TABLE 5. PROPERTIES OF MONOFLUOROTRICHLOROMETHANE (F_{11})

Sat. Temp. F	Abs. Press. Lb per Sq In.	Volume		Heat Content and Entropy Taken From −40 F							
				Heat Content		Entropy		25 F Superheat		50 F Superheat	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Ht. Ct.	Entropy	Ht. Ct.	Entropy
0	2.59	0.01020	13.700	7.81	90.4	0.0178	0.1975	93.9	0.2049	97.4	0.2120
5	2.96	0.01024	12.100	8.81	91.2	0.0200	0.1974	94.7	0.2047	98.2	0.2117
10	3.38	0.01028	10.700	9.82	92.0	0.0222	0.1973	95.5	0.2045	99.0	0.2114
15	3.85	0.01032	9.530	10.80	92.8	0.0243	0.1971	96.3	0.2043	99.8	0.2111
20	4.36	0.01036	8.490	11.90	93.7	0.0264	0.1970	97.2	0.2041	100.7	0.2109
25	4.94	0.01040	7.580	12.90	94.5	0.0286	0.1969	98.0	0.2039	101.5	0.2107
30	5.57	0.01045	6.770	13.90	95.3	0.0307	0.1969	98.8	0.2038	102.3	0.2105
35	6.27	0.01049	6.080	14.90	96.1	0.0328	0.1968	99.6	0.2037	103.1	0.2103
40	7.03	0.01053	5.460	16.00	96.8	0.0349	0.1968	100.3	0.2036	103.8	0.2101
45	7.88	0.01057	4.920	17.00	97.6	0.0370	0.1967	101.1	0.2035	104.6	0.2099
50	8.79	0.01062	4.440	18.10	98.4	0.0391	0.1967	101.9	0.2034	105.4	0.2098
55	9.80	0.01066	4.020	19.10	99.2	0.0412	0.1967	102.7	0.2033	106.2	0.2097
60	10.90	0.01071	3.640	20.20	100.0	0.0432	0.1967	103.5	0.2033	107.0	0.2096
65	12.10	0.01076	3.300	21.30	100.8	0.0453	0.1967	104.3	0.2032	107.8	0.2094
70	13.40	0.01081	3.000	22.40	101.5	0.0473	0.1967	105.0	0.2032	108.5	0.2093
75	14.80	0.01086	2.740	23.50	102.2	0.0493	0.1967	105.7	0.2031	109.2	0.2092
80	16.30	0.01091	2.500	24.50	102.9	0.0513	0.1966	106.4	0.2030	109.9	0.2090
85	17.90	0.01096	2.280	25.60	103.6	0.0533	0.1966	107.1	0.2029	110.6	0.2089
90	19.70	0.01101	2.090	26.70	104.4	0.0553	0.1966	107.9	0.2028	111.4	0.2088
95	21.60	0.01106	1.918	27.80	105.1	0.0573	0.1966	108.6	0.2028	112.1	0.2087
100	23.60	0.01111	1.761	28.90	105.7	0.0593	0.1965	109.2	0.2027	112.7	0.2085
105	25.90	0.01116	1.620	30.10	106.4	0.0613	0.1965	109.9	0.2026	113.4	0.2084

Example 1. What is the heat content above −40 F of 2.5 lb of ammonia when under a pressure of 92.9 lb per square inch gage and a temperature of 160 F?

Solution. First determine the condition of the ammonia at the stated temperature and pressure. Do this by finding the absolute pressure which in this case is 92.9 lb gage plus 14.7 or 107.6 lb per square inch absolute. From Table 1 note that the saturation temperature at this pressure is 60 F. Therefore, the ammonia is superheated 100 F, and the total heat per pound can be read directly from the Table as 689.9 Btu. In the 2.5 lb of ammonia there are 2.5 × 689.9, or 1724.75 Btu.

Example 2. What volume is necessary to accommodate 0.27 lb of saturated F_{12} vapor when compressed to 99.6 lb gage?

Solution. The absolute pressure is 99.6 plus 14.7 or 114.3 lb. In Table 2 find that one pound of F_{12} vapor saturated occupies 0.368 cu ft. Then the 0.27 lb would occupy 0.27 × 0.368, or 0.099 cu ft.

Example 3. How much heat would be removed from air passing over a coil through which 2 lb of methyl chloride per minute is forced? The coil is under a gage pressure of 64 lb per square inch and the liquid refrigerant is completely vaporized in passing through the coil.

