

## SATURATED WATER TABLES (Temperature)<sup>†</sup>

| Temp<br>°F | Press<br>psia | Specific Volume |        | Enthalpy |          |        | Internal Energy |        | Entropy |        |
|------------|---------------|-----------------|--------|----------|----------|--------|-----------------|--------|---------|--------|
|            |               | $v_f$           | $v_g$  | $h_f$    | $h_{fg}$ | $h_g$  | $u_f$           | $u_g$  | $s_f$   | $s_g$  |
| 32.018     | .08866        | .016022         | 3302.  | 0.01     | 1075.4   | 1075.4 | .00             | 1021.2 | .00000  | 2.1869 |
| 40         | .12166        | .016020         | 2445.  | 8.02     | 1070.9   | 1078.9 | 8.02            | 1023.9 | .01617  | 2.1592 |
| 60         | .2563         | .016035         | 1206.9 | 28.08    | 1059.6   | 1087.7 | 28.08           | 1030.4 | .05555  | 2.0943 |
| 80         | .5073         | .016073         | 632.8  | 48.09    | 1048.3   | 1096.4 | 48.08           | 1037.0 | .09332  | 2.0356 |
| 100        | 0.9503        | .016130         | 350.0  | 68.05    | 1037.0   | 1105.0 | 68.04           | 1043.5 | .12963  | 1.9822 |
| 120        | 1.6945        | .016205         | 203.0  | 88.00    | 1025.5   | 1113.5 | 87.99           | 1049.9 | .16465  | 1.9336 |
| 140        | 2.892         | .016293         | 122.88 | 107.96   | 1014.0   | 1121.9 | 107.95          | 1056.2 | .19851  | 1.8892 |
| 160        | 4.745         | .016395         | 77.23  | 127.96   | 1002.2   | 1130.1 | 127.94          | 1062.3 | .23130  | 1.8484 |
| 180        | 7.515         | .016509         | 50.20  | 147.99   | 990.2    | 1138.2 | 147.97          | 1068.3 | .26311  | 1.8109 |
| 200        | 11.529        | .016634         | 33.63  | 168.07   | 977.9    | 1145.9 | 168.04          | 1074.2 | .29400  | 1.7762 |
| 212        | 14.698        | .016716         | 26.80  | 180.16   | 970.3    | 1150.5 | 180.11          | 1077.6 | .31213  | 1.7567 |
| 220        | 17.188        | .016772         | 23.15  | 188.22   | 965.3    | 1153.5 | 188.17          | 1079.8 | .32406  | 1.7441 |
| 240        | 24.97         | .016922         | 16.327 | 208.44   | 952.3    | 1160.7 | 208.36          | 1085.3 | .35335  | 1.7143 |
| 260        | 35.42         | .017084         | 11.768 | 228.76   | 938.8    | 1167.6 | 228.64          | 1090.5 | .38193  | 1.6864 |
| 280        | 49.18         | .017259         | 8.650  | 249.18   | 924.9    | 1174.1 | 249.02          | 1095.4 | .40986  | 1.6602 |
| 300        | 66.98         | .017448         | 6.472  | 269.73   | 910.4    | 1180.2 | 269.52          | 1100.0 | .43720  | 1.6356 |
| 320        | 89.60         | .017652         | 4.919  | 290.43   | 895.3    | 1185.8 | 290.14          | 1104.2 | .46400  | 1.6123 |
