

Date: 10/28/13

Sheet 1 of 2

**MARINE SAFETY CENTER PLAN APPROVAL EXTENSION REQUEST FORM**

**Directions:**

1. Complete the table below with all approved plans and corresponding MSC approval letters for which plan approval extension is requested.
2. Electronically submit this form with a copy of the vessel's Application for Inspection directly to the MSC (MSC@USCG.mil), or submit a paper copy to our mailing address:

Commanding Officer (MSC)  
2100 2nd St SW Stop 7102  
Washington, DC 20593-7102

<b>NAME AND IDENTIFICATION (O.N., CG NUMBER) OF VESSEL FOR WHICH PLANS WERE PREVIOUSLY APPROVED:</b> CBC 1335, CG1111608, Southwest Shipyard Hull 9628
<b>NAME AND IDENTIFICATION OF VESSEL(S) TO WHICH PLAN APPROVAL IS TO BE EXTENDED:</b> CBC 1370 thru CBC 1379, Southwest Shipyard Hulls 9702 thru 9711

Drawing Number	# of Sheets	Rev. #	Drawing Title	MSC Project Number	Approval Date	Approval Letter Serial Number	Denied (MSC Use)
081002CP-1	2	3	Cargo Piping	P016344	5/25/11	E1-1101394	
081002STP-1	1	2	Stripping Piping	P016344	5/25/11	E1-1101394	
081002DP-1	1	0	4 Barrel Drip Pan	P016344	5/25/11	E1-1101394	
081002EF-1	1	0	Engine Foundation	P016344	5/25/11	E1-1101394	
-	-	-	Scantling Calculations	P016344	4/4/11	C1-1100845	
081002VP	1	2	Vapor Piping	P016344	5/27/11	C1-1101625	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	

**By submission of this form, I hereby certify that I am the legal owner of the plans and documents listed herein; or, have the permission of the legal owner to request plan approval extension on their behalf.**

(MSC Use) This PAE Request is addressed in MSC letter Serial No. C1-1303376

Enclosure (1) to MTN 01-11

Date: 10/28/13

Sheet 2 of 2

**MARINE SAFETY CENTER PLAN APPROVAL EXTENSION REQUEST FORM**

**Directions:**

1. Complete the table below with all approved plans and corresponding MSC approval letters for which plan approval extension is requested.
2. Electronically submit this form with a copy of the vessel's Application for Inspection directly to the MSC (MSC@USCG.mil), or submit a paper copy to our mailing address:

Commanding Officer (MSC)  
2100 2nd St SW Stop 7102  
Washington, DC 20593-7102

<b>NAME AND IDENTIFICATION (O.N., CG NUMBER) OF VESSEL FOR WHICH PLANS WERE PREVIOUSLY APPROVED:</b> CBC 1335, CG1111608, Southwest Shipyard Hull 9628
<b>NAME AND IDENTIFICATION OF VESSEL(S) TO WHICH PLAN APPROVAL IS TO BE EXTENDED:</b> CBC 1370 thru CBC 1379, Southwest Shipyard Hulls 9702 thru 9711

Drawing Number	# of Sheets	Rev. #	Drawing Title	MSC Project Number	Approval Date	Approval Letter Serial Number	Denied (MSC Use)
-	-	-	Vapor Collection System Calculations	P016344	5/27/11	C1-1101625	
-	-	-	Stability Calculations	P016344	5/27/11	C1-1101637	
081002HL	1	1	High Level Overfill Alarm System	P016344	6/2/11	E2-1101564	
081002HZ	1	3	Hazardous Area Plan	P016344	6/2/11	E2-1101564	
081002EL	2	2	Electrical Arrangement	P016344	6/2/11	E2-1101564	
-	-	-	Capacitance and Inductance Calculation	P016344	6/2/11	E2-1101564	

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(MSC Use) This PAE Request is addressed in MSC letter Serial No. C1-1303376

Enclosure (1) to MTN 01-11

U.S. Department of  
Homeland Security

United States  
Coast Guard



Commanding Officer  
United States Coast Guard  
Marine Safety Center

U.S. Coast Guard Stop 7410  
4200 Wilson Blvd. Ste 400  
Arlington, VA 20598-7410  
Staff Symbol: MSC-3  
Phone: (703) 872-6731  
Email: msc@uscg.mil

16710/P018455  
Serial: C1-1303376  
October 31, 2013

Marine Solutions, Inc.  
Attn: Mr. Chetan Kumaria, P.E.  
7985 Boone Trace  
Nashville, TN 37221  
MarineSolInc@aol.com

- Subj: CBC 1370, O.N. 1249103, Southwest Shipyard Hull No. 9702  
CBC 1371, O.N. 1249104, Southwest Shipyard Hull No. 9703  
CBC 1372, O.N. 1249105, Southwest Shipyard Hull No. 9704  
CBC 1373, O.N. 1249106, Southwest Shipyard Hull No. 9705  
CBC 1374, O.N. 1249107, Southwest Shipyard Hull No. 9706  
CBC 1375, O.N. 1249108, Southwest Shipyard Hull No. 9707  
CBC 1376, O.N. 1249109, Southwest Shipyard Hull No. 9708  
CBC 1377, O.N. 1249110, Southwest Shipyard Hull No. 9709  
CBC 1378, O.N. 1249111, Southwest Shipyard Hull No. 9710  
CBC 1379, O.N. 1249112, Southwest Shipyard Hull No. 9711  
200' x 35' x 12'-6" Unmanned Double Hull Type I/II/III Tank Barges (D/O)  
Grade A (max. 25 psia Reid) and Lower Grades Flammable Liquids Identified in 46 CFR  
Table 30.25-1 or 46 CFR 153 Table 2, and Specified Hazardous Cargoes  
Design Density 8.7 lbs/gal; Maximum Cargo Density 14.07 lbs/gal (at slack load)  
Rivers; Lakes, Bays, and Sounds; Limited Coastwise on unmanned fair weather voyages  
only, not more than 12 miles offshore between St. Marks and Carrabelle, Florida  
New Construction: General Arrangement, Plan Approval Extension, and Plan Review  
Information Sheet (PRIS)
- Ref: (a) Marine Solutions, Inc., DWG No. 091301GA-1, Rev. 0, "General Arrangement,"  
Sheet 1 of 2, dated September 2, 2013  
(b) Marine Solutions, Inc., DWG No. 091301GA-1, Rev. 1, "General Arrangement,"  
Sheet 2 of 2, dated September 25, 2013  
(c) Marine Solutions, Inc., "Calculations for Trunk Side Longitudinal," dated September  
25, 2013  
(d) American Bureau of Shipping Rules, "Steel Vessels for Service on Rivers and  
Intracoastal Waterways," 2007

Dear Mr. Kumaria:

We have reviewed the information submitted with your emails dated September 2, 2013 (MSC Document No. 1316021), September 25, 2013 (MSC Document No. 1316675) and October 28, 2013 (MSC Document No. 1317530) for compliance with 46 CFR Subchapters D and O.

Subj: Southwest Shipyard Hull No. 9702 through 9711  
New Construction: General Arrangement, Plan Approval Extension, and Plan Review  
Information Sheet (PRIS)

References (a) and (b) are “**Approved.**” The installation, workmanship, and testing shall be to the satisfaction of the cognizant Officer in Charge Marine Inspection (OCMI). Our approval does not limit in any way the authority of the cognizant OCMI to require correction of material, design, equipment, construction, installation, etc. that are found not to be in compliance with Coast Guard requirements. Reference (c) has been “**Examined.**” Information such as this is not normally approved; however, it is used in the evaluation of the vessels to ensure they comply with the requirements of the applicable regulatory standards. You also requested that plans previously approved under project P016344, Southwest Shipyard Hull No. 9628, be used for the construction of the subject vessels. While we have no objection to you using the plans that were previously approved plans, please be advised that the cognizant OCMI has the final authority for these issues. The following comment applies:

1. We note you have modified the original general arrangement plans by moving the trunk deck lap joint from the trunk top to the trunk side and replacing the trunk side angle (originally 5 x 3 x 5/16”) with flat bar (6 x 3/4”). Your calculations in reference (c) show that the flat bar has a higher section modulus than the original design. Therefore, we accept these design modifications.

Enclosure (1) includes details regarding MSC approval letters for previously approved plans you wish to use for the construction of the subject vessels. By copy of this letter, we recommend the OCMI extend approval of all drawings and calculations addressed in enclosure (1) to the subject vessels. This extension of plan approval is based on our understanding that:

- a. The subject vessel will be built to the same plans as those specified in enclosure (1),
- b. The regulations used for the original plan approval have not changed since the original plan approval,
- c. The owner of the original plans specifically authorizes the use of the plans for new construction,
- d. There are no modifications to subject vessels or any of the installed systems which would require additional review, and
- e. All comments provided in the original approval letters, accompanying the approved plans, still apply.

You must provide the OCMI a copy of each item listed in enclosure (1) with its corresponding MSC approval letter. Plans that do not conform to any part of (a) through (e) above shall be submitted to our office for approval. The installation, workmanship, and testing shall be to the satisfaction of the OCMI. Any vessel system, arrangement, structure, or other item that requires plan approval but is not covered by an extension must be either submitted to the MSC for review or reviewed by the OCMI.

16710/P018455  
Serial: C1-1303376  
October 31, 2013

Subj: Southwest Shipyard Hull No. 9702 through 9711  
New Construction: General Arrangement, Plan Approval Extension, and Plan Review  
Information Sheet (PRIS)

Enclosure (2) is the vessel's Plan Review Information Sheet (PRIS). The information on the PRIS is based on the vessel being constructed from all of the plans used to build Southwest Shipyard Hull 9628. Due to the variation in plans, a deadweight survey of one barge must be conducted to verify the assumed lightship characteristics. Provided the deadweight survey results confirm the lightship displacement and LCG assumed for your calculations in enclosure (1), revised calculations will not be required.

