marinesolutionsinc.net

E-mail
MSI/121401/S03

March 28, 2015

Attn: Chief-Tank Vessel Offshore Branch
United States Coast Guard,
Marine Safety Center,
4200 Wilson Blvd., Suite 400, STOP 7410
Arlington, VA 20598-7410

Sub: 200'-0" x 35' x 12'-6" Double Skin Tank Barges (O/D)
Barge Name(S): CBC 1380 THRU CBC1387
Southwest Shipyard Hull(S): 9739 THRU 9746
Plan Submittal

Encl.: 1. Dwg. No. 121401VP-1, SH 1 of 2, Rev 1 "Vapor Piping"
2. Dwg. No. 121401VP-1, SH 2 of 2, Rev 1 "Vapor Piping"
3. Vapor Recovery Calculations
4. VCS Form

Ref: 1. USCG Project P018455

Dear Commanding Officer:

As a technical agent of the Southwest Shipyard, Houston, TX, We are submitting enclosures 1 thru 4 for your review and approval.

The MSO-Galveston, TX is inspecting these barges.

The barge will be certificate for carriage of Subchapter D, Grade A and lower cargoes with limited Subchapter O cargoes.

With this letter, we request you to kindly review the enclosures and advise us of your approval with or without comments.

Please do not hesitate to call at 615-364-9598 if you have question.

Thank you,

Chetan Kumaria, PE, MBA

cc: Mr. Josh Roy-Project Manager, Southwest Shipyard, L.P.

Marine Solution Inc., P.O. Box 218197, TN 37221-8197
Tel: 615-364-9598 Fax: 615-662-9608
Marinesolinc@aol.com

VAPOR COLLECTION SYSTEM CALCULATIONS

FOR

BARGE NAME(s): "CBC 1380" thru "CBC 1387"

SOUTHWEST SHIPYARD HULL(s): 9739 thru 9746

200'-0" X 35'-0" X 12'-6" DOUBLE SKIN TANK BARGE (O/D)

CANAL BARGE COMPANY, INC.

March 28, 2015

Prepared by:

A handwritten signature in black ink, appearing to read 'Kumaria', with a stylized flourish at the end.

**Chetan Kumaria, PE, MBA
MARINE SOLUTIONS, INC.**

**P.O. Box 218197
NASHVILLE, TN. 37221-8197.
615-364-9598**

MARINE SOLUTIONS, INC.

Rev. 0 dated March 28, 2015

VCS SYSTEM INFORMATION:

1. GENERAL DESCRIPTION OF VESSEL:

A. NAME (S): CBC 1380 THRU CBC 1387
B. USCG PROJECT NUMBER: P018455
C. DIMENSIONS: 200'-0" X 35'-0" X 12'-6"
D. SERVICE: TANK BARGE (O/D)
E. MAX. DESIGN WORKING PRESSURE: 3.5 PSIG
F. PV VALVE PRESSURE SETTING: 1 PSIG
G. PV VALVE VACUUM SETTING: 0.5 PSIG
H. MAX. DISCHARGE RATE: 800 BBL/HR

2. VAPOR CONTROL SYSTEM

A. PIPE DIAMETER: 7.981 INCHES IPS
B. PIPE LENGTHS: A- 1'-7 1/4" B-3'-5 7/8" C-53'-2 23/64" D-8'-1 39/64", E-34'-2 3/64"
F- 48'-9 15/16" G-1'-9 19/232" H-4'-1 1/4" J-9'-6 7/8"

C. P/V VALVE VENTING CAPACITY:

(1) 6" BERGAN KLPH, SET @ 1.0 PSI
(2) MAX. CAPACITY: 21666 BBL/HR OF AIR
(3) 0.5 PSIG VAC.

D. SPILL VALVE RELIEVING CAPACITY:

NON INSTALLED

E. MAX. VAPOR-AIR MIXTURE DENSITY:

0.335 LBM/FT³ FOR SUB D

0.213 LBM/FT³ FOR SUB O

F. MAX. LIQUID LOADING RATE:

3500 BBL/HR

G. DARCY FRICTION FACTOR:

0.014

H. VCS CARGOES:

SEE TABLE 1 & TABLE 4

I. ADDITIONAL MIS. INFORMATION:

SYSTEM IS DESIGNED TO ACCOMMODATE INTERNAL VISUAL INSPECTION.

VCS CALCULATIONS

1. CARGO AUTHORITY::

The vapor collection system installed on this barge is designed to carry the cargoes listed in Table 1, Table 4 and Crude Oil and Gasoline Blends. These Cargoes are to be listed on the barge's Certificate of Inspection.

2. DETERMINING VAPOR_AIR MIXTURE DENSITY AND VAPOR GROWTH RATE:

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

3. THE MAXIMUM LIQUID TRANSFER RATE AS IMPOSED BY THE CAPACITY OF THE CARGO VENTING SYSTEM:

Tank 3 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	UNIT EQ. LENGTH (FT)	TOTAL EQ. LENGTH (FT)
Straight Pipe	1	63.015	63.015
Entrance	1	37.05	37.05
T Branch	4	39.91	159.64
8"X6"RED	1	39.88	39.88
T Run Thru	6	13.3	79.8
	Total		379.385

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 #3 cargo tank and the P/V valve for each cargo is shown in Table 1 & Table 4.

Using a 3500 bbl/h liquid transfer rate, the vapor-air mixture and air-equivalent volumetric flow rate for each cargo are given in Table 1 & Table 4. At a setting of 1.0 psig, the Bergan KLPH-6 PV Valve has an adequate pressure relieving capacity of air for each cargo listed in Table 1 & Table 4. The greatest pressure drop in the venting system (1.169 psig) does not exceed the cargo tank maximum design working pressure of 3.5 psi.

The maximum vacuum that can exist in a tank is 0.511 psig. The barges are constructed as per ABS rules and regulations for a pressure of 3.5 psig and are tested for a pressure of 3.5 psig. Therefore the maximum vacuum of 0.511 psig is within the design capacity of these barges and an unloading rate of 800 bbl/h is acceptable.

4. THE MAXIMUM LIQUID TRANSFER RATE AS IMPOSED BY THE RELIEVING CAPACITY OF THE CARGO TANK SPILL VALVE. Non-installed

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

The #1 cargo tank has a trunk top dimension of 46'-8" x 27'-0". The set point of the overfill alarm is set at 9" below the trunk top at tank centerline. With a liquid transfer rate of 3500 bbl/h, the person in charge of transfer of transfer operation has more than 2 minutes to stop the transfer operation before tank overflows. Thus VCS meets 46 CFR 39.20-9.

6. THE MAXIMUM LIQUID TRANSFER RATE AS IMPOSED BY 46 CFR 39.30-1(d)(3).

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

TABLE 3

PIPE/FITTINGS	QUANTITY	UNIT EQ. LENGTH (FT)	TOTAL EQ. LENGTH (FT)
Straight Pipe	1	161.495	161.495
Entrance	1	37.05	37.05
T Branch	4	39.91	159.64
T Run	8	13.33	106.64
8" Gate Valve	1	5.32	5.32
		Total	470.145

Pressure drop at the maximum liquid transfer rate of 3500 bbl/h along this path for each cargo is given in Tables 1 & 4. The largest pressure drop does not exceed 80 percent of the P/V valve pressure setting (0.8 psig).

