คณะวิศวกรรมศาสตร์

มหาวิทยาลัยสงขลานครินทร์

การสอบกลางภาค ประจำภาคการศึกษาที่ 1 ประจำปีการศึกษา 2547

วันที่ 31 กรกฎาคม 2547 เวลา 13.30-16.00 น.

วิชา 216-433 Refrigeration and Air-conditioning ห้อง R 300

คำสั่ง

1. ข้อสอบมีทั้งหมด 4 ข้อ ให้ทำทุกข้อ
2. ไม่อนุญาตให้นำโน้ต ตำรา หรือเอกสารใด ๆ เข้าห้องสอบ
3. ให้ทำข้อสอบในสมุดคำตอบที่จัดไว้ให้เท่านั้น และให้ระบุข้อไว้ให้ชัดเจนด้วย
4. อนุญาตให้นำเครื่องคิดเลขเข้าห้องสอบได้

รศ.กำพล ประทีปชัยกูร

ผู้ออกข้อสอบ

1) ให้อธิบายความหมายของหลักการหรือกระบวนงานการทำความเย็นต่อไปนี้ให้ได้ใจความ

ก) การเปลี่ยนเฟส

ข) การเพิ่มอุณหภูมิของ coolant

ค) การทำความเย็นโดยกระบวนการทางไฟฟ้า

1.2) วัฏจักรทำความเย็นสามารถแยกได้เป็นกี่ประเภท อะไรบ้าง

1.3) ให้เขียนไดอะแกรมของวัฏจักรทำความเย็นแบบดูดกลืน พร้อมอธิบายการทำงาน

1.4) เขียนไดอะแกรมของระบบทำความเย็นแบบเจ็ทไอน้ำ พร้อมอธิบายการทำงาน

(20 marks)

2) Refrigerant 12 is used as the refrigerant in an ideal vapor compression cycle with saturation conditions conditions existing before throttling and compression. Evaporation occurs at 30°F and condensation at 95°F. Determine

a) evaporator and condenser pressure and pressure ratio

b) temperature after compression

c) percent flash gas from expansion valve

d) enthalpies at process end states

e) lbs/ton-min of refrigerants circulated

f) theoretical piston displacement in ft^3/ton-min

g) work in Btu/lb

h) COP and cycle efficiency

(25 marks)

3) For a refrigeration cycle using R-12 as a refrigerant and operates at 86°F condensing temperature, 25°F evaporating temperature

a) If the liquid line from the condenser attaches to the suction line from the evaporator in order to be used as a heat exchanger and causing the refrigerant from the condenser sub cooled to 6°F. How many degrees that the refrigerant from the evaporator be superheated.

b) Compare the COP of the systems with and without heat exchanger if both systems operate on the same temperatures.

Draw the diagram of the cycle.

(25 marks)

4) For the refrigeration system using R-12, the refrigerating effect is 20 tons at 0°F evaporating temperature, and 70°F condensing temperature, and 4% clearance in compressor.

a) if the condensing temperature increases to 100°F and the other conditions are at the same conditions, calculate the refrigerating effect of this system.

b) if this system operates at 100°F condensing temperature, what is the evaporating temperature in order to give zero evaporating effect.

Give n = 1.13

$$\eta_{th} = 1 + C - C\left(\frac{P_d}{P_s}\right)^{\frac{1}{n}}$$

(25 marks)

TABLE B-3

Thermodynamic properties of Freon-12
(properties of saturated liquid and saturated vapor)

