UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester/ Supplementary Examination, December 2020

Programme Name: B.Tech- Mechanical   **Semester : III**
Course Name : Thermodynamics   **Time : 03 hrs**
Course Code : MECH2020, MECH 1002   **Max. Marks: 100**

SECTION A

1. **Each Question will carry 5 Marks**
2. **Instruction: Complete the statement / Select the correct answer(s)**

S. No.	Questions	CO
Q 1	Discuss the limitations of second law of thermodynamics. Explain the necessity of third law of thermodynamics	**CO1**
Q 2	Entropy and Exergy is not a _____ *a* _____ Property. Entropy can be _____ *b* _____ .but cannot be _____ *c* _____ Whereas Exergy can be _____ *d* _____ but can't be _____ *e* _____	**CO1**
Q 3	At state 1, superheated water vapor is contained in a sealed glass vial at $T_1 = 200\ ^0C$. You would like to know the pressure at this state, but have no means of measuring it directly. However, when the vial is slowly cooled to state 2, $T_2 = 120\ ^0C$, you notice that droplets of liquid begin to form on the glass walls. Use this information to determine the pressure at state 1.	**CO1**

Q.4 Complete the table below:

State	Pressure (kPa)	Temperature (^0C)	Specific Internal Energy (kJ/kg)	Quality	Specific Volume
1	P_1	7	u_1	0.169	v_1
2	250	T_2	u_2	1	v_2

Fill table in the sequence given below:
P_1 =
u_1 =
v_1 =
T_2 =
u_2 =
v_2 =

CO1

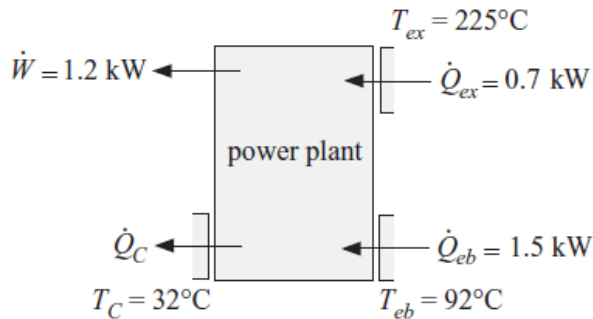| Q.5	A tank with volume *V* has been completely evacuated. What is the exergy of the tank if the surroundings consist of air at temperature T_0 and pressure P_0?	**CO1**
Q.6	Discuss perpetual motion machine of first (PMMI) kind and second (PMMII) kind.	**CO1**

SECTION B

1. **Each question will carry 10 marks**
2. **Instruction: Write short / brief notes**

Q 7	A rigid tank with volume $V = 8000$ cm^3 is filled with water with quality $x_1 = 0.05$ and temperature $T_1 = 140\ ^0$C. a) What is the specific volume (m3/kg) and the pressure (kPa) of the water? b) What is the total mass of water in the tank (kg)? What is the mass of liquid (kg) and the mass of vapor (kg) in the tank? c) What are the volumes of liquid and vapor in the tank (m^3)?	CO2
Q 8	Interpret by using increase in entropy principle that free expansion is an irreversible process? <center>Or</center> Discuss equivalence of Kelvin Plank Statement and Clausius Statement?	CO2
Q.9	In a Brayton cycle based power plant, the air at the inlet is at 27 ^{0}C, 0.1 MPa. The pressure ratio is 6.25and the maximum temperature is 800 ^{0}C. Find efficiency of the cycle.	CO3
Q.10	Design a 1200-W electric hair dryer such that the air temperature and velocity in the dryer will not exceed 50 ^{0}C and 3 m/s, respectively.	CO4
Q.11	An inventor claims to have developed a power cycle capable of delivering a net work output of 410 kJ for an energy input by heat transfer of 1000 kJ. The system undergoing the cycle receives the heat transfer from hot gases at a temperature of 500 K and discharges energy by heat transfer to the atmosphere at 300 K. Evaluate this claim.	CO3

SECTION C

1. **Each Question carries 20 Marks.**
2. **Instruction: Write long answer.**

| Q 12 | Spent steam is exhausted at a rate of $m_s = 2350$ kg/hr from an industrial process at $T_{s,in} = 110$ ^{0}C and $Ps = 1$ atm and is currently condensed and cooled to $T_{s,out} = 40\ ^0$C at constant pressure by heat transfer to cooling water in a heat exchanger. The cooling water enters the heat exchanger at $T_{cw,in} = 12\ ^0$C and $P_{cw} = 1$ atm and exits at $T_{cw,out} = 18\ ^0$C and the same pressure. An engineer in the plant has recognized that this heat exchange process is wasteful and he has proposed an alternative process in which power is generated. He claims that in this alternative process, the temperature and pressures of both streams remain exactly the same as they were in the original process.
a) What is the rate at which exergy is destroyed in the existing process?
b) Do you believe that this alternative process is possible? If so, determine the maximum possible rate that power could be produced.
<center>==OR==</center>

The two places that thermal energy is transferred from a car are through the engine block (to the coolant) and through the exhaust pipe. A company is marketing a device that scavenges heat from your car in order to produce some auxiliary power. The device is shown schematically in figure. | CO4 |

$T_{ex} = 225°C$

$\dot{W} = 1.2$ kW ←

$\dot{Q}_{ex} = 0.7$ kW

power plant

$\dot{Q}_C$ ←

$\dot{Q}_{eb} = 1.5$ kW

$T_C = 32°C$ $T_{eb} = 92°C$

You have been hired to assess the feasibility of this device for some potential investors. The company claims that the device receives $\dot{Q}_{eb} = 1.5$ kW from the engine block and the engine block temperature is $T_{eb} = 92\ ^0C$. The device also receives $\dot{Q}_{ex} = 0.7$ kW from the exhaust pipe and the exhaust pipe temperature is $T_{ex} = 225\ ^0C$. The device rejects heat to surrounding air and is supposed to continue to function as advertised even in climates where the air temperature reaches $T_C = 32\ ^0C$. The company claims that they have measured a power output equal to $\dot{W} = 1.2$ kW under these conditions. The device operates at steady state.

a) Assess the company's claim using the Second Law of Thermodynamics – would you suggest that the investors invest money or not?

b) What is the maximum rate at which the engine can produce power under these conditions?

12.4   Steam Tables

SATURATED STEAM - TEMPERATURE TABLE

T °C	P bar	Spec. vol. m^3=kg Sat. liq. v_f X1000	Sat. vap. v_g	Int. Ener. kJ/kg Sat. liq. u_f	Sat. vap. u_g	Enthalpy kJ/kg Sat. liq. h_f	Sat. vap. h_g	Entropy kJ=(kg°K) Sat. liq. s_f	Sat. vap. s_g
0.01	0.0061	1.0002	206.1	0.01	2376	0.01	2501	0	9.156
4	0.0081	1.0001	157.2	16.79	2381	16.79	2509	0.061	9.051
5	0.0087	1.0001	147.1	21.00	2383	21	2511	0.0762	9.026
6	0.0093	1.0001	137.7	25.21	2384	25.21	2512	0.0912	9.000
8	0.0107	1.0001	120.9	33.61	2387	33.61	2516	0.1212	8.950
10	0.0123	1.0001	106.4	42.01	2389	42.01	2520	0.151	8.901
11	0.0131	1.0007	99.86	46.19	2391	46.19	2522	0.1658	8.876
12	0.0140	1.0007	93.79	50.40	2392	50.4	2523	0.1806	8.852
13	0.0150	1.0007	88.13	54.59	2393	54.59	2525	0.1953	8.828
14	0.0160	1.0007	82.85	58.80	2394	58.8	2527	0.2099	8.805
15	0.0170	1.0007	77.93	62.99	2396	62.99	2529	0.2245	8.781
16	0.0182	1.0013	73.34	67.17	2397	67.17	2531	0.239	8.758
17	0.0194	1.0013	69.05	71.36	2399	71.36	2533	0.2535	8.735
18	0.0206	1.0013	65.04	75.57	2400	75.57	2534	0.2679	8.712
19	0.0220	1.0013	61.30	79.76	2401	79.76	2536	0.2823	8.690
20	0.0234	1.002	57.79	83.94	2403	83.94	2538	0.2966	8.667
21	0.0249	1.002	54.52	88.13	2404	88.13	2540	0.3108	8.645
22	0.0264	1.002	51.45	92.32	2406	92.32	2542	0.3251	8.623
23	0.0281	1.0026	48.58	96.50	2407	96.5	2544	0.3392	8.601
24	0.0298	1.0026	45.89	100.7	2409	100.7	2545	0.3533	8.579
25	0.0317	1.0032	43.36	104.9	2410	104.9	2547	0.3673	8.558
26	0.0336	1.0032	41.00	109.0	2411	109.0	2549	0.3814	8.537
27	0.0357	1.0032	38.78	113.2	2412	113.2	2551	0.3953	8.515
28	0.0378	1.0038	36.69	117.4	2414	117.4	2553	0.4093	8.495
29	0.0401	1.0038	34.73	121.6	2415	121.6	2554	0.4231	8.474
30	0.0425	1.0045	32.90	125.8	2416	125.8	2556	0.4369	8.453
31	0.0450	1.0045	31.17	130.0	2418	130.0	2558	0.4507	8.433
32	0.0476	1.0051	29.54	134.1	2419	134.1	2560	0.4644	8.413
33	0.0503	1.0051	28.01	138.3	2421	138.3	2562	0.478	8.393
34	0.0532	1.0057	26.57	142.5	2422	142.5	2563	0.4917	8.373
35	0.0563	1.0057	25.22	146.7	2423	146.7	2565	0.5053	8.353
36	0.0595	1.0063	23.94	150.8	2425	150.8	2567	0.5188	8.333
38	0.0663	1.007	21.60	159.2	2427	159.2	2571	0.5457	8.295
40	0.0738	1.0076	19.52	167.5	2430	167.5	2574	0.5725	8.257
45	0.0959	1.010	15.26	188.4	2437	188.4	2583	0.6386	8.165
50	0.1235	1.012	12.03	209.3	2443	209.3	2592	0.7037	8.076
55	0.1576	1.015	9.569	230.2	2450	230.2	2601	0.7679	7.991
60	0.1994	1.017	7.671	251.1	2457	251.1	2610	0.8311	7.910
65	0.2503	1.020	6.197	272.0	2463	272.0	2618	0.8934	7.831
70	0.3119	1.023	5.042	293.0	2470	293.0	2627	0.9549	7.755
75	0.3858	1.026	4.131	313.9	2476	313.9	2635	1.016	7.682
80	0.4739	1.029	3.407	334.8	2482	334.9	2644	1.075	7.612