TABLE 1 (SUB CHAPTER "D" CARGOES)

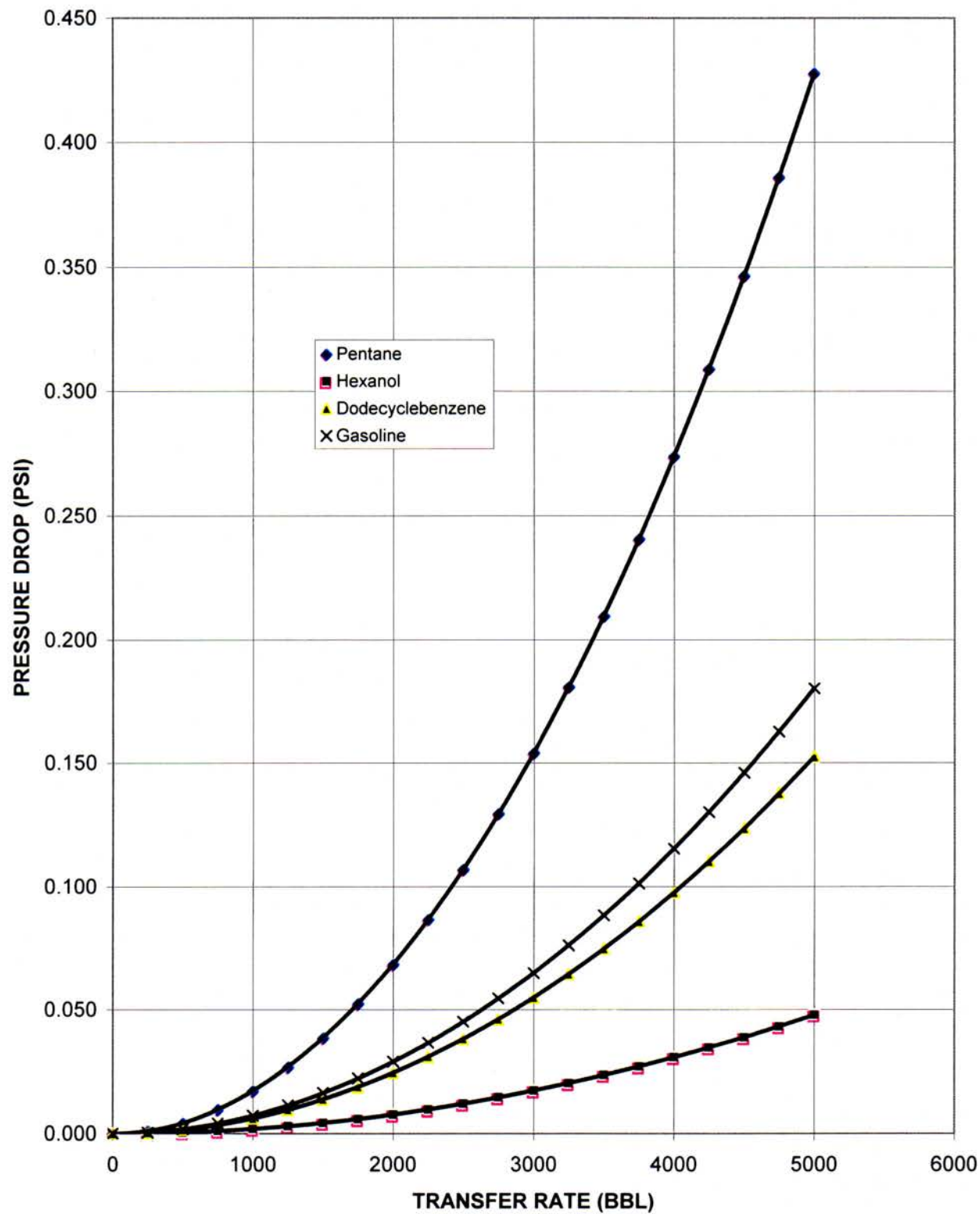
CHRIS CODE	NAME	VCS CAT	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR WEIGHT DENSITY	VAPOR GROWTH RATE	PRESSURE DROP TO PV VALVE IN VCS (psig) (LOADING)	VAPOR VOLUMETRIC FLOW RATE (bbl/h)	AIR EQUIVALENT VOLUMETRIC FLOW RATE	PRESSURE DROP TO SHORE CONNECTION IN VCS (psig) (LOADING)*	PRESSURE DROP TO PV VALVE IN VCS (psig) (UNLOADING)	PRESSURE DROP TO SHORE CONNECTION IN VCS (psig) (UNLOADING)*
1 ACT	Acetone	1	0.79	10	2	0.121	1.2000	0.037	4200	5372	0.046	0.002	0.002
2 ACP	Acetophenone	1	1.03	0.6	4.14	0.082	1.0120	0.018	3542	3747	0.022	0.001	0.001
19 AAT	Amyl Acetate (iso-)	1	0.88	0.33	4.48	0.079	1.0066	0.017	3523	3649	0.021	0.001	0.001
20 AAI	Amyl Alcohol (iso-, n-, sec-, primary) (See also IAA)	1	0.82	0.3	3.04	0.077	1.0060	0.016	3521	3588	0.020	0.001	0.001
21 AAN	Amyl Alcohol (n-)	1	0.82	0.3	3.04	0.077	1.0060	0.016	3521	3588	0.020	0.001	0.001
23 APM	Amyl Alcohol, Primary	1	0.82	0.3	3.04	0.077	1.0060	0.016	3521	3588	0.020	0.001	0.001
24 ASE	Amyl Alcohol, (sec-)	1	0.82	0.3	3.04	0.077	1.0060	0.016	3521	3588	0.020	0.001	0.001
26 IAA	Amyl Alcohol, (iso-)	1	0.82	0.3	3.04	0.077	1.0060	0.016	3521	3588	0.020	0.001	0.001
34 BAL	Benzyl Alcohol	1	1.05	0.1	3.73	0.075	1.0020	0.016	3507	3536	0.020	0.001	0.001
40 BAX	Butyl Acetate (iso-, n-)	1	0.87	0.6	4	0.082	1.0120	0.018	3542	3738	0.022	0.001	0.001
42 BTA	Butyl Acetate (sec-)	1	0.89	1.5	4	0.095	1.0300	0.021	3605	4088	0.026	0.001	0.001
44 IAL	Butyl Alcohol (iso-)	1	0.81	0.9	2.6	0.080	1.0180	0.018	3563	3722	0.022	0.001	0.001
46 BAS	Butyl Alcohol (sec-)	1	0.81	1.3	2.6	0.083	1.0260	0.019	3591	3820	0.023	0.001	0.001
47 BAT	Butyl Alcohol (tert-)	1	0.78	2.8	2.6	0.095	1.0560	0.022	3696	4189	0.028	0.001	0.001
48 BPH	Butyl Benzyl Phthalate	1	1.12	0.01	10.8	0.074	1.0002	0.016	3501	3511	0.020	0.001	0.001
64 CLS	Caprolactam Solutions	1	1.02	0.05	3.9	0.074	1.0010	0.016	3504	3519	0.020	0.001	0.001
70 CUM	Cumene	1	0.86	0.60	4.20	0.083	1.0120	0.018	3542	3751	0.022	0.001	0.001
72 CHX	Cyclohexane	1	0.78	4.5	2.9	0.114	1.0900	0.029	3815	4740	0.036	0.002	0.002
73 CHN	Cyclohexanol	1	0.95	0.15	3.45	0.075	1.0030	0.016	3511	3550	0.020	0.001	0.001
74 CPD	1,3-Cyclopentadiene dimer (molten)	1	0.69	0.25	4.55	0.078	1.0050	0.017	3518	3615	0.021	0.001	0.001
76 CMP	Cymene (para-)	1	0.86	0.11	4.62	0.076	1.0022	0.016	3508	3551	0.020	0.001	0.001
77 DHN	Decahydronaphthalene	1	0.89	0.1	4.76	0.075	1.0020	0.016	3507	3548	0.020	0.001	0.001
78 IDA	Decaldehyde (iso-)	1	0.83	0.01	5	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
79 DAL	Decaldehyde (n-)	1	0.83	0	5.01	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
81 DCE	Decane	1	0.74	0.12	4.8	0.076	1.0024	0.016	3508	3558	0.020	0.001	0.001
82 DAX	Decyl Alcohol (all isomers) (Decanol)	1	0.83	0.01	5.3	0.074	1.0002	0.016	3501	3505	0.019	0.001	0.001
83 ISA	Decyl Alcohol (iso-)	1	0.83	0.01	5.3	0.074	1.0002	0.016	3501	3505	0.019	0.001	0.001
84 DAN	Decyl Alcohol (n-)	1	0.83	0.01	5.3	0.074	1.0002	0.016	3501	3505	0.019	0.001	0.001
85 DBZ	Decylbenzene (n-)	1	0.86	0.01	7.52	0.074	1.0002	0.016	3501	3507	0.019	0.001	0.001
