Vapor Collection System
Pressure Drop Calculations

for

Hull 456

for

Raymond and Associates, LLC.

rev. 1

12 April, 2012

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Vessel Information:

Builder:	Raymond and Associates, LLC
Hull #:	456
O.N.	TBD
Owner:	Harley Marine Gulf, LLC
Name:	TBD
Length:	297.5 ft
Breadth:	54.0 ft
Depth:	12.0 ft
Classification:	n/a
Service:	Rivers, Lakes, Bays, Sounds
Cargo:	Subchapter D

Vapor System Information:

Pipe:

Header:	8" schedule 40
Manifold:	8" schedule 40

Notes:

All tanks are to be connected to the main header and PV valve during cargo loading or discharge. ***<u>Port and Starboard tanks to be loaded simultaneously.</u>***

High-Velocity P-V Valve:	***ERL SUPERAC MODEL II***					
Pressure Setting:				1.5	psi	
Vacuum Setting:				0.5	psi	
Flow Capacity:	16436	BBL/hr	@	2.23	psi	loading (pressure)
	10673	BBL/hr	@	0.49	psi	discharge (vacuum)

Maximum Liquid Loading Rate:	5000	**BBL/hr**	
Maximum Discharge Rate:	5000	**BBL/hr**	
Maximum Vapor-Air Mixture Density:	0.347	**lb/ft^3**	for Subchapter D

Summary of Calculations:

1. Cargo Authority

The vapor collection system on this barge is designed to carry the cargoes listed in the accompanying List of Allowable Cargoes.

These calculations estimate the flow characteristics for a number of cargoes in terms of a suitable flowrate for the vapor collection and overpressure protection system only. These calculations do not assess additional carriage considerations which may exist for the listed cargoes (e.g. IBC & USCG requirements) based on other characteristics of the cargoes - toxicity, pollution potential, pressure and temperature restrictions, and other hazardous characteristics whic may affect vessel outfit, equipment, and operations.

The VCS cargoes shall be listed on the barge's Certificate of Inspection, pending carriage authority from USCG.

2. Vapor-Air Mixture Density and Vapor Growth Rate

The maximum vapor-air mixture density, estimated in accordance with USCG "*Industry Guidelines for Determining the Maximum Liquid Transfer Rate for A Tank Vessel Transferring a Flammable or Combustible Cargo Using a Vapor Control System (USCG Guidelines) is:*

0.347 lb/ft^3 for a 50/50 mixture of air and **Subchapter O/D products**

The vapor growth rate is calculated in accordance with the USCG Guidelines, as R = 1 + 0.25 (VP/12.5); however, a minimum of 1.25 is used in all loading cases, in accordance with ABS SBR 5-2-3/7.5.2(d) and 46 CFR 39.30-1(b)(2) as stipulated for crude oil, benzene, and gasoline blends.

See the accompanying List of Allowable Cargoes or specific data on vapor-air mixture density and vapor growth rates for various cargoes.

3. Maximum Liquid Transfer Rate as Imposed by the Capacity of the Cargo Tank Venting Systems (46 CFR 39.20-11 & 39.30-1(d))

Design Cargo S.G.:	1.05	
Deck Design Pressure/Vacuum:	3.00	psig

LOADING:

Tank #1P presents the longest equivalent pipe run to the high-velocity P-V valve. Using friction factors appropriate to the applicable pipe sizes, the maximum pressure drop through the vapor control piping at the maximum liquid transfer rate of

5000 BBL/hr is:

0.325 psi for a 50/50 mix of air and **Subchapter D products**

The air-equivalent flowrate through the P-V valve is:	16436	BBL/hr		
The pressure drop across the P-V valve at this flowrate is:	2.23	psi		
The total pressure drop:	2.56	psi ≤ the design pressure of	3.00	psi

DISCHARGE:

The maximum pressure drop through the vapor piping at the maximum discharge rate of 5000 BBL/hr is:

0.139 psi for a 50/50 mix of air and **Subchapter D products**

The air-equivalent flowrate through the P-V valve is:	10673	BBL/hr (*a density adjustment is conservatively used to provide for fouling)*		
The pressure drop across the P-V valve at this flowrate is:	0.49	psi		
The total pressure drop:	0.63	psi ≤ the design pressure of	3.00	psi

4. Maximum Liquid Transfer Rate as Imposed by the Spill Valves (46 CFR 39.20-9(c)(3))

No spill valves are installed on the vessel.

5. Maximum Liquid Transfer Rate as Imposed by the Set Point of the High-Level Alarm (46 CFR 39.20-7(c)(1) and -9(b)(2))

High Level Alarm Set Point:

Cargo Height:	12.83	ft	(Approx) Tank #3 P/S at 95% load, per 46 CFR 39.30-1(e)(1) and ABS SBR 5-2-3/7.19.2
High-Level Sensor Height:	12.83	ft	(corresponds to 95% load)
Cargo Volume above Sensor:	836	BBL	
Maximum Tank Loading Rate:	2500	BBL/hr per tank	
Time to Overfill:	1203.8	sec	

6. Maximum Liquid Transfer Rate as Imposed by the Pressure Drop to the Facility Vapor Connection (46 CFR 39.30-1(d)(3))

The pressure drop through the most restrictive path Tank #1P to the facility vapor connection shall not exceed 80% of the P-V valve setting. Pressure Drop calculations for each cargo at 25%, 50%, 75% and 100% of maximum loading rate are attached. From this data, a plot of allowable pressure at the facility vapor connection versus liquid loading rate is generated.

Curves are provided for representative cargoes, including:

the heaviest:	Pentane (iso-)	with a Vapor-Air mixture density of	0.347	lb/ft^3
and the lightest:		wth a mixture density of	0.076	lb/ft^3

as well as intermediate cargoes.

The maximum allowable backpressure at the FVC is: 0.544 PSIG for the highest density cargo at the maximum loading rate.

The operator shall monitor pressure at the facility vapor connection and adjust the loading rate when necessary, for the particular cargo being loaded, in order to maintain cargo tank pressure within acceptable limits.

Pipe Length and Valve & Fitting Equivalent Lengths:

Pipe sizes, nominal (in):	8
Pipe ID (in):	7.981
Pipe ID (ft):	0.665
Pipe Flow Area (in^2):	50.03
Reynold's Number:	Varies (see attached sheets)
f, friction factor, pipe:	Varies (see attached sheets)
f_t, friction factor (fittings):	0.014

Friction Factors for Clean Commercial Steel Pipe, Crane 410 Table A-25, function of Reynold's Number, pipe condition, and pipe diameter (see attached sheets)

Pipe Friction Data for Clean Commercial Steel Pipe (Turbulent Flow), Crane 410, Table A-25

CONDITION #1 - Relief through P/V Valve during loading or discharge

From #1 Cargo Tank to P/V Valve (per 46 CFR 39.30 - 1(d)(1)&(2) and ABS SBR 5-2-3/7.5.2(a)&(b))

PIPE

Description	ID (in)	Length (ft)
Straight Pipe	7.981	135.00

$L_{8"\ PIPE}$:	135.00	ft

VALVES & FITTINGS

Description	ID (in)	Qty	$L_{eq}/D = K/f_t$ [1]	K [2]		L_{eq} [3]	Total K	Total L_{eq}
Entrance	7.981	1	56	0.78		37.055	0.78	37.05
T-Branch	7.981	2	60		0.84	39.905	1.68	79.81
T-Run	7.981	2	20		0.28	13.302	0.56	26.60
90° Elbow	7.981	1	30		0.42	19.953	0.42	19.95
8x6 reducer (sudden)	7.981	1	49	0.69		32.844	0.69	32.84

$L_{EQ8"\ VALVES\ \&\ FITTINGS}$:	**196.26**	**ft**

CONDITION #2 - Vapor Collection via Shore Connection

From #1 Cargo Tank to Shore Connection (per 46 CFR 39.30 - 1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

PIPE

Description	ID (in)	Length (ft)
Straight Pipe	7.981	231.000

$L_{8"\ PIPE}$:	231.00	ft

Vapor Recovery Hose [4]	6.065	50.000

$L_{6"\ HOSE}$:	50.000	ft

VALVES & FITTINGS

Description	ID (in)	Qty	$L_{eq}/D = K/f_t$ [1]	K [2]		L_{eq} [3]	Total K	Total L_{eq}
Entrance	7.981	1	56	0.78		37.055	0.78	37.05
T-Branch	7.981	2	60		0.84	39.905	1.68	79.81
T-Run	7.981	4	20		0.28	13.302	1.12	53.21
90° Elbow	7.981	1	30		0.42	19.953	0.42	19.95
45° Elbow	7.981	4	16		0.22	10.641	0.90	42.57
8x6 reducer (60°)	7.981	1	35	0.49		23.224	0.49	23.22

$L_{EQ8"\ VALVES\ \&\ FITTINGS}$:	**255.81**	**ft**

1) L_{eq}/D and K determined from "K" Factor table, sheets 1-4, Crane 410 pp A-26 thru A-29 for valves & fittings based on turbulent flow friction factor.

2) K calculated from tabular L_{eq}/D and ft values where applicable: $K = f_t\ (L_{eq}/D)$ or directly from tabular data, where given.

3) Valve or fitting equivalent length based on pipe ID: $L_{eq} = (L_{eq}/D)xD$ or $L_{eq} = KD/f_t$ when taken directly from tabular data.

4) Hose friction factor assumed similar to Sch 40 clean commercial steel pipe, based on available manufacturer information.

SUBCHAPTER "D" CARGOES

									Loading		Discharge	
	CHRIS CODE	PRODUCT	LIQ SG	VAPOR PRESS @ 115F (psia)	VAPOR SG	VAPOR AIR WEIGHT DENSITY[1] (lb/ft^3)	VAPOR GROWTH RATE[2]	DENSITY CORRECTION FACTOR[3]	VAPOR FLOW RATE (BBL/hr)	AIR EQUIVALENT FLOW RATE (BBL/hr)	VAPOR FLOW RATE (BBL/hr)	AIR EQUIVALENT FLOW RATE (BBL/hr)
1	ACT	Acetone	0.79	10.0	2.00	0.123	1.25	1.27	6250	7949	5000	6359
2	ACP	Acetophenone	1.03	0.60	4.14	0.085	1.25	1.06	6250	6604	5000	5283
19	AAT	Amyl Acetate (iso-)	0.88	0.33	4.48	0.082	1.25	1.03	6250	6468	5000	5174
20	AAI	Amyl Alcohol (iso-, no, sec-, primary) (See also IAA)	0.82	0.30	3.04	0.079	1.25	1.02	6250	6367	5000	5094
21	AAN	Amyl Alcohol (n.)	0.82	0.30	3.04	0.079	1.25	1.02	6250	6367	5000	5094
23	APM	Amyl Alcohol, Primary	0.82	0.30	3.04	0.079	1.25	1.02	6250	6367	5000	5094
24	ASE	Amyl Alcohol, (sec-)	0.82	0.30	3.04	0.079	1.25	1.02	6250	6367	5000	5094
26	IAA	Amyl Alcohol, (iso-)	0.82	0.30	3.04	0.079	1.25	1.02	6250	6367	5000	5094
34	BAL	Benzyl Alcohol	1.05	0.10	3.73	0.077	1.25	1.01	6250	6303	5000	5042
40	BAX	Butyl Acetate (iso-. n-)	0.87	0.60	4.00	0.085	1.25	1.05	6250	6588	5000	5271
42	BTA	Butyl Acetate (sec-)	0.89	1.50	4.00	0.097	1.25	1.13	6250	7065	5000	5652
44	IAL	Butyl AlCOhol (iso-)	0.81	0.90	2.60	0.083	1.25	1.04	6250	6522	5000	5218
46	BAS	Butyl AlCOhol (sec-)	0.81	1.30	2.60	0.086	1.25	1.06	6250	6639	5000	5311
47	BAT	Butyl Alcohol (tert-)	0.78	2.80	2.60	0.097	1.25	1.13	6250	7062	5000	5649
48	BPH	Butyl Benzyl Phthalate	1.12	0.01	10.80	0.077	1.25	1.00	6250	6269	5000	5015
58	BUE	Butyl Toluene	0.85	0.10	5.11	0.078	1.25	1.01	6250	6329	5000	5063
64	CLS	Caprolactam Solutions	1.02	0.05	3.90	0.077	1.25	1.00	6250	6278	5000	5022
70	CUM	Cumene	0.86	0.60	4.20	0.085	1.25	1.06	6250	6610	5000	5288
72	CHX	Cyclohexane	0.78	4.50	2.90	0.116	1.25	1.24	6250	7726	5000	6180
73	CHN	Cyclohexanol	0.95	0.15	3.45	0.078	1.25	1.01	6250	6321	5000	5056
74	CPD	1,3-Cyclopentadiene dimer (molten)	0.69	0.25	4.55	0.080	1.25	1.03	6250	6419	5000	5135
76	CMP	Cymene (para-)	0.86	0.11	4.62	0.078	1.25	1.01	6250	6326	5000	5061
77	DHN	Decahydronaphthalene	0.89	0.10	4.76	0.078	1.25	1.01	6250	6322	5000	5058
78	IDA	Decaldehyde (iso-)	0.83	0.01	5.00	0.076	1.25	1.00	6250	6258	5000	5006
79	DAL	Decaldehyde (n-)	0.83	0.00	5.01	0.076	1.25	1.00	6250	6250	5000	5000
81	DCE	Decane	0.74	0.12	4.80	0.078	1.25	1.01	6250	6337	5000	5070
82	DAX	Decyl Alcohol (all isomers) (Decanol)	0.83	0.01	5.30	0.076	1.25	1.00	6250	6258	5000	5007
83	ISA	Decyl Alcohol (iso-)	0.83	0.01	5.30	0.076	1.25	1.00	6250	6258	5000	5007
84	DAN	Decyl Alcohol (n-)	0.83	0.01	5.30	0.076	1.25	1.00	6250	6258	5000	5007
85	DBZ	Decylbenzene (n-)	0.86	0.01	7.52	0.076	1.25	1.00	6250	6263	5000	5010
87	DAA	Diacetone Alcohol	0.97	0.10	4.00	0.078	1.25	1.01	6250	6308	5000	5046
91	DPA	Dibutyl Phthalate (ortho-)	1.05	0.00	9.59	0.076	1.25	1.00	6250	6250	5000	5000
92	DPT	Dicyclopentadlene, See 1,3-Cyclopentadlene Dimer (mo	0.98	0.25	4.55	0.080	1.25	1.03	6250	6419	5000	5135
93	DEB	Diethybenzene	0.87	0.08	4.62	0.077	1.25	1.01	6250	6306	5000	5045
94	DEG	Diethylene Glycol	1.12	0.01	3.66	0.076	1.25	1.00	6250	6255	5000	5004
95	DME	Diethylene Glycol Butyl Ether	0.95	0.01	5.50	0.076	1.25	1.00	6250	6259	5000	5007
100	DGA	Diethylene Glycol Ethyl Ether Acetate	0.99	0.02	4.62	0.076	1.25	1.00	6250	6264	5000	5011
101	DGM	Diethylene Glycol Methyl Ether	1.03	0.03	4.14	0.077	1.25	1.00	6250	6268	5000	5015
111	DBC	Diisobutylcarblnol	0.81	0.09	4.97	0.078	1.25	1.01	6250	6319	5000	5055
112	DBL	Diisobutylene	0.72	2.00	3.86	0.103	1.25	1.16	6250	7270	5000	5816
113	DIX	Diisobutyl Ketone	0.81	0.16	4.90	0.079	1.25	1.02	6250	6369	5000	5095
119	DIX	Diisopropylbenzene (all isomer)	0.86	0.03	5.60	0.077	1.25	1.00	6250	6277	5000	5021
124	DTL	Dimethyl Phthalate	1.19	0.00	6.69	0.076	1.25	1.00	6250	6250	5000	5000
128	DIF	Dinonyl Phthalate	0.97	0.01	14.40	0.077	1.25	1.00	6250	6276	5000	5021
130	DOP	Dioctyl Phthalate	0.98	0.00	13.47	0.076	1.25	1.00	6250	6250	5000	5000
131	DPN	Dipentene	0.84	0.10	4.90	0.078	1.25	1.01	6250	6325	5000	5060
132	DIL	Diphenyl	0.99	0.01	5.31	0.076	1.25	1.00	6250	6258	5000	5007
133	DDO	Diphenyl, Diphenyl Ether Mixture	1.07	0.01	5.86	0.076	1.25	1.00	6250	6259	5000	5008
134	DPE	Diphenyl Ether	1.07	0.01	5.87	0.076	1.25	1.00	6250	6259	5000	5008
136	DPG	Dipropylene GlYCOl	1.03	0.07	4.63	0.077	1.25	1.01	6250	6299	5000	5039
139	DFF	Distillates: Flashed Feed Stocks	0.75	2.30	3.40	0.102	1.25	1.16	6250	7237	5000	5790
140	DSR	Distillates: Straight Run	0.73	2.30	3.40	0.102	1.25	1.16	6250	7237	5000	5790
145	DOZ	Dodecene (all isomers)	0.76	0.02	5.81	0.077	1.25	1.00	6250	6269	5000	5015
146	DOD	Dodecene	0.76	0.02	5.81	0.077	1.25	1.00	6250	6269	5000	5015
147	DDB	Dodecylbenzene	0.86	4.70	8.40	0.240	1.25	1.77	6250	11088	5000	8870
155	ETG	Ethoxy Trlglycol (crude)	1.02	0.00	6.14	0.076	1.25	1.00	6250	6250	5000	5000
156	ETA	Ethyl Acetate	0.90	4.50	3.04	0.119	1.25	1.25	6250	7823	5000	6259
157	EAA	Ethyl Acetoacetate	1.03	0.20	4.48	0.079	1.25	1.02	6250	6383	5000	5106
158	EAL	Ethyl Alcohol (Ethanol)	0.79	3.50	1.60	0.086	1.25	1.06	6250	6643	5000	5314
160	ETB	Ethyl Benzene	0.87	0.60	3.56	0.083	1.25	1.05	6250	6540	5000	5232
161	EBT	Ethyl Butanol	0.83	0.12	3.52	0.078	1.25	1.01	6250	6308	5000	5047
162	EBR	Ethyl Butyrate	0.88	1.00	4.00	0.090	1.25	1.09	6250	6804	5000	5443
163	ECY	Ethyl Cyclohexane	0.79	0.50	3.87	0.083	1.25	1.04	6250	6521	5000	5217
166	EGL	Ethylene Glycol	1.19	0.01	2.21	0.076	1.25	1.00	6250	6252	5000	5002
169	EMA	Ethylene Glycol Butyl Ether Acetate	0.94	0.05	5.52	0.077	1.25	1.01	6250	6294	5000	5035
172	EGY	Ethylene Glycol Diacetate	1.10	0.01	5.03	0.076	1.25	1.00	6250	6258	5000	5006
178	EME	Ethylene Glycol Methyl Ether	1.10	0.01	4.80	0.076	1.25	1.00	6250	6257	5000	5006
180	EPE	Ethylene Glycol Phenyl Ether	1.10	0.01	4.80	0.076	1.25	1.00	6250	6257	5000	5006
184	EHA	2-Ethylhexaldehyde, See Octyl Aldehydes	0.82	0.17	4.41	0.079	1.25	1.02	6250	6361	5000	5089
186	EHX	2-Ethylhexanol , see Octanol (all isomers)	0.84	0.02	4.50	0.076	1.25	1.00	6250	6264	5000	5011
190	EPR	Ethyl Propionate	0.89	3.50	1.60	0.086	1.25	1.06	6250	6643	5000	5314
191	ETE	Ethyl Toulene	0.88	0.28	4.15	0.080	1.25	1.03	6250	6418	5000	5134
194	FAM	Formamide	1.13	0.10	1.55	0.076	1.25	1.00	6250	6261	5000	5009
195	FAL	Furfuryl Alcohol	1.13	0.05	3.40	0.077	1.25	1.00	6250	6273	5000	5019
197	GAK	Gasoline Blended Stocks: Alkylates	0.75	12.5	3.40	0.217	1.25	1.69	6250	10555	5000	8444
198	GRF	Gasoline Blended Stocks: Reformate	0.80	12.5	3.40	0.217	1.25	1.69	6250	10555	5000	8444
199	GAT	Gasolines: Automotive (containing not over 4.23 grams	0.74	12.5	3.40	0.217	1.25	1.69	6250	10555	5000	8444
200	GAV	Gasolines: Aviation (containing not over 4.86 grams lead	0.71	12.5	3.40	0.217	1.25	1.69	6250	10555	5000	8444
201	GCS	Gasolines: Casinghead	0.67	12.5	3.40	0.217	1.25	1.69	6250	10555	5000	8444
202	GPL	Gasolines: Polymer	0.75	12.5	3.40	0.217	1.25	1.69	6250	10555	5000	8444
203	GSR	Gasolines: Straight Run	0.75	12.5	3.40	0.217	1.25	1.69	6250	10555	5000	8444
204	GCR	Glycerine	1.26	0.00	3.17	0.076	1.25	1.00	6250	6250	5000	5000

217	HMX	Heptane (all isomers) (Methylhexane)	0.68	2.50	3.45	0.105	1.25	1.17	6250	7337	5000	5870
218	HPT	Heptane (n-)	0.68	2.50	3.45	0.105	1.25	1.17	6250	7337	5000	5870
219	HEP	Heptonic Acid	0.92	0.01	4.49	0.076	1.25	1.00	6250	6257	5000	5005
220	HTX	Heptanol (all isomers)	0.82	0.04	4.00	0.077	1.25	1.00	6250	6273	5000	5019
221	HTN	Heptanol (all isomers)	0.82	0.04	4.00	0.077	1.25	1.00	6250	6273	5000	5019
222	HPX	Heptene (all isomers)	0.70	2.90	3.40	0.109	1.25	1.20	6250	7473	5000	5979
223	THE	Heptene (1-)	0.70	2.80	3.40	0.108	1.25	1.19	6250	7434	5000	5948
224	HPE	Heptyl Acetate	0.88	0.10	5.50	0.078	1.25	1.01	6250	6336	5000	5069
229	HXS	Hexane (all isomers)	0.66	7.00	3.00	0.142	1.25	1.37	6250	8534	5000	6827
230	HXA	Hexane	0.66	7.00	3.00	0.142	1.25	1.37	6250	8534	5000	6827
231	HXO	Hexaonic Acid	0.93	0.01	4.00	0.076	1.25	1.00	6250	6256	5000	5005
232	HXN	Hexanol	0.82	1.00	3.52	0.088	1.25	1.07	6250	6719	5000	5375
234	HEX	Hexene (all isomers)	0.67	8.00	2.90	0.148	1.25	1.39	6250	8702	5000	6961
235	HXE	Hexene (1-)	0.67	8.20	2.90	0.149	1.25	1.40	6250	8754	5000	7004
236	HXT	Hexene (2-)	0.67	8.20	2.90	0.149	1.25	1.40	6250	8754	5000	7004
238	HXG	Hexylene Glycol	0.92	0.01	1.10	0.076	1.25	1.00	6250	6250	5000	5000
243	IPH	isophorone	0.93	0.01	4.75	0.076	1.25	1.00	6250	6257	5000	5006
244	JPO	Jet Fuels: JP-I (Kerosene)	0.80	0.14	4.50	0.078	1.25	1.02	6250	6344	5000	5075
245	JPT	Jet Fuels: JP-3	0.80	8.51	4.50	0.216	1.25	1.68	6250	10531	5000	8425
246	JPF	Jet Fuels: JP-4	0.81	3.40	4.00	0.124	1.25	1.28	6250	7979	5000	6383
247	JPV	Jet Fuels: JP-5 (Kerosene, heavy)	0.82	0.10	4.00	0.078	1.25	1.01	6250	6308	5000	5046
249	KRS	Kerosene	0.81	0.15	4.50	0.079	1.25	1.02	6250	6351	5000	5080
263	MTT	Methyl Acetate	0.92	6.10	2.60	0.122	1.25	1.27	6250	7912	5000	6330
265	MAL	Methyl Alcohol (See Methanol)	0.79	6.63	1.10	0.079	1.25	1.02	6250	6377	5000	5101
266	MAC	Methyl Amyl Acetate	0.86	0.33	4.97	0.082	1.25	1.04	6250	6498	5000	5198
267	MAA	Methyl Amyl Alcohol	0.81	0.43	3.52	0.081	1.25	1.03	6250	6456	5000	5165
271	MBK	Methyl n-Butyl Ketone	0.81	0.97	3.50	0.088	1.25	1.07	6250	6702	5000	5361
273	MBU	Methyl Butyrate	0.90	1.26	3.53	0.091	1.25	1.09	6250	6838	5000	5470
274	MEK	Methyl Ethyl Ketone	0.80	4.50	2.50	0.108	1.25	1.19	6250	7439	5000	5951
275	MTF	Methyl Formal (Dimethyl Formal)	0.86	15.4	2.60	0.208	1.31	1.65	6542	10805	5000	8258
276	MHK	Methyl Heptyl Ketone	0.83	0.06	4.90	0.077	1.25	1.01	6250	6295	5000	5036
278	MIK	Methyl Isobutyl Ketone	0.80	1.15	3.45	0.089	1.25	1.08	6250	6772	5000	5418
281	MNA	1-Methyl Napthalene	1.02	0.01	4.91	0.076	1.25	1.00	6250	6258	5000	5006
283	MPN	2-Methyl-1-Pentene	0.69	6.30	2.90	0.132	1.25	1.32	6250	8242	5000	6594
284	MTN	5-Methyl-1-Pentene	0.67	8.49	2.90	0.152	1.25	1.41	6250	8830	5000	7064
286	MBE	Methyl Tert-Butyl Ether (MTBE)	0.74	0.04	3.10	0.077	1.25	1.00	6250	6266	5000	5013
288	MNS	Mineral Spirits	0.75	0.20	4.30	0.079	1.25	1.02	6250	6376	5000	5101
289	MRE	Myrcene	0.80	0.17	4.70	0.079	1.25	1.02	6250	6370	5000	5096
295	NSV	Naphtha: Solvent	0.87	0.20	3.50	0.078	1.25	1.02	6250	6346	5000	5077
296	NSS	Naphtha: Stoddard Solvant	0.78	0.20	4.30	0.079	1.25	1.02	6250	6376	5000	5101
297	NVM	Naphtha: Vamlsh Maker's and Painters (75%)	0.77	0.19	4.30	0.079	1.25	1.02	6250	6370	5000	5096
300	NAX	Nonane (all isomers)	0.72	0.27	4.40	0.080	1.25	1.03	6250	6425	5000	5140
301	NAN	Nonane	0.72	0.27	4.40	0.080	1.25	1.03	6250	6425	5000	5140
304	NON	Nonene	0.73	0.35	4.30	0.082	1.25	1.04	6250	6469	5000	5175
305	NNS	Nonyl Alcohol (all isomers)	0.94	0.10	5.00	0.078	1.25	1.01	6250	6327	5000	5061
306	NNN	Nonyl Alcohol	0.94	0.10	5.00	0.078	1.25	1.01	6250	6327	5000	5061
307	NNI	Nonyl Alcohol (iso-)	0.94	0.10	5.00	0.078	1.25	1.01	6250	6327	5000	5061
309	NNP	Nonyl Phenol	0.95	0.01	7.60	0.076	1.25	1.00	6250	6263	5000	5010
316	OAX	Octane (all isomers)	0.70	0.79	3.90	0.087	1.25	1.07	6250	6677	5000	5342
317	OAN	Octane	0.70	0.79	3.90	0.087	1.25	1.07	6250	6677	5000	5342
318	OAA	Octanoic Acid (all isomers)	0.91	0.01	5.00	0.076	1.25	1.00	6250	6258	5000	5006
319	OCX	Octanol (all isomers)	0.83	0.01	4.48	0.076	1.25	1.00	6250	6257	5000	5005
320	OTA	Octanol	0.83	0.01	4.48	0.076	1.25	1.00	6250	6257	5000	5005
321	OTX	Octene (all isomers) 2	0.72	0.90	3.90	0.088	1.25	1.08	6250	6735	5000	5388
322	OTE	Octene (1-)	0.72	1.00	3.86	0.090	1.25	1.08	6250	6779	5000	5424
324	OCX	Octyl Alcohol (iso-,n.) (all isomers), See Octanol (all isomers)	0.83	0.01	4.48	0.076	1.25	1.00	6250	6257	5000	5005
325	IOA	Octyl Alcohol	0.83	0.01	4.48	0.076	1.25	1.00	6250	6257	5000	5005
364	OTW	Fuel: NO.2	0.88	0.56	8.00	0.095	1.25	1.11	6250	6965	5000	5572
366	OFR	Fuel: NO.4	0.90	0.15	3.40	0.078	1.25	1.01	6250	6319	5000	5055
367	OFV	Fuel: No.5	0.94	0.15	3.40	0.078	1.25	1.01	6250	6319	5000	5055
366	OSX	Fuel: NO.6	0.95	0.15	3.40	0.078	1.25	1.01	6250	6319	5000	5055
382	OIL	OIL, Mise: Crude	0.95	0.15	3.40	0.078	1.25	1.01	6250	6319	5000	5055
383	ODS	Oil, Mise: Diesel	0.90	0.69	3.40	0.084	1.25	1.05	6250	6562	5000	5249
389	OLB	OIL, Mise: Lubricating	0.90	0.15	1.00	0.076	1.25	1.00	6250	6250	5000	5000
403	ORS	OIL, Mise: Resin	1.02	0.15	1.00	0.076	1.25	1.00	6250	6250	5000	5000
418	OTB	Oil, Mise: Turbine	0.87	0.30	5.40	0.082	1.25	1.04	6250	6500	5000	5200
429	PDC	Pentadecanol, See Alcohols (C13 and above)	0.83	0.01	7.88	0.076	1.25	1.00	6250	6263	5000	5011
432	PTY	Pentane (all isomers)	0.63	21.00	2.48	0.270	1.42	1.88	7100	13366	5000	9412
433	IPT	Pentane (iso-)	0.62	27.00	2.48	0.347	1.54	2.13	7700	16436	5000	10673
434	PTA	Pentane (n-)	0.63	20.44	2.50	0.265	1.41	1.86	7044	13135	5000	9323
436	PTX	Pentene (all isomers)	0.64	24.90	2.40	0.310	1.50	2.02	7490	15104	5000	10082
437	PTE	Pentene (1-)	0.64	24.90	2.40	0.310	1.50	2.02	7490	15104	5000	10082
442	PIN	Pinene	0.86	0.35	4.70	0.082	1.25	1.04	6250	6495	5000	5196
448	PLB	Polybutene	0.91	0.01	79.30	0.080	1.25	1.02	6250	6399	5000	5120
457	PGC	Polypropylene Glycol	1.01	0.10	1.00	0.076	1.25	1.00	6250	6250	5000	5000
458	PGM	Polypropylene Glycol Methyl Ether	0.92	0.80	3.11	0.084	1.25	1.05	6250	6568	5000	5254
464	IAC	Propyl Acetate (iso-)	0.89	1.80	3.52	0.097	1.25	1.13	6250	7071	5000	5657
465	PAT	Propyl Acetate (n-)	0.00	1.85	3.52	0.098	1.25	1.13	6250	7093	5000	5674
466	IPA	Propyl Alcohol (iso-)	0.79	3.00	2.07	0.091	1.25	1.09	6250	6841	5000	5473
467	PAL	Propyl Alcohol (n-)	0.80	1.20	2.07	0.082	1.25	1.04	6250	6493	5000	5194
468	PBZ	Propylbenzene (n-)	0.86	0.20	4.14	0.079	1.25	1.02	6250	6370	5000	5096
469	IPX	iso-Propylcyclohexane	0.80	0.01	4.35	0.076	1.25	1.00	6250	6257	5000	5005
473	PPG	Propylene Glycol (1,2-Propandlol)	1.04	0.01	2.62	0.076	1.25	1.00	6250	6253	5000	5003
476	PME	Propylene Glycol Methyl Ether	0.92	0.70	3.11	0.083	1.25	1.04	6250	6529	5000	5223
478	PTT	Propylene Tetramer	0.29	0.02	1.00	0.076	1.25	1.00	6250	6250	5000	5000
468	SFL	Sulfolane	1.26	0.01	4.14	0.076	1.25	1.00	6250	6256	5000	5005
493	TTN	Tetradecanol	0.82	0.00	7.39	0.076	1.25	1.00	6250	6250	5000	5000
494	TTD	1-Tetradecene, See the olefin or Alpha-Olefin Entries	0.77	0.01	6.77	0.076	1.25	1.00	6250	6261	5000	5009
496	TTG	Tetraethylene Glycol	1.12	0.01	6.70	0.076	1.25	1.00	6250	6261	5000	5009
497	THN	Tetrahydronaphthalene	0.97	0.04	4.56	0.077	1.25	1.00	6250	6278	5000	5022

499	TOL	Toluene	0.87	1.50	3.14	0.091	1.25	1.09	6250	6841	5000	5473
502	TCP	Tricresyl Phosphate (less than 1% of the ortho isomer)	1.16	0.01	12.69	0.077	1.25	1.00	6250	6273	5000	5018
503	TRD	Tridecane	0.76	0.02	6.40	0.077	1.25	1.00	6250	6271	5000	5017
505	TDN	Tridecanol , See Alcohols (C13 and above)	0.85	0.01	6.91	0.076	1.25	1.00	6250	6261	5000	5009
506	TDC	l-Tridecene	0.77	0.01	6.29	0.076	1.25	1.00	6250	6260	5000	5008
508	TEB	Triethylbenzene	0.86	0.02	5.60	0.077	1.25	1.00	6250	6268	5000	5014
509	TEG	Trielhylene Glycol	1.12	0.01	5.17	0.076	1.25	1.00	6250	6258	5000	5007
519	TRE	Trimathylbenzenes (all isomers)	0.89	0.14	4.20	0.078	1.25	1.01	6250	6336	5000	5069
520	TMB	Trimethyl Benzene (1,2,5-)	0.89	0.14	4.14	0.078	1.25	1.01	6250	6334	5000	5067
521	TMD	Trimethyl Benzene (1,2,3-)	0.89	0.14	4.14	0.078	1.25	1.01	6250	6334	5000	5067
522	TME	Trimethyl Benzene (1,2,4-) (Pseudocumene)	0.89	0.14	4.14	0.078	1.25	1.01	6250	6334	5000	5067
529	TRP	Trixylenyl Phosphate	1.16	0.00	14.20	0.076	1.25	1.00	6250	6250	5000	5000
533	UDC	Undecene (1-)	0.75	0.05	5.32	0.077	1.25	1.01	6250	6292	5000	5033
534	UND	Undecyl Alcohol	0.84	0.01	5.94	0.076	1.25	1.00	6250	6260	5000	5008
546	XLX	Xylenes (Ortho-, meta., para-)	0.89	0.51	3.66	0.083	1.25	1.04	6250	6507	5000	5205
547	XLM	Xylene (M-)	0.87	0.51	3.66	0.083	1.25	1.04	6250	6507	5000	5205
548	XLO	Xylene (O-)	0.89	0.40	3.66	0.081	1.25	1.03	6250	6452	5000	5162
549	XLP	Xylene (P-)	0.86	0.51	3.66	0.083	1.25	1.04	6250	6507	5000	5205
550	XYL	Xylenol	1.01	0.10	3.66	0.077	1.25	1.01	6250	6301	5000	5041
551		Zinc Dialkyldithiophosphate										

Note: All product data extracted from Chemical Hazard Response Information System (CHRIS), Chemical Data Guide for Bulk Shipment by Water, or best available petroleum vendor data, where omitted.

1) Based on a dry air density of: **0.076** lb/ft^3 and 50%-50% mixture of vapor and air at P-V set pressure of **16.20** PSIA and T = **115** F

$\rho_{v\text{-}a} = (SG_v V_v + V_a)(0.0047(P_p/V)$ where $V_v = P_v/P_t$ and $V_a = (P_t - P_v)/P_t$, and $P_t = P_{p/v}$ (see USCG VCS Guidelines Rev 10-01, 7/15/01)

(note: vapor-air density and vapor growth rate calculations for Pentane (vapor pressure > 14.7 PSIA) are per USCG Guidelines

2) Vapor Growth Rate, R = 1 + 0.25 (VP/12.5) but not less than 1.25, in accordance with ABS SBR 5-2-3/7.5.2(d) and 46 CFR 39.30-1(b)(2) for loading. No growth rate or density correction is required for discharge (vacuum) relieving capacity per USCG guidance. Density correction has been maintained for conservatism and as a provision for fouling.

