

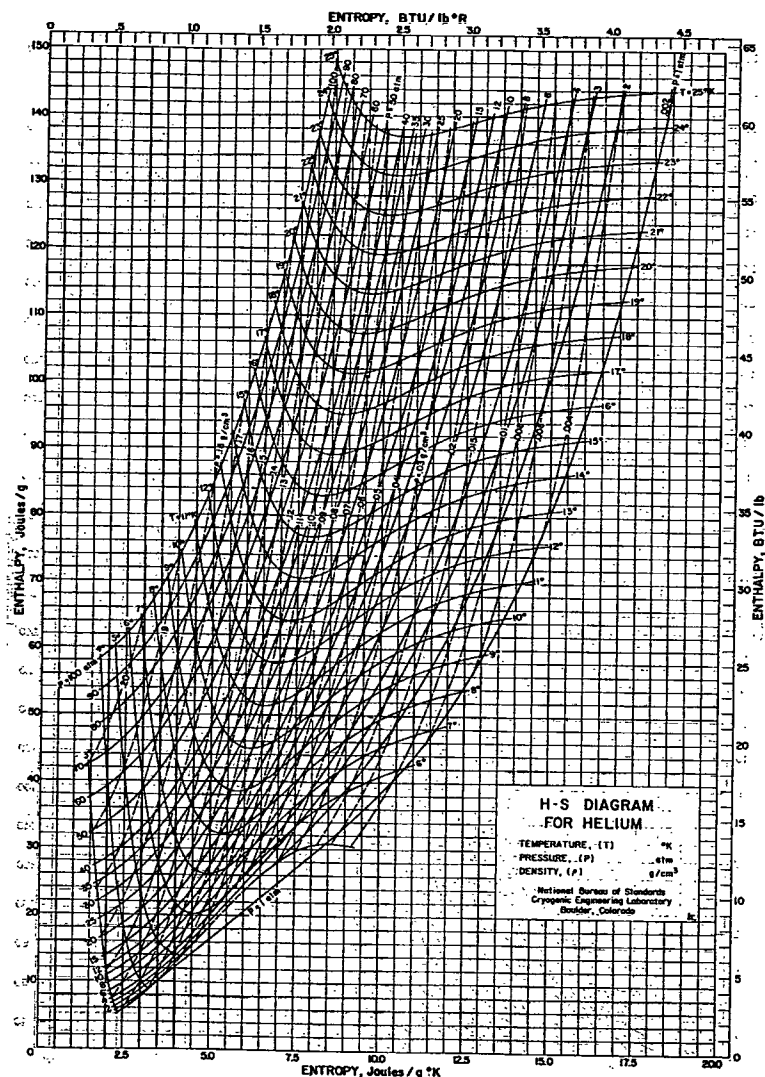


Fig. 29 ... Enthalpy-Entropy Diagram for Refrigerant 704

Table 37 ... Refrigerant 704 (Helium) Properties of Saturated Liquid and Saturated Vapor*

Temp	Pressure	Volume (cm³/g)	Enthalpy (J/g)	Entropy (J/g·K)	Temp	Pressure	Volume (cm³/g)	Enthalpy (J/g)	Entropy (J/g·K)
K	atm	Sat Liquid	Sat Vapor	Sat Liquid	Sat Vapor	K	atm	Sat Liquid	Sat Vapor
3.0	0.241	7.083	224.1	8.30	23.96	4.0	0.814	7.779	73.86
3.2	0.320	7.183	174.3	6.35	22.37	4.2	0.990	7.989	60.61
3.4	0.418	7.303	138.7	6.47	20.93	4.4	1.190	8.231	49.80
3.6	0.529	7.431	111.5	7.18	30.34	4.6	1.417	8.547	40.78
3.8	0.661	7.597	90.50	7.53	30.59	4.8	1.673	8.933	32.87
						5.0	1.959	9.340	25.67

* From published data in National Bureau of Standards, Technical Note No. 154 (Jan. 1963).