TEMP.	PRESSURE		VOLUME cu ft/lb		DENSITY lb/cu ft		ENTHALPY Btu/lb			ENTROPY Btu/(lb)(° R)		TEMP.
°F	PSIA	PSIG	LIQUID v_f	VAPOR v_g	LIQUID $1/v_f$	VAPOR $1/v_g$	LIQUID h_f	LATENT h_{fg}	VAPOR h_g	LIQUID s_f	VAPOR s_g	°F
−40	9.3076	10.9709*	0.010564	3.8750	94.661	0.25806	0	72.913	72.913	0	0.17373	−40
−39	9.5530	10.4712*	0.010575	3.7823	94.565	0.26439	0.2107	72.812	73.023	0.000500	0.17357	−39
−38	9.8035	9.9611*	0.010586	3.6922	94.469	0.27084	0.4215	72.712	73.134	0.001000	0.17343	−38
−37	10.059	9.441*	0.010596	3.6047	94.372	0.27741	0.6324	72.611	73.243	0.001498	0.17328	−37
−36	10.320	8.909*	0.010607	3.5198	94.275	0.28411	0.8434	72.511	73.354	0.001995	0.17313	−36
−35	10.586	8.367*	0.010618	3.4373	94.178	0.29093	1.0546	72.409	73.464	0.002492	0.17299	−35
−34	10.858	7.814*	0.010629	3.3571	94.081	0.29788	1.2659	72.309	73.575	0.002988	0.17285	−34
−33	11.135	7.250*	0.010640	3.2792	93.983	0.30495	1.4772	72.208	73.685	0.003482	0.17271	−33
−32	11.417	6.675*	0.010651	3.2035	93.886	0.31216	1.6887	72.106	73.795	0.003976	0.17257	−32
−31	11.706	6.088*	0.010662	3.1300	93.788	0.31949	1.9003	72.004	73.904	0.004469	0.17243	−31
−30	11.999	5.490*	0.010674	3.0585	93.690	0.32696	2.1120	71.903	74.015	0.004961	0.17229	−30
−29	12.299	4.880*	0.010685	2.9890	93.592	0.33457	2.3239	71.801	74.125	0.005452	0.17216	−29
−28	12.604	4.259*	0.010696	2.9214	93.493	0.34231	2.5358	71.698	74.234	0.005942	0.17203	−28
−27	12.916	3.625*	0.010707	2.8556	93.395	0.35018	2.7479	71.596	74.344	0.006431	0.17189	−27
−26	13.233	2.979*	0.010719	2.7917	93.296	0.35820	2.9601	71.494	74.454	0.006919	0.17177	−26
−25	13.556	2.320*	0.010730	2.7295	93.197	0.36636	3.1724	71.391	74.563	0.007407	0.17164	−25
−24	13.886	1.649*	0.010741	2.6691	93.098	0.37466	3.3848	71.288	74.673	0.007894	0.17151	−24
−23	14.222	0.966*	0.010753	2.6102	92.999	0.38311	3.5973	71.185	74.782	0.008379	0.17139	−23
−22	14.564	0.270*	0.010764	2.5529	92.899	0.39171	3.8100	71.081	74.891	0.008864	0.17126	−22
−21	14.912	0.216	0.010776	2.4972	92.799	0.40045	4.0228	70.978	75.001	0.009348	0.17114	−21
−20	15.267	0.571	0.010788	2.4429	92.699	0.40934	4.2357	70.874	75.110	0.009831	0.17102	−20
−19	15.628	0.932	0.010799	2.3901	92.599	0.41839	4.4487	70.770	75.219	0.010314	0.17090	−19
−18	15.996	1.300	0.010811	2.3387	92.499	0.42758	4.6618	70.666	75.328	0.010795	0.17078	−18
−17	16.371	1.675	0.010823	2.2886	92.399	0.43694	4.8751	70.561	75.436	0.011276	0.17066	−17
−16	16.753	2.057	0.010834	2.2399	92.298	0.44645	5.0885	70.456	75.545	0.011755	0.17055	−16
−15	17.141	2.445	0.010846	2.1924	92.197	0.45612	5.3020	70.352	75.654	0.012234	0.17043	−15
−14	17.536	2.840	0.010858	2.1461	92.096	0.46595	5.5157	70.246	75.762	0.012712	0.17032	−14
−13	17.939	3.243	0.010870	2.1011	91.995	0.47595	5.7295	70.141	75.871	0.013190	0.17021	−13
−12	18.348	3.652	0.010882	2.0572	91.893	0.48611	5.9434	70.036	75.979	0.013666	0.17010	−12
−11	18.765	4.069	0.010894	2.0144	91.791	0.49643	6.1574	69.930	76.087	0.014142	0.16999	−11
−10	19.189	4.493	0.010906	1.9727	91.689	0.50693	6.3716	69.824	76.196	0.014617	0.16989	−10
− 9	19.621	4.925	0.010919	1.9320	91.587	0.51759	6.5859	69.718	76.304	0.015091	0.16978	− 9
− 8	20.059	5.363	0.010931	1.8924	91.485	0.52843	6.8003	69.611	76.411	0.015564	0.16967	− 8
− 7	20.506	5.810	0.010943	1.8538	91.382	0.53944	7.0149	69.505	76.520	0.016037	0.16957	− 7
− 6	20.960	6.264	0.010955	1.8161	91.280	0.55063	7.2296	69.397	76.627	0.016508	0.16947	− 6
− 5	21.422	6.726	0.010968	1.7794	91.177	0.56199	7.4444	69.291	76.735	0.016979	0.16937	− 5
− 4	21.891	7.195	0.010980	1.7436	91.074	0.57354	7.6594	69.183	76.842	0.017449	0.16927	− 4
− 3	22.369	7.673	0.010993	1.7086	90.970	0.58526	7.8745	69.075	76.950	0.017919	0.16917	− 3
− 2	22.854	8.158	0.011005	1.6745	90.867	0.59718	8.0898	68.967	77.057	0.018388	0.16907	− 2
− 1	23.348	8.652	0.011018	1.6413	90.763	0.60927	8.3052	68.859	77.164	0.018855	0.16897	− 1
0	23.849	9.153	0.011030	1.6089	90.659	0.62156	8.5207	68.750	77.271	0.019323	0.16888	0
1	24.359	9.663	0.011043	1.5772	90.554	0.63404	8.7364	68.642	77.378	0.019789	0.16878	1
2	24.878	10.182	0.011056	1.5463	90.450	0.64670	8.9522	68.533	77.485	0.020255	0.16869	2
3	25.404	10.708	0.011069	1.5161	90.345	0.65957	9.1682	68.424	77.592	0.020719	0.16860	3
4	25.939	11.243	0.011082	1.4867	90.240	0.67263	9.3843	68.314	77.698	0.021184	0.16851	4
5	26.483	11.787	0.011094	1.4580	90.135	0.68588	9.6005	68.204	77.805	0.021647	0.16842	5
6	27.036	12.340	0.011107	1.4299	90.030	0.69934	9.8169	68.094	77.911	0.022110	0.16833	6
7	27.597	12.901	0.011121	1.4025	89.924	0.71300	10.033	67.984	78.017	0.022572	0.16824	7
8	28.167	13.471	0.011134	1.3758	89.818	0.72687	10.250	67.873	78.123	0.023033	0.16815	8
9	28.747	14.051	0.011147	1.3496	89.712	0.74094	10.467	67.762	78.229	0.023494	0.16807	9
10	29.335	14.639	0.011160	1.3241	89.606	0.75523	10.684	67.651	78.335	0.023954	0.16798	10
11	29.932	15.236	0.011173	1.2992	89.499	0.76972	10.901	67.539	78.440	0.024413	0.16790	11
12	30.539	15.843	0.011187	1.2748	89.392	0.78443	11.118	67.428	78.546	0.024871	0.16782	12
13	31.155	16.459	0.011200	1.2510	89.285	0.79935	11.336	67.315	78.651	0.025329	0.16774	13
14	31.780	17.084	0.011214	1.2278	89.178	0.81449	11.554	67.203	78.757	0.025786	0.16765	14
15	32.415	17.719	0.011227	1.2050	89.070	0.82986	11.771	67.090	78.861	0.026243	0.16758	15

* Inches of mercury below one atmosphere

TABLE B-3 (Continued)