3) Density Correction Factor, F = $(\rho_{v\text{-}a}/\rho_a)^{1/2}$ per ABS SBR 5-2-3/7.5.2(d)

Pressure Drop through VCS - From #1P Cargo Tank to P/V Valve (per 46 CFR 39.30-1(d)(1)&(2) and ABS SBR 5-2-3/7.5.2(a)&(b))

Pipe sizes, nominal:	8	in
Pipe ID:	7.981	in
Pipe Flow Area:	50.03	in^2
Vapor Dynamic Viscosity:	0.019	cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)

PIPE LENGTH

Length (ft):	135	ft (Condition 1)
f, friction factor (pipe):	Varies with Reynold's Number (see table below)	

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft):	196.26	ft (Condition 1)
f_t, friction factor, turbulent flow (fittings):	0.014	constant, for each pipe size

Loading (Pressure) Condition:

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
						8" Pipe			8" Pipe			8" Pipe					8" Pipe	8" Fittings					8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s									ft/s					ft	ft					psi	psi	psi
1	0.123	6250	9.75			179807			0.0175			28.1					43.54	50.51					0.0372	0.0432	0.0804
2	0.085	6250	9.75			124102			0.0185			28.1					45.89	50.51					0.0271	0.0298	0.0569
19	0.082	6250	9.75			119053			0.0186			28.1					46.18	50.51					0.0261	0.0286	0.0547
20	0.079	6250	9.75			115371			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
21	0.079	6250	9.75			115371			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
23	0.079	6250	9.75			115371			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
24	0.079	6250	9.75			115371			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
26	0.079	6250	9.75			115371			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
34	0.077	6250	9.75			113045			0.0188			28.1					46.55	50.51					0.0250	0.0272	0.0522
40	0.085	6250	9.75			123525			0.0185			28.1					45.92	50.51					0.0270	0.0297	0.0566
42	0.097	6250	9.75			142057			0.0181			28.1					44.98	50.51					0.0304	0.0341	0.0645
44	0.083	6250	9.75			121054			0.0186			28.1					46.06	50.51					0.0265	0.0291	0.0556
46	0.086	6250	9.75			125447			0.0185			28.1					45.81	50.51					0.0273	0.0301	0.0575
47	0.097	6250	9.75			141920			0.0181			28.1					44.99	50.51					0.0304	0.0341	0.0644
48	0.077	6250	9.75			111843			0.0188			28.1					46.63	50.51					0.0248	0.0269	0.0517
58	0.078	6250	9.75			113992			0.0187			28.1					46.49	50.51					0.0252	0.0274	0.0526
64	0.077	6250	9.75			112166			0.0188			28.1					46.61	50.51					0.0249	0.0269	0.0518
70	0.085	6250	9.75			124349			0.0185			28.1					45.88	50.51					0.0271	0.0299	0.0570
72	0.116	6250	9.75			169855			0.0177			28.1					43.88	50.51					0.0354	0.0408	0.0762
73	0.078	6250	9.75			113693			0.0187			28.1					46.51	50.51					0.0251	0.0273	0.0525
74	0.080	6250	9.75			117262			0.0187			28.1					46.29	50.51					0.0258	0.0282	0.0540
76	0.078	6250	9.75			113904			0.0187			28.1					46.50	50.51					0.0252	0.0274	0.0525
77	0.078	6250	9.75			113752			0.0187			28.1					46.51	50.51					0.0252	0.0273	0.0525
78	0.076	6250	9.75			111445			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
79	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
81	0.078	6250	9.75			114301			0.0187			28.1					46.47	50.51					0.0253	0.0275	0.0527
82	0.076	6250	9.75			111466			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
83	0.076	6250	9.75			111466			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
84	0.076	6250	9.75			111466			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
85	0.076	6250	9.75			111618			0.0188			28.1					46.64	50.51					0.0248	0.0268	0.0516
87	0.078	6250	9.75			113230			0.0188			28.1					46.54	50.51					0.0251	0.0272	0.0523
91	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
92	0.080	6250	9.75			117262			0.0187			28.1					46.29	50.51					0.0258	0.0282	0.0540
93	0.077	6250	9.75			113158			0.0188			28.1					46.54	50.51					0.0250	0.0272	0.0522
94	0.076	6250	9.75			111353			0.0188			28.1					46.66	50.51					0.0247	0.0267	0.0515
95	0.076	6250	9.75			111480			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
100	0.076	6250	9.75			111668			0.0188			28.1					46.64	50.51					0.0248	0.0268	0.0516
101	0.077	6250	9.75			111817			0.0188			28.1					46.63	50.51					0.0248	0.0269	0.0517
111	0.078	6250	9.75			113623			0.0187			28.1					46.51	50.51					0.0251	0.0273	0.0524
112	0.103	6250	9.75			150431			0.0180			28.1					44.62	50.51					0.0319	0.0361	0.0680
113	0.079	6250	9.75			115454			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
119	0.077	6250	9.75			112118			0.0188			28.1					46.61	50.51					0.0249	0.0269	0.0518
124	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
128	0.077	6250	9.75			112091			0.0188			28.1					46.61	50.51					0.0248	0.0269	0.0518
130	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
131	0.078	6250	9.75			113848			0.0187			28.1					46.50	50.51					0.0252	0.0273	0.0525
132	0.076	6250	9.75			111467			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
133	0.076	6250	9.75			111504			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
134	0.076	6250	9.75			111505			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515

136	0.077	6250	9.75			112915			0.0188			28.1					46.56	50.51					0.0250	0.0271	0.0521
139	0.102	6250	9.75			149058			0.0180			28.1					44.67	50.51					0.0317	0.0358	0.0675
140	0.102	6250	9.75			149058			0.0180			28.1					44.67	50.51					0.0317	0.0358	0.0675
145	0.077	6250	9.75			111831			0.0188			28.1					46.63	50.51					0.0248	0.0269	0.0517
146	0.077	6250	9.75			111831			0.0188			28.1					46.63	50.51					0.0248	0.0269	0.0517
147	0.240	6250	9.75			349889			0.0163			28.1					40.34	50.51					0.0671	0.0840	0.1512
155	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
156	0.119	6250	9.75			174179			0.0176			28.1					43.73	50.51					0.0362	0.0418	0.0781
157	0.079	6250	9.75			115948			0.0187			28.1					46.37	50.51					0.0256	0.0278	0.0534
158	0.086	6250	9.75			125584			0.0185			28.1					45.81	50.51					0.0274	0.0302	0.0575
160	0.083	6250	9.75			121713			0.0185			28.1					46.02	50.51					0.0266	0.0292	0.0559
161	0.078	6250	9.75			113246			0.0188			28.1					46.54	50.51					0.0251	0.0272	0.0523
162	0.090	6250	9.75			131762			0.0183			28.1					45.48	50.51					0.0285	0.0316	0.0601
163	0.083	6250	9.75			121020			0.0186			28.1					46.06	50.51					0.0265	0.0291	0.0556
166	0.076	6250	9.75			111254			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
169	0.077	6250	9.75			112722			0.0188			28.1					46.57	50.51					0.0250	0.0271	0.0520
172	0.076	6250	9.75			111447			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
178	0.076	6250	9.75			111432			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
180	0.076	6250	9.75			111432			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
184	0.079	6250	9.75			115150			0.0187			28.1					46.42	50.51					0.0254	0.0277	0.0531
186	0.076	6250	9.75			111651			0.0188			28.1					46.64	50.51					0.0248	0.0268	0.0516
190	0.086	6250	9.75			125584			0.0185			28.1					45.81	50.51					0.0274	0.0302	0.0575
191	0.080	6250	9.75			117225			0.0187			28.1					46.29	50.51					0.0258	0.0282	0.0540
194	0.076	6250	9.75			111548			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
195	0.077	6250	9.75			111994			0.0188			28.1					46.62	50.51					0.0248	0.0269	0.0517
197	0.217	6250	9.75			317081			0.0164			28.1					40.74	50.51					0.0614	0.0762	0.1376
198	0.217	6250	9.75			317081			0.0164			28.1					40.74	50.51					0.0614	0.0762	0.1376
199	0.217	6250	9.75			317081			0.0164			28.1					40.74	50.51					0.0614	0.0762	0.1376
200	0.217	6250	9.75			317081			0.0164			28.1					40.74	50.51					0.0614	0.0762	0.1376
201	0.217	6250	9.75			317081			0.0164			28.1					40.74	50.51					0.0614	0.0762	0.1376
202	0.217	6250	9.75			317081			0.0164			28.1					40.74	50.51					0.0614	0.0762	0.1376
203	0.217	6250	9.75			317081			0.0164			28.1					40.74	50.51					0.0614	0.0762	0.1376
204	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
217	0.105	6250	9.75			153211			0.0179			28.1					44.50	50.51					0.0324	0.0368	0.0692
218	0.105	6250	9.75			153211			0.0179			28.1					44.50	50.51					0.0324	0.0368	0.0692
219	0.076	6250	9.75			111410			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
220	0.077	6250	9.75			111994			0.0188			28.1					46.62	50.51					0.0248	0.0269	0.0517
221	0.077	6250	9.75			111994			0.0188			28.1					46.62	50.51					0.0248	0.0269	0.0517
222	0.109	6250	9.75			158942			0.0178			28.1					44.27	50.51					0.0335	0.0382	0.0716
223	0.108	6250	9.75			157295			0.0179			28.1					44.34	50.51					0.0332	0.0378	0.0709
224	0.078	6250	9.75			114259			0.0187			28.1					46.47	50.51					0.0253	0.0274	0.0527
229	0.142	6250	9.75			207262			0.0172			28.1					42.76	50.51					0.0421	0.0498	0.0919
230	0.142	6250	9.75			207262			0.0172			28.1					42.76	50.51					0.0421	0.0498	0.0919
231	0.076	6250	9.75			111377			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
232	0.088	6250	9.75			128467			0.0184			28.1					45.65	50.51					0.0279	0.0309	0.0587
234	0.148	6250	9.75			215498			0.0171			28.1					42.55	50.51					0.0436	0.0518	0.0954
235	0.149	6250	9.75			218107			0.0171			28.1					42.49	50.51					0.0441	0.0524	0.0965
236	0.149	6250	9.75			218107			0.0171			28.1					42.49	50.51					0.0441	0.0524	0.0965
238	0.076	6250	9.75			111178			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
243	0.076	6250	9.75			111428			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
244	0.078	6250	9.75			114534			0.0187			28.1					46.46	50.51					0.0253	0.0275	0.0528
245	0.216	6250	9.75			315605			0.0164			28.1					40.76	50.51					0.0612	0.0758	0.1370
246	0.124	6250	9.75			181180			0.0175			28.1					43.50	50.51					0.0375	0.0435	0.0810
247	0.078	6250	9.75			113230			0.0188			28.1					46.54	50.51					0.0251	0.0272	0.0523
249	0.079	6250	9.75			114774			0.0187			28.1					46.44	50.51					0.0253	0.0276	0.0529
263	0.122	6250	9.75			178160			0.0176			28.1					43.60	50.51					0.0369	0.0428	0.0797
265	0.079	6250	9.75			115721			0.0187			28.1					46.38	50.51					0.0255	0.0278	0.0533
266	0.082	6250	9.75			120163			0.0186			28.1					46.11	50.51					0.0264	0.0289	0.0552
267	0.081	6250	9.75			118608			0.0186			28.1					46.21	50.51					0.0261	0.0285	0.0545
271	0.088	6250	9.75			127815			0.0184			28.1					45.69	50.51					0.0278	0.0307	0.0585
273	0.091	6250	9.75			133051			0.0183			28.1					45.41	50.51					0.0287	0.0320	0.0607
274	0.108	6250	9.75			157501			0.0179			28.1					44.33	50.51					0.0332	0.0378	0.0710
275	0.208	6542	10.20			317432			0.0164			29.4					44.63	55.34					0.0644	0.0798	0.1442
276	0.077	6250	9.75			112777			0.0188			28.1					46.57	50.51					0.0250	0.0271	0.0521
278	0.089	6250	9.75			130509			0.0184			28.1					45.54	50.51					0.0283	0.0313	0.0596
281	0.076	6250	9.75			111439			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
283	0.132	6250	9.75			193329			0.0174			28.1					43.13	50.51					0.0397	0.0464	0.0861
284	0.152	6250	9.75			221889			0.0171			28.1					42.40	50.51					0.0447	0.0533	0.0980
286	0.077	6250	9.75			111747			0.0188			28.1					46.63	50.51					0.0248	0.0268	0.0516

288	0.079	6250	9.75			115701			0.0187			28.1					46.38	50.51					0.0255	0.0278	0.0533
289	0.079	6250	9.75			115488			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
295	0.078	6250	9.75			114603			0.0187			28.1					46.45	50.51					0.0253	0.0275	0.0528
296	0.079	6250	9.75			115701			0.0187			28.1					46.38	50.51					0.0255	0.0278	0.0533
297	0.079	6250	9.75			115474			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
300	0.080	6250	9.75			117472			0.0186			28.1					46.27	50.51					0.0258	0.0282	0.0541
301	0.080	6250	9.75			117472			0.0186			28.1					46.27	50.51					0.0258	0.0282	0.0541
304	0.082	6250	9.75			119098			0.0186			28.1					46.18	50.51					0.0262	0.0286	0.0548
305	0.078	6250	9.75			113916			0.0187			28.1					46.49	50.51					0.0252	0.0274	0.0525
306	0.078	6250	9.75			113916			0.0187			28.1					46.49	50.51					0.0252	0.0274	0.0525
307	0.078	6250	9.75			113916			0.0187			28.1					46.49	50.51					0.0252	0.0274	0.0525
309	0.076	6250	9.75			111624			0.0188			28.1					46.64	50.51					0.0248	0.0268	0.0516
316	0.087	6250	9.75			126895			0.0184			28.1					45.74	50.51					0.0276	0.0305	0.0581
317	0.087	6250	9.75			126895			0.0184			28.1					45.74	50.51					0.0276	0.0305	0.0581
318	0.076	6250	9.75			111445			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
319	0.076	6250	9.75			111410			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
320	0.076	6250	9.75			111410			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
321	0.088	6250	9.75			129085			0.0184			28.1					45.62	50.51					0.0280	0.0310	0.0590
322	0.090	6250	9.75			130801			0.0183			28.1					45.53	50.51					0.0283	0.0314	0.0597
324	0.076	6250	9.75			111410			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
325	0.076	6250	9.75			111410			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
364	0.095	6250	9.75			138076			0.0182			28.1					45.17	50.51					0.0297	0.0332	0.0628
366	0.078	6250	9.75			113642			0.0187			28.1					46.51	50.51					0.0251	0.0273	0.0524
367	0.078	6250	9.75			113642			0.0187			28.1					46.51	50.51					0.0251	0.0273	0.0524
366	0.078	6250	9.75			113642			0.0187			28.1					46.51	50.51					0.0251	0.0273	0.0524
382	0.078	6250	9.75			113642			0.0187			28.1					46.51	50.51					0.0251	0.0273	0.0524
383	0.084	6250	9.75			122537			0.0185			28.1					45.98	50.51					0.0268	0.0294	0.0562
389	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
403	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
418	0.082	6250	9.75			120231			0.0186			28.1					46.11	50.51					0.0264	0.0289	0.0552
429	0.076	6250	9.75			111643			0.0188			28.1					46.64	50.51					0.0248	0.0268	0.0516
432	0.270	7100	11.07			447519			0.0159			31.9					50.89	65.18					0.0953	0.1221	0.2174
433	0.347	7700	12.01			624005			0.0155			34.6					58.32	76.66					0.1405	0.1847	0.3251
434	0.265	7044	10.99			435634			0.0159			31.6					50.21	64.16					0.0923	0.1179	0.2102
436	0.310	7490	11.68			541719			0.0156			33.6					55.76	72.54					0.1199	0.1559	0.2758
437	0.310	7490	11.68			541719			0.0156			33.6					55.76	72.54					0.1199	0.1559	0.2758
442	0.082	6250	9.75			120059			0.0186			28.1					46.12	50.51					0.0263	0.0288	0.0552
448	0.080	6250	9.75			116545			0.0187			28.1					46.33	50.51					0.0257	0.0280	0.0537
457	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
458	0.084	6250	9.75			122757			0.0185			28.1					45.96	50.51					0.0268	0.0295	0.0563
464	0.097	6250	9.75			142304			0.0181			28.1					44.97	50.51					0.0304	0.0342	0.0646
465	0.098	6250	9.75			143169			0.0181			28.1					44.93	50.51					0.0306	0.0344	0.0650
466	0.091	6250	9.75			133203			0.0183			28.1					45.41	50.51					0.0288	0.0320	0.0608
467	0.082	6250	9.75			119984			0.0186			28.1					46.12	50.51					0.0263	0.0288	0.0551
468	0.079	6250	9.75			115481			0.0187			28.1					46.40	50.51					0.0255	0.0277	0.0532
469	0.076	6250	9.75			111401			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
473	0.076	6250	9.75			111282			0.0188			28.1					46.66	50.51					0.0247	0.0267	0.0514
476	0.083	6250	9.75			121308			0.0186			28.1					46.05	50.51					0.0266	0.0291	0.0557
478	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
468	0.076	6250	9.75			111386			0.0188			28.1					46.66	50.51					0.0247	0.0268	0.0515
493	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
494	0.076	6250	9.75			111567			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
496	0.076	6250	9.75			111562			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
497	0.077	6250	9.75			112148			0.0188			28.1					46.61	50.51					0.0249	0.0269	0.0518
499	0.091	6250	9.75			133203			0.0183			28.1					45.41	50.51					0.0288	0.0320	0.0608
502	0.077	6250	9.75			111973			0.0188			28.1					46.62	50.51					0.0248	0.0269	0.0517
503	0.077	6250	9.75			111912			0.0188			28.1					46.62	50.51					0.0248	0.0269	0.0517
505	0.076	6250	9.75			111576			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
506	0.076	6250	9.75			111534			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
508	0.077	6250	9.75			111802			0.0188			28.1					46.63	50.51					0.0248	0.0269	0.0516
509	0.076	6250	9.75			111457			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
519	0.078	6250	9.75			114246			0.0187			28.1					46.47	50.51					0.0252	0.0274	0.0527
520	0.078	6250	9.75			114188			0.0187			28.1					46.48	50.51					0.0252	0.0274	0.0527
521	0.078	6250	9.75			114188			0.0187			28.1					46.48	50.51					0.0252	0.0274	0.0527
522	0.078	6250	9.75			114188			0.0187			28.1					46.48	50.51					0.0252	0.0274	0.0527
529	0.076	6250	9.75			111171			0.0188			28.1					46.67	50.51					0.0247	0.0267	0.0514
533	0.077	6250	9.75			112653			0.0188			28.1					46.58	50.51					0.0250	0.0271	0.0520
534	0.076	6250	9.75			111510			0.0188			28.1					46.65	50.51					0.0247	0.0268	0.0515
546	0.083	6250	9.75			120482			0.0186			28.1					46.10	50.51					0.0264	0.0289	0.0553

547	0.083	6250	9.75			120482			0.0186			28.1					46.10	50.51					0.0264	0.0289	0.0553
548	0.081	6250	9.75			118474			0.0186			28.1					46.21	50.51					0.0260	0.0285	0.0545
549	0.083	6250	9.75			120482			0.0186			28.1					46.10	50.51					0.0264	0.0289	0.0553
550	0.077	6250	9.75			112997			0.0188			28.1					#REF!	50.51					0.0250	0.0271	0.0522

Notes: 1) Vapor flow rate used in loading condition is vapor equivalent loading rate including vapor growth rate

2) Air equivalent flow rate derived from maximum liquid discharge rate and a density correction factor for conservatism (see list of allowable cargoes for details)

MAX ΔP:	0.3251

Maximum design pressure of tank: 3.00 psi

Loading (Pressure) Summary:

Cargo	Piping ΔP	Vapor Flowrate	Air Equivalent Flowrate		ΔP across P-V[1]		Total Vapor ΔP thru P-V system
	psi	BBL/hr	BBL/hr	ft^3/hr	kPa	psi	psi
Acetone	0.080	6250	7949	44632	n/a	2.23	2.310
Acetophenone	0.057	6250	6604	37079	n/a	2.23	2.287
Amyl Acetate (iso-)	0.055	6250	6468	36317	n/a	2.23	2.285
Amyl Alcohol (iso-, no, sec-, primary) (See also IAA)	0.053	6250	6367	35751	n/a	2.23	2.283
Amyl Alcohol (n.)	0.053	6250	6367	35751	n/a	2.23	2.283
Amyl Alcohol, Primary	0.053	6250	6367	35751	n/a	2.23	2.283
Amyl Alcohol, (sec-)	0.053	6250	6367	35751	n/a	2.23	2.283
Amyl Alcohol, (iso-)	0.053	6250	6367	35751	n/a	2.23	2.283
Benzyl Alcohol	0.052	6250	6303	35389	n/a	2.23	2.282
Butyl Acetate (iso-. n-)	0.057	6250	6588	36993	n/a	2.23	2.287
Butyl Acetate (sec-)	0.065	6250	7065	39671	n/a	2.23	2.295
Butyl AlCOhol (iso-)	0.056	6250	6522	36621	n/a	2.23	2.286
Butyl AlCOhol (sec-)	0.057	6250	6639	37279	n/a	2.23	2.287
Butyl Alcohol (tert-)	0.064	6250	7062	39652	n/a	2.23	2.294
Butyl Benzyl Phthalate	0.052	6250	6269	35200	n/a	2.23	2.282
Butyl Toluene	0.053	6250	6329	35537	n/a	2.23	2.283
Caprolactam Solutions	0.052	6250	6278	35251	n/a	2.23	2.282
Cumene	0.057	6250	6610	37116	n/a	2.23	2.287
Cyclohexane	0.076	6250	7726	43379	n/a	2.23	2.306
Cyclohexanol	0.052	6250	6321	35490	n/a	2.23	2.282
1,3-Cyclopentadiene dimer (molten)	0.054	6250	6419	36043	n/a	2.23	2.284
Cymene (para-)	0.053	6250	6326	35523	n/a	2.23	2.283
Decahydronaphthalene	0.052	6250	6322	35499	n/a	2.23	2.282
Decaldehyde (iso-)	0.051	6250	6258	35137	n/a	2.23	2.281
Decaldehyde (n-)	0.051	6250	6250	35094	n/a	2.23	2.281
Decane	0.053	6250	6337	35585	n/a	2.23	2.283
Decyl Alcohol (all isomers) (Decanol)	0.052	6250	6258	35141	n/a	2.23	2.282
Decyl Alcohol (iso-)	0.052	6250	6258	35141	n/a	2.23	2.282
Decyl Alcohol (n-)	0.052	6250	6258	35141	n/a	2.23	2.282
Decylbenzene (n-)	0.052	6250	6263	35165	n/a	2.23	2.282
Diacetone Alcohol	0.052	6250	6308	35418	n/a	2.23	2.282
Dibutyl Phthalate (ortho-)	0.051	6250	6250	35094	n/a	2.23	2.281
Dicyclopentadlene, See 1,3-Cyclopentadlene Dimer (mo	0.054	6250	6419	36043	n/a	2.23	2.284
Diethybenzene	0.052	6250	6306	35406	n/a	2.23	2.282
Diethylene Glycol	0.051	6250	6255	35123	n/a	2.23	2.281
Diethylene Glycol Butyl Ether	0.052	6250	6259	35143	n/a	2.23	2.282
Diethylene Glycol Ethyl Ether Acetate	0.052	6250	6264	35172	n/a	2.23	2.282
Diethylene Glycol Methyl Ether	0.052	6250	6268	35196	n/a	2.23	2.282
Diisobutylcarblnol	0.052	6250	6319	35479	n/a	2.23	2.282
Diisobutylene	0.068	6250	7270	40823	n/a	2.23	2.298
DIisobutyl Ketone	0.053	6250	6369	35764	n/a	2.23	2.283
Diisopropylbenzene (all isomer)	0.052	6250	6277	35243	n/a	2.23	2.282
Dimethyl Phthalate	0.051	6250	6250	35094	n/a	2.23	2.281
Dinonyl Phthalate	0.052	6250	6276	35239	n/a	2.23	2.282
Dioctyl Phthalate	0.051	6250	6250	35094	n/a	2.23	2.281
Dipentene	0.053	6250	6325	35514	n/a	2.23	2.283
Diphenyl	0.052	6250	6258	35141	n/a	2.23	2.282
Diphenyl, Diphenyl Ether Mixture	0.052	6250	6259	35147	n/a	2.23	2.282
Diphenyl Ether	0.052	6250	6259	35147	n/a	2.23	2.282
Dipropylene GlYCOl	0.052	6250	6299	35368	n/a	2.23	2.282
Distillates: Flashed Feed Stocks	0.067	6250	7237	40637	n/a	2.23	2.297
Distillates: Straight Run	0.067	6250	7237	40637	n/a	2.23	2.297
Dodecene (all isomers)	0.052	6250	6269	35198	n/a	2.23	2.282

Dodecene	0.052	6250	6269	35198	n/a	2.23	2.282
Dodecylbenzene	0.151	6250	11088	62259	n/a	2.23	2.381
Ethoxy Trlglycol (crude)	0.051	6250	6250	35094	n/a	2.23	2.281
Ethyl Acetate	0.078	6250	7823	43928	n/a	2.23	2.308
Ethyl Acetoacetate	0.053	6250	6383	35840	n/a	2.23	2.283
Ethyl Alcohol (Ethanol)	0.058	6250	6643	37300	n/a	2.23	2.288
Ethyl Benzene	0.056	6250	6540	36720	n/a	2.23	2.286
Ethyl Butanol	0.052	6250	6308	35420	n/a	2.23	2.282
Ethyl Butyrate	0.060	6250	6804	38206	n/a	2.23	2.290
Ethyl Cyclohexane	0.056	6250	6521	36616	n/a	2.23	2.286
Ethylene Glycol	0.051	6250	6252	35107	n/a	2.23	2.281
Ethylene Glycol Butyl Ether Acetate	0.052	6250	6294	35338	n/a	2.23	2.282
Ethylene Glycol Diacetate	0.051	6250	6258	35138	n/a	2.23	2.281
Ethylene Glycol Methyl Ether	0.051	6250	6257	35135	n/a	2.23	2.281
Ethylene Glycol Phenyl Ether	0.051	6250	6257	35135	n/a	2.23	2.281
2-Ethylhexaldehyde, See Octyl Aldehydes	0.053	6250	6361	35717	n/a	2.23	2.283
2-Ethylhexanol , see Octanol (all isomers)	0.052	6250	6264	35170	n/a	2.23	2.282
Ethyl Propionate	0.058	6250	6643	37300	n/a	2.23	2.288
Ethyl Toulene	0.054	6250	6418	36037	n/a	2.23	2.284
Formamide	0.052	6250	6261	35154	n/a	2.23	2.282
Furfuryl Alcohol	0.052	6250	6273	35224	n/a	2.23	2.282
Gasoline Blended Stocks: Alkylates	0.138	6250	10555	59268	n/a	2.23	2.368
Gasoline Blended Stocks: Reformate	0.138	6250	10555	59268	n/a	2.23	2.368
Gasolines: Automotive (containing not over 4.23 grams	0.138	6250	10555	59268	n/a	2.23	2.368
Gasolines: Aviation (containing not over 4.86 grams lead	0.138	6250	10555	59268	n/a	2.23	2.368
Gasolines: Casinghead	0.138	6250	10555	59268	n/a	2.23	2.368
Gasolines: Polymer	0.138	6250	10555	59268	n/a	2.23	2.368
Gasolines: Straight Run	0.138	6250	10555	59268	n/a	2.23	2.368
Glycerine	0.051	6250	6250	35094	n/a	2.23	2.281
Heptane (all isomers) (Methylhexane)	0.069	6250	7337	41199	n/a	2.23	2.299
Heptane (n-)	0.069	6250	7337	41199	n/a	2.23	2.299
Heptonic Acid	0.051	6250	6257	35132	n/a	2.23	2.281
Heptanol (all isomers)	0.052	6250	6273	35224	n/a	2.23	2.282
Heptanol (all isomers)	0.052	6250	6273	35224	n/a	2.23	2.282
Heptene (all isomers)	0.072	6250	7473	41962	n/a	2.23	2.302
Heptene (1-)	0.071	6250	7434	41744	n/a	2.23	2.301
Heptyl Acetate	0.053	6250	6336	35578	n/a	2.23	2.283
Hexane (all isomers)	0.092	6250	8534	47918	n/a	2.23	2.322
Hexane	0.092	6250	8534	47918	n/a	2.23	2.322
Hexaonic Acid	0.051	6250	6256	35127	n/a	2.23	2.281
Hexanol	0.059	6250	6719	37725	n/a	2.23	2.289
Hexene (all isomers)	0.095	6250	8702	48861	n/a	2.23	2.325
Hexene (1-)	0.096	6250	8754	49156	n/a	2.23	2.326
Hexene (2-)	0.096	6250	8754	49156	n/a	2.23	2.326
Hexylene Glycol	0.051	6250	6250	35095	n/a	2.23	2.281
isophorone	0.051	6250	6257	35135	n/a	2.23	2.281
Jet Fuels: JP-l (Kerosene)	0.053	6250	6344	35621	n/a	2.23	2.283
Jet Fuels: JP-3	0.137	6250	10531	59130	n/a	2.23	2.367
Jet Fuels: JP-4	0.081	6250	7979	44802	n/a	2.23	2.311
Jet Fuels: JP-5 (Kerosene, heavy)	0.052	6250	6308	35418	n/a	2.23	2.282
Kerosene	0.053	6250	6351	35658	n/a	2.23	2.283
Methyl Acetate	0.080	6250	7912	44427	n/a	2.23	2.310
Methyl Alcohol (See Methanol)	0.053	6250	6377	35805	n/a	2.23	2.283
Methyl Amyl Acetate	0.055	6250	6498	36486	n/a	2.23	2.285
Methyl Amyl Alcohol	0.055	6250	6456	36249	n/a	2.23	2.285
Methyl n-Butyl Ketone	0.058	6250	6702	37630	n/a	2.23	2.288
Methyl Butyrate	0.061	6250	6838	38393	n/a	2.23	2.291
Methyl Ethyl Ketone	0.071	6250	7439	41771	n/a	2.23	2.301
Methyl Formal (Dimethyl Formal)	0.144	6542	10805	60671	n/a	2.23	2.374
Methyl Heptyl Ketone	0.052	6250	6295	35347	n/a	2.23	2.282

Methyl Isobutyl Ketone	0.060	6250	6772	38024	n/a	2.23	2.290
1-Methyl Napthalene	0.051	6250	6258	35136	n/a	2.23	2.281
2-Methyl-1-Pentene	0.086	6250	8242	46279	n/a	2.23	2.316
5-Methyl-1-Pentene	0.098	6250	8830	49580	n/a	2.23	2.328
Methyl Tert-Butyl Ether (MTBE)	0.052	6250	6266	35185	n/a	2.23	2.282
Mineral Spirits	0.053	6250	6376	35802	n/a	2.23	2.283
Myrcene	0.053	6250	6370	35769	n/a	2.23	2.283
Naphtha: Solvent	0.053	6250	6346	35632	n/a	2.23	2.283
Naphtha: Stoddard Solvant	0.053	6250	6376	35802	n/a	2.23	2.283
Naphtha: Vamlsh Maker's and Painters (75%)	0.053	6250	6370	35767	n/a	2.23	2.283
Nonane (all isomers)	0.054	6250	6425	36075	n/a	2.23	2.284
Nonane	0.054	6250	6425	36075	n/a	2.23	2.284
Nonene	0.055	6250	6469	36324	n/a	2.23	2.285
Nonyl Alcohol (all isomers)	0.053	6250	6327	35525	n/a	2.23	2.283
Nonyl Alcohol	0.053	6250	6327	35525	n/a	2.23	2.283
Nonyl Alcohol (iso-)	0.053	6250	6327	35525	n/a	2.23	2.283
Nonyl Phenol	0.052	6250	6263	35165	n/a	2.23	2.282
Octane (all isomers)	0.058	6250	6677	37494	n/a	2.23	2.288
Octane	0.058	6250	6677	37494	n/a	2.23	2.288
Octanoic Acid (all isomers)	0.051	6250	6258	35137	n/a	2.23	2.281
Octanol (all isomers)	0.051	6250	6257	35132	n/a	2.23	2.281
Octanol	0.051	6250	6257	35132	n/a	2.23	2.281
Octene (all isomers) 2	0.059	6250	6735	37816	n/a	2.23	2.289
Octene (1-)	0.060	6250	6779	38067	n/a	2.23	2.290
Octyl Alcohol (iso-,n.) (all isomers), See Octanol (all isomers)	0.051	6250	6257	35132	n/a	2.23	2.281
Octyl Alcohol	0.051	6250	6257	35132	n/a	2.23	2.281
Fuel: NO.2	0.063	6250	6965	39111	n/a	2.23	2.293
Fuel: NO.4	0.052	6250	6319	35482	n/a	2.23	2.282
Fuel: No.5	0.052	6250	6319	35482	n/a	2.23	2.282
Fuel: NO.6	0.052	6250	6319	35482	n/a	2.23	2.282
OIL, Mise: Crude	0.052	6250	6319	35482	n/a	2.23	2.282
Oil, Mise: Diesel	0.056	6250	6562	36844	n/a	2.23	2.286
OIL, Mise: Lubricating	0.051	6250	6250	35094	n/a	2.23	2.281
OIL, Mise: Resin	0.051	6250	6250	35094	n/a	2.23	2.281
Oil, Mise: Turbine	0.055	6250	6500	36496	n/a	2.23	2.285
Pentadecanol, See Alcohols (C13 and above)	0.052	6250	6263	35169	n/a	2.23	2.282
Pentane (all isomers)	0.217	7100	13366	75047	n/a	2.23	2.447
Pentane (iso-)	0.325	7700	16436	92286	n/a	2.23	2.555
Pentane (n-)	0.210	7044	13135	73751	n/a	2.23	2.440
Pentene (all isomers)	0.276	7490	15104	84806	n/a	2.23	2.506
Pentene (1-)	0.276	7490	15104	84806	n/a	2.23	2.506
Pinene	0.055	6250	6495	36470	n/a	2.23	2.285
Polybutene	0.054	6250	6399	35932	n/a	2.23	2.284
Polypropylene Glycol	0.051	6250	6250	35094	n/a	2.23	2.281
Polypropylene Glycol Methyl Ether	0.056	6250	6568	36877	n/a	2.23	2.286
Propyl Acetate (iso-)	0.065	6250	7071	39705	n/a	2.23	2.295
Propyl Acetate (n-)	0.065	6250	7093	39826	n/a	2.23	2.295
Propyl Alcohol (iso-)	0.061	6250	6841	38415	n/a	2.23	2.291
Propyl Alcohol (n-)	0.055	6250	6493	36459	n/a	2.23	2.285
Propylbenzene (n-)	0.053	6250	6370	35768	n/a	2.23	2.283
iso-Propylcyclohexane	0.051	6250	6257	35130	n/a	2.23	2.281
Propylene Glycol (1,2-Propandlol)	0.051	6250	6253	35112	n/a	2.23	2.281
Propylene Glycol Methyl Ether	0.056	6250	6529	36659	n/a	2.23	2.286
Propylene Tetramer	0.051	6250	6250	35094	n/a	2.23	2.281
Sulfolane	0.051	6250	6256	35128	n/a	2.23	2.281
Tetradecanol	0.051	6250	6250	35094	n/a	2.23	2.281
1-Tetradecene, See the olefin or Alpha-Olefin Entries	0.052	6250	6261	35157	n/a	2.23	2.282
Tetraethylene Glycol	0.052	6250	6261	35156	n/a	2.23	2.282
Tetrahydronaphthalene	0.052	6250	6278	35248	n/a	2.23	2.282
Toluene	0.061	6250	6841	38415	n/a	2.23	2.291

Tricresyl Phosphate (less than 1% of the ortho isomer)	0.052	6250	6273	35220	n/a	2.23	2.282
Tridecane	0.052	6250	6271	35211	n/a	2.23	2.282
Tridecanol , See Alcohols (C13 and above)	0.052	6250	6261	35158	n/a	2.23	2.282
l-Tridecene	0.052	6250	6260	35151	n/a	2.23	2.282
Triethylbenzene	0.052	6250	6268	35194	n/a	2.23	2.282
Trielhylene Glycol	0.051	6250	6258	35139	n/a	2.23	2.281
Trimathylbenzenes (all isomers)	0.053	6250	6336	35576	n/a	2.23	2.283
Trimethyl Benzene (1,2,5-)	0.053	6250	6334	35567	n/a	2.23	2.283
Trimethyl Benzene (1,2,3-)	0.053	6250	6334	35567	n/a	2.23	2.283
Trimethyl Benzene (1,2,4-) (Pseudocumene)	0.053	6250	6334	35567	n/a	2.23	2.283
Trixylenyl Phosphate	0.051	6250	6250	35094	n/a	2.23	2.281
Undecene (1-)	0.052	6250	6292	35327	n/a	2.23	2.282
Undecyl Alcohol	0.052	6250	6260	35148	n/a	2.23	2.282
Xylenes (Ortho-, meta., para-)	0.055	6250	6507	36534	n/a	2.23	2.285
Xylene (M-)	0.055	6250	6507	36534	n/a	2.23	2.285
Xylene (O-)	0.054	6250	6452	36228	n/a	2.23	2.284
Xylene (P-)	0.055	6250	6507	36534	n/a	2.23	2.285
Xylenol	0.052	6250	6301	35381	n/a	2.23	2.282
Zinc Dialkyldithiophosphate	0.000	0	0	0	n/a	2.23	2.230

Cargo with the highest pressure drop is:

Pentane (iso-)	Max ΔP =	2.56 psi	<	3.00 psi	OK

Notes: 1) See ERL flow curve "180U172B"

Pressure Drop through VCS - From #1P Cargo Tank to P/V Valve (per 46 CFR 39.30-1(d)(1)&(2) and ABS SBR 5-2-3/7.5.2(a)&(b))

Discharge (Vacuum) Condition:

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
						8" Pipe			8" Pipe			8" Pipe					8" Pipe	8" Fittings					8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s									ft/s					ft	ft					psi	psi	psi
1	0.123	5000	7.8			143846			0.0181			22.4					28.7	32.3					0.0246	0.0276	0.0522
2	0.085	5000	7.8			99282			0.0191			22.4					30.4	32.3					0.0179	0.0191	0.0370
19	0.082	5000	7.8			95242			0.0193			22.4					30.6	32.3					0.0173	0.0183	0.0356
20	0.079	5000	7.8			92297			0.0194			22.4					30.8	32.3					0.0169	0.0177	0.0346
21	0.079	5000	7.8			92297			0.0194			22.4					30.8	32.3					0.0169	0.0177	0.0346
23	0.079	5000	7.8			92297			0.0194			22.4					30.8	32.3					0.0169	0.0177	0.0346
24	0.079	5000	7.8			92297			0.0194			22.4					30.8	32.3					0.0169	0.0177	0.0346
26	0.079	5000	7.8			92297			0.0194			22.4					30.8	32.3					0.0169	0.0177	0.0346
34	0.077	5000	7.8			90436			0.0194			22.4					30.9	32.3					0.0166	0.0174	0.0340
40	0.085	5000	7.8			98820			0.0192			22.4					30.4	32.3					0.0179	0.0190	0.0369
42	0.097	5000	7.8			113646			0.0187			22.4					29.8	32.3					0.0201	0.0218	0.0419
44	0.083	5000	7.8			96844			0.0192			22.4					30.5	32.3					0.0176	0.0186	0.0362
46	0.086	5000	7.8			100358			0.0191			22.4					30.4	32.3					0.0181	0.0193	0.0374
47	0.097	5000	7.8			113536			0.0187			22.4					29.8	32.3					0.0201	0.0218	0.0419
48	0.077	5000	7.8			89475			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0336
58	0.078	5000	7.8			91193			0.0194			22.4					30.8	32.3					0.0167	0.0175	0.0342
64	0.077	5000	7.8			89733			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
70	0.085	5000	7.8			99479			0.0191			22.4					30.4	32.3					0.0180	0.0191	0.0371
72	0.116	5000	7.8			135884			0.0182			22.4					29.0	32.3					0.0234	0.0261	0.0495
73	0.078	5000	7.8			90955			0.0194			22.4					30.9	32.3					0.0167	0.0175	0.0342
74	0.080	5000	7.8			93810			0.0193			22.4					30.7	32.3					0.0171	0.0180	0.0351
76	0.078	5000	7.8			91123			0.0194			22.4					30.8	32.3					0.0167	0.0175	0.0342
77	0.078	5000	7.8			91001			0.0194			22.4					30.9	32.3					0.0167	0.0175	0.0342
78	0.076	5000	7.8			89156			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
79	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
81	0.078	5000	7.8			91440			0.0194			22.4					30.8	32.3					0.0168	0.0176	0.0343
82	0.076	5000	7.8			89173			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
83	0.076	5000	7.8			89173			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
84	0.076	5000	7.8			89173			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
85	0.076	5000	7.8			89295			0.0195			22.4					30.9	32.3					0.0164	0.0172	0.0336
87	0.078	5000	7.8			90584			0.0194			22.4					30.9	32.3					0.0166	0.0174	0.0340
91	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
92	0.080	5000	7.8			93810			0.0193			22.4					30.7	32.3					0.0171	0.0180	0.0351
93	0.077	5000	7.8			90527			0.0194			22.4					30.9	32.3					0.0166	0.0174	0.0340
94	0.076	5000	7.8			89083			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
95	0.076	5000	7.8			89184			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
100	0.076	5000	7.8			89334			0.0195			22.4					30.9	32.3					0.0164	0.0172	0.0336
101	0.077	5000	7.8			89454			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0336
111	0.078	5000	7.8			90899			0.0194			22.4					30.9	32.3					0.0167	0.0175	0.0341
112	0.103	5000	7.8			120345			0.0186			22.4					29.5	32.3					0.0211	0.0231	0.0442
113	0.079	5000	7.8			92363			0.0194			22.4					30.8	32.3					0.0169	0.0177	0.0346
119	0.077	5000	7.8			89694			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
124	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
128	0.077	5000	7.8			89672			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
130	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
131	0.078	5000	7.8			91078			0.0194			22.4					30.8	32.3					0.0167	0.0175	0.0342
132	0.076	5000	7.8			89173			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
133	0.076	5000	7.8			89203			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0336
134	0.076	5000	7.8			89204			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0336
136	0.077	5000	7.8			90332			0.0194			22.4					30.9	32.3					0.0166	0.0174	0.0339
139	0.102	5000	7.8			119247			0.0186			22.4					29.5	32.3					0.0209	0.0229	0.0439
140	0.102	5000	7.8			119247			0.0186			22.4					29.5	32.3					0.0209	0.0229	0.0439
145	0.077	5000	7.8			89465			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0336
146	0.077	5000	7.8			89465			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0336
147	0.240	5000	7.8			279911			0.0166			22.4					26.4	32.3					0.0440	0.0538	0.0977
155	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
156	0.119	5000	7.8			139343			0.0182			22.4					28.9	32.3					0.0239	0.0268	0.0507
157	0.079	5000	7.8			92758			0.0194			22.4					30.8	32.3					0.0170	0.0178	0.0348
158	0.086	5000	7.8			100468			0.0191			22.4					30.4	32.3					0.0181	0.0193	0.0374
160	0.083	5000	7.8			97371			0.0192			22.4					30.5	32.3					0.0177	0.0187	0.0364
161	0.078	5000	7.8			90597			0.0194			22.4					30.9	32.3					0.0166	0.0174	0.0340
162	0.090	5000	7.8			105409			0.0190			22.4					30.1	32.3					0.0189	0.0203	0.0391

163	0.083	5000	7.8			96816			0.0192			22.4					30.5	32.3					0.0176	0.0186	0.0362
166	0.076	5000	7.8			89003			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
169	0.077	5000	7.8			90178			0.0195			22.4					30.9	32.3					0.0166	0.0173	0.0339
172	0.076	5000	7.8			89158			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
178	0.076	5000	7.8			89145			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
180	0.076	5000	7.8			89145			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
184	0.079	5000	7.8			92120			0.0194			22.4					30.8	32.3					0.0169	0.0177	0.0346
186	0.076	5000	7.8			89321			0.0195			22.4					30.9	32.3					0.0164	0.0172	0.0336
190	0.086	5000	7.8			100468			0.0191			22.4					30.4	32.3					0.0181	0.0193	0.0374
191	0.080	5000	7.8			93780			0.0193			22.4					30.7	32.3					0.0171	0.0180	0.0351
194	0.076	5000	7.8			89239			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0336
195	0.077	5000	7.8			89596			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
197	0.217	5000	7.8			253665			0.0168			22.4					26.7	32.3					0.0403	0.0487	0.0890
198	0.217	5000	7.8			253665			0.0168			22.4					26.7	32.3					0.0403	0.0487	0.0890
199	0.217	5000	7.8			253665			0.0168			22.4					26.7	32.3					0.0403	0.0487	0.0890
200	0.217	5000	7.8			253665			0.0168			22.4					26.7	32.3					0.0403	0.0487	0.0890
201	0.217	5000	7.8			253665			0.0168			22.4					26.7	32.3					0.0403	0.0487	0.0890
202	0.217	5000	7.8			253665			0.0168			22.4					26.7	32.3					0.0403	0.0487	0.0890
203	0.217	5000	7.8			253665			0.0168			22.4					26.7	32.3					0.0403	0.0487	0.0890
204	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
217	0.105	5000	7.8			122569			0.0185			22.4					29.4	32.3					0.0214	0.0236	0.0450
218	0.105	5000	7.8			122569			0.0185			22.4					29.4	32.3					0.0214	0.0236	0.0450
219	0.076	5000	7.8			89128			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
220	0.077	5000	7.8			89596			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
221	0.077	5000	7.8			89596			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
222	0.109	5000	7.8			127154			0.0184			22.4					29.3	32.3					0.0221	0.0244	0.0465
223	0.108	5000	7.8			125836			0.0185			22.4					29.3	32.3					0.0219	0.0242	0.0461
224	0.078	5000	7.8			91408			0.0194			22.4					30.8	32.3					0.0168	0.0176	0.0343
229	0.142	5000	7.8			165810			0.0177			22.4					28.2	32.3					0.0278	0.0319	0.0596
230	0.142	5000	7.8			165810			0.0177			22.4					28.2	32.3					0.0278	0.0319	0.0596
231	0.076	5000	7.8			89101			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
232	0.088	5000	7.8			102774			0.0190			22.4					30.2	32.3					0.0185	0.0197	0.0382
234	0.148	5000	7.8			172399			0.0176			22.4					28.0	32.3					0.0287	0.0331	0.0618
235	0.149	5000	7.8			174485			0.0176			22.4					28.0	32.3					0.0290	0.0335	0.0625
236	0.149	5000	7.8			174485			0.0176			22.4					28.0	32.3					0.0290	0.0335	0.0625
238	0.076	5000	7.8			88942			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
243	0.076	5000	7.8			89143			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
244	0.078	5000	7.8			91627			0.0194			22.4					30.8	32.3					0.0168	0.0176	0.0344
245	0.216	5000	7.8			252484			0.0168			22.4					26.7	32.3					0.0401	0.0485	0.0886
246	0.124	5000	7.8			144944			0.0181			22.4					28.7	32.3					0.0247	0.0279	0.0526
247	0.078	5000	7.8			90584			0.0194			22.4					30.9	32.3					0.0166	0.0174	0.0340
249	0.079	5000	7.8			91819			0.0194			22.4					30.8	32.3					0.0168	0.0176	0.0345
263	0.122	5000	7.8			142528			0.0181			22.4					28.8	32.3					0.0244	0.0274	0.0518
265	0.079	5000	7.8			92577			0.0194			22.4					30.8	32.3					0.0169	0.0178	0.0347
266	0.082	5000	7.8			96130			0.0193			22.4					30.6	32.3					0.0175	0.0185	0.0359
267	0.081	5000	7.8			94887			0.0193			22.4					30.6	32.3					0.0173	0.0182	0.0355
271	0.088	5000	7.8			102252			0.0191			22.4					30.3	32.3					0.0184	0.0196	0.0380
273	0.091	5000	7.8			106441			0.0189			22.4					30.1	32.3					0.0190	0.0205	0.0395
274	0.108	5000	7.8			126000			0.0184			22.4					29.3	32.3					0.0219	0.0242	0.0462
275	0.208	5000	7.8			242611			0.0169			22.4					26.8	32.3					0.0387	0.0466	0.0853
276	0.077	5000	7.8			90222			0.0195			22.4					30.9	32.3					0.0166	0.0173	0.0339
278	0.089	5000	7.8			104407			0.0190			22.4					30.2	32.3					0.0187	0.0201	0.0388
281	0.076	5000	7.8			89151			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
283	0.132	5000	7.8			154663			0.0179			22.4					28.4	32.3					0.0261	0.0297	0.0559
284	0.152	5000	7.8			177511			0.0176			22.4					27.9	32.3					0.0295	0.0341	0.0636
286	0.077	5000	7.8			89398			0.0195			22.4					30.9	32.3					0.0164	0.0172	0.0336
288	0.079	5000	7.8			92561			0.0194			22.4					30.8	32.3					0.0169	0.0178	0.0347
289	0.079	5000	7.8			92390			0.0194			22.4					30.8	32.3					0.0169	0.0178	0.0347
295	0.078	5000	7.8			91682			0.0194			22.4					30.8	32.3					0.0168	0.0176	0.0344
296	0.079	5000	7.8			92561			0.0194			22.4					30.8	32.3					0.0169	0.0178	0.0347
297	0.079	5000	7.8			92379			0.0194			22.4					30.8	32.3					0.0169	0.0178	0.0346
300	0.080	5000	7.8			93977			0.0193			22.4					30.7	32.3					0.0171	0.0181	0.0352
301	0.080	5000	7.8			93977			0.0193			22.4					30.7	32.3					0.0171	0.0181	0.0352
304	0.082	5000	7.8			95279			0.0193			22.4					30.6	32.3					0.0173	0.0183	0.0356
305	0.078	5000	7.8			91133			0.0194			22.4					30.8	32.3					0.0167	0.0175	0.0342
306	0.078	5000	7.8			91133			0.0194			22.4					30.8	32.3					0.0167	0.0175	0.0342
307	0.078	5000	7.8			91133			0.0194			22.4					30.8	32.3					0.0167	0.0175	0.0342
309	0.076	5000	7.8			89299			0.0195			22.4					30.9	32.3					0.0164	0.0172	0.0336
316	0.087	5000	7.8			101516			0.0191			22.4					30.3	32.3					0.0183	0.0195	0.0378