SATURATED STEAM - TEMPERATURE TABLE (Continued)

T °C	P bar	Spec. vol. m³=kg		Int. Ener. kJ/kg		Enthalpy kJ/kg		Entropy kJ=(kg°K)	
		Sat. liq. v_f X1000	Sat. vap. v_g	Sat. liq. u_f	Sat. vap. u_g	Sat. liq. h_f	Sat. vap. h_g	Sat. liq. s_f	Sat. vap. s_g
85	0.5783	1.033	2.828	355.8	2488	355.9	2652	1.134	7.544
90	0.7013	1.036	2.361	376.8	2494	376.9	2660	1.193	7.479
95	0.8455	1.039	1.982	397.9	2501	398.0	2668	1.250	7.416
100	1.013	1.044	1.673	418.9	2507	419.0	2676	1.307	7.355
110	1.433	1.052	1.21	461.1	2518	461.3	2691	1.418	7.239
120	1.985	1.060	0.892	503.5	2529	503.7	2706	1.528	7.130
130	2.701	1.069	0.669	546.0	2540	546.3	2720	1.634	7.027
140	3.613	1.080	0.509	588.7	2550	589.1	2734	1.739	6.930
150	4.758	1.091	0.393	631.7	2559	632.2	2746	1.842	6.838
160	6.178	1.102	0.307	674.9	2568	675.5	2758	1.943	6.750
170	7.916	1.114	0.243	718.3	2576	719.2	2769	2.042	6.666
180	10.02	1.127	0.194	762.1	2584	763.2	2778	2.140	6.586
190	12.54	1.141	0.157	806.2	2589	807.6	2786	2.236	6.508
200	15.54	1.156	0.127	850.6	2596	852.4	2793	2.331	6.432
210	19.06	1.172	0.104	895.5	2600	897.8	2798	2.425	6.358
220	23.18	1.190	0.086	940.8	2603	943.6	2802	2.518	6.286
230	27.95	1.209	0.072	986.7	2603	990.1	2804	2.610	6.215
240	33.44	1.229	0.06	1033	2603	1037.3	2804	2.702	6.144
250	39.73	1.251	0.05	1080	2603	1085.3	2802	2.793	6.073
260	46.88	1.275	0.042	1128	2600	1134.4	2797	2.884	6.002
270	54.98	1.302	0.036	1177	2592	1184.5	2790	2.975	5.930
280	64.11	1.332	0.03	1227	2587	1236.0	2780	3.067	5.857
290	74.36	1.365	0.026	1279	2573	1289.0	2766	3.159	5.782
300	85.81	1.403	0.022	1332	2560	1344.0	2749	3.253	5.704
320	112.7	1.499	0.015	1445	2531	1461.5	2700	3.448	5.536
340	145.9	1.638	0.011	1570	2462	1594.1	2622	3.659	5.336
360	186.5	1.893	0.007	1725	2351	1760.5	2481	3.915	5.053
374.14	220.9	3.155	0.003155	2030	2030	2099.3	2099	4.430	4.430

SATURATED STEAM - PRESSURE TABLE

P bar	T °C	Spec. vol. m³=kg Sat. liq. v_f X1000	Spec. vol. Sat. vap. v_g	Int. Ener. kJ/kg Sat. liq. u_f	Int. Ener. Sat. vap. u_g	Enthalpy kJ/kg Sat. liq. h_f	Enthalpy Sat. vap. h_g	Entropy kJ=(kg°K) Sat. liq. s_f	Entropy Sat. vap. s_g
0.04	28.96	1.004	34.80	121.4	2415	121.4	2554	0.423	8.475
0.06	36.15	1.006	23.75	151.5	2425	151.5	2567	0.521	8.331
0.08	41.5	1.008	18.11	173.8	2432	173.8	2577	0.593	8.229
0.1	45.8	1.010	14.68	191.8	2438	191.8	2585	0.649	8.150
0.2	60.07	1.017	7.649	251.4	2457	251.4	2610	0.832	7.908
0.3	69.11	1.023	5.229	289.2	2468	289.2	2625	0.944	7.769
0.4	75.87	1.026	3.994	317.5	2477	317.6	2637	1.026	7.670
0.5	81.33	1.030	3.240	340.4	2484	340.5	2646	1.091	7.594
0.6	85.94	1.033	2.732	359.8	2490	359.9	2653	1.145	7.532
0.7	89.95	1.036	2.365	376.6	2494	376.7	2660	1.192	7.480
0.8	93.5	1.039	2.087	391.6	2499	391.7	2666	1.233	7.435
0.9	96.71	1.041	1.870	405.1	2503	405.1	2671	1.270	7.395
1	99.62	1.043	1.694	417.3	2506	417.4	2675	1.303	7.359
1.5	111.4	1.053	1.159	466.9	2520	467.1	2694	1.434	7.223
2	120.2	1.061	0.886	504.5	2530	504.7	2707	1.530	7.127
3	133.6	1.073	0.606	561.1	2544	561.5	2725	1.672	6.992
4	143.6	1.084	0.463	604.3	2554	604.8	2739	1.777	6.896
5	151.9	1.093	0.375	639.7	2561	640.2	2749	1.861	6.821
6	158.9	1.101	0.316	669.9	2567	670.6	2757	1.931	6.760
7	165.0	1.108	0.273	696.4	2573	697.2	2764	1.992	6.708
8	170.4	1.115	0.240	720.2	2577	721.1	2769	2.046	6.663
9	175.4	1.121	0.215	741.8	2580	742.8	2774	2.095	6.623
10	179.9	1.127	0.194	761.7	2584	762.8	2778	2.139	6.586
20	212.4	1.177	0.100	906.4	2600	908.8	2800	2.447	6.341
30	233.9	1.217	0.067	1005	2604	1008	2804	2.646	6.187
40	250.4	1.252	0.050	1082	2602	1087	2801	2.796	6.070
50	264.0	1.286	0.039	1148	2597	1154	2794	2.920	5.973
60	275.6	1.319	0.032	1205	2590	1213	2784	3.027	5.889
70	285.9	1.352	0.027	1258	2580	1267	2772	3.121	5.813
80	295.1	1.384	0.024	1306	2570	1317	2758	3.207	5.743
90	303.4	1.418	0.021	1350	2558	1363	2742	3.286	5.677
100	311.1	1.453	0.018	1393	2545	1408	2725	3.360	5.614
110	318.2	1.489	0.016	1434	2530	1450	2706	3.429	5.553
120	324.8	1.527	0.014	1473	2513	1491	2685	3.496	5.492
130	331.0	1.567	0.013	1511	2496	1532	2662	3.561	5.432
140	336.8	1.611	0.012	1549	2477	1571	2638	3.623	5.372
150	342.3	1.658	0.010	1586	2456	1611	2611	3.685	5.310
160	347.4	1.711	0.009	1623	2432	1650	2581	3.746	5.246
170	352.4	1.770	0.008	1660	2405	1690	2547	3.808	5.178
180	357.0	1.839	0.008	1699	2375	1732	2510	3.871	5.105
190	361.5	1.924	0.007	1740	2338	1776	2465	3.938	5.024
200	365.8	2.036	0.006	1786	2295	1826	2411	4.013	4.931
220.9	374.1	3.155	0.003	2030	2029	2099	2099	4.430	4.430