TEMP.	PRESSURE		VOLUME cu ft/lb		DENSITY lb/cu ft		ENTHALPY Btu/lb			ENTROPY Btu/(lb)(° R)		TEMP.
°F	PSIA	PSIG	LIQUID v_f	VAPOR v_g	LIQUID $1/v_f$	VAPOR $1/v_g$	LIQUID h_f	LATENT h_{fg}	VAPOR h_g	LIQUID s_f	VAPOR s_g	°F
15	32.415	17.719	0.011227	1.2050	89.070	0.82986	11.771	67.090	78.861	0.026243	0.16758	15
16	33.060	18.364	0.011241	1.1828	88.962	0.84544	11.989	66.977	78.966	0.026699	0.16750	16
17	33.714	19.018	0.011254	1.1611	88.854	0.86125	12.207	66.864	79.071	0.027154	0.16742	17
18	34.378	19.682	0.011268	1.1399	88.746	0.87729	12.426	66.750	79.176	0.027608	0.16734	18
19	35.052	20.356	0.011282	1.1191	88.637	0.89356	12.644	66.636	79.280	0.028062	0.16727	19
20	35.736	21.040	0.011296	1.0988	88.529	0.91006	12.863	66.522	79.385	0.028515	0.16719	20
21	36.430	21.734	0.011310	1.0790	88.419	0.92679	13.081	66.407	79.488	0.028968	0.16712	21
22	37.135	22.439	0.011324	1.0596	88.310	0.94377	13.300	66.293	79.593	0.029420	0.16704	22
23	37.849	23.153	0.011338	1.0406	88.201	0.96098	13.520	66.177	79.697	0.029871	0.16697	23
24	38.574	23.878	0.011352	1.0220	88.091	0.97843	13.739	66.061	79.800	0.030322	0.16690	24
25	39.310	24.614	0.011366	1.0039	87.981	0.99613	13.958	65.946	79.904	0.030772	0.16683	25
26	40.056	25.360	0.011380	0.98612	87.870	1.0141	14.178	65.829	80.007	0.031221	0.16676	26
27	40.813	26.117	0.011395	0.96874	87.760	1.0323	14.398	65.713	80.111	0.031670	0.16669	27
28	41.580	26.884	0.011409	0.95173	87.649	1.0507	14.618	65.596	80.214	0.032118	0.16662	28
29	42.359	27.663	0.011424	0.93509	87.537	1.0694	14.838	65.478	80.316	0.032566	0.16655	29
30	43.148	28.452	0.011438	0.91880	87.426	1.0884	15.058	65.361	80.419	0.033013	0.16648	30
31	43.948	29.252	0.011453	0.90286	87.314	1.1076	15.279	65.243	80.522	0.033460	0.16642	31
32	44.760	30.064	0.011468	0.88725	87.202	1.1271	15.500	65.124	80.624	0.033905	0.16635	32
33	45.583	30.887	0.011482	0.87197	87.090	1.1468	15.720	65.006	80.726	0.034351	0.16629	33
34	46.417	31.721	0.011497	0.85702	86.977	1.1668	15.942	64.886	80.828	0.034796	0.16622	34
35	47.263	32.567	0.011512	0.84237	86.865	1.1871	16.163	64.767	80.930	0.035240	0.16616	35
36	48.120	33.424	0.011527	0.82803	86.751	1.2077	16.384	64.647	81.031	0.035683	0.16610	36
37	48.989	34.293	0.011542	0.81399	86.638	1.2285	16.606	64.527	81.133	0.036126	0.16604	37
38	49.870	35.174	0.011557	0.80023	86.524	1.2496	16.828	64.406	81.234	0.036569	0.16598	38
39	50.763	36.067	0.011573	0.78676	86.410	1.2710	17.050	64.285	81.335	0.037011	0.16592	39
40	51.667	36.971	0.011588	0.77357	86.296	1.2927	17.273	64.163	81.436	0.037453	0.16586	40
41	52.584	37.888	0.011603	0.76064	86.181	1.3147	17.495	64.042	81.537	0.037893	0.16580	41
42	53.513	38.817	0.011619	0.74798	86.066	1.3369	17.718	63.919	81.637	0.038334	0.16574	42
43	54.454	39.758	0.011635	0.73557	85.951	1.3595	17.941	63.796	81.737	0.038774	0.16568	43
44	55.407	40.711	0.011650	0.72341	85.836	1.3823	18.164	63.673	81.837	0.039213	0.16562	44
45	56.373	41.677	0.011666	0.71149	85.720	1.4055	18.387	63.550	81.937	0.039652	0.16557	45
46	57.352	42.656	0.011682	0.69982	85.604	1.4289	18.611	63.426	82.037	0.040091	0.16551	46
47	58.343	43.647	0.011698	0.68837	85.487	1.4527	18.835	63.301	82.136	0.040529	0.16546	47
48	59.347	44.651	0.011714	0.67715	85.371	1.4768	19.059	63.177	82.236	0.040966	0.16540	48
49	60.364	45.668	0.011730	0.66616	85.254	1.5012	19.283	63.051	82.334	0.041403	0.16535	49
50	61.394	46.698	0.011746	0.65537	85.136	1.5258	19.507	62.926	82.433	0.041839	0.16530	50
51	62.437	47.741	0.011762	0.64480	85.018	1.5509	19.732	62.800	82.532	0.042276	0.16524	51
52	63.494	48.798	0.011779	0.63444	84.900	1.5762	19.957	62.673	82.630	0.042711	0.16519	52
53	64.563	49.867	0.011795	0.62428	84.782	1.6019	20.182	62.546	82.728	0.043146	0.16514	53
54	65.646	50.950	0.011811	0.61431	84.663	1.6278	20.408	62.418	82.826	0.043581	0.16509	54
55	66.743	52.047	0.011828	0.60453	84.544	1.6542	20.634	62.290	82.924	0.044015	0.16504	55
56	67.853	53.157	0.011845	0.59495	84.425	1.6808	20.859	62.162	83.021	0.044449	0.16499	56
57	68.977	54.281	0.011862	0.58554	84.305	1.7078	21.086	62.033	83.119	0.044883	0.16494	57
58	70.115	55.419	0.011879	0.57632	84.185	1.7352	21.312	61.903	83.215	0.045316	0.16489	58
59	71.267	56.571	0.011896	0.56727	84.065	1.7628	21.539	61.773	83.312	0.045748	0.16484	59
60	72.433	57.737	0.011913	0.55839	83.944	1.7909	21.766	61.643	83.409	0.046180	0.16479	60
61	73.613	58.917	0.011930	0.54967	83.823	1.8193	21.993	61.512	83.505	0.046612	0.16474	61
62	74.807	60.111	0.011947	0.54112	83.701	1.8480	22.221	61.380	83.601	0.047044	0.16470	62
63	76.016	61.320	0.011965	0.53273	83.580	1.8771	22.448	61.248	83.696	0.047475	0.16465	63
64	77.239	62.543	0.011982	0.52450	83.457	1.9066	22.676	61.116	83.792	0.047905	0.16460	64
65	78.477	63.781	0.012000	0.51642	83.335	1.9364	22.905	60.982	83.887	0.048336	0.16456	65
66	79.729	65.033	0.012017	0.50848	83.212	1.9666	23.133	60.849	83.982	0.048765	0.16451	66
67	80.996	66.300	0.012035	0.50070	83.089	1.9972	23.362	60.715	84.077	0.049195	0.16447	67
68	82.279	67.583	0.012053	0.49305	82.965	2.0282	23.591	60.580	84.171	0.049624	0.16442	68
69	83.576	68.880	0.012071	0.48555	82.841	2.0595	23.821	60.445	84.266	0.050053	0.16438	69
70	84.888	70.192	0.012089	0.47818	82.717	2.0913	24.050	60.309	84.359	0.050482	0.16434	70

TABLE B-3 (Continued)