317	0.087	5000	7.8			101516			0.0191			22.4					30.3	32.3					0.0183	0.0195	0.0378
318	0.076	5000	7.8			89156			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
319	0.076	5000	7.8			89128			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
320	0.076	5000	7.8			89128			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
321	0.088	5000	7.8			103268			0.0190			22.4					30.2	32.3					0.0186	0.0198	0.0384
322	0.090	5000	7.8			104641			0.0190			22.4					30.2	32.3					0.0188	0.0201	0.0389
324	0.076	5000	7.8			89128			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
325	0.076	5000	7.8			89128			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
364	0.095	5000	7.8			110461			0.0188			22.4					29.9	32.3					0.0196	0.0212	0.0409
366	0.078	5000	7.8			90913			0.0194			22.4					30.9	32.3					0.0167	0.0175	0.0341
367	0.078	5000	7.8			90913			0.0194			22.4					30.9	32.3					0.0167	0.0175	0.0341
366	0.078	5000	7.8			90913			0.0194			22.4					30.9	32.3					0.0167	0.0175	0.0341
382	0.078	5000	7.8			90913			0.0194			22.4					30.9	32.3					0.0167	0.0175	0.0341
383	0.084	5000	7.8			98030			0.0192			22.4					30.5	32.3					0.0178	0.0188	0.0366
389	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
403	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
418	0.082	5000	7.8			96185			0.0192			22.4					30.6	32.3					0.0175	0.0185	0.0360
429	0.076	5000	7.8			89314			0.0195			22.4					30.9	32.3					0.0164	0.0172	0.0336
432	0.270	5000	7.8			315154			0.0164			22.4					26.1	32.3					0.0489	0.0606	0.1094
433	0.347	5000	7.8			405198			0.0160			22.4					25.5	32.3					0.0613	0.0779	0.1392
434	0.265	5000	7.8			309224			0.0165			22.4					26.1	32.3					0.0480	0.0594	0.1075
436	0.310	5000	7.8			361628			0.0162			22.4					25.7	32.3					0.0553	0.0695	0.1248
437	0.310	5000	7.8			361628			0.0162			22.4					25.7	32.3					0.0553	0.0695	0.1248
442	0.082	5000	7.8			96047			0.0193			22.4					30.6	32.3					0.0175	0.0185	0.0359
448	0.080	5000	7.8			93236			0.0193			22.4					30.7	32.3					0.0170	0.0179	0.0349
457	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
458	0.084	5000	7.8			98205			0.0192			22.4					30.5	32.3					0.0178	0.0189	0.0367
464	0.097	5000	7.8			113843			0.0187			22.4					29.8	32.3					0.0201	0.0219	0.0420
465	0.098	5000	7.8			114535			0.0187			22.4					29.7	32.3					0.0202	0.0220	0.0422
466	0.091	5000	7.8			106563			0.0189			22.4					30.1	32.3					0.0190	0.0205	0.0395
467	0.082	5000	7.8			95987			0.0193			22.4					30.6	32.3					0.0174	0.0184	0.0359
468	0.079	5000	7.8			92385			0.0194			22.4					30.8	32.3					0.0169	0.0178	0.0347
469	0.076	5000	7.8			89121			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
473	0.076	5000	7.8			89026			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
476	0.083	5000	7.8			97047			0.0192			22.4					30.5	32.3					0.0176	0.0186	0.0363
478	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
468	0.076	5000	7.8			89109			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
493	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
494	0.076	5000	7.8			89253			0.0195			22.4					31.0	32.3					0.0164	0.0172	0.0336
496	0.076	5000	7.8			89250			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0336
497	0.077	5000	7.8			89719			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
499	0.091	5000	7.8			106563			0.0189			22.4					30.1	32.3					0.0190	0.0205	0.0395
502	0.077	5000	7.8			89579			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
503	0.077	5000	7.8			89530			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0337
505	0.076	5000	7.8			89261			0.0195			22.4					31.0	32.3					0.0164	0.0172	0.0336
506	0.076	5000	7.8			89227			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0336
508	0.077	5000	7.8			89442			0.0195			22.4					30.9	32.3					0.0165	0.0172	0.0336
509	0.076	5000	7.8			89166			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
519	0.078	5000	7.8			91397			0.0194			22.4					30.8	32.3					0.0167	0.0176	0.0343
520	0.078	5000	7.8			91350			0.0194			22.4					30.8	32.3					0.0167	0.0176	0.0343
521	0.078	5000	7.8			91350			0.0194			22.4					30.8	32.3					0.0167	0.0176	0.0343
522	0.078	5000	7.8			91350			0.0194			22.4					30.8	32.3					0.0167	0.0176	0.0343
529	0.076	5000	7.8			88937			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0335
533	0.077	5000	7.8			90123			0.0195			22.4					30.9	32.3					0.0166	0.0173	0.0339
534	0.076	5000	7.8			89208			0.0195			22.4					31.0	32.3					0.0164	0.0171	0.0336
546	0.083	5000	7.8			96386			0.0192			22.4					30.6	32.3					0.0175	0.0185	0.0360
547	0.083	5000	7.8			96386			0.0192			22.4					30.6	32.3					0.0175	0.0185	0.0360
548	0.081	5000	7.8			94779			0.0193			22.4					30.6	32.3					0.0173	0.0182	0.0355
549	0.083	5000	7.8			96386			0.0192			22.4					30.6	32.3					0.0175	0.0185	0.0360
550	0.077	5000	7.8			90397			0.0194			22.4					30.9	32.3					0.0166	0.0174	0.0340

Notes: 1) Vapor flow rate used in discharge condition is liquid discharge rate, per USCG guidance 7/15/01

2) Air equivalent flow rate derived from maximum liquid discharge rate and a density correction factor for conservatism (see list of allowable cargoes for details)

MAX ΔP:	0.1392

Maximum design pressure of deck: 3.00 psi

Discharge (Vacuum) Summary:

Cargo	Piping ΔP	Vapor Flowrate[1]	Air Equivalent Flowrate[2]		ΔP across P-V[3]		Total Vapor ΔP thru P-V system
	psi	BBL/hr	BBL/hr	ft^3/hr	kPa	psi	psi
Acetone	0.052	5000	6359	35705	n/a	0.50	0.552
Acetophenone	0.037	5000	5283	29663	n/a	0.50	0.537
Amyl Acetate (iso-)	0.036	5000	5174	29054	n/a	0.50	0.536
Amyl Alcohol (iso-, no, sec-, primary) (See also IAA)	0.035	5000	5094	28601	n/a	0.50	0.535
Amyl Alcohol (n.)	0.035	5000	5094	28601	n/a	0.50	0.535
Amyl Alcohol, Primary	0.035	5000	5094	28601	n/a	0.50	0.535
Amyl Alcohol, (sec-)	0.035	5000	5094	28601	n/a	0.50	0.535
Amyl Alcohol, (iso-)	0.035	5000	5094	28601	n/a	0.50	0.535
Benzyl Alcohol	0.034	5000	5042	28311	n/a	0.50	0.534
Butyl Acetate (iso-. n-)	0.037	5000	5271	29594	n/a	0.50	0.537
Butyl Acetate (sec-)	0.042	5000	5652	31737	n/a	0.50	0.542
Butyl AlCOhol (iso-)	0.036	5000	5218	29297	n/a	0.50	0.536
Butyl AlCOhol (sec-)	0.037	5000	5311	29824	n/a	0.50	0.537
Butyl Alcohol (tert-)	0.042	5000	5649	31721	n/a	0.50	0.542
Butyl Benzyl Phthalate	0.034	5000	5015	28160	n/a	0.50	0.534
Butyl Toluene	0.034	5000	5063	28429	n/a	0.50	0.534
Caprolactam Solutions	0.034	5000	5022	28201	n/a	0.50	0.534
Cumene	0.037	5000	5288	29693	n/a	0.50	0.537
Cyclohexane	0.050	5000	6180	34703	n/a	0.50	0.550
Cyclohexanol	0.034	5000	5056	28392	n/a	0.50	0.534
1,3-Cyclopentadiene dimer (molten)	0.035	5000	5135	28834	n/a	0.50	0.535
Cymene (para-)	0.034	5000	5061	28418	n/a	0.50	0.534
Decahydronaphthalene	0.034	5000	5058	28399	n/a	0.50	0.534
Decaldehyde (iso-)	0.034	5000	5006	28110	n/a	0.50	0.534
Decaldehyde (n-)	0.033	5000	5000	28075	n/a	0.50	0.533
Decane	0.034	5000	5070	28468	n/a	0.50	0.534
Decyl Alcohol (all isomers) (Decanol)	0.034	5000	5007	28112	n/a	0.50	0.534
Decyl Alcohol (iso-)	0.034	5000	5007	28112	n/a	0.50	0.534
Decyl Alcohol (n-)	0.034	5000	5007	28112	n/a	0.50	0.534
Decylbenzene (n-)	0.034	5000	5010	28132	n/a	0.50	0.534
Diacetone Alcohol	0.034	5000	5046	28334	n/a	0.50	0.534
Dibutyl Phthalate (ortho-)	0.033	5000	5000	28075	n/a	0.50	0.533
Dicyclopentadlene, See 1,3-Cyclopentadlene Dimer (mo	0.035	5000	5135	28834	n/a	0.50	0.535
Diethybenzene	0.034	5000	5045	28325	n/a	0.50	0.534
Diethylene Glycol	0.034	5000	5004	28098	n/a	0.50	0.534
Diethylene Glycol Butyl Ether	0.034	5000	5007	28114	n/a	0.50	0.534
Diethylene Glycol Ethyl Ether Acetate	0.034	5000	5011	28138	n/a	0.50	0.534
Diethylene Glycol Methyl Ether	0.034	5000	5015	28157	n/a	0.50	0.534
Diisobutylcarblnol	0.034	5000	5055	28383	n/a	0.50	0.534
Diisobutylene	0.044	5000	5816	32659	n/a	0.50	0.544
DIisobutyl Ketone	0.035	5000	5095	28611	n/a	0.50	0.535
Diisopropylbenzene (all isomer)	0.034	5000	5021	28195	n/a	0.50	0.534
Dimethyl Phthalate	0.033	5000	5000	28075	n/a	0.50	0.533
Dinonyl Phthalate	0.034	5000	5021	28191	n/a	0.50	0.534
Dioctyl Phthalate	0.033	5000	5000	28075	n/a	0.50	0.533
Dipentene	0.034	5000	5060	28411	n/a	0.50	0.534
Diphenyl	0.034	5000	5007	28113	n/a	0.50	0.534
Diphenyl, Diphenyl Ether Mixture	0.034	5000	5008	28117	n/a	0.50	0.534
Diphenyl Ether	0.034	5000	5008	28117	n/a	0.50	0.534
Dipropylene GlYCOl	0.034	5000	5039	28295	n/a	0.50	0.534
Distillates: Flashed Feed Stocks	0.044	5000	5790	32509	n/a	0.50	0.544
Distillates: Straight Run	0.044	5000	5790	32509	n/a	0.50	0.544

Dodecene (all isomers)	0.034	5000	5015	28159	n/a	0.50	0.534
Dodecene	0.034	5000	5015	28159	n/a	0.50	0.534
Dodecylbenzene	0.098	5000	8870	49807	n/a	0.50	0.598
Ethoxy Trlglycol (crude)	0.033	5000	5000	28075	n/a	0.50	0.533
Ethyl Acetate	0.051	5000	6259	35142	n/a	0.50	0.551
Ethyl Acetoacetate	0.035	5000	5106	28672	n/a	0.50	0.535
Ethyl Alcohol (Ethanol)	0.037	5000	5314	29840	n/a	0.50	0.537
Ethyl Benzene	0.036	5000	5232	29376	n/a	0.50	0.536
Ethyl Butanol	0.034	5000	5047	28336	n/a	0.50	0.534
Ethyl Butyrate	0.039	5000	5443	30565	n/a	0.50	0.539
Ethyl Cyclohexane	0.036	5000	5217	29293	n/a	0.50	0.536
Ethylene Glycol	0.033	5000	5002	28086	n/a	0.50	0.533
Ethylene Glycol Butyl Ether Acetate	0.034	5000	5035	28270	n/a	0.50	0.534
Ethylene Glycol Diacetate	0.034	5000	5006	28110	n/a	0.50	0.534
Ethylene Glycol Methyl Ether	0.034	5000	5006	28108	n/a	0.50	0.534
Ethylene Glycol Phenyl Ether	0.034	5000	5006	28108	n/a	0.50	0.534
2-Ethylhexaldehyde, See Octyl Aldehydes	0.035	5000	5089	28573	n/a	0.50	0.535
2-Ethylhexanol , see Octanol (all isomers)	0.034	5000	5011	28136	n/a	0.50	0.534
Ethyl Propionate	0.037	5000	5314	29840	n/a	0.50	0.537
Ethyl Toulene	0.035	5000	5134	28830	n/a	0.50	0.535
Formamide	0.034	5000	5009	28123	n/a	0.50	0.534
Furfuryl Alcohol	0.034	5000	5019	28179	n/a	0.50	0.534
Gasoline Blended Stocks: Alkylates	0.089	5000	8444	47415	n/a	0.50	0.589
Gasoline Blended Stocks: Reformate	0.089	5000	8444	47415	n/a	0.50	0.589
Gasolines: Automotive (containing not over 4.23 grams	0.089	5000	8444	47415	n/a	0.50	0.589
Gasolines: Aviation (containing not over 4.86 grams lead	0.089	5000	8444	47415	n/a	0.50	0.589
Gasolines: Casinghead	0.089	5000	8444	47415	n/a	0.50	0.589
Gasolines: Polymer	0.089	5000	8444	47415	n/a	0.50	0.589
Gasolines: Straight Run	0.089	5000	8444	47415	n/a	0.50	0.589
Glycerine	0.033	5000	5000	28075	n/a	0.50	0.533
Heptane (all isomers) (Methylhexane)	0.045	5000	5870	32959	n/a	0.50	0.545
Heptane (n-)	0.045	5000	5870	32959	n/a	0.50	0.545
Heptonic Acid	0.034	5000	5005	28105	n/a	0.50	0.534
Heptanol (all isomers)	0.034	5000	5019	28179	n/a	0.50	0.534
Heptanol (all isomers)	0.034	5000	5019	28179	n/a	0.50	0.534
Heptene (all isomers)	0.047	5000	5979	33570	n/a	0.50	0.547
Heptene (1-)	0.046	5000	5948	33395	n/a	0.50	0.546
Heptyl Acetate	0.034	5000	5069	28463	n/a	0.50	0.534
Hexane (all isomers)	0.060	5000	6827	38334	n/a	0.50	0.560
Hexane	0.060	5000	6827	38334	n/a	0.50	0.560
Hexaonic Acid	0.034	5000	5005	28101	n/a	0.50	0.534
Hexanol	0.038	5000	5375	30180	n/a	0.50	0.538
Hexene (all isomers)	0.062	5000	6961	39089	n/a	0.50	0.562
Hexene (1-)	0.063	5000	7004	39324	n/a	0.50	0.563
Hexene (2-)	0.063	5000	7004	39324	n/a	0.50	0.563
Hexylene Glycol	0.033	5000	5000	28076	n/a	0.50	0.533
isophorone	0.034	5000	5006	28108	n/a	0.50	0.534
Jet Fuels: JP-l (Kerosene)	0.034	5000	5075	28497	n/a	0.50	0.534
Jet Fuels: JP-3	0.089	5000	8425	47304	n/a	0.50	0.589
Jet Fuels: JP-4	0.053	5000	6383	35841	n/a	0.50	0.553
Jet Fuels: JP-5 (Kerosene, heavy)	0.034	5000	5046	28334	n/a	0.50	0.534
Kerosene	0.034	5000	5080	28527	n/a	0.50	0.534
Methyl Acetate	0.052	5000	6330	35541	n/a	0.50	0.552
Methyl Alcohol (See Methanol)	0.035	5000	5101	28644	n/a	0.50	0.535
Methyl Amyl Acetate	0.036	5000	5198	29189	n/a	0.50	0.536
Methyl Amyl Alcohol	0.036	5000	5165	28999	n/a	0.50	0.536
Methyl n-Butyl Ketone	0.038	5000	5361	30104	n/a	0.50	0.538
Methyl Butyrate	0.039	5000	5470	30714	n/a	0.50	0.539
Methyl Ethyl Ketone	0.046	5000	5951	33417	n/a	0.50	0.546
Methyl Formal (Dimethyl Formal)	0.085	5000	8258	46370	n/a	0.50	0.585

Methyl Heptyl Ketone	0.034	5000	5036	28277	n/a	0.50	0.534
Methyl Isobutyl Ketone	0.039	5000	5418	30419	n/a	0.50	0.539
1-Methyl Napthalene	0.034	5000	5006	28109	n/a	0.50	0.534
2-Methyl-1-Pentene	0.056	5000	6594	37023	n/a	0.50	0.556
5-Methyl-1-Pentene	0.064	5000	7064	39664	n/a	0.50	0.564
Methyl Tert-Butyl Ether (MTBE)	0.034	5000	5013	28148	n/a	0.50	0.534
Mineral Spirits	0.035	5000	5101	28642	n/a	0.50	0.535
Myrcene	0.035	5000	5096	28615	n/a	0.50	0.535
Naphtha: Solvent	0.034	5000	5077	28505	n/a	0.50	0.534
Naphtha: Stoddard Solvant	0.035	5000	5101	28642	n/a	0.50	0.535
Naphtha: Vamlsh Maker's and Painters (75%)	0.035	5000	5096	28614	n/a	0.50	0.535
Nonane (all isomers)	0.035	5000	5140	28860	n/a	0.50	0.535
Nonane	0.035	5000	5140	28860	n/a	0.50	0.535
Nonene	0.036	5000	5175	29059	n/a	0.50	0.536
Nonyl Alcohol (all isomers)	0.034	5000	5061	28420	n/a	0.50	0.534
Nonyl Alcohol	0.034	5000	5061	28420	n/a	0.50	0.534
Nonyl Alcohol (iso-)	0.034	5000	5061	28420	n/a	0.50	0.534
Nonyl Phenol	0.034	5000	5010	28132	n/a	0.50	0.534
Octane (all isomers)	0.038	5000	5342	29995	n/a	0.50	0.538
Octane	0.038	5000	5342	29995	n/a	0.50	0.538
Octanoic Acid (all isomers)	0.034	5000	5006	28110	n/a	0.50	0.534
Octanol (all isomers)	0.034	5000	5005	28105	n/a	0.50	0.534
Octanol	0.034	5000	5005	28105	n/a	0.50	0.534
Octene (all isomers) 2	0.038	5000	5388	30253	n/a	0.50	0.538
Octene (1-)	0.039	5000	5424	30453	n/a	0.50	0.539
Octyl Alcohol (iso-,n.) (all isomers), See Octanol (all isomers)	0.034	5000	5005	28105	n/a	0.50	0.534
Octyl Alcohol	0.034	5000	5005	28105	n/a	0.50	0.534
Fuel: NO.2	0.041	5000	5572	31289	n/a	0.50	0.541
Fuel: NO.4	0.034	5000	5055	28386	n/a	0.50	0.534
Fuel: No.5	0.034	5000	5055	28386	n/a	0.50	0.534
Fuel: NO.6	0.034	5000	5055	28386	n/a	0.50	0.534
OIL, Mise: Crude	0.034	5000	5055	28386	n/a	0.50	0.534
Oil, Mise: Diesel	0.037	5000	5249	29476	n/a	0.50	0.537
OIL, Mise: Lubricating	0.033	5000	5000	28075	n/a	0.50	0.533
OIL, Mise: Resin	0.033	5000	5000	28075	n/a	0.50	0.533
Oil, Mise: Turbine	0.036	5000	5200	29197	n/a	0.50	0.536
Pentadecanol, See Alcohols (C13 and above)	0.034	5000	5011	28135	n/a	0.50	0.534
Pentane (all isomers)	0.109	5000	9412	52850	n/a	0.50	0.609
Pentane (iso-)	0.139	5000	10673	59926	n/a	0.50	0.639
Pentane (n-)	0.107	5000	9323	52350	n/a	0.50	0.607
Pentene (all isomers)	0.125	5000	10082	56613	n/a	0.50	0.625
Pentene (1-)	0.125	5000	10082	56613	n/a	0.50	0.625
Pinene	0.036	5000	5196	29176	n/a	0.50	0.536
Polybutene	0.035	5000	5120	28746	n/a	0.50	0.535
Polypropylene Glycol	0.033	5000	5000	28075	n/a	0.50	0.533
Polypropylene Glycol Methyl Ether	0.037	5000	5254	29502	n/a	0.50	0.537
Propyl Acetate (iso-)	0.042	5000	5657	31764	n/a	0.50	0.542
Propyl Acetate (n-)	0.042	5000	5674	31861	n/a	0.50	0.542
Propyl Alcohol (iso-)	0.040	5000	5473	30732	n/a	0.50	0.540
Propyl Alcohol (n-)	0.036	5000	5194	29167	n/a	0.50	0.536
Propylbenzene (n-)	0.035	5000	5096	28614	n/a	0.50	0.535
iso-Propylcyclohexane	0.034	5000	5005	28104	n/a	0.50	0.534
Propylene Glycol (1,2-Propandlol)	0.033	5000	5003	28089	n/a	0.50	0.533
Propylene Glycol Methyl Ether	0.036	5000	5223	29327	n/a	0.50	0.536
Propylene Tetramer	0.033	5000	5000	28075	n/a	0.50	0.533
Sulfolane	0.034	5000	5005	28102	n/a	0.50	0.534
Tetradecanol	0.033	5000	5000	28075	n/a	0.50	0.533
1-Tetradecene, See the olefin or Alpha-Olefin Entries	0.034	5000	5009	28125	n/a	0.50	0.534
Tetraethylene Glycol	0.034	5000	5009	28125	n/a	0.50	0.534
Tetrahydronaphthalene	0.034	5000	5022	28198	n/a	0.50	0.534

Toluene	0.040	5000	5473	30732	n/a	0.50	0.540
Tricresyl Phosphate (less than 1% of the ortho isomer)	0.034	5000	5018	28176	n/a	0.50	0.534
Tridecane	0.034	5000	5017	28169	n/a	0.50	0.534
Tridecanol , See Alcohols (C13 and above)	0.034	5000	5009	28126	n/a	0.50	0.534
l-Tridecene	0.034	5000	5008	28121	n/a	0.50	0.534
Triethylbenzene	0.034	5000	5014	28155	n/a	0.50	0.534
Trielhylene Glycol	0.034	5000	5007	28111	n/a	0.50	0.534
Trimathylbenzenes (all isomers)	0.034	5000	5069	28461	n/a	0.50	0.534
Trimethyl Benzene (1,2,5-)	0.034	5000	5067	28454	n/a	0.50	0.534
Trimethyl Benzene (1,2,3-)	0.034	5000	5067	28454	n/a	0.50	0.534
Trimethyl Benzene (1,2,4-) (Pseudocumene)	0.034	5000	5067	28454	n/a	0.50	0.534
Trixylenyl Phosphate	0.033	5000	5000	28075	n/a	0.50	0.533
Undecene (1-)	0.034	5000	5033	28262	n/a	0.50	0.534
Undecyl Alcohol	0.034	5000	5008	28118	n/a	0.50	0.534
Xylenes (Ortho-, meta., para-)	0.036	5000	5205	29227	n/a	0.50	0.536
Xylene (M-)	0.036	5000	5205	29227	n/a	0.50	0.536
Xylene (O-)	0.035	5000	5162	28983	n/a	0.50	0.535
Xylene (P-)	0.036	5000	5205	29227	n/a	0.50	0.536
Xylenol	0.034	5000	5041	28305	n/a	0.50	0.534
Zinc Dialkyldithiophosphate	0.000	0	0	0	n/a	0.50	0.500

Cargo with the highest pressure drop is:

Pentane (iso-)	Max ΔP =	0.64 psi	<	3.00 psi	OK

Notes: 1) Vapor flow rate used in discharge condition is liquid discharge rate, per USCG guidance 7/15/01

2) Air equivalent flow rate derived from maximum liquid discharge rate and a density correction factor for conservatism (see list of allowable cargoes for details)

3) See ERL flow curve "080M077B"

Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal:	8	in
Pipe ID:	7.981	in
Pipe Flow Area:	50.03	in^2
Vapor Dynamic Viscosity:	0.019	cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)

PIPE LENGTH

Length (ft):	231.00	ft	8" pipe
Length (ft):	50.00	ft	6" hose
f, friction factor (pipe):	Varies with Reynold's Number (see table below)		

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft):	255.81	ft
f_t, friction factor, turbulent flow (fittings):	0.014	constant, for each pipe size

Shore Connection Pressure Drop (at 25% of Maximum Liquid Loading Rate): 1250 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP				ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s									ft/s					ft	ft					psi	psi	psi
1	0.123	1563	2.44		59153	44952		0.0212	0.0221		12.1	7.0				4.82	5.87	4.11				0.0041	0.0050	0.0035	0.0127
2	0.085	1563	2.44		40827	31025		0.0228	0.0233		12.1	7.0				5.16	6.18	4.11				0.0030	0.0036	0.0024	0.0091
19	0.082	1563	2.44		39166	29763		0.0230	0.0235		12.1	7.0				5.21	6.24	4.11				0.0029	0.0035	0.0023	0.0088
20	0.079	1563	2.44		37955	28843		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
21	0.079	1563	2.44		37955	28843		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
23	0.079	1563	2.44		37955	28843		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
24	0.079	1563	2.44		37955	28843		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
26	0.079	1563	2.44		37955	28843		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
34	0.077	1563	2.44		37189	28261		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084
40	0.085	1563	2.44		40637	30881		0.0228	0.0233		12.1	7.0				5.17	6.19	4.11				0.0030	0.0036	0.0024	0.0091
42	0.097	1563	2.44		46734	35514		0.0222	0.0226		12.1	7.0				5.03	5.99	4.11				0.0034	0.0040	0.0028	0.0102
44	0.083	1563	2.44		39824	30264		0.0229	0.0234		12.1	7.0				5.19	6.22	4.11				0.0030	0.0036	0.0024	0.0089
46	0.086	1563	2.44		41269	31362		0.0227	0.0232		12.1	7.0				5.15	6.17	4.11				0.0031	0.0037	0.0025	0.0092
47	0.097	1563	2.44		46689	35480		0.0222	0.0226		12.1	7.0				5.03	5.99	4.11				0.0034	0.0040	0.0028	0.0102
48	0.077	1563	2.44		36794	27961		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
58	0.078	1563	2.44		37501	28498		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
64	0.077	1563	2.44		36900	28042		0.0232	0.0239		12.1	7.0				5.27	6.33	4.11				0.0028	0.0034	0.0022	0.0084
70	0.085	1563	2.44		40908	31087		0.0228	0.0233		12.1	7.0				5.16	6.18	4.11				0.0031	0.0037	0.0024	0.0091
72	0.116	1563	2.44		55879	42464		0.0215	0.0217		12.1	7.0				4.87	5.75	4.11				0.0039	0.0046	0.0033	0.0119
73	0.078	1563	2.44		37403	28423		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
74	0.080	1563	2.44		38577	29316		0.0230	0.0236		12.1	7.0				5.22	6.27	4.11				0.0029	0.0035	0.0023	0.0087
76	0.078	1563	2.44		37472	28476		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
77	0.078	1563	2.44		37422	28438		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
78	0.076	1563	2.44		36663	27861		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
79	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
81	0.078	1563	2.44		37602	28575		0.0232	0.0238		12.1	7.0				5.25	6.30	4.11				0.0029	0.0034	0.0022	0.0085
82	0.076	1563	2.44		36670	27866		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
83	0.076	1563	2.44		36670	27866		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
84	0.076	1563	2.44		36670	27866		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
85	0.076	1563	2.44		36720	27905		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0083
87	0.078	1563	2.44		37250	28307		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084
91	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
92	0.080	1563	2.44		38577	29316		0.0230	0.0236		12.1	7.0				5.22	6.27	4.11				0.0029	0.0035	0.0023	0.0087
93	0.077	1563	2.44		37227	28290		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084
94	0.076	1563	2.44		36633	27838		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
95	0.076	1563	2.44		36674	27870		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
100	0.076	1563	2.44		36736	27917		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
101	0.077	1563	2.44		36785	27954		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
111	0.078	1563	2.44		37379	28406		0.0232	0.0238		12.1	7.0				5.26	6.31	4.11				0.0028	0.0034	0.0022	0.0085
112	0.103	1563	2.44		49488	37608		0.0220	0.0223		12.1	7.0				4.98	5.91	4.11				0.0036	0.0042	0.0029	0.0107
113	0.079	1563	2.44		37982	28863		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
119	0.077	1563	2.44		36884	28029		0.0232	0.0239		12.1	7.0				5.27	6.33	4.11				0.0028	0.0034	0.0022	0.0084
124	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
128	0.077	1563	2.44		36875	28023		0.0232	0.0239		12.1	7.0				5.27	6.33	4.11				0.0028	0.0034	0.0022	0.0084
130	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
131	0.078	1563	2.44		37453	28462		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
132	0.076	1563	2.44		36670	27867		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
133	0.076	1563	2.44		36682	27876		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083

134	0.076	1563	2.44		36683	27876		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
136	0.077	1563	2.44		37146	28229		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084
139	0.102	1563	2.44		49037	37265		0.0220	0.0223		12.1	7.0				4.98	5.93	4.11				0.0035	0.0042	0.0029	0.0107
140	0.102	1563	2.44		49037	37265		0.0220	0.0223		12.1	7.0				4.98	5.93	4.11				0.0035	0.0042	0.0029	0.0107
145	0.077	1563	2.44		36790	27958		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
146	0.077	1563	2.44		36790	27958		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
147	0.240	1563	2.44		115106	87472		0.0191	0.0186		12.1	7.0				4.33	4.93	4.11				0.0072	0.0082	0.0068	0.0222
155	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
156	0.119	1563	2.44		57301	43545		0.0214	0.0216		12.1	7.0				4.84	5.72	4.11				0.0040	0.0047	0.0034	0.0122
157	0.079	1563	2.44		38144	28987		0.0231	0.0237		12.1	7.0				5.23	6.28	4.11				0.0029	0.0035	0.0023	0.0086
158	0.086	1563	2.44		41314	31396		0.0227	0.0232		12.1	7.0				5.15	6.17	4.11				0.0031	0.0037	0.0025	0.0092
160	0.083	1563	2.44		40041	30428		0.0229	0.0234		12.1	7.0				5.18	6.21	4.11				0.0030	0.0036	0.0024	0.0090
161	0.078	1563	2.44		37256	28312		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0085
162	0.090	1563	2.44		43347	32940		0.0225	0.0230		12.1	7.0				5.10	6.10	4.11				0.0032	0.0038	0.0026	0.0096
163	0.083	1563	2.44		39813	30255		0.0229	0.0234		12.1	7.0				5.19	6.22	4.11				0.0030	0.0036	0.0024	0.0089
166	0.076	1563	2.44		36600	27813		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
169	0.077	1563	2.44		37083	28180		0.0232	0.0238		12.1	7.0				5.26	6.33	4.11				0.0028	0.0034	0.0022	0.0084
172	0.076	1563	2.44		36664	27862		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
178	0.076	1563	2.44		36659	27858		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
180	0.076	1563	2.44		36659	27858		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
184	0.079	1563	2.44		37882	28787		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0034	0.0023	0.0086
186	0.076	1563	2.44		36731	27913		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
190	0.086	1563	2.44		41314	31396		0.0227	0.0232		12.1	7.0				5.15	6.17	4.11				0.0031	0.0037	0.0025	0.0092
191	0.080	1563	2.44		38564	29306		0.0230	0.0236		12.1	7.0				5.22	6.27	4.11				0.0029	0.0035	0.0023	0.0087
194	0.076	1563	2.44		36697	27887		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0083
195	0.077	1563	2.44		36844	27999		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
197	0.217	1563	2.44		104313	79270		0.0194	0.0190		12.1	7.0				4.39	5.03	4.11				0.0066	0.0076	0.0062	0.0204
198	0.217	1563	2.44		104313	79270		0.0194	0.0190		12.1	7.0				4.39	5.03	4.11				0.0066	0.0076	0.0062	0.0204
199	0.217	1563	2.44		104313	79270		0.0194	0.0190		12.1	7.0				4.39	5.03	4.11				0.0066	0.0076	0.0062	0.0204
200	0.217	1563	2.44		104313	79270		0.0194	0.0190		12.1	7.0				4.39	5.03	4.11				0.0066	0.0076	0.0062	0.0204
201	0.217	1563	2.44		104313	79270		0.0194	0.0190		12.1	7.0				4.39	5.03	4.11				0.0066	0.0076	0.0062	0.0204
202	0.217	1563	2.44		104313	79270		0.0194	0.0190		12.1	7.0				4.39	5.03	4.11				0.0066	0.0076	0.0062	0.0204
203	0.217	1563	2.44		104313	79270		0.0194	0.0190		12.1	7.0				4.39	5.03	4.11				0.0066	0.0076	0.0062	0.0204
204	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
217	0.105	1563	2.44		50403	38303		0.0219	0.0222		12.1	7.0				4.96	5.89	4.11				0.0036	0.0043	0.0030	0.0109
218	0.105	1563	2.44		50403	38303		0.0219	0.0222		12.1	7.0				4.96	5.89	4.11				0.0036	0.0043	0.0030	0.0109
219	0.076	1563	2.44		36652	27853		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
220	0.077	1563	2.44		36844	27999		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
221	0.077	1563	2.44		36844	27999		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
222	0.109	1563	2.44		52288	39735		0.0217	0.0220		12.1	7.0				4.93	5.84	4.11				0.0037	0.0044	0.0031	0.0112
223	0.108	1563	2.44		51746	39324		0.0218	0.0221		12.1	7.0				4.93	5.85	4.11				0.0037	0.0044	0.0031	0.0111
224	0.078	1563	2.44		37589	28565		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0029	0.0034	0.0022	0.0085
229	0.142	1563	2.44		68185	51816		0.0207	0.0207		12.1	7.0				4.70	5.51	4.11				0.0046	0.0054	0.0041	0.0141
230	0.142	1563	2.44		68185	51816		0.0207	0.0207		12.1	7.0				4.70	5.51	4.11				0.0046	0.0054	0.0041	0.0141
231	0.076	1563	2.44		36640	27844		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
232	0.088	1563	2.44		42263	32117		0.0226	0.0231		12.1	7.0				5.13	6.13	4.11				0.0031	0.0037	0.0025	0.0094
234	0.148	1563	2.44		70894	53875		0.0206	0.0206		12.1	7.0				4.67	5.46	4.11				0.0048	0.0056	0.0042	0.0146
235	0.149	1563	2.44		71752	54527		0.0205	0.0205		12.1	7.0				4.66	5.44	4.11				0.0048	0.0056	0.0043	0.0147
236	0.149	1563	2.44		71752	54527		0.0205	0.0205		12.1	7.0				4.66	5.44	4.11				0.0048	0.0056	0.0043	0.0147
238	0.076	1563	2.44		36575	27794		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
243	0.076	1563	2.44		36657	27857		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
244	0.078	1563	2.44		37679	28633		0.0231	0.0237		12.1	7.0				5.25	6.30	4.11				0.0029	0.0034	0.0022	0.0085
245	0.216	1563	2.44		103827	78901		0.0194	0.0190		12.1	7.0				4.39	5.04	4.11				0.0066	0.0076	0.0062	0.0203
246	0.124	1563	2.44		59604	45295		0.0212	0.0214		12.1	7.0				4.81	5.67	4.11				0.0041	0.0049	0.0035	0.0126
247	0.078	1563	2.44		37250	28307		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084
249	0.079	1563	2.44		37758	28694		0.0231	0.0237		12.1	7.0				5.24	6.30	4.11				0.0029	0.0034	0.0022	0.0085
263	0.122	1563	2.44		58611	44540		0.0213	0.0215		12.1	7.0				4.82	5.69	4.11				0.0041	0.0048	0.0035	0.0124
265	0.079	1563	2.44		38070	28930		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
266	0.082	1563	2.44		39531	30041		0.0229	0.0235		12.1	7.0				5.20	6.23	4.11				0.0030	0.0036	0.0024	0.0089
267	0.081	1563	2.44		39019	29652		0.0230	0.0235		12.1	7.0				5.21	6.25	4.11				0.0029	0.0035	0.0023	0.0088
271	0.088	1563	2.44		42048	31954		0.0226	0.0231		12.1	7.0				5.13	6.14	4.11				0.0031	0.0037	0.0025	0.0094
273	0.091	1563	2.44		43771	33263		0.0225	0.0229		12.1	7.0				5.09	6.08	4.11				0.0032	0.0038	0.0026	0.0097
274	0.108	1563	2.44		51814	39375		0.0218	0.0221		12.1	7.0				4.93	5.85	4.11				0.0037	0.0044	0.0031	0.0112
275	0.208	1636	2.55		104428	79358		0.0194	0.0189		12.7	7.3				4.81	5.51	4.51				0.0069	0.0079	0.0065	0.0214
276	0.077	1563	2.44		37101	28194		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084
278	0.089	1563	2.44		42935	32627		0.0226	0.0230		12.1	7.0				5.11	6.11	4.11				0.0032	0.0038	0.0026	0.0095
281	0.076	1563	2.44		36661	27860		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
283	0.132	1563	2.44		63601	48332		0.0210	0.0211		12.1	7.0				4.75	5.59	4.11				0.0044	0.0051	0.0038	0.0133
284	0.152	1563	2.44		72996	55472		0.0205	0.0204		12.1	7.0				4.64	5.42	4.11				0.0049	0.0057	0.0043	0.0150