87 DAA	Diacetone Alcohol	1	0.97	0.1	4	0.075	1.0020	0.016	3507	3539	0.020	0.001	0.001
91 DPA	Dibutyl Phthalate (ortho-)	1	1.05	0	9.59	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
92 DPT	Dicyclopentadiene, See 1,3-Cyclopentadiene Dimer	2	0.98	0.25	4.55	0.078	1.0050	0.017	3518	3615	0.021	0.001	0.001
93 DEB	Diethylbenzene	1	0.87	0.08	4.62	0.075	1.0016	0.016	3506	3537	0.020	0.001	0.001
94 DEG	Diethylene Glycol	1	1.12	0.01	3.66	0.074	1.0002	0.016	3501	3503	0.019	0.001	0.001
95 DME	Diethylene Glycol Butyl Ether	1	0.95	0.01	5.5	0.074	1.0002	0.016	3501	3505	0.019	0.001	0.001
100 DGA	Diethylene Glycol Ethyl Ether Acetate	1	0.99	0.02	4.62	0.074	1.0004	0.016	3501	3508	0.020	0.001	0.001
101 DGM	Diethylene Glycol Methyl Ether	1	1.03	0.03	4.14	0.074	1.0006	0.016	3502	3512	0.020	0.001	0.001
111 DBC	Diisobutylcarbinol	1	0.81	0.09	4.97	0.075	1.0018	0.016	3506	3545	0.020	0.001	0.001
112 DBL	Diisobutylene	1	0.72	2	3.86	0.100	1.0400	0.023	3640	4251	0.029	0.001	0.001
113 DIX	Diisobutyl Ketone	1	0.81	0.16	4.9	0.077	1.0032	0.016	3511	3579	0.020	0.001	0.001
119 DIX	Diisopropylbenzene (all isomer)	1	0.86	0.03	5.6	0.074	1.0006	0.016	3502	3516	0.020	0.001	0.001
124 DTL	Dimethyl Phthalate	1	1.19	0	6.69	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
130 DOP	Diocetyl Phthalate	1	0.98	0	13.47	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
131 DPN	Dipentene	1	0.84	0.1	4.9	0.075	1.0020	0.016	3507	3549	0.020	0.001	0.001
132 DIL	Diphenyl	1	0.99	0.01	5.31	0.074	1.0002	0.016	3501	3505	0.019	0.001	0.001
133 DDO	Diphenyl, Diphenyl Ether Mixture	1	1.07	0.01	5.86	0.074	1.0002	0.016	3501	3505	0.019	0.001	0.001
134 DPE	Diphenyl Ether	1	1.07	0.01	5.87	0.074	1.0002	0.016	3501	3505	0.019	0.001	0.001
136 DPG	Dipropylene Glycol	1	1.03	0.07	4.63	0.075	1.0014	0.016	3505	3532	0.020	0.001	0.001
139 DFF	Distillates: Flashed Feed Stocks	1	0.75	2.3	3.4	0.100	1.0460	0.023	3661	4255	0.029	0.001	0.001
140 DSR	Distillates: Straight Run	1	0.73	2.3	3.4	0.100	1.0460	0.023	3661	4255	0.029	0.001	0.001
145 DOZ	Dodecene (all isomers)	1	0.76	0.02	5.81	0.074	1.0004	0.016	3501	3511	0.020	0.001	0.001
146 DOD	Dodecene	1	0.76	0.02	5.81	0.074	1.0004	0.016	3501	3511	0.020	0.001	0.001
147 DDB	Dodecylbenzene	1	0.86	4.7	8.4	0.237	1.0940	0.060	3829	6864	0.075	0.003	0.004
155 ETG	Ethoxy Triglycol (crude)	1	1.02	0	6.14	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
156 ETA	Ethyl Acetate	1	0.9	4.5	3.04	0.117	1.0900	0.029	3815	4801	0.037	0.002	0.002
157 EAA	Ethyl Acetoacetate	1	1.03	0.2	4.48	0.077	1.0040	0.016	3514	3590	0.020	0.001	0.001
158 EAL	Ethyl Alcohol (Ethanol)	1	0.79	3.5	1.6	0.083	1.0700	0.020	3745	3986	0.025	0.001	0.001
160 ETB	Ethyl Benzene	1	0.87	0.6	3.56	0.081	1.0120	0.018	3542	3710	0.022	0.001	0.001
161 EBT	Ethyl Butanol	1	0.83	0.12	3.52	0.075	1.0024	0.016	3508	3541	0.020	0.001	0.001
162 EBR	Ethyl Butyrate	1	0.88	1	4	0.088	1.0200	0.019	3570	3895	0.024	0.001	0.001
163 ECY	Ethyl Cyclohexane	1	0.79	0.5	3.87	0.080	1.0100	0.017	3535	3692	0.022	0.001	0.001
166 EGL	Ethylene Glycol	1	1.19	0.01	2.21	0.074	1.0002	0.016	3501	3501	0.019	0.001	0.001
169 EMA	Ethylene Glycol Butyl Ether Acetate	1	0.94	0.05	5.52	0.075	1.0010	0.016	3504	3528	0.020	0.001	0.001