TEMP.	PRESSURE		VOLUME cu ft/lb		DENSITY lb/cu ft		ENTHALPY Btu/lb			ENTROPY Btu/(lb)(°R)		TEMP.
°F	PSIA	PSIG	LIQUID v_f	VAPOR v_g	LIQUID $1/v_f$	VAPOR $1/v_g$	LIQUID h_f	LATENT h_{fg}	VAPOR h_g	LIQUID s_f	VAPOR s_g	°F
70	84.888	70.192	0.012089	0.47818	82.717	2.0913	24.050	60.309	84.359	0.050482	0.16434	70
71	86.216	71.520	0.012108	0.47094	82.592	2.1234	24.281	60.172	84.453	0.050910	0.16429	71
72	87.559	72.863	0.012126	0.46383	82.467	2.1559	24.511	60.035	84.546	0.051338	0.16425	72
73	88.918	74.222	0.012145	0.45686	82.341	2.1889	24.741	59.898	84.639	0.051766	0.16421	73
74	90.292	75.596	0.012163	0.45000	82.215	2.2222	24.973	59.759	84.732	0.052193	0.16417	74
75	91.682	76.986	0.012182	0.44327	82.089	2.2560	25.204	59.621	84.825	0.052620	0.16412	75
76	93.087	78.391	0.012201	0.43666	81.962	2.2901	25.435	59.481	84.916	0.053047	0.16408	76
77	94.509	79.813	0.012220	0.43016	81.835	2.3247	25.667	59.341	85.008	0.053473	0.16404	77
78	95.946	81.250	0.012239	0.42378	81.707	2.3597	25.899	59.201	85.100	0.053900	0.16400	78
79	97.400	82.704	0.012258	0.41751	81.579	2.3951	26.132	59.059	85.191	0.054326	0.16396	79
80	98.870	84.174	0.012277	0.41135	81.450	2.4310	26.365	58.917	85.282	0.054751	0.16392	80
81	100.36	85.66	0.012297	0.40530	81.322	2.4673	26.598	58.775	85.373	0.055177	0.16388	81
82	101.86	87.16	0.012316	0.39935	81.192	2.5041	26.832	58.631	85.463	0.055602	0.16384	82
83	103.38	88.68	0.012336	0.39351	81.063	2.5413	27.065	58.488	85.553	0.056027	0.16380	83
84	104.92	90.22	0.012356	0.38776	80.932	2.5789	27.300	58.343	85.643	0.056452	0.16376	84
85	106.47	91.77	0.012376	0.38212	80.802	2.6170	27.534	58.198	85.732	0.056877	0.16372	85
86	108.04	93.34	0.012396	0.37657	80.671	2.6556	27.769	58.052	85.821	0.057301	0.16368	86
87	109.63	94.93	0.012416	0.37111	80.539	2.6946	28.005	57.905	85.910	0.057725	0.16364	87
88	111.23	96.53	0.012437	0.36575	80.407	2.7341	28.241	57.757	85.998	0.058149	0.16360	88
89	112.85	98.15	0.012457	0.36047	80.275	2.7741	28.477	57.609	86.086	0.058573	0.16357	89
90	114.49	99.79	0.012478	0.35529	80.142	2.8146	28.713	57.461	86.174	0.058997	0.16353	90
91	116.15	101.45	0.012499	0.35019	80.008	2.8556	28.950	57.311	86.261	0.059420	0.16349	91
92	117.82	103.12	0.012520	0.3451\	79.874	2.8970	29.187	57.161	86.348	0.059844	0.16345	92
93	119.51	104.81	0.012541	0.34025	79.740	2.9390	29.425	57.009	86.434	0.060267	0.16341	93
94	121.22	106.52	0.012562	0.33540	79.605	2.9815	29.663	56.858	86.521	0.060690	0.16338	94
95	122.95	108.25	0.012583	0.33063	79.470	3.0245	29.901	56.705	86.606	0.061113	0.16334	95
96	124.70	110.00	0.012605	0.32594	79.334	3.0680	30.140	56.551	86.691	0.061536	0.16330	96
97	126.46	111.76	0.012627	0.32133	79.198	3.1120	30.380	56.397	86.777	0.061959	0.16326	97
98	128.24	113.54	0.012649	0.31679	79.061	3.1566	30.619	56.242	86.861	0.062381	0.16323	98
99	130.04	115.34	0.012671	0.31233	78.923	3.2017	30.859	56.086	86.945	0.062804	0.16319	99
100	131.86	117.16	0.012693	0.30794	78.785	3.2474	31.100	55.929	87.029	0.063227	0.16315	100
101	133.70	119.00	0.012715	0.30362	78.647	3.2936	31.341	55.772	87.113	0.063649	0.16312	101
102	135.56	120.86	0.012738	0.29937	78.508	3.3404	31.583	55.613	87.196	0.064072	0.16308	102
103	137.44	122.74	0.012760	0.29518	78.368	3.3877	31.824	55.454	87.278	0.064494	0.16304	103
104	139.33	124.63	0.012783	0.29106	78.228	3.4357	32.067	55.293	87.360	0.064916	0.16301	104
105	141.25	126.55	0.012806	0.28701	78.088	3.4842	32.310	55.132	87.442	0.065339	0.16297	105
106	143.18	128.48	0.012829	0.28303	77.946	3.5333	32.553	54.970	87.523	0.065761	0.16293	106
107	145.13	130.43	0.012853	0.27910	77.804	3.5829	32.797	54.807	87.604	0.066184	0.16290	107
108	147.11	132.41	0.012876	0.27524	77.662	3.6332	33.041	54.643	87.684	0.066606	0.16286	108
109	149.10	134.40	0.012900	0.27143	77.519	3.6841	33.286	54.478	87.764	0.067028	0.16282	109
110	151.11	136.41	0.012924	0.26769	77.376	3.7357	33.531	54.313	87.844	0.067451	0.16279	110
111	153.14	138.44	0.012948	0.26400	77.231	3.7878	33.777	54.146	87.923	0.067873	0.16275	111
112	155.19	140.49	0.012972	0.26037	77.087	3.8406	34.023	53.978	88.001	0.068296	0.16271	112
113	157.27	142.57	0.012997	0.25680	76.941	3.8941	34.270	53.809	88.079	0.068719	0.16268	113
114	159.36	144.66	0.013022	0.25328	76.795	3.9482	34.517	53.639	88.156	0.069141	0.16264	114
115	161.47	146.77	0.013047	0.24982	76.649	4.0029	34.765	53.468	88.233	0.069564	0.16260	115
116	163.61	148.91	0.013072	0.24641	76.501	4.0584	35.014	53.296	88.310	0.069987	0.16256	116
117	165.76	151.06	0.013097	0.24304	76.353	4.1145	35.263	53.123	88.386	0.070410	0.16253	117
118	167.94	153.24	0.013123	0.23974	76.205	4.1713	35.512	52.949	88.461	0.070833	0.16249	118
119	170.13	155.43	0.013148	0.23647	76.056	4.2288	35.762	52.774	88.536	0.071257	0.16245	119
120	172.35	157.65	0.013174	0.23326	75.906	4.2870	36.013	52.597	88.610	0.071680	0.16241	120
121	174.59	159.89	0.013200	0.23010	75.755	4.3459	36.264	52.420	88.684	0.072104	0.16237	121
122	176.85	162.15	0.013227	0.22698	75.604	4.4056	36.516	52.241	88.757	0.072528	0.16234	122
123	179.13	164.43	0.013254	0.22391	75.452	4.4660	36.768	52.062	88.830	0.072952	0.16230	123
124	181.43	166.73	0.013280	0.22089	75.299	4.5272	37.021	51.881	88.902	0.073376	0.16226	124
125	183.76	169.06	0.013308	0.21791	75.145	4.5891	37.275	51.698	88.973	0.073800	0.16222	125

TABLE B-4

Thermodynamic properties of Freon-12
(properties of superheated vapor)