The Vapor Control System (VCS) PRIS for the subject vessels is included as enclosures (3). In addition, we have updated each vessel's cargo and vapor control authority. The 46 CFR 151 Cargo List and VCS List of Cargoes are included as enclosures (4) and (5).

The Cargo Authority Attachments (CAAs), containing the cargoes found in enclosure (4) and vapor control authority for the cargoes found in enclosure (5), are now available for issuance by the OCMI.

Please note that only the local OCMI can issue a vessel's CAA as part of the Certificate of Inspection (COI). The OCMI will verify the carriage authority and vapor control tank group characteristics we used as a basis for creating enclosures (4) and (5) are consistent with the vessel's actual design. For the OCMI's convenience, we have included the following recommended COI endorsement:

Only those hazardous cargoes named in the vessel's Cargo Authority Attachment, Serial No. C1-1303376 dated October 31, 2013, may be carried and then only in the tanks indicated.

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, excluding part 39.40, this vessel's vapor control system has been inspected to the plans approved by Marine Safety Center letters Serial No. C1-1101625 dated May 27, 2011, and extended by C1-1303376 dated October 31, 2013 and found acceptable for collection of bulk liquid cargo vapors annotated with "Yes" in the CAA's VCS column.

Our Project Number for these vessels is **P018455**. Please ensure that future correspondence includes the Project Number and Official Number (ON) that appears in the subject line.

(continued...)

16710/P018455  
Serial: C1-1303376  
October 31, 2013

Subj: Southwest Shipyard Hull No. 9702 through 9711  
New Construction: General Arrangement, Plan Approval Extension, and Plan Review  
Information Sheet (PRIS)

If you have any questions concerning our review, please contact LT Dan Brahan at the number listed above.

Sincerely,

M. J. SEXTON  
Lieutenant, U. S. Coast Guard  
Assistant Chief, Tank Vessel and Offshore Division  
By direction

Encl: (1) Plan Approval Extension Form, dated October 28, 2013  
(2) PRIS for Southwest Shipyard Hull No. 1370 through 1379, dated October 31, 2013  
(3) VCS PRIS, CBC 1370 through 1379, Southwest Shipyard Hull Nos. 9702 through 9711, dated October 31, 2013  
(4) 46 CFR Part 151 Cargo List, CBC 1370 through 1379, Southwest Shipyard Hull Nos. 9702 through 9711, dated October 31, 2013  
(5) VCS List of Cargoes, CBC 1370 through 1379, Southwest Shipyard Hull Nos. 9702 through 9711, dated October 31, 2013

Copy: Commander, Coast Guard Sector Houston-Galveston (spi)

## Plan Review Information Sheet (PRIS) for Unmanned Inland Tank Barge

1. Vessel Identification	Hull Type	Service	ABS classified?
CBC 1370, O.N. 1249103, Southwest Shipyard Hull No. 9702	I/II/III	O/D	No
CBC 1371, O.N. 1249104, Southwest Shipyard Hull No. 9703	I/II/III	O/D	No
CBC 1372, O.N. 1249105, Southwest Shipyard Hull No. 9704	I/II/III	O/D	No
CBC 1373, O.N. 1249106, Southwest Shipyard Hull No. 9705	I/II/III	O/D	No
CBC 1374, O.N. 1249107, Southwest Shipyard Hull No. 9706	I/II/III	O/D	No
CBC 1375, O.N. 1249108, Southwest Shipyard Hull No. 9707	I/II/III	O/D	No
CBC 1376, O.N. 1249109, Southwest Shipyard Hull No. 9708	I/II/III	O/D	No
CBC 1377, O.N. 1249110, Southwest Shipyard Hull No. 9709	I/II/III	O/D	No
CBC 1378, O.N. 1249111, Southwest Shipyard Hull No. 9710	I/II/III	O/D	No
CBC 1379, O.N. 1249112, Southwest Shipyard Hull No. 9711	I/II/III	O/D	No

### 2. Route Permitted - Routes and Conditions

R	Rivers
LBS	Lakes, Bays, and Sounds
LC 0-12	Limited Coastwise (0-12 miles offshore b/t St. Marks, FL and Carrabelle, FL)

### 3. Cargo Authority - "Authorization" Tab in "Cargo" Window

Authorization:

46 CFR Sub. D Authority:	Highst Grade	A	Capacity (bbls)	11,300		
46 CFR Sub. O Authority:	Part 151	Yes	Part 153	No	Part 154	No
33 CFR Sub. O Authority:	Part 151.47	No	Part 151.49a	No	Part 151.49b	No

### 4. "Conditions of Carriage" Tab in "Cargo" Window

a. The following statement should appear at the beginning of the COI's "Conditions of Carriage" section:

Only those cargoes named in the vessel's Cargo Authority Attachment may be carried, and then only in the tanks indicated. 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.

Per 46 CFR 150.130, the Person In Charge of the vessel is responsible for ensuring that the compatibility requirements of 46 CFR 150 are met. Cargoes must be checked for compatibility using the figures, tables, and appendices of 46 CFR 150 in conjunction with the reactive group numbers from the "Compat Group No" column listed in the vessel's Cargo Authority Attachment.

b. The maximum design density of cargo which may be filled to the tank top is 8.74 lbs/gal. Cargoes with higher densities, up to 14.07 lbs/gal, may be carried as slack loads, but shall not exceed the tank weight limits as listed below.

**Note:** Per 46 CFR 151.10-15(c)(2) the max. tank weights listed below reflect uniform (within 5%) loading at the deepest draft allowed. When carrying Subchapter O cargoes at shallower drafts, the barge(s) should always be loaded uniformly.

### 5. Loading Constraints

<u>Loading Constraints - Structural</u>			<u>Loading Constraints - Stability</u>				
Tank	Max Cargo		Hull Type	Route	Max. Load (ST)	Max Draft (ft. in)	Max Density (lbs/gal)
	Wgt/Each Tank (ST)	Max Density (lbs/gal)					
1 C	585	14.07	I	R, LBS	1460.00	9'-0"	14.07
2 C	680	14.07	II	R, LBS	1567.00	9'-6"	10.66
3 C	608	14.07	III	R, LBS	1621.00	9'-6"	8.33
			III	R, LBS	1513.00	9'-3"	11.58
			III	R	1675.00	10'-0"	14.07
			III	R	1784.00	10'-6"	11.58



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



<b>Vessel Name</b>	CBC 1370 through CBC 1379	<b>Shipyard</b>	Southwest Shipyard
<b>Official Number</b>	Various	<b>Hull Number</b>	9702 Through 9711

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.

<b>2. Tank Maximum Design Working Pressure</b>	<input style="width: 80%;" type="text" value="3.50"/>	psig	<b>Raised Trunk</b> <input checked="" type="checkbox"/>
			<b>Flush Deck</b> <input type="checkbox"/>
<b>3. Authorized Maximum Cargo Transfer Rate(s)</b>	<input style="width: 80%;" type="text" value="3500"/>	bbl/hr loading (max 2 tanks simultaneously)	
	<input style="width: 80%;" type="text" value="800"/>	bbl/hr discharging	
<b>4. Authorized Maximum Cargo Density</b>	<input style="width: 80%;" type="text" value="0.346"/>	lbm/ft <sup>3</sup>	
<b>5. Authorized VCS Categories</b>	<input style="width: 80%;" type="text" value="1 through 7"/>		

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

a. Cargo Name                     Iso-Pentane (PTY)                    

b. Cargo Name                     Iso-Pentane (PTY)                    

<b>7. Pressure Vacuum Valve:</b>		<b>8. VCS Pipe Sizes:</b>	
Manufacturer <input style="width: 80%;" type="text" value="BERGAN KLPH"/>	Settings in psig:	Approx. Inside Diameter	
Size <input style="width: 80%;" type="text" value="6"/>	Pressure-side <input style="width: 80%;" type="text" value="1"/>	Longitudinal Header (inches)	<input style="width: 80%;" type="text" value="8"/>
CG Approval <input style="width: 80%;" type="text" value="162.017/0000144/3"/>	Vacuum-side <input style="width: 80%;" type="text" value="0.5"/>	Transverse Header (Inches)	<input style="width: 80%;" type="text" value="8"/>
Required Venting Capacity of Pressure-Side of P/V valve		<input style="width: 80%;" type="text" value="11504"/> bbl/hr (air)	
Required Venting Capacity of Vacuum-Side of P/V valve		<input style="width: 80%;" type="text" value="800"/> bbl/hr (air)	

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

a. High Level/Tank Overfill Alarm	<input checked="" type="checkbox"/>	Type	<input style="width: 80%;" type="text" value="BERGAN GUARD"/>	
b. Overfill Control Shutdown	<input checked="" type="checkbox"/>	Type	<input style="width: 80%;" type="text" value="BERGAN GUARD"/>	
c. Spill Valve	<input type="checkbox"/>	Type	<input style="width: 80%;" type="text" value="N/A"/>	Meets ASTM F1271 <input style="width: 80%;" type="text" value="N/A"/>
d. Rupture Disk	<input type="checkbox"/>	Type	<input style="width: 80%;" type="text" value="N/A"/>	

**10. Closed Gauging**     Verify the vessel has closed gauging that satisfies 46 CFR 39.20-3 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 39.40, this vessel's vapor collection system has been inspected to the plans approved by Marine Safety Center letters Serial No. C1-1101625 dated May 27, 2011, and extended by MSC Letter Serial No. C1-1303376, dated October 31, 2013 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. 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.

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.