Table 38 ... Refrigerant 704 (Helium) Properties of Liquid and Vapor*

Temp K	P=0.5 atm (Sat Temp = 3.56 K)			P=1 atm (Sat Temp = 4.21 K)			P=2 atm (Sat Temp = 5.03 K)			P=5 atm			P=10 atm		
T	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K
Sat. Liq	7.41	7.0	2.84	8.01	10.0	3.47	10.18	16.6	4.67						
Sat. Vapor	117.6	30.2	9.88	59.53	30.9	8.43	24.33	27.7	8.90						
3	7.06	5.5	2.34	6.99	5.7	2.23	6.87	6.3	2.28	6.60	8.1	2.17	6.30	10.9	2.05
4	140.1	32.9	10.12	7.70	8.9	3.23	7.45	9.3	3.14	6.99	10.7	2.94	6.56	13.3	2.74
5	188.3	38.6	11.39	82.85	36.2	9.61	9.36	15.9	4.50	7.71	14.5	3.82	6.96	16.5	3.47
6	231.4	44.1	12.58	108.1	42.3	10.79	12.53	21.2	5.20	7.61	20.7	4.24	7.61	20.7	4.24
8	318.3	55.0	15.95	134.3	53.8	13.41	17.35	31.2	7.35	8.34	31.7	6.06	8.34	31.7	6.06
10	394.1	65.7	17.27	158.1	64.8	15.64	22.09	43.0	7.94	8.84	16.09	50.1	7.92	50.1	7.92
15	611.7	92.0	19.14	234.3	91.6	18.81	35.0	58.59	10.28	12.78	38.3	85.4	10.54	85.4	10.54
20	818.5	118.2	19.78	308.6	117.8	19.32	45.7	80.99	11.83	13.88	40.4	117.3	12.33	117.3	12.33
25	1025	144.3	19.94	413.2	144.0	19.49	56.2	102.4	12.58	15.06	51.6	144.3	13.06	144.3	13.06
30	1230	170.3	20.59	518.4	170.1	19.44	66.8	122.6	13.06	16.06	62.31	167.7	14.56	167.7	14.56
40	1641	223.3	22.39	681.3	222.2	20.94	111.3	155.4	14.57	221.7	83.54	221.3	18.10	221.3	18.10
60	2462	326.2	24.49	1232	326.3	23.05	216.1	243.3	16.70	17.70	125.3	326.8	18.24	125.3	18.24
80	3255	430.1	25.99	1643	430.2	24.56	327.4	330.1	18.30	430.7	21.50	166.7	19.53	166.7	19.53
100	4103	534.0	27.15	2053	534.1	25.71	427.2	428.5	19.53	534.9	22.38	236.0	20.81	236.0	20.81
120	4923	637.9	28.09	2463	638.0	26.65	533.3	535.1	20.47	638.9	23.81	249.2	21.96	249.2	21.96
140	5743	741.7	28.90	2873	741.9	27.46	632.2	631.7	21.22	742.9	24.11	290.3	22.67	290.3	22.67
160	6563	845.6	29.62	3283	846.0	28.18	742.9	742.9	21.87	845.7	25.43	372.5	23.42	372.5	23.42
180	7383	949.4	30.29	3693	949.8	28.78	848.9	848.9	22.43	949.4	26.46	454.6	24.07	454.6	24.07
200	8203	1053.2	30.88	4103	1053.6	29.30	950.5	950.5	22.91	1053.2	27.07	537.3	24.63	537.3	24.63
220	9023	1157.0	31.41	4513	1157.3	29.75	1053.3	1053.3	23.33	1157.0	27.33	620.3	25.13	620.3	25.13
240	9843	1260.8	31.90	4923	1261.1	30.17	1157.3	1157.3	23.71	1260.8	27.57	703.3	25.63	703.3	25.63
260	10663	1364.6	32.35	5333	1365.0	30.57	1261.1	1261.1	24.06	1364.6	27.83	786.3	26.13	786.3	26.13
280	11483	1468.4	32.78	5743	1469.3	30.95	1365.0	1365.0	24.40	1468.4	28.07	869.3	26.63	869.3	26.63
300	12303	1572.2	33.19	6153	1573.6	31.31	1469.3	1469.3	24.71	1572.2	28.31	952.3	27.13	952.3	27.13