Temp. F	Abs. Pressure 0.14 lb/in.² Gage Pressure 29.64 in. vac. (Sat. Temp. −151.7 F)			Abs. Pressure 0.20 lb/in.² Gage Pressure 29.51 in. vac. (Sat. Temp. −144.9 F)			Abs. Pressure 0.40 lb/in.² Gage Pressure 29.11 in. vac. (Sat. Temp. −130.7 F)			Abs. Pressure 0.60 lb/in.² Gage Pressure 28.70 in. vac. (Sat. Temp. −121.6 F)		
t	v	h	s	v	h	s	v	h	s	v	h	s
Sat.	*(194.91)*	*(60.656)*	*(0.20804)*	*(39.38)*	*(61.378)*	*(0.20449)*	*(78.766)*	*(62.897)*	*(0.19788)*	*(49.788)*	*(63.881)*	*(0.19419)*
−150	196.01	60.840	0.20864	.....	.....	.....	.....	.....	.....	.....	.....	.....
−140	202.37	61.916	.21205	141.58	61.906	0.20617	.....	.....	.....	.....	.....	.....
−130	208.73	63.012	.21543	146.04	63.002	.20955	72.903	62.970	0.19810	.....	.....	.....
−120	215.09	64.127	.21876	150.50	64.118	.21288	75.139	64.088	.20144	50.020	64.058	0.19472
−110	221.44	65.261	.22205	154.95	65.253	.21618	77.374	65.225	.20474	51.515	65.197	.19802
−100	227.80	66.414	0.22530	159.40	66.406	0.21943	79.607	66.381	0.20799	53.009	66.355	0.20128
− 90	234.15	67.585	.22851	163.85	67.578	.22264	81.839	67.554	.21121	54.502	67.530	.20451
− 80	240.50	68.774	.23169	168.30	68.768	.22582	84.070	68.746	.21439	55.993	68.723	.20769
− 70	246.85	69.981	.23482	172.75	69.975	.22896	86.299	69.954	.21753	57.483	69.934	.21084
− 60	253.20	71.206	.23793	177.19	71.200	.23206	88.527	71.181	.22064	58.972	71.161	.21395
− 50	259.54	72.447	0.24099	181.64	72.442	0.23513	90.755	72.424	0.22371	60.460	72.406	0.21702
− 40	265.89	73.706	.24403	186.09	73.701	.23816	92.982	73.684	.22675	61.947	73.667	.22006
− 30	272.23	74.980	.24703	190.53	74.976	.24117	95.207	74.960	.22976	63.433	74.944	.22307
− 20	278.58	76.271	.25000	194.97	76.267	.24414	97.433	76.252	.23273	64.919	76.238	.22605
− 10	284.92	77.578	.25294	199.42	77.574	.24708	99.657	77.560	.23567	66.404	77.546	.22899
0	291.27	78.901	0.25585	203.86	78.897	0.24998	101.88	78.884	0.23858	67.889	78.871	0.23190
10	297.61	80.239	.25873	208.30	80.235	.25286	104.11	80.223	.24146	69.373	80.210	.23479
20	303.95	81.591	.26158	212.74	81.588	.25571	106.33	81.576	.24431	70.857	81.565	.23764
30	310.30	82.959	.26440	217.18	82.955	.25854	108.55	82.945	.24714	72.340	82.934	.24046
40	316.64	84.341	.26719	221.62	84.338	.26133	110.77	84.327	.24993	73.823	84.317	.24326
50	322.98	85.737	0.26996	226.07	85.734	0.26410	113.00	85.724	0.25270	75.306	85.714	0.24603
60	329.32	87.147	.27270	230.51	87.144	.26684	115.22	87.135	.25544	76.789	87.126	.24877
70	335.66	88.570	.27541	234.95	88.567	.26955	117.44	88.559	.25816	78.271	88.550	.25149
80	342.01	90.007	.27810	239.39	90.004	.27224	119.66	89.996	.26084	79.753	89.988	.25417
90	348.35	91.457	.28076	243.82	91.454	.27490	121.88	91.447	.26351	81.235	91.439	.25684
100	354.69	92.920	0.28340	248.26	92.917	0.27754	124.10	92.910	0.26614	82.716	92.902	0.25948
110	361.03	94.395	.28601	252.70	94.393	.28015	126.32	94.386	.26876	84.197	94.378	.26209
120	367.37	95.882	.28860	257.14	95.880	.28274	128.54	95.874	.27135	85.679	95.867	.26468
130	373.71	97.382	.29116	261.58	97.380	.28530	130.77	97.374	.27391	87.160	97.367	.26725
140	380.05	98.893	.29370	266.02	98.891	.28784	132.99	98.885	.27645	88.641	98.879	.26979

TABLE B-4 (Cont.)

Temp. F	Abs. Pressure 0.80 lb/in.² Gage Pressure 28.29 in. vac. (Sat. Temp. −114.8 F)			Abs. Pressure 1.00 lb/in. Gage Pressure 27.88 in. vac. (Sat. Temp. −109.3 F)			Abs. Pressure 2.0 lb/in.² Gage Pressure 25.85 in. vac. (Sat. Temp. −90.7 F)			Abs. Pressure 3.0 lb/in.² Gage Pressure 23.81 in. vac. (Sat. Temp. −78.8 F)		
Sat.	*(38.051)*	*(64.624)*	*(0.19167)*	*(30.896)*	*(65.229)*	*(0.18977)*	*(16.195)*	*(67.276)*	*(0.18417)*	*(11.106)*	*(68.604)*	*(0.18114)*
−110	38.586	65.170	0.19324	.....	.....	.....	.....	.....	.....	.....	.....	.....
−100	39.710	66.329	0.19651	31.730	66.303	0.19279	.....	.....	.....	.....	.....	.....
− 90	40.833	67.506	.19974	32.631	67.482	.19602	16.228	67.361	0.18440	.....	.....	.....
− 80	41.954	68.701	.20292	33.531	68.679	.19922	16.634	68.567	.18762	.....	.....	.....
− 70	43.074	69.913	.20608	34.429	69.892	.20237	17.139	69.788	.19079	11.375	69.683	0.18394
− 60	44.194	71.142	.20919	35.327	71.123	.20549	17.593	71.026	.19393	11.681	70.928	.18709
− 50	45.312	72.388	0.21227	36.223	72.370	0.20857	18.046	72.279	0.19703	11.986	72.188	0.19021
− 40	46.429	73.650	.21531	37.119	73.633	.21162	18.498	73.549	.20009	12.290	73.463	.19328
− 30	47.546	74.928	.21832	38.014	74.913	.21463	18.949	74.834	.20311	12.594	74.754	.19632
− 20	48.662	76.223	.22130	38.908	76.208	.21761	19.400	76.134	.20611	12.897	76.059	.19932
− 10	49.778	77.533	.22424	39.802	77.519	.22056	19.850	77.449	.20906	13.199	77.379	.20229
0	50.893	78.858	0.22716	40.695	78.845	0.22347	20.299	78.780	0.21199	13.500	78.714	0.20523
10	52.007	80.198	0.23004	41.587	80.186	.22636	20.748	80.125	.21488	13.802	80.063	.20813
20	53.121	81.553	.23290	42.480	81.542	.22922	21.197	81.484	.21775	14.102	81.426	.21100
30	54.235	82.923	.23572	43.372	82.912	.23204	21.645	82.858	.22058	14.403	82.803	.21384
40	55.348	84.307	.23852	44.263	84.297	.23484	22.093	84.245	.22339	14.703	84.194	.21665
50	56.461	85.705	0.24129	45.154	85.695	0.23761	22.540	85.646	0.22616	15.002	85.598	0.21944
60	57.574	87.116	.24403	46.045	87.107	.24036	22.988	87.061	.22891	15.302	87.015	.22219
70	58.686	88.541	.24675	46.936	88.533	.24307	23.435	88.489	.23163	15.601	88.445	.22492
80	59.799	89.9 0	.24944	47.826	89.971	.24576	23.881	89.930	.23433	15.900	89.859	.22762
90	60.911	91.431	.25210	48.716	91.423	.24843	24.328	91.384	.23700	16.198	91.345	.23029
100	62.023	92.895	0.25474	49.606	92.887	0.25107	24.774	92.850	0.23964	16.497	92.813	0.23293
110	63.134	94.371	.25736	50.496	94.364	.25368	25.220	94.329	.24226	16.795	94.293	.23556
120	64.246	95.860	.25995	51.386	95.853	.25628	25.666	95.819	.24485	17.093	95.785	.23815
130	65.357	97.361	.26251	52.275	97.354	.25884	26.112	97.322	.24742	17.391	97.289	.24073
140	66.468	98.873	.26506	53.165	98.867	.26139	26.558	98.836	.24997	17.689	98.805	.24327
150	67.579	100.397	0.26758	54.054	100.391	0.26391	27.003	100.361	0.25249	17.987	100.332	0.24580
160	68.690	101.932	.27007	54.943	101.926	.26640	27.449	101.898	.25499	18.284	101.869	.24830
170	69.801	103.478	.27255	55.832	103.472	.26888	27.894	103.445	.25747	18.582	103.418	.25078
180	70.912	105.035	.27500	56.721	105.030	.27133	28.340	105.003	.25992	18.879	104.977	.25324
190	.....	.....	.....	.....	.....	.....	28.785	106.572	.26236	19.176	106.547	.25567
200	.....	.....	.....	.....	.....	.....	29.230	108.151	0.26477	19.473	108.127	0.25808