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 0.06 bar				P= 0.35 bar		
T	v	u	h	s	v	u	h	s
80	27.13	2487	2650	8.580	4.625	2484	2646	7.756
100	28.68	2516	2688	8.685	4.895	2513	2684	7.863
120	30.22	2545	2726	8.784	5.163	2542	2723	7.964
160	33.30	2603	2802	8.969	5.696	2601	2801	8.152
200	36.38	2661	2880	9.140	6.228	2660	2878	8.324
240	39.46	2721	2958	9.298	6.757	2720	2957	8.483
280	42.54	2782	3037	9.446	7.286	2781	3036	8.631
320	45.62	2843	3117	9.586	7.814	2843	3116	8.771
360	48.69	2905	3198	9.718	8.341	2905	3197	8.903
400	51.77	2969	3280	9.843	8.872	2969	3279	9.029
450	55.62	3050	3383	9.992	9.532	3049	3383	9.178
500	59.47	3132	3489	10.13	10.19	3132	3489	9.319

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 0.7 bar				P= 1 bar		
T	v	u	h	s	v	u	h	s
100	2.434	2510	2680	7.534	1.695	2506	2676	7.361
120	2.571	2540	2720	7.637	1.793	2537	2717	7.467
160	2.841	2599	2798	7.828	1.984	2598	2796	7.660
200	3.108	2659	2877	8.001	2.172	2658	2875	7.834
240	3.374	2719	2956	8.161	2.359	2719	2954	7.995
280	3.639	2780	3035	8.310	2.545	2780	3034	8.144
320	3.904	2842	3115	8.450	2.730	2842	3115	8.285
360	4.170	2905	3196	8.583	2.917	2904	3196	8.417
400	4.434	2968	3279	8.708	3.102	2968	3278	8.543
450	4.764	3049	3383	8.858	3.334	3049	3382	8.693
500	5.094	3132	3488	8.999	3.565	3132	3488	8.834
550	5.423	3213	3593	9.129	3.796	3216	3596	8.969
600	5.753	3298	3701	9.257	4.027	3302	3705	9.097

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 1.5 bar				P= 3 bar		
T	v	u	h	s	v	u	h	s
120	1.188	2533	2711	7.269	XXX	XXX	XXX	XXX
160	1.317	2595	2793	7.466	0.6506	2587	2782	7.128
200	1.444	2656	2873	7.643	0.7162	2651	2866	7.311
240	1.570	2717	2953	7.805	0.7802	2713	2947	7.477
280	1.694	2779	3033	7.955	0.8438	2775	3029	7.630
320	1.819	2841	3113	8.096	0.9067	2838	3110	7.772
360	1.943	2903	3195	8.229	0.9692	2901	3192	7.906
400	2.067	2967	3277	8.355	1.031	2966	3275	8.033
450	2.221	3048	3382	8.505	1.109	3047	3380	8.183
500	2.376	3131	3488	8.646	1.186	3130	3486	8.325
550	2.530	3216	3595	8.781	1.264	3215	3594	8.460
600	2.684	3302	3704	8.910	1.341	3301	3703	8.589

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kgᵒK)

	P= 5 bar				P= 7 bar			
T	v	u	h	s	v	u	h	s
160	0.3836	2576	2767	6.865	XXX	XXX	XXX	XXX
200	0.4249	2643	2855	7.059	0.2999	2635	2845	6.886
240	0.4644	2708	2940	7.230	0.3292	2702	2932	7.064
280	0.5034	2771	3023	7.386	0.3574	2767	3017	7.223
320	0.5416	2835	3105	7.531	0.3852	2831	3101	7.370
360	0.5795	2899	3188	7.666	0.4125	2896	3185	7.506
400	0.617	2963	3272	7.793	0.4397	2961	3269	7.635
450	0.6642	3045	3377	7.945	0.4735	3043	3375	7.787
500	0.7109	3128	3484	8.087	0.507	3127	3482	7.930
550	0.7575	3213	3592	8.223	0.5405	3212	3590	8.066
600	0.8041	3300	3702	8.352	0.5738	3298	3700	8.195
650	0.8505	3388	3813	8.476	0.6071	3387	3812	8.320
700	0.8969	3477	3926	8.595	0.6403	3477	3925	8.439

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kgᵒK)

	P= 10 bar				P= 15 bar			
T	v	u	h	s	v	u	h	s
200	0.2059	2622	2828	6.694	0.1325	2598	2797	6.455
240	0.2275	2693	2920	6.882	0.1482	2677	2899	6.663
280	0.248	2760	3008	7.046	0.1627	2749	2993	6.838
320	0.2678	2826	3094	7.196	0.1765	2817	3082	6.994
360	0.2873	2892	3179	7.335	0.1899	2884	3169	7.136
400	0.3066	2957	3264	7.465	0.203	2951	3256	7.269
450	0.3304	3040	3371	7.618	0.2192	3035	3364	7.424
500	0.3541	3124	3478	7.762	0.2352	3120	3473	7.570
550	0.3776	3210	3587	7.899	0.251	3206	3583	7.707
600	0.4011	3297	3698	8.029	0.2668	3294	3694	7.838
650	0.4245	3385	3810	8.153	0.2825	3383	3806	7.964
700	0.4478	3475	3923	8.273	0.2981	3473	3920	8.084

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kgᵒK)

	P= 20 bar				P= 30 bar			
T	v	u	h	s	v	u	h	s
240	0.1084	2660	2876	6.495	0.0682	2620	2824	6.226
280	0.12	2736	2976	6.683	0.0771	2710	2941	6.446
320	0.1308	2808	3069	6.845	0.085	2788	3043	6.624
360	0.1411	2877	3159	6.992	0.0923	2862	3139	6.780
400	0.1512	2945	3248	7.127	0.0994	2933	3231	6.921
450	0.1635	3030	3357	7.284	0.1079	3020	3344	7.083
500	0.1757	3116	3468	7.432	0.1162	3108	3456	7.234
550	0.1877	3203	3578	7.570	0.1244	3196	3569	7.375
600	0.1996	3291	3690	7.702	0.1324	3285	3682	7.508
650	0.2114	3380	3803	7.828	0.1404	3375	3796	7.636
700	0.2232	3471	3917	7.949	0.1484	3466	3912	7.757

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 40 bar				P= 60 bar		
T	v	u	h	s	v	u	h	s
280	0.0555	2680	2902	6.257	0.0332	2605	2804	5.925
320	0.062	2767	3015	6.455	0.0387	2720	2952	6.184
360	0.0679	2846	3117	6.621	0.0433	2811	3071	6.378
400	0.0734	2920	3213	6.769	0.0474	2893	3177	6.541
450	0.08	3010	3330	6.936	0.0521	2989	3302	6.719
500	0.0864	3100	3445	7.090	0.0567	3082	3422	6.880
550	0.0927	3189	3560	7.233	0.061	3175	3541	7.029
600	0.0988	3279	3674	7.369	0.0653	3267	3658	7.168
650	0.1049	3370	3790	7.497	0.0694	3360	3776	7.299
700	0.1109	3462	3906	7.620	0.0735	3453	3894	7.423
750	0.1169	3556	4023	7.737	0.0776	3547	4013	7.542

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 80 bar				P= 100 bar		
T	v	u	h	s	v	u	h	s
320	0.0268	2663	2877	5.949	0.0193	2588	2781	5.710
360	0.0309	2773	3020	6.182	0.0233	2729	2962	6.006
400	0.0343	2864	3138	6.363	0.0264	2832	3096	6.212
450	0.0382	2966	3272	6.555	0.0297	2944	3241	6.419
500	0.0417	3065	3398	6.724	0.0328	3046	3374	6.597
550	0.0451	3160	3521	6.878	0.0356	3145	3501	6.756
600	0.0485	3254	3642	7.020	0.0384	3241	3625	6.903
650	0.0517	3349	3762	7.154	0.041	3338	3748	7.040
700	0.0548	3444	3882	7.281	0.0436	3434	3870	7.169
750	0.0579	3540	4003	7.402	0.0461	3532	3993	7.291