172	EGY	Ethylene Glycol Diacetate	1	1.1	0.01	5.03	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
178	EME	Ethylene Glycol Methyl Ether	1	1.1	0.01	4.8	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
180	EPE	Ethylene Glycol Phenyl Ether	1	1.1	0.01	4.8	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
184	EHA	2-Ethylhexaldehyde, See Octyl Aldehydes	1	0.82	0.17	4.41	0.076	1.0034	0.016	3512	3575	0.020	0.001	0.001
186	EHX	2-Ethylhexanol, see Octanol (all isomers)	1	0.84	0.02	4.5	0.074	1.0004	0.016	3501	3508	0.020	0.001	0.001
190	EPR	Ethyl Propionate	1	0.89	3.5	1.6	0.083	1.0700	0.020	3745	3986	0.025	0.001	0.001
191	ETE	Ethyl Toulene	1	0.88	0.28	4.15	0.078	1.0056	0.017	3520	3616	0.021	0.001	0.001
194	FAM	Formamide	1	1.13	0.1	1.55	0.074	1.0020	0.016	3507	3512	0.020	0.001	0.001
195	FAL	Furfuryl Alcohol	1	1.13	0.05	3.4	0.074	1.0010	0.016	3504	3516	0.020	0.001	0.001
197	GAK	Gasoline Blended Stocks: Alkylates	1	0.75	12.5	3.4	0.214	1.2500	0.071	4375	7462	0.088	0.004	0.005
198	GRF	Gasoline Blended Stocks: Reformate	1	0.8	12.5	3.4	0.214	1.2500	0.071	4375	7462	0.088	0.004	0.005
199	GAT	Gasolines: Automotive (containing not over 4.23 gr 1	1	0.74	12.5	3.4	0.214	1.2500	0.071	4375	7462	0.088	0.004	0.005
200	GAV	Gasolines: Aviation (containing not over 4.86 grams 1	1	0.71	12.5	3.4	0.214	1.2500	0.071	4375	7462	0.088	0.004	0.005
201	GCS	Gasolines: Casinghead	1	0.67	12.5	3.4	0.214	1.2500	0.071	4375	7462	0.088	0.004	0.005
202	GPL	Gasolines: Polymer	1	0.75	12.5	3.4	0.214	1.2500	0.071	4375	7462	0.088	0.004	0.005
203	GSR	Gasolines: Straight Run	1	0.75	12.5	3.4	0.214	1.2500	0.071	4375	7462	0.088	0.004	0.005
204	GCR	Glycerine	1	1.26	0	3.17	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
217	HMX	Heptane (all isomers) (Methylhexane)	1	0.68	2.5	3.45	0.102	1.0500	0.024	3675	4332	0.030	0.001	0.002
218	HPT	Heptane (n-)	1	0.68	2.5	3.45	0.102	1.0500	0.024	3675	4332	0.030	0.001	0.002
220	HTX	Heptanol (all isomers)	1	0.82	0.04	4	0.074	1.0008	0.016	3503	3515	0.020	0.001	0.001
221	HTN	Heptanol (all isomers)	1	0.82	0.04	4	0.074	1.0008	0.016	3503	3515	0.020	0.001	0.001
222	HPX	Heptene (all isomers)	2	0.7	2.9	3.4	0.106	1.0580	0.025	3703	4447	0.031	0.001	0.002
223	THE	Heptene (1-)	1	0.7	2.8	3.4	0.105	1.0560	0.025	3696	4415	0.031	0.001	0.002
229	HXS	Hexane (all isomers)	1	0.66	7	3	0.139	1.1400	0.038	3990	5486	0.048	0.002	0.002
230	HXA	Hexane	1	0.66	7	3	0.139	1.1400	0.038	3990	5486	0.048	0.002	0.002
231	HXO	Hexanoic Acid	1	0.93	0.01	4	0.074	1.0002	0.016	3501	3503	0.019	0.001	0.001
232	HXN	Hexanol	1	0.82	1	3.52	0.085	1.0200	0.019	3570	3845	0.023	0.001	0.001
234	HEX	Hexene (all isomers)	2	0.67	8	2.9	0.145	1.1600	0.041	4060	5694	0.051	0.002	0.003
235	HXE	Hexene (1-)	1	0.67	8.2	2.9	0.147	1.1640	0.042	4074	5749	0.052	0.002	0.003
236	HXT	Hexene (2-)	1	0.67	8.2	2.9	0.147	1.1640	0.042	4074	5749	0.052	0.002	0.003
238	HXG	Hexylene Glycol	4	0.92	0.01	1.1	0.074	1.0002	0.016	3501	3500	0.019	0.001	0.001
243	IPH	Isophorone	1	0.93	0.01	4.75	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
244	JPO	Jet Fuels: JP-1 (Kerosene)	1	0.8	0.14	4.5	0.076	1.0028	0.016	3510	3563	0.020	0.001	0.001
245	JPT	Jet Fuels: JP-3	1	0.8	8.51	4.5	0.213	1.1702	0.062	4096	6969	0.077	0.003	0.004
246	JPF	Jet Fuels: JP-4	1	0.81	3.4	4	0.121	1.0680	0.029	3738	4800	0.037	0.002	0.002
247	JPV	Jet Fuels: JP-5 (Kerosene, heavy)	1	0.82	0.1	4	0.075	1.0020	0.016	3507	3539	0.020	0.001	0.001
249	KRS	Kerosene	1	0.81	0.15	4.5	0.076	1.0030	0.016	3511	3568	0.020	0.001	0.001
263	MTT	Methyl Acetate	1	0.92	6.1	2.6	0.119	1.1220	0.032	3927	4999	0.040	0.002	0.002
265	MAL	Methyl Alcohol (See Methanol)	1	0.79	6.63	1.1	0.077	1.1326	0.021	3964	4046	0.026	0.001	0.001
266	MAC	Methyl Amyl Acetate	1	0.86	0.33	4.97	0.080	1.0066	0.017	3523	3666	0.021	0.001	0.001
267	MAA	Methyl Amyl Alcohol	1	0.81	0.43	3.52	0.079	1.0086	0.017	3530	3649	0.021	0.001	0.001
271	MBK	Methyl n-Butyl Ketone	1	0.81	0.97	3.5	0.085	1.0194	0.019	3568	3832	0.023	0.001	0.001
273	MBU	Methyl Butyrate	1	0.9	1.26	3.53	0.089	1.0252	0.020	3588	3935	0.025	0.001	0.001
274	MEK	Methyl Ethyl Ketone	1	0.8	4.5	2.5	0.105	1.0900	0.027	3815	4561	0.033	0.001	0.002
275	MTF	Methyl Formal (Dimethyl Formal)	1	0.86	15.42	2.6	0.189	1.3084	0.069	4579	7341	0.085	0.004	0.004
276	MHK	Methyl Heptyl Ketone	1	0.83	0.06	4.9	0.075	1.0012	0.016	3504	3529	0.020	0.001	0.001
278	MIK	Methyl Isobutyl Ketone	1	0.8	1.15	3.45	0.087	1.0230	0.019	3581	3887	0.024	0.001	0.001
281	MNA	1-Methyl Naphthalene	1	1.02	0.01	4.91	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
283	MPN	2-Methyl-1-Pentene	1	0.69	6.3	2.9	0.130	1.1260	0.035	3941	5230	0.043	0.002	0.002
284	MTN	5-Methyl-1-Pentene	1	0.67	8.49	2.9	0.149	1.1698	0.043	4094	5828	0.054	0.002	0.003
286	MBE	Methyl Tert-Butyl Ether (MTBE)	1	0.74	0.04	3.1	0.074	1.0008	0.016	3503	3511	0.020	0.001	0.001
288	MNS	Mineral Spirits	1	0.75	0.2	4.3	0.077	1.0040	0.016	3514	3586	0.020	0.001	0.001
289	MRE	Myrcene	1	0.8	0.17	4.7	0.077	1.0034	0.016	3512	3581	0.020	0.001	0.001
295	NSV	Naphtha: Solvent	1	0.87	0.2	3.5	0.076	1.0040	0.016	3514	3569	0.020	0.001	0.001
296	NSS	Naphtha: Stoddard Solvant	1	0.78	0.2	4.3	0.077	1.0040	0.016	3514	3586	0.020	0.001	0.001
297	NVM	Naphtha: Varnish Maker's and Painters (75%)	1	0.77	0.19	4.3	0.077	1.0038	0.016	3513	3582	0.020	0.001	0.001
300	NAX	Nonane (all isomers)	1	0.72	0.27	4.4	0.078	1.0054	0.017	3519	3619	0.021	0.001	0.001
301	NAN	Nonane	1	0.72	0.27	4.4	0.078	1.0054	0.017	3519	3619	0.021	0.001	0.001
304	NON	Nonene	1	0.73	0.35	4.3	0.079	1.0070	0.017	3525	3651	0.021	0.001	0.001
305	NNS	Nonyl Alcohol (all isomers)	1	0.94	0.1	5	0.076	1.0020	0.016	3507	3550	0.020	0.001	0.001
306	NNN	Nonyl Alcohol	1	0.94	0.1	5	0.076	1.0020	0.016	3507	3550	0.020	0.001	0.001
307	NNI	Nonyl Alcohol (iso-)	1	0.94	0.1	5	0.076	1.0020	0.016	3507	3550	0.020	0.001	0.001
309	NNP	Nonyl Phenol	1	0.95	0.01	7.6	0.074	1.0002	0.016	3501	3507	0.019	0.001	0.001
316	OAX	Octane (all isomers)	1	0.7	0.79	3.9	0.084	1.0158	0.019	3555	3805	0.023	0.001	0.001
317	OAN	Octane	1	0.7	0.79	3.9	0.084	1.0158	0.019	3555	3805	0.023	0.001	0.001
320	OTA	Octanol	1	0.83	0.01	4.48	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
322	OTE	Octene (1-)	1	0.72	1	3.86	0.087	1.0200	0.019	3570	3880	0.024	0.001	0.001
324	OCX	Octyl Alcohol (iso-, n-) (all isomers), See Octanol (all isomers)	1	0.83	0.01	4.48	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
325	IOA	Octyl Alcohol	1	0.83	0.01	4.48	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
364	OTW	Fuel: No. 2	1	0.88	0.56	8	0.092	1.0112	0.020	3539	3955	0.025	0.001	0.001