TABLE B-4 (Cont.)

Temp. F	Abs. Pressure 5.0 lb/in.² Gage Pressure 19.74 in. vac. (Sat. Temp. −62.4 F)			Abs. Pressure 7.5 lb/in.² Gage Pressure 14.65 in. vac. (Sat. Temp. −48.1 F)			Abs. Pressure 10.0 lb/in.² Gage Pressure 9.56 in. vac. (Sat. Temp. −37.2 F)			Abs. Pressure 15 lb/in.² Gage Pressure 0.3 lb/in.² (Sat. Temp. −20.8 F)		
t	v	h	s	v	h	s	v	h	s	v	h	s
Sat.	*(6.9069)*	*(70.432)*	*(0.17759)*	*(4.7374)*	*(72.017)*	*(0.17501)*	*(3.6246)*	*(73.219)*	*(0.17331)*	*(2.4835)*	*(75.208)*	*(0.17111)*
−60	6.9509	70.729	0.17834	.....	.....	.....	.....	.....	.....	.....	.....	.....
−50	7.1378	72.003	0.18149	.....	.....	.....	.....	.....	.....	.....	.....	.....
−40	7.3239	73.291	.18459	4.8401	73.073	0.17755	.....	.....	.....	.....	.....	.....
−30	7.5092	74.593	.18766	4.9664	74.390	.18065	3.6945	74.183	0.17557	.....	.....	.....
−20	7.6938	75.909	.19069	5.0919	75.719	.18371	3.7906	75.526	.17866	2.4885	75.131	0.17134
−10	7.8777	77.239	.19368	5.2169	77.061	.18673	3.8861	76.880	.18171	2.5546	76.512	.17445
0	8.0611	78.582	0.19663	5.3412	78.415	0.18971	3.9809	78.246	0.18471	2.6201	77.902	0.17751
10	8.2441	79.939	.19955	5.4650	79.782	.19265	4.0753	79.624	.18768	2.6850	79.302	.18052
20	8.4265	81.309	.20244	5.5884	81.162	.19556	4.1691	81.014	.19061	2.7494	80.712	.18349
30	8.6086	82.693	.20529	5.7114	82.555	.19843	4.2626	82.415	.19350	2.8134	82.131	.18642
40	8.7903	84.090	.20812	5.8340	83.959	.20127	4.3556	83.828	.19635	2.8770	83.561	.18931
50	8.9717	85.500	0.21091	5.9562	85.377	0.20408	4.4484	85.252	0.19918	2.9402	85.001	0.19216
60	9.1528	86.922	.21367	6.0782	86.806	.20685	4.5408	86.689	.20197	3.0031	86.451	.19498
70	9.3336	88.358	.21641	6.1999	88.247	.20960	4.6329	88.136	.20473	3.0657	87.912	.19776
80	9.5142	89.806	.21912	6.3213	89.701	.21232	4.7248	89.596	.20746	3.1281	89.383	.20051
90	9.6945	91.266	.22180	6.4425	91.166	.21501	4.8165	91.067	.21016	3.1902	90.865	.20324
100	9.8747	92.738	0.22445	6.5636	92.643	0.21767	4.9079	92.548	0.21283	3.2521	92.357	0.20593
110	10.055	94.222	.22708	6.6844	94.132	.22031	4.9992	94.042	.21547	3.3139	93.860	.20859
120	10.234	95.717	.22968	6.8051	95.632	.22292	5.0903	95.546	.21809	3.3754	95.373	.21122
130	10.414	97.224	.23226	6.9256	97.143	.22550	5.1812	97.061	.22068	3.4368	96.896	.21382
140	10.594	98.743	.23481	7.0459	98.665	.22806	5.2720	98.586	.22325	3.4981	98.429	.21640
150	10.773	100.272	0.23734	7.1662	100.198	0.23060	5.3627	100.123	0.22579	3.5592	99.972	0.21895
160	10.952	101.812	.23985	7.2863	101.741	.23311	5.4533	101.669	.22830	3.6202	101.525	.22148
170	11.131	103.363	.24233	7.4063	103.295	.23560	5.5437	103.226	.23080	3.6811	103.088	.22398
180	11.311	104.925	.24479	7.5262	104.859	.23806	5.6341	104.793	.23326	3.7419	104.661	.22646
190	11.489	106.497	.24723	7.6461	106.434	.24050	5.7243	106.370	.23571	3.8025	106.243	.22891
200	11.668	108.079	0.24964	7.7658	108.018	0.24292	5.8145	107.957	0.23813	3.8632	107.835	0.23135
210	11.847	109.670	.25204	7.8855	109.612	.24532	5.9046	109.553	.24054	3.9237	109.436	.23375
220	12.026	111.272	.25441	8.0051	111.215	.24770	5.9946	111.159	.24291	3.9841	111.046	.23614
230	12.205	112.883	.25677	8.1246	112.828	.25005	6.0846	112.774	.24527	4.0445	112.665	.23850
240	.....	.....	.....	8.2441	114.451	.25239	6.1745	114.398	.24761	4.1049	114.292	.24085
250	.....	.....	.....	.....	.....	.....	6.2643	116.031	0.24993	4.1651	115.929	0.24317

TABLE B-4 (Cont.)

