

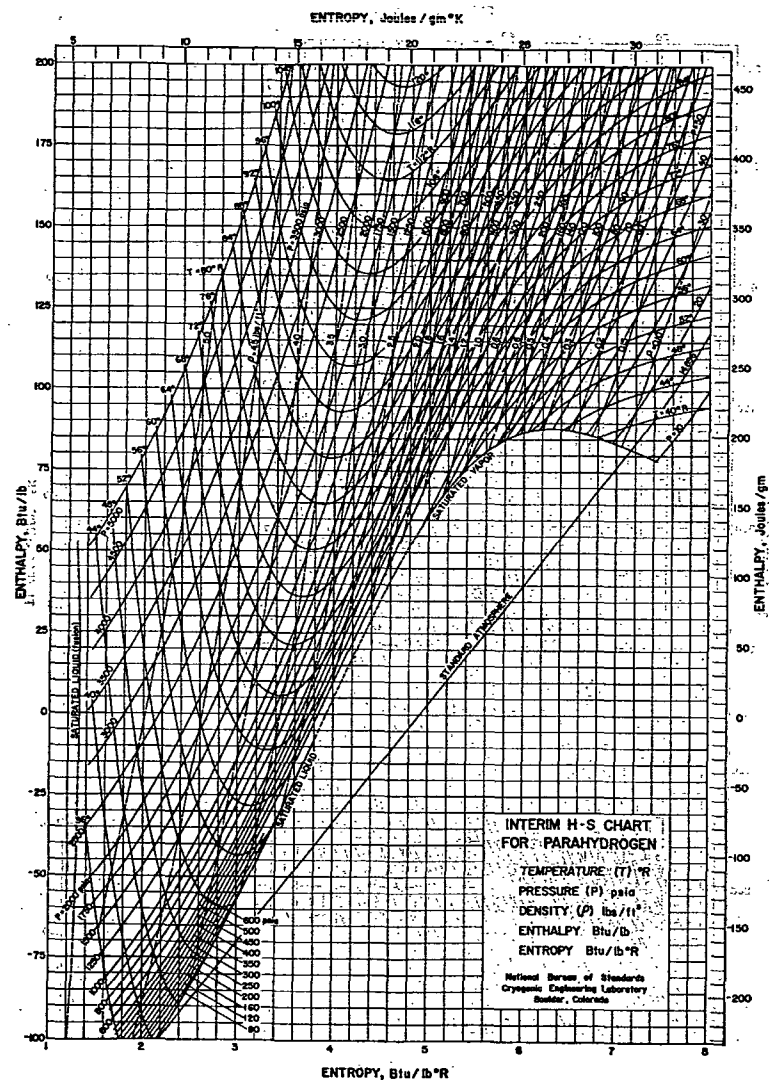


Fig. 26 Enthalpy-Entropy Diagram for Refrigerant 702 (Parahydrogen)