366 OFR	Fuel: No. 4	1	0.9	0.15	3.4	0.075	1.0030	0.016	3511	3550	0.020	0.001	0.001
367 OFV	Fuel: No. 5	1	0.94	0.15	3.4	0.075	1.0030	0.016	3511	3550	0.020	0.001	0.001
368 OSX	Fuel: No. 6	1	0.95	0.15	3.4	0.075	1.0030	0.016	3511	3550	0.020	0.001	0.001
382 OIL	OIL, Misc: Crude	1	0.95	0.15	3.4	0.075	1.0030	0.016	3511	3550	0.020	0.001	0.001
383 ODS	OIL, Misc: Diesel	1	0.9	0.69	3.4	0.081	1.0138	0.018	3548	3730	0.022	0.001	0.001
389 OLB	OIL, Misc: Lubricating	1	0.9	0.15	1	0.074	1.0030	0.016	3511	3510	0.020	0.001	0.001
403 ORS	OIL, Misc: Resin	1	1.02	0.15	1	0.074	1.0030	0.016	3511	3510	0.020	0.001	0.001
418 OTB	OIL, Misc: Turbine	1	0.87	0.3	5.4	0.080	1.0060	0.017	3521	3685	0.021	0.001	0.001
429 PDC	Pentadecanol, See Alcohols (C13 and above)	1	0.83	0.01	7.88	0.074	1.0002	0.016	3501	3507	0.019	0.001	0.001
433 IPT	Pentane (iso-)	5	0.62	27	2.48	0.335	1.5400	0.169	5390	11501	0.210	0.009	0.011
434 PTA	Pentane (n-)	5	0.63	20.44	2.5	0.256	1.4088	0.108	4931	9191	0.134	0.006	0.007
437 PTE	Pentene (1-)	5	0.64	24.9	2.4	0.299	1.4980	0.143	5243	10568	0.177	0.007	0.009
442 PIN	Pinene	1	0.86	0.35	4.7	0.080	1.0070	0.017	3525	3666	0.021	0.001	0.001
448 PLB	Polybutene	1	0.91	0.01	79.3	0.077	1.0002	0.016	3501	3586	0.020	0.001	0.001
457 PGC	Polypropylene Glycol	1	1.01	0.1	1	0.074	1.0020	0.016	3507	3506	0.019	0.001	0.001
464 IAC	Propyl Acetate (iso-)	1	0.89	1.8	3.52	0.095	1.0360	0.022	3626	4115	0.027	0.001	0.001
465 PAT	Propyl Acetate (n-)	1	0	1.85	3.52	0.095	1.0370	0.022	3630	4132	0.027	0.001	0.001
466 IPA	Propyl Alcohol (iso-)	1	0.79	3	2.07	0.089	1.0600	0.021	3710	4071	0.026	0.001	0.001
467 PAL	Propyl Alcohol (n-)	1	0.8	1.2	2.07	0.080	1.0240	0.018	3584	3727	0.022	0.001	0.001
468 PBZ	Propylbenzene (n-)	1	0.86	0.2	4.14	0.077	1.0040	0.016	3514	3583	0.020	0.001	0.001
469 IPX	Iso-Propylcyclohexane	1	0.8	0.01	4.35	0.074	1.0002	0.016	3501	3503	0.019	0.001	0.001
473 PPG	Propylene Glycol (1,2-Propandiol)	1	1.04	0.01	2.62	0.074	1.0002	0.016	3501	3502	0.019	0.001	0.001
476 PME	Propylene Glycol Methyl Ether	1	0.92	0.7	3.11	0.081	1.0140	0.018	3549	3711	0.022	0.001	0.001
488 SFL	Sulfolane	1	1.26	0.01	4.14	0.074	1.0002	0.016	3501	3503	0.019	0.001	0.001
493 TTN	Tetradecanol	1	0.82	0	7.39	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
494 TTD	1-Tetradecene, See the olefin or Alpha-Olefin Entries	1	0.77	0.01	6.77	0.074	1.0002	0.016	3501	3506	0.019	0.001	0.001
496 TTG	Tetraethylene Glycol	1	1.12	0.01	6.7	0.074	1.0002	0.016	3501	3506	0.019	0.001	0.001
497 THN	Tetrahydronaphthalene	1	0.97	0.04	4.56	0.074	1.0008	0.016	3503	3518	0.020	0.001	0.001
499 TOL	Toluene	1	0.87	1.5	3.14	0.089	1.0300	0.020	3605	3955	0.025	0.001	0.001
502 TCP	Tricresyl Phosphate (less than 1% of the ortho isom)	1	1.16	0.01	12.69	0.074	1.0002	0.016	3501	3513	0.020	0.001	0.001
503 TRD	Tridecane	1	0.76	0.02	6.4	0.074	1.0004	0.016	3501	3512	0.020	0.001	0.001
505 TDN	Tridecanol, See Alcohols (C13 and above)	1	0.85	0.01	6.91	0.074	1.0002	0.016	3501	3506	0.019	0.001	0.001
506 TDC	1-Tridecene	1	0.77	0.01	6.29	0.074	1.0002	0.016	3501	3506	0.019	0.001	0.001
508 TEB	Triethylbenzene	1	0.86	0.02	5.6	0.074	1.0004	0.016	3501	3511	0.020	0.001	0.001
509 TEG	Triethylene Glycol	1	1.12	0.01	5.17	0.074	1.0002	0.016	3501	3504	0.019	0.001	0.001
519 TRE	Trimethylbenzenes (all isomers)	1	0.89	0.14	4.2	0.076	1.0028	0.016	3510	3559	0.020	0.001	0.001
520 TMB	Trimethyl Benzene (1,2,5-)	1	0.89	0.14	4.14	0.076	1.0028	0.016	3510	3558	0.020	0.001	0.001
521 TMD	Trimethyl Benzene (1,2,3-)	1	0.89	0.14	4.14	0.076	1.0028	0.016	3510	3558	0.020	0.001	0.001
522 TME	Trimethyl Benzene (1,2,4-) (Pseudocumene)	1	0.89	0.14	4.14	0.076	1.0028	0.016	3510	3558	0.020	0.001	0.001
529 TRP	Triphenyl Phosphate	1	1.16	0	14.2	0.074	1.0000	0.016	3500	3499	0.019	0.001	0.001
546 XLX	Xylenes (Ortho-, meta-, para-)	1	0.89	0.51	3.66	0.080	1.0102	0.017	3536	3684	0.022	0.001	0.001
547 XLM	Xylene (M-)	1	0.87	0.51	3.66	0.080	1.0102	0.017	3536	3684	0.022	0.001	0.001
548 XLO	Xylene (O-)	1	0.89	0.4	3.66	0.079	1.0080	0.017	3528	3645	0.021	0.001	0.001
549 XLP	Xylene (P-)	1	0.86	0.51	3.66	0.080	1.0102	0.017	3536	3684	0.022	0.001	0.001
550 XYL	Xylenol	1	1.01	0.1	3.66	0.075	1.0020	0.016	3507	3536	0.020	0.001	0.001
551	Zinc Dialkyldithiophosphate												
Max.			1.260	27.000	79.300	0.335	1.540	0.169	5390	11501	0.210	0.009	0.011
Min.			0.000	0.000	1.000	0.000	1.000	0.016	3500	3499	0.019	0.000	0.000