Temp. F	Abs. Pressure 20 lb/in.² Gage Pressure 5.3 lb/in.² (Sat. Temp. −8.1 F)			Abs. Pressure 26 lb/in.² Gage Pressure 11.3 lb/in.² (Sat. Temp. 4.1 F)			Abs. Pressure 32 lb/in.² Gage Pressure 17.3 lb/in.² (Sat. Temp. 14.4 F)			Abs. Pressure 40 lb/in.² Gage Pressure 25.3 lb/in.² (Sat. Temp. 25.9 F)		
Sat.	*(1.8977)*	*(76.397)*	*(0.16969)*	*(1.4835)*	*(77.710)*	*(0.16850)*	*(1.2198)*	*(78.793)*	*(0.16763)*	*(0.98743)*	*(80.000)*	*(0.16676)*
0	1.9390	77.550	0.17222	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	1.9893	78.973	.17528	1.5071	78.566	0.17033	.....	.....	.....	.....	.....	.....
20	2.0391	80.403	.17829	1.5468	80.024	.17340	1.2387	79.634	0.16939	.....	.....	.....
30	2.0884	81.842	.18126	1.5861	81.487	.17642	1.2717	81.123	.17246	0.99865	80.622	0.16804
40	2.1373	83.289	.18419	1.6248	82.956	.17939	1.3042	82.616	.17548	1.0258	82.148	.17112
50	2.1858	84.745	0.18707	1.6632	84.432	0.18232	1.3363	84.113	0.17845	1.0526	83.676	0.17415
60	2.2340	86.210	.18992	1.7013	85.916	.18520	1.3681	85.616	.18137	1.0789	85.206	.17712
70	2.2819	87.684	.19273	1.7390	87.407	.18804	1.3995	87.124	.18424	1.1049	86.739	.18005
80	2.3295	89.168	.19550	1.7765	88.906	.19084	1.4306	88.639	.18707	1.1306	88.277	.18292
90	2.3769	90.661	.19824	1.8137	90.413	.19361	1.4615	90.161	.18987	1.1560	89.819	.18575
100	2.4241	92.164	0.20095	1.8507	91.929	0.19634	1.4921	91.690	0.19263	1.1812	91.367	0.18854
110	2.4711	93.676	.20363	1.8874	93.453	.19904	1.5225	93.227	.19535	1.2061	92.920	.19129
120	2.5179	95.198	.20628	1.9240	94.986	.20171	1.5528	94.771	.19803	1.2309	94.480	.19401
130	2.5645	96.729	.20890	1.9605	96.527	.20435	1.5828	96.323	.20069	1.2554	96.047	.19669
140	2.6110	98.270	.21149	1.9967	98.078	.20695	1.6127	97.883	.20331	1.2798	97.620	.19933
150	2.6573	99.820	0.21405	2.0329	99.637	0.20953	1.6425	99.451	0.20590	1.3041	99.200	0.20195
160	2.7036	101.380	.21659	2.0689	101.204	.21208	1.6721	101.027	.20847	1.3282	100.788	.20453
170	2.7497	102.949	.21910	2.1048	102.781	.21461	1.7017	102.611	.21100	1.3522	102.383	.20708
180	2.7957	104.528	.22159	2.1406	104.367	.21710	1.7311	104.204	.21351	1.3761	103.985	.20961
190	2.8416	106.115	.22405	2.1763	105.961	.21958	1.7604	105.805	.21600	1.3999	105.595	.21210
200	2.8874	107.712	0.22649	2.2119	107.563	0.22202	1.7896	107.414	0.21845	1.4236	107.212	0.21457
210	2.9332	109.317	.22891	2.2474	109.174	.22445	1.8187	109.031	.22089	1.4472	108.837	.21702
220	2.9789	110.932	.23130	2.2828	110.794	.22685	1.8478	110.656	.22330	1.4707	110.469	.21944
230	3.0245	112.555	.23367	2.3182	112.422	.22923	1.8768	112.289	.22568	1.4942	112.109	.22183
240	3.0700	114.186	.23602	2.3535	114.058	.23158	1.9057	113.930	.22804	1.5176	113.757	.22420
250	3.1155	115.826	0.23835	2.3888	115.703	0.23391	1.9346	115.579	0.23038	1.5409	115.412	0.22655
260	3.1609	117.475	.24065	2.4240	117.355	.23623	1.9634	117.235	.23270	1.5642	117.074	.22888
270	3.2063	119.131	.24294	2.4592	119.016	.23852	1.9922	118.900	.23500	1.5874	118.744	.23118
280	3.2517	120.796	.24520	2.4943	120.684	.24079	2.0209	120.572	.23727	1.6106	120.421	.23347
290	3.2970	122.469	.24745	2.5293	122.360	.24304	2.0495	122.251	.23953	1.6337	122.105	.23573

TABLE B-4 (Cont.)

Temp. F	Abs. Pressure 50 lb/in.² Gage Pressure 35.3 lb/in.² (Sat. Temp. 38.2 F)			Abs. Pressure 60 lb/in.² Gage Pressure 45.3 lb/in.² (Sat. Temp. 48.6 F)			Abs. Pressure 80 lb/in.² Gage Pressure 65.3 lb/in.² (Sat. Temp. 66.2 F)			Abs. Pressure 100 lb/in.² Gage Pressure 85.3 lb/in.² (Sat. Temp. 80.8 F)		
t	v	h	s	v	h	s	v	h	s	v	h	s
Sat.	*(0.79824)*	*(81.249)*	*(0.16597)*	*(0.67005)*	*(82.299)*	*(0.16537)*	*(0.50680)*	*(84.003)*	*(0.16450)*	*(0.40674)*	*(85.351)*	*(0.16389)*
40	0.80248	81.540	0.16655	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	0.82502	83.109	0.16966	0.67272	82.518	0.16580	.....	.....	.....	.....	.....	.....
60	.84713	84.676	.17271	.69210	84.126	.16892	.....	.....	.....	.....	.....	.....
70	.86886	86.243	.17569	.71105	85.729	.17198	0.51269	84.640	0.16571	.....	.....	.....
80	.89025	87.811	.17862	.72964	87.330	.17497	.52795	86.316	.16885	.....	.....	.....
90	.91134	89.380	.18151	.74790	88.929	.17791	.54281	87.981	.17190	0.41876	86.964	0.16685
100	0.93216	90.953	0.18434	0.76588	90.528	0.18079	0.55734	89.640	0.17489	0.43138	88.694	0.16996
110	.95275	92.529	.18713	.78360	92.128	.18362	.57158	91.294	.17782	.44365	90.410	.17300
120	.97313	94.110	.18988	.80110	93.731	.18641	.58556	92.945	.18070	.45562	92.116	.17597
130	.99332	95.695	.19259	.81840	95.336	.18916	.59931	94.594	.18352	.46733	93.814	.17888
140	1.0133	97.286	.19527	.83551	96.945	.19186	.61286	96.242	.18629	.47881	95.507	.18172
150	1.0332	98.882	0.19791	0.85247	98.558	0.19453	0.62623	97.891	0.18902	0.49009	97.197	0.18452
160	1.0529	100.485	.20051	.86928	100.176	.19716	.63943	99.542	.19170	.50118	98.884	.18726
170	1.0725	102.093	.20309	.88596	101.799	.19976	.65250	101.195	.19435	.51212	100.571	.18996
180	1.0920	103.708	.20563	.90252	103.427	.20233	.66543	102.851	.19696	.52291	102.257	.19262
190	1.1114	105.330	.20815	.91896	105.060	.20486	.67824	104.511	.19953	.53358	103.944	.19524
200	1.1307	106.958	0.21064	0.93531	106.700	0.20736	0.69095	106.174	0.20207	0.54413	105.633	0.19782
210	1.1499	108.593	.21310	.95157	108.345	.20984	.70356	107.841	.20458	.55457	107.324	.20036
220	1.1690	110.235	.21553	.96775	109.997	.21229	.71609	109.513	.20706	.56492	109.018	.20287
230	1.1880	111.883	.21794	.98385	111.655	.21471	.72853	111.190	.20951	.57519	110.714	.20535
240	1.2070	113.539	.22032	.99988	113.319	.21710	.74090	112.872	.21193	.58538	112.415	.20780
250	1.2259	115.202	0.22268	1.0159	114.989	0.21947	0.75220	114.559	0.21432	0.59549	114.119	0.21022
260	1.2447	116.871	.22502	1.0318	116.666	.22182	.76544	116.251	.21669	.60554	115.828	.21261
270	1.2636	118.547	.22733	1.0476	118.350	.22414	.77762	117.949	.21903	.61553	117.540	.21497
280	1.2823	120.231	.22962	1.0634	120.039	.22644	.78975	119.652	.22135	.62546	119.258	.21731
290	1.3010	121.921	.23189	1.0792	121.736	.22872	.80183	121.361	.22364	.63534	120.980	.21962
300	1.3197	123.618	0.23414	1.0949	123.438	0.23098	0.81386	123.075	0.22592	0.64518	122.707	0.22191
310	1.3383	125.321	.23637	1.1106	125.147	.23321	.82586	124.795	.22817	.65497	124.439	.22417
320	1.3569	127.032	.23857	1.1262	126.863	.23543	.83781	126.521	.23039	.66472	126.176	.22641
330	1.3754	128.749	.24076	1.1418	128.585	.23762	.84973	128.253	.23260	.67444	127.917	.22863
340	.....	.....	.....	1.1574	130.313	.23980	.86161	129.990	.23479	.68411	129.665	.23083