286	0.077	1563	2.44		36762	27937		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
288	0.079	1563	2.44		38063	28925		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
289	0.079	1563	2.44		37993	28872		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
295	0.078	1563	2.44		37702	28651		0.0231	0.0237		12.1	7.0				5.25	6.30	4.11				0.0029	0.0034	0.0022	0.0085
296	0.079	1563	2.44		38063	28925		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
297	0.079	1563	2.44		37988	28869		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
300	0.080	1563	2.44		38646	29368		0.0230	0.0236		12.1	7.0				5.22	6.26	4.11				0.0029	0.0035	0.0023	0.0087
301	0.080	1563	2.44		38646	29368		0.0230	0.0236		12.1	7.0				5.22	6.26	4.11				0.0029	0.0035	0.0023	0.0087
304	0.082	1563	2.44		39181	29775		0.0230	0.0235		12.1	7.0				5.21	6.24	4.11				0.0029	0.0035	0.0023	0.0088
305	0.078	1563	2.44		37476	28479		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
306	0.078	1563	2.44		37476	28479		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
307	0.078	1563	2.44		37476	28479		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0028	0.0034	0.0022	0.0085
309	0.076	1563	2.44		36722	27906		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0083
316	0.087	1563	2.44		41746	31724		0.0227	0.0232		12.1	7.0				5.14	6.15	4.11				0.0031	0.0037	0.0025	0.0093
317	0.087	1563	2.44		41746	31724		0.0227	0.0232		12.1	7.0				5.14	6.15	4.11				0.0031	0.0037	0.0025	0.0093
318	0.076	1563	2.44		36663	27861		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
319	0.076	1563	2.44		36651	27852		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
320	0.076	1563	2.44		36651	27852		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
321	0.088	1563	2.44		42466	32271		0.0226	0.0231		12.1	7.0				5.12	6.13	4.11				0.0031	0.0038	0.0025	0.0094
322	0.090	1563	2.44		43031	32700		0.0225	0.0230		12.1	7.0				5.11	6.11	4.11				0.0032	0.0038	0.0026	0.0095
324	0.076	1563	2.44		36651	27852		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
325	0.076	1563	2.44		36651	27852		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
364	0.095	1563	2.44		45424	34519		0.0223	0.0227		12.1	7.0				5.06	6.03	4.11				0.0033	0.0040	0.0027	0.0100
366	0.078	1563	2.44		37386	28410		0.0232	0.0238		12.1	7.0				5.26	6.31	4.11				0.0028	0.0034	0.0022	0.0085
367	0.078	1563	2.44		37386	28410		0.0232	0.0238		12.1	7.0				5.26	6.31	4.11				0.0028	0.0034	0.0022	0.0085
366	0.078	1563	2.44		37386	28410		0.0232	0.0238		12.1	7.0				5.26	6.31	4.11				0.0028	0.0034	0.0022	0.0085
382	0.078	1563	2.44		37386	28410		0.0232	0.0238		12.1	7.0				5.26	6.31	4.11				0.0028	0.0034	0.0022	0.0085
383	0.084	1563	2.44		40312	30634		0.0228	0.0234		12.1	7.0				5.18	6.20	4.11				0.0030	0.0036	0.0024	0.0090
389	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
403	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
418	0.082	1563	2.44		39553	30058		0.0229	0.0235		12.1	7.0				5.20	6.23	4.11				0.0030	0.0036	0.0024	0.0089
429	0.076	1563	2.44		36728	27911		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
432	0.270	1775	2.77		147224	111880		0.0184	0.0177		13.8	8.0				5.40	6.06	5.31				0.0101	0.0113	0.0099	0.0314
433	0.347	1925	3.00		205284	156001		0.0177	0.0166		15.0	8.6				6.10	6.68	6.25				0.0147	0.0161	0.0150	0.0458
434	0.265	1761	2.75		143314	108909		0.0185	0.0178		13.7	7.9				5.33	5.99	5.23				0.0098	0.0110	0.0096	0.0304
436	0.310	1873	2.92		178214	135430		0.0180	0.0170		14.6	8.4				5.86	6.50	5.91				0.0126	0.0140	0.0127	0.0393
437	0.310	1873	2.92		178214	135430		0.0180	0.0170		14.6	8.4				5.86	6.50	5.91				0.0126	0.0140	0.0127	0.0393
442	0.082	1563	2.44		39497	30015		0.0229	0.0235		12.1	7.0				5.20	6.23	4.11				0.0030	0.0036	0.0023	0.0089
448	0.080	1563	2.44		38341	29136		0.0231	0.0236		12.1	7.0				5.23	6.28	4.11				0.0029	0.0035	0.0023	0.0087
457	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
458	0.084	1563	2.44		40384	30689		0.0228	0.0234		12.1	7.0				5.17	6.20	4.11				0.0030	0.0036	0.0024	0.0090
464	0.097	1563	2.44		46815	35576		0.0222	0.0226		12.1	7.0				5.03	5.99	4.11				0.0034	0.0041	0.0028	0.0102
465	0.098	1563	2.44		47099	35792		0.0222	0.0225		12.1	7.0				5.02	5.98	4.11				0.0034	0.0041	0.0028	0.0103
466	0.091	1563	2.44		43821	33301		0.0225	0.0229		12.1	7.0				5.09	6.08	4.11				0.0032	0.0039	0.0026	0.0097
467	0.082	1563	2.44		39472	29996		0.0229	0.0235		12.1	7.0				5.20	6.23	4.11				0.0030	0.0036	0.0023	0.0089
468	0.079	1563	2.44		37991	28870		0.0231	0.0237		12.1	7.0				5.24	6.29	4.11				0.0029	0.0035	0.0023	0.0086
469	0.076	1563	2.44		36648	27850		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
473	0.076	1563	2.44		36609	27820		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
476	0.083	1563	2.44		39908	30327		0.0229	0.0234		12.1	7.0				5.19	6.22	4.11				0.0030	0.0036	0.0024	0.0090
478	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
468	0.076	1563	2.44		36644	27847		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
493	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
494	0.076	1563	2.44		36703	27892		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0083
496	0.076	1563	2.44		36701	27891		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0083
497	0.077	1563	2.44		36894	28037		0.0232	0.0239		12.1	7.0				5.27	6.33	4.11				0.0028	0.0034	0.0022	0.0084
499	0.091	1563	2.44		43821	33301		0.0225	0.0229		12.1	7.0				5.09	6.08	4.11				0.0032	0.0039	0.0026	0.0097
502	0.077	1563	2.44		36837	27993		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
503	0.077	1563	2.44		36817	27978		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
505	0.076	1563	2.44		36706	27894		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0083
506	0.076	1563	2.44		36692	27883		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0083
508	0.077	1563	2.44		36780	27951		0.0233	0.0239		12.1	7.0				5.27	6.34	4.11				0.0028	0.0034	0.0022	0.0084
509	0.076	1563	2.44		36667	27864		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083
519	0.078	1563	2.44		37584	28561		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0029	0.0034	0.0022	0.0085
520	0.078	1563	2.44		37565	28547		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0029	0.0034	0.0022	0.0085
521	0.078	1563	2.44		37565	28547		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0029	0.0034	0.0022	0.0085
522	0.078	1563	2.44		37565	28547		0.0232	0.0238		12.1	7.0				5.25	6.31	4.11				0.0029	0.0034	0.0022	0.0085
529	0.076	1563	2.44		36573	27793		0.0233	0.0239		12.1	7.0				5.28	6.35	4.11				0.0028	0.0034	0.0022	0.0083
533	0.077	1563	2.44		37060	28163		0.0232	0.0238		12.1	7.0				5.26	6.33	4.11				0.0028	0.0034	0.0022	0.0084
534	0.076	1563	2.44		36684	27877		0.0233	0.0239		12.1	7.0				5.28	6.34	4.11				0.0028	0.0034	0.0022	0.0083

546	0.083	1563	2.44		39636	30121		0.0229	0.0235		12.1	7.0				5.19	6.23	4.11				0.0030	0.0036	0.0024	0.0089
547	0.083	1563	2.44		39636	30121		0.0229	0.0235		12.1	7.0				5.19	6.23	4.11				0.0030	0.0036	0.0024	0.0089
548	0.081	1563	2.44		38975	29618		0.0230	0.0236		12.1	7.0				5.21	6.25	4.11				0.0029	0.0035	0.0023	0.0088
549	0.083	1563	2.44		39636	30121		0.0229	0.0235		12.1	7.0				5.19	6.23	4.11				0.0030	0.0036	0.0024	0.0089
550	0.077	1563	2.44		37173	28249		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084

MAX ΔP:	0.0458

P-V valve pressure setting: 1.5 psi
80% of P-V valve setting: 1.2 psi

Maximum pressure drop to shore connection: 0.046 psi

TOTAL PRESSURE DROP TO SHORE CONNECTION: 0.046 psi *OK*

Max. allowable back pressure at facility: 1.154 psi

Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal:	8	in	
Pipe ID:	7.981	in	
Pipe Flow Area:	50.03	in^2	
Vapor Dynamic Viscosity:	0.019	cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)	

PIPE LENGTH

Length (ft):	231.00	ft	8" pipe
Length (ft):	50.00	ft	6" hose
f, friction factor (pipe):	Varies with Reynold's Number (see table below)		

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft):	255.81	ft
f_t, friction factor, turbulent flow (fittings):	0.014	constant, for each pipe size

Shore Connection Pressure Drop (at 50% of Maximum Liquid Loading Rate): 2500 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s									ft/s					ft	ft					psi	psi	psi
1	0.123	3125	4.87		118305	89904		0.0190	0.0195		24.3	14.0				17.23	20.66	16.46				0.0147	0.0177	0.0141	0.0465
2	0.085	3125	4.87		81654	62051		0.0201	0.0200		24.3	14.0				18.23	21.18	16.46				0.0108	0.0125	0.0097	0.0330
19	0.082	3125	4.87		78332	59527		0.0202	0.0201		24.3	14.0				18.36	21.37	16.46				0.0104	0.0121	0.0093	0.0318
20	0.079	3125	4.87		75909	57686		0.0204	0.0203		24.3	14.0				18.45	21.52	16.46				0.0101	0.0118	0.0090	0.0310
21	0.079	3125	4.87		75909	57686		0.0204	0.0203		24.3	14.0				18.45	21.52	16.46				0.0101	0.0118	0.0090	0.0310
23	0.079	3125	4.87		75909	57686		0.0204	0.0203		24.3	14.0				18.45	21.52	16.46				0.0101	0.0118	0.0090	0.0310
24	0.079	3125	4.87		75909	57686		0.0204	0.0203		24.3	14.0				18.45	21.52	16.46				0.0101	0.0118	0.0090	0.0310
26	0.079	3125	4.87		75909	57686		0.0204	0.0203		24.3	14.0				18.45	21.52	16.46				0.0101	0.0118	0.0090	0.0310
34	0.077	3125	4.87		74378	56522		0.0204	0.0204		24.3	14.0				18.52	21.61	16.46				0.0100	0.0116	0.0088	0.0304
40	0.085	3125	4.87		81274	61763		0.0201	0.0200		24.3	14.0				18.25	21.20	16.46				0.0107	0.0125	0.0097	0.0328
42	0.097	3125	4.87		93467	71029		0.0197	0.0194		24.3	14.0				17.85	20.59	16.46				0.0121	0.0139	0.0111	0.0371
44	0.083	3125	4.87		79648	60527		0.0202	0.0201		24.3	14.0				18.31	21.29	16.46				0.0105	0.0123	0.0095	0.0323
46	0.086	3125	4.87		82539	62724		0.0201	0.0199		24.3	14.0				18.20	21.13	16.46				0.0109	0.0126	0.0098	0.0333
47	0.097	3125	4.87		93377	70960		0.0197	0.0194		24.3	14.0				17.85	20.59	16.46				0.0120	0.0139	0.0111	0.0371
48	0.077	3125	4.87		73588	55922		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0088	0.0301
58	0.078	3125	4.87		75001	56996		0.0204	0.0203		24.3	14.0				18.49	21.57	16.46				0.0100	0.0117	0.0089	0.0306
64	0.077	3125	4.87		73800	56083		0.0204	0.0204		24.3	14.0				18.54	21.65	16.46				0.0099	0.0115	0.0088	0.0302
70	0.085	3125	4.87		81816	62175		0.0201	0.0199		24.3	14.0				18.23	21.17	16.46				0.0108	0.0125	0.0097	0.0330
72	0.116	3125	4.87		111757	84928		0.0192	0.0187		24.3	14.0				17.38	19.84	16.46				0.0140	0.0160	0.0133	0.0434
73	0.078	3125	4.87		74805	56847		0.0204	0.0203		24.3	14.0				18.50	21.58	16.46				0.0100	0.0117	0.0089	0.0306
74	0.080	3125	4.87		77153	58631		0.0203	0.0202		24.3	14.0				18.40	21.44	16.46				0.0103	0.0120	0.0092	0.0314
76	0.078	3125	4.87		74944	56952		0.0204	0.0203		24.3	14.0				18.49	21.58	16.46				0.0100	0.0117	0.0089	0.0306
77	0.078	3125	4.87		74843	56876		0.0204	0.0203		24.3	14.0				18.50	21.58	16.46				0.0100	0.0117	0.0089	0.0306
78	0.076	3125	4.87		73326	55723		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
79	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
81	0.078	3125	4.87		75205	57150		0.0204	0.0203		24.3	14.0				18.48	21.56	16.46				0.0100	0.0117	0.0089	0.0307
82	0.076	3125	4.87		73340	55733		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0301
83	0.076	3125	4.87		73340	55733		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0301
84	0.076	3125	4.87		73340	55733		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0301
85	0.076	3125	4.87		73440	55809		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301
87	0.078	3125	4.87		74500	56615		0.0204	0.0203		24.3	14.0				18.51	21.60	16.46				0.0100	0.0116	0.0089	0.0305
91	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
92	0.080	3125	4.87		77153	58631		0.0203	0.0202		24.3	14.0				18.40	21.44	16.46				0.0103	0.0120	0.0092	0.0314
93	0.077	3125	4.87		74453	56579		0.0204	0.0204		24.3	14.0				18.51	21.61	16.46				0.0100	0.0116	0.0089	0.0304
94	0.076	3125	4.87		73266	55677		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
95	0.076	3125	4.87		73349	55740		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0301
100	0.076	3125	4.87		73472	55834		0.0205	0.0204		24.3	14.0				18.55	21.67	16.46				0.0099	0.0115	0.0087	0.0301
101	0.077	3125	4.87		73571	55909		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0088	0.0301
111	0.078	3125	4.87		74759	56812		0.0204	0.0203		24.3	14.0				18.50	21.59	16.46				0.0100	0.0117	0.0089	0.0306
112	0.103	3125	4.87		98977	75215		0.0195	0.0192		24.3	14.0				17.69	20.34	16.46				0.0127	0.0146	0.0118	0.0390
113	0.079	3125	4.87		75963	57727		0.0204	0.0203		24.3	14.0				18.45	21.51	16.46				0.0101	0.0118	0.0090	0.0310
119	0.077	3125	4.87		73769	56059		0.0205	0.0204		24.3	14.0				18.54	21.65	16.46				0.0099	0.0115	0.0088	0.0302
124	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
128	0.077	3125	4.87		73751	56045		0.0205	0.0204		24.3	14.0				18.54	21.65	16.46				0.0099	0.0115	0.0088	0.0302
130	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
131	0.078	3125	4.87		74907	56924		0.0204	0.0203		24.3	14.0				18.49	21.58	16.46				0.0100	0.0117	0.0089	0.0306
132	0.076	3125	4.87		73340	55733		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0301
133	0.076	3125	4.87		73365	55752		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0301

134	0.076	3125	4.87		73365	55753		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0301
136	0.077	3125	4.87		74293	56457		0.0204	0.0204		24.3	14.0				18.52	21.62	16.46				0.0099	0.0116	0.0088	0.0304
139	0.102	3125	4.87		98074	74529		0.0195	0.0192		24.3	14.0				17.72	20.38	16.46				0.0126	0.0144	0.0117	0.0387
140	0.102	3125	4.87		98074	74529		0.0195	0.0192		24.3	14.0				17.72	20.38	16.46				0.0126	0.0144	0.0117	0.0387
145	0.077	3125	4.87		73580	55916		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0088	0.0301
146	0.077	3125	4.87		73580	55916		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0088	0.0301
147	0.240	3125	4.87		230211	174945		0.0175	0.0162		24.3	14.0				15.86	17.25	16.46				0.0264	0.0287	0.0274	0.0825
155	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
156	0.119	3125	4.87		114602	87090		0.0191	0.0186		24.3	14.0				17.31	19.74	16.46				0.0143	0.0163	0.0136	0.0443
157	0.079	3125	4.87		76289	57974		0.0203	0.0202		24.3	14.0				18.44	21.49	16.46				0.0102	0.0119	0.0091	0.0311
158	0.086	3125	4.87		82629	62792		0.0201	0.0199		24.3	14.0				18.20	21.13	16.46				0.0109	0.0126	0.0098	0.0333
160	0.083	3125	4.87		80082	60857		0.0202	0.0200		24.3	14.0				18.29	21.27	16.46				0.0106	0.0123	0.0095	0.0324
161	0.078	3125	4.87		74511	56623		0.0204	0.0203		24.3	14.0				18.51	21.60	16.46				0.0100	0.0116	0.0089	0.0305
162	0.090	3125	4.87		86693	65881		0.0199	0.0197		24.3	14.0				18.06	20.91	16.46				0.0113	0.0131	0.0103	0.0347
163	0.083	3125	4.87		79626	60510		0.0202	0.0201		24.3	14.0				18.31	21.30	16.46				0.0105	0.0123	0.0095	0.0323
166	0.076	3125	4.87		73200	55627		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
169	0.077	3125	4.87		74166	56361		0.0204	0.0204		24.3	14.0				18.53	21.62	16.46				0.0099	0.0116	0.0088	0.0303
172	0.076	3125	4.87		73327	55724		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
178	0.076	3125	4.87		73317	55716		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
180	0.076	3125	4.87		73317	55716		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
184	0.079	3125	4.87		75763	57575		0.0204	0.0203		24.3	14.0				18.46	21.53	16.46				0.0101	0.0118	0.0090	0.0309
186	0.076	3125	4.87		73462	55826		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0099	0.0115	0.0087	0.0301
190	0.086	3125	4.87		82629	62792		0.0201	0.0199		24.3	14.0				18.20	21.13	16.46				0.0109	0.0126	0.0098	0.0333
191	0.080	3125	4.87		77129	58612		0.0203	0.0202		24.3	14.0				18.41	21.44	16.46				0.0103	0.0120	0.0092	0.0314
194	0.076	3125	4.87		73394	55774		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301
195	0.077	3125	4.87		73687	55997		0.0205	0.0204		24.3	14.0				18.55	21.65	16.46				0.0099	0.0115	0.0088	0.0302
197	0.217	3125	4.87		208625	158540		0.0177	0.0165		24.3	14.0				16.03	17.56	16.46				0.0242	0.0265	0.0248	0.0755
198	0.217	3125	4.87		208625	158540		0.0177	0.0165		24.3	14.0				16.03	17.56	16.46				0.0242	0.0265	0.0248	0.0755
199	0.217	3125	4.87		208625	158540		0.0177	0.0165		24.3	14.0				16.03	17.56	16.46				0.0242	0.0265	0.0248	0.0755
200	0.217	3125	4.87		208625	158540		0.0177	0.0165		24.3	14.0				16.03	17.56	16.46				0.0242	0.0265	0.0248	0.0755
201	0.217	3125	4.87		208625	158540		0.0177	0.0165		24.3	14.0				16.03	17.56	16.46				0.0242	0.0265	0.0248	0.0755
202	0.217	3125	4.87		208625	158540		0.0177	0.0165		24.3	14.0				16.03	17.56	16.46				0.0242	0.0265	0.0248	0.0755
203	0.217	3125	4.87		208625	158540		0.0177	0.0165		24.3	14.0				16.03	17.56	16.46				0.0242	0.0265	0.0248	0.0755
204	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
217	0.105	3125	4.87		100806	76605		0.0195	0.0191		24.3	14.0				17.64	20.26	16.46				0.0129	0.0148	0.0120	0.0396
218	0.105	3125	4.87		100806	76605		0.0195	0.0191		24.3	14.0				17.64	20.26	16.46				0.0129	0.0148	0.0120	0.0396
219	0.076	3125	4.87		73303	55705		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
220	0.077	3125	4.87		73687	55997		0.0205	0.0204		24.3	14.0				18.55	21.65	16.46				0.0099	0.0115	0.0088	0.0302
221	0.077	3125	4.87		73687	55997		0.0205	0.0204		24.3	14.0				18.55	21.65	16.46				0.0099	0.0115	0.0088	0.0302
222	0.109	3125	4.87		104577	79471		0.0194	0.0189		24.3	14.0				17.55	20.11	16.46				0.0133	0.0152	0.0124	0.0409
223	0.108	3125	4.87		103493	78647		0.0194	0.0190		24.3	14.0				17.57	20.15	16.46				0.0131	0.0151	0.0123	0.0405
224	0.078	3125	4.87		75178	57130		0.0204	0.0203		24.3	14.0				18.48	21.56	16.46				0.0100	0.0117	0.0089	0.0307
229	0.142	3125	4.87		136369	103631		0.0186	0.0180		24.3	14.0				16.90	19.06	16.46				0.0167	0.0188	0.0162	0.0517
230	0.142	3125	4.87		136369	103631		0.0186	0.0180		24.3	14.0				16.90	19.06	16.46				0.0167	0.0188	0.0162	0.0517
231	0.076	3125	4.87		73281	55688		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
232	0.088	3125	4.87		84526	64234		0.0200	0.0198		24.3	14.0				18.13	21.03	16.46				0.0111	0.0128	0.0101	0.0340
234	0.148	3125	4.87		141788	107749		0.0185	0.0178		24.3	14.0				16.81	18.91	16.46				0.0172	0.0194	0.0169	0.0535
235	0.149	3125	4.87		143504	109053		0.0185	0.0178		24.3	14.0				16.78	18.87	16.46				0.0174	0.0196	0.0171	0.0540
236	0.149	3125	4.87		143504	109053		0.0185	0.0178		24.3	14.0				16.78	18.87	16.46				0.0174	0.0196	0.0171	0.0540
238	0.076	3125	4.87		73150	55589		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
243	0.076	3125	4.87		73315	55714		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
244	0.078	3125	4.87		75358	57267		0.0204	0.0203		24.3	14.0				18.48	21.55	16.46				0.0101	0.0117	0.0090	0.0308
245	0.216	3125	4.87		207654	157803		0.0177	0.0166		24.3	14.0				16.04	17.58	16.46				0.0241	0.0264	0.0247	0.0752
246	0.124	3125	4.87		119208	90590		0.0190	0.0184		24.3	14.0				17.22	19.58	16.46				0.0148	0.0169	0.0142	0.0459
247	0.078	3125	4.87		74500	56615		0.0204	0.0203		24.3	14.0				18.51	21.60	16.46				0.0100	0.0116	0.0089	0.0305
249	0.079	3125	4.87		75516	57387		0.0204	0.0203		24.3	14.0				18.47	21.54	16.46				0.0101	0.0118	0.0090	0.0308
263	0.122	3125	4.87		117221	89080		0.0190	0.0185		24.3	14.0				17.26	19.65	16.46				0.0146	0.0166	0.0139	0.0452
265	0.079	3125	4.87		76140	57861		0.0203	0.0203		24.3	14.0				18.44	21.50	16.46				0.0101	0.0118	0.0091	0.0310
266	0.082	3125	4.87		79062	60081		0.0202	0.0201		24.3	14.0				18.33	21.33	16.46				0.0105	0.0122	0.0094	0.0321
267	0.081	3125	4.87		78039	59304		0.0203	0.0201		24.3	14.0				18.37	21.39	16.46				0.0104	0.0121	0.0093	0.0317
271	0.088	3125	4.87		84097	63908		0.0200	0.0198		24.3	14.0				18.15	21.05	16.46				0.0110	0.0128	0.0100	0.0338
273	0.091	3125	4.87		87541	66525		0.0199	0.0197		24.3	14.0				18.03	20.87	16.46				0.0114	0.0132	0.0104	0.0350
274	0.108	3125	4.87		103628	78750		0.0194	0.0190		24.3	14.0				17.57	20.15	16.46				0.0132	0.0151	0.0123	0.0406
275	0.208	3271	5.10		208856	158716		0.0177	0.0165		25.4	14.7				17.57	19.24	18.03				0.0253	0.0277	0.0260	0.0791
276	0.077	3125	4.87		74202	56388		0.0204	0.0204		24.3	14.0				18.52	21.62	16.46				0.0099	0.0116	0.0088	0.0304
278	0.089	3125	4.87		85869	65255		0.0199	0.0197		24.3	14.0				18.09	20.96	16.46				0.0112	0.0130	0.0102	0.0344
281	0.076	3125	4.87		73322	55720		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
283	0.132	3125	4.87		127202	96664		0.0188	0.0182		24.3	14.0				17.06	19.33	16.46				0.0157	0.0178	0.0151	0.0486
284	0.152	3125	4.87		145993	110944		0.0185	0.0177		24.3	14.0				16.75	18.80	16.46				0.0177	0.0198	0.0174	0.0549

286	0.077	3125	4.87		73525	55874		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0087	0.0301
288	0.079	3125	4.87		76126	57850		0.0203	0.0203		24.3	14.0				18.45	21.50	16.46				0.0101	0.0118	0.0091	0.0310
289	0.079	3125	4.87		75986	57744		0.0204	0.0203		24.3	14.0				18.45	21.51	16.46				0.0101	0.0118	0.0090	0.0310
295	0.078	3125	4.87		75403	57301		0.0204	0.0203		24.3	14.0				18.47	21.55	16.46				0.0101	0.0117	0.0090	0.0308
296	0.079	3125	4.87		76126	57850		0.0203	0.0203		24.3	14.0				18.45	21.50	16.46				0.0101	0.0118	0.0091	0.0310
297	0.079	3125	4.87		75977	57737		0.0204	0.0203		24.3	14.0				18.45	21.51	16.46				0.0101	0.0118	0.0090	0.0310
300	0.080	3125	4.87		77291	58736		0.0203	0.0202		24.3	14.0				18.40	21.43	16.46				0.0103	0.0120	0.0092	0.0314
301	0.080	3125	4.87		77291	58736		0.0203	0.0202		24.3	14.0				18.40	21.43	16.46				0.0103	0.0120	0.0092	0.0314
304	0.082	3125	4.87		78361	59549		0.0202	0.0201		24.3	14.0				18.36	21.37	16.46				0.0104	0.0121	0.0093	0.0318
305	0.078	3125	4.87		74952	56958		0.0204	0.0203		24.3	14.0				18.49	21.58	16.46				0.0100	0.0117	0.0089	0.0306
306	0.078	3125	4.87		74952	56958		0.0204	0.0203		24.3	14.0				18.49	21.58	16.46				0.0100	0.0117	0.0089	0.0306
307	0.078	3125	4.87		74952	56958		0.0204	0.0203		24.3	14.0				18.49	21.58	16.46				0.0100	0.0117	0.0089	0.0306
309	0.076	3125	4.87		73443	55812		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301
316	0.087	3125	4.87		83492	63448		0.0200	0.0199		24.3	14.0				18.17	21.08	16.46				0.0110	0.0127	0.0099	0.0336
317	0.087	3125	4.87		83492	63448		0.0200	0.0199		24.3	14.0				18.17	21.08	16.46				0.0110	0.0127	0.0099	0.0336
318	0.076	3125	4.87		73326	55723		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
319	0.076	3125	4.87		73303	55705		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
320	0.076	3125	4.87		73303	55705		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
321	0.088	3125	4.87		84932	64542		0.0200	0.0198		24.3	14.0				18.12	21.01	16.46				0.0111	0.0129	0.0101	0.0341
322	0.090	3125	4.87		86061	65400		0.0199	0.0197		24.3	14.0				18.08	20.95	16.46				0.0112	0.0130	0.0102	0.0345
324	0.076	3125	4.87		73303	55705		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
325	0.076	3125	4.87		73303	55705		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
364	0.095	3125	4.87		90848	69038		0.0198	0.0195		24.3	14.0				17.93	20.71	16.46				0.0118	0.0136	0.0108	0.0362
366	0.078	3125	4.87		74771	56821		0.0204	0.0203		24.3	14.0				18.50	21.59	16.46				0.0100	0.0117	0.0089	0.0306
367	0.078	3125	4.87		74771	56821		0.0204	0.0203		24.3	14.0				18.50	21.59	16.46				0.0100	0.0117	0.0089	0.0306
366	0.078	3125	4.87		74771	56821		0.0204	0.0203		24.3	14.0				18.50	21.59	16.46				0.0100	0.0117	0.0089	0.0306
382	0.078	3125	4.87		74771	56821		0.0204	0.0203		24.3	14.0				18.50	21.59	16.46				0.0100	0.0117	0.0089	0.0306
383	0.084	3125	4.87		80624	61269		0.0202	0.0200		24.3	14.0				18.27	21.24	16.46				0.0106	0.0124	0.0096	0.0326
389	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
403	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
418	0.082	3125	4.87		79107	60115		0.0202	0.0201		24.3	14.0				18.33	21.33	16.46				0.0105	0.0122	0.0094	0.0321
429	0.076	3125	4.87		73456	55822		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0099	0.0115	0.0087	0.0301
432	0.270	3550	5.54		294447	223759		0.0171	0.0155		27.6	15.9				19.97	21.30	21.24				0.0374	0.0399	0.0398	0.1171
433	0.347	3850	6.00		410568	312003		0.0166	0.0147		29.9	17.3				22.83	23.67	24.98				0.0550	0.0570	0.0602	0.1722
434	0.265	3522	5.49		286628	217817		0.0171	0.0156		27.4	15.8				19.71	21.06	20.91				0.0362	0.0387	0.0384	0.1134
436	0.310	3745	5.84		356427	270860		0.0168	0.0150		29.1	16.8				21.85	22.93	23.64				0.0470	0.0493	0.0508	0.1471
437	0.310	3745	5.84		356427	270860		0.0168	0.0150		29.1	16.8				21.85	22.93	23.64				0.0470	0.0493	0.0508	0.1471
442	0.082	3125	4.87		78994	60030		0.0202	0.0201		24.3	14.0				18.33	21.33	16.46				0.0105	0.0122	0.0094	0.0320
448	0.080	3125	4.87		76681	58273		0.0203	0.0202		24.3	14.0				18.42	21.47	16.46				0.0102	0.0119	0.0091	0.0312
457	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
458	0.084	3125	4.87		80768	61378		0.0201	0.0200		24.3	14.0				18.27	21.23	16.46				0.0107	0.0124	0.0096	0.0327
464	0.097	3125	4.87		93630	71152		0.0197	0.0194		24.3	14.0				17.84	20.58	16.46				0.0121	0.0139	0.0111	0.0371
465	0.098	3125	4.87		94199	71585		0.0197	0.0194		24.3	14.0				17.83	20.55	16.46				0.0121	0.0140	0.0112	0.0373
466	0.091	3125	4.87		87642	66602		0.0199	0.0197		24.3	14.0				18.03	20.87	16.46				0.0114	0.0132	0.0104	0.0351
467	0.082	3125	4.87		78944	59992		0.0202	0.0201		24.3	14.0				18.34	21.34	16.46				0.0105	0.0122	0.0094	0.0320
468	0.079	3125	4.87		75981	57741		0.0204	0.0203		24.3	14.0				18.45	21.51	16.46				0.0101	0.0118	0.0090	0.0310
469	0.076	3125	4.87		73297	55700		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
473	0.076	3125	4.87		73219	55641		0.0205	0.0204		24.3	14.0				18.57	21.68	16.46				0.0098	0.0115	0.0087	0.0300
476	0.083	3125	4.87		79816	60654		0.0202	0.0201		24.3	14.0				18.30	21.29	16.46				0.0106	0.0123	0.0095	0.0323
478	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
468	0.076	3125	4.87		73287	55693		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
493	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
494	0.076	3125	4.87		73406	55783		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301
496	0.076	3125	4.87		73403	55781		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301
497	0.077	3125	4.87		73789	56074		0.0204	0.0204		24.3	14.0				18.54	21.65	16.46				0.0099	0.0115	0.0088	0.0302
499	0.091	3125	4.87		87642	66602		0.0199	0.0197		24.3	14.0				18.03	20.87	16.46				0.0114	0.0132	0.0104	0.0351
502	0.077	3125	4.87		73673	55987		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0088	0.0302
503	0.077	3125	4.87		73633	55956		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0088	0.0302
505	0.076	3125	4.87		73412	55788		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301
506	0.076	3125	4.87		73384	55767		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301
508	0.077	3125	4.87		73561	55901		0.0205	0.0204		24.3	14.0				18.55	21.66	16.46				0.0099	0.0115	0.0088	0.0301
509	0.076	3125	4.87		73334	55728		0.0205	0.0204		24.3	14.0				18.56	21.68	16.46				0.0098	0.0115	0.0087	0.0300
519	0.078	3125	4.87		75169	57123		0.0204	0.0203		24.3	14.0				18.48	21.56	16.46				0.0100	0.0117	0.0089	0.0307
520	0.078	3125	4.87		75131	57094		0.0204	0.0203		24.3	14.0				18.49	21.56	16.46				0.0100	0.0117	0.0089	0.0307
521	0.078	3125	4.87		75131	57094		0.0204	0.0203		24.3	14.0				18.49	21.56	16.46				0.0100	0.0117	0.0089	0.0307
522	0.078	3125	4.87		75131	57094		0.0204	0.0203		24.3	14.0				18.49	21.56	16.46				0.0100	0.0117	0.0089	0.0307
529	0.076	3125	4.87		73145	55585		0.0205	0.0204		24.3	14.0				18.57	21.69	16.46				0.0098	0.0115	0.0087	0.0300
533	0.077	3125	4.87		74121	56327		0.0204	0.0204		24.3	14.0				18.53	21.63	16.46				0.0099	0.0116	0.0088	0.0303
534	0.076	3125	4.87		73369	55755		0.0205	0.0204		24.3	14.0				18.56	21.67	16.46				0.0098	0.0115	0.0087	0.0301

546	0.083	3125	4.87		79272	60241		0.0202	0.0201		24.3	14.0				18.32	21.32	16.46				0.0105	0.0122	0.0094	0.0321
547	0.083	3125	4.87		79272	60241		0.0202	0.0201		24.3	14.0				18.32	21.32	16.46				0.0105	0.0122	0.0094	0.0321
548	0.081	3125	4.87		77950	59237		0.0203	0.0202		24.3	14.0				18.37	21.39	16.46				0.0104	0.0121	0.0093	0.0317
549	0.083	3125	4.87		79272	60241		0.0202	0.0201		24.3	14.0				18.32	21.32	16.46				0.0105	0.0122	0.0094	0.0321
550	0.077	1563	2.44		37173	28249		0.0232	0.0238		12.1	7.0				5.26	6.32	4.11				0.0028	0.0034	0.0022	0.0084

MAX ΔP:	0.1722

P-V valve pressure setting: 1.5 psi
80% of P-V valve setting: 1.2 psi

Maximum pressure drop to shore connection: 0.172 psi

TOTAL PRESSURE DROP TO SHORE CONNECTION: **0.172 psi** *OK*

Max. allowable back pressure at facility: **1.028 psi**

Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal:	8	in	
Pipe ID:	7.981	in	
Pipe Flow Area:	50.03	in^2	
Vapor Dynamic Viscosity:	0.019	cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)	

PIPE LENGTH

Length (ft):	231.00	ft	8" pipe
Length (ft):	50.00	ft	6" hose
f, friction factor (pipe):	Varies with Reynold's Number (see table below)		

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft):	255.81	ft	
f_t, friction factor, turbulent flow (fittings):	0.014	constant, for each pipe size	

Shore Connection Pressure Drop (at 75% of Maximum Liquid Loading Rate): 3750 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s									ft/s					ft	ft					psi	psi	psi
1	0.123	4688	7.31		177458	134856		0.0180	0.0183		36.4	21.0				36.76	43.62	37.03				0.0314	0.0373	0.0317	0.1004
2	0.085	4688	7.31		122480	93076		0.0189	0.0183		36.4	21.0				38.59	43.81	37.03				0.0228	0.0259	0.0219	0.0705
19	0.082	4688	7.31		117497	89290		0.0190	0.0185		36.4	21.0				38.81	44.18	37.03				0.0220	0.0250	0.0210	0.0680
20	0.079	4688	7.31		113864	86529		0.0191	0.0186		36.4	21.0				38.99	44.47	37.03				0.0214	0.0244	0.0203	0.0661
21	0.079	4688	7.31		113864	86529		0.0191	0.0186		36.4	21.0				38.99	44.47	37.03				0.0214	0.0244	0.0203	0.0661
23	0.079	4688	7.31		113864	86529		0.0191	0.0186		36.4	21.0				38.99	44.47	37.03				0.0214	0.0244	0.0203	0.0661
24	0.079	4688	7.31		113864	86529		0.0191	0.0186		36.4	21.0				38.99	44.47	37.03				0.0214	0.0244	0.0203	0.0661
26	0.079	4688	7.31		113864	86529		0.0191	0.0186		36.4	21.0				38.99	44.47	37.03				0.0214	0.0244	0.0203	0.0661
34	0.077	4688	7.31		111567	84783		0.0192	0.0187		36.4	21.0				39.10	44.65	37.03				0.0210	0.0240	0.0199	0.0649
40	0.085	4688	7.31		121911	92644		0.0189	0.0184		36.4	21.0				38.61	43.86	37.03				0.0227	0.0258	0.0218	0.0702
42	0.097	4688	7.31		140201	106543		0.0186	0.0179		36.4	21.0				37.88	42.65	37.03				0.0256	0.0288	0.0250	0.0794
44	0.083	4688	7.31		119473	90791		0.0190	0.0184		36.4	21.0				38.72	44.03	37.03				0.0223	0.0253	0.0213	0.0690
46	0.086	4688	7.31		123808	94085		0.0189	0.0183		36.4	21.0				38.53	43.72	37.03				0.0230	0.0261	0.0221	0.0712
47	0.097	4688	7.31		140066	106440		0.0186	0.0179		36.4	21.0				37.88	42.66	37.03				0.0256	0.0288	0.0250	0.0793
48	0.077	4688	7.31		110382	83883		0.0192	0.0187		36.4	21.0				39.17	44.75	37.03				0.0208	0.0238	0.0197	0.0643
58	0.078	4688	7.31		112502	85494		0.0191	0.0187		36.4	21.0				39.06	44.58	37.03				0.0212	0.0242	0.0201	0.0654
64	0.077	4688	7.31		110700	84125		0.0192	0.0187		36.4	21.0				39.15	44.72	37.03				0.0209	0.0239	0.0198	0.0645
70	0.085	4688	7.31		122724	93262		0.0189	0.0183		36.4	21.0				38.58	43.80	37.03				0.0228	0.0259	0.0219	0.0706
72	0.116	4688	7.31		167636	127391		0.0181	0.0172		36.4	21.0				37.02	41.19	37.03				0.0299	0.0333	0.0299	0.0931
73	0.078	4688	7.31		112208	85270		0.0192	0.0187		36.4	21.0				39.07	44.60	37.03				0.0211	0.0241	0.0200	0.0653
74	0.080	4688	7.31		115730	87947		0.0191	0.0186		36.4	21.0				38.90	44.32	37.03				0.0217	0.0247	0.0206	0.0671
76	0.078	4688	7.31		112416	85428		0.0191	0.0187		36.4	21.0				39.06	44.58	37.03				0.0212	0.0241	0.0201	0.0654
77	0.078	4688	7.31		112265	85314		0.0192	0.0187		36.4	21.0				39.07	44.59	37.03				0.0211	0.0241	0.0200	0.0653
78	0.076	4688	7.31		109989	83584		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
79	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
81	0.078	4688	7.31		112807	85725		0.0191	0.0187		36.4	21.0				39.04	44.55	37.03				0.0212	0.0242	0.0201	0.0656
82	0.076	4688	7.31		110009	83599		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0641
83	0.076	4688	7.31		110009	83599		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0641
84	0.076	4688	7.31		110009	83599		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0641
85	0.076	4688	7.31		110160	83714		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0197	0.0642
87	0.078	4688	7.31		111750	84922		0.0192	0.0187		36.4	21.0				39.10	44.64	37.03				0.0211	0.0240	0.0199	0.0650
91	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
92	0.080	4688	7.31		115730	87947		0.0191	0.0186		36.4	21.0				38.90	44.32	37.03				0.0217	0.0247	0.0206	0.0671
93	0.077	4688	7.31		111680	84869		0.0192	0.0187		36.4	21.0				39.10	44.64	37.03				0.0210	0.0240	0.0199	0.0650
94	0.076	4688	7.31		109898	83515		0.0192	0.0188		36.4	21.0				39.19	44.79	37.03				0.0208	0.0237	0.0196	0.0641
95	0.076	4688	7.31		110023	83610		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0641
100	0.076	4688	7.31		110209	83751		0.0192	0.0187		36.4	21.0				39.17	44.76	37.03				0.0208	0.0238	0.0197	0.0642
101	0.077	4688	7.31		110356	83863		0.0192	0.0187		36.4	21.0				39.17	44.75	37.03				0.0208	0.0238	0.0197	0.0643
111	0.078	4688	7.31		112138	85217		0.0192	0.0187		36.4	21.0				39.08	44.61	37.03				0.0211	0.0241	0.0200	0.0652
112	0.103	4688	7.31		148465	112823		0.0184	0.0177		36.4	21.0				37.59	42.17	37.03				0.0269	0.0302	0.0265	0.0835
113	0.079	4688	7.31		113945	86590		0.0191	0.0186		36.4	21.0				38.99	44.46	37.03				0.0214	0.0244	0.0203	0.0661
119	0.077	4688	7.31		110653	84088		0.0192	0.0187		36.4	21.0				39.15	44.73	37.03				0.0209	0.0238	0.0197	0.0645
124	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
128	0.077	4688	7.31		110626	84068		0.0192	0.0187		36.4	21.0				39.15	44.73	37.03				0.0209	0.0238	0.0197	0.0645
130	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
131	0.078	4688	7.31		112360	85386		0.0191	0.0187		36.4	21.0				39.06	44.59	37.03				0.0211	0.0241	0.0200	0.0653
132	0.076	4688	7.31		110010	83600		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0641
133	0.076	4688	7.31		110047	83628		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0642