*when barge vapor piping is connected to facility vapor recovery system.

LIQUID TRANSFER RATE vs PRESSURE DROP



PRESSURE vs MAXIMUM TRANSFER RATE (FOR SUB-CHAPTER "D" CARGOES)

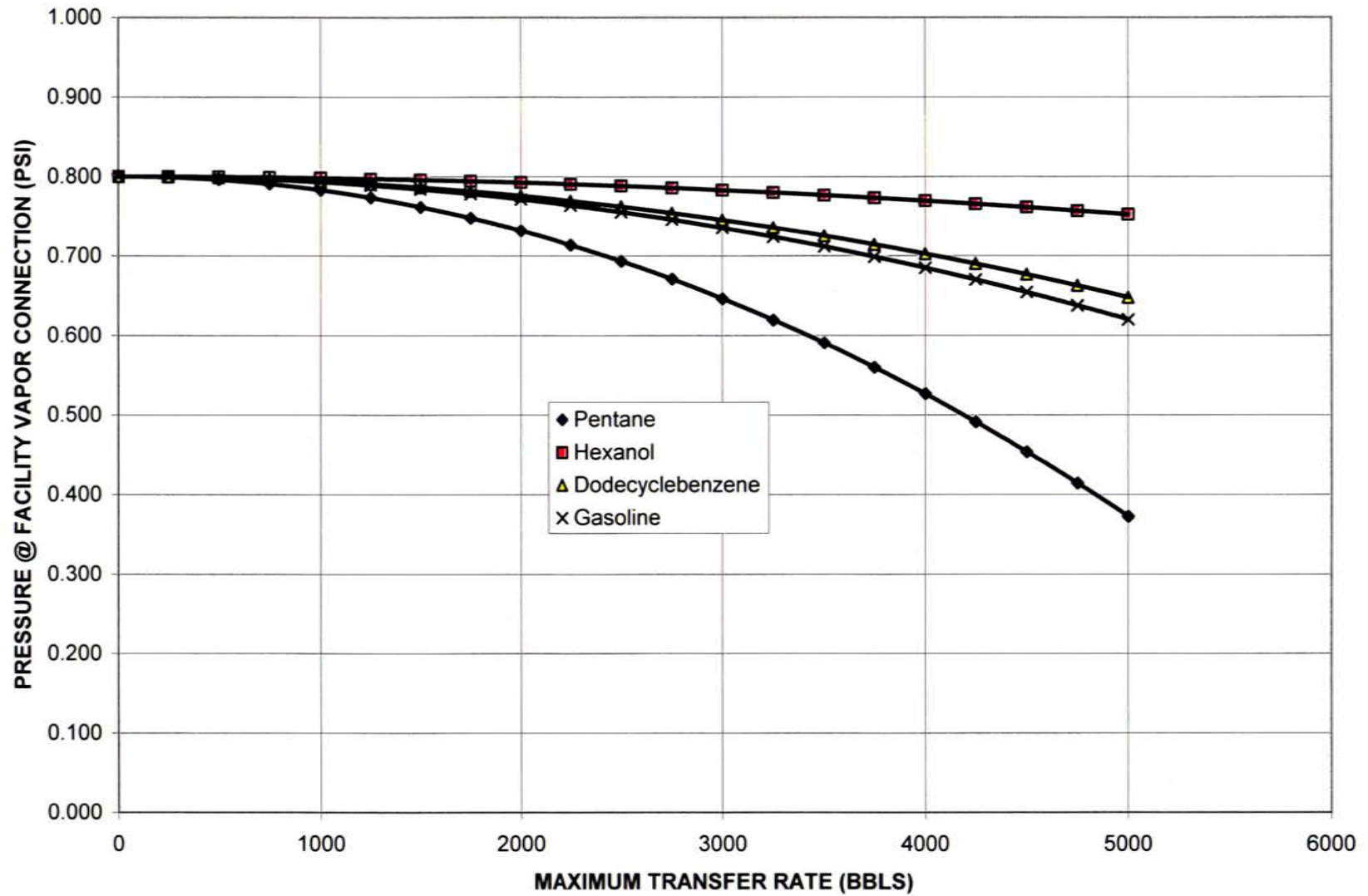
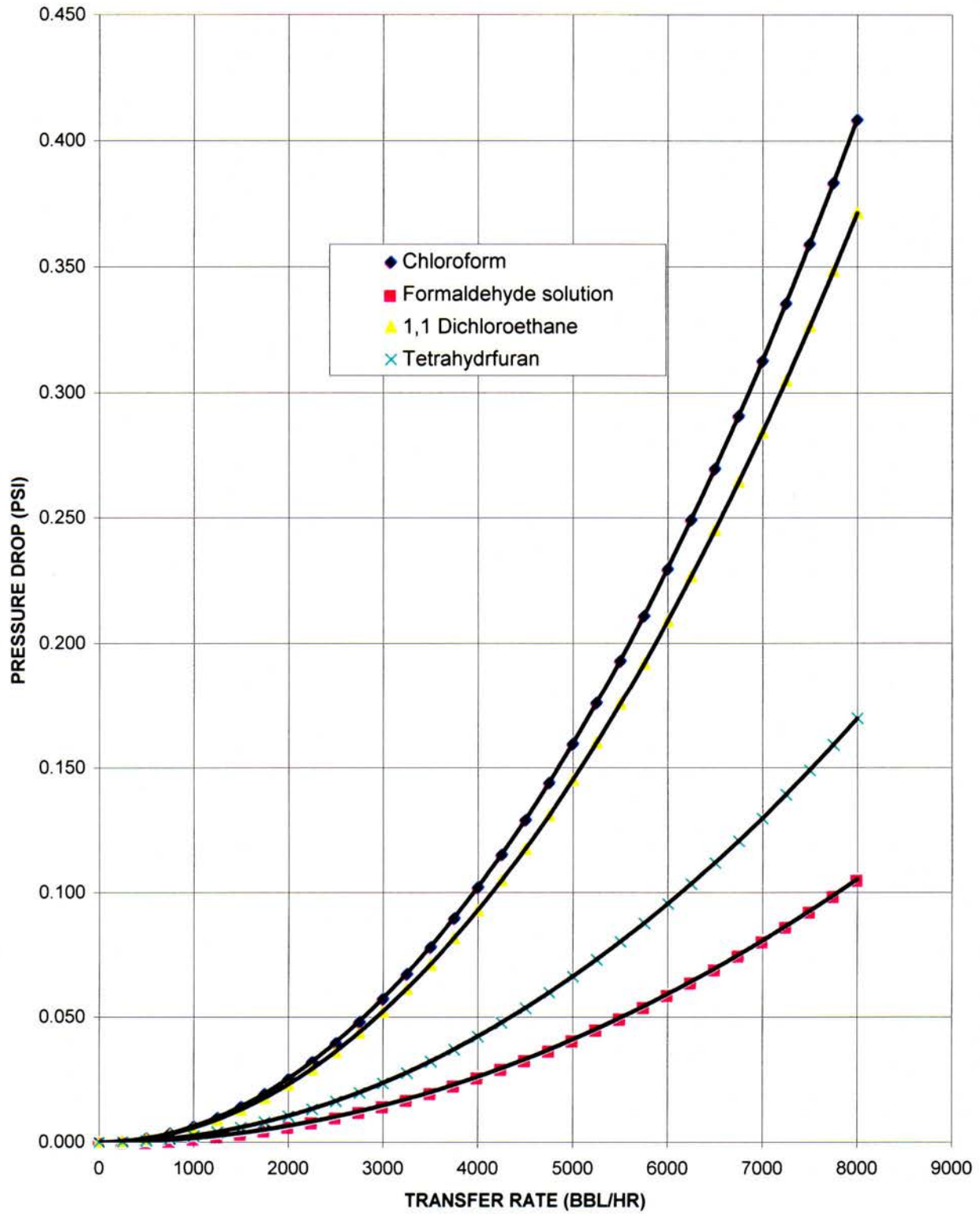


TABLE 4 (SUBCHAPTER "O" CARGOES)