| 340        | 117.93        | .017872         | 3.792  | 311.30   | 879.5    | 1190.8 | 310.91          | 1108.0 | .49031  | 1.5901 |
| 360        | 152.92        | .018108         | 2.961  | 332.35   | 862.9    | 1195.2 | 331.84          | 1111.4 | .51617  | 1.5688 |
| 380        | 195.60        | .018363         | 2.339  | 353.62   | 845.4    | 1199.0 | 352.95          | 1114.3 | .54163  | 1.5483 |
| 400        | 247.1         | .018638         | 1.8661 | 375.12   | 826.8    | 1202.0 | 374.27          | 1116.6 | .56672  | 1.5284 |
| 420        | 308.5         | .018936         | 1.5024 | 396.89   | 807.2    | 1204.1 | 395.81          | 1118.3 | .59152  | 1.5091 |
| 440        | 381.2         | .019260         | 1.2192 | 418.98   | 786.3    | 1205.3 | 417.62          | 1119.3 | .61605  | 1.4900 |
| 460        | 466.3         | .019614         | 0.9961 | 441.4    | 764.1    | 1205.5 | 439.7           | 1119.6 | .6404   | 1.4712 |
| 480        | 565.5         | .020002         | 0.8187 | 464.3    | 740.3    | 1204.6 | 462.2           | 1118.9 | .6646   | 1.4524 |
| 500        | 680.0         | .02043          | .6761  | 487.7    | 714.8    | 1202.5 | 485.1           | 1117.4 | .6888   | 1.4335 |
| 520        | 811.4         | .02091          | .5605  | 511.7    | 687.3    | 1198.9 | 508.5           | 1114.8 | .7130   | 1.4145 |
| 540        | 961.5         | .02145          | .4658  | 536.4    | 657.5    | 1193.8 | 532.6           | 1111.0 | .7374   | 1.3950 |
| 560        | 1131.8        | .02207          | .3877  | 562.0    | 625.0    | 1187.0 | 557.4           | 1105.8 | .7620   | 1.3749 |
| 580        | 1324.3        | .02278          | .3225  | 588.6    | 589.3    | 1178.0 | 583.1           | 1098.9 | .7872   | 1.3540 |
| 600        | 1541.0        | .02363          | .2677  | 616.7    | 549.7    | 1166.4 | 609.9           | 1090.0 | .8130   | 1.3317 |
| 620        | 1784.4        | .02465          | .2209  | 646.4    | 505.0    | 1151.4 | 638.3           | 1078.5 | .8398   | 1.3075 |
| 640        | 2057.1        | .02593          | .1805  | 678.6    | 453.4    | 1131.9 | 668.7           | 1063.2 | .8681   | 1.2803 |
| 660        | 2362.         | .02767          | .14459 | 714.4    | 391.1    | 1105.5 | 702.3           | 1042.3 | .8990   | 1.2483 |
| 680        | 2705.         | .03032          | .11127 | 756.9    | 309.8    | 1066.7 | 741.7           | 1011.0 | .9350   | 1.2068 |
| 700        | 3090.         | .03666          | .07438 | 822.7    | 167.5    | 990.2  | 801.7           | 947.7  | 0.9902  | 1.1346 |
| 705.44     | 3204.         | .05053          | .05053 | 902.5    | 0.0      | 902.5  | 872.6           | 872.6  | 1.0580  | 1.0580 |