Table 36 Refrigerant 702 (Parahydrogen) Properties of Liquid and Vapor*

Temp K	P = 1 atm (Sat temp = 20.27 K)			P = 2 atm (Sat temp = 22.86 K)			P = 5 atm (Sat temp = 27.19 K)			P = 10 atm (Sat temp = 31.34 K)			P = 15 atm		
	v cm³/g	h J/g	s J/g·K	v cm³/g	h J/g	s J/g·K	v cm³/g	h J/g	s J/g·K	v cm³/g	h J/g	s J/g·K	v cm³/g	h J/g	s J/g·K
Sat. Liq.	14.24	-338	6.04	14.91	-230	9.29	16.62	-168	11.65	20.47	-78	14.37	20.47	-78	14.37
Sat. Vapor	783.4	191	10.21	398.3	202	28.18	163.0	202	23.18	66.75	156	21.50	66.75	156	21.50
15	15.25	-302	5.55	13.22	-301	5.54	13.19	-298	5.50	13.11	-292	5.43	13.04	-287	5.19
20	14.18	-261	7.91	14.15	-260	7.89	14.07	-257	7.82	13.95	-252	7.77	13.83	-247	7.63
25	970.0	234	32.18	453.7	229	29.33	15.33	-201	10.30	15.27	-198	10.11	15.05	-195	9.94
30	1100	801	24.06	572.9	290	31.54	108.7	249	26.82	18.21	-116	13.97	17.38	-121	12.62
35	1404	355	36.53	855.6	348	33.29	253.0	317	28.94	105.1	-236	24.63	47.28	144	20.57
40	1618	409	37.78	791.0	402	34.78	301.9	370	30.58	136.5	-336	26.98	80.18	296	24.39
50	2533	815	40.12	1099	810	37.18	853.5	494	33.16	457	-29.91	120.1	432	27.83	32.07
60	2451	815	42.08	1220	818	39.18	481.2	607	35.21	233.3	-787	32.10	153.5	568	30.18
70	2885	732	43.78	1479	729	40.88	567.1	720	36.96	280.1	-104	33.89	184.6	690	32.07
80	3278	647	45.31	1829	645	42.41	651.8	838	38.53	322.8	-126	35.63	214.6	815	33.78
100	4122	1101	48.14	2500	1099	45.24	819.6	1094	41.39	609.4	-1087	38.44	272.9	1080	36.68
120	4887	1378	50.41	2444	1377	47.54	978.3	1378	43.78	489.9	-1368	40.32	327.2	1353	39.10
140	5703	1688	52.90	2523	1687	49.93	1143	1685	46.13	572.6	-1681	42.23	382.6	1678	41.62
160	6518	2012	54.96	2591	2011	52.09	1307	2010	48.30	635.2	-2018	44.11	438.1	2006	43.71
180	7333	2235	56.39	2629	2239	54.02	1470	2238	50.23	737.4	-2237	47.34	493.2	2235	45.52
200	8145	2563	58.60	2663	2663	55.73	1634	2663	51.94	819.5	-2663	49.06	548.0	2663	47.37
220	8962	2882	60.11	2682	2882	57.25	1797	2882	53.48	901.4	-2882	50.69	602.8	2882	48.90
240	9777	3204	61.47	2694	3204	58.61	1960	3204	54.83	983.2	-3204	51.95	657.6	3204	50.28
260	10590	3520	62.70	2698	3520	59.84	2123	3520	56.05	1065	-3520	53.18	712.0	3520	51.60
280	11403	3842	63.82	2703	3842	60.95	2286	3842	57.17	1146	-3842	54.30	766.3	3842	52.93
300	12220	4201	64.85	2714	4201	61.98	2450	4201	58.20	1228	-4201	55.33	821.1	4201	53.63