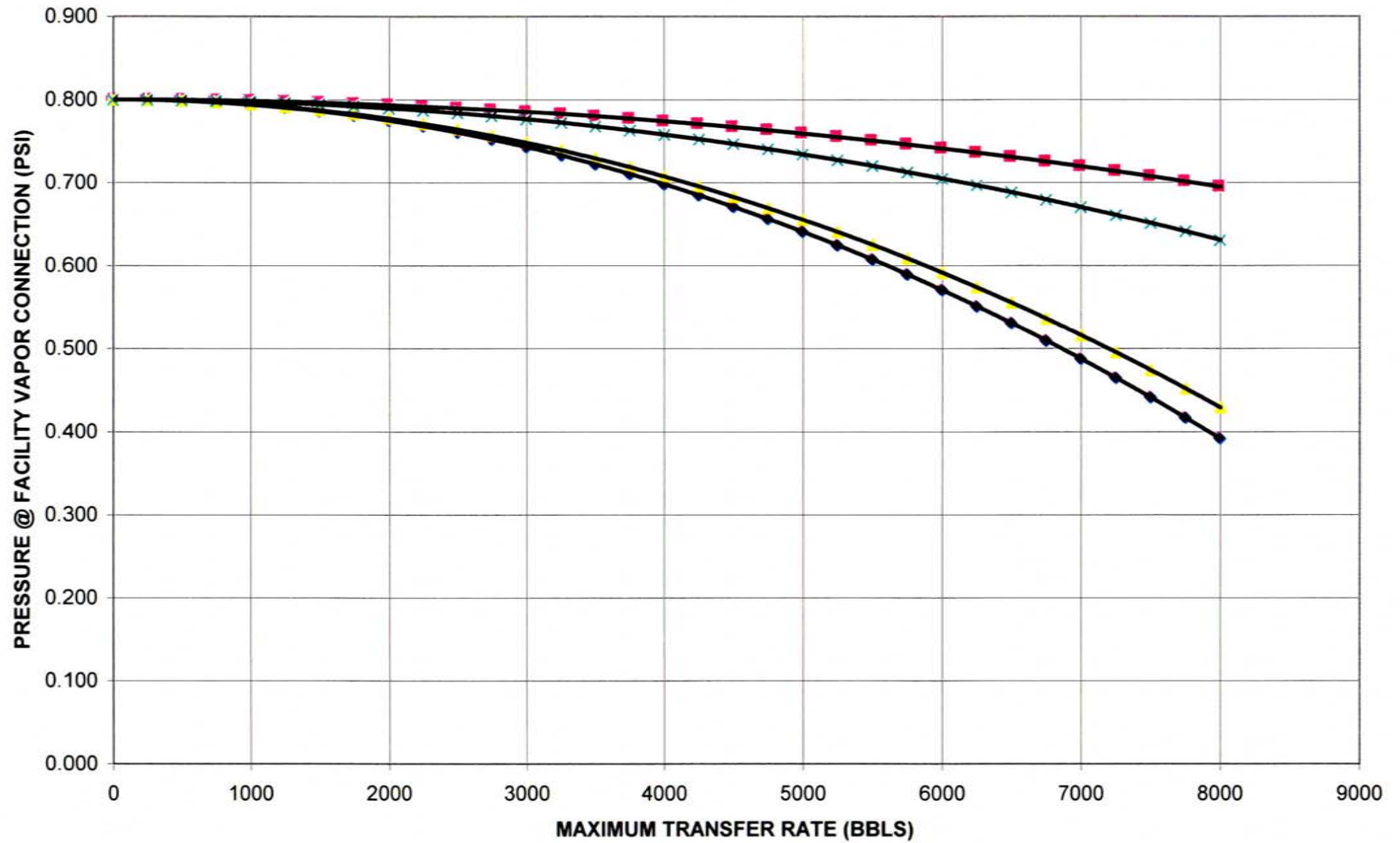
CHRIS CODE	NAME	VCS CAT	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR WEIGHT DENSITY	VAPOR GROWTH RATE	PRESSURE DROP TO PV VALVE IN VCS(psig) (LOADING)	VAPOR VOLUMETRIC FLOW RATE (bbl/h)	AIR EQUIVALENT VOLUMETRIC FLOW RATE	PRESSURE DROP TO SHORE CONNECTION IN VCS (psig) (LOADING)*	PRESSURE DROP TO PV VALVE IN VCS(psig) (UNLOADING)	PRESSURE DROP TO SHORE CONNECTION IN VCS (psig) (UNLOADING)*
1 ACN	Acrylonitrile	4	0.81	5.00	1.80	0.095	1.1000	0.024	3850	4298	0.030	0.001	0.002
2 ADN	Adiponitrile	1	0.95	0.01	3.73	0.076	1.0002	0.016	3501	3503	0.020	0.001	0.001
3 ATN	Acetonitrile	3	0.78	0.03	1.41	0.076	1.0006	0.016	3502	3502	0.020	0.001	0.001
4 BAD	Iso-Butyraldehyde	1	0.80	7.80	2.50	0.131	1.1560	0.037	4046	5308	0.046	0.002	0.002
5 BAR	Butyl acrylate (iso-, n-)	2	0.90	0.60	4.42	0.086	1.0120	0.019	3542	3759	0.023	0.001	0.001
6 BMH	Butyl Methacrylate	2	0.88	0.29	4.9	0.081	1.0058	0.017	3520	3640	0.022	0.001	0.001
7 BNZ	Benzene	1	0.88	4.50	2.80	0.114	1.0900	0.029	3815	4671	0.036	0.002	0.002
8 BTR	n-Butyraldehyde	1	0.80	7.80	2.50	0.131	1.1560	0.037	4046	5308	0.046	0.002	0.002
9 BTX	Benzene, Toluene, Xylene mixtures (10% Benzene or more)	1	0.84	7.30	2.80	0.138	1.1460	0.038	4011	5396	0.048	0.002	0.002
10 CCH	Cyclohexanone	1	0.95	0.20	3.40	0.078	1.0040	0.017	3514	3565	0.021	0.001	0.001
11 CHA	Cyclohexylamine	1	0.87	0.62	3.42	0.083	1.0124	0.018	3543	3703	0.022	0.001	0.001
12 CRB	Chlorobenzene	1	1.11	0.80	3.88	0.087	1.0160	0.019	3556	3799	0.024	0.001	0.001
13 CRF	Chloroform	3	1.48	9	4.25	0.213	1.1800	0.063	4130	6916	0.078	0.003	0.004
14 NCT	Coal Tar Naphtha Solvent	1	0.86	0.2	4	0.079	1.0040	0.017	3514	3577	0.021	0.001	0.001
15 CRS	Cresols	1	1.05	0.06	3.72	0.077	1.0012	0.016	3504	3521	0.020	0.001	0.001
16 CTA	Crotonaldehyde	4	0.85	2	2.41	0.089	1.0400	0.021	3640	3943	0.025	0.001	0.001
17 DCH	1,1-Dichloroethane	1	1.18	9.90	3.41	0.188	1.1980	0.057	4193	6592	0.071	0.003	0.004
18 DPP	1,2-Dichloropropane	3	1.16	2.5	3.89	0.110	1.0500	0.026	3675	4418	0.032	0.001	0.002
19 DPU	1,3-Dichloropropene	4	1.23	5.5	3.84	0.149	1.1100	0.039	3885	5443	0.048	0.002	0.003
20 DEN	Diethylamine	3	0.71	1.00	2.50	0.083	1.0200	0.018	3570	3731	0.023	0.001	0.001
21 DIP	Diisopropanolamine	1	0.98	0.01	4.59	0.076	1.0002	0.016	3501	3504	0.020	0.001	0.001
22 DMF	Dimethylformamide	1	0.95	0.30	2.51	0.078	1.0060	0.017	3521	3569	0.021	0.001	0.001
23 DPX	1,1-,1,2-, or 1,3-Dichloropropane	3	1.16	6.30	3.90	0.162	1.1260	0.044	3941	5747	0.054	0.002	0.003
24 EAC	Ethyl acrylate	2	0.93	2.00	3.50	0.099	1.0400	0.023	3640	4163	0.028	0.001	0.001
25 EAI	2-Ethylhexyl acrylate	2	0.89	0.02	6.35	0.076	1.0004	0.016	3501	3512	0.020	0.001	0.001
26 EDC	Ethylene dichloride	1	1.26	4.00	3.42	0.121	1.0800	0.030	3780	4776	0.037	0.002	0.002
27 ETM	Ethyl Methacrylate	2	0.92	1	3.94	0.090	1.0200	0.020	3570	3879	0.025	0.001	0.001
28 EPA	2-Ethyl-3-propylacrolein	1	0.85	0.12	4.5	0.078	1.0024	0.017	3508	3553	0.021	0.001	0.001
29 FFA	Furfural	1	1.20	0.15	3.31	0.078	1.0030	0.017	3511	3547	0.021	0.001	0.001
30 FMS	Formaldehyde solution (37% to 50%)	1	1.13	0.15	1.03	0.076	1.0030	0.016	3511	3510	0.020	0.001	0.001
31 MSO	Mesityl Oxide	1	0.86	0.67	3.5	0.084	1.0134	0.018	3547	3725	0.023	0.001	0.001
32 MAM	Methyl acrylate	2	0.95	4.10	3.00	0.114	1.0820	0.028	3787	4646	0.035	0.001	0.002
33 MBE	Methylcyclopentadiene dimer	1	0.74	0.04	3.10	0.076	1.0008	0.016	3503	3511	0.020	0.001	0.001
34 MMM	Methyl methacrylate	2	0.94	2.02	3.45	0.099	1.0404	0.023	3641	4159	0.028	0.001	0.001
35 MPL	Morpholine	1	1.00	0.80	3.00	0.083	1.0160	0.018	3556	3726	0.023	0.001	0.001
36 NPM	1- or 2-Nitropropane	1	0.99	1.05	3.06	0.086	1.0210	0.019	3574	3804	0.024	0.001	0.001
37 PRD	Pyridine	1	0.98	1.30	2.72	0.086	1.0260	0.019	3591	3830	0.024	0.001	0.001
38 STY	Styrene	2	0.92	0.40	3.60	0.081	1.0080	0.017	3528	3638	0.022	0.001	0.001
39 TCN	1,2,3-Trichloropropane	3	1.39	0.15	5.60	0.079	1.0030	0.017	3511	3583	0.021	0.001	0.001
40 TEN	Triethylamine	3	0.73	2.50	3.49	0.105	1.0500	0.025	3675	4323	0.031	0.001	0.002
41 THF	Tetrahydrofuran	1	0.89	8.50	1.35	0.090	1.1700	0.026	4095	4454	0.032	0.001	0.002
42 VAM	Vinyl acetate	2	0.94	5.80	2.97	0.130	1.1160	0.034	3906	5099	0.043	0.002	0.002
		Max.	1.39	12.5	8.40	0.213	1.198	0.063	4193	6916	0.078	0.003	0.004
		Min.	0.63	0.01	1.03	0.076	1.000	0.016	3501	3502	0.020	0.001	0.001

*when barge vapor piping is connected to facility vapor recovery system.