TABLE B-4 (Cont.)

Temp. F	Abs. Press. 120 lb/in.² Gage Press. 105.3 lb/in.² (Sat. Temp. 93.3 F)			Abs. Press. 140 lb/in.² Gage Press. 125.3 lb/in.² (Sat. Temp. 104.4 F)			Abs. Press. 180 lb/in.² Gage Press. 165.3 lb/in.² (Sat. Temp. 123.4 F)			Abs. Press. 220 lb/in.² Gage Press. 205.3 lb/in.² (Sat. Temp. 139.5 F)		
Sat.	*(0.33886)*	*(86.459)*	*(0.16340)*	*(0.28964)*	*(87.389)*	*(0.16299)*	*(0.22276)*	*(88.857)*	*(0.16228)*	*(0.17917)*	*(89.937)*	*(0.16161)*
100	0.34655	87.675	0.16559	.....	.....	.....	.....	.....	.....	.....	.....	.....
110	.35766	89.466	.16876	0.29548	88.448	0.16486	.....	.....	.....	.....	.....	.....
120	.36841	91.237	.17184	.30549	90.297	.16808	.....	.....	.....	.....	.....	.....
130	.37884	92.992	.17484	.31513	92.120	.17120	0.22863	90.179	0.16454	.....	.....	.....
140	.38901	94.736	.17778	.32445	93.923	.17423	.23710	92.136	.16783	0.17957	90.043	0.16179
150	0.39896	96.471	0.18065	0.33350	95.709	0.17718	0.24519	94.053	0.17100	0.18746	92.156	0.16528
160	.40870	98.199	.18346	.34232	97.483	.18007	.25297	95.940	.17407	.19487	94.203	.16861
170	.41826	99.922	.18622	.35095	99.247	.18289	.26047	97.803	.17705	.20190	96.199	.17181
180	.42766	101.642	.18892	.35939	101.003	.18566	.26775	99.647	.17995	.20861	98.157	.17489
190	.43692	103.359	.19159	.36769	102.754	.18838	.27484	101.475	.18279	.21506	100.084	.17788
200	0.44606	105.076	0.19421	0.37584	104.501	0.19104	0.28176	103.291	0.18556	0.22130	101.986	0.18079
210	.45508	106.792	.19679	.38387	106.245	.19367	.28852	105.098	.18828	.22735	103.869	.18362
220	.46401	108.509	.19934	.39179	107.987	.19625	.29516	106.896	.19095	.23324	105.735	.18638
230	.47284	110.227	.20185	.39961	109.728	.19879	.30168	108.689	.19357	.23900	107.589	.18909
240	.48158	111.948	.20432	.40734	111.470	.20130	.30810	110.478	.19614	.24463	109.432	.19175
250	0.49025	113.670	0.20677	0.41499	113.212	0.20377	0.31442	112.263	0.19868	0.25015	111.267	0.19435
260	.49885	115.396	.20918	.42257	114.956	.20621	.32066	114.046	.20117	.25557	113.095	.19691
270	.50739	117.125	.21157	.43008	116.701	.20862	.32682	115.828	.20363	.26091	114.919	.19942
280	.51587	118.857	.21393	.43753	118.449	.21100	.33292	117.610	.20605	.26617	116.738	.20190
290	.52429	120.593	.21626	.44492	120.199	.21335	.33895	119.392	.20845	.27136	118.555	.20434
300	0.53267	122.333	0.21856	0.45226	121.953	0.21567	0.34492	121.174	0.21081	0.27648	120.369	0.20674
310	.54100	124.077	.22084	.45955	123.709	.21797	.35084	122.958	.21314	.28155	122.183	.20912
320	.54929	125.825	.22310	.46680	125.470	.22024	.35672	124.744	.21545	.28657	123.996	.21146
330	.55754	127.578	.22533	.47400	127.233	.22249	.36255	126.531	.21772	.29153	125.809	.21377
340	.56575	129.335	.22754	.48117	129.001	.22471	.36834	128.321	.21998	.29645	127.623	.21605
350	0.57393	131.097	0.22973	0.48831	130.773	0.22692	0.37409	130.113	0.22220	0.30134	129.438	0.21830
360	.58208	132.863	.23190	.49541	132.548	.22910	.37980	131.909	.22441	.30618	131.255	.22053
370	.59019	134.634	.23405	.50248	134.328	.23125	.38549	133.707	.22659	.31099	133.073	.22274
380	.59829	136.410	.23618	.50953	136.112	.23339	.39114	135.509	.22875	.31576	134.893	.22492
390	.60635	138.191	.23829	.51654	137.901	.23551	.39677	137.314	.23088	.32051	136.715	.22708
400	.....	.....	.....	.....	.....	.....	0.40237	139.122	0.23300	0.32523	138.540	0.22921
410	.....	.....	.....	.....	.....	.....	.40794	140.934	.23509	.32992	140.368	.23133

Source: Courtesy of E. I. DuPont de Nemours and Company, Inc., Organic Chemicals Department "Freon" Products Division.