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 120 bar				P= 140 bar		
T	v	u	h	s	v	u	h	s
360	0.0181	2678	2896	5.836	0.0142	2618	2816	5.660
400	0.0211	2798	3051	6.075	0.0172	2761	3002	5.945
450	0.0241	2919	3208	6.300	0.0201	2893	3174	6.192
500	0.0268	3027	3348	6.487	0.0225	3007	3322	6.390
550	0.0293	3129	3480	6.653	0.0247	3113	3459	6.562
600	0.0316	3229	3608	6.804	0.0268	3216	3591	6.717
650	0.0339	3327	3734	6.944	0.0288	3316	3720	6.860
700	0.0361	3425	3858	7.075	0.0307	3416	3846	6.994
750	0.0382	3524	3982	7.199	0.0326	3515	3972	7.120
800	0.0403	3611	4095	7.305	0.0344	3604	4085	7.227

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 160 bar				P= 180 bar		
T	v	u	h	s	v	u	h	s
360	0.0111	2538	2716	5.461	0.0081	2418	2564	5.192
400	0.0143	2719	2948	5.817	0.0119	2673	2887	5.689
450	0.017	2866	3138	6.091	0.0146	2837	3100	5.995
500	0.0193	2986	3295	6.301	0.0168	2965	3267	6.218
550	0.0213	3097	3438	6.480	0.0187	3079	3416	6.405
600	0.0232	3202	3573	6.640	0.0204	3188	3556	6.570
650	0.025	3305	3705	6.786	0.0221	3292	3690	6.719
700	0.0267	3407	3834	6.922	0.0236	3397	3821	6.858
750	0.0284	3507	3961	7.050	0.0251	3499	3951	6.988
800	0.03	3608	4088	7.171	0.0266	3600	4079	7.110

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 200 bar				P= 240 bar		
T	v	u	h	s	v	u	h	s
400	0.0099	2620	2818	5.554	0.0067	2479	2639	5.239
450	0.0127	2806	3060	5.902	0.0098	2738	2973	5.720
500	0.0148	2942	3238	6.140	0.0117	2897	3178	5.994
550	0.0166	3061	3393	6.335	0.0134	3026	3347	6.207
600	0.0182	3174	3538	6.505	0.0148	3145	3501	6.387
650	0.0197	3281	3675	6.658	0.0161	3259	3645	6.548
700	0.0211	3387	3809	6.799	0.0174	3366	3784	6.695
750	0.0225	3490	3940	6.931	0.0186	3473	3919	6.830
800	0.0239	3592	4070	7.054	0.0197	3579	4052	6.957
900	0.0264	3782	4310	7.267	0.0219	3787	4312	7.189

SUPERHEATED STEAM

v in m³=kg, u in kJ/kg, h in kJ/kg, s in kJ=(kg°K)

	P= 280 bar				P= 320 bar		
T	v	u	h	s	v	u	h	s
400	0.0038	2224	2331	4.749	0.0024	1979	2056	4.324
450	0.0076	2662	2875	5.537	0.006	2572	2764	5.346
500	0.0096	2845	3114	5.857	0.0079	2794	3047	5.725
550	0.0111	2989	3300	6.090	0.0094	2950	3251	5.981
600	0.0124	3116	3463	6.282	0.0106	3085	3425	6.186
650	0.0136	3234	3614	6.451	0.0117	3209	3583	6.363
700	0.0147	3347	3758	6.603	0.0127	3326	3733	6.520
750	0.0158	3455	3898	6.742	0.0137	3438	3876	6.664
800	0.0168	3563	4033	6.872	0.0146	3548	4015	6.797
900	0.0187	3775	4299	7.108	0.0163	3763	4285	7.037

SATURATED STEAM - TEMPERATURE TABLE

T °F	P psi	Spec. vol. ft^3=lbm		Int. Ener. BTU/lbm		Enthalpy BTU/lbm		Entropy BTU=(lbm^{o}R)	
		Sat. liq. v_f X100	Sat. vap. v_g	Sat. liq. u_f	Sat. vap. u_g	Sat. liq. h_f	Sat. vap. h_g	Sat. liq. s_f	Sat. vap. s_g
32.018	0.0887	1.5	3305	0	1021	0	1075	0.0000	2.187
35	0.0999	1.602	2948	3	1022	3	1077	0.0061	2.176
40	0.1217	1.602	2445	8.02	1024	8.02	1079	0.0162	2.159
45	0.1475	1.602	2037	13.04	1026	13.04	1081	0.0262	2.142
50	0.1781	1.602	1704	18.06	1027	18.06	1083	0.0361	2.126
60	0.2563	1.603	1207	28.08	1030	28.08	1088	0.0555	2.094
70	0.3632	1.605	867.6	38.09	1034	38.09	1092	0.0746	2.064
80	0.5073	1.607	632.7	48.08	1037	48.08	1096	0.0933	2.036
90	0.6989	1.61	467.6	58.07	1040	58.07	1101	0.1116	2.008
100	0.9503	1.613	350.0	68.05	1043	68.05	1105	0.1296	1.982
110	1.276	1.617	265.1	78.02	1047	78.02	1109	0.1473	1.957
120	1.695	1.62	203.0	87.98	1050	87.99	1114	0.1647	1.934
130	2.225	1.625	157.2	97.97	1053	97.98	1118	0.1817	1.911
140	2.892	1.629	122.9	108.0	1056	108.0	1122	0.1985	1.889
150	3.722	1.634	96.98	118.0	1059	118.0	1126	0.2150	1.868
160	4.745	1.639	77.23	128.0	1062	128.0	1130	0.2313	1.848
170	5.997	1.645	62.02	138.0	1065	138.0	1134	0.2473	1.829
180	7.515	1.651	50.20	148.0	1068	148.0	1138	0.2631	1.811
190	9.344	1.657	40.94	158.0	1071	158.0	1142	0.2787	1.793
200	11.53	1.663	33.63	168.0	1074	168.1	1146	0.2940	1.776
210	14.13	1.67	27.81	178.1	1077	178.1	1150	0.3091	1.760
212	14.70	1.672	26.80	180.1	1078	180.2	1150	0.3121	1.757
220	17.19	1.677	23.15	188.2	1080	188.2	1153	0.3241	1.744
230	20.78	1.685	19.39	198.3	1083	198.3	1157	0.3388	1.729
240	24.97	1.692	16.33	208.4	1085	208.4	1161	0.3533	1.714
250	29.82	1.7	13.83	218.5	1088	218.6	1164	0.3677	1.700
260	35.42	1.708	11.77	228.6	1090	228.8	1168	0.3819	1.686
270	41.85	1.717	10.07	238.8	1093	239.0	1171	0.3960	1.673
280	49.19	1.726	8.650	249.0	1095	249.2	1174	0.4099	1.660
290	57.53	1.735	7.466	259.3	1098	259.4	1177	0.4236	1.648

SATURATED STEAM - TEMPERATURE TABLE (Continued)