134	0.076	4688	7.31		110048	83629		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0642
136	0.077	4688	7.31		111439	84686		0.0192	0.0187		36.4	21.0				39.11	44.66	37.03				0.0210	0.0240	0.0199	0.0649
139	0.102	4688	7.31		147111	111794		0.0185	0.0177		36.4	21.0				37.64	42.25	37.03				0.0267	0.0299	0.0262	0.0829
140	0.102	4688	7.31		147111	111794		0.0185	0.0177		36.4	21.0				37.64	42.25	37.03				0.0267	0.0299	0.0262	0.0829
145	0.077	4688	7.31		110370	83873		0.0192	0.0187		36.4	21.0				39.17	44.75	37.03				0.0208	0.0238	0.0197	0.0643
146	0.077	4688	7.31		110370	83873		0.0192	0.0187		36.4	21.0				39.17	44.75	37.03				0.0208	0.0238	0.0197	0.0643
147	0.240	4688	7.31		345317	262417		0.0168	0.0151		36.4	21.0				34.32	36.12	37.03				0.0571	0.0601	0.0616	0.1788
155	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
156	0.119	4688	7.31		171903	130634		0.0181	0.0172		36.4	21.0				36.91	40.99	37.03				0.0306	0.0339	0.0307	0.0952
157	0.079	4688	7.31		114433	86961		0.0191	0.0186		36.4	21.0				38.96	44.42	37.03				0.0215	0.0245	0.0204	0.0664
158	0.086	4688	7.31		123943	94188		0.0189	0.0183		36.4	21.0				38.52	43.71	37.03				0.0230	0.0261	0.0221	0.0712
160	0.083	4688	7.31		120123	91285		0.0190	0.0184		36.4	21.0				38.69	43.99	37.03				0.0224	0.0255	0.0214	0.0693
161	0.078	4688	7.31		111767	84935		0.0192	0.0187		36.4	21.0				39.09	44.64	37.03				0.0211	0.0240	0.0199	0.0650
162	0.090	4688	7.31		130040	98821		0.0188	0.0181		36.4	21.0				38.27	43.29	37.03				0.0240	0.0271	0.0232	0.0743
163	0.083	4688	7.31		119439	90765		0.0190	0.0184		36.4	21.0				38.72	44.04	37.03				0.0223	0.0253	0.0213	0.0689
166	0.076	4688	7.31		109800	83440		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
169	0.077	4688	7.31		111249	84541		0.0192	0.0187		36.4	21.0				39.12	44.68	37.03				0.0210	0.0239	0.0199	0.0648
172	0.076	4688	7.31		109991	83586		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
178	0.076	4688	7.31		109976	83574		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
180	0.076	4688	7.31		109976	83574		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
184	0.079	4688	7.31		113645	86362		0.0191	0.0186		36.4	21.0				39.00	44.48	37.03				0.0214	0.0244	0.0203	0.0660
186	0.076	4688	7.31		110192	83738		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0197	0.0642
190	0.086	4688	7.31		123943	94188		0.0189	0.0183		36.4	21.0				38.52	43.71	37.03				0.0230	0.0261	0.0221	0.0712
191	0.080	4688	7.31		115693	87918		0.0191	0.0186		36.4	21.0				38.90	44.32	37.03				0.0217	0.0247	0.0206	0.0670
194	0.076	4688	7.31		110091	83661		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0196	0.0642
195	0.077	4688	7.31		110531	83996		0.0192	0.0187		36.4	21.0				39.16	44.74	37.03				0.0209	0.0238	0.0197	0.0644
197	0.217	4688	7.31		312938	237811		0.0170	0.0154		36.4	21.0				34.62	36.74	37.03				0.0522	0.0554	0.0558	0.1634
198	0.217	4688	7.31		312938	237811		0.0170	0.0154		36.4	21.0				34.62	36.74	37.03				0.0522	0.0554	0.0558	0.1634
199	0.217	4688	7.31		312938	237811		0.0170	0.0154		36.4	21.0				34.62	36.74	37.03				0.0522	0.0554	0.0558	0.1634
200	0.217	4688	7.31		312938	237811		0.0170	0.0154		36.4	21.0				34.62	36.74	37.03				0.0522	0.0554	0.0558	0.1634
201	0.217	4688	7.31		312938	237811		0.0170	0.0154		36.4	21.0				34.62	36.74	37.03				0.0522	0.0554	0.0558	0.1634
202	0.217	4688	7.31		312938	237811		0.0170	0.0154		36.4	21.0				34.62	36.74	37.03				0.0522	0.0554	0.0558	0.1634
203	0.217	4688	7.31		312938	237811		0.0170	0.0154		36.4	21.0				34.62	36.74	37.03				0.0522	0.0554	0.0558	0.1634
204	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
217	0.105	4688	7.31		151209	114908		0.0184	0.0176		36.4	21.0				37.51	42.02	37.03				0.0273	0.0306	0.0270	0.0849
218	0.105	4688	7.31		151209	114908		0.0184	0.0176		36.4	21.0				37.51	42.02	37.03				0.0273	0.0306	0.0270	0.0849
219	0.076	4688	7.31		109955	83558		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
220	0.077	4688	7.31		110531	83996		0.0192	0.0187		36.4	21.0				39.16	44.74	37.03				0.0209	0.0238	0.0197	0.0644
221	0.077	4688	7.31		110531	83996		0.0192	0.0187		36.4	21.0				39.16	44.74	37.03				0.0209	0.0238	0.0197	0.0644
222	0.109	4688	7.31		156865	119206		0.0183	0.0175		36.4	21.0				37.33	41.72	37.03				0.0282	0.0315	0.0280	0.0877
223	0.108	4688	7.31		155239	117971		0.0183	0.0175		36.4	21.0				37.38	41.80	37.03				0.0280	0.0313	0.0277	0.0869
224	0.078	4688	7.31		112766	85695		0.0191	0.0187		36.4	21.0				39.04	44.55	37.03				0.0212	0.0242	0.0201	0.0655
229	0.142	4688	7.31		204554	155447		0.0177	0.0166		36.4	21.0				36.16	39.66	37.03				0.0356	0.0391	0.0365	0.1112
230	0.142	4688	7.31		204554	155447		0.0177	0.0166		36.4	21.0				36.16	39.66	37.03				0.0356	0.0391	0.0365	0.1112
231	0.076	4688	7.31		109921	83533		0.0192	0.0188		36.4	21.0				39.19	44.79	37.03				0.0208	0.0237	0.0196	0.0641
232	0.088	4688	7.31		126789	96350		0.0188	0.0182		36.4	21.0				38.40	43.51	37.03				0.0235	0.0266	0.0226	0.0727
234	0.148	4688	7.31		212683	161624		0.0176	0.0165		36.4	21.0				36.00	39.37	37.03				0.0369	0.0403	0.0379	0.1152
235	0.149	4688	7.31		215257	163580		0.0176	0.0164		36.4	21.0				35.95	39.29	37.03				0.0373	0.0407	0.0384	0.1164
236	0.149	4688	7.31		215257	163580		0.0176	0.0164		36.4	21.0				35.95	39.29	37.03				0.0373	0.0407	0.0384	0.1164
238	0.076	4688	7.31		109725	83383		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
243	0.076	4688	7.31		109972	83571		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
244	0.078	4688	7.31		113037	85900		0.0191	0.0186		36.4	21.0				39.03	44.53	37.03				0.0213	0.0243	0.0202	0.0657
245	0.216	4688	7.31		311481	236704		0.0170	0.0154		36.4	21.0				34.64	36.77	37.03				0.0520	0.0552	0.0556	0.1627
246	0.124	4688	7.31		178813	135885		0.0180	0.0170		36.4	21.0				36.73	40.68	37.03				0.0316	0.0350	0.0319	0.0986
247	0.078	4688	7.31		111750	84922		0.0192	0.0187		36.4	21.0				39.10	44.64	37.03				0.0211	0.0240	0.0199	0.0650
249	0.079	4688	7.31		113274	86081		0.0191	0.0186		36.4	21.0				39.02	44.51	37.03				0.0213	0.0243	0.0202	0.0658
263	0.122	4688	7.31		175832	133620		0.0180	0.0171		36.4	21.0				36.80	40.81	37.03				0.0312	0.0346	0.0314	0.0971
265	0.079	4688	7.31		114209	86791		0.0191	0.0186		36.4	21.0				38.97	44.44	37.03				0.0214	0.0245	0.0204	0.0663
266	0.082	4688	7.31		118593	90122		0.0190	0.0185		36.4	21.0				38.76	44.10	37.03				0.0221	0.0252	0.0212	0.0685
267	0.081	4688	7.31		117058	88956		0.0190	0.0185		36.4	21.0				38.83	44.22	37.03				0.0219	0.0249	0.0209	0.0677
271	0.088	4688	7.31		126145	95861		0.0188	0.0182		36.4	21.0				38.43	43.55	37.03				0.0234	0.0265	0.0225	0.0723
273	0.091	4688	7.31		131312	99788		0.0187	0.0181		36.4	21.0				38.22	43.21	37.03				0.0242	0.0273	0.0234	0.0749
274	0.108	4688	7.31		155442	118125		0.0183	0.0175		36.4	21.0				37.37	41.79	37.03				0.0280	0.0313	0.0277	0.0870
275	0.208	4907	7.65		313284	238074		0.0170	0.0154		38.1	22.0				37.93	40.24	40.57				0.0547	0.0580	0.0585	0.1712
276	0.077	4688	7.31		111303	84583		0.0192	0.0187		36.4	21.0				39.12	44.67	37.03				0.0210	0.0240	0.0199	0.0648
278	0.089	4688	7.31		128804	97882		0.0188	0.0182		36.4	21.0				38.32	43.37	37.03				0.0238	0.0269	0.0230	0.0737
281	0.076	4688	7.31		109983	83579		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
283	0.132	4688	7.31		190803	144997		0.0179	0.0168		36.4	21.0				36.45	40.18	37.03				0.0335	0.0369	0.0340	0.1045
284	0.152	4688	7.31		218989	166416		0.0176	0.0164		36.4	21.0				35.88	39.16	37.03				0.0379	0.0413	0.0391	0.1183

286	0.077	4688	7.31		110287	83810		0.0192	0.0187		36.4	21.0				39.17	44.76	37.03				0.0208	0.0238	0.0197	0.0643
288	0.079	4688	7.31		114189	86776		0.0191	0.0186		36.4	21.0				38.97	44.44	37.03				0.0214	0.0245	0.0204	0.0663
289	0.079	4688	7.31		113979	86616		0.0191	0.0186		36.4	21.0				38.98	44.46	37.03				0.0214	0.0244	0.0203	0.0662
295	0.078	4688	7.31		113105	85952		0.0191	0.0186		36.4	21.0				39.03	44.53	37.03				0.0213	0.0243	0.0202	0.0657
296	0.079	4688	7.31		114189	86776		0.0191	0.0186		36.4	21.0				38.97	44.44	37.03				0.0214	0.0245	0.0204	0.0663
297	0.079	4688	7.31		113965	86606		0.0191	0.0186		36.4	21.0				38.98	44.46	37.03				0.0214	0.0244	0.0203	0.0662
300	0.080	4688	7.31		115937	88104		0.0191	0.0185		36.4	21.0				38.89	44.30	37.03				0.0217	0.0247	0.0207	0.0672
301	0.080	4688	7.31		115937	88104		0.0191	0.0185		36.4	21.0				38.89	44.30	37.03				0.0217	0.0247	0.0207	0.0672
304	0.082	4688	7.31		117542	89324		0.0190	0.0185		36.4	21.0				38.81	44.18	37.03				0.0220	0.0250	0.0210	0.0680
305	0.078	4688	7.31		112428	85437		0.0191	0.0187		36.4	21.0				39.06	44.58	37.03				0.0212	0.0242	0.0201	0.0654
306	0.078	4688	7.31		112428	85437		0.0191	0.0187		36.4	21.0				39.06	44.58	37.03				0.0212	0.0242	0.0201	0.0654
307	0.078	4688	7.31		112428	85437		0.0191	0.0187		36.4	21.0				39.06	44.58	37.03				0.0212	0.0242	0.0201	0.0654
309	0.076	4688	7.31		110165	83718		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0197	0.0642
316	0.087	4688	7.31		125237	95172		0.0189	0.0183		36.4	21.0				38.47	43.62	37.03				0.0232	0.0263	0.0223	0.0719
317	0.087	4688	7.31		125237	95172		0.0189	0.0183		36.4	21.0				38.47	43.62	37.03				0.0232	0.0263	0.0223	0.0719
318	0.076	4688	7.31		109989	83584		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
319	0.076	4688	7.31		109954	83557		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
320	0.076	4688	7.31		109954	83557		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
321	0.088	4688	7.31		127398	96814		0.0188	0.0182		36.4	21.0				38.37	43.47	37.03				0.0236	0.0267	0.0227	0.0730
322	0.090	4688	7.31		129092	98101		0.0188	0.0182		36.4	21.0				38.30	43.35	37.03				0.0238	0.0270	0.0230	0.0738
324	0.076	4688	7.31		109954	83557		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
325	0.076	4688	7.31		109954	83557		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
364	0.095	4688	7.31		136272	103557		0.0186	0.0180		36.4	21.0				38.02	42.89	37.03				0.0250	0.0282	0.0243	0.0774
366	0.078	4688	7.31		112157	85231		0.0192	0.0187		36.4	21.0				39.07	44.60	37.03				0.0211	0.0241	0.0200	0.0652
367	0.078	4688	7.31		112157	85231		0.0192	0.0187		36.4	21.0				39.07	44.60	37.03				0.0211	0.0241	0.0200	0.0652
366	0.078	4688	7.31		112157	85231		0.0192	0.0187		36.4	21.0				39.07	44.60	37.03				0.0211	0.0241	0.0200	0.0652
382	0.078	4688	7.31		112157	85231		0.0192	0.0187		36.4	21.0				39.07	44.60	37.03				0.0211	0.0241	0.0200	0.0652
383	0.084	4688	7.31		120936	91903		0.0189	0.0184		36.4	21.0				38.66	43.93	37.03				0.0225	0.0256	0.0216	0.0697
389	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
403	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
418	0.082	4688	7.31		118660	90173		0.0190	0.0185		36.4	21.0				38.76	44.10	37.03				0.0222	0.0252	0.0212	0.0685
429	0.076	4688	7.31		110184	83732		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0197	0.0642
432	0.270	5325	8.31		441671	335639		0.0165	0.0145		41.4	23.9				43.42	44.74	47.79				0.0813	0.0838	0.0895	0.2547
433	0.347	5775	9.01		615851	468004		0.0161	0.0138		44.9	25.9				49.94	49.95	56.21				0.1203	0.1203	0.1354	0.3760
434	0.265	5283	8.24		429942	326726		0.0165	0.0146		41.1	23.7				42.83	44.23	47.04				0.0787	0.0813	0.0865	0.2465
436	0.310	5618	8.76		534641	406290		0.0163	0.0141		43.7	25.2				47.68	48.30	53.18				0.1025	0.1038	0.1143	0.3206
437	0.310	5618	8.76		534641	406290		0.0163	0.0141		43.7	25.2				47.68	48.30	53.18				0.1025	0.1038	0.1143	0.3206
442	0.082	4688	7.31		118490	90044		0.0190	0.0185		36.4	21.0				38.77	44.11	37.03				0.0221	0.0252	0.0211	0.0685
448	0.080	4688	7.31		115022	87409		0.0191	0.0186		36.4	21.0				38.93	44.37	37.03				0.0216	0.0246	0.0205	0.0667
457	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
458	0.084	4688	7.31		121153	92067		0.0189	0.0184		36.4	21.0				38.65	43.91	37.03				0.0226	0.0256	0.0216	0.0698
464	0.097	4688	7.31		140445	106728		0.0186	0.0178		36.4	21.0				37.87	42.63	37.03				0.0256	0.0288	0.0251	0.0795
465	0.098	4688	7.31		141298	107377		0.0185	0.0178		36.4	21.0				37.84	42.58	37.03				0.0258	0.0290	0.0252	0.0800
466	0.091	4688	7.31		131463	99902		0.0187	0.0181		36.4	21.0				38.21	43.20	37.03				0.0242	0.0274	0.0235	0.0750
467	0.082	4688	7.31		118416	89988		0.0190	0.0185		36.4	21.0				38.77	44.11	37.03				0.0221	0.0252	0.0211	0.0684
468	0.079	4688	7.31		113972	86611		0.0191	0.0186		36.4	21.0				38.98	44.46	37.03				0.0214	0.0244	0.0203	0.0662
469	0.076	4688	7.31		109945	83551		0.0192	0.0187		36.4	21.0				39.19	44.79	37.03				0.0208	0.0237	0.0196	0.0641
473	0.076	4688	7.31		109828	83461		0.0192	0.0188		36.4	21.0				39.19	44.80	37.03				0.0207	0.0237	0.0196	0.0640
476	0.083	4688	7.31		119723	90981		0.0190	0.0184		36.4	21.0				38.71	44.02	37.03				0.0223	0.0254	0.0214	0.0691
478	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
468	0.076	4688	7.31		109931	83540		0.0192	0.0188		36.4	21.0				39.19	44.79	37.03				0.0208	0.0237	0.0196	0.0641
493	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
494	0.076	4688	7.31		110109	83675		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0196	0.0642
496	0.076	4688	7.31		110104	83672		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0196	0.0642
497	0.077	4688	7.31		110683	84111		0.0192	0.0187		36.4	21.0				39.15	44.72	37.03				0.0209	0.0239	0.0197	0.0645
499	0.091	4688	7.31		131463	99902		0.0187	0.0181		36.4	21.0				38.21	43.20	37.03				0.0242	0.0274	0.0235	0.0750
502	0.077	4688	7.31		110510	83980		0.0192	0.0187		36.4	21.0				39.16	44.74	37.03				0.0209	0.0238	0.0197	0.0644
503	0.077	4688	7.31		110450	83934		0.0192	0.0187		36.4	21.0				39.16	44.74	37.03				0.0208	0.0238	0.0197	0.0644
505	0.076	4688	7.31		110118	83682		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0238	0.0196	0.0642
506	0.076	4688	7.31		110076	83650		0.0192	0.0187		36.4	21.0				39.18	44.77	37.03				0.0208	0.0237	0.0196	0.0642
508	0.077	4688	7.31		110341	83852		0.0192	0.0187		36.4	21.0				39.17	44.75	37.03				0.0208	0.0238	0.0197	0.0643
509	0.076	4688	7.31		110001	83593		0.0192	0.0187		36.4	21.0				39.19	44.78	37.03				0.0208	0.0237	0.0196	0.0641
519	0.078	4688	7.31		112753	85684		0.0191	0.0187		36.4	21.0				39.04	44.56	37.03				0.0212	0.0242	0.0201	0.0655
520	0.078	4688	7.31		112696	85641		0.0191	0.0187		36.4	21.0				39.05	44.56	37.03				0.0212	0.0242	0.0201	0.0655
521	0.078	4688	7.31		112696	85641		0.0191	0.0187		36.4	21.0				39.05	44.56	37.03				0.0212	0.0242	0.0201	0.0655
522	0.078	4688	7.31		112696	85641		0.0191	0.0187		36.4	21.0				39.05	44.56	37.03				0.0212	0.0242	0.0201	0.0655
529	0.076	4688	7.31		109718	83378		0.0192	0.0188		36.4	21.0				39.20	44.80	37.03				0.0207	0.0237	0.0196	0.0640
533	0.077	4688	7.31		111181	84490		0.0192	0.0187		36.4	21.0				39.12	44.68	37.03				0.0210	0.0239	0.0198	0.0647
534	0.076	4688	7.31		110053	83632		0.0192	0.0187		36.4	21.0				39.18	44.78	37.03				0.0208	0.0237	0.0196	0.0642

546	0.083	4688	7.31		118908	90362		0.0190	0.0185		36.4	21.0				38.75	44.08	37.03				0.0222	0.0253	0.0212	0.0687
547	0.083	4688	7.31		118908	90362		0.0190	0.0185		36.4	21.0				38.75	44.08	37.03				0.0222	0.0253	0.0212	0.0687
548	0.081	4688	7.31		116926	88855		0.0190	0.0185		36.4	21.0				38.84	44.23	37.03				0.0219	0.0249	0.0209	0.0677
549	0.083	4688	7.31		118908	90362		0.0190	0.0185		36.4	21.0				38.75	44.08	37.03				0.0222	0.0253	0.0212	0.0687
550	0.077	4688	7.31		111520	84747		0.0192	0.0187		36.4	21.0				39.11	44.66	37.03				0.0210	0.0240	0.0199	0.0649

MAX ΔP:	0.3760

P-V valve pressure setting: 1.5 psi
80% of P-V valve setting: 1.2 psi

Maximum pressure drop to shore connection: 0.376 psi

TOTAL PRESSURE DROP TO SHORE CONNECTION: 0.376 psi *OK*

Max. allowable back pressure at facility: 0.824 psi

Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal: 8 in
Pipe ID: 7.981 in
Pipe Flow Area: 50.03 in^2
Vapor Dynamic Viscosity: 0.019 cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)

PIPE LENGTH

Length (ft): 231.00 ft 8" pipe
Length (ft): 50.00 ft 6" hose
f, friction factor (pipe): Varies with Reynold's Number (see table below)

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft): 255.81 ft
f_t, friction factor, turbulent flow (fittings): 0.014 constant, for each pipe size

Shore Connection Pressure Drop (at 100% of Maximum Liquid Loading Rate): 5000 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s									ft/s					ft	ft					psi	psi	psi
1	0.123	6250	9.75		236611	179807		0.0174	0.0175		48.6	28.1				63.27	74.51	65.83				0.0541	0.0637	0.0563	0.1741
2	0.085	6250	9.75		163307	124102		0.0182	0.0173		48.6	28.1				66.03	73.59	65.83				0.0390	0.0434	0.0389	0.1212
19	0.082	6250	9.75		156663	119053		0.0183	0.0175		48.6	28.1				66.37	74.19	65.83				0.0376	0.0420	0.0373	0.1168
20	0.079	6250	9.75		151818	115371		0.0184	0.0176		48.6	28.1				66.64	74.64	65.83				0.0366	0.0410	0.0361	0.1136
21	0.079	6250	9.75		151818	115371		0.0184	0.0176		48.6	28.1				66.64	74.64	65.83				0.0366	0.0410	0.0361	0.1136
23	0.079	6250	9.75		151818	115371		0.0184	0.0176		48.6	28.1				66.64	74.64	65.83				0.0366	0.0410	0.0361	0.1136
24	0.079	6250	9.75		151818	115371		0.0184	0.0176		48.6	28.1				66.64	74.64	65.83				0.0366	0.0410	0.0361	0.1136
26	0.079	6250	9.75		151818	115371		0.0184	0.0176		48.6	28.1				66.64	74.64	65.83				0.0366	0.0410	0.0361	0.1136
34	0.077	6250	9.75		148757	113045		0.0184	0.0176		48.6	28.1				66.82	74.94	65.83				0.0359	0.0403	0.0354	0.1116
40	0.085	6250	9.75		162548	123525		0.0182	0.0173		48.6	28.1				66.07	73.66	65.83				0.0388	0.0433	0.0387	0.1207
42	0.097	6250	9.75		186935	142057		0.0179	0.0169		48.6	28.1				64.95	71.71	65.83				0.0439	0.0484	0.0445	0.1368
44	0.083	6250	9.75		159297	121054		0.0183	0.0174		48.6	28.1				66.23	73.95	65.83				0.0381	0.0426	0.0379	0.1186
46	0.086	6250	9.75		165077	125447		0.0182	0.0173		48.6	28.1				65.94	73.44	65.83				0.0393	0.0438	0.0393	0.1224
47	0.097	6250	9.75		186754	141920		0.0179	0.0169		48.6	28.1				64.96	71.73	65.83				0.0438	0.0484	0.0444	0.1367
48	0.077	6250	9.75		147176	111843		0.0184	0.0177		48.6	28.1				66.91	75.10	65.83				0.0356	0.0399	0.0350	0.1105
58	0.078	6250	9.75		150003	113992		0.0184	0.0176		48.6	28.1				66.74	74.82	65.83				0.0362	0.0406	0.0357	0.1124
64	0.077	6250	9.75		147600	112166		0.0184	0.0177		48.6	28.1				66.89	75.05	65.83				0.0357	0.0400	0.0351	0.1108
70	0.085	6250	9.75		163632	124349		0.0182	0.0173		48.6	28.1				66.01	73.56	65.83				0.0390	0.0435	0.0389	0.1215
72	0.116	6250	9.75		223514	169855		0.0176	0.0163		48.6	28.1				63.65	69.36	65.83				0.0514	0.0560	0.0532	0.1606
73	0.078	6250	9.75		149610	113693		0.0184	0.0176		48.6	28.1				66.77	74.86	65.83				0.0361	0.0405	0.0356	0.1122
74	0.080	6250	9.75		154307	117262		0.0183	0.0175		48.6	28.1				66.50	74.40	65.83				0.0371	0.0415	0.0367	0.1153
76	0.078	6250	9.75		149887	113904		0.0184	0.0176		48.6	28.1				66.75	74.83	65.83				0.0362	0.0405	0.0357	0.1123
77	0.078	6250	9.75		149687	113752		0.0184	0.0176		48.6	28.1				66.76	74.85	65.83				0.0361	0.0405	0.0356	0.1122
78	0.076	6250	9.75		146652	111445		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
79	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
81	0.078	6250	9.75		150409	114301		0.0184	0.0176		48.6	28.1				66.72	74.78	65.83				0.0363	0.0406	0.0358	0.1127
82	0.076	6250	9.75		146679	111466		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
83	0.076	6250	9.75		146679	111466		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
84	0.076	6250	9.75		146679	111466		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
85	0.076	6250	9.75		146880	111618		0.0185	0.0177		48.6	28.1				66.93	75.13	65.83				0.0355	0.0399	0.0349	0.1103
87	0.078	6250	9.75		149000	113230		0.0184	0.0176		48.6	28.1				66.80	74.92	65.83				0.0360	0.0403	0.0354	0.1118
91	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
92	0.080	6250	9.75		154307	117262		0.0183	0.0175		48.6	28.1				66.50	74.40	65.83				0.0371	0.0415	0.0367	0.1153
93	0.077	6250	9.75		148907	113158		0.0184	0.0176		48.6	28.1				66.81	74.92	65.83				0.0359	0.0403	0.0354	0.1117
94	0.076	6250	9.75		146531	111353		0.0185	0.0177		48.6	28.1				66.95	75.16	65.83				0.0355	0.0398	0.0349	0.1101
95	0.076	6250	9.75		146697	111480		0.0185	0.0177		48.6	28.1				66.94	75.14	65.83				0.0355	0.0398	0.0349	0.1102
100	0.076	6250	9.75		146945	111668		0.0185	0.0177		48.6	28.1				66.92	75.12	65.83				0.0355	0.0399	0.0350	0.1104
101	0.077	6250	9.75		147142	111817		0.0185	0.0177		48.6	28.1				66.91	75.10	65.83				0.0356	0.0399	0.0350	0.1105
111	0.078	6250	9.75		149518	113623		0.0184	0.0176		48.6	28.1				66.77	74.86	65.83				0.0361	0.0405	0.0356	0.1121
112	0.103	6250	9.75		197954	150431		0.0178	0.0167		48.6	28.1				64.52	70.94	65.83				0.0462	0.0507	0.0471	0.1440
113	0.079	6250	9.75		151927	115454		0.0184	0.0176		48.6	28.1				66.63	74.63	65.83				0.0366	0.0410	0.0361	0.1137
119	0.077	6250	9.75		147537	112118		0.0184	0.0177		48.6	28.1				66.89	75.06	65.83				0.0357	0.0400	0.0351	0.1108
124	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
128	0.077	6250	9.75		147501	112091		0.0184	0.0177		48.6	28.1				66.89	75.06	65.83				0.0357	0.0400	0.0351	0.1108
130	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
131	0.078	6250	9.75		149813	113848		0.0184	0.0176		48.6	28.1				66.76	74.84	65.83				0.0361	0.0405	0.0356	0.1123
132	0.076	6250	9.75		146680	111467		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
133	0.076	6250	9.75		146730	111504		0.0185	0.0177		48.6	28.1				66.94	75.14	65.83				0.0355	0.0398	0.0349	0.1102

134	0.076	6250	9.75		146731	111505		0.0185	0.0177		48.6	28.1				66.94	75.14	65.83				0.0355	0.0398	0.0349	0.1102
136	0.077	6250	9.75		148586	112915		0.0184	0.0177		48.6	28.1				66.83	74.96	65.83				0.0359	0.0402	0.0353	0.1115
139	0.102	6250	9.75		196147	149058		0.0178	0.0167		48.6	28.1				64.59	71.07	65.83				0.0458	0.0504	0.0467	0.1428
140	0.102	6250	9.75		196147	149058		0.0178	0.0167		48.6	28.1				64.59	71.07	65.83				0.0458	0.0504	0.0467	0.1428
145	0.077	6250	9.75		147160	111831		0.0184	0.0177		48.6	28.1				66.91	75.10	65.83				0.0356	0.0399	0.0350	0.1105
146	0.077	6250	9.75		147160	111831		0.0184	0.0177		48.6	28.1				66.91	75.10	65.83				0.0356	0.0399	0.0350	0.1105
147	0.240	6250	9.75		460423	349889		0.0164	0.0144		48.6	28.1				59.64	61.22	65.83				0.0992	0.1019	0.1095	0.3106
155	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
156	0.119	6250	9.75		229204	174179		0.0175	0.0163		48.6	28.1				63.48	69.04	65.83				0.0526	0.0572	0.0545	0.1643
157	0.079	6250	9.75		152577	115948		0.0184	0.0176		48.6	28.1				66.60	74.57	65.83				0.0367	0.0411	0.0363	0.1141
158	0.086	6250	9.75		165258	125584		0.0182	0.0173		48.6	28.1				65.93	73.42	65.83				0.0394	0.0438	0.0393	0.1225
160	0.083	6250	9.75		160164	121713		0.0183	0.0174		48.6	28.1				66.19	73.87	65.83				0.0383	0.0428	0.0381	0.1192
161	0.078	6250	9.75		149022	113246		0.0184	0.0176		48.6	28.1				66.80	74.91	65.83				0.0360	0.0403	0.0355	0.1118
162	0.090	6250	9.75		173387	131762		0.0181	0.0171		48.6	28.1				65.54	72.75	65.83				0.0411	0.0456	0.0413	0.1279
163	0.083	6250	9.75		159252	121020		0.0183	0.0174		48.6	28.1				66.24	73.95	65.83				0.0381	0.0426	0.0379	0.1186
166	0.076	6250	9.75		146400	111254		0.0185	0.0177		48.6	28.1				66.96	75.17	65.83				0.0354	0.0398	0.0348	0.1100
169	0.077	6250	9.75		148332	112722		0.0184	0.0177		48.6	28.1				66.84	74.98	65.83				0.0358	0.0402	0.0353	0.1113
172	0.076	6250	9.75		146655	111447		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
178	0.076	6250	9.75		146634	111432		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
180	0.076	6250	9.75		146634	111432		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
184	0.079	6250	9.75		151527	115150		0.0184	0.0176		48.6	28.1				66.66	74.67	65.83				0.0365	0.0409	0.0360	0.1134
186	0.076	6250	9.75		146923	111651		0.0185	0.0177		48.6	28.1				66.93	75.12	65.83				0.0355	0.0399	0.0350	0.1104
190	0.086	6250	9.75		165258	125584		0.0182	0.0173		48.6	28.1				65.93	73.42	65.83				0.0394	0.0438	0.0393	0.1225
191	0.080	6250	9.75		154257	117225		0.0183	0.0175		48.6	28.1				66.50	74.41	65.83				0.0371	0.0415	0.0367	0.1152
194	0.076	6250	9.75		146788	111548		0.0185	0.0177		48.6	28.1				66.93	75.14	65.83				0.0355	0.0399	0.0349	0.1103
195	0.077	6250	9.75		147375	111994		0.0184	0.0177		48.6	28.1				66.90	75.08	65.83				0.0356	0.0400	0.0351	0.1107
197	0.217	6250	9.75		417250	317081		0.0166	0.0147		48.6	28.1				60.08	62.21	65.83				0.0906	0.0938	0.0993	0.2837
198	0.217	6250	9.75		417250	317081		0.0166	0.0147		48.6	28.1				60.08	62.21	65.83				0.0906	0.0938	0.0993	0.2837
199	0.217	6250	9.75		417250	317081		0.0166	0.0147		48.6	28.1				60.08	62.21	65.83				0.0906	0.0938	0.0993	0.2837
200	0.217	6250	9.75		417250	317081		0.0166	0.0147		48.6	28.1				60.08	62.21	65.83				0.0906	0.0938	0.0993	0.2837
201	0.217	6250	9.75		417250	317081		0.0166	0.0147		48.6	28.1				60.08	62.21	65.83				0.0906	0.0938	0.0993	0.2837
202	0.217	6250	9.75		417250	317081		0.0166	0.0147		48.6	28.1				60.08	62.21	65.83				0.0906	0.0938	0.0993	0.2837
203	0.217	6250	9.75		417250	317081		0.0166	0.0147		48.6	28.1				60.08	62.21	65.83				0.0906	0.0938	0.0993	0.2837
204	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
217	0.105	6250	9.75		201612	153211		0.0178	0.0166		48.6	28.1				64.39	70.70	65.83				0.0469	0.0515	0.0480	0.1464
218	0.105	6250	9.75		201612	153211		0.0178	0.0166		48.6	28.1				64.39	70.70	65.83				0.0469	0.0515	0.0480	0.1464
219	0.076	6250	9.75		146606	111410		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
220	0.077	6250	9.75		147375	111994		0.0184	0.0177		48.6	28.1				66.90	75.08	65.83				0.0356	0.0400	0.0351	0.1107
221	0.077	6250	9.75		147375	111994		0.0184	0.0177		48.6	28.1				66.90	75.08	65.83				0.0356	0.0400	0.0351	0.1107
222	0.109	6250	9.75		209153	158942		0.0177	0.0165		48.6	28.1				64.12	70.22	65.83				0.0485	0.0531	0.0498	0.1513
223	0.108	6250	9.75		206986	157295		0.0177	0.0166		48.6	28.1				64.19	70.35	65.83				0.0480	0.0526	0.0492	0.1499
224	0.078	6250	9.75		150355	114259		0.0184	0.0176		48.6	28.1				66.72	74.78	65.83				0.0363	0.0406	0.0358	0.1127
229	0.142	6250	9.75		272738	207262		0.0172	0.0158		48.6	28.1				62.36	66.91	65.83				0.0615	0.0659	0.0649	0.1923
230	0.142	6250	9.75		272738	207262		0.0172	0.0158		48.6	28.1				62.36	66.91	65.83				0.0615	0.0659	0.0649	0.1923
231	0.076	6250	9.75		146562	111377		0.0185	0.0177		48.6	28.1				66.95	75.16	65.83				0.0355	0.0398	0.0349	0.1101
232	0.088	6250	9.75		169051	128467		0.0181	0.0172		48.6	28.1				65.74	73.10	65.83				0.0402	0.0447	0.0402	0.1250
234	0.148	6250	9.75		283577	215498		0.0171	0.0156		48.6	28.1				62.12	66.45	65.83				0.0637	0.0681	0.0675	0.1992
235	0.149	6250	9.75		287009	218107		0.0171	0.0156		48.6	28.1				62.05	66.31	65.83				0.0644	0.0688	0.0683	0.2014
236	0.149	6250	9.75		287009	218107		0.0171	0.0156		48.6	28.1				62.05	66.31	65.83				0.0644	0.0688	0.0683	0.2014
238	0.076	6250	9.75		146300	111178		0.0185	0.0177		48.6	28.1				66.96	75.18	65.83				0.0354	0.0397	0.0348	0.1100
243	0.076	6250	9.75		146630	111428		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
244	0.078	6250	9.75		150717	114534		0.0184	0.0176		48.6	28.1				66.70	74.75	65.83				0.0363	0.0407	0.0359	0.1129
245	0.216	6250	9.75		415308	315605		0.0166	0.0147		48.6	28.1				60.10	62.26	65.83				0.0902	0.0934	0.0988	0.2824
246	0.124	6250	9.75		238417	181180		0.0174	0.0161		48.6	28.1				63.22	68.55	65.83				0.0545	0.0591	0.0567	0.1702
247	0.078	6250	9.75		149000	113230		0.0184	0.0176		48.6	28.1				66.80	74.92	65.83				0.0360	0.0403	0.0354	0.1118
249	0.079	6250	9.75		151033	114774		0.0184	0.0176		48.6	28.1				66.69	74.72	65.83				0.0364	0.0408	0.0359	0.1131
263	0.122	6250	9.75		234443	178160		0.0175	0.0162		48.6	28.1				63.33	68.76	65.83				0.0537	0.0583	0.0558	0.1677
265	0.079	6250	9.75		152279	115721		0.0184	0.0176		48.6	28.1				66.62	74.60	65.83				0.0367	0.0410	0.0362	0.1139
266	0.082	6250	9.75		158124	120163		0.0183	0.0174		48.6	28.1				66.30	74.05	65.83				0.0379	0.0423	0.0376	0.1178
267	0.081	6250	9.75		156078	118608		0.0183	0.0175		48.6	28.1				66.41	74.24	65.83				0.0375	0.0419	0.0371	0.1165
271	0.088	6250	9.75		168193	127815		0.0181	0.0172		48.6	28.1				65.79	73.17	65.83				0.0400	0.0445	0.0400	0.1245
273	0.091	6250	9.75		175083	133051		0.0181	0.0171		48.6	28.1				65.46	72.61	65.83				0.0414	0.0459	0.0417	0.1290
274	0.108	6250	9.75		207257	157501		0.0177	0.0166		48.6	28.1				64.19	70.34	65.83				0.0481	0.0527	0.0493	0.1501
275	0.208	6542	10.20		417712	317432		0.0166	0.0146		50.9	29.4				65.82	68.15	72.13				0.0949	0.0983	0.1040	0.2972
276	0.077	6250	9.75		148404	112777		0.0184	0.0177		48.6	28.1				66.84	74.97	65.83				0.0358	0.0402	0.0353	0.1114
278	0.089	6250	9.75		171738	130509		0.0181	0.0172		48.6	28.1				65.62	72.88	65.83				0.0407	0.0452	0.0409	0.1268
281	0.076	6250	9.75		146644	111439		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
283	0.132	6250	9.75		254404	193329		0.0173	0.0160		48.6	28.1				62.79	67.75	65.83				0.0577	0.0623	0.0605	0.1805
284	0.152	6250	9.75		291986	221889		0.0171	0.0156		48.6	28.1				61.95	66.11	65.83				0.0654	0.0698	0.0695	0.2046

286	0.077	6250	9.75		147050	111747		0.0185	0.0177		48.6	28.1				66.92	75.11	65.83				0.0356	0.0399	0.0350	0.1105
288	0.079	6250	9.75		152252	115701		0.0184	0.0176		48.6	28.1				66.62	74.60	65.83				0.0367	0.0410	0.0362	0.1139
289	0.079	6250	9.75		151972	115488		0.0184	0.0176		48.6	28.1				66.63	74.63	65.83				0.0366	0.0410	0.0362	0.1137
295	0.078	6250	9.75		150807	114603		0.0184	0.0176		48.6	28.1				66.70	74.74	65.83				0.0363	0.0407	0.0359	0.1130
296	0.079	6250	9.75		152252	115701		0.0184	0.0176		48.6	28.1				66.62	74.60	65.83				0.0367	0.0410	0.0362	0.1139
297	0.079	6250	9.75		151954	115474		0.0184	0.0176		48.6	28.1				66.63	74.63	65.83				0.0366	0.0410	0.0362	0.1137
300	0.080	6250	9.75		154582	117472		0.0183	0.0175		48.6	28.1				66.49	74.38	65.83				0.0371	0.0415	0.0368	0.1155
301	0.080	6250	9.75		154582	117472		0.0183	0.0175		48.6	28.1				66.49	74.38	65.83				0.0371	0.0415	0.0368	0.1155
304	0.082	6250	9.75		156723	119098		0.0183	0.0175		48.6	28.1				66.37	74.18	65.83				0.0376	0.0420	0.0373	0.1169
305	0.078	6250	9.75		149904	113916		0.0184	0.0176		48.6	28.1				66.75	74.83	65.83				0.0362	0.0405	0.0357	0.1124
306	0.078	6250	9.75		149904	113916		0.0184	0.0176		48.6	28.1				66.75	74.83	65.83				0.0362	0.0405	0.0357	0.1124
307	0.078	6250	9.75		149904	113916		0.0184	0.0176		48.6	28.1				66.75	74.83	65.83				0.0362	0.0405	0.0357	0.1124
309	0.076	6250	9.75		146887	111624		0.0185	0.0177		48.6	28.1				66.93	75.13	65.83				0.0355	0.0399	0.0349	0.1103
316	0.087	6250	9.75		166983	126895		0.0182	0.0173		48.6	28.1				65.84	73.27	65.83				0.0397	0.0442	0.0397	0.1237
317	0.087	6250	9.75		166983	126895		0.0182	0.0173		48.6	28.1				65.84	73.27	65.83				0.0397	0.0442	0.0397	0.1237
318	0.076	6250	9.75		146652	111445		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
319	0.076	6250	9.75		146605	111410		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
320	0.076	6250	9.75		146605	111410		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
321	0.088	6250	9.75		169864	129085		0.0181	0.0172		48.6	28.1				65.71	73.03	65.83				0.0403	0.0448	0.0404	0.1256
322	0.090	6250	9.75		172122	130801		0.0181	0.0172		48.6	28.1				65.60	72.85	65.83				0.0408	0.0453	0.0409	0.1271
324	0.076	6250	9.75		146605	111410		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
325	0.076	6250	9.75		146605	111410		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
364	0.095	6250	9.75		181696	138076		0.0180	0.0170		48.6	28.1				65.17	72.10	65.83				0.0428	0.0473	0.0432	0.1334
366	0.078	6250	9.75		149542	113642		0.0184	0.0176		48.6	28.1				66.77	74.86	65.83				0.0361	0.0405	0.0356	0.1121
367	0.078	6250	9.75		149542	113642		0.0184	0.0176		48.6	28.1				66.77	74.86	65.83				0.0361	0.0405	0.0356	0.1121
366	0.078	6250	9.75		149542	113642		0.0184	0.0176		48.6	28.1				66.77	74.86	65.83				0.0361	0.0405	0.0356	0.1121
382	0.078	6250	9.75		149542	113642		0.0184	0.0176		48.6	28.1				66.77	74.86	65.83				0.0361	0.0405	0.0356	0.1121
383	0.084	6250	9.75		161248	122537		0.0182	0.0174		48.6	28.1				66.13	73.77	65.83				0.0385	0.0430	0.0384	0.1199
389	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
403	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
418	0.082	6250	9.75		158213	120231		0.0183	0.0174		48.6	28.1				66.29	74.04	65.83				0.0379	0.0423	0.0376	0.1179
429	0.076	6250	9.75		146912	111643		0.0185	0.0177		48.6	28.1				66.93	75.12	65.83				0.0355	0.0399	0.0350	0.1104
432	0.270	7100	11.07		588895	447519		0.0162	0.0139		55.2	31.9				75.69	76.01	84.96				0.1418	0.1424	0.1592	0.4433
433	0.347	7700	12.01		821135	624005		0.0159	0.0132		59.9	34.6				87.38	85.15	99.93				0.2105	0.2051	0.2407	0.6562
434	0.265	7044	10.99		573256	435634		0.0162	0.0139		54.8	31.6				74.63	75.13	83.62				0.1372	0.1381	0.1537	0.4290
436	0.310	7490	11.68		712854	541719		0.0160	0.0135		58.2	33.6				83.29	82.22	94.55				0.1790	0.1767	0.2032	0.5590
437	0.310	7490	11.68		712854	541719		0.0160	0.0135		58.2	33.6				83.29	82.22	94.55				0.1790	0.1767	0.2032	0.5590
442	0.082	6250	9.75		157987	120059		0.0183	0.0174		48.6	28.1				66.30	74.06	65.83				0.0379	0.0423	0.0376	0.1177
448	0.080	6250	9.75		153363	116545		0.0184	0.0175		48.6	28.1				66.55	74.49	65.83				0.0369	0.0413	0.0365	0.1147
457	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
458	0.084	6250	9.75		161537	122757		0.0182	0.0174		48.6	28.1				66.12	73.75	65.83				0.0386	0.0430	0.0384	0.1201
464	0.097	6250	9.75		187260	142304		0.0179	0.0169		48.6	28.1				64.94	71.69	65.83				0.0439	0.0485	0.0446	0.1370
465	0.098	6250	9.75		188398	143169		0.0179	0.0169		48.6	28.1				64.89	71.61	65.83				0.0442	0.0488	0.0448	0.1378
466	0.091	6250	9.75		175283	133203		0.0180	0.0171		48.6	28.1				65.45	72.60	65.83				0.0415	0.0460	0.0417	0.1291
467	0.082	6250	9.75		157888	119984		0.0183	0.0174		48.6	28.1				66.31	74.07	65.83				0.0378	0.0423	0.0376	0.1177
468	0.079	6250	9.75		151963	115481		0.0184	0.0176		48.6	28.1				66.63	74.63	65.83				0.0366	0.0410	0.0362	0.1137
469	0.076	6250	9.75		146593	111401		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
473	0.076	6250	9.75		146437	111282		0.0185	0.0177		48.6	28.1				66.95	75.17	65.83				0.0354	0.0398	0.0348	0.1100
476	0.083	6250	9.75		159631	121308		0.0183	0.0174		48.6	28.1				66.22	73.92	65.83				0.0382	0.0426	0.0380	0.1188
478	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
468	0.076	6250	9.75		146574	111386		0.0185	0.0177		48.6	28.1				66.95	75.16	65.83				0.0355	0.0398	0.0349	0.1101
493	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
494	0.076	6250	9.75		146812	111567		0.0185	0.0177		48.6	28.1				66.93	75.13	65.83				0.0355	0.0399	0.0349	0.1103
496	0.076	6250	9.75		146806	111562		0.0185	0.0177		48.6	28.1				66.93	75.13	65.83				0.0355	0.0399	0.0349	0.1103
497	0.077	6250	9.75		147577	112148		0.0184	0.0177		48.6	28.1				66.89	75.06	65.83				0.0357	0.0400	0.0351	0.1108
499	0.091	6250	9.75		175283	133203		0.0180	0.0171		48.6	28.1				65.45	72.60	65.83				0.0415	0.0460	0.0417	0.1291
502	0.077	6250	9.75		147347	111973		0.0184	0.0177		48.6	28.1				66.90	75.08	65.83				0.0356	0.0400	0.0351	0.1107
503	0.077	6250	9.75		147266	111912		0.0184	0.0177		48.6	28.1				66.90	75.09	65.83				0.0356	0.0400	0.0350	0.1106
505	0.076	6250	9.75		146825	111576		0.0185	0.0177		48.6	28.1				66.93	75.13	65.83				0.0355	0.0399	0.0349	0.1103
506	0.076	6250	9.75		146769	111534		0.0185	0.0177		48.6	28.1				66.93	75.14	65.83				0.0355	0.0399	0.0349	0.1103
508	0.077	6250	9.75		147122	111802		0.0185	0.0177		48.6	28.1				66.91	75.10	65.83				0.0356	0.0399	0.0350	0.1105
509	0.076	6250	9.75		146667	111457		0.0185	0.0177		48.6	28.1				66.94	75.15	65.83				0.0355	0.0398	0.0349	0.1102
519	0.078	6250	9.75		150337	114246		0.0184	0.0176		48.6	28.1				66.73	74.78	65.83				0.0363	0.0406	0.0358	0.1126
520	0.078	6250	9.75		150261	114188		0.0184	0.0176		48.6	28.1				66.73	74.79	65.83				0.0362	0.0406	0.0357	0.1126
521	0.078	6250	9.75		150261	114188		0.0184	0.0176		48.6	28.1				66.73	74.79	65.83				0.0362	0.0406	0.0357	0.1126
522	0.078	6250	9.75		150261	114188		0.0184	0.0176		48.6	28.1				66.73	74.79	65.83				0.0362	0.0406	0.0357	0.1126
529	0.076	6250	9.75		146291	111171		0.0185	0.0177		48.6	28.1				66.96	75.19	65.83				0.0354	0.0397	0.0348	0.1100
533	0.077	6250	9.75		148242	112653		0.0184	0.0177		48.6	28.1				66.85	74.99	65.83				0.0358	0.0402	0.0353	0.1113
534	0.076	6250	9.75		146737	111510		0.0185	0.0177		48.6	28.1				66.94	75.14	65.83				0.0355	0.0398	0.0349	0.1102