11d. Previous applicable approval letters:

**VAPOR COLLECTION SYSTEM CALCULATIONS**

**FOR**

**BARGE NAME(s): "CBC 1335" thru "CBC 1359"**

**SOUTHWEST SHIPYARD HULL(s): 9628 thru 9652**

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

**CANAL BARGE COMPANY, INC.**

**May 17, 2011**

**Prepared by:**

A handwritten signature in black ink, appearing to read "Chetan Kumaria", written over the printed name.

**Chetan Kumaria, PE, MBA  
MARINE SOLUTIONS, INC.  
7985 BOONE TRACE  
NASHVILLE, TN. 37221.  
615-364-9598**

# MARINE SOLUTIONS, INC.

Rev. 0 dated May 16, 2011

## VCS SYSTEM INFORMATION:

### 1. GENERAL DESCRIPTION OF VESSEL:

A. NAME (S): CBC 1335 THRU CBC 1359  
B. USCG PROJECT NUMBER: P016344  
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-42'-3 43/64", E-48'-9 15/16"  
F- 4'-1 1/4" G-1'-6 1/8" H-8'-0 3/4"

### C. PV 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/FT<sup>3</sup> FOR SUB D  
0.213 LBM/FT<sup>3</sup> 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 PV 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. LENGHT (FT)	TOTAL EQ. LENGTH (FT)
Straight Pipe	1	155.51	155.51
Entrance	1	37.05	37.05
T Branch	5	39.91	199.55
8"X6"RED	1	39.88	39.88
T Run Thru	6	13.3	79.8
		Total	511.79

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 (1.228 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 0.512 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 0.512 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	163.73	163.73
Entrance	1	37.05	37.05
T Branch	4	39.91	159.64
T Run	7	13.33	93.31
8" Gate Valve	1	5.32	5.32
		<b>Total</b>	<b>459.05</b>

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)

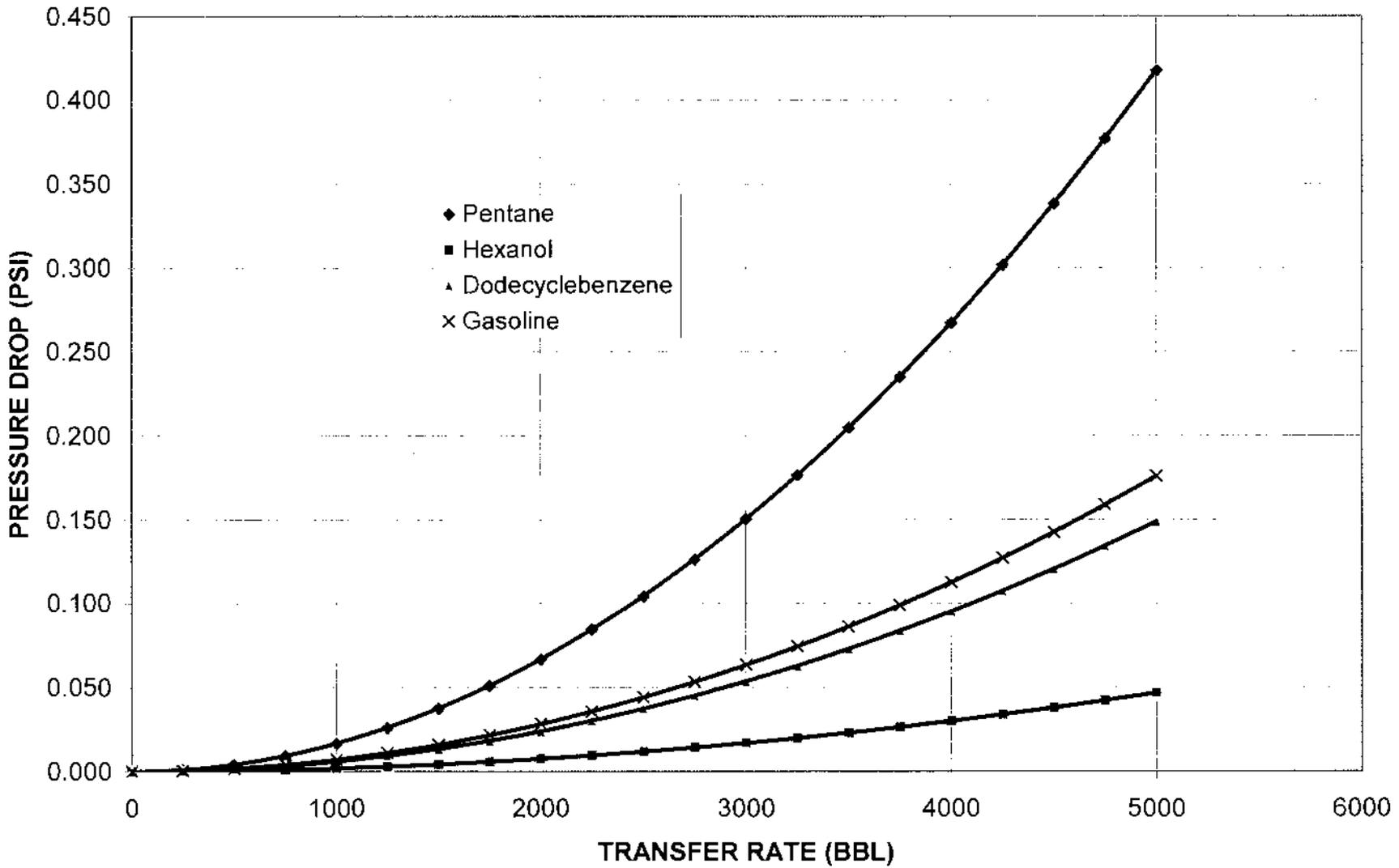
CHRIS CODE	NAME	VCS CAT	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR DENSITY	VAPOR GROWTH RATE	PRESSURE DROP TO PV VCS(psig) (LOADING)	VAPOR FLOW RATE (lb/ft)	AIR EQUIVALENT VOLUMETRIC FLOW RATE	PRESSURE DROP TO SHORE CONNECTION IN VCS (psig) (LOADING)*	PRESSURE DROP TO PV VALVE IN VCS (psig) (UNLOADING)	PRESSURE DROP TO SHORE CONNECT IN VCS (ps) (UNLOADING)
1 ACT	Acetone	1	0.79	10	2	0.121	1.2000	0.050	4200	5372	0.045	0.003	0.002
2 ACP	Acetophenone	1	1.03	0.6	4.14	0.082	1.0120	0.024	3542	3747	0.022	0.001	0.001
19 AAT	Amyl Acetate (iso-)	1	0.88	0.33	4.48	0.079	1.0066	0.023	3523	3649	0.021	0.001	0.001
20 AAI	Amyl Alcohol (iso-, n-, sec, primary) (See also IAA-1)	1	0.82	0.3	3.04	0.077	1.0060	0.022	3521	3688	0.020	0.001	0.001
21 AAN	Amyl Alcohol (n-)	1	0.82	0.3	3.04	0.077	1.0060	0.022	3521	3588	0.020	0.001	0.001
23 APM	Amyl Alcohol, Primary	1	0.82	0.3	3.04	0.077	1.0060	0.022	3521	3588	0.020	0.001	0.001
24 ASE	Amyl Alcohol, (sec-)	1	0.82	0.3	3.04	0.077	1.0060	0.022	3521	3588	0.020	0.001	0.001
26 IAA	Amyl Alcohol, (iso-)	1	0.82	0.3	3.04	0.077	1.0060	0.022	3521	3588	0.020	0.001	0.001
34 BAL	Benzyl Alcohol	1	1.05	0.1	3.73	0.075	1.0020	0.022	3507	3536	0.019	0.001	0.001
40 BAX	Butyl Acetate (iso-, n-)	1	0.87	0.6	4	0.082	1.0120	0.024	3542	3738	0.022	0.001	0.001
42 BTA	Butyl Acetate (sec-)	1	0.89	1.5	4	0.095	1.0300	0.029	3605	4088	0.026	0.002	0.001
44 IAL	Butyl Alcohol (iso-)	1	0.81	0.9	2.6	0.080	1.0160	0.024	3563	3722	0.021	0.001	0.001
46 BAS	Butyl Alcohol (sec-)	1	0.81	1.3	2.6	0.083	1.0260	0.025	3591	3820	0.023	0.001	0.001
47 BAT	Butyl Alcohol (tert-)	1	0.78	2.8	2.6	0.085	1.0560	0.030	3696	4189	0.027	0.002	0.001
48 BPH	Butyl Benzyl Phthalate	1	1.12	0.01	10.8	0.074	1.0002	0.021	3501	3511	0.019	0.001	0.001
54 CLS	Caprolactam Solutions	1	1.02	0.05	0.1	0.074	1.0010	0.021	3504	3519	0.019	0.001	0.001
70 CUM	Cumene	1	0.86	0.60	4.20	0.083	1.0120	0.024	3542	3751	0.022	0.001	0.001
72 CHX	Cyclohexane	1	0.78	4.5	2.9	0.114	1.0600	0.039	3815	4740	0.035	0.002	0.002
73 CHN	Cyclohexanol	1	0.95	0.15	3.45	0.075	1.0030	0.022	3511	3650	0.020	0.001	0.001
74 CPD	1,3-Cyclopentadiene dimer (molten)	1	0.89	0.25	4.95	0.078	1.0050	0.023	3518	3615	0.020	0.001	0.001
76 CMP	Cymene (para-)	1	0.86	0.11	4.62	0.076	1.0022	0.022	3508	3551	0.020	0.001	0.001
77 DHN	Decahydrophthalene	1	0.89	0.1	4.76	0.075	1.0020	0.022	3507	3548	0.019	0.001	0.001
78 IDA	Decaldehyde (iso-)	1	0.83	0.01	5	0.074	1.0002	0.021	3501	3504	0.019	0.001	0.001
79 DAL	Decaldehyde (n-)	1	0.83	0	5.01	0.074	1.0000	0.021	3500	3498	0.019	0.001	0.001
81 DCE	Decane	1	0.74	0.12	4.8	0.076	1.0024	0.022	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	0.021	3501	3505	0.019	0.001	0.001
83 ISA	Decyl Alcohol (iso-)	1	0.83	0.01	5.3	0.074	1.0002	0.021	3501	3505	0.019	0.001	0.001
84 DAN	Decyl Alcohol (n-)	1	0.83	0.01	5.3	0.074	1.0002	0.021	3561	3505	0.019	0.001	0.001
85 DBZ	Decylbenzene (n-)	1	0.86	0.01	7.52	0.074	1.0002	0.021	3501	3507	0.019	0.001	0.001
87 DAA	Diacetone Alcohol	1	0.97	0.1	4	0.075	1.0020	0.022	3507	3539	0.019	0.001	0.001
91 DPA	Dibutyl Phthalate (ortho-)	1	1.05	0	9.59	0.074	1.0000	0.021	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	0.023	3518	3615	0.020	0.001	0.001
93 DEB	Diethylbenzene	1	0.87	0.08	4.62	0.075	1.0016	0.022	3506	3537	0.019	0.001	0.001
94 DEG	Diethylene Glycol	1	1.12	0.01	3.66	0.074	1.0002	0.021	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	0.021	3501	3505	0.019	0.001	0.001
100 DGA	Diethylene Glycol Ethyl Ether Acetate	1	0.99	0.02	4.62	0.074	1.0034	0.021	3501	3508	0.019	0.001	0.001
101 DGM	Diethylene Glycol Methyl Ether	1	1.03	0.03	4.14	0.074	1.0006	0.021	3502	3512	0.019	0.001	0.001
111 DBC	Diisobutylcarbinol	1	0.81	0.09	4.97	0.075	1.0018	0.022	3506	3545	0.019	0.001	0.001
112 DBL	Diisobutylene	1	0.72	2	3.86	0.100	1.0400	0.031	3640	4251	0.028	0.002	0.001
113 DIX	Diisobutyl Ketone	1	0.81	0.16	4.9	0.077	1.0032	0.022	3511	3579	0.020	0.001	0.001
119 DIX	Diisopropylbenzene (all isomer)	1	0.86	0.03	5.6	0.074	1.0006	0.021	3502	3516	0.019	0.001	0.001
124 DTL	Dimethyl Phthalate	1	1.19	0	6.69	0.074	1.0000	0.021	3500	3499	0.019	0.001	0.001
130 DOP	Diocyl Phthalate	1	0.98	0	13.47	0.074	1.0000	0.021	3500	3499	0.019	0.001	0.001
131 DPN	Dipentene	1	0.84	0.1	4.9	0.075	1.0020	0.022	3507	3549	0.019	0.001	0.001
132 DIL	Diphenyl	1	0.99	0.01	5.31	0.074	1.0002	0.021	3501	3505	0.019	0.001	0.001
133 DDO	Diphenyl, Diphenyl Ether Mixture	1	1.07	0.01	5.96	0.074	1.0002	0.021	3501	3505	0.019	0.001	0.001
134 DPE	Diphenyl Ether	1	1.07	0.01	5.97	0.074	1.0002	0.021	3501	3505	0.019	0.001	0.001
136 DPG	Dipropylene Glycol	1	1.03	0.07	4.63	0.075	1.0014	0.022	3505	3532	0.019	0.001	0.001
139 DFF	Distillates; Fresh Feed Stocks	1	0.75	2.3	3.4	0.100	1.0490	0.031	3661	4255	0.028	0.002	0.001
140 DSR	Distillates; Straight Run	1	0.73	2.3	3.4	0.100	1.0460	0.031	3661	4255	0.028	0.002	0.001
145 DOZ	Dodecene (all isomers)	1	0.76	0.02	5.81	0.074	1.0004	0.021	3501	3511	0.019	0.001	0.001
146 DOD	Dodecene	1	0.76	0.02	5.81	0.074	1.0004	0.021	3501	3511	0.019	0.001	0.001
147 DDB	Dodecylbenzene	1	0.86	4.7	8.4	0.237	1.0940	0.081	3829	6864	0.073	0.004	0.004
155 ETG	Ethoxy Triglycol (crude)	1	1.02	0	6.14	0.074	1.0000	0.021	3500	3499	0.019	0.001	0.001
156 ETA	Ethyl Acetate	1	0.9	4.5	3.04	0.117	1.0900	0.040	3815	4801	0.038	0.002	0.002
157 EAA	Ethyl Acetoacetate	1	1.03	0.2	4.48	0.077	1.0040	0.022	3514	3590	0.020	0.001	0.001
158 EAL	Ethyl Alcohol (Ethanol)	1	0.79	3.5	1.6	0.083	1.0700	0.027	3745	3986	0.025	0.001	0.001
160 ETB	Ethyl Benzene	1	0.87	0.8	3.56	0.081	1.0120	0.024	3542	3710	0.021	0.001	0.001
161 EBT	Ethyl Butanol	1	0.83	0.12	3.52	0.075	1.0024	0.022	3508	3541	0.019	0.001	0.001
162 EBR	Ethyl Butyrate	1	0.88	1	4	0.088	1.0200	0.026	3570	3895	0.023	0.001	0.001