T °F	P psi	Spec. vol. ft³=lbm Sat. liq. v_f X100	Sat. vap. v_g	Int. Ener. BTU/lbm Sat. liq. u_f	Sat. vap. u_g	Enthalpy BTU/lbm Sat. liq. h_f	Sat. vap. h_g	Entropy BTU=(lbm°R) Sat. liq. s_f	Sat. vap. s_g
300	66.98	1.745	6.472	269.5	1100	269.7	1180	0.4372	1.636
310	77.64	1.755	5.632	279.8	1102	280.1	1183	0.4507	1.624
320	89.60	1.765	4.919	290.1	1104	290.4	1186	0.4640	1.612
330	103.0	1.776	4.312	300.5	1106	300.8	1188	0.4772	1.601
340	117.9	1.787	3.792	310.9	1108	311.3	1191	0.4903	1.590
350	134.5	1.799	3.346	321.4	1110	321.8	1193	0.5033	1.579
360	152.9	1.811	2.961	331.8	1111	332.4	1195	0.5162	1.569
370	173.2	1.823	2.628	342.4	1113	343.0	1197	0.5289	1.558
380	195.6	1.836	2.339	353.0	1114	353.6	1199	0.5416	1.548
390	220.2	1.85	2.087	363.6	1116	364.3	1201	0.5542	1.538
400	247.1	1.864	1.866	374.3	1117	375.1	1202	0.5667	1.528
410	276.5	1.878	1.673	385.0	1118	386.0	1203	0.5792	1.519
420	308.5	1.894	1.502	395.8	1118	396.9	1204	0.5915	1.509
430	343.3	1.909	1.352	406.7	1119	407.9	1205	0.6038	1.500
440	381.2	1.926	1.219	417.6	1119	419.0	1205	0.6161	1.490
450	422.1	1.943	1.101	428.6	1120	430.2	1206	0.6282	1.481
460	466.3	1.961	0.9961	439.7	1120	441.4	1206	0.6404	1.471
470	514.1	1.98	0.9025	450.9	1119	452.8	1205	0.6525	1.462
480	565.5	2	0.8187	462.2	1119	464.3	1205	0.6646	1.452
490	620.7	2.021	0.7436	473.6	1118	475.9	1204	0.6767	1.443
500	680.0	2.043	0.6761	485.1	1117	487.7	1202	0.6888	1.434
520	811.4	2.091	0.5605	508.5	1115	511.7	1199	0.7130	1.414
540	961.5	2.145	0.4658	532.6	1111	536.4	1194	0.7374	1.395
560	1132	2.207	0.3877	557.4	1106	562.0	1187	0.7620	1.375
580	1324	2.278	0.3225	583.1	1099	588.6	1178	0.7872	1.354
600	1541	2.363	0.2677	609.9	1090	616.7	1166	0.8130	1.332
620	1784	2.465	0.2209	638.3	1078	646.4	1151	0.8398	1.308
640	2057	2.593	0.1805	668.7	1063	678.6	1132	0.8681	1.280
660	2362	2.766	0.1446	702.2	1042	714.3	1106	0.8990	1.248
680	2705	3.032	0.1113	741.7	1011	756.9	1067	0.9350	1.207
700	3090	3.664	0.0747	801.8	949.2	822.8	991.9	0.9894	1.137
705.44	3204	5.053	0.0505	872.5	872.5	902.5	902.5	1.058	1.058

SATURATED STEAM - PRESSURE TABLE

P psi	T °F	Spec. vol. ft³=lbm		Int. Ener. BTU/lbm		Enthalpy BTU/lbm		Entropy BTU=(lbm°R)	
		Sat. liq. v_f X100	Sat. vap. v_g	Sat. liq. u_f	Sat. vap. u_g	Sat. liq. h_f	Sat. vap. h_g	Sat. liq. s_f	Sat. vap. s_g
1	101.7	1.614	333.8	69.72	1044	69.72	1106	0.1326	1.978
2	126.0	1.623	173.8	94	1052	94.01	1116	0.1750	1.920
3	141.4	1.63	118.7	109.4	1057	109.4	1123	0.2009	1.886
4	152.9	1.636	90.64	120.9	1060	120.9	1127	0.2198	1.862
5	162.2	1.641	73.53	130.1	1063	130.2	1131	0.2349	1.844
6	170.0	1.645	61.99	138.0	1065	138.0	1134	0.2474	1.829
8	182.8	1.653	47.35	150.8	1069	150.8	1139	0.2675	1.806
10	193.2	1.659	38.42	161.2	1072	161.2	1143	0.2836	1.788
14.696	212.0	1.672	26.80	180.1	1078	180.1	1150	0.3121	1.757
15	213.0	1.672	26.30	181.1	1078	181.2	1151	0.3137	1.755
20	228.0	1.683	20.09	196.2	1082	196.3	1156	0.3358	1.732
25	240.1	1.692	16.31	208.4	1085	208.5	1161	0.3535	1.714
30	250.3	1.7	13.75	218.8	1088	218.9	1164	0.3682	1.700
35	259.3	1.708	11.90	227.9	1090	228.0	1167	0.3809	1.687
40	267.3	1.715	10.50	236.0	1092	236.2	1170	0.3921	1.677
45	274.5	1.721	9.403	243.4	1094	243.5	1172	0.4022	1.667
50	281.0	1.727	8.518	250.1	1096	250.2	1174	0.4113	1.659
55	287.1	1.732	7.789	256.3	1097	256.5	1176	0.4196	1.651
60	292.7	1.738	7.177	262.1	1098	262.3	1178	0.4273	1.644
65	298.0	1.743	6.657	267.5	1100	267.7	1180	0.4345	1.638
70	303.0	1.748	6.209	272.6	1101	272.8	1181	0.4412	1.632
75	307.6	1.752	5.818	277.4	1102	277.6	1182	0.4475	1.627
80	312.1	1.757	5.475	281.9	1103	282.2	1184	0.4534	1.621
85	316.3	1.761	5.170	286.3	1103	286.6	1185	0.4591	1.617
90	320.3	1.766	4.899	290.5	1104	290.8	1186	0.4644	1.612
95	324.2	1.77	4.655	294.5	1105	294.8	1187	0.4695	1.608
100	327.9	1.774	4.434	298.3	1106	298.6	1188	0.4744	1.603
110	334.8	1.781	4.051	305.5	1107	305.9	1190	0.4835	1.596

SATURATED STEAM - PRESSURE TABLE (Continued)

P psi	T °F	Spec. vol. ft³=lbm		Int. Ener. BTU/lbm		Enthalpy BTU/lbm		Entropy BTU=(lbm°R)	
		Sat. liq. v_f X100	Sat. vap. v_g	Sat. liq. u_f	Sat. vap. u_g	Sat. liq. h_f	Sat. vap. h_g	Sat. liq. s_f	Sat. vap. s_g
120	341.3	1.789	3.730	312.3	1108	312.7	1191	0.4920	1.589
130	347.4	1.796	3.457	318.6	1109	319.0	1193	0.4999	1.582
140	353.1	1.802	3.221	324.6	1110	325.1	1194	0.5073	1.576
150	358.5	1.809	3.016	330.2	1111	330.7	1195	0.5142	1.570
160	363.6	1.815	2.836	335.6	1112	336.2	1196	0.5208	1.565
170	368.5	1.821	2.676	340.8	1113	341.3	1197	0.5270	1.560
180	373.1	1.827	2.533	345.7	1113	346.3	1198	0.5329	1.555
190	377.6	1.833	2.405	350.4	1114	351.0	1199	0.5386	1.551
200	381.9	1.839	2.289	354.9	1115	355.6	1199	0.5440	1.546
250	401.0	1.865	1.845	375.4	1117	376.2	1202	0.5680	1.527
300	417.4	1.89	1.544	393.0	1118	394.1	1204	0.5883	1.512
350	431.8	1.912	1.327	408.7	1119	409.9	1205	0.6061	1.498
400	444.7	1.934	1.162	422.8	1119	424.2	1205	0.6218	1.486
450	456.4	1.955	1.033	435.7	1120	437.4	1206	0.6360	1.475
500	467.1	1.975	0.9283	447.7	1119	449.5	1205	0.6490	1.464
550	477.1	1.994	0.8423	458.9	1119	460.9	1205	0.6611	1.455
600	486.3	2.013	0.7702	469.4	1119	471.7	1204	0.6723	1.446
700	503.2	2.051	0.6558	488.9	1117	491.5	1202	0.6927	1.430
800	518.4	2.087	0.5691	506.6	1115	509.7	1199	0.7110	1.416
900	532.1	2.123	0.5009	523.0	1113	526.6	1196	0.7278	1.403
1000	544.8	2.159	0.4459	538.4	1110	542.4	1192	0.7432	1.390
1200	567.4	2.232	0.3623	566.7	1103	571.7	1184	0.7712	1.367
1400	587.2	2.307	0.3016	592.6	1096	598.6	1174	0.7964	1.346
1600	605.1	2.386	0.2552	616.9	1087	624.0	1163	0.8196	1.326
1800	621.2	2.472	0.2183	640.1	1078	648.3	1150	0.8414	1.306
2000	636.0	2.565	0.1881	662.4	1067	671.9	1136	0.8623	1.286
2500	668.3	2.86	0.1307	717.6	1031	730.8	1092	0.9130	1.233
3000	695.5	3.432	0.0842	783.5	969.7	802.6	1016	0.9728	1.159
3203.6	705.4	5.053	0.0505	872.5	872.5	902.5	903	1.0580	1.058

SUPERHEATED STEAM

v in ft^3=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm^{o}R)