546	0.083	6250	9.75		158544	120482		0.0183	0.0174		48.6	28.1				66.27	74.01	65.83				0.0380	0.0424	0.0377	0.1181
547	0.083	6250	9.75		158544	120482		0.0183	0.0174		48.6	28.1				66.27	74.01	65.83				0.0380	0.0424	0.0377	0.1181
548	0.081	6250	9.75		155901	118474		0.0183	0.0175		48.6	28.1				66.41	74.26	65.83				0.0374	0.0418	0.0371	0.1163
549	0.083	6250	9.75		158544	120482		0.0183	0.0174		48.6	28.1				66.27	74.01	65.83				0.0380	0.0424	0.0377	0.1181
550	0.077	6250	9.75		148693	112997		0.0184	0.0176		48.6	28.1				66.82	74.95	65.83				0.0359	0.0403	0.0354	0.1116

MAX ΔP:	0.6562

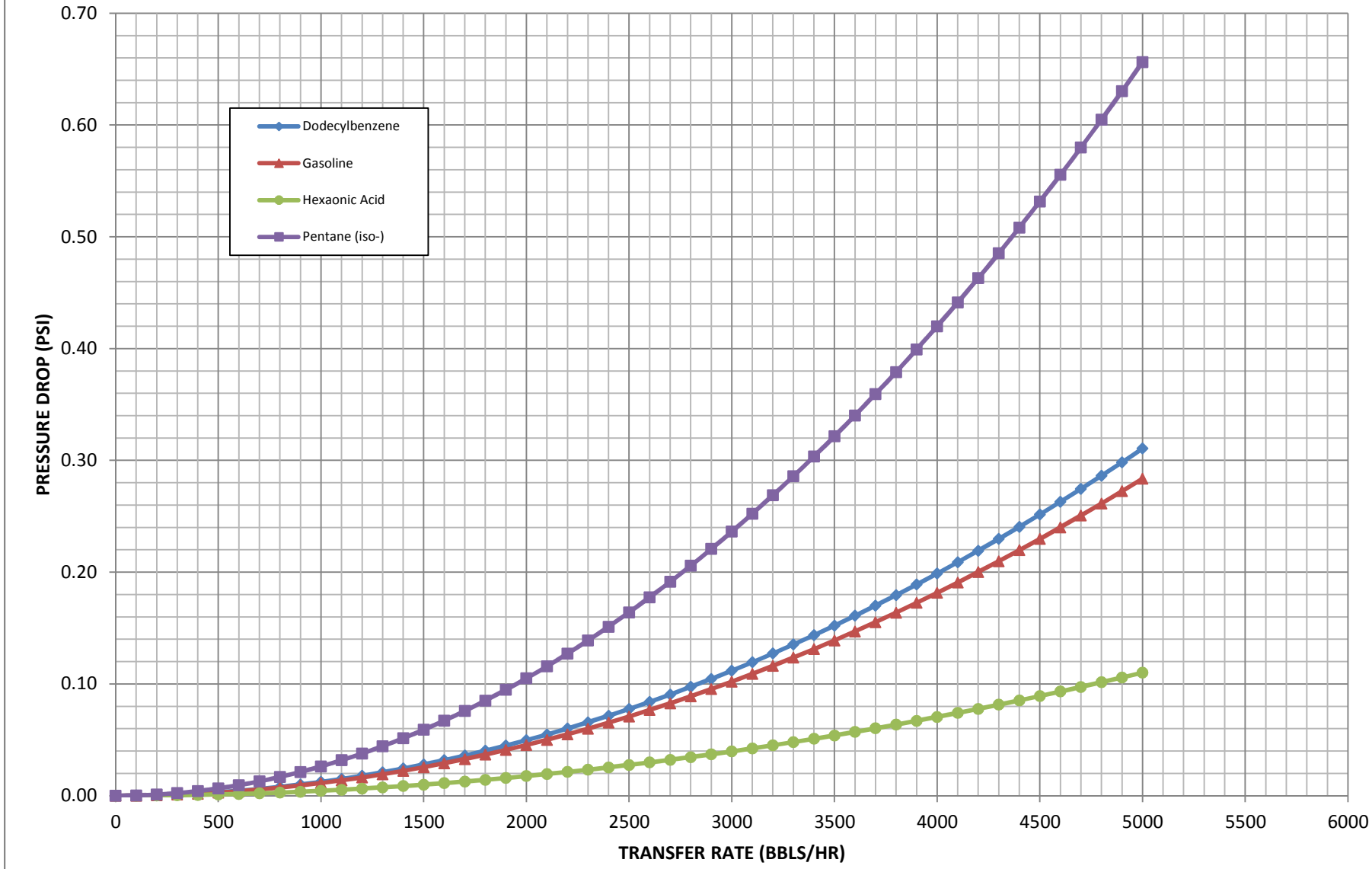
P-V valve pressure setting: 1.5 psi
80% of P-V valve setting: 1.2 psi

Maximum pressure drop to shore connection: 0.656 psi

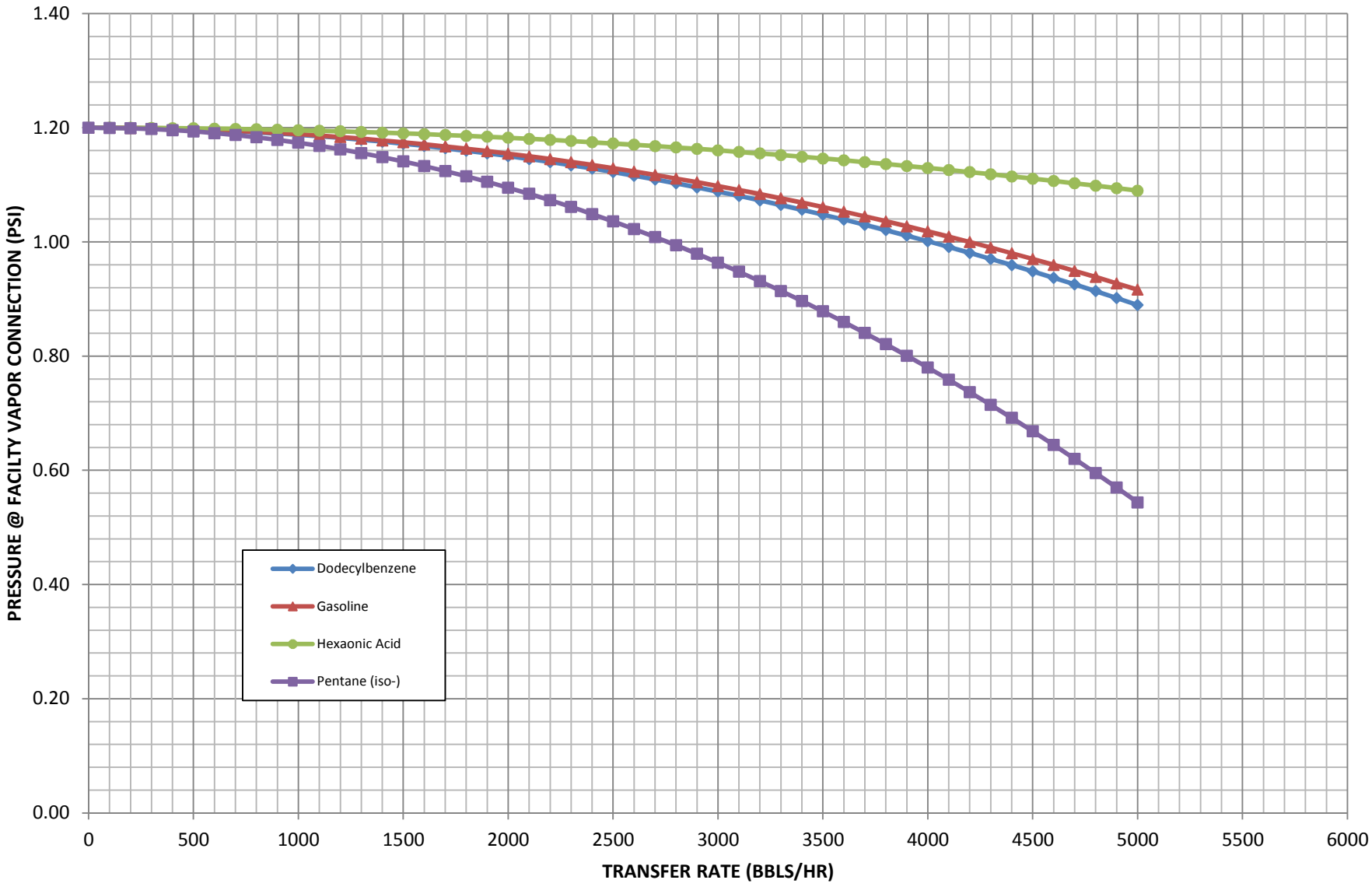
TOTAL PRESSURE DROP TO SHORE CONNECTION: **0.656 psi** *OK*

Max. allowable back pressure at facility: **0.544 psi**

LIQUID TRANSFER RATE vs PRESSURE DROP
(FOR SUBCHAPTER "D" CARGOES)



LIQUID TRANSFER RATE vs PRESSURE DROP
(FOR SUBCHAPTER "D" CARGOES)



Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal:	8	in	
Pipe ID:	7.981	in	
Pipe Flow Area:	50.03	in^2	
Vapor Dynamic Viscosity:	0.019	cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)	

PIPE LENGTH

Length (ft):	231.00	ft	8" pipe
Length (ft):	50.00	ft	6" hose
f, friction factor (pipe):	Varies with Reynold's Number (see table below)		

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft):	255.81	ft	
f_t, friction factor, turbulent flow (fittings):	0.014	constant, for each pipe size	

Shore Connection Pressure Drop (at 25% of Maximum Liquid Discharge Rate): 1250 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s								ft/s	ft/s				ft	ft	ft				psi	psi	psi	psi
1	0.123	1250	1.95		47322	35961		0.0221	0.0231		9.7	5.6				3.21	3.93	2.63				0.0027	0.0034	0.0023	0.0084
2	0.085	1250	1.95		32661	24820		0.0238	0.0246		9.7	5.6				3.46	4.17	2.63				0.0020	0.0025	0.0016	0.0061
19	0.082	1250	1.95		31333	23811		0.0240	0.0248		9.7	5.6				3.49	4.22	2.63				0.0020	0.0024	0.0015	0.0059
20	0.079	1250	1.95		30364	23074		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
21	0.079	1250	1.95		30364	23074		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
23	0.079	1250	1.95		30364	23074		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
24	0.079	1250	1.95		30364	23074		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
26	0.079	1250	1.95		30364	23074		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
34	0.077	1250	1.95		29751	22609		0.0243	0.0251		9.7	5.6				3.53	4.27	2.63				0.0019	0.0023	0.0014	0.0056
40	0.085	1250	1.95		32510	24705		0.0239	0.0246		9.7	5.6				3.46	4.18	2.63				0.0020	0.0025	0.0015	0.0060
42	0.097	1250	1.95		37387	28411		0.0232	0.0238		9.7	5.6				3.36	4.04	2.63				0.0023	0.0027	0.0018	0.0068
44	0.083	1250	1.95		31859	24211		0.0240	0.0247		9.7	5.6				3.48	4.20	2.63				0.0020	0.0024	0.0015	0.0059
46	0.086	1250	1.95		33015	25089		0.0238	0.0245		9.7	5.6				3.45	4.16	2.63				0.0021	0.0025	0.0016	0.0061
47	0.097	1250	1.95		37351	28384		0.0232	0.0238		9.7	5.6				3.36	4.04	2.63				0.0023	0.0027	0.0018	0.0068
48	0.077	1250	1.95		29435	22369		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
58	0.078	1250	1.95		30001	22798		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
64	0.077	1250	1.95		29520	22433		0.0243	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
70	0.085	1250	1.95		32726	24870		0.0238	0.0246		9.7	5.6				3.46	4.17	2.63				0.0020	0.0025	0.0016	0.0061
72	0.116	1250	1.95		44703	33971		0.0224	0.0228		9.7	5.6				3.25	3.87	2.63				0.0026	0.0031	0.0021	0.0079
73	0.078	1250	1.95		29922	22739		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
74	0.080	1250	1.95		30861	23452		0.0241	0.0249		9.7	5.6				3.50	4.23	2.63				0.0020	0.0024	0.0015	0.0058
76	0.078	1250	1.95		29977	22781		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
77	0.078	1250	1.95		29937	22750		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
78	0.076	1250	1.95		29330	22289		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
79	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
81	0.078	1250	1.95		30082	22860		0.0242	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0057
82	0.076	1250	1.95		29336	22293		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
83	0.076	1250	1.95		29336	22293		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
84	0.076	1250	1.95		29336	22293		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
85	0.076	1250	1.95		29376	22324		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
87	0.078	1250	1.95		29800	22646		0.0243	0.0251		9.7	5.6				3.52	4.27	2.63				0.0019	0.0023	0.0014	0.0056
91	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
92	0.080	1250	1.95		30861	23452		0.0241	0.0249		9.7	5.6				3.50	4.23	2.63				0.0020	0.0024	0.0015	0.0058
93	0.077	1250	1.95		29781	22632		0.0243	0.0251		9.7	5.6				3.53	4.27	2.63				0.0019	0.0023	0.0014	0.0056
94	0.076	1250	1.95		29306	22271		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
95	0.076	1250	1.95		29339	22296		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
100	0.076	1250	1.95		29389	22334		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
101	0.077	1250	1.95		29428	22363		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
111	0.078	1250	1.95		29904	22725		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
112	0.103	1250	1.95		39591	30086		0.0229	0.0235		9.7	5.6				3.32	3.99	2.63				0.0024	0.0029	0.0019	0.0071
113	0.079	1250	1.95		30385	23091		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
119	0.077	1250	1.95		29507	22424		0.0243	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
124	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
128	0.077	1250	1.95		29500	22418		0.0243	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
130	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
131	0.078	1250	1.95		29963	22770		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
132	0.076	1250	1.95		29336	22293		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
133	0.076	1250	1.95		29346	22301		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055

134	0.076	1250	1.95		29346	22301		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
136	0.077	1250	1.95		29717	22583		0.0243	0.0251		9.7	5.6				3.53	4.27	2.63				0.0019	0.0023	0.0014	0.0056
139	0.102	1250	1.95		39229	29812		0.0230	0.0235		9.7	5.6				3.33	3.99	2.63				0.0024	0.0028	0.0019	0.0071
140	0.102	1250	1.95		39229	29812		0.0230	0.0235		9.7	5.6				3.33	3.99	2.63				0.0024	0.0028	0.0019	0.0071
145	0.077	1250	1.95		29432	22366		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
146	0.077	1250	1.95		29432	22366		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
147	0.240	1250	1.95		92085	69978		0.0197	0.0195		9.7	5.6				2.86	3.30	2.63				0.0048	0.0055	0.0044	0.0146
155	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
156	0.119	1250	1.95		45841	34836		0.0223	0.0227		9.7	5.6				3.23	3.85	2.63				0.0027	0.0032	0.0022	0.0080
157	0.079	1250	1.95		30515	23190		0.0242	0.0250		9.7	5.6				3.51	4.24	2.63				0.0019	0.0023	0.0015	0.0057
158	0.086	1250	1.95		33052	25117		0.0238	0.0245		9.7	5.6				3.45	4.16	2.63				0.0021	0.0025	0.0016	0.0061
160	0.083	1250	1.95		32033	24343		0.0239	0.0247		9.7	5.6				3.47	4.19	2.63				0.0020	0.0024	0.0015	0.0060
161	0.078	1250	1.95		29804	22649		0.0243	0.0251		9.7	5.6				3.52	4.27	2.63				0.0019	0.0023	0.0014	0.0056
162	0.090	1250	1.95		34677	26352		0.0235	0.0242		9.7	5.6				3.41	4.11	2.63				0.0021	0.0026	0.0017	0.0064
163	0.083	1250	1.95		31850	24204		0.0240	0.0247		9.7	5.6				3.48	4.20	2.63				0.0020	0.0024	0.0015	0.0059
166	0.076	1250	1.95		29280	22251		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
169	0.077	1250	1.95		29666	22544		0.0243	0.0252		9.7	5.6				3.53	4.27	2.63				0.0019	0.0023	0.0014	0.0056
172	0.076	1250	1.95		29331	22289		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
178	0.076	1250	1.95		29327	22286		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
180	0.076	1250	1.95		29327	22286		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
184	0.079	1250	1.95		30305	23030		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
186	0.076	1250	1.95		29385	22330		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
190	0.086	1250	1.95		33052	25117		0.0238	0.0245		9.7	5.6				3.45	4.16	2.63				0.0021	0.0025	0.0016	0.0061
191	0.080	1250	1.95		30851	23445		0.0241	0.0249		9.7	5.6				3.50	4.23	2.63				0.0020	0.0024	0.0015	0.0058
194	0.076	1250	1.95		29358	22310		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
195	0.077	1250	1.95		29475	22399		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
197	0.217	1250	1.95		83450	63416		0.0200	0.0199		9.7	5.6				2.91	3.37	2.63				0.0044	0.0051	0.0040	0.0134
198	0.217	1250	1.95		83450	63416		0.0200	0.0199		9.7	5.6				2.91	3.37	2.63				0.0044	0.0051	0.0040	0.0134
199	0.217	1250	1.95		83450	63416		0.0200	0.0199		9.7	5.6				2.91	3.37	2.63				0.0044	0.0051	0.0040	0.0134
200	0.217	1250	1.95		83450	63416		0.0200	0.0199		9.7	5.6				2.91	3.37	2.63				0.0044	0.0051	0.0040	0.0134
201	0.217	1250	1.95		83450	63416		0.0200	0.0199		9.7	5.6				2.91	3.37	2.63				0.0044	0.0051	0.0040	0.0134
202	0.217	1250	1.95		83450	63416		0.0200	0.0199		9.7	5.6				2.91	3.37	2.63				0.0044	0.0051	0.0040	0.0134
203	0.217	1250	1.95		83450	63416		0.0200	0.0199		9.7	5.6				2.91	3.37	2.63				0.0044	0.0051	0.0040	0.0134
204	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
217	0.105	1250	1.95		40322	30642		0.0228	0.0234		9.7	5.6				3.31	3.97	2.63				0.0024	0.0029	0.0019	0.0072
218	0.105	1250	1.95		40322	30642		0.0228	0.0234		9.7	5.6				3.31	3.97	2.63				0.0024	0.0029	0.0019	0.0072
219	0.076	1250	1.95		29321	22282		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
220	0.077	1250	1.95		29475	22399		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
221	0.077	1250	1.95		29475	22399		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
222	0.109	1250	1.95		41831	31788		0.0227	0.0232		9.7	5.6				3.29	3.94	2.63				0.0025	0.0030	0.0020	0.0075
223	0.108	1250	1.95		41397	31459		0.0227	0.0232		9.7	5.6				3.30	3.94	2.63				0.0025	0.0030	0.0020	0.0074
224	0.078	1250	1.95		30071	22852		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0057
229	0.142	1250	1.95		54548	41452		0.0216	0.0218		9.7	5.6				3.13	3.70	2.63				0.0031	0.0036	0.0026	0.0093
230	0.142	1250	1.95		54548	41452		0.0216	0.0218		9.7	5.6				3.13	3.70	2.63				0.0031	0.0036	0.0026	0.0093
231	0.076	1250	1.95		29312	22275		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
232	0.088	1250	1.95		33810	25693		0.0237	0.0244		9.7	5.6				3.43	4.14	2.63				0.0021	0.0025	0.0016	0.0062
234	0.148	1250	1.95		56715	43100		0.0214	0.0216		9.7	5.6				3.11	3.67	2.63				0.0032	0.0038	0.0027	0.0096
235	0.149	1250	1.95		57402	43621		0.0214	0.0216		9.7	5.6				3.10	3.66	2.63				0.0032	0.0038	0.0027	0.0097
236	0.149	1250	1.95		57402	43621		0.0214	0.0216		9.7	5.6				3.10	3.66	2.63				0.0032	0.0038	0.0027	0.0097
238	0.076	1250	1.95		29260	22236		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
243	0.076	1250	1.95		29326	22286		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
244	0.078	1250	1.95		30143	22907		0.0242	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0057
245	0.216	1250	1.95		83062	63121		0.0201	0.0199		9.7	5.6				2.91	3.38	2.63				0.0044	0.0051	0.0040	0.0134
246	0.124	1250	1.95		47683	36236		0.0221	0.0225		9.7	5.6				3.21	3.82	2.63				0.0028	0.0033	0.0023	0.0083
247	0.078	1250	1.95		29800	22646		0.0243	0.0251		9.7	5.6				3.52	4.27	2.63				0.0019	0.0023	0.0014	0.0056
249	0.079	1250	1.95		30207	22955		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
263	0.122	1250	1.95		46889	35632		0.0222	0.0226		9.7	5.6				3.22	3.83	2.63				0.0027	0.0032	0.0022	0.0082
265	0.079	1250	1.95		30456	23144		0.0242	0.0250		9.7	5.6				3.51	4.24	2.63				0.0019	0.0023	0.0014	0.0057
266	0.082	1250	1.95		31625	24033		0.0240	0.0248		9.7	5.6				3.48	4.21	2.63				0.0020	0.0024	0.0015	0.0059
267	0.081	1250	1.95		31216	23722		0.0241	0.0248		9.7	5.6				3.49	4.22	2.63				0.0020	0.0024	0.0015	0.0058
271	0.088	1250	1.95		33639	25563		0.0237	0.0244		9.7	5.6				3.44	4.14	2.63				0.0021	0.0025	0.0016	0.0062
273	0.091	1250	1.95		35017	26610		0.0235	0.0242		9.7	5.6				3.41	4.10	2.63				0.0022	0.0026	0.0017	0.0064
274	0.108	1250	1.95		41451	31500		0.0227	0.0232		9.7	5.6				3.29	3.94	2.63				0.0025	0.0030	0.0020	0.0074
275	0.208	1250	1.95		79813	60653		0.0202	0.0201		9.7	5.6				2.93	3.41	2.63				0.0042	0.0049	0.0038	0.0129
276	0.077	1250	1.95		29681	22555		0.0243	0.0251		9.7	5.6				3.53	4.27	2.63				0.0019	0.0023	0.0014	0.0056
278	0.089	1250	1.95		34348	26102		0.0236	0.0243		9.7	5.6				3.42	4.12	2.63				0.0021	0.0026	0.0016	0.0063
281	0.076	1250	1.95		29329	22288		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
283	0.132	1250	1.95		50881	38666		0.0218	0.0221		9.7	5.6				3.17	3.76	2.63				0.0029	0.0035	0.0024	0.0088
284	0.152	1250	1.95		58397	44378		0.0213	0.0215		9.7	5.6				3.09	3.65	2.63				0.0033	0.0038	0.0028	0.0099

286	0.077	1250	1.95		29410	22349		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
288	0.079	1250	1.95		30450	23140		0.0242	0.0250		9.7	5.6				3.51	4.24	2.63				0.0019	0.0023	0.0014	0.0057
289	0.079	1250	1.95		30394	23098		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
295	0.078	1250	1.95		30161	22921		0.0242	0.0250		9.7	5.6				3.52	4.25	2.63				0.0019	0.0023	0.0014	0.0057
296	0.079	1250	1.95		30450	23140		0.0242	0.0250		9.7	5.6				3.51	4.24	2.63				0.0019	0.0023	0.0014	0.0057
297	0.079	1250	1.95		30391	23095		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
300	0.080	1250	1.95		30916	23494		0.0241	0.0249		9.7	5.6				3.50	4.23	2.63				0.0020	0.0024	0.0015	0.0058
301	0.080	1250	1.95		30916	23494		0.0241	0.0249		9.7	5.6				3.50	4.23	2.63				0.0020	0.0024	0.0015	0.0058
304	0.082	1250	1.95		31345	23820		0.0240	0.0248		9.7	5.6				3.49	4.22	2.63				0.0020	0.0024	0.0015	0.0059
305	0.078	1250	1.95		29981	22783		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
306	0.078	1250	1.95		29981	22783		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
307	0.078	1250	1.95		29981	22783		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
309	0.076	1250	1.95		29377	22325		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
316	0.087	1250	1.95		33397	25379		0.0237	0.0244		9.7	5.6				3.44	4.15	2.63				0.0021	0.0025	0.0016	0.0062
317	0.087	1250	1.95		33397	25379		0.0237	0.0244		9.7	5.6				3.44	4.15	2.63				0.0021	0.0025	0.0016	0.0062
318	0.076	1250	1.95		29330	22289		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
319	0.076	1250	1.95		29321	22282		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
320	0.076	1250	1.95		29321	22282		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
321	0.088	1250	1.95		33973	25817		0.0236	0.0243		9.7	5.6				3.43	4.13	2.63				0.0021	0.0025	0.0016	0.0063
322	0.090	1250	1.95		34424	26160		0.0236	0.0243		9.7	5.6				3.42	4.12	2.63				0.0021	0.0026	0.0016	0.0063
324	0.076	1250	1.95		29321	22282		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
325	0.076	1250	1.95		29321	22282		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
364	0.095	1250	1.95		36339	27615		0.0233	0.0239		9.7	5.6				3.38	4.07	2.63				0.0022	0.0027	0.0017	0.0066
366	0.078	1250	1.95		29908	22728		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
367	0.078	1250	1.95		29908	22728		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
366	0.078	1250	1.95		29908	22728		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
382	0.078	1250	1.95		29908	22728		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0056
383	0.084	1250	1.95		32250	24507		0.0239	0.0246		9.7	5.6				3.47	4.19	2.63				0.0020	0.0024	0.0015	0.0060
389	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
403	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
418	0.082	1250	1.95		31643	24046		0.0240	0.0248		9.7	5.6				3.48	4.21	2.63				0.0020	0.0024	0.0015	0.0059
429	0.076	1250	1.95		29382	22329		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
432	0.270	1250	1.95		103679	78789		0.0194	0.0190		9.7	5.6				2.81	3.22	2.63				0.0053	0.0060	0.0049	0.0162
433	0.347	1250	1.95		133301	101300		0.0187	0.0180		9.7	5.6				2.71	3.06	2.63				0.0065	0.0074	0.0063	0.0203
434	0.265	1250	1.95		101728	77306		0.0194	0.0191		9.7	5.6				2.82	3.24	2.63				0.0052	0.0059	0.0048	0.0160
436	0.310	1250	1.95		118968	90407		0.0190	0.0185		9.7	5.6				2.76	3.13	2.63				0.0059	0.0067	0.0057	0.0183
437	0.310	1250	1.95		118968	90407		0.0190	0.0185		9.7	5.6				2.76	3.13	2.63				0.0059	0.0067	0.0057	0.0183
442	0.082	1250	1.95		31597	24012		0.0240	0.0248		9.7	5.6				3.48	4.21	2.63				0.0020	0.0024	0.0015	0.0059
448	0.080	1250	1.95		30673	23309		0.0241	0.0249		9.7	5.6				3.50	4.24	2.63				0.0019	0.0023	0.0015	0.0057
457	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
458	0.084	1250	1.95		32307	24551		0.0239	0.0246		9.7	5.6				3.47	4.18	2.63				0.0020	0.0024	0.0015	0.0060
464	0.097	1250	1.95		37452	28461		0.0232	0.0238		9.7	5.6				3.36	4.04	2.63				0.0023	0.0027	0.0018	0.0068
465	0.098	1250	1.95		37680	28634		0.0231	0.0237		9.7	5.6				3.36	4.03	2.63				0.0023	0.0027	0.0018	0.0068
466	0.091	1250	1.95		35057	26641		0.0235	0.0242		9.7	5.6				3.41	4.10	2.63				0.0022	0.0026	0.0017	0.0064
467	0.082	1250	1.95		31578	23997		0.0240	0.0248		9.7	5.6				3.48	4.21	2.63				0.0020	0.0024	0.0015	0.0059
468	0.079	1250	1.95		30393	23096		0.0242	0.0250		9.7	5.6				3.51	4.25	2.63				0.0019	0.0023	0.0014	0.0057
469	0.076	1250	1.95		29319	22280		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
473	0.076	1250	1.95		29287	22256		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
476	0.083	1250	1.95		31926	24262		0.0239	0.0247		9.7	5.6				3.47	4.20	2.63				0.0020	0.0024	0.0015	0.0059
478	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
468	0.076	1250	1.95		29315	22277		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
493	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
494	0.076	1250	1.95		29362	22313		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
496	0.076	1250	1.95		29361	22312		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
497	0.077	1250	1.95		29515	22430		0.0243	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
499	0.091	1250	1.95		35057	26641		0.0235	0.0242		9.7	5.6				3.41	4.10	2.63				0.0022	0.0026	0.0017	0.0064
502	0.077	1250	1.95		29469	22395		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
503	0.077	1250	1.95		29453	22382		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
505	0.076	1250	1.95		29365	22315		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
506	0.076	1250	1.95		29354	22307		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
508	0.077	1250	1.95		29424	22360		0.0244	0.0252		9.7	5.6				3.53	4.28	2.63				0.0019	0.0023	0.0014	0.0056
509	0.076	1250	1.95		29333	22291		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055
519	0.078	1250	1.95		30067	22849		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0057
520	0.078	1250	1.95		30052	22838		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0057
521	0.078	1250	1.95		30052	22838		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0057
522	0.078	1250	1.95		30052	22838		0.0243	0.0251		9.7	5.6				3.52	4.26	2.63				0.0019	0.0023	0.0014	0.0057
529	0.076	1250	1.95		29258	22234		0.0244	0.0252		9.7	5.6				3.54	4.29	2.63				0.0019	0.0023	0.0014	0.0055
533	0.077	1250	1.95		29648	22531		0.0243	0.0252		9.7	5.6				3.53	4.27	2.63				0.0019	0.0023	0.0014	0.0056
534	0.076	1250	1.95		29347	22302		0.0244	0.0252		9.7	5.6				3.54	4.28	2.63				0.0019	0.0023	0.0014	0.0055

546	0.083	1250	1.95		31709	24096		0.0240	0.0247		9.7	5.6				3.48	4.20	2.63				0.0020	0.0024	0.0015	0.0059
547	0.083	1250	1.95		31709	24096		0.0240	0.0247		9.7	5.6				3.48	4.20	2.63				0.0020	0.0024	0.0015	0.0059
548	0.081	1250	1.95		31180	23695		0.0241	0.0248		9.7	5.6				3.49	4.22	2.63				0.0020	0.0024	0.0015	0.0058
549	0.083	1250	1.95		31709	24096		0.0240	0.0247		9.7	5.6				3.48	4.20	2.63				0.0020	0.0024	0.0015	0.0059
550	0.077	1250	1.95		29739	22599		0.0243	0.0251		9.7	5.6				3.53	4.27	2.63				0.0019	0.0023	0.0014	0.0056

MAX ΔP:	0.0203

P-V valve vacuum setting: 0.5 psi
80% of P-V valve setting: 0.4 psi

Maximum pressure drop to shore connection: 0.020 psi

TOTAL PRESSURE DROP TO SHORE CONNECTION: **0.020 psi** *OK*

Max. allowable back pressure at facility: **0.380 psi**

Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal:	8	in
Pipe ID:	7.981	in
Pipe Flow Area:	50.03	in^2
Vapor Dynamic Viscosity:	0.019	cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)

PIPE LENGTH

Length (ft):	231.00	ft	8" pipe
Length (ft):	50.00	ft	6" hose
f, friction factor (pipe):	Varies with Reynold's Number (see table below)		

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft):	255.81	ft
f_t, friction factor, turbulent flow (fittings):	0.014	constant, for each pipe size

Shore Connection Pressure Drop (at 50% of Maximum Liquid Discharge Rate): 2500 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s								ft/s	ft/s				ft	ft	ft				psi	psi	psi	psi
1	0.123	2500	3.90		94644	71923		0.0196	0.0202		19.4	11.2				11.40	13.74	10.53				0.0097	0.0118	0.0090	0.0305
2	0.085	2500	3.90		65323	49641		0.0209	0.0209		19.4	11.2				12.12	14.23	10.53				0.0071	0.0084	0.0062	0.0218
19	0.082	2500	3.90		62665	47621		0.0210	0.0211		19.4	11.2				12.20	14.36	10.53				0.0069	0.0081	0.0060	0.0210
20	0.079	2500	3.90		60727	46149		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0204
21	0.079	2500	3.90		60727	46149		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0204
23	0.079	2500	3.90		60727	46149		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0204
24	0.079	2500	3.90		60727	46149		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0204
26	0.079	2500	3.90		60727	46149		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0204
34	0.077	2500	3.90		59503	45218		0.0212	0.0214		19.4	11.2				12.32	14.53	10.53				0.0066	0.0078	0.0057	0.0201
40	0.085	2500	3.90		65019	49410		0.0209	0.0210		19.4	11.2				12.13	14.24	10.53				0.0071	0.0084	0.0062	0.0217
42	0.097	2500	3.90		74774	56823		0.0204	0.0203		19.4	11.2				11.84	13.82	10.53				0.0080	0.0093	0.0071	0.0244
44	0.083	2500	3.90		63719	48422		0.0210	0.0211		19.4	11.2				12.17	14.31	10.53				0.0070	0.0082	0.0061	0.0213
46	0.086	2500	3.90		66031	50179		0.0208	0.0209		19.4	11.2				12.09	14.19	10.53				0.0072	0.0085	0.0063	0.0220
47	0.097	2500	3.90		74702	56768		0.0204	0.0203		19.4	11.2				11.84	13.82	10.53				0.0080	0.0093	0.0071	0.0244
48	0.077	2500	3.90		58870	44737		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
58	0.078	2500	3.90		60001	45597		0.0212	0.0213		19.4	11.2				12.30	14.50	10.53				0.0067	0.0079	0.0057	0.0202
64	0.077	2500	3.90		59040	44866		0.0213	0.0214		19.4	11.2				12.33	14.55	10.53				0.0066	0.0078	0.0056	0.0200
70	0.085	2500	3.90		65453	49740		0.0209	0.0209		19.4	11.2				12.11	14.22	10.53				0.0072	0.0084	0.0062	0.0218
72	0.116	2500	3.90		89406	67942		0.0198	0.0196		19.4	11.2				11.50	13.30	10.53				0.0093	0.0107	0.0085	0.0285
73	0.078	2500	3.90		59844	45477		0.0212	0.0214		19.4	11.2				12.30	14.51	10.53				0.0067	0.0078	0.0057	0.0202
74	0.080	2500	3.90		61723	46905		0.0211	0.0212		19.4	11.2				12.24	14.41	10.53				0.0068	0.0080	0.0059	0.0207
76	0.078	2500	3.90		59955	45562		0.0212	0.0213		19.4	11.2				12.30	14.50	10.53				0.0067	0.0079	0.0057	0.0202
77	0.078	2500	3.90		59875	45501		0.0212	0.0213		19.4	11.2				12.30	14.50	10.53				0.0067	0.0078	0.0057	0.0202
78	0.076	2500	3.90		58661	44578		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
79	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
81	0.078	2500	3.90		60164	45720		0.0212	0.0213		19.4	11.2				12.29	14.49	10.53				0.0067	0.0079	0.0057	0.0203
82	0.076	2500	3.90		58672	44586		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
83	0.076	2500	3.90		58672	44586		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
84	0.076	2500	3.90		58672	44586		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
85	0.076	2500	3.90		58752	44647		0.0213	0.0214		19.4	11.2				12.34	14.57	10.53				0.0066	0.0077	0.0056	0.0199
87	0.078	2500	3.90		59600	45292		0.0212	0.0214		19.4	11.2				12.31	14.52	10.53				0.0066	0.0078	0.0057	0.0201
91	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
92	0.080	2500	3.90		61723	46905		0.0211	0.0212		19.4	11.2				12.24	14.41	10.53				0.0068	0.0080	0.0059	0.0207
93	0.077	2500	3.90		59563	45263		0.0212	0.0214		19.4	11.2				12.31	14.52	10.53				0.0066	0.0078	0.0057	0.0201
94	0.076	2500	3.90		58612	44541		0.0213	0.0215		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
95	0.076	2500	3.90		58679	44592		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
100	0.076	2500	3.90		58778	44667		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
101	0.077	2500	3.90		58857	44727		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
111	0.078	2500	3.90		59807	45449		0.0212	0.0214		19.4	11.2				12.30	14.51	10.53				0.0066	0.0078	0.0057	0.0202
112	0.103	2500	3.90		79181	60172		0.0202	0.0201		19.4	11.2				11.73	13.65	10.53				0.0084	0.0098	0.0075	0.0257
113	0.079	2500	3.90		60771	46181		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0205
119	0.077	2500	3.90		59015	44847		0.0213	0.0214		19.4	11.2				12.33	14.55	10.53				0.0066	0.0078	0.0056	0.0200
124	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
128	0.077	2500	3.90		59000	44836		0.0213	0.0214		19.4	11.2				12.33	14.55	10.53				0.0066	0.0078	0.0056	0.0199
130	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
131	0.078	2500	3.90		59925	45539		0.0212	0.0213		19.4	11.2				12.30	14.50	10.53				0.0067	0.0079	0.0057	0.0202
132	0.076	2500	3.90		58672	44587		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
133	0.076	2500	3.90		58692	44602		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199