163	ECY	Ethyl Cyclohexane	1	0.79	0.5	3.87	0.080	1.0100	0.024	3535	3692	0.021	0.001
166	EGL	Ethylene Glycol	1	1.19	0.01	2.21	0.074	1.0002	0.021	3501	3501	0.019	0.001
169	EMA	Ethylene Glycol Butyl Ether Acetate	1	0.94	0.05	5.52	0.075	1.0010	0.021	3504	3528	0.019	0.001
172	EGY	Ethylene Glycol Diacetate	1	1.1	0.01	5.03	0.074	1.0002	0.021	3501	3504	0.019	0.001
178	EME	Ethylene Glycol Methyl Ether	1	1.1	0.01	4.8	0.074	1.0002	0.021	3501	3504	0.019	0.001
180	EPE	Ethylene Glycol Phenyl Ether	1	1.1	0.01	4.8	0.074	1.0002	0.021	3501	3504	0.019	0.001
184	EHA	2-Ethylhexaldehyde, See Octyl Aldehydes	1	0.82	0.17	4.41	0.076	1.0034	0.022	3512	3675	0.020	0.001
186	EHX	2-Ethylhexanol, see Octanol (all isomers)	1	0.84	0.02	4.5	0.074	1.0004	0.021	3501	3508	0.019	0.001
190	EPR	Ethyl Propionate	1	0.89	3.5	1.6	0.083	1.0700	0.027	3745	3986	0.025	0.001
191	ETE	Ethyl Toulene	1	0.88	0.28	4.15	0.078	1.0056	0.023	3520	3616	0.020	0.001
194	FAM	Formamide	1	1.13	0.1	1.55	0.074	1.0020	0.021	3507	3512	0.019	0.001
195	FAL	Furfuryl Alcohol	1	1.13	0.05	3.4	0.074	1.0010	0.021	3504	3516	0.019	0.001
197	GAK	Gasoline Blended Stocks: Alkylates	1	0.75	12.5	3.4	0.214	1.2500	0.066	4375	7462	0.066	0.005
198	GRF	Gasoline Blended Stocks: Reformate	1	0.8	12.5	3.4	0.214	1.2500	0.066	4375	7462	0.066	0.005
199	GAT	Gasolines: Automotive (containing nct. over 4.23 grs)	1	0.74	12.5	3.4	0.214	1.2500	0.066	4375	7462	0.066	0.005
200	GAV	Gasolines: Aviation (containing nct. over 4.86 grams)	1	0.71	12.5	3.4	0.214	1.2500	0.066	4375	7462	0.066	0.005
201	GCS	Gasolines: Casinghead	1	0.67	12.5	3.4	0.214	1.2500	0.066	4375	7462	0.066	0.005
202	GGL	Gasolines: Polymer	1	0.75	12.5	3.4	0.214	1.2500	0.066	4375	7462	0.066	0.005
203	GSR	Gasolines: Straight Run	1	0.75	12.5	3.4	0.214	1.2500	0.066	4375	7462	0.066	0.005
204	GCR	Glycerine	1	1.26	0	3.17	0.074	1.0000	0.021	3500	3499	0.019	0.001
217	HMX	Heptane (all isomers) (Methylhexane)	1	0.88	2.5	3.45	0.102	1.0500	0.032	3675	4332	0.029	0.002
218	HPT	Heptane (n-)	1	0.68	2.5	3.45	0.102	1.0500	0.032	3675	4332	0.029	0.002
220	HTX	Heptanol (all isomers)	1	0.82	0.04	4	0.074	1.0008	0.021	3503	3515	0.019	0.001
221	HTN	Heptanol (all isomers)	1	0.82	0.04	4	0.074	1.0008	0.021	3503	3515	0.019	0.001
222	HPX	Heptene (all isomers)	2	0.7	2.9	3.4	0.106	1.0580	0.034	3703	4447	0.031	0.001
223	THE	Heptene (1-)	1	0.7	2.8	3.4	0.105	1.0560	0.034	3696	4415	0.030	0.002
228	HXS	Hexane (all isomers)	1	0.66	0.66	3	0.139	1.1400	0.052	3890	5486	0.047	0.003
230	HXA	Hexane	1	0.66	7	3	0.139	1.1400	0.052	3890	5486	0.047	0.003
231	HXO	Hexanoic Acid	1	0.93	0.01	4	0.074	1.0002	0.021	3501	3503	0.019	0.001
232	HXN	Hexanol	1	0.82	1	3.52	0.085	1.0200	0.025	3570	3845	0.023	0.001
234	HEX	Hexene (all isomers)	2	0.67	8	2.9	0.145	1.1600	0.056	4060	5694	0.050	0.003
235	HXE	Hexene (1-)	1	0.67	8.2	2.9	0.147	1.1640	0.057	4074	5749	0.051	0.003
236	HXT	Hexene (2-)	1	0.67	8.2	2.9	0.147	1.1640	0.057	4074	5749	0.051	0.003
238	HXG	Hexylene Glycol	4	0.92	0.01	4.75	0.074	1.0002	0.021	3501	3504	0.019	0.001
243	IPH	Isophorone	1	0.8	0.14	4.5	0.076	1.0028	0.022	3510	3563	0.020	0.001
244	JPO	Jet Fuels: JP-1 (Kerosene)	1	0.8	8.1	4.5	0.213	1.1702	0.084	4096	6969	0.075	0.004
245	JPT	Jet Fuels: JP-3	1	0.8	8.1	4.5	0.213	1.1702	0.084	4096	6969	0.075	0.004
246	JPF	Jet Fuels: JP-4	1	0.81	3.4	4	0.121	1.0680	0.040	3738	4800	0.036	0.002
247	JPV	Jet Fuels: JP-5 (Kerosene, heavy)	1	0.82	0.1	4	0.075	1.0020	0.022	3507	3539	0.018	0.001
249	KRS	Kerosene	1	0.81	0.15	4.5	0.076	1.0030	0.022	3511	3568	0.020	0.001
263	MITT	Methyl Acetate	1	0.92	1.1	2.6	0.119	1.1220	0.043	3927	4999	0.039	0.002
265	MAL	Methyl Alcohol (See Methanol)	1	0.79	6.63	1.1	0.077	1.1326	0.028	3964	4046	0.025	0.001
268	MAC	Methyl Amyl Acetate	1	0.86	0.33	4.97	0.080	1.0088	0.023	3523	3666	0.021	0.001
269	MAA	Methyl Amyl Alcohol	1	0.81	0.43	3.52	0.079	1.0086	0.023	3530	3649	0.021	0.001
271	MBK	Methyl n-Butyl Ketone	1	0.81	0.97	3.5	0.085	1.0194	0.025	3568	3932	0.023	0.001
273	MBU	Methyl Butyrate	1	0.9	1.26	3.53	0.089	1.0252	0.027	3588	3935	0.024	0.001
274	MEK	Methyl Ethyl Ketone	1	0.8	4.5	2.5	0.105	1.0900	0.038	3815	4561	0.032	0.002
275	MTF	Methyl Formal (Dimethyl Formal)	1	0.86	15.42	2.8	0.189	1.3084	0.093	4579	7341	0.083	0.004
276	MHK	Methyl Heptyl Ketone	1	0.83	0.06	4.9	0.075	1.0012	0.021	3504	3529	0.019	0.001
278	MIK	Methyl Isobutyl Ketone	1	0.8	1.15	3.45	0.087	1.0230	0.026	3581	3687	0.023	0.001
281	MNA	1-Methyl Naphthalene	1	1.02	0.01	4.91	0.074	1.0002	0.021	3504	3504	0.019	0.001
283	MPN	2-Methyl-1-Pentene	1	0.89	6.3	2.9	0.130	1.1260	0.047	3941	5230	0.042	0.002
284	MTN	5-Methyl-1-Pentene	1	0.67	8.49	2.9	0.149	1.1698	0.059	4094	5828	0.053	0.003
286	MBE	Methyl Tert-Butyl Ether (MTBE)	1	0.74	0.04	3.1	0.074	1.0008	0.021	3503	3519	0.019	0.001
288	MNS	Mineral Spirits	1	0.75	0.2	4.3	0.077	1.0040	0.022	3514	3586	0.020	0.001
289	MRE	Myrcene	1	0.8	0.17	4.7	0.077	1.0034	0.022	3512	3581	0.020	0.001
295	NSV	Naphtha: Solvent	1	0.87	0.2	3.5	0.076	1.0040	0.022	3514	3569	0.020	0.001
296	NSS	Naphtha: Stoddard Solvant	1	0.78	0.2	4.3	0.077	1.0040	0.022	3514	3586	0.020	0.001
297	NVM	Naphtha: Varnish Makers and Painters (75%)	1	0.77	0.19	4.3	0.077	1.0038	0.022	3513	3582	0.020	0.001
300	NAX	Nonane (all isomers)	1	0.72	0.27	4.4	0.078	1.0054	0.023	3519	3519	0.020	0.001
301	NAN	Nonane	1	0.72	0.27	4.4	0.078	1.0054	0.023	3519	3519	0.020	0.001
304	NON	Nonene	1	0.73	0.35	4.3	0.079	1.0070	0.023	3525	3661	0.021	0.001
305	NNS	Nonyl Alcohol (all isomers)	1	0.94	0.1	5	0.076	1.0020	0.022	3507	3550	0.020	0.001
306	NNN	Nonyl Alcohol	1	0.94	0.1	5	0.076	1.0020	0.022	3507	3550	0.020	0.001
307	NNI	Nonyl Alcohol (iso-)	1	0.94	0.1	5	0.075	1.0020	0.022	3507	3550	0.020	0.001
309	NNP	Nonyl Phenol	1	0.95	0.01	7.6	0.075	1.0002	0.021	3501	3507	0.019	0.001
316	OAX	Octane (all isomers)	1	0.7	0.79	3.9	0.084	1.0158	0.025	3555	3805	0.022	0.001