	P= 1 psi				P= 5 psi			
T	v	u	h	s	v	u	h	s
200	392.5	1077	1150	2.051	78.15	1076	1149	1.871
240	416.4	1091	1168	2.077	83.00	1090	1167	1.899
280	440.3	1105	1187	2.103	87.83	1104	1186	1.924
320	464.2	1119	1205	2.127	92.64	1118	1204	1.949
360	488.1	1133	1223	2.150	97.45	1132	1223	1.972
400	511.9	1147	1242	2.172	102.2	1147	1241	1.994
450	541.7	1165	1265	2.198	108.2	1164	1265	2.021
500	571.5	1183	1289	2.223	114.2	1183	1288	2.046
550	601.3	1201	1312	2.248	120.2	1201	1312	2.070
600	631.1	1219	1336	2.271	126.1	1219	1336	2.093
650	660.9	1238	1360	2.293	132.1	1238	1360	2.115
700	690.6	1257	1384	2.314	138.1	1256	1384	2.137
750	720.5	1276	1409	2.335	144.0	1275	1409	2.157
800	750.3	1295	1434	2.355	150.0	1295	1434	2.177
850	780.1	1314	1459	2.374	156.0	1314	1458	2.197
900	809.9	1334	1484	2.393	161.9	1334	1484	2.216
950	839.7	1354	1509	2.412	167.9	1354	1509	2.234
1000	869.4	1374	1535	2.429	173.9	1374	1535	2.252
1100	929.0	1415	1587	2.464	185.8	1415	1587	2.286
1200	988.6	1457	1640	2.497	197.7	1457	1640	2.319
1400	1108	1543	1748	2.558	221.5	1543	1748	2.381

SUPERHEATED STEAM

v in ft^3=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm^{o}R)

	P= 10 psi				P= 14.696 psi			
T	v	u	h	s	v	u	h	s
200	38.85	1075	1147	1.793	XXX	XXX	XXX	XXX
240	41.32	1089	1165	1.821	28.00	1088	1164	1.776
280	43.77	1103	1184	1.847	29.69	1102	1183	1.803
320	46.20	1118	1203	1.871	31.36	1117	1202	1.828
360	48.62	1132	1222	1.895	33.02	1131	1221	1.852
400	51.03	1146	1241	1.917	34.67	1146	1240	1.874
450	54.04	1164	1264	1.944	36.72	1164	1264	1.901
500	57.03	1182	1288	1.969	38.77	1182	1287	1.926
550	60.02	1200	1312	1.993	40.81	1200	1311	1.950
600	63.01	1219	1335	2.016	42.84	1219	1335	1.974
650	66.02	1237	1360	2.039	44.90	1237	1359	1.996
700	69.01	1256	1384	2.060	46.93	1256	1384	2.018
750	71.99	1275	1409	2.081	48.96	1275	1408	2.038
800	74.97	1295	1433	2.101	51.00	1294	1433	2.058
850	77.96	1314	1458	2.120	53.03	1314	1458	2.078
900	80.94	1334	1483	2.139	55.06	1334	1483	2.097
950	83.92	1354	1509	2.158	57.09	1354	1509	2.115
1000	86.90	1374	1535	2.175	59.12	1374	1534	2.133
1100	92.87	1415	1587	2.210	63.18	1415	1586	2.167
1200	98.83	1457	1639	2.243	67.24	1456	1639	2.200
1400	110.7	1543	1748	2.305	75.35	1543	1748	2.262
1600	122.7	1630	1857	2.360	83.46	1633	1860	2.319

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm°R)

	P= 20 psi				P= 40 psi			
T	v	u	h	s	v	u	h	s
240	20.48	1087	1162	1.741	XXX	XXX	XXX	XXX
280	21.73	1101	1182	1.768	10.71	1097	1177	1.686
320	22.98	1116	1201	1.793	11.36	1113	1197	1.712
360	24.20	1131	1220	1.817	12.00	1128	1217	1.737
400	25.43	1145	1239	1.840	12.62	1143	1236	1.761
450	26.94	1163	1263	1.866	13.39	1162	1261	1.788
500	28.45	1181	1287	1.892	14.16	1180	1285	1.814
550	29.95	1200	1311	1.916	14.93	1199	1309	1.839
600	31.47	1218	1335	1.940	15.69	1217	1333	1.862
650	32.97	1237	1359	1.962	16.44	1236	1358	1.885
700	34.47	1256	1383	1.983	17.20	1255	1382	1.906
750	35.96	1275	1408	2.004	17.94	1274	1407	1.927
800	37.45	1294	1433	2.024	18.70	1294	1432	1.947
850	38.95	1314	1458	2.044	19.45	1313	1457	1.967
900	40.44	1333	1483	2.063	20.20	1333	1482	1.986
950	41.94	1353	1509	2.081	20.94	1353	1508	2.004
1000	43.43	1374	1534	2.099	21.69	1373	1534	2.022
1100	46.41	1415	1586	2.133	23.19	1414	1586	2.057
1200	49.40	1456	1639	2.166	24.68	1456	1639	2.090
1400	55.36	1543	1748	2.228	27.67	1543	1748	2.152
1600	61.32	1633	1860	2.285	30.65	1633	1860	2.209

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm°R)

	P= 60 psi				P= 80 psi			
T	v	u	h	s	v	u	h	s
320	7.485	1109	1193	1.663	5.544	1106	1188	1.627
360	7.923	1125	1213	1.689	5.886	1123	1210	1.654
400	8.352	1141	1234	1.713	6.216	1139	1231	1.679
450	8.877	1160	1258	1.741	6.618	1158	1256	1.708
500	9.399	1179	1283	1.768	7.017	1177	1281	1.735
550	9.914	1197	1308	1.793	7.407	1196	1306	1.760
600	10.42	1216	1332	1.816	7.794	1215	1331	1.784
650	10.93	1235	1357	1.839	8.178	1234	1355	1.807
700	11.44	1254	1381	1.861	8.560	1254	1380	1.829
750	11.94	1274	1406	1.882	8.942	1273	1405	1.850
800	12.44	1293	1431	1.902	9.321	1292	1430	1.870
850	12.94	1313	1456	1.922	9.700	1312	1456	1.890
900	13.45	1333	1482	1.941	10.08	1332	1481	1.909
950	13.95	1353	1507	1.959	10.45	1352	1507	1.927
1000	14.45	1373	1533	1.977	10.83	1372	1533	1.945
1100	15.45	1414	1585	2.012	11.58	1413	1585	1.980
1200	16.45	1456	1638	2.045	12.33	1455	1638	2.013
1400	18.45	1542	1747	2.107	13.83	1542	1747	2.075
1600	20.44	1633	1860	2.164	15.32	1633	1859	2.132
1800	22.43	1727	1976	2.218	16.82	1727	1975	2.186
2000	24.40	1824	2095	2.268	18.31	1824	2095	2.237

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmºR)

	P= 100 psi				P= 120 psi		
T	v	u	h	s	v	u	h	s
360	4.661	1120	1206	1.626	3.844	1117	1202	1.602
400	4.934	1136	1228	1.652	4.078	1134	1224	1.629
450	5.262	1156	1254	1.681	4.358	1154	1251	1.659
500	5.587	1176	1279	1.708	4.633	1174	1277	1.687
550	5.903	1195	1304	1.734	4.900	1194	1303	1.713
600	6.216	1214	1329	1.758	5.163	1213	1328	1.737
650	6.526	1233	1354	1.781	5.424	1233	1353	1.760
700	6.832	1253	1379	1.803	5.680	1252	1378	1.782
750	7.140	1272	1404	1.824	5.939	1271	1403	1.804
800	7.445	1292	1430	1.845	6.195	1291	1429	1.824
850	7.750	1312	1455	1.865	6.449	1311	1454	1.844
900	8.053	1331	1480	1.884	6.703	1331	1480	1.863
950	8.355	1352	1506	1.902	6.956	1351	1506	1.882
1000	8.657	1372	1532	1.920	7.208	1371	1532	1.900
1100	9.260	1413	1584	1.955	7.711	1413	1584	1.935
1200	9.861	1455	1638	1.988	8.213	1455	1637	1.968
1400	11.06	1542	1747	2.050	9.214	1542	1746	2.030
1600	12.26	1632	1859	2.108	10.21	1632	1859	2.087
1800	13.45	1726	1975	2.161	11.21	1726	1975	2.141
2000	14.65	1824	2095	2.212	12.21	1824	2095	2.192

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmºR)