Temp K	P=20 atm			P=40 atm			P=60 atm			P=80 atm			P=100 atm		
T	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K	cm ³ /g	h J/g	v J/g·K
3	5.90	16.6	1.88	5.42	27.4	1.96	5.13	37.3	1.90						
4	6.08	18.7	2.40	5.52	29.9	2.20	5.20	39.2	2.01	4.96	48.9	1.98	4.75	58.3	1.78
5	6.28	21.3	3.11	5.63	31.4	2.78	5.28	41.3	2.49	5.03	60.9	2.32	4.94	60.3	2.15
6	6.59	24.6	3.70	5.80	34.1	3.21	5.39	43.7	2.93	5.15	63.7	2.72	5.15	63.7	2.72
8	7.56	33.1	4.91	6.23	40.6	4.15	5.66	49.5	3.75	5.32	68.4	3.48	5.07	67.2	3.28
10	9.13	45.0	6.94	6.79	49.7	5.15	6.01	57.5	4.65	5.07	68.9	4.33	5.27	74.4	4.07
15	14.80	78.3	9.94	8.86	77.5	7.40	7.30	83.4	6.66	6.40	83.2	6.19	5.90	96.8	5.86
20	20.70	109.2	10.72	11.49	107.4	9.12	8.73	110.8	8.22	6.55	107.7	8.46	6.17	110.2	8.02
25	26.39	138.2	12.02	14.29	139.9	10.43	10.47	138.9	9.53	6.82	138.8	9.82	6.71	145.0	9.47
30	31.94	166.2	13.04	17.07	163.7	11.48	12.29	167.5	10.58	6.96	170.7	10.94	6.81	175.4	10.47
40	42.76	230.9	14.61	22.57	221.7	13.10	15.94	223.9	12.20	12.67	227.1	11.96	10.78	231.0	11.07
60	63.92	327.6	16.78	33.31	330.2	15.30	23.16	333.5	14.42	18.10	337.3	13.80	12.61	339.6	12.61
80	84.78	432.0	18.30	43.88	439.7	16.93	30.24	440.7	15.45	22.44	444.5	14.72	15.22	449.6	14.07
100	105.3	537.9	19.47	54.30	543.2	18.01	37.22	546.9	17.15	25.73	551.7	16.54	18.21	555.7	15.86
120	126.2	642.4	20.42	64.69	647.3	18.96	44.21	652.3	18.11	33.97	657.8	17.01	20.61	661.9	16.67
140	146.8	746.7	21.22	75.05	752.0	19.77	51.14	757.4	18.92	39.19	762.9	18.31	32.01	768.3	17.84
160	166.5	850.8	21.90	85.39	856.9	20.46	58.07	862.3	19.59	46.27	867.8	19.03	34.04	873.8	18.16
180	185.1	954.7	22.50	95.63	961.6	21.07	65.00	967.0	20.20	53.22	972.3	19.52	36.03	978.9	18.49
200	202.1	1163.2	23.58	116.3	1169.4	22.13	71.91	1171.7	21.28	59.92	1182.0	20.63	43.03	1188.9	20.23
220	217.1	1271.2	24.44	136.9	1277.7	23.00	78.74	1276.4	22.16	66.80	1292.3	21.59	45.03	1295.9	20.94
240	231.2	1379.1	25.19	157.4	1385.9	23.75	85.56	1381.0	22.90	73.64	1399.3	22.30	48.16	1406.0	21.64

* From published data in National Bureau of Standards, Technical Note No. 154 (Jan. 1963).

Bold horizontal line indicates phase change (liquid above, vapor below the line).

Conversions for Units, to Equivalent in British System of Units.

To convert temperature in degree Kelvin (°K) to degree Rankine (°R), multiply (°K) by 1.8.

To convert pressure in atmospheres (atm) to (psia), multiply (atm) by 14.696.

To convert (v) in cubic centimeters per gram (cm³/g) to (cu ft/lb), multiply (cm³/g) by 0.00016018.

To convert enthalpy (h) in joules per gram (J/g) to (Btu/lb), multiply (J/g) by 0.00042993.

To convert entropy (s) in joules per gram (J/g·K) to (Btu/lb·R), multiply (J/g·K) by 0.00023885.