317 OAN		1	0.7	0.79	3.9	0.084	1.0158	0.025	3555	3805	0.001	0.001
320 OTA		1	0.83	0.01	4.48	0.074	1.0002	0.021	3501	3504	0.001	0.001
322 OTE		1	0.72	1	3.86	0.087	1.0200	0.026	3670	3860	0.001	0.001
324 OCX		1	0.83	0.01	4.48	0.074	1.0002	0.021	3501	3504	0.001	0.001
325 IOA		1	0.88	0.01	4.48	0.074	1.0002	0.021	3501	3504	0.001	0.001
364 OTW		1	0.88	0.56	8	0.062	1.0112	0.027	3539	3955	0.001	0.001
366 OFR		1	0.9	0.15	3.4	0.075	1.0030	0.022	3511	3550	0.001	0.001
367 OFV		1	0.94	0.15	3.4	0.075	1.0030	0.022	3511	3550	0.001	0.001
368 OSX		1	0.95	0.15	3.4	0.075	1.0030	0.022	3511	3550	0.001	0.001
382 OIL		1	0.95	0.15	3.4	0.075	1.0030	0.022	3511	3550	0.001	0.001
383 ODS		1	0.9	0.69	3.4	0.081	1.0138	0.024	3548	3730	0.001	0.001
389 OLB		1	0.9	0.15	1	0.074	1.0030	0.021	3511	3510	0.001	0.001
403 ORS		1	1.02	0.15	1	0.074	1.0030	0.021	3511	3510	0.001	0.001
418 OTB		1	0.87	0.3	5.4	0.080	1.0060	0.023	3521	3665	0.001	0.001
429 PDC		1	0.83	0.01	7.88	0.074	1.0002	0.021	3501	3507	0.001	0.001
433 IPT		5	0.62	27	2.48	0.335	1.5400	0.228	5390	11501	0.012	0.012
434 PTA		5	0.63	20.44	2.5	0.256	1.4088	0.146	4931	9191	0.008	0.008
437 PTE		5	0.64	24.9	2.4	0.299	1.4980	0.193	5243	10568	0.010	0.010
442 PIN		1	0.86	0.35	4.7	0.080	1.0070	0.023	3525	3666	0.001	0.001
448 PLB		1	0.91	0.01	79.3	0.077	1.0002	0.022	3501	3586	0.001	0.001
457 PGC		1	1.01	0.1	1	0.074	1.0020	0.021	3507	3508	0.001	0.001
464 IAC		1	0.89	1.8	3.52	0.095	1.0360	0.029	3626	4115	0.002	0.002
465 PAT		1	0	1.85	3.52	0.095	1.0370	0.029	3630	4132	0.002	0.002
466 IPA		1	0.79	3	2.07	0.089	1.0600	0.029	3710	4071	0.001	0.001
467 PAL		1	0.8	1.2	2.07	0.080	1.0240	0.024	3584	3727	0.001	0.001
468 PBZ		1	0.86	0.2	4.14	0.077	1.0040	0.022	3514	3583	0.001	0.001
469 IPX		1	0.8	0.01	4.35	0.074	1.0002	0.021	3501	3503	0.001	0.001
473 PPG		1	1.04	0.01	2.62	0.074	1.0002	0.021	3501	3502	0.001	0.001
476 PME		1	0.92	0.7	3.11	0.081	1.0140	0.024	3549	3711	0.001	0.001
488 SFL		1	1.26	0.01	4.14	0.074	1.0002	0.021	3501	3503	0.001	0.001
493 TTN		1	0.82	0	7.39	0.074	1.0000	0.021	3500	3499	0.001	0.001
494 TTD		1	0.77	0.01	6.77	0.074	1.0002	0.021	3501	3506	0.001	0.001
496 TTG		1	1.12	0.01	6.7	0.074	1.0002	0.021	3501	3506	0.001	0.001
499 THN		1	0.97	0.04	4.58	0.074	1.0008	0.021	3503	3518	0.001	0.001
502 TCP		1	0.87	1.5	3.14	0.089	1.0300	0.027	3605	3955	0.001	0.001
503 TRD		1	1.16	0.01	12.89	0.074	1.0002	0.021	3501	3513	0.001	0.001
505 TDN		1	0.76	0.02	6.4	0.074	1.0004	0.021	3501	3512	0.001	0.001
508 TDC		1	0.85	0.01	6.91	0.074	1.0002	0.021	3501	3506	0.001	0.001
509 TEG		1	0.77	0.01	6.29	0.074	1.0002	0.021	3501	3506	0.001	0.001
519 TFE		1	0.86	0.02	5.6	0.074	1.0004	0.021	3501	3511	0.001	0.001
520 TMB		1	1.12	0.01	5.17	0.074	1.0002	0.021	3501	3504	0.001	0.001
521 TMD		1	0.89	0.14	4.2	0.076	1.0028	0.022	3510	3559	0.001	0.001
522 TME		1	0.89	0.14	4.14	0.076	1.0028	0.022	3510	3558	0.001	0.001
529 TRP		1	1.16	0	14.2	0.074	1.0000	0.021	3500	3499	0.001	0.001
546 XLX		1	0.85	0.51	3.66	0.080	1.0102	0.023	3536	3684	0.001	0.001
547 XLM		1	0.87	0.51	3.66	0.080	1.0102	0.023	3536	3684	0.001	0.001
548 XLO		1	0.89	0.4	3.66	0.079	1.0080	0.023	3528	3645	0.001	0.001
549 XLP		1	0.86	0.51	3.66	0.080	1.0102	0.023	3536	3684	0.001	0.001
550 XYL		1	1.01	0.1	3.66	0.075	1.0020	0.022	3507	3536	0.001	0.001
551												
		Max.	1.260	27.000	79.300	0.335	1.540	0.228	5390	11501	0.012	0.012
		Min.	0.000	0.000	1.000	0.000	1.000	0.021	3500	3499	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)