134	0.076	2500	3.90		58692	44602		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
136	0.077	2500	3.90		59434	45166		0.0212	0.0214		19.4	11.2				12.32	14.53	10.53				0.0066	0.0078	0.0057	0.0201
139	0.102	2500	3.90		78459	59623		0.0202	0.0201		19.4	11.2				11.75	13.67	10.53				0.0083	0.0097	0.0075	0.0255
140	0.102	2500	3.90		78459	59623		0.0202	0.0201		19.4	11.2				11.75	13.67	10.53				0.0083	0.0097	0.0075	0.0255
145	0.077	2500	3.90		58864	44732		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
146	0.077	2500	3.90		58864	44732		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
147	0.240	2500	3.90		184169	139956		0.0179	0.0169		19.4	11.2				10.41	11.51	10.53				0.0173	0.0191	0.0175	0.0540
155	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
156	0.119	2500	3.90		91682	69672		0.0197	0.0195		19.4	11.2				11.46	13.23	10.53				0.0095	0.0110	0.0087	0.0292
157	0.079	2500	3.90		61031	46379		0.0211	0.0213		19.4	11.2				12.26	14.44	10.53				0.0068	0.0080	0.0058	0.0205
158	0.086	2500	3.90		66103	50234		0.0208	0.0209		19.4	11.2				12.09	14.19	10.53				0.0072	0.0085	0.0063	0.0220
160	0.083	2500	3.90		64066	48685		0.0209	0.0210		19.4	11.2				12.16	14.29	10.53				0.0070	0.0083	0.0061	0.0214
161	0.078	2500	3.90		59609	45299		0.0212	0.0214		19.4	11.2				12.31	14.52	10.53				0.0066	0.0078	0.0057	0.0201
162	0.090	2500	3.90		69355	52705		0.0207	0.0207		19.4	11.2				11.99	14.04	10.53				0.0075	0.0088	0.0066	0.0229
163	0.083	2500	3.90		63701	48408		0.0210	0.0211		19.4	11.2				12.17	14.31	10.53				0.0070	0.0082	0.0061	0.0213
166	0.076	2500	3.90		58560	44502		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
169	0.077	2500	3.90		59333	45089		0.0212	0.0214		19.4	11.2				12.32	14.53	10.53				0.0066	0.0078	0.0056	0.0200
172	0.076	2500	3.90		58662	44579		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
178	0.076	2500	3.90		58654	44573		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
180	0.076	2500	3.90		58654	44573		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
184	0.079	2500	3.90		60611	46060		0.0212	0.0213		19.4	11.2				12.28	14.47	10.53				0.0067	0.0079	0.0058	0.0204
186	0.076	2500	3.90		58769	44660		0.0213	0.0214		19.4	11.2				12.34	14.57	10.53				0.0066	0.0077	0.0056	0.0199
190	0.086	2500	3.90		66103	50234		0.0208	0.0209		19.4	11.2				12.09	14.19	10.53				0.0072	0.0085	0.0063	0.0220
191	0.080	2500	3.90		61703	46890		0.0211	0.0212		19.4	11.2				12.24	14.41	10.53				0.0068	0.0080	0.0059	0.0207
194	0.076	2500	3.90		58715	44619		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
195	0.077	2500	3.90		58950	44798		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0078	0.0056	0.0199
197	0.217	2500	3.90		166900	126832		0.0182	0.0173		19.4	11.2				10.54	11.73	10.53				0.0159	0.0177	0.0159	0.0494
198	0.217	2500	3.90		166900	126832		0.0182	0.0173		19.4	11.2				10.54	11.73	10.53				0.0159	0.0177	0.0159	0.0494
199	0.217	2500	3.90		166900	126832		0.0182	0.0173		19.4	11.2				10.54	11.73	10.53				0.0159	0.0177	0.0159	0.0494
200	0.217	2500	3.90		166900	126832		0.0182	0.0173		19.4	11.2				10.54	11.73	10.53				0.0159	0.0177	0.0159	0.0494
201	0.217	2500	3.90		166900	126832		0.0182	0.0173		19.4	11.2				10.54	11.73	10.53				0.0159	0.0177	0.0159	0.0494
202	0.217	2500	3.90		166900	126832		0.0182	0.0173		19.4	11.2				10.54	11.73	10.53				0.0159	0.0177	0.0159	0.0494
203	0.217	2500	3.90		166900	126832		0.0182	0.0173		19.4	11.2				10.54	11.73	10.53				0.0159	0.0177	0.0159	0.0494
204	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
217	0.105	2500	3.90		80645	61284		0.0202	0.0200		19.4	11.2				11.69	13.59	10.53				0.0085	0.0099	0.0077	0.0261
218	0.105	2500	3.90		80645	61284		0.0202	0.0200		19.4	11.2				11.69	13.59	10.53				0.0085	0.0099	0.0077	0.0261
219	0.076	2500	3.90		58642	44564		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
220	0.077	2500	3.90		58950	44798		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0078	0.0056	0.0199
221	0.077	2500	3.90		58950	44798		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0078	0.0056	0.0199
222	0.109	2500	3.90		83661	63577		0.0200	0.0199		19.4	11.2				11.62	13.49	10.53				0.0088	0.0102	0.0080	0.0269
223	0.108	2500	3.90		82794	62918		0.0201	0.0199		19.4	11.2				11.64	13.52	10.53				0.0087	0.0101	0.0079	0.0267
224	0.078	2500	3.90		60142	45704		0.0212	0.0213		19.4	11.2				12.29	14.49	10.53				0.0067	0.0079	0.0057	0.0203
229	0.142	2500	3.90		109095	82905		0.0192	0.0188		19.4	11.2				11.16	12.76	10.53				0.0110	0.0126	0.0104	0.0340
230	0.142	2500	3.90		109095	82905		0.0192	0.0188		19.4	11.2				11.16	12.76	10.53				0.0110	0.0126	0.0104	0.0340
231	0.076	2500	3.90		58625	44551		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
232	0.088	2500	3.90		67621	51387		0.0208	0.0208		19.4	11.2				12.04	14.12	10.53				0.0074	0.0086	0.0064	0.0224
234	0.148	2500	3.90		113431	86199		0.0191	0.0186		19.4	11.2				11.10	12.66	10.53				0.0114	0.0130	0.0108	0.0351
235	0.149	2500	3.90		114804	87243		0.0191	0.0186		19.4	11.2				11.08	12.63	10.53				0.0115	0.0131	0.0109	0.0355
236	0.149	2500	3.90		114804	87243		0.0191	0.0186		19.4	11.2				11.08	12.63	10.53				0.0115	0.0131	0.0109	0.0355
238	0.076	2500	3.90		58520	44471		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
243	0.076	2500	3.90		58652	44571		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
244	0.078	2500	3.90		60287	45814		0.0212	0.0213		19.4	11.2				12.29	14.48	10.53				0.0067	0.0079	0.0057	0.0203
245	0.216	2500	3.90		166123	126242		0.0182	0.0173		19.4	11.2				10.54	11.74	10.53				0.0158	0.0176	0.0158	0.0492
246	0.124	2500	3.90		95367	72472		0.0196	0.0193		19.4	11.2				11.39	13.12	10.53				0.0098	0.0113	0.0091	0.0302
247	0.078	2500	3.90		59600	45292		0.0212	0.0214		19.4	11.2				12.31	14.52	10.53				0.0066	0.0078	0.0057	0.0201
249	0.079	2500	3.90		60413	45910		0.0212	0.0213		19.4	11.2				12.28	14.48	10.53				0.0067	0.0079	0.0057	0.0204
263	0.122	2500	3.90		93777	71264		0.0197	0.0194		19.4	11.2				11.42	13.17	10.53				0.0097	0.0112	0.0089	0.0298
265	0.079	2500	3.90		60912	46289		0.0211	0.0213		19.4	11.2				12.26	14.45	10.53				0.0067	0.0080	0.0058	0.0205
266	0.082	2500	3.90		63249	48065		0.0210	0.0211		19.4	11.2				12.18	14.33	10.53				0.0070	0.0082	0.0060	0.0212
267	0.081	2500	3.90		62431	47443		0.0210	0.0212		19.4	11.2				12.21	14.37	10.53				0.0069	0.0081	0.0059	0.0209
271	0.088	2500	3.90		67277	51126		0.0208	0.0208		19.4	11.2				12.05	14.14	10.53				0.0073	0.0086	0.0064	0.0223
273	0.091	2500	3.90		70033	53220		0.0206	0.0206		19.4	11.2				11.97	14.01	10.53				0.0076	0.0089	0.0067	0.0231
274	0.108	2500	3.90		82903	63000		0.0201	0.0199		19.4	11.2				11.64	13.51	10.53				0.0087	0.0101	0.0079	0.0267
275	0.208	2500	3.90		159627	121305		0.0183	0.0174		19.4	11.2				10.59	11.83	10.53				0.0153	0.0171	0.0152	0.0475
276	0.077	2500	3.90		59362	45111		0.0212	0.0214		19.4	11.2				12.32	14.53	10.53				0.0066	0.0078	0.0056	0.0201
278	0.089	2500	3.90		68695	52204		0.0207	0.0207		19.4	11.2				12.01	14.07	10.53				0.0075	0.0087	0.0065	0.0227
281	0.076	2500	3.90		58658	44576		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
283	0.132	2500	3.90		101761	77332		0.0194	0.0191		19.4	11.2				11.28	12.94	10.53				0.0104	0.0119	0.0097	0.0319
284	0.152	2500	3.90		116794	88755		0.0190	0.0185		19.4	11.2				11.05	12.58	10.53				0.0117	0.0133	0.0111	0.0361

286	0.077	2500	3.90		58820	44699		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
288	0.079	2500	3.90		60901	46280		0.0211	0.0213		19.4	11.2				12.27	14.45	10.53				0.0067	0.0080	0.0058	0.0205
289	0.079	2500	3.90		60789	46195		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0205
295	0.078	2500	3.90		60323	45841		0.0212	0.0213		19.4	11.2				12.29	14.48	10.53				0.0067	0.0079	0.0057	0.0203
296	0.079	2500	3.90		60901	46280		0.0211	0.0213		19.4	11.2				12.27	14.45	10.53				0.0067	0.0080	0.0058	0.0205
297	0.079	2500	3.90		60782	46190		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0205
300	0.080	2500	3.90		61833	46989		0.0211	0.0212		19.4	11.2				12.23	14.40	10.53				0.0068	0.0080	0.0059	0.0208
301	0.080	2500	3.90		61833	46989		0.0211	0.0212		19.4	11.2				12.23	14.40	10.53				0.0068	0.0080	0.0059	0.0208
304	0.082	2500	3.90		62689	47639		0.0210	0.0211		19.4	11.2				12.20	14.36	10.53				0.0069	0.0081	0.0060	0.0210
305	0.078	2500	3.90		59961	45566		0.0212	0.0213		19.4	11.2				12.30	14.50	10.53				0.0067	0.0079	0.0057	0.0202
306	0.078	2500	3.90		59961	45566		0.0212	0.0213		19.4	11.2				12.30	14.50	10.53				0.0067	0.0079	0.0057	0.0202
307	0.078	2500	3.90		59961	45566		0.0212	0.0213		19.4	11.2				12.30	14.50	10.53				0.0067	0.0079	0.0057	0.0202
309	0.076	2500	3.90		58755	44650		0.0213	0.0214		19.4	11.2				12.34	14.57	10.53				0.0066	0.0077	0.0056	0.0199
316	0.087	2500	3.90		66793	50758		0.0208	0.0208		19.4	11.2				12.07	14.16	10.53				0.0073	0.0085	0.0064	0.0222
317	0.087	2500	3.90		66793	50758		0.0208	0.0208		19.4	11.2				12.07	14.16	10.53				0.0073	0.0085	0.0064	0.0222
318	0.076	2500	3.90		58661	44578		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
319	0.076	2500	3.90		58642	44564		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
320	0.076	2500	3.90		58642	44564		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
321	0.088	2500	3.90		67946	51634		0.0207	0.0208		19.4	11.2				12.03	14.11	10.53				0.0074	0.0087	0.0065	0.0225
322	0.090	2500	3.90		68849	52320		0.0207	0.0207		19.4	11.2				12.01	14.07	10.53				0.0075	0.0087	0.0066	0.0228
324	0.076	2500	3.90		58642	44564		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
325	0.076	2500	3.90		58642	44564		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
364	0.095	2500	3.90		72678	55231		0.0205	0.0205		19.4	11.2				11.90	13.90	10.53				0.0078	0.0091	0.0069	0.0239
366	0.078	2500	3.90		59817	45457		0.0212	0.0214		19.4	11.2				12.30	14.51	10.53				0.0066	0.0078	0.0057	0.0202
367	0.078	2500	3.90		59817	45457		0.0212	0.0214		19.4	11.2				12.30	14.51	10.53				0.0066	0.0078	0.0057	0.0202
366	0.078	2500	3.90		59817	45457		0.0212	0.0214		19.4	11.2				12.30	14.51	10.53				0.0066	0.0078	0.0057	0.0202
382	0.078	2500	3.90		59817	45457		0.0212	0.0214		19.4	11.2				12.30	14.51	10.53				0.0066	0.0078	0.0057	0.0202
383	0.084	2500	3.90		64499	49015		0.0209	0.0210		19.4	11.2				12.14	14.27	10.53				0.0071	0.0083	0.0061	0.0215
389	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
403	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
418	0.082	2500	3.90		63285	48092		0.0210	0.0211		19.4	11.2				12.18	14.33	10.53				0.0070	0.0082	0.0060	0.0212
429	0.076	2500	3.90		58765	44657		0.0213	0.0214		19.4	11.2				12.34	14.57	10.53				0.0066	0.0077	0.0056	0.0199
432	0.270	2500	3.90		207357	157577		0.0177	0.0166		19.4	11.2				10.27	11.25	10.53				0.0192	0.0211	0.0197	0.0601
433	0.347	2500	3.90		266602	202599		0.0172	0.0158		19.4	11.2				10.00	10.75	10.53				0.0241	0.0259	0.0254	0.0753
434	0.265	2500	3.90		203455	154612		0.0177	0.0166		19.4	11.2				10.29	11.29	10.53				0.0189	0.0208	0.0194	0.0590
436	0.310	2500	3.90		237935	180814		0.0174	0.0161		19.4	11.2				10.12	10.97	10.53				0.0217	0.0236	0.0226	0.0680
437	0.310	2500	3.90		237935	180814		0.0174	0.0161		19.4	11.2				10.12	10.97	10.53				0.0217	0.0236	0.0226	0.0680
442	0.082	2500	3.90		63195	48024		0.0210	0.0211		19.4	11.2				12.19	14.33	10.53				0.0070	0.0082	0.0060	0.0212
448	0.080	2500	3.90		61345	46618		0.0211	0.0212		19.4	11.2				12.25	14.43	10.53				0.0068	0.0080	0.0058	0.0206
457	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
458	0.084	2500	3.90		64615	49103		0.0209	0.0210		19.4	11.2				12.14	14.26	10.53				0.0071	0.0083	0.0061	0.0216
464	0.097	2500	3.90		74904	56922		0.0204	0.0203		19.4	11.2				11.84	13.81	10.53				0.0080	0.0093	0.0071	0.0245
465	0.098	2500	3.90		75359	57268		0.0204	0.0203		19.4	11.2				11.82	13.79	10.53				0.0081	0.0094	0.0072	0.0246
466	0.091	2500	3.90		70113	53281		0.0206	0.0206		19.4	11.2				11.97	14.01	10.53				0.0076	0.0089	0.0067	0.0231
467	0.082	2500	3.90		63155	47993		0.0210	0.0211		19.4	11.2				12.19	14.33	10.53				0.0070	0.0082	0.0060	0.0211
468	0.079	2500	3.90		60785	46192		0.0211	0.0213		19.4	11.2				12.27	14.46	10.53				0.0067	0.0079	0.0058	0.0205
469	0.076	2500	3.90		58637	44560		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
473	0.076	2500	3.90		58575	44513		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
476	0.083	2500	3.90		63852	48523		0.0210	0.0210		19.4	11.2				12.16	14.30	10.53				0.0070	0.0082	0.0061	0.0213
478	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
468	0.076	2500	3.90		58630	44555		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
493	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
494	0.076	2500	3.90		58725	44627		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
496	0.076	2500	3.90		58722	44625		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
497	0.077	2500	3.90		59031	44859		0.0213	0.0214		19.4	11.2				12.33	14.55	10.53				0.0066	0.0078	0.0056	0.0200
499	0.091	2500	3.90		70113	53281		0.0206	0.0206		19.4	11.2				11.97	14.01	10.53				0.0076	0.0089	0.0067	0.0231
502	0.077	2500	3.90		58939	44789		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0078	0.0056	0.0199
503	0.077	2500	3.90		58907	44765		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
505	0.076	2500	3.90		58730	44631		0.0213	0.0214		19.4	11.2				12.34	14.57	10.53				0.0065	0.0077	0.0056	0.0199
506	0.076	2500	3.90		58707	44614		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199
508	0.077	2500	3.90		58849	44721		0.0213	0.0214		19.4	11.2				12.34	14.56	10.53				0.0066	0.0077	0.0056	0.0199
509	0.076	2500	3.90		58667	44583		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0198
519	0.078	2500	3.90		60135	45698		0.0212	0.0213		19.4	11.2				12.29	14.49	10.53				0.0067	0.0079	0.0057	0.0203
520	0.078	2500	3.90		60105	45675		0.0212	0.0213		19.4	11.2				12.29	14.49	10.53				0.0067	0.0079	0.0057	0.0203
521	0.078	2500	3.90		60105	45675		0.0212	0.0213		19.4	11.2				12.29	14.49	10.53				0.0067	0.0079	0.0057	0.0203
522	0.078	2500	3.90		60105	45675		0.0212	0.0213		19.4	11.2				12.29	14.49	10.53				0.0067	0.0079	0.0057	0.0203
529	0.076	2500	3.90		58516	44468		0.0213	0.0215		19.4	11.2				12.35	14.58	10.53				0.0065	0.0077	0.0056	0.0198
533	0.077	2500	3.90		59297	45061		0.0212	0.0214		19.4	11.2				12.32	14.54	10.53				0.0066	0.0078	0.0056	0.0200
534	0.076	2500	3.90		58695	44604		0.0213	0.0214		19.4	11.2				12.35	14.57	10.53				0.0065	0.0077	0.0056	0.0199

546	0.083	2500	3.90		63417	48193		0.0210	0.0211		19.4	11.2				12.18	14.32	10.53				0.0070	0.0082	0.0060	0.0212
547	0.083	2500	3.90		63417	48193		0.0210	0.0211		19.4	11.2				12.18	14.32	10.53				0.0070	0.0082	0.0060	0.0212
548	0.081	2500	3.90		62360	47389		0.0210	0.0212		19.4	11.2				12.21	14.37	10.53				0.0069	0.0081	0.0059	0.0209
549	0.083	2500	3.90		63417	48193		0.0210	0.0211		19.4	11.2				12.18	14.32	10.53				0.0070	0.0082	0.0060	0.0212
550	0.077	2500	3.90		59477	45199		0.0212	0.0214		19.4	11.2				12.32	14.53	10.53				0.0066	0.0078	0.0057	0.0201

MAX ΔP:	0.0753

P-V valve vacuum setting: 0.5 psi
80% of P-V valve setting: 0.4 psi

Maximum pressure drop to shore connection: 0.075 psi

TOTAL PRESSURE DROP TO SHORE CONNECTION: 0.075 psi *OK*

Max. allowable back pressure at facility: 0.325 psi

Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal:	8	in	
Pipe ID:	7.981	in	
Pipe Flow Area:	50.03	in^2	
Vapor Dynamic Viscosity:	0.019	cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)	

PIPE LENGTH

Length (ft):	231.00	ft	8" pipe
Length (ft):	50.00	ft	6" hose
f, friction factor (pipe):	Varies with Reynold's Number (see table below)		

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft):	255.81	ft
f_t, friction factor, turbulent flow (fittings):	0.014	constant, for each pipe size

Shore Connection Pressure Drop (at 75% of Maximum Liquid Discharge Rate): 3750 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s								ft/s	ft/s				ft	ft	ft				psi	psi	psi	psi
1	0.123	3750	5.85		141966	107884		0.0185	0.0189		29.2	16.8				24.20	28.89	23.70				0.0207	0.0247	0.0203	0.0657
2	0.085	3750	5.85		97984	74461		0.0195	0.0192		29.2	16.8				25.52	29.35	23.70				0.0151	0.0173	0.0140	0.0464
19	0.082	3750	5.85		93998	71432		0.0197	0.0194		29.2	16.8				25.68	29.61	23.70				0.0145	0.0168	0.0134	0.0447
20	0.079	3750	5.85		91091	69223		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
21	0.079	3750	5.85		91091	69223		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
23	0.079	3750	5.85		91091	69223		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
24	0.079	3750	5.85		91091	69223		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
26	0.079	3750	5.85		91091	69223		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
34	0.077	3750	5.85		89254	67827		0.0198	0.0196		29.2	16.8				25.89	29.93	23.70				0.0139	0.0161	0.0127	0.0427
40	0.085	3750	5.85		97529	74115		0.0196	0.0192		29.2	16.8				25.53	29.38	23.70				0.0150	0.0173	0.0139	0.0462
42	0.097	3750	5.85		112161	85234		0.0192	0.0187		29.2	16.8				25.01	28.55	23.70				0.0169	0.0193	0.0160	0.0522
44	0.083	3750	5.85		95578	72633		0.0196	0.0193		29.2	16.8				25.61	29.50	23.70				0.0147	0.0170	0.0136	0.0454
46	0.086	3750	5.85		99046	75268		0.0195	0.0192		29.2	16.8				25.47	29.29	23.70				0.0152	0.0175	0.0141	0.0468
47	0.097	3750	5.85		112052	85152		0.0192	0.0187		29.2	16.8				25.01	28.55	23.70				0.0169	0.0193	0.0160	0.0521
48	0.077	3750	5.85		88306	67106		0.0199	0.0196		29.2	16.8				25.93	30.00	23.70				0.0138	0.0160	0.0126	0.0424
58	0.078	3750	5.85		90002	68395		0.0198	0.0195		29.2	16.8				25.85	29.88	23.70				0.0140	0.0162	0.0128	0.0431
64	0.077	3750	5.85		88560	67300		0.0199	0.0196		29.2	16.8				25.92	29.98	23.70				0.0138	0.0160	0.0126	0.0425
70	0.085	3750	5.85		98179	74609		0.0195	0.0192		29.2	16.8				25.51	29.34	23.70				0.0151	0.0173	0.0140	0.0464
72	0.116	3750	5.85		134109	101913		0.0187	0.0180		29.2	16.8				24.39	27.54	23.70				0.0197	0.0222	0.0191	0.0611
73	0.078	3750	5.85		89766	68216		0.0198	0.0196		29.2	16.8				25.86	29.90	23.70				0.0140	0.0162	0.0128	0.0430
74	0.080	3750	5.85		92584	70357		0.0197	0.0194		29.2	16.8				25.74	29.70	23.70				0.0144	0.0166	0.0132	0.0441
76	0.078	3750	5.85		89932	68342		0.0198	0.0195		29.2	16.8				25.86	29.88	23.70				0.0140	0.0162	0.0128	0.0430
77	0.078	3750	5.85		89812	68251		0.0198	0.0196		29.2	16.8				25.86	29.89	23.70				0.0140	0.0162	0.0128	0.0430
78	0.076	3750	5.85		87991	66867		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
79	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
81	0.078	3750	5.85		90246	68580		0.0198	0.0195		29.2	16.8				25.84	29.86	23.70				0.0140	0.0162	0.0129	0.0432
82	0.076	3750	5.85		88008	66880		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
83	0.076	3750	5.85		88008	66880		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
84	0.076	3750	5.85		88008	66880		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
85	0.076	3750	5.85		88128	66971		0.0199	0.0196		29.2	16.8				25.94	30.01	23.70				0.0138	0.0159	0.0126	0.0423
87	0.078	3750	5.85		89400	67938		0.0198	0.0196		29.2	16.8				25.88	29.92	23.70				0.0139	0.0161	0.0128	0.0428
91	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
92	0.080	3750	5.85		92584	70357		0.0197	0.0194		29.2	16.8				25.74	29.70	23.70				0.0144	0.0166	0.0132	0.0441
93	0.077	3750	5.85		89344	67895		0.0198	0.0196		29.2	16.8				25.88	29.93	23.70				0.0139	0.0161	0.0128	0.0428
94	0.076	3750	5.85		87919	66812		0.0199	0.0196		29.2	16.8				25.95	30.03	23.70				0.0137	0.0159	0.0125	0.0422
95	0.076	3750	5.85		88018	66888		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
100	0.076	3750	5.85		88167	67001		0.0199	0.0196		29.2	16.8				25.94	30.01	23.70				0.0138	0.0159	0.0126	0.0423
101	0.077	3750	5.85		88285	67090		0.0199	0.0196		29.2	16.8				25.93	30.00	23.70				0.0138	0.0160	0.0126	0.0423
111	0.078	3750	5.85		89711	68174		0.0198	0.0196		29.2	16.8				25.87	29.90	23.70				0.0140	0.0162	0.0128	0.0429
112	0.103	3750	5.85		118772	90259		0.0190	0.0185		29.2	16.8				24.80	28.22	23.70				0.0177	0.0202	0.0170	0.0549
113	0.079	3750	5.85		91156	69272		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
119	0.077	3750	5.85		88522	67271		0.0199	0.0196		29.2	16.8				25.92	29.98	23.70				0.0138	0.0160	0.0126	0.0424
124	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
128	0.077	3750	5.85		88501	67254		0.0199	0.0196		29.2	16.8				25.92	29.99	23.70				0.0138	0.0160	0.0126	0.0424
130	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
131	0.078	3750	5.85		89888	68309		0.0198	0.0196		29.2	16.8				25.86	29.89	23.70				0.0140	0.0162	0.0128	0.0430
132	0.076	3750	5.85		88008	66880		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
133	0.076	3750	5.85		88038	66903		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422

134	0.076	3750	5.85		88038	66903		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
136	0.077	3750	5.85		89152	67749		0.0198	0.0196		29.2	16.8				25.89	29.94	23.70				0.0139	0.0161	0.0127	0.0427
139	0.102	3750	5.85		117688	89435		0.0190	0.0185		29.2	16.8				24.83	28.27	23.70				0.0176	0.0200	0.0168	0.0544
140	0.102	3750	5.85		117688	89435		0.0190	0.0185		29.2	16.8				24.83	28.27	23.70				0.0176	0.0200	0.0168	0.0544
145	0.077	3750	5.85		88296	67099		0.0199	0.0196		29.2	16.8				25.93	30.00	23.70				0.0138	0.0160	0.0126	0.0423
146	0.077	3750	5.85		88296	67099		0.0199	0.0196		29.2	16.8				25.93	30.00	23.70				0.0138	0.0160	0.0126	0.0423
147	0.240	3750	5.85		276254	209933		0.0172	0.0157		29.2	16.8				22.42	24.03	23.70				0.0373	0.0400	0.0394	0.1167
155	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
156	0.119	3750	5.85		137523	104508		0.0186	0.0179		29.2	16.8				24.31	27.40	23.70				0.0201	0.0227	0.0196	0.0625
157	0.079	3750	5.85		91546	69569		0.0197	0.0195		29.2	16.8				25.78	29.77	23.70				0.0142	0.0164	0.0131	0.0437
158	0.086	3750	5.85		99155	75351		0.0195	0.0192		29.2	16.8				25.47	29.28	23.70				0.0152	0.0175	0.0142	0.0468
160	0.083	3750	5.85		96098	73028		0.0196	0.0193		29.2	16.8				25.59	29.47	23.70				0.0148	0.0171	0.0137	0.0456
161	0.078	3750	5.85		89413	67948		0.0198	0.0196		29.2	16.8				25.88	29.92	23.70				0.0139	0.0161	0.0128	0.0428
162	0.090	3750	5.85		104032	79057		0.0194	0.0190		29.2	16.8				25.29	28.99	23.70				0.0158	0.0182	0.0149	0.0489
163	0.083	3750	5.85		95551	72612		0.0196	0.0193		29.2	16.8				25.61	29.51	23.70				0.0147	0.0170	0.0136	0.0454
166	0.076	3750	5.85		87840	66752		0.0199	0.0196		29.2	16.8				25.95	30.03	23.70				0.0137	0.0159	0.0125	0.0422
169	0.077	3750	5.85		88999	67633		0.0198	0.0196		29.2	16.8				25.90	29.95	23.70				0.0139	0.0161	0.0127	0.0426
172	0.076	3750	5.85		87993	66868		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0138	0.0159	0.0126	0.0422
178	0.076	3750	5.85		87980	66859		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
180	0.076	3750	5.85		87980	66859		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
184	0.079	3750	5.85		90916	69090		0.0198	0.0195		29.2	16.8				25.81	29.82	23.70				0.0141	0.0163	0.0130	0.0434
186	0.076	3750	5.85		88154	66991		0.0199	0.0196		29.2	16.8				25.94	30.01	23.70				0.0138	0.0159	0.0126	0.0423
190	0.086	3750	5.85		99155	75351		0.0195	0.0192		29.2	16.8				25.47	29.28	23.70				0.0152	0.0175	0.0142	0.0468
191	0.080	3750	5.85		92554	70335		0.0197	0.0194		29.2	16.8				25.74	29.70	23.70				0.0143	0.0166	0.0132	0.0441
194	0.076	3750	5.85		88073	66929		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0423
195	0.077	3750	5.85		88425	67197		0.0199	0.0196		29.2	16.8				25.93	29.99	23.70				0.0138	0.0160	0.0126	0.0424
197	0.217	3750	5.85		250350	190248		0.0173	0.0160		29.2	16.8				22.64	24.46	23.70				0.0341	0.0369	0.0357	0.1068
198	0.217	3750	5.85		250350	190248		0.0173	0.0160		29.2	16.8				22.64	24.46	23.70				0.0341	0.0369	0.0357	0.1068
199	0.217	3750	5.85		250350	190248		0.0173	0.0160		29.2	16.8				22.64	24.46	23.70				0.0341	0.0369	0.0357	0.1068
200	0.217	3750	5.85		250350	190248		0.0173	0.0160		29.2	16.8				22.64	24.46	23.70				0.0341	0.0369	0.0357	0.1068
201	0.217	3750	5.85		250350	190248		0.0173	0.0160		29.2	16.8				22.64	24.46	23.70				0.0341	0.0369	0.0357	0.1068
202	0.217	3750	5.85		250350	190248		0.0173	0.0160		29.2	16.8				22.64	24.46	23.70				0.0341	0.0369	0.0357	0.1068
203	0.217	3750	5.85		250350	190248		0.0173	0.0160		29.2	16.8				22.64	24.46	23.70				0.0341	0.0369	0.0357	0.1068
204	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
217	0.105	3750	5.85		120967	91926		0.0189	0.0184		29.2	16.8				24.74	28.11	23.70				0.0180	0.0205	0.0173	0.0558
218	0.105	3750	5.85		120967	91926		0.0189	0.0184		29.2	16.8				24.74	28.11	23.70				0.0180	0.0205	0.0173	0.0558
219	0.076	3750	5.85		87964	66846		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
220	0.077	3750	5.85		88425	67197		0.0199	0.0196		29.2	16.8				25.93	29.99	23.70				0.0138	0.0160	0.0126	0.0424
221	0.077	3750	5.85		88425	67197		0.0199	0.0196		29.2	16.8				25.93	29.99	23.70				0.0138	0.0160	0.0126	0.0424
222	0.109	3750	5.85		125492	95365		0.0189	0.0183		29.2	16.8				24.61	27.90	23.70				0.0186	0.0211	0.0179	0.0576
223	0.108	3750	5.85		124191	94377		0.0189	0.0183		29.2	16.8				24.65	27.96	23.70				0.0184	0.0209	0.0177	0.0571
224	0.078	3750	5.85		90213	68556		0.0198	0.0195		29.2	16.8				25.84	29.86	23.70				0.0140	0.0162	0.0129	0.0431
229	0.142	3750	5.85		163643	124357		0.0182	0.0173		29.2	16.8				23.76	26.48	23.70				0.0234	0.0261	0.0234	0.0729
230	0.142	3750	5.85		163643	124357		0.0182	0.0173		29.2	16.8				23.76	26.48	23.70				0.0234	0.0261	0.0234	0.0729
231	0.076	3750	5.85		87937	66826		0.0199	0.0196		29.2	16.8				25.95	30.03	23.70				0.0137	0.0159	0.0126	0.0422
232	0.088	3750	5.85		101431	77080		0.0194	0.0191		29.2	16.8				25.38	29.14	23.70				0.0155	0.0178	0.0145	0.0478
234	0.148	3750	5.85		170146	129299		0.0181	0.0172		29.2	16.8				23.65	26.28	23.70				0.0242	0.0269	0.0243	0.0755
235	0.149	3750	5.85		172205	130864		0.0181	0.0172		29.2	16.8				23.61	26.22	23.70				0.0245	0.0272	0.0246	0.0763
236	0.149	3750	5.85		172205	130864		0.0181	0.0172		29.2	16.8				23.61	26.22	23.70				0.0245	0.0272	0.0246	0.0763
238	0.076	3750	5.85		87780	66707		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
243	0.076	3750	5.85		87978	66857		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
244	0.078	3750	5.85		90430	68720		0.0198	0.0195		29.2	16.8				25.83	29.85	23.70				0.0141	0.0163	0.0129	0.0432
245	0.216	3750	5.85		249185	189363		0.0174	0.0160		29.2	16.8				22.65	24.48	23.70				0.0340	0.0367	0.0356	0.1063
246	0.124	3750	5.85		143050	108708		0.0185	0.0178		29.2	16.8				24.18	27.19	23.70				0.0208	0.0234	0.0204	0.0647
247	0.078	3750	5.85		89400	67938		0.0198	0.0196		29.2	16.8				25.88	29.92	23.70				0.0139	0.0161	0.0128	0.0428
249	0.079	3750	5.85		90620	68865		0.0198	0.0195		29.2	16.8				25.83	29.84	23.70				0.0141	0.0163	0.0129	0.0433
263	0.122	3750	5.85		140666	106896		0.0186	0.0178		29.2	16.8				24.23	27.28	23.70				0.0205	0.0231	0.0201	0.0637
265	0.079	3750	5.85		91367	69433		0.0198	0.0195		29.2	16.8				25.79	29.78	23.70				0.0142	0.0164	0.0130	0.0436
266	0.082	3750	5.85		94874	72098		0.0196	0.0193		29.2	16.8				25.64	29.55	23.70				0.0147	0.0169	0.0135	0.0451
267	0.081	3750	5.85		93647	71165		0.0197	0.0194		29.2	16.8				25.69	29.63	23.70				0.0145	0.0167	0.0134	0.0446
271	0.088	3750	5.85		100916	76689		0.0195	0.0191		29.2	16.8				25.40	29.17	23.70				0.0154	0.0177	0.0144	0.0476
273	0.091	3750	5.85		105050	79830		0.0193	0.0189		29.2	16.8				25.25	28.93	23.70				0.0160	0.0183	0.0150	0.0493
274	0.108	3750	5.85		124354	94500		0.0189	0.0183		29.2	16.8				24.64	27.96	23.70				0.0185	0.0209	0.0178	0.0571
275	0.208	3750	5.85		239440	181958		0.0174	0.0161		29.2	16.8				22.75	24.66	23.70				0.0328	0.0356	0.0342	0.1025
276	0.077	3750	5.85		89043	67666		0.0198	0.0196		29.2	16.8				25.90	29.95	23.70				0.0139	0.0161	0.0127	0.0427
278	0.089	3750	5.85		103043	78305		0.0194	0.0190		29.2	16.8				25.32	29.05	23.70				0.0157	0.0180	0.0147	0.0485
281	0.076	3750	5.85		87986	66863		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
283	0.132	3750	5.85		152642	115997		0.0184	0.0176		29.2	16.8				23.97	26.84	23.70				0.0220	0.0247	0.0218	0.0685
284	0.152	3750	5.85		175191	133133		0.0180	0.0171		29.2	16.8				23.56	26.14	23.70				0.0249	0.0276	0.0250	0.0775

286	0.077	3750	5.85		88230	67048		0.0199	0.0196		29.2	16.8				25.93	30.00	23.70				0.0138	0.0159	0.0126	0.0423
288	0.079	3750	5.85		91351	69420		0.0198	0.0195		29.2	16.8				25.79	29.79	23.70				0.0142	0.0164	0.0130	0.0436
289	0.079	3750	5.85		91183	69293		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
295	0.078	3750	5.85		90484	68762		0.0198	0.0195		29.2	16.8				25.83	29.85	23.70				0.0141	0.0163	0.0129	0.0433
296	0.079	3750	5.85		91351	69420		0.0198	0.0195		29.2	16.8				25.79	29.79	23.70				0.0142	0.0164	0.0130	0.0436
297	0.079	3750	5.85		91172	69285		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
300	0.080	3750	5.85		92749	70483		0.0197	0.0194		29.2	16.8				25.73	29.69	23.70				0.0144	0.0166	0.0132	0.0442
301	0.080	3750	5.85		92749	70483		0.0197	0.0194		29.2	16.8				25.73	29.69	23.70				0.0144	0.0166	0.0132	0.0442
304	0.082	3750	5.85		94034	71459		0.0197	0.0194		29.2	16.8				25.68	29.61	23.70				0.0145	0.0168	0.0134	0.0447
305	0.078	3750	5.85		89942	68350		0.0198	0.0195		29.2	16.8				25.86	29.88	23.70				0.0140	0.0162	0.0128	0.0430
306	0.078	3750	5.85		89942	68350		0.0198	0.0195		29.2	16.8				25.86	29.88	23.70				0.0140	0.0162	0.0128	0.0430
307	0.078	3750	5.85		89942	68350		0.0198	0.0195		29.2	16.8				25.86	29.88	23.70				0.0140	0.0162	0.0128	0.0430
309	0.076	3750	5.85		88132	66974		0.0199	0.0196		29.2	16.8				25.94	30.01	23.70				0.0138	0.0159	0.0126	0.0423
316	0.087	3750	5.85		100190	76137		0.0195	0.0191		29.2	16.8				25.43	29.22	23.70				0.0153	0.0176	0.0143	0.0473
317	0.087	3750	5.85		100190	76137		0.0195	0.0191		29.2	16.8				25.43	29.22	23.70				0.0153	0.0176	0.0143	0.0473
318	0.076	3750	5.85		87991	66867		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
319	0.076	3750	5.85		87963	66846		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
320	0.076	3750	5.85		87963	66846		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
321	0.088	3750	5.85		101919	77451		0.0194	0.0190		29.2	16.8				25.36	29.11	23.70				0.0156	0.0179	0.0145	0.0480
322	0.090	3750	5.85		103273	78481		0.0194	0.0190		29.2	16.8				25.31	29.03	23.70				0.0157	0.0181	0.0147	0.0485
324	0.076	3750	5.85		87963	66846		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
325	0.076	3750	5.85		87963	66846		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
364	0.095	3750	5.85		109018	82846		0.0192	0.0188		29.2	16.8				25.11	28.71	23.70				0.0165	0.0189	0.0156	0.0509
366	0.078	3750	5.85		89725	68185		0.0198	0.0196		29.2	16.8				25.87	29.90	23.70				0.0140	0.0162	0.0128	0.0429
367	0.078	3750	5.85		89725	68185		0.0198	0.0196		29.2	16.8				25.87	29.90	23.70				0.0140	0.0162	0.0128	0.0429
366	0.078	3750	5.85		89725	68185		0.0198	0.0196		29.2	16.8				25.87	29.90	23.70				0.0140	0.0162	0.0128	0.0429
382	0.078	3750	5.85		89725	68185		0.0198	0.0196		29.2	16.8				25.87	29.90	23.70				0.0140	0.0162	0.0128	0.0429
383	0.084	3750	5.85		96749	73522		0.0196	0.0193		29.2	16.8				25.57	29.43	23.70				0.0149	0.0171	0.0138	0.0459
389	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
403	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
418	0.082	3750	5.85		94928	72138		0.0196	0.0193		29.2	16.8				25.64	29.55	23.70				0.0147	0.0169	0.0136	0.0451
429	0.076	3750	5.85		88147	66986		0.0199	0.0196		29.2	16.8				25.94	30.01	23.70				0.0138	0.0159	0.0126	0.0423
432	0.270	3750	5.85		311036	236366		0.0170	0.0154		29.2	16.8				22.17	23.54	23.70				0.0415	0.0441	0.0444	0.1300
433	0.347	3750	5.85		399903	303899		0.0166	0.0148		29.2	16.8				21.70	22.55	23.70				0.0523	0.0543	0.0571	0.1637
434	0.265	3750	5.85		305183	231918		0.0170	0.0154		29.2	16.8				22.21	23.61	23.70				0.0408	0.0434	0.0436	0.1278
436	0.310	3750	5.85		356903	271221		0.0168	0.0150		29.2	16.8				21.90	22.99	23.70				0.0471	0.0494	0.0509	0.1474
437	0.310	3750	5.85		356903	271221		0.0168	0.0150		29.2	16.8				21.90	22.99	23.70				0.0471	0.0494	0.0509	0.1474
442	0.082	3750	5.85		94792	72036		0.0196	0.0193		29.2	16.8				25.65	29.56	23.70				0.0146	0.0169	0.0135	0.0450
448	0.080	3750	5.85		92018	69927		0.0197	0.0195		29.2	16.8				25.76	29.74	23.70				0.0143	0.0165	0.0131	0.0439
457	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
458	0.084	3750	5.85		96922	73654		0.0196	0.0192		29.2	16.8				25.56	29.42	23.70				0.0149	0.0172	0.0138	0.0459
464	0.097	3750	5.85		112356	85383		0.0191	0.0187		29.2	16.8				25.00	28.54	23.70				0.0169	0.0193	0.0160	0.0523
465	0.098	3750	5.85		113039	85902		0.0191	0.0186		29.2	16.8				24.98	28.50	23.70				0.0170	0.0194	0.0161	0.0525
466	0.091	3750	5.85		105170	79922		0.0193	0.0189		29.2	16.8				25.25	28.93	23.70				0.0160	0.0183	0.0150	0.0493
467	0.082	3750	5.85		94733	71990		0.0196	0.0193		29.2	16.8				25.65	29.56	23.70				0.0146	0.0169	0.0135	0.0450
468	0.079	3750	5.85		91178	69289		0.0198	0.0195		29.2	16.8				25.80	29.80	23.70				0.0142	0.0164	0.0130	0.0435
469	0.076	3750	5.85		87956	66840		0.0199	0.0196		29.2	16.8				25.95	30.02	23.70				0.0137	0.0159	0.0126	0.0422
473	0.076	3750	5.85		87862	66769		0.0199	0.0196		29.2	16.8				25.95	30.03	23.70				0.0137	0.0159	0.0125	0.0422
476	0.083	3750	5.85		95779	72785		0.0196	0.0193		29.2	16.8				25.60	29.49	23.70				0.0148	0.0170	0.0137	0.0455
478	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
468	0.076	3750	5.85		87945	66832		0.0199	0.0196		29.2	16.8				25.95	30.03	23.70				0.0137	0.0159	0.0126	0.0422
493	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
494	0.076	3750	5.85		88087	66940		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0423
496	0.076	3750	5.85		88083	66937		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0423
497	0.077	3750	5.85		88546	67289		0.0199	0.0196		29.2	16.8				25.92	29.98	23.70				0.0138	0.0160	0.0126	0.0425
499	0.091	3750	5.85		105170	79922		0.0193	0.0189		29.2	16.8				25.25	28.93	23.70				0.0160	0.0183	0.0150	0.0493
502	0.077	3750	5.85		88408	67184		0.0199	0.0196		29.2	16.8				25.93	29.99	23.70				0.0138	0.0160	0.0126	0.0424
503	0.077	3750	5.85		88360	67147		0.0199	0.0196		29.2	16.8				25.93	30.00	23.70				0.0138	0.0160	0.0126	0.0424
505	0.076	3750	5.85		88095	66946		0.0199	0.0196		29.2	16.8				25.94	30.01	23.70				0.0138	0.0159	0.0126	0.0423
506	0.076	3750	5.85		88061	66920		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
508	0.077	3750	5.85		88273	67081		0.0199	0.0196		29.2	16.8				25.93	30.00	23.70				0.0138	0.0160	0.0126	0.0423
509	0.076	3750	5.85		88000	66874		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422
519	0.078	3750	5.85		90202	68547		0.0198	0.0195		29.2	16.8				25.84	29.87	23.70				0.0140	0.0162	0.0129	0.0431
520	0.078	3750	5.85		90157	68513		0.0198	0.0195		29.2	16.8				25.85	29.87	23.70				0.0140	0.0162	0.0129	0.0431
521	0.078	3750	5.85		90157	68513		0.0198	0.0195		29.2	16.8				25.85	29.87	23.70				0.0140	0.0162	0.0129	0.0431
522	0.078	3750	5.85		90157	68513		0.0198	0.0195		29.2	16.8				25.85	29.87	23.70				0.0140	0.0162	0.0129	0.0431
529	0.076	3750	5.85		87775	66702		0.0199	0.0196		29.2	16.8				25.96	30.04	23.70				0.0137	0.0159	0.0125	0.0421
533	0.077	3750	5.85		88945	67592		0.0198	0.0196		29.2	16.8				25.90	29.95	23.70				0.0139	0.0160	0.0127	0.0426
534	0.076	3750	5.85		88042	66906		0.0199	0.0196		29.2	16.8				25.94	30.02	23.70				0.0138	0.0159	0.0126	0.0422