Solution. Find that the absolute pressure is 64 plus 14.7 or 78.7 lb per square inch. From Table 3 note that the saturation temperature at this pressure is 75 F (nearly) and that the heat content per pound of the vapor is 207.8 Btu. Also that the heat content of the liquid is 42.2 Btu per pound. Subtract 42.2 from 207.8 and 165.6 Btu per pound is the heat necessary to change the liquid refrigerant to a vapor (latent heat). As the heat to accomplish this change comes from the air around the coil, the heat removed from the air is 165.6 Btu per pound of methyl chloride evaporated in the coil. When the refrigerant is circulated at 2 lb per minute, 2 × 165.6, or 331.2 Btu per minute are removed from the air, or refrigerating effect is produced at the rate of 331.2 ÷ 200, or 1.65 tons.

AIR DRYING AGENTS

Moisture may be removed from air, thus accomplishing dehumidification, by the use of any one of a number of substances if the moist air

and these substances are brought together under suitable circumstances. One class of these substances are solids at ordinary conditions and have the power of adsorbing the moisture from the air. Another class of air drying agents are liquids under ordinary conditions and absorb the moisture from the air. Nearly all the drying agents in frequent commercial use in air conditioning installations are of one or the other of these two classes.

Adsorbents

These substances are characterized by a physical structure containing a great number of extremely small pores but still retaining sufficient mechanical strength to resist whatever wear and handling to which they are subjected. To be suitable for air drying purposes they must be widely available at economical cost, durable in use, stable in form and properties, and capable of withstanding the re-activation processes by which they are made ready for repeated use. They must also possess capacity for adsorbing and holding so sufficient a quantity of moisture that the dimensions of the beds necessary to accommodate them will be practical.

Aluminum Oxide, (Alumina), in a porous, amorphous form is a solid adsorbent frequently called by the common name *activated alumina,* and containing small amounts of hydrated aluminum oxide, and very small amounts of soda, and various metallic oxides. A good grade of activated alumina will show 92 per cent of Al_2O_3, and its soda content will be combined with silica and alumina into an insoluble compound. This substance also has the property of adsorbing certain gases and certain vapors other than water vapor—a property which is sometimes useful in air conditioning installations. It is available commercially in granules ranging from a fine powder to pieces approximately 1.5 in. in diameter. It has

TABLE 6. PROPERTIES OF WATER

Sat. Temp. F	Abs. Press. Lb per Sq In.	Volume		Heat Content and Entropy Taken From +32 F							
				Heat Content		Entropy		50 F Superheat		100 F Superheat	
		Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Ht. Ct.	Entropy	Ht. Ct.	Entropy
32	0.0887	0.01602	3296.0	0.00	1073.0	0.0000	2.1826	1096.9	2.2277	1120.8	2.2688
35	0.1000	0.01602	2941.0	3.02	1074.4	0.0062	2.1724	1098.3	2.2172	1122.2	2.2581
40	0.1217	0.01602	2441.0	8.05	1076.8	0.0163	2.1555	1100.6	2.2000	1124.5	2.2406
45	0.1475	0.01602	2034.0	13.07	1079.2	0.0262	2.1390	1102.9	2.1832	1126.7	2.2234
50	0.1780	0.01602	1702.0	18.08	1081.5	0.0361	2.1230	1105.2	2.1667	1129.0	2.2066
55	0.2140	0.01603	1430.0	23.08	1083.9	0.0459	2.1073	1107.5	2.1506	1131.3	2.1902
60	0.2561	0.01603	1206.0	28.08	1086.2	0.0556	2.0920	1109.8	2.1349	1133.5	2.1742
65	0.3054	0.01604	1021.0	33.08	1088.6	0.0652	2.0771	1112.2	2.1196	1135.8	2.1585
70	0.3628	0.01605	868.0	38.07	1090.9	0.0746	2.0625	1114.5	2.1046	1138.1	2.1432
75	0.4295	0.01606	740.0	43.06	1093.2	0.0840	2.0483	1116.7	2.0900	1140.3	2.1283
80	0.507	0.01607	632.9	48.05	1095.5	0.0933	2.0344	1119.0	2.0758	1142.5	2.1138
85	0.596	0.01609	543.3	53.04	1097.8	0.1025	2.0208	1121.2	2.0619	1144.7	2.0996
90	0.698	0.01610	467.9	58.03	1100.0	0.1116	2.0075	1123.4	2.0483	1146.8	2.0857
95	0.815	0.01612	404.2	63.01	1102.3	0.1206	1.9946	1125.6	2.0350	1148.9	2.0721
100	0.949	0.01613	350.3	68.00	1104.6	0.1296	1.9819	1127.9	2.0220	1151.1	2.0588
105	1.101	0.01615	304.4	72.98	1106.8	0.1384	1.9695	1130.2	2.0093	1153.2	2.0458

For properties of steam at high temperatures, see Page 27.