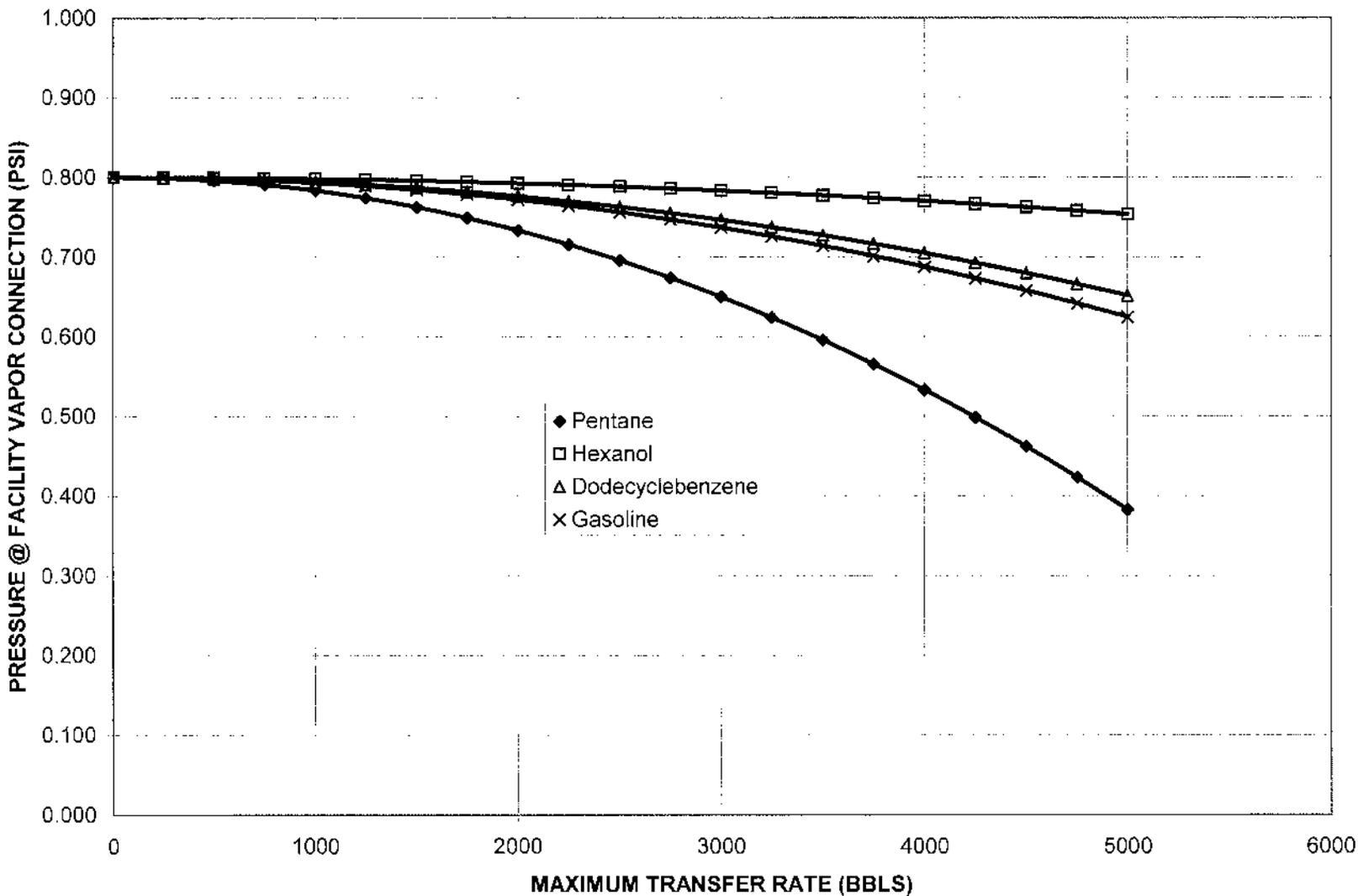
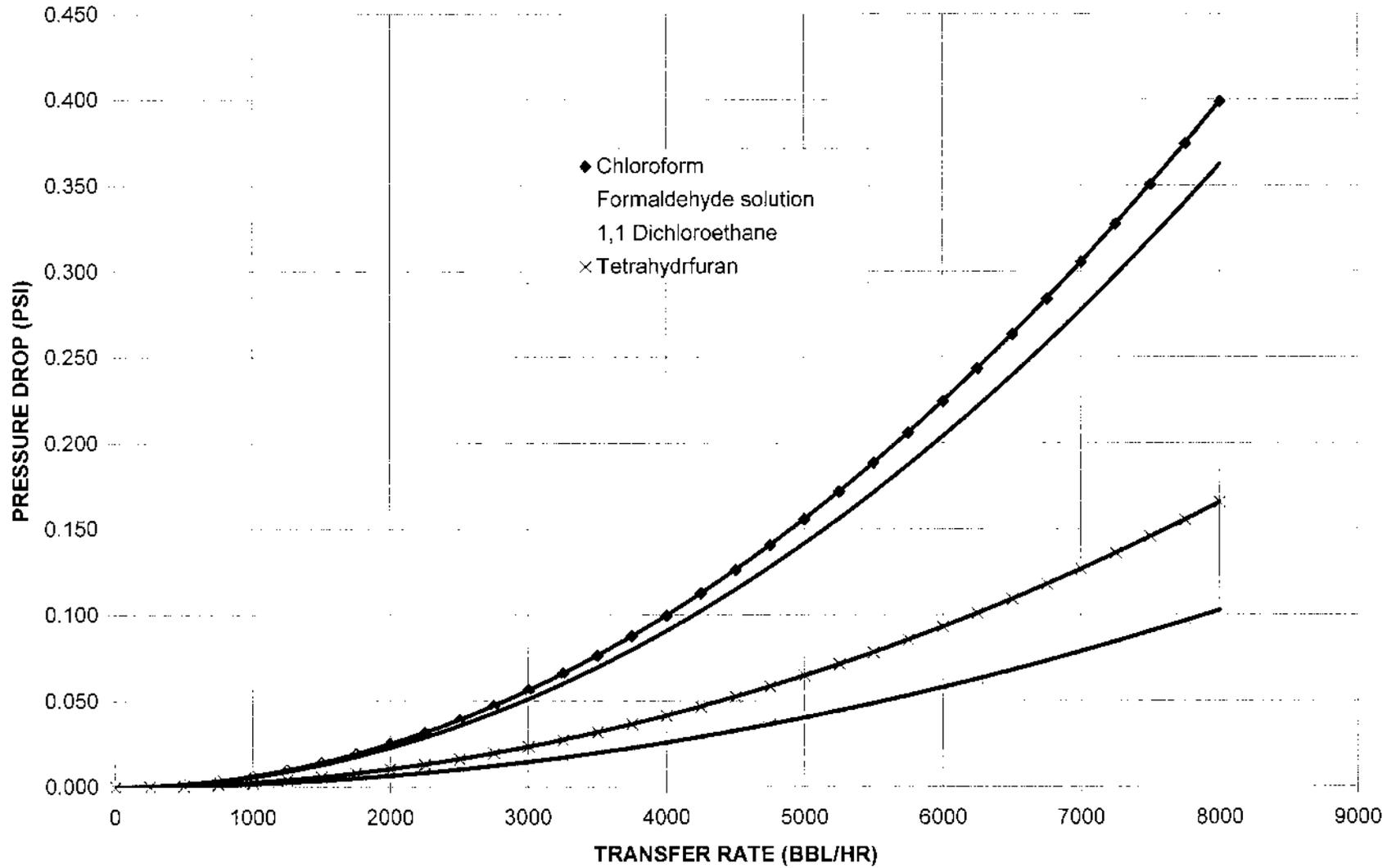


TABLE 4 (SUBCHAPTER "O" CARGOES)