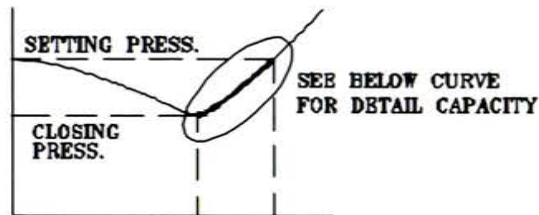
LIQUID TRANSFER RATE vs PRESSURE DROP



PRESSURE vs MAXIMUM TRANSFER RATE (FOR SUB-CHAPTER "O" CARGOES)



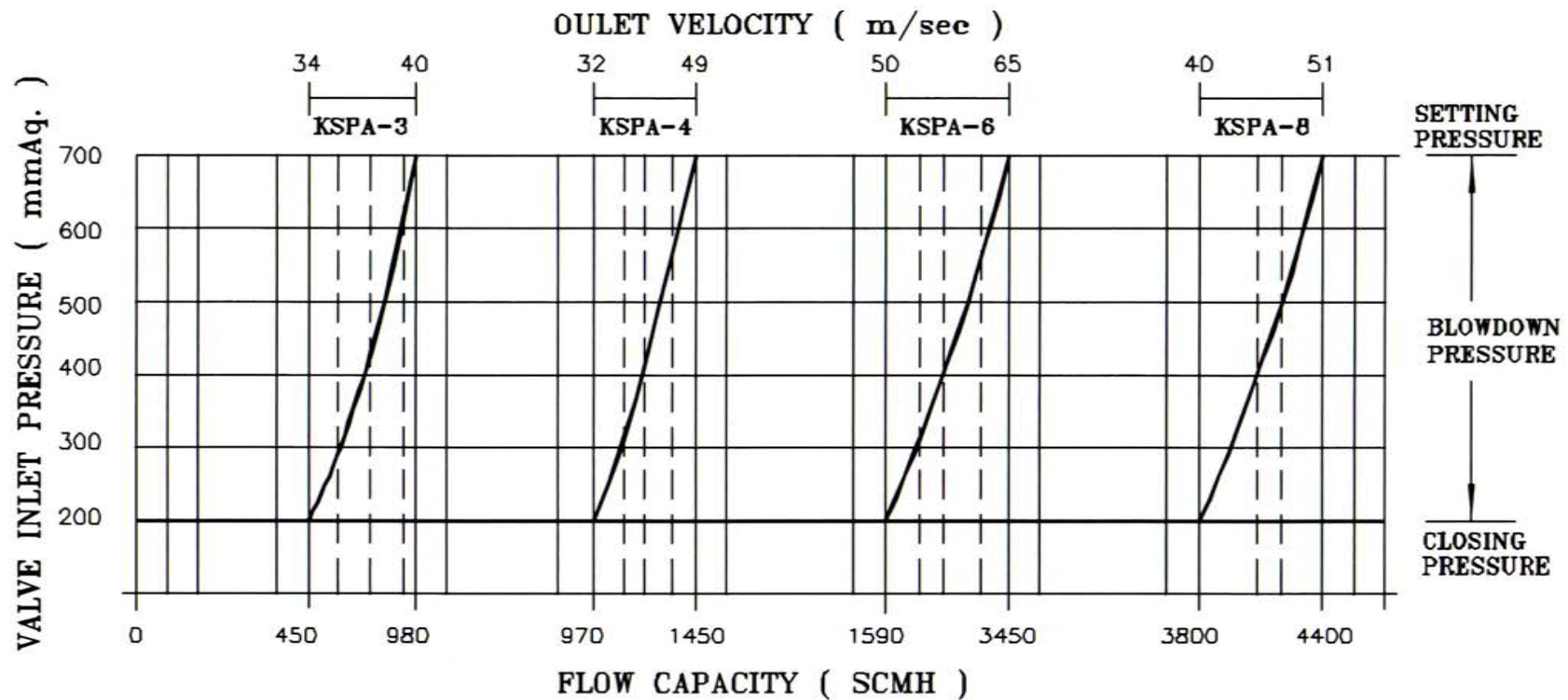
PROGRESS OF VALVE PRESSURE



TANKTECH HIGH VELOCITY VENT VALVES

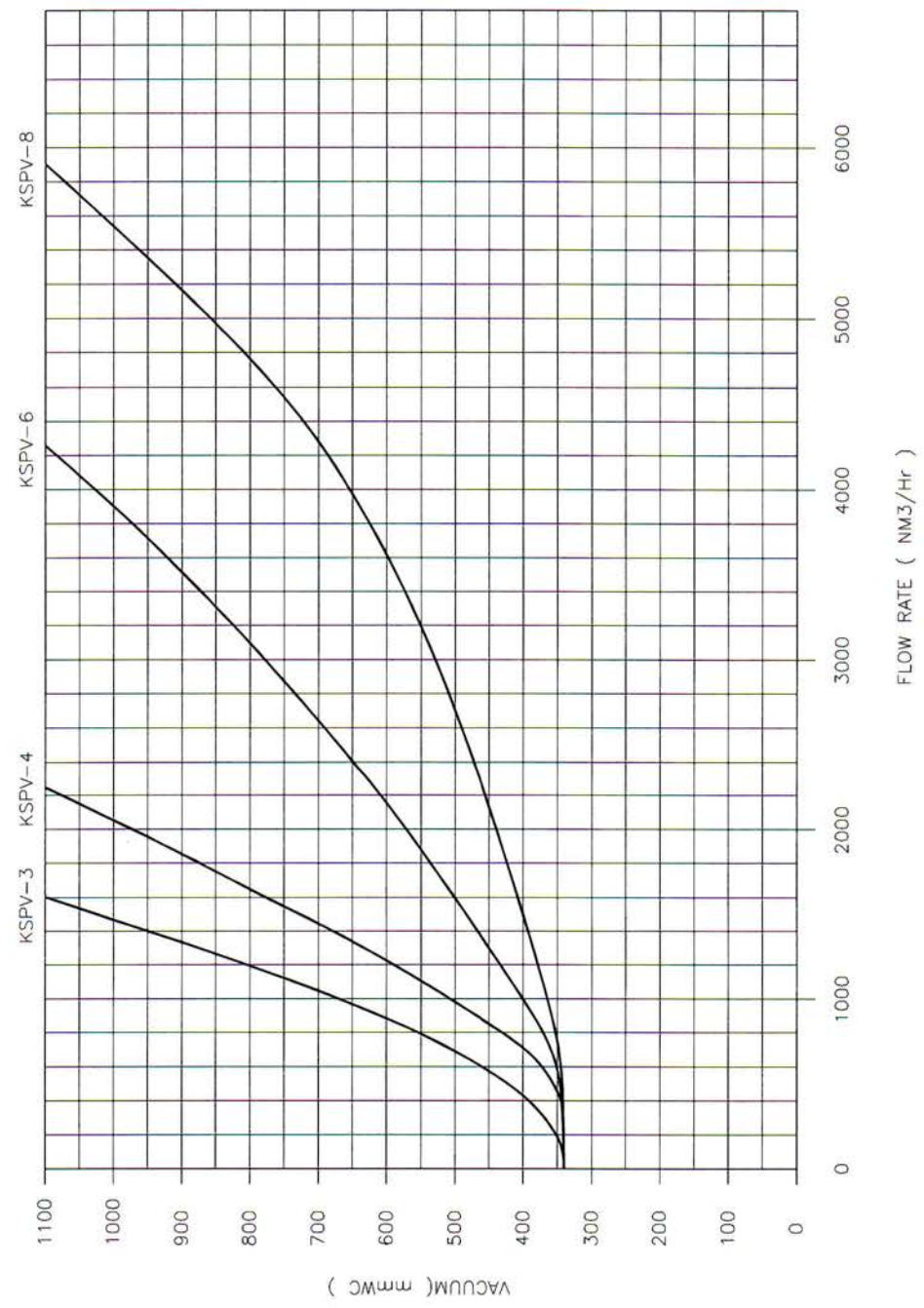
KSPA TYPE FLOW CAPACITY CURVE

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



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



1. Vessel Name	CBC 1380 - CBC 1387	Shipyard	SOUTHWEST
Official Number		Hull #	9839-9746

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 ☒ Maximum Design Working Pressure: 3.5 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**

350	bbl/hr loading
800	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	PENTANE	0.335	lbm/ft3
b. Cargo Name	PENTANE	0.335	lbm/ft3

6. **VCS Categories Requested (list):** 1-5

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	0.169	0.169
b. Most Remote Cargo Tank to VCS Facility Connection	0.210	0.210
c. ΔP across P/V valve @ cargoes' Maximum Transfer Rate	1.0	1.0
d. ΔP across Vacuum P/V @ MTR or Max. Discharge Rate	0.5	
e. ΔP across Spill Valve for Max. Density Cargo at MTR	-	

8. **Pressure Vacuum Valve:**

Manufacturer	BERGAN	Settings in psig:	
Model/Size	KLPH-6	Pressure-side	1.00
CG Approval Number	162.017/144/13	Vacuum-side	0.50

Include the Manufacturer's ΔP versus Flow for both parts of P/V & Spill Valve: ☒

9. **VCS Pipe Sizes:**

Longitudinal Header 7.981 inches Transverse Headers 7.981 inches

10. **Closed Gauging** ☒

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	☒	BERGAN	Setting in psig	
b. Overfill Control Shutdown	☒	BERGAN		
c. Spill Valve	☐		Meets ASTM F1271	☐
d. Rupture Disk	☐			

If applicable, Calculations demonstrate compliance with 39.20-9(b)(2). ☒

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. ☒

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. ☒

14. **Previous VCS approval letters:**