546	0.083	3750	5.85		95126	72289		0.0196	0.0193		29.2	16.8				25.63	29.53	23.70				0.0147	0.0169	0.0136	0.0452
547	0.083	3750	5.85		95126	72289		0.0196	0.0193		29.2	16.8				25.63	29.53	23.70				0.0147	0.0169	0.0136	0.0452
548	0.081	3750	5.85		93541	71084		0.0197	0.0194		29.2	16.8				25.70	29.64	23.70				0.0145	0.0167	0.0134	0.0445
549	0.083	3750	5.85		95126	72289		0.0196	0.0193		29.2	16.8				25.63	29.53	23.70				0.0147	0.0169	0.0136	0.0452
550	0.077	3750	5.85		89216	67798		0.0198	0.0196		29.2	16.8				25.89	29.93	23.70				0.0139	0.0161	0.0127	0.0427

MAX ΔP:	0.1637

P-V valve vacuum setting: 0.5 psi
80% of P-V valve setting: 0.4 psi

Maximum pressure drop to shore connection: 0.164 psi

TOTAL PRESSURE DROP TO SHORE CONNECTION: 0.164 psi *OK*

Max. allowable back pressure at facility: 0.236 psi

Pressure Drop through VCS - From #1P Cargo Tank to Shore Connection (per 46 CFR 39.30-1(d)(3) and ABS SBR 5-2-3/7.5.2(c))

Pipe sizes, nominal: 8 in
Pipe ID: 7.981 in
Pipe Flow Area: 50.03 in^2
Vapor Dynamic Viscosity: 0.019 cenitpoise (estimated, based on air @ 115F, Crane 410, Table A-5)

PIPE LENGTH

Length (ft): 231.00 ft 8" pipe
Length (ft): 50.00 ft 6" hose
f, friction factor (pipe): Varies with Reynold's Number (see table below)

VALVE & FITTING EQUIVALENT LENGTH

Equivalent Length (ft): 255.81 ft
f_t, friction factor, turbulent flow (fittings): 0.014 constant, for each pipe size

Shore Connection Pressure Drop (at 100% of Maximum Liquid Discharge Rate) 5000 BBL/hr

Cargo	Vapor-Air Mix. Density	Vapor Flow Rate		Reynold's Number			Friction Factor			Vapor Velocity			Head Loss						Component ΔP						ΔP
					6" Hose	8" Pipe		6" Hose	8" Pipe		6" Hose	8" Pipe				6" Hose	8" Pipe	8" Fittings				6" Hose	8" Pipe	8" Fittings	TOTAL
	(lb/ft^3)	BBL/hr	ft^3/s								ft/s	ft/s				ft	ft	ft				psi	psi	psi	psi
1	0.123	5000	7.80		189288	143846		0.0179	0.0181		38.9	22.4				41.51	49.17	42.13				0.0355	0.0420	0.0360	0.1136
2	0.085	5000	7.80		130646	99282		0.0187	0.0181		38.9	22.4				43.51	49.21	42.13				0.0257	0.0290	0.0249	0.0796
19	0.082	5000	7.80		125331	95242		0.0189	0.0183		38.9	22.4				43.76	49.62	42.13				0.0248	0.0281	0.0239	0.0767
20	0.079	5000	7.80		121455	92297		0.0189	0.0184		38.9	22.4				43.95	49.94	42.13				0.0241	0.0274	0.0231	0.0746
21	0.079	5000	7.80		121455	92297		0.0189	0.0184		38.9	22.4				43.95	49.94	42.13				0.0241	0.0274	0.0231	0.0746
23	0.079	5000	7.80		121455	92297		0.0189	0.0184		38.9	22.4				43.95	49.94	42.13				0.0241	0.0274	0.0231	0.0746
24	0.079	5000	7.80		121455	92297		0.0189	0.0184		38.9	22.4				43.95	49.94	42.13				0.0241	0.0274	0.0231	0.0746
26	0.079	5000	7.80		121455	92297		0.0189	0.0184		38.9	22.4				43.95	49.94	42.13				0.0241	0.0274	0.0231	0.0746
34	0.077	5000	7.80		119005	90436		0.0190	0.0185		38.9	22.4				44.08	50.14	42.13				0.0237	0.0270	0.0226	0.0733
40	0.085	5000	7.80		130039	98820		0.0188	0.0181		38.9	22.4				43.54	49.25	42.13				0.0256	0.0289	0.0247	0.0793
42	0.097	5000	7.80		149548	113646		0.0184	0.0176		38.9	22.4				42.73	47.91	42.13				0.0289	0.0324	0.0285	0.0897
44	0.083	5000	7.80		127438	96844		0.0188	0.0182		38.9	22.4				43.66	49.45	42.13				0.0251	0.0285	0.0243	0.0779
46	0.086	5000	7.80		132062	100358		0.0187	0.0181		38.9	22.4				43.45	49.10	42.13				0.0259	0.0293	0.0251	0.0803
47	0.097	5000	7.80		149403	113536		0.0184	0.0176		38.9	22.4				42.74	47.92	42.13				0.0288	0.0323	0.0284	0.0896
48	0.077	5000	7.80		117741	89475		0.0190	0.0185		38.9	22.4				44.15	50.25	42.13				0.0235	0.0267	0.0224	0.0726
58	0.078	5000	7.80		120002	91193		0.0190	0.0184		38.9	22.4				44.03	50.06	42.13				0.0239	0.0271	0.0228	0.0738
64	0.077	5000	7.80		118080	89733		0.0190	0.0185		38.9	22.4				44.13	50.22	42.13				0.0235	0.0268	0.0225	0.0728
70	0.085	5000	7.80		130906	99479		0.0187	0.0181		38.9	22.4				43.50	49.19	42.13				0.0257	0.0291	0.0249	0.0797
72	0.116	5000	7.80		178811	135884		0.0180	0.0170		38.9	22.4				41.79	46.29	42.13				0.0338	0.0374	0.0340	0.1052
73	0.078	5000	7.80		119688	90955		0.0190	0.0184		38.9	22.4				44.05	50.08	42.13				0.0238	0.0271	0.0228	0.0737
74	0.080	5000	7.80		123445	93810		0.0189	0.0183		38.9	22.4				43.85	49.77	42.13				0.0245	0.0278	0.0235	0.0757
76	0.078	5000	7.80		119910	91123		0.0190	0.0184		38.9	22.4				44.03	50.06	42.13				0.0239	0.0271	0.0228	0.0738
77	0.078	5000	7.80		119749	91001		0.0190	0.0184		38.9	22.4				44.04	50.08	42.13				0.0238	0.0271	0.0228	0.0737
78	0.076	5000	7.80		117322	89156		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
79	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
81	0.078	5000	7.80		120328	91440		0.0190	0.0184		38.9	22.4				44.01	50.03	42.13				0.0239	0.0272	0.0229	0.0740
82	0.076	5000	7.80		117343	89173		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724
83	0.076	5000	7.80		117343	89173		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724
84	0.076	5000	7.80		117343	89173		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724
85	0.076	5000	7.80		117504	89295		0.0190	0.0185		38.9	22.4				44.16	50.27	42.13				0.0234	0.0267	0.0224	0.0725
87	0.078	5000	7.80		119200	90584		0.0190	0.0184		38.9	22.4				44.07	50.12	42.13				0.0237	0.0270	0.0227	0.0734
91	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
92	0.080	5000	7.80		123445	93810		0.0189	0.0183		38.9	22.4				43.85	49.77	42.13				0.0245	0.0278	0.0235	0.0757
93	0.077	5000	7.80		119125	90527		0.0190	0.0184		38.9	22.4				44.07	50.13	42.13				0.0237	0.0270	0.0227	0.0734
94	0.076	5000	7.80		117225	89083		0.0190	0.0185		38.9	22.4				44.18	50.29	42.13				0.0234	0.0266	0.0223	0.0723
95	0.076	5000	7.80		117358	89184		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724
100	0.076	5000	7.80		117556	89334		0.0190	0.0185		38.9	22.4				44.16	50.27	42.13				0.0234	0.0267	0.0224	0.0725
101	0.077	5000	7.80		117713	89454		0.0190	0.0185		38.9	22.4				44.15	50.25	42.13				0.0235	0.0267	0.0224	0.0726
111	0.078	5000	7.80		119614	90899		0.0190	0.0184		38.9	22.4				44.05	50.09	42.13				0.0238	0.0271	0.0228	0.0736
112	0.103	5000	7.80		158363	120345		0.0183	0.0174		38.9	22.4				42.42	47.38	42.13				0.0303	0.0339	0.0301	0.0944
113	0.079	5000	7.80		121541	92363		0.0189	0.0184		38.9	22.4				43.95	49.93	42.13				0.0241	0.0274	0.0231	0.0747
119	0.077	5000	7.80		118030	89694		0.0190	0.0185		38.9	22.4				44.13	50.22	42.13				0.0235	0.0268	0.0225	0.0728
124	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
128	0.077	5000	7.80		118001	89672		0.0190	0.0185		38.9	22.4				44.13	50.23	42.13				0.0235	0.0268	0.0225	0.0728
130	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
131	0.078	5000	7.80		119851	91078		0.0190	0.0184		38.9	22.4				44.04	50.07	42.13				0.0238	0.0271	0.0228	0.0738
132	0.076	5000	7.80		117344	89173		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724
133	0.076	5000	7.80		117384	89203		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724

134	0.076	5000	7.80		117385	89204		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724
136	0.077	5000	7.80		118869	90332		0.0190	0.0185		38.9	22.4				44.09	50.15	42.13				0.0237	0.0269	0.0226	0.0732
139	0.102	5000	7.80		156918	119247		0.0183	0.0175		38.9	22.4				42.47	47.46	42.13				0.0301	0.0336	0.0299	0.0936
140	0.102	5000	7.80		156918	119247		0.0183	0.0175		38.9	22.4				42.47	47.46	42.13				0.0301	0.0336	0.0299	0.0936
145	0.077	5000	7.80		117728	89465		0.0190	0.0185		38.9	22.4				44.15	50.25	42.13				0.0235	0.0267	0.0224	0.0726
146	0.077	5000	7.80		117728	89465		0.0190	0.0185		38.9	22.4				44.15	50.25	42.13				0.0235	0.0267	0.0224	0.0726
147	0.240	5000	7.80		368338	279911		0.0167	0.0150		38.9	22.4				38.84	40.65	42.13				0.0646	0.0676	0.0701	0.2024
155	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
156	0.119	5000	7.80		183363	139343		0.0180	0.0169		38.9	22.4				41.66	46.06	42.13				0.0345	0.0382	0.0349	0.1076
157	0.079	5000	7.80		122062	92758		0.0189	0.0184		38.9	22.4				43.92	49.88	42.13				0.0242	0.0275	0.0232	0.0750
158	0.086	5000	7.80		132206	100468		0.0187	0.0181		38.9	22.4				43.44	49.09	42.13				0.0259	0.0293	0.0252	0.0804
160	0.083	5000	7.80		128131	97371		0.0188	0.0182		38.9	22.4				43.63	49.40	42.13				0.0253	0.0286	0.0244	0.0782
161	0.078	5000	7.80		119218	90597		0.0190	0.0184		38.9	22.4				44.07	50.12	42.13				0.0237	0.0270	0.0227	0.0734
162	0.090	5000	7.80		138709	105409		0.0186	0.0179		38.9	22.4				43.16	48.63	42.13				0.0270	0.0305	0.0264	0.0839
163	0.083	5000	7.80		127401	96816		0.0188	0.0182		38.9	22.4				43.66	49.46	42.13				0.0251	0.0285	0.0242	0.0778
166	0.076	5000	7.80		117120	89003		0.0190	0.0185		38.9	22.4				44.18	50.30	42.13				0.0234	0.0266	0.0223	0.0723
169	0.077	5000	7.80		118666	90178		0.0190	0.0185		38.9	22.4				44.10	50.17	42.13				0.0236	0.0269	0.0226	0.0731
172	0.076	5000	7.80		117324	89158		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
178	0.076	5000	7.80		117307	89145		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
180	0.076	5000	7.80		117307	89145		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
184	0.079	5000	7.80		121221	92120		0.0189	0.0184		38.9	22.4				43.97	49.95	42.13				0.0241	0.0274	0.0231	0.0745
186	0.076	5000	7.80		117538	89321		0.0190	0.0185		38.9	22.4				44.16	50.27	42.13				0.0234	0.0267	0.0224	0.0725
190	0.086	5000	7.80		132206	100468		0.0187	0.0181		38.9	22.4				43.44	49.09	42.13				0.0259	0.0293	0.0252	0.0804
191	0.080	5000	7.80		123406	93780		0.0189	0.0183		38.9	22.4				43.86	49.77	42.13				0.0244	0.0277	0.0235	0.0757
194	0.076	5000	7.80		117430	89239		0.0190	0.0185		38.9	22.4				44.16	50.28	42.13				0.0234	0.0267	0.0223	0.0724
195	0.077	5000	7.80		117900	89596		0.0190	0.0185		38.9	22.4				44.14	50.24	42.13				0.0235	0.0268	0.0224	0.0727
197	0.217	5000	7.80		333800	253665		0.0169	0.0152		38.9	22.4				39.17	41.34	42.13				0.0591	0.0623	0.0635	0.1849
198	0.217	5000	7.80		333800	253665		0.0169	0.0152		38.9	22.4				39.17	41.34	42.13				0.0591	0.0623	0.0635	0.1849
199	0.217	5000	7.80		333800	253665		0.0169	0.0152		38.9	22.4				39.17	41.34	42.13				0.0591	0.0623	0.0635	0.1849
200	0.217	5000	7.80		333800	253665		0.0169	0.0152		38.9	22.4				39.17	41.34	42.13				0.0591	0.0623	0.0635	0.1849
201	0.217	5000	7.80		333800	253665		0.0169	0.0152		38.9	22.4				39.17	41.34	42.13				0.0591	0.0623	0.0635	0.1849
202	0.217	5000	7.80		333800	253665		0.0169	0.0152		38.9	22.4				39.17	41.34	42.13				0.0591	0.0623	0.0635	0.1849
203	0.217	5000	7.80		333800	253665		0.0169	0.0152		38.9	22.4				39.17	41.34	42.13				0.0591	0.0623	0.0635	0.1849
204	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
217	0.105	5000	7.80		161289	122569		0.0182	0.0174		38.9	22.4				42.32	47.21	42.13				0.0308	0.0344	0.0307	0.0959
218	0.105	5000	7.80		161289	122569		0.0182	0.0174		38.9	22.4				42.32	47.21	42.13				0.0308	0.0344	0.0307	0.0959
219	0.076	5000	7.80		117285	89128		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
220	0.077	5000	7.80		117900	89596		0.0190	0.0185		38.9	22.4				44.14	50.24	42.13				0.0235	0.0268	0.0224	0.0727
221	0.077	5000	7.80		117900	89596		0.0190	0.0185		38.9	22.4				44.14	50.24	42.13				0.0235	0.0268	0.0224	0.0727
222	0.109	5000	7.80		167323	127154		0.0182	0.0172		38.9	22.4				42.13	46.88	42.13				0.0318	0.0354	0.0318	0.0991
223	0.108	5000	7.80		165589	125836		0.0182	0.0173		38.9	22.4				42.18	46.97	42.13				0.0316	0.0351	0.0315	0.0982
224	0.078	5000	7.80		120284	91408		0.0190	0.0184		38.9	22.4				44.01	50.03	42.13				0.0239	0.0272	0.0229	0.0740
229	0.142	5000	7.80		218191	165810		0.0176	0.0164		38.9	22.4				40.84	44.59	42.13				0.0403	0.0439	0.0415	0.1257
230	0.142	5000	7.80		218191	165810		0.0176	0.0164		38.9	22.4				40.84	44.59	42.13				0.0403	0.0439	0.0415	0.1257
231	0.076	5000	7.80		117249	89101		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0723
232	0.088	5000	7.80		135241	102774		0.0187	0.0180		38.9	22.4				43.31	48.87	42.13				0.0265	0.0299	0.0257	0.0821
234	0.148	5000	7.80		226861	172399		0.0175	0.0163		38.9	22.4				40.67	44.27	42.13				0.0417	0.0454	0.0432	0.1302
235	0.149	5000	7.80		229607	174485		0.0175	0.0163		38.9	22.4				40.62	44.17	42.13				0.0421	0.0458	0.0437	0.1316
236	0.149	5000	7.80		229607	174485		0.0175	0.0163		38.9	22.4				40.62	44.17	42.13				0.0421	0.0458	0.0437	0.1316
238	0.076	5000	7.80		117040	88942		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
243	0.076	5000	7.80		117304	89143		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
244	0.078	5000	7.80		120573	91627		0.0190	0.0184		38.9	22.4				44.00	50.01	42.13				0.0240	0.0272	0.0229	0.0741
245	0.216	5000	7.80		332247	252484		0.0169	0.0152		38.9	22.4				39.18	41.37	42.13				0.0588	0.0621	0.0632	0.1841
246	0.124	5000	7.80		190734	144944		0.0179	0.0168		38.9	22.4				41.47	45.72	42.13				0.0357	0.0394	0.0363	0.1114
247	0.078	5000	7.80		119200	90584		0.0190	0.0184		38.9	22.4				44.07	50.12	42.13				0.0237	0.0270	0.0227	0.0734
249	0.079	5000	7.80		120826	91819		0.0190	0.0184		38.9	22.4				43.99	49.99	42.13				0.0240	0.0273	0.0230	0.0743
263	0.122	5000	7.80		187554	142528		0.0179	0.0169		38.9	22.4				41.55	45.87	42.13				0.0352	0.0389	0.0357	0.1098
265	0.079	5000	7.80		121823	92577		0.0189	0.0184		38.9	22.4				43.94	49.90	42.13				0.0242	0.0275	0.0232	0.0748
266	0.082	5000	7.80		126499	96130		0.0188	0.0182		38.9	22.4				43.70	49.53	42.13				0.0250	0.0283	0.0241	0.0774
267	0.081	5000	7.80		124862	94887		0.0189	0.0183		38.9	22.4				43.78	49.66	42.13				0.0247	0.0280	0.0238	0.0765
271	0.088	5000	7.80		134555	102252		0.0187	0.0180		38.9	22.4				43.34	48.92	42.13				0.0263	0.0297	0.0256	0.0817
273	0.091	5000	7.80		140066	106441		0.0186	0.0179		38.9	22.4				43.10	48.53	42.13				0.0273	0.0307	0.0267	0.0846
274	0.108	5000	7.80		165805	126000		0.0182	0.0173		38.9	22.4				42.18	46.96	42.13				0.0316	0.0352	0.0316	0.0983
275	0.208	5000	7.80		319254	242611		0.0169	0.0153		38.9	22.4				39.32	41.65	42.13				0.0567	0.0601	0.0608	0.1775
276	0.077	5000	7.80		118723	90222		0.0190	0.0185		38.9	22.4				44.10	50.17	42.13				0.0236	0.0269	0.0226	0.0731
278	0.089	5000	7.80		137391	104407		0.0186	0.0179		38.9	22.4				43.21	48.72	42.13				0.0268	0.0302	0.0261	0.0832
281	0.076	5000	7.80		117315	89151		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
283	0.132	5000	7.80		203523	154663		0.0177	0.0166		38.9	22.4				41.16	45.17	42.13				0.0378	0.0415	0.0387	0.1181
284	0.152	5000	7.80		233588	177511		0.0175	0.0162		38.9	22.4				40.55	44.03	42.13				0.0428	0.0465	0.0445	0.1337

286	0.077	5000	7.80		117640	89398		0.0190	0.0185		38.9	22.4				44.15	50.26	42.13				0.0235	0.0267	0.0224	0.0726
288	0.079	5000	7.80		121802	92561		0.0189	0.0184		38.9	22.4				43.94	49.91	42.13				0.0242	0.0275	0.0232	0.0748
289	0.079	5000	7.80		121578	92390		0.0189	0.0184		38.9	22.4				43.95	49.92	42.13				0.0241	0.0274	0.0231	0.0747
295	0.078	5000	7.80		120645	91682		0.0190	0.0184		38.9	22.4				44.00	50.00	42.13				0.0240	0.0272	0.0230	0.0742
296	0.079	5000	7.80		121802	92561		0.0189	0.0184		38.9	22.4				43.94	49.91	42.13				0.0242	0.0275	0.0232	0.0748
297	0.079	5000	7.80		121563	92379		0.0189	0.0184		38.9	22.4				43.95	49.93	42.13				0.0241	0.0274	0.0231	0.0747
300	0.080	5000	7.80		123666	93977		0.0189	0.0183		38.9	22.4				43.84	49.75	42.13				0.0245	0.0278	0.0235	0.0758
301	0.080	5000	7.80		123666	93977		0.0189	0.0183		38.9	22.4				43.84	49.75	42.13				0.0245	0.0278	0.0235	0.0758
304	0.082	5000	7.80		125378	95279		0.0189	0.0183		38.9	22.4				43.76	49.62	42.13				0.0248	0.0281	0.0239	0.0767
305	0.078	5000	7.80		119923	91133		0.0190	0.0184		38.9	22.4				44.03	50.06	42.13				0.0239	0.0271	0.0228	0.0738
306	0.078	5000	7.80		119923	91133		0.0190	0.0184		38.9	22.4				44.03	50.06	42.13				0.0239	0.0271	0.0228	0.0738
307	0.078	5000	7.80		119923	91133		0.0190	0.0184		38.9	22.4				44.03	50.06	42.13				0.0239	0.0271	0.0228	0.0738
309	0.076	5000	7.80		117510	89299		0.0190	0.0185		38.9	22.4				44.16	50.27	42.13				0.0234	0.0267	0.0224	0.0725
316	0.087	5000	7.80		133586	101516		0.0187	0.0180		38.9	22.4				43.38	48.99	42.13				0.0262	0.0296	0.0254	0.0812
317	0.087	5000	7.80		133586	101516		0.0187	0.0180		38.9	22.4				43.38	48.99	42.13				0.0262	0.0296	0.0254	0.0812
318	0.076	5000	7.80		117322	89156		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
319	0.076	5000	7.80		117284	89128		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
320	0.076	5000	7.80		117284	89128		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
321	0.088	5000	7.80		135891	103268		0.0186	0.0180		38.9	22.4				43.28	48.82	42.13				0.0266	0.0300	0.0259	0.0824
322	0.090	5000	7.80		137698	104641		0.0186	0.0179		38.9	22.4				43.20	48.70	42.13				0.0269	0.0303	0.0262	0.0834
324	0.076	5000	7.80		117284	89128		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
325	0.076	5000	7.80		117284	89128		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
364	0.095	5000	7.80		145357	110461		0.0185	0.0177		38.9	22.4				42.89	48.18	42.13				0.0282	0.0316	0.0277	0.0875
366	0.078	5000	7.80		119634	90913		0.0190	0.0184		38.9	22.4				44.05	50.09	42.13				0.0238	0.0271	0.0228	0.0736
367	0.078	5000	7.80		119634	90913		0.0190	0.0184		38.9	22.4				44.05	50.09	42.13				0.0238	0.0271	0.0228	0.0736
366	0.078	5000	7.80		119634	90913		0.0190	0.0184		38.9	22.4				44.05	50.09	42.13				0.0238	0.0271	0.0228	0.0736
382	0.078	5000	7.80		119634	90913		0.0190	0.0184		38.9	22.4				44.05	50.09	42.13				0.0238	0.0271	0.0228	0.0736
383	0.084	5000	7.80		128998	98030		0.0188	0.0182		38.9	22.4				43.59	49.33	42.13				0.0254	0.0287	0.0246	0.0787
389	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
403	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
418	0.082	5000	7.80		126570	96185		0.0188	0.0182		38.9	22.4				43.70	49.52	42.13				0.0250	0.0283	0.0241	0.0774
429	0.076	5000	7.80		117530	89314		0.0190	0.0185		38.9	22.4				44.16	50.27	42.13				0.0234	0.0267	0.0224	0.0725
432	0.270	5000	7.80		414715	315154		0.0166	0.0147		38.9	22.4				38.47	39.85	42.13				0.0721	0.0747	0.0789	0.2257
433	0.347	5000	7.80		533205	405198		0.0163	0.0141		38.9	22.4				37.78	38.28	42.13				0.0910	0.0922	0.1015	0.2847
434	0.265	5000	7.80		406911	309224		0.0166	0.0147		38.9	22.4				38.53	39.98	42.13				0.0708	0.0735	0.0774	0.2217
436	0.310	5000	7.80		475871	361628		0.0164	0.0143		38.9	22.4				38.08	38.97	42.13				0.0818	0.0838	0.0906	0.2562
437	0.310	5000	7.80		475871	361628		0.0164	0.0143		38.9	22.4				38.08	38.97	42.13				0.0818	0.0838	0.0906	0.2562
442	0.082	5000	7.80		126390	96047		0.0188	0.0182		38.9	22.4				43.71	49.54	42.13				0.0250	0.0283	0.0241	0.0773
448	0.080	5000	7.80		122690	93236		0.0189	0.0183		38.9	22.4				43.89	49.83	42.13				0.0243	0.0276	0.0234	0.0753
457	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
458	0.084	5000	7.80		129229	98205		0.0188	0.0181		38.9	22.4				43.58	49.32	42.13				0.0254	0.0288	0.0246	0.0788
464	0.097	5000	7.80		149808	113843		0.0184	0.0176		38.9	22.4				42.72	47.89	42.13				0.0289	0.0324	0.0285	0.0898
465	0.098	5000	7.80		150718	114535		0.0184	0.0176		38.9	22.4				42.69	47.84	42.13				0.0291	0.0326	0.0287	0.0903
466	0.091	5000	7.80		140227	106563		0.0186	0.0179		38.9	22.4				43.10	48.52	42.13				0.0273	0.0307	0.0267	0.0847
467	0.082	5000	7.80		126310	95987		0.0188	0.0182		38.9	22.4				43.71	49.54	42.13				0.0249	0.0283	0.0240	0.0772
468	0.079	5000	7.80		121570	92385		0.0189	0.0184		38.9	22.4				43.95	49.93	42.13				0.0241	0.0274	0.0231	0.0747
469	0.076	5000	7.80		117275	89121		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
473	0.076	5000	7.80		117150	89026		0.0190	0.0185		38.9	22.4				44.18	50.30	42.13				0.0234	0.0266	0.0223	0.0723
476	0.083	5000	7.80		127705	97047		0.0188	0.0182		38.9	22.4				43.65	49.43	42.13				0.0252	0.0285	0.0243	0.0780
478	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
468	0.076	5000	7.80		117260	89109		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0266	0.0223	0.0724
493	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
494	0.076	5000	7.80		117450	89253		0.0190	0.0185		38.9	22.4				44.16	50.28	42.13				0.0234	0.0267	0.0224	0.0725
496	0.076	5000	7.80		117445	89250		0.0190	0.0185		38.9	22.4				44.16	50.28	42.13				0.0234	0.0267	0.0224	0.0725
497	0.077	5000	7.80		118062	89719		0.0190	0.0185		38.9	22.4				44.13	50.22	42.13				0.0235	0.0268	0.0225	0.0728
499	0.091	5000	7.80		140227	106563		0.0186	0.0179		38.9	22.4				43.10	48.52	42.13				0.0273	0.0307	0.0267	0.0847
502	0.077	5000	7.80		117877	89579		0.0190	0.0185		38.9	22.4				44.14	50.24	42.13				0.0235	0.0268	0.0224	0.0727
503	0.077	5000	7.80		117813	89530		0.0190	0.0185		38.9	22.4				44.14	50.24	42.13				0.0235	0.0267	0.0224	0.0727
505	0.076	5000	7.80		117460	89261		0.0190	0.0185		38.9	22.4				44.16	50.27	42.13				0.0234	0.0267	0.0224	0.0725
506	0.076	5000	7.80		117415	89227		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724
508	0.077	5000	7.80		117697	89442		0.0190	0.0185		38.9	22.4				44.15	50.25	42.13				0.0235	0.0267	0.0224	0.0726
509	0.076	5000	7.80		117334	89166		0.0190	0.0185		38.9	22.4				44.17	50.29	42.13				0.0234	0.0267	0.0223	0.0724
519	0.078	5000	7.80		120270	91397		0.0190	0.0184		38.9	22.4				44.02	50.03	42.13				0.0239	0.0272	0.0229	0.0740
520	0.078	5000	7.80		120209	91350		0.0190	0.0184		38.9	22.4				44.02	50.04	42.13				0.0239	0.0272	0.0229	0.0740
521	0.078	5000	7.80		120209	91350		0.0190	0.0184		38.9	22.4				44.02	50.04	42.13				0.0239	0.0272	0.0229	0.0740
522	0.078	5000	7.80		120209	91350		0.0190	0.0184		38.9	22.4				44.02	50.04	42.13				0.0239	0.0272	0.0229	0.0740
529	0.076	5000	7.80		117033	88937		0.0190	0.0185		38.9	22.4				44.19	50.31	42.13				0.0234	0.0266	0.0223	0.0722
533	0.077	5000	7.80		118593	90123		0.0190	0.0185		38.9	22.4				44.10	50.18	42.13				0.0236	0.0269	0.0226	0.0731
534	0.076	5000	7.80		117390	89208		0.0190	0.0185		38.9	22.4				44.17	50.28	42.13				0.0234	0.0267	0.0223	0.0724

546	0.083	5000	7.80		126835	96386		0.0188	0.0182		38.9	22.4				43.69	49.50	42.13				0.0250	0.0284	0.0241	0.0775
547	0.083	5000	7.80		126835	96386		0.0188	0.0182		38.9	22.4				43.69	49.50	42.13				0.0250	0.0284	0.0241	0.0775
548	0.081	5000	7.80		124721	94779		0.0189	0.0183		38.9	22.4				43.79	49.67	42.13				0.0247	0.0280	0.0237	0.0764
549	0.083	5000	7.80		126835	96386		0.0188	0.0182		38.9	22.4				43.69	49.50	42.13				0.0250	0.0284	0.0241	0.0775
550	0.077	5000	7.80		118955	90397		0.0190	0.0185		38.9	22.4				44.08	50.15	42.13				0.0237	0.0269	0.0226	0.0733

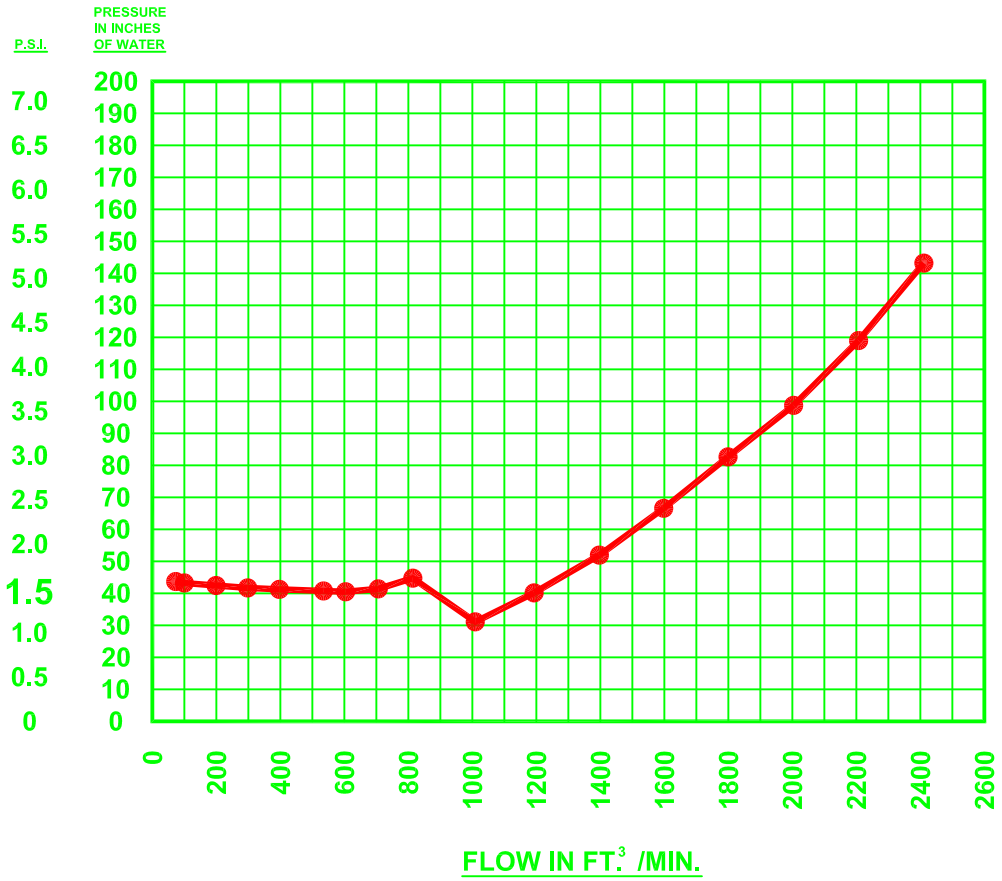
MAX ΔP:	0.2847

P-V valve vacuum setting: 0.5 psi
80% of P-V valve setting: 0.4 psi

Maximum pressure drop to shore connection: 0.285 psi

TOTAL PRESSURE DROP TO SHORE CONNECTION: **0.285 psi** *OK*

Max. allowable back pressure at facility: **0.115 psi**



Barrels Per Hour	Flow FT.^{3} per Min.	Pressure In. of H2O
781	73	43.70
1070	100	43.23
2129	199	42.46
3189	298	41.71
4248	397	41.24
5725	535	40.76
6463	604	40.51
7554	706	41.40
8710	814	44.76
10796	1009	31.09
12765	1193	40.15
14948	1397	51.94
17099	1598	66.58
19249	1799	82.64
21443	2004	98.75
23615	2207	118.99
25798	2411	143.23

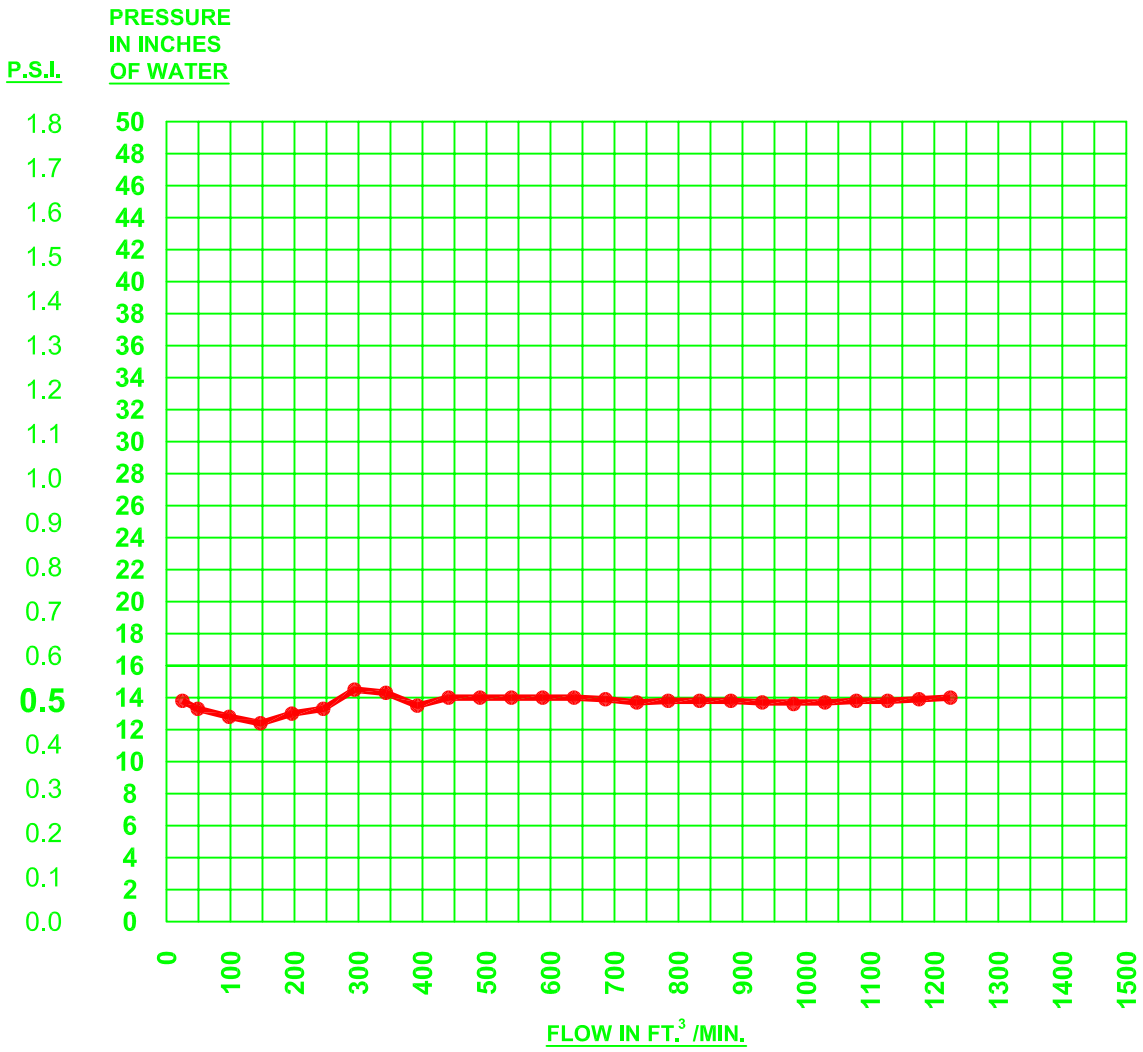
Curve for *PRESSURE* side of 6" PV Valve - *1.5 PSI*

CEESI - Colorado Engineering

data based on air flow

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

DATE 6/30/09	DRAWN D. URBAN	PART NAME Flow Curve 1.5 PSI Pressure	
TOLERANCES .0= +/- .030 .00= +/- .015 .000= +/- .005	APPROVED	UNIT NAME 6" PV Valve MDII	
	SCALE / JOB NO.	DRAWING NO. 180U172B	ITEM NO.



BARRELS PER HOUR	FLOW FT.^{3} / MIN.	PRESSURE IN. OF H_2O
262	25	13.8
524	49	13.3
1048	98	12.8
1571	147	12.4
2095	196	13.0
2619	245	13.3
3143	294	14.5
3667	343	14.3
4190	392	13.5
4714	441	14.0
5238	490	14.0
5762	539	14.0
6286	588	14.0
6810	637	14.0
7333	686	13.9
7857	735	13.7
8381	784	13.8
8905	833	13.8
9429	882	13.8
9953	931	13.7
11001	980	13.6
11525	1029	13.7
12049	1078	13.8
12573	1127	13.8
13097	1176	13.9
13621	1225	14.0

CURVE FOR VACUUM SIDE OF 6" PV VALVE - 0.5 PSI

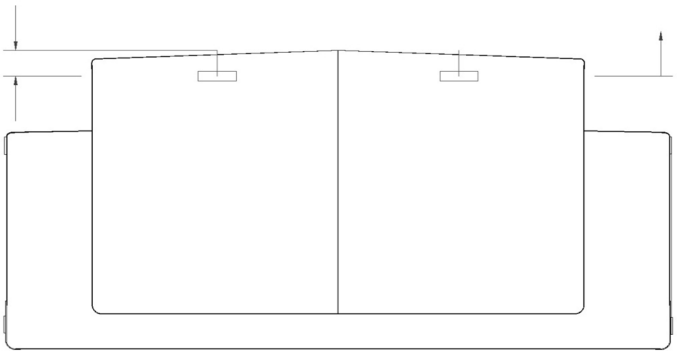
DATA BASED ON AIR FLOW

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

DATE 3/21/01	DRAWN D. URBAN		PART NAME Flow Curve 0.5 PSI Vacuum
TOLERANCES .0= +/- .030 .00= +/- .015 .000= +/- .005	APPROVED		UNIT NAME Marine 6" PV (MD II)
	SCALE	JOB NO.	DRAWING NO. 080M077B / ITEM NO.

High Level and Overfill Alarm Calculations

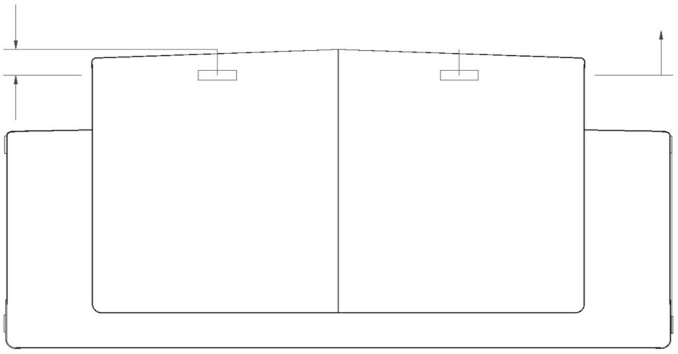
Recommended High Level Set Point = 20.625 inches (below top of tank at Centerline) (95% tank level)



Volume Above High Level Set Point = 836 ft^3

Maximum Cargo Loading Rate (per Tank) =	2500	BBL/hr	
=	234.0	ft^3/min	
Camber Height =	0.50	ft	
Trunk Width =	23.50	ft	
Trunk Length =	53.33	ft	Tank #3 P/S
the Least High Level Set Point =	0.917	ft	
=	11.00	in	rounded-up
Total Tank Volume =	16607	ft^3	
Actual Volume Above High Level Indicator Set Point =	836	ft^3	
Percentage of Tank Vol Above High Level Set Point =	5%		
Percentage of Tank Vol Below High Level Set Point =	95%		

Recommended Overfill Alarm Level
Set Point = 3.75 inches
(Below top of tank at Centerline)
(98% tank level)



Volume Above Overfill
Level Set Point =
235 ft^3

Maximum Cargo Loading Rate (per Tank) =	2500	BBL/hr	
=	234.0	ft^3/min	
Camber Height =	0.50	ft	
Trunk Width =	23.50	ft	
Trunk Length =	53.33	ft	Tank #3 P/S
the Least High Level Set Point =	0.435	ft	
=	5.25	in	rounded-up
Minimum Allowable Time From Alarm to Overflow =	1.00	min	
Actual Time From Alarm to Overflow =	1.00	min	
Total Tank Volume =	16607	ft^3	
Actual Volume Above High Level Indicator Set Point =	235	ft^3	
Percentage of Tank Vol Above High Level Set Point =	1%		
Percentage of Tank Vol Below High Level Set Point =	99%		