Temp K	P = 20 atm			P = 40 atm			P = 60 atm			P = 80 atm			P = 100 atm		
	v	h	s	v	h	s	v	h	s	v	h	s	v	h	s
15	12.97	-251	5.29	13.30	-221	7.19	13.07	-200	9.91	12.82	-179	6.67	12.60	-157	6.45
20	13.73	-242	7.63	14.25	-174	9.30	13.62	-155	8.92	13.46	-135	8.60	13.17	-115	8.33
25	14.53	-191	9.79	14.55	-114	11.46	14.61	-100	10.91	14.29	-82	10.45	13.88	-62	10.13
30	15.25	-120	12.30	15.55	-39	13.78	15.37	-35	12.92	15.27	-23	12.34	14.77	-8.4	11.88
35	23.96	0	16.01	17.66	-39	13.78	15.37	-35	12.92	15.27	-23	12.34	14.77	-8.4	11.88
40	31.30	223	22.01	21.63	61	16.45	18.28	43	14.90	18.81	46	14.18	15.90	56	13.50
50	55.98	410	28.22	37.31	296	21.70	25.37	231	19.18	21.15	219	17.76	19.03	202	16.86
60	112.7	545	33.74	82.90	473	24.04	34.89	416	22.54	22.54	381	20.33	23.32	354	19.80
70	137.1	676	36.43	95.58	622	27.24	44.22	577	25.04	33.91	545	23.47	28.27	525	22.20
80	160.2	813	38.42	79.22	733	29.11	53.00	728	27.04	40.47	701	25.55	33.36	682	24.39
100	204.8	1072	42.42	102.3	1047	32.28	60.38	1065	30.37	62.91	1005	28.98	43.39	996	27.80
120	245.9	1259	44.70	154.8	1343	34.44	84.00	1320	33.01	64.25	1319	31.69	52.46	1311	30.65
140	287.9	1475	46.30	145.9	1504	37.32	98.53	1656	35.53	74.44	1651	34.25	61.53	1648	32.24
160	329.7	1704	48.09	167.3	1997	39.64	113.31	1993	37.78	86.43	1992	36.82	70.88	1991	35.54
180	371.2	1934	49.44	188.3	2231	41.21	127.5	2231	39.77	97.22	2232	38.53	79.08	2234	37.66
200	412.6	2163	50.67	209.3	2462	42.23	141.6	2462	41.53	107.9	2467	40.29	87.65	2471	39.33
220	453.7	2393	51.70	230.1	2683	44.70	155.6	2689	43.08	118.4	2694	41.85	96.15	3000	40.00
240	494.8	2627	52.67	250.8	2901	46.16	169.5	2906	44.40	128.9	3213	43.24	104.6	3224	42.29
260	535.8	2865	53.56	271.4	3111	47.60	183.3	3118	45.70	139.2	3428	44.49	112.9	3434	43.55
280	576.7	3108	54.43	292.0	3315	48.93	197.1	3323	46.84	149.7	3632	45.63	121.3	3643	44.69
300	617.7	3351	55.28	312.6	3516	50.27	210.9	3528	47.85	160.1	3835	46.67	129.6	3845	45.74

Temp K	P = 140 atm			P = 200 atm			P = 240 atm			P = 300 atm			P = 340 atm		
	v	h	s	v	h	s	v	h	s	v	h	s	v	h	s
20	12.24	-114	6.08	11.81	-50	6.82	11.91	-29	7.01	11.58	-99	6.62	11.36	-131	6.39
25	13.70	-74	7.87	12.18	-12	7.22	11.91	-29	7.01	11.58	-99	6.62	11.36	-131	6.39
30	15.27	-27	9.67	12.62	11	8.92	12.28	72	8.57	11.88	-123	8.12	11.65	-171	7.96
35	16.94	26	11.19	13.12	81	10.44	12.71	119	10.04	12.23	-178	9.23	11.87	-216	9.25
40	18.74	84	12.75	13.69	153	11.83	13.26	171	11.43	12.83	-228	10.37	12.32	-255	10.53
50	18.77	215	15.07	15.08	254	14.53	14.23	286	15.08	15.88	-337	13.29	13.12	-373	13.94
60	19.40	341	16.31	16.11	386	16.87	16.87	418	17.28	16.68	-450	15.52	14.04	-491	15.20
70	22.50	511	20.68	18.63	528	19.09	17.19	548	18.36	18.36	-558	17.61	16.10	-596	17.05
80	25.94	681	23.57	21.54	673	21.06	20.57	720	20.57	20.57	-666	19.36	18.10	-633	18.88
100	32.71	983	28.24	25.25	988	24.54	22.48	998	23.70	19.79	1027	22.71	18.54	1031	22.17

* Data from 15 to 100°K, unpublished data from Cryogenic Engineering Laboratory, National Bureau of Standards, Boulder, Colorado.

Data from 120 to 300°K, published data from National Bureau of Standards, Technical Note 120 (Dec. 1961).

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 degrees Kelvin (°K) to degrees Rankine (°R), multiply (°K) by 1.8.

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

To convert volume (v) in cubic centimeters per gram (cm³/g) to (in³/lb), multiply (cm³/g) by 0.016018.

To convert enthalpy (h) in joules per gram (J/g) to (Btu/lb), multiply (J/g) by 0.23885.

To convert entropy (s) in joules per gram °K (J/g·K) to (Btu/lb·R), multiply (J/g·K) by 0.23885.