	P= 140 psi				P= 160 psi		
T	v	u	h	s	v	u	h	s
360	3.259	1114	1198	1.581	XXX	XXX	XXX	XXX
400	3.466	1131	1221	1.609	3.006	1129	1218	1.591
450	3.712	1152	1249	1.640	3.227	1151	1246	1.623
500	3.952	1173	1275	1.668	3.440	1171	1273	1.652
550	4.184	1193	1301	1.694	3.646	1191	1299	1.678
600	4.412	1212	1326	1.719	3.848	1211	1325	1.703
650	4.636	1232	1352	1.742	4.046	1231	1351	1.727
700	4.860	1251	1377	1.765	4.243	1250	1376	1.749
750	5.081	1271	1402	1.786	4.438	1270	1401	1.771
800	5.301	1291	1428	1.807	4.631	1290	1427	1.792
850	5.520	1310	1453	1.827	4.824	1310	1453	1.812
900	5.739	1330	1479	1.846	5.015	1330	1478	1.831
950	5.956	1351	1505	1.865	5.206	1350	1504	1.850
1000	6.173	1371	1531	1.883	5.397	1371	1530	1.868
1100	6.605	1412	1584	1.918	5.776	1412	1583	1.903
1200	7.036	1455	1637	1.951	6.154	1454	1637	1.936
1400	7.895	1542	1746	2.013	6.906	1541	1746	1.998
1600	8.752	1632	1859	2.070	7.656	1632	1859	2.056
1800	9.607	1726	1975	2.124	8.405	1726	1975	2.109
2000	10.46	1823	2094	2.175	9.153	1823	2094	2.160

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmºR)

T	P= 180 psi				P= 200 psi			
	v	u	h	s	v	u	h	s
400	2.648	1126	1214	1.575	2.361	1123	1211	1.560
450	2.849	1149	1243	1.608	2.547	1146	1241	1.594
500	3.042	1170	1271	1.637	2.724	1168	1269	1.624
550	3.228	1190	1297	1.664	2.893	1189	1296	1.651
600	3.409	1210	1324	1.689	3.058	1209	1322	1.677
650	3.587	1230	1349	1.713	3.219	1229	1348	1.701
700	3.763	1250	1375	1.736	3.379	1249	1374	1.723
750	3.937	1269	1401	1.757	3.537	1269	1400	1.745
800	4.110	1289	1426	1.778	3.693	1289	1425	1.766
850	4.282	1309	1452	1.798	3.848	1309	1451	1.786
900	4.453	1329	1478	1.817	4.003	1329	1477	1.805
950	4.623	1350	1504	1.836	4.157	1349	1503	1.824
1000	4.793	1370	1530	1.854	4.310	1370	1529	1.843
1100	5.131	1412	1583	1.889	4.614	1411	1582	1.878
1200	5.467	1454	1636	1.923	4.918	1454	1636	1.911
1400	6.137	1541	1746	1.985	5.521	1541	1745	1.973
1600	6.804	1632	1858	2.043	6.123	1632	1858	2.031
1800	7.470	1726	1975	2.096	6.722	1726	1974	2.085
2000	8.135	1823	2094	2.147	7.321	1823	2094	2.135

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmºR)

T	P= 225 psi				P= 250 psi			
	v	u	h	s	v	u	h	s
400	2.073	1120	1206	1.543	XXX	XXX	XXX	XXX
450	2.244	1144	1237	1.578	2.001	1141	1234	1.563
500	2.405	1166	1266	1.609	2.150	1164	1263	1.595
550	2.558	1187	1294	1.637	2.290	1185	1291	1.623
600	2.707	1207	1320	1.662	2.426	1206	1318	1.649
650	2.851	1228	1346	1.687	2.557	1227	1345	1.674
700	2.995	1248	1372	1.710	2.688	1247	1371	1.697
750	3.136	1268	1398	1.731	2.816	1267	1397	1.719
800	3.276	1288	1424	1.752	2.943	1287	1423	1.740
850	3.415	1308	1450	1.773	3.068	1307	1449	1.760
900	3.553	1328	1476	1.792	3.193	1328	1475	1.780
950	3.690	1349	1502	1.811	3.317	1348	1502	1.799
1000	3.827	1369	1529	1.829	3.440	1369	1528	1.817
1100	4.098	1411	1582	1.864	3.685	1410	1581	1.852
1200	4.369	1453	1635	1.898	3.929	1453	1635	1.886
1400	4.906	1541	1745	1.960	4.414	1540	1745	1.948
1600	5.441	1631	1858	2.018	4.896	1631	1858	2.006
1800	5.975	1725	1974	2.072	5.376	1725	1974	2.060
2000	6.507	1823	2094	2.122	5.856	1823	2094	2.111

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmºR)

	P= 275 psi				P= 300 psi			
T	v	u	h	s	v	u	h	s
450	1.802	1138	1230	1.549	1.636	1135	1226	1.537
500	1.941	1162	1260	1.582	1.766	1159	1258	1.570
550	2.071	1184	1289	1.611	1.888	1182	1287	1.600
600	2.196	1205	1316	1.638	2.004	1203	1314	1.627
650	2.317	1225	1343	1.662	2.116	1224	1342	1.652
700	2.436	1246	1370	1.686	2.227	1245	1368	1.675
750	2.554	1266	1396	1.708	2.335	1265	1395	1.697
800	2.670	1286	1422	1.729	2.442	1285	1421	1.719
850	2.784	1307	1448	1.749	2.548	1306	1447	1.739
900	2.898	1327	1474	1.769	2.653	1326	1474	1.759
950	3.011	1347	1501	1.788	2.757	1347	1500	1.778
1000	3.124	1368	1527	1.806	2.860	1368	1526	1.796
1100	3.348	1410	1580	1.842	3.066	1410	1580	1.832
1200	3.570	1453	1634	1.875	3.270	1452	1634	1.865
1400	4.011	1540	1744	1.938	3.675	1540	1744	1.928
1600	4.450	1631	1857	1.995	4.078	1631	1857	1.986
1800	4.887	1725	1974	2.049	4.479	1725	1973	2.040
2000	5.323	1822	2093	2.100	4.879	1822	2093	2.090

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmºR)

	P= 350 psi				P= 400 psi			
T	v	u	h	s	v	u	h	s
450	1.373	1129	1218	1.512	1.175	1123	1210	1.490
500	1.491	1155	1251	1.548	1.284	1150	1245	1.528
550	1.600	1178	1282	1.579	1.383	1175	1277	1.561
600	1.702	1200	1311	1.607	1.476	1197	1307	1.589
650	1.801	1222	1338	1.632	1.565	1219	1335	1.615
700	1.897	1243	1365	1.656	1.650	1240	1363	1.640
750	1.992	1263	1392	1.679	1.734	1261	1390	1.663
800	2.085	1284	1419	1.700	1.816	1282	1417	1.684
850	2.176	1304	1445	1.721	1.897	1303	1443	1.705
900	2.267	1325	1472	1.741	1.978	1324	1470	1.725
950	2.357	1346	1498	1.760	2.057	1345	1497	1.745
1000	2.446	1367	1525	1.779	2.136	1365	1524	1.763
1100	2.624	1409	1579	1.814	2.292	1408	1577	1.799
1200	2.799	1451	1633	1.848	2.446	1451	1632	1.833
1400	3.148	1539	1743	1.911	2.752	1539	1742	1.896
1600	3.494	1630	1856	1.968	3.055	1630	1856	1.954
1800	3.838	1724	1973	2.022	3.357	1724	1973	2.008
2000	4.182	1822	2093	2.073	3.658	1822	2092	2.058

SUPERHEATED STEAM

v in ft^3=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm^{o}R)

	P= 450 psi				P= 500 psi			
T	v	u	h	s	v	u	h	s
500	1.123	1145	1239	1.510	0.992	1140	1232	1.492
550	1.214	1171	1272	1.544	1.079	1167	1267	1.528
600	1.299	1194	1302	1.573	1.158	1191	1298	1.558
650	1.380	1217	1332	1.600	1.233	1214	1328	1.586
700	1.458	1238	1360	1.625	1.304	1236	1357	1.611
750	1.534	1259	1387	1.648	1.373	1258	1385	1.635
800	1.608	1280	1414	1.670	1.441	1279	1412	1.657
850	1.681	1301	1441	1.691	1.507	1300	1439	1.678
900	1.752	1322	1468	1.711	1.572	1321	1467	1.699
950	1.824	1343	1495	1.731	1.637	1342	1494	1.718
1000	1.894	1364	1522	1.749	1.701	1363	1521	1.737
1100	2.034	1407	1576	1.785	1.827	1406	1575	1.773
1200	2.172	1450	1631	1.819	1.952	1449	1630	1.807
1400	2.444	1538	1742	1.882	2.198	1538	1741	1.870
1600	2.715	1629	1855	1.940	2.442	1629	1855	1.929
1800	2.983	1724	1972	1.994	2.684	1723	1972	1.983
2000	3.252	1821	2092	2.045	2.926	1821	2092	2.034

SUPERHEATED STEAM

v in ft^3=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm^{o}R)