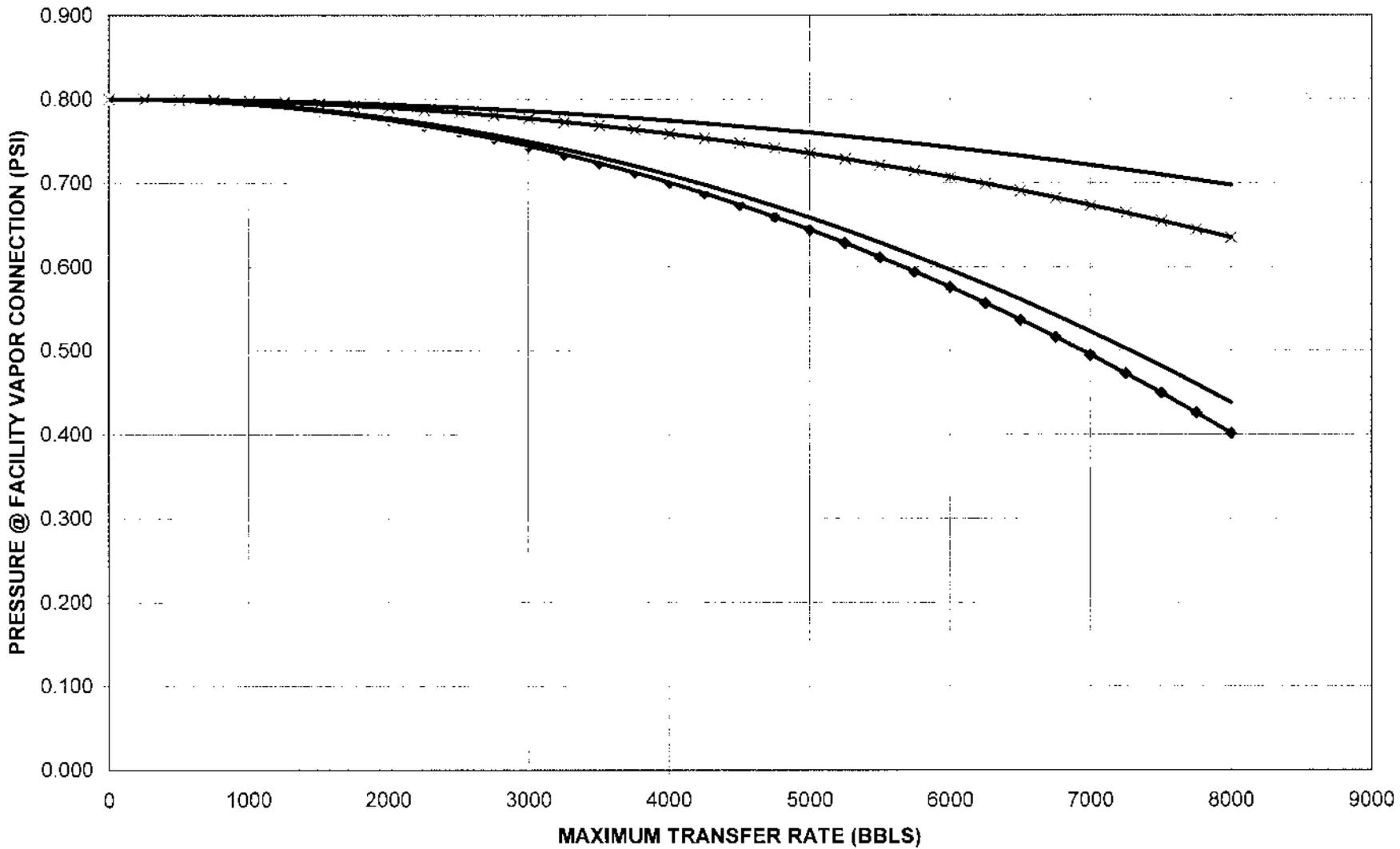
CHRIS CODE	NAME	VCS CAT	LIQ SG	VAPOR PRESS	VAPOR SG	VAPOR AIR WEIGHT DENSITY	VAPOR GROWTH RATE	PRESSURE DROP TO PV VALVE IN VCS(psig) (LOADING)	VAPOR VOLUMETRIC FLOW RATE (bbt/h)	AIR EQUIVALENT VOLUMETRIC FLOW RATE	PRESSURE DROP TO SHORE CONNECTION	PRESSURE DROP TO PV VALVE IN VCS(psig) (UNLOADING)	PRESSURE DROP TO SHORE CONNECTION
											IN VCS (psig) (LOADING)*	(UNLOADING)	IN VCS (psig) (UNLOADING)*
1 ACN	Acrylonitrile	4	0.81	5.00	1.80	0.095	1.1000	0.033	3850	4298	0.029	0.002	0.002
2 ADN	Adiponitrile	1	0.95	0.01	3.73	0.076	1.0002	0.022	3501	3503	0.020	0.001	0.001
3 ATN	Acetonitrile	3	0.78	0.03	1.41	0.076	1.0006	0.022	3502	3502	0.020	0.001	0.001
4 BAD	Iso-Butyraldehyde	1	0.80	7.80	2.50	0.131	1.1580	0.050	4046	5308	0.045	0.003	0.002
5 BAR	Butyl acrylate (iso-, n-)	2	0.90	0.60	4.42	0.086	1.0120	0.025	3542	3759	0.023	0.001	0.001
6 BMH	Butyl Methacrylate	2	0.88	0.29	4.9	0.081	1.0058	0.024	3520	3640	0.021	0.001	0.001
7 BNZ	Benzene	1	0.88	4.50	2.80	0.114	1.0900	0.039	3815	4671	0.035	0.002	0.002
8 BTR	n-Butyraldehyde	1	0.80	7.80	2.50	0.131	1.1580	0.050	4046	5308	0.045	0.003	0.002
9 BTX	Benzene, Toluene, Xylene mixtures (10% Benzene or more)	1	0.84	7.30	2.80	0.138	1.1460	0.052	4011	5396	0.046	0.003	0.002
10 CCH	Cyclohexanone	1	0.95	0.20	3.40	0.078	1.0040	0.023	3514	3585	0.020	0.001	0.001
11 CHA	Cyclohexylamine	1	0.87	0.62	3.42	0.083	1.0124	0.024	3543	3703	0.022	0.001	0.001
12 CRB	Chlorobenzene	1	1.11	0.80	3.88	0.087	1.0160	0.026	3566	3799	0.023	0.001	0.001
13 CRF	Chloroform	3	1.48	9	4.25	0.213	1.1800	0.085	4130	6916	0.076	0.004	0.004
14 NCT	Coal Tar Naphtha Solvent	1	0.86	0.2	4	0.079	1.0040	0.023	3514	3577	0.020	0.001	0.001
15 CRS	Cresols	1	1.05	0.06	3.72	0.077	1.0012	0.022	3504	3521	0.020	0.001	0.001
16 CTA	Crotonaldehyde	4	0.85	2	2.41	0.089	1.0400	0.028	3640	3943	0.025	0.001	0.001
17 DCH	1,1-Dichloroethane	1	1.18	9.90	3.41	0.188	1.1980	0.077	4193	6592	0.069	0.004	0.004
18 DPP	1,2-Dichloropropane	3	1.16	2.5	3.88	0.110	1.0500	0.035	3675	4418	0.031	0.002	0.002
19 DPU	1,3-Dichloropropene	4	1.23	5.5	3.84	0.149	1.1100	0.053	3885	5443	0.047	0.003	0.002
20 DEN	Diethylamine	3	0.71	1.00	2.50	0.083	1.0200	0.025	3570	3731	0.022	0.001	0.001
21 DIP	Diisopropanolamine	1	0.98	0.01	4.59	0.076	1.0002	0.022	3501	3504	0.020	0.001	0.001
22 DMF	Dimethylformamide	1	0.95	0.30	2.51	0.078	1.0060	0.023	3521	3569	0.020	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	0.059	3941	5747	0.053	0.003	0.003
24 EAC	Ethyl acrylate	2	0.93	2.00	3.50	0.099	1.0400	0.031	3640	4163	0.028	0.002	0.001
25 EAI	2-Ethylhexyl acrylate	2	0.89	0.02	6.35	0.076	1.0004	0.022	3501	3512	0.020	0.001	0.001
26 EDC	Ethylene dichloride	1	1.26	4.00	3.42	0.121	1.0800	0.041	3780	4776	0.036	0.002	0.002
27 ETM	Ethyl Methacrylate	2	0.92	1	3.84	0.090	1.0200	0.027	3570	3879	0.024	0.001	0.001
28 EPA	2-Ethyl-3-propylacrolein	1	0.85	0.12	4.5	0.078	1.0024	0.022	3508	3553	0.020	0.001	0.001
29 FFA	Furfural	1	1.20	0.15	3.31	0.078	1.0030	0.022	3511	3547	0.020	0.001	0.001
30 FMS	Formaldehyde solution (37% to 50%)	1	1.13	0.15	1.03	0.076	1.0030	0.022	3511	3510	0.020	0.001	0.001
31 MSO	Mesityl Oxide	1	0.86	0.67	3.5	0.084	1.0134	0.025	3547	3725	0.022	0.001	0.001
32 MAM	Methyl acrylate	2	0.95	4.10	3.00	0.114	1.0820	0.038	3787	4646	0.034	0.002	0.002
33 MBE	Methylcyclopentadiene dimer	1	0.74	0.04	3.10	0.076	1.0008	0.022	3503	3511	0.020	0.001	0.001
34 MMM	Methyl methacrylate	2	0.94	2.02	3.45	0.099	1.0404	0.031	3641	4159	0.028	0.002	0.001
35 MPL	Morpholine	1	1.00	0.80	3.00	0.083	1.0160	0.025	3556	3726	0.022	0.001	0.001
36 NPM	1- or 2-Nitropropane	1	0.99	1.05	3.06	0.086	1.0210	0.028	3574	3804	0.023	0.001	0.001
37 PRD	Pyridine	1	0.98	1.30	2.72	0.086	1.0260	0.026	3591	3830	0.023	0.001	0.001
38 STY	Styrene	2	0.92	0.40	3.60	0.081	1.0080	0.024	3528	3638	0.021	0.001	0.001
39 TCN	1,2,3-Trichloropropane	3	1.39	0.15	5.60	0.079	1.0030	0.023	3511	3583	0.020	0.001	0.001
40 TEN	Triethylamine	3	0.73	2.50	3.49	0.105	1.0500	0.033	3675	4323	0.030	0.002	0.002
41 THF	Tetrahydrofuran	1	0.89	8.50	1.35	0.090	1.1700	0.035	4095	4454	0.032	0.002	0.002
42 VAM	Vinyl acetate	2	0.94	5.80	2.97	0.130	1.1160	0.046	3906	5099	0.042	0.002	0.002
		Max.	1.39	12.5	8.40	0.213	1.198	0.085	4193	6916	0.076	0.004	0.004
		Min.	0.63	0.01	1.03	0.076	1.000	0.022	3501	3502	0.020	0.001	0.001