Enthalpy:  $h$  [Btu/lbm]

$$h \equiv u + pv$$

Entropy:  $s$  [Btu/lbm·°R]

$$1 \text{ Watt} = 3.4121 \text{ Btu/hr}$$

Internal energy:  $u$  [Btu/lbm]

$$1 \text{ Btu} = 778.16 \text{ ft}\cdot\text{lb}_f$$

Specific volume:  $v$  [ft<sup>3</sup>/lbm]

$$1 \text{ Btu/lbm} = 2.326 \text{ kW}\cdot\text{sec/kg}$$

<sup>†</sup> J.H. Keenan, F.G. Keyes *et al.*, Steam Tables, John Wiley and Sons, NY, 1969 [QC311.S79]

## SATURATED WATER TABLES (Pressure)

| Press<br>psia | Temp<br>°F | Specific Volume |        | Enthalpy |          |        | Internal Energy |        | Entropy |        |
|---------------|------------|-----------------|--------|----------|----------|--------|-----------------|--------|---------|--------|
|               |            | $v_f$           | $v_g$  | $h_f$    | $h_{fg}$ | $h_g$  | $u_f$           | $u_g$  | $s_f$   | $s_g$  |
| 1             | 101.70     | .016136         | 333.6  | 69.74    | 1036.0   | 1105.8 | 69.74           | 1044.0 | .13266  | 1.9779 |
| 5             | 162.21     | .016407         | 73.53  | 130.17   | 1000.9   | 1131.0 | 130.15          | 1063.0 | .23486  | 1.8441 |
| 10            | 193.19     | .016590         | 38.42  | 161.23   | 982.1    | 1143.3 | 161.20          | 1072.2 | .28358  | 1.7877 |
| 14.696        | 211.99     | .016715         | 26.80  | 180.15   | 970.4    | 1150.5 | 180.10          | 1077.6 | .31212  | 1.7567 |
| 20            | 227.96     | .016830         | 20.09  | 196.26   | 960.1    | 1156.4 | 196.19          | 1082.0 | .33580  | 1.7320 |
| 40            | 267.26     | .017146         | 10.501 | 236.16   | 933.8    | 1170.0 | 236.03          | 1092.3 | .39214  | 1.6767 |
| 60            | 292.73     | .017378         | 7.177  | 262.25   | 915.8    | 1178.0 | 262.06          | 1098.3 | .42733  | 1.6444 |
| 80            | 312.07     | .017570         | 5.474  | 282.21   | 901.4    | 1183.6 | 281.95          | 1102.6 | .45344  | 1.6214 |
| 100           | 327.86     | .017736         | 4.434  | 298.61   | 889.2    | 1187.8 | 298.28          | 1105.8 | .47439  | 1.6034 |
| 200           | 381.86     | .018387         | 2.289  | 355.6    | 843.7    | 1199.3 | 354.9           | 1114.6 | .5440   | 1.5464 |
| 300           | 417.43     | .018896         | 1.5442 | 394.1    | 809.8    | 1203.9 | 393.0           | 1118.2 | .5883   | 1.5115 |
| 400           | 444.70     | .019340         | 1.1620 | 424.2    | 781.2    | 1205.5 | 422.8           | 1119.5 | .6218   | 1.4856 |
| 500           | 467.13     | .019748         | .9283  | 449.5    | 755.8    | 1205.3 | 447.7           | 1119.4 | .6490   | 1.4645 |
| 600           | 486.33     | .02013          | .7702  | 471.7    | 732.4    | 1204.1 | 469.4           | 1118.6 | .6723   | 1.4464 |
| 700           | 503.23     | .02051          | .6558  | 491.5    | 710.5    | 1202.0 | 488.9           | 1117.0 | .6927   | 1.4305 |
| 800           | 518.36     | .02087          | .5691  | 509.7    | 689.6    | 1199.3 | 506.6           | 1115.0 | .7110   | 1.4160 |
| 900           | 532.12     | .02123          | .5009  | 526.6    | 669.5    | 1196.0 | 523.0           | 1112.6 | .7277   | 1.4027 |
| 1000          | 544.75     | .02159          | .4459  | 542.4    | 650.0    | 1192.4 | 538.4           | 1109.9 | .7432   | 1.3903 |
| 1100          | 556.45     | .02195          | .4005  | 557.4    | 631.0    | 1188.3 | 552.9           | 1106.8 | .7576   | 1.3786 |
| 1200          | 567.37     | .02232          | .3623  | 571.7    | 612.3    | 1183.9 | 566.7           | 1103.5 | .7712   | 1.3673 |