	P= 600 psi				P= 700 psi			
T	v	u	h	s	v	u	h	s
500	0.7946	1128	1216	1.459	XXX	XXX	XXX	XXX
550	0.8748	1158	1255	1.499	0.7274	1149	1243	1.472
600	0.9452	1185	1289	1.532	0.7926	1178	1280	1.508
650	1.011	1209	1321	1.561	0.8520	1203	1313	1.539
700	1.073	1232	1351	1.587	0.9073	1227	1344	1.566
750	1.132	1254	1379	1.611	0.9595	1250	1374	1.591
800	1.190	1275	1408	1.634	1.011	1272	1403	1.614
850	1.247	1297	1435	1.656	1.060	1294	1431	1.637
900	1.302	1318	1463	1.677	1.109	1316	1459	1.658
950	1.357	1340	1490	1.696	1.157	1337	1487	1.678
1000	1.411	1361	1518	1.716	1.204	1359	1515	1.697
1100	1.517	1404	1573	1.752	1.296	1402	1570	1.734
1200	1.622	1448	1628	1.786	1.387	1446	1626	1.768
1400	1.829	1536	1739	1.850	1.565	1535	1738	1.832
1600	2.033	1628	1854	1.908	1.741	1627	1853	1.891
1800	2.236	1723	1971	1.962	1.915	1722	1970	1.945
2000	2.438	1820	2091	2.013	2.089	1819	2090	1.996

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm°R)

	P= 800 psi				P= 1000 psi			
T	v	u	h	s	v	u	h	s
550	0.6154	1139	1230	1.447	0.4534	1115	1199	1.397
600	0.6773	1170	1270	1.486	0.5138	1154	1249	1.445
650	0.7324	1197	1306	1.519	0.5637	1185	1289	1.482
700	0.7829	1222	1338	1.547	0.6080	1212	1325	1.514
750	0.8304	1246	1369	1.573	0.6490	1237	1357	1.541
800	0.8759	1268	1398	1.597	0.6877	1261	1388	1.566
850	0.9208	1291	1427	1.619	0.7248	1284	1419	1.590
900	0.9640	1313	1456	1.641	0.7607	1307	1448	1.612
950	1.006	1335	1484	1.661	0.7961	1330	1477	1.633
1000	1.048	1357	1512	1.681	0.8305	1352	1506	1.653
1100	1.130	1401	1568	1.718	0.8976	1397	1563	1.691
1200	1.210	1445	1624	1.753	0.9630	1441	1620	1.726
1400	1.367	1534	1737	1.817	1.090	1532	1734	1.791
1600	1.522	1626	1851	1.875	1.215	1624	1849	1.850
1800	1.675	1721	1969	1.930	1.338	1719	1967	1.905
2000	1.827	1819	2089	1.981	1.460	1818	2088	1.956

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm°R)

	P= 1250 psi				P= 1500 psi			
T	v	u	h	s	v	u	h	s
600	0.3786	1129	1217	1.395	0.2816	1097	1175	1.342
650	0.4267	1167	1266	1.441	0.3329	1147	1239	1.401
700	0.4670	1198	1306	1.477	0.3716	1183	1287	1.443
750	0.5028	1226	1342	1.507	0.4049	1214	1327	1.477
800	0.5364	1252	1376	1.534	0.4350	1242	1363	1.506
850	0.5680	1276	1408	1.559	0.4630	1268	1396	1.532
900	0.5983	1300	1438	1.582	0.4897	1293	1428	1.556
950	0.6276	1323	1469	1.604	0.5153	1317	1460	1.579
1000	0.6561	1346	1498	1.624	0.5400	1340	1490	1.600
1100	0.7114	1392	1557	1.663	0.5875	1387	1550	1.640
1200	0.7649	1438	1614	1.699	0.6332	1433	1609	1.677
1400	0.8690	1529	1730	1.765	0.7211	1526	1726	1.743
1600	0.9699	1622	1846	1.824	0.8061	1620	1844	1.803
1800	1.069	1718	1965	1.879	0.8897	1716	1963	1.858
2000	1.167	1816	2086	1.930	0.9724	1814	2084	1.910

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmᵒR)

	P= 1750 psi				P= 2000 psi		
T	v	u	h	s	v	u	h	s
650	0.2626	1122	1208	1.360	0.2056	1091	1167	1.314
700	0.3022	1167	1265	1.411	0.2487	1148	1240	1.378
750	0.3342	1201	1309	1.449	0.2805	1187	1291	1.422
800	0.3622	1231	1349	1.480	0.3072	1220	1334	1.456
850	0.3878	1259	1384	1.508	0.3312	1249	1372	1.486
900	0.4117	1285	1418	1.533	0.3534	1277	1408	1.513
950	0.4348	1310	1451	1.557	0.3744	1303	1441	1.537
1000	0.4569	1334	1482	1.579	0.3943	1328	1474	1.560
1100	0.4990	1382	1544	1.620	0.4325	1377	1537	1.602
1200	0.5391	1429	1604	1.657	0.4685	1425	1599	1.640
1400	0.6158	1523	1723	1.725	0.5368	1520	1719	1.708
1600	0.6895	1618	1841	1.785	0.6020	1615	1838	1.769
1800	0.7616	1714	1960	1.840	0.6656	1712	1958	1.825
2000	0.8330	1812	2082	1.892	0.7284	1811	2080	1.877

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmᵒR)

	P= 2500 psi				P= 3000 psi		
T	v	u	h	s	v	u	h	s
700	0.1684	1099	1177	1.307	0.0976	1004	1058	1.194
750	0.2030	1155	1249	1.369	0.1483	1115	1197	1.312
800	0.2292	1196	1302	1.411	0.1757	1168	1265	1.368
850	0.2513	1230	1346	1.446	0.1973	1208	1317	1.408
900	0.2712	1260	1385	1.475	0.2160	1242	1362	1.441
950	0.2896	1288	1422	1.502	0.2329	1273	1402	1.470
1000	0.3070	1315	1457	1.526	0.2485	1302	1440	1.497
1100	0.3392	1367	1524	1.570	0.2772	1356	1510	1.543
1200	0.3695	1417	1588	1.610	0.3035	1408	1577	1.585
1400	0.4261	1514	1711	1.680	0.3523	1508	1704	1.657
1600	0.4795	1611	1833	1.742	0.3978	1606	1827	1.720
1800	0.5312	1708	1954	1.799	0.4416	1704	1950	1.777
2000	0.5820	1807	2076	1.851	0.4844	1804	2073	1.829

SUPERHEATED STEAM

v in ft³=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbmᵒR)

	P= 3500 psi				P= 4000 psi		
T	v	u	h	s	v	u	h	s
750	0.1046	1058	1126	1.244	0.0633	960.6	1007	1.139
800	0.1363	1135	1223	1.323	0.1053	1095	1173	1.274
850	0.1582	1183	1286	1.372	0.1283	1156	1251	1.335
900	0.1763	1222	1337	1.410	0.1462	1201	1310	1.379
950	0.1922	1256	1381	1.442	0.1616	1239	1359	1.414
1000	0.2067	1288	1421	1.470	0.1752	1273	1403	1.445
1100	0.2328	1345	1496	1.519	0.1996	1334	1482	1.497
1200	0.2566	1399	1565	1.562	0.2213	1390	1554	1.542
1400	0.2997	1502	1696	1.637	0.2603	1496	1688	1.619
1600	0.3395	1602	1822	1.701	0.2959	1597	1816	1.684
1800	0.3776	1701	1945	1.758	0.3296	1697	1941	1.742
2000	0.4147	1801	2069	1.811	0.3625	1797	2066	1.795

SUPERHEATED STEAM

v in ft^3=lbm, u in BTU/lbm, h in BTU/lbm, s in BTU=(lbm^{o}R)

T	\multicolumn{4}{c}{P= 5000 psi}	\multicolumn{4}{c}{P= 6000 psi}
	v	u	h	s	v	u	h	s
750	0.0336	821.4	852.6	1.005	0.0298	788.6	821.7	0.9747
800	0.0594	987.4	1042	1.158	0.0394	897.0	940.7	1.071
850	0.0856	1093	1172	1.260	0.0582	1019	1083	1.182
900	0.1039	1155	1251	1.319	0.0759	1103	1187	1.260
950	0.1185	1202	1312	1.363	0.0901	1162	1262	1.314
1000	0.1313	1242	1363	1.399	0.1021	1209	1322	1.356
1100	0.1530	1311	1452	1.458	0.1222	1286	1422	1.422
1200	0.1720	1372	1531	1.507	0.1393	1353	1507	1.475
1400	0.2052	1483	1673	1.588	0.1685	1470	1658	1.561
1600	0.2348	1588	1805	1.655	0.1942	1579	1794	1.631
1800	0.2626	1690	1933	1.714	0.2180	1682	1925	1.691
2000	0.2895	1791	2059	1.768	0.2409	1784	2052	1.745