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

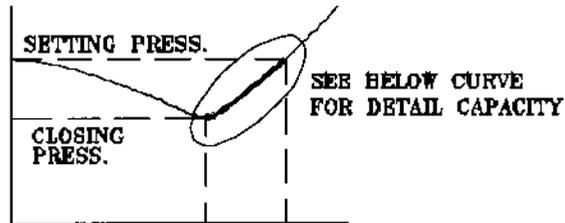
# LIQUID TRANSFER RATE vs PRESSURE DROP



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



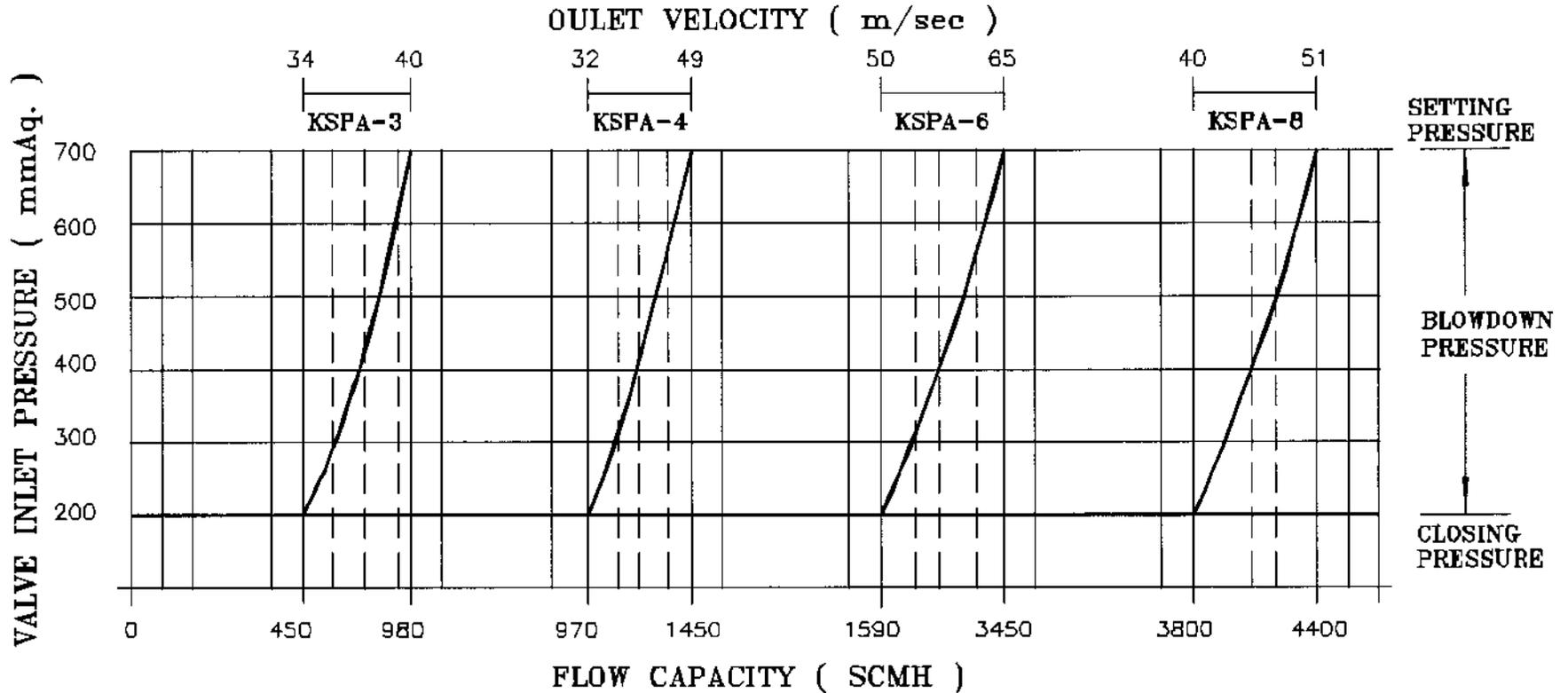
PROGRESS OF VALVE PRESSURE



TANKTECH HIGH VELOCITY VENT VALVES

KSPA TYPE FLOW CAPACITY CURVE

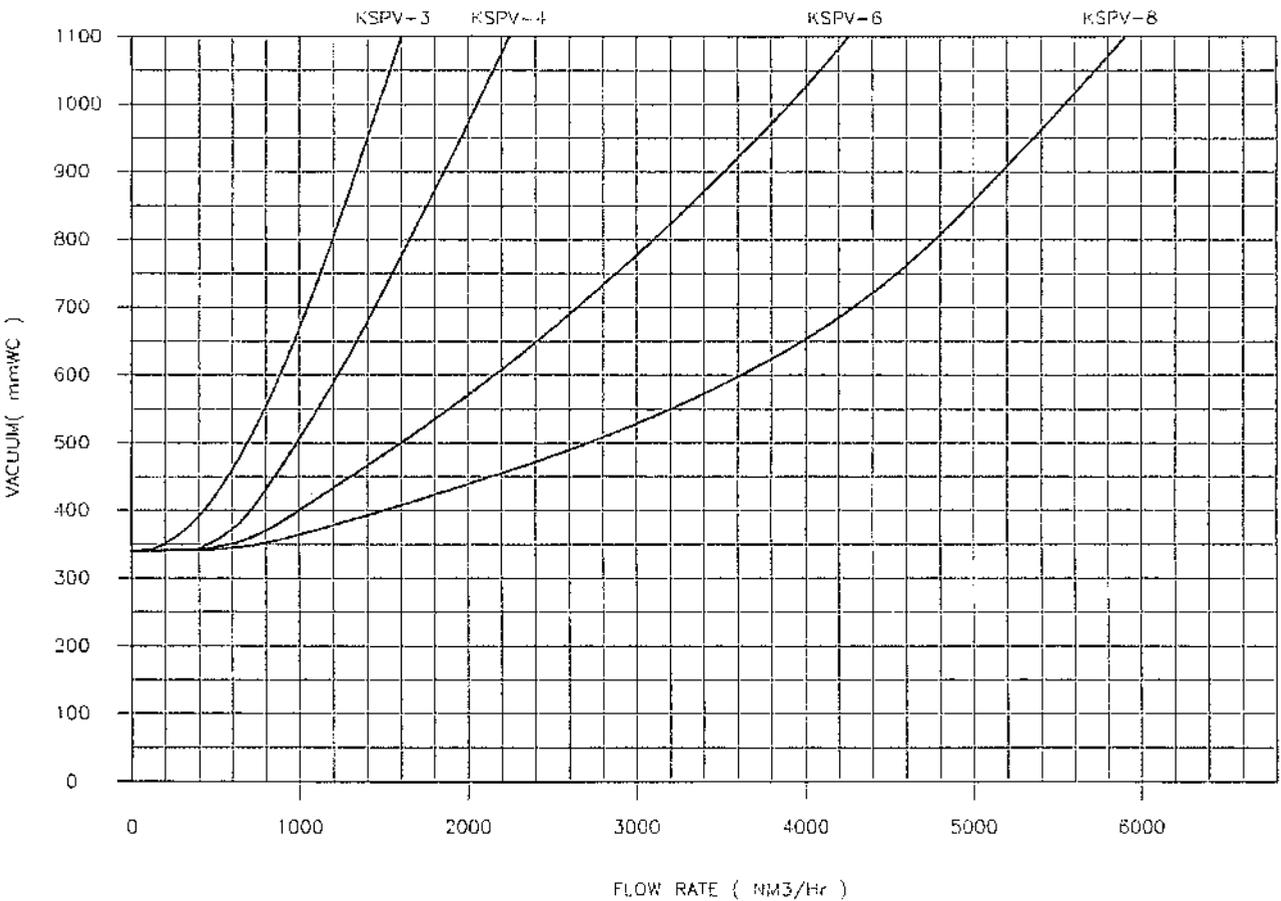
700 mmAq. SETTING PRESSURE



(1)

# FLOW CAPACITY CURVE GRAPH

FLOW TEST PERFORMED ON EQUIPMENT  
 USING AIR, AT TEMP. T=15.6°C AND  
 AMBIENT PRESSURE P=1.0332 KG/CM<sup>2</sup>.



# TANKTECH

TITLE

HIGH VELOCITY VACUUM RELIEF VALVE

KSPV TYPE

(12)