| 1300          | 577.60     | .02269          | .3297  | 585.4    | 593.8    | 1179.2 | 579.9           | 1099.8 | .7841   | 1.3565 |
| 1400          | 587.25     | .02307          | .3016  | 598.6    | 575.5    | 1174.1 | 592.7           | 1096.0 | .7964   | 1.3461 |
| 1500          | 596.39     | .02346          | .2769  | 611.5    | 557.2    | 1168.7 | 605.0           | 1091.8 | .8082   | 1.3359 |
| 1600          | 605.06     | .02386          | .2552  | 624.0    | 538.9    | 1162.9 | 616.9           | 1087.4 | .8196   | 1.3258 |
| 1700          | 613.32     | .02428          | .2358  | 636.2    | 520.6    | 1156.9 | 628.6           | 1082.7 | .8307   | 1.3159 |
| 1800          | 621.21     | .02472          | .2183  | 648.3    | 502.1    | 1150.4 | 640.0           | 1077.7 | .8414   | 1.3060 |
| 1900          | 628.76     | .02517          | .2025  | 660.1    | 483.4    | 1143.5 | 651.3           | 1072.3 | .8519   | 1.2961 |
| 2000          | 636.00     | .02565          | .18813 | 671.9    | 464.4    | 1136.3 | 662.4           | 1066.6 | .8623   | 1.2861 |
| 2100          | 642.95     | .02616          | .17491 | 683.6    | 445.0    | 1128.5 | 673.4           | 1060.6 | .8725   | 1.2760 |
| 2200          | 649.64     | .02670          | .16270 | 695.3    | 425.0    | 1120.3 | 684.4           | 1054.0 | .8826   | 1.2657 |
| 2300          | 656.09     | .02728          | .15133 | 707.0    | 404.4    | 1111.4 | 695.4           | 1047.0 | .8927   | 1.2551 |
| 2400          | 662.31     | .02791          | .14067 | 718.8    | 383.0    | 1101.8 | 706.4           | 1039.3 | .9028   | 1.2441 |
| 2500          | 668.31     | .02860          | .13059 | 730.9    | 360.5    | 1091.4 | 717.7           | 1031.0 | .9131   | 1.2327 |
| 2600          | 674.11     | .02938          | .12099 | 743.3    | 336.7    | 1080.0 | 729.2           | 1021.8 | .9236   | 1.2205 |
| 2700          | 679.73     | .03027          | .11172 | 756.2    | 311.1    | 1067.4 | 741.1           | 1011.5 | .9345   | 1.2075 |
| 2800          | 685.16     | .03131          | .10264 | 770.0    | 283.0    | 1053.0 | 753.8           | 999.8  | .9460   | 1.1932 |
| 2900          | 690.42     | .03260          | .09353 | 785.1    | 251.1    | 1036.2 | 767.6           | 986.0  | .9586   | 1.1769 |
| 3000          | 695.52     | .03431          | .08404 | 802.5    | 213.0    | 1015.5 | 783.4           | 968.8  | .9732   | 1.1575 |
| 3100          | 700.47     | .03701          | .07322 | 825.4    | 161.5    | 986.8  | 804.2           | 944.8  | .9924   | 1.1316 |
| 3203.6        | 705.44     | .05053          | .05053 | 902.5    | 0.0      | 902.5  | 872.6           | 872.6  | 1.0580  | 1.0580 |

For steam quality  $x$ , the enthalpy is:  $h_x = h_f + x(h_g - h_f) = h_f + x h_{fg}$   
 Similar expressions for specific volume ( $v_x$ ), internal energy ( $u_x$ ) and entropy ( $s_x$ ).

$$^{\circ}\text{R} = ^{\circ}\text{F} + 460$$

$$^{\circ}\text{K} = ^{\circ}\text{C} + 273$$

## SUPERHEATED STEAM TABLES

| Pressure (psia)<br>(T <sub>sat</sub> ) |   | Temperature (°F) |        |        |        |        |        |        |        |        |        |        |        |
|--|---|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|  |   | 250              | 300    | 350    | 400    | 450    | 500    | 600    | 700    | 800    | 900    | 1000   | 1100   |
| 14.696<br>(211.99)                     | v | 28.42            | 30.52  | 32.60  | 34.67  | 36.72  | 38.77  | 42.86  | 46.93  | 51.00  | 55.07  | 59.13  | 63.19  |
|  | h | 1168.8           | 1192.6 | 1216.3 | 1239.9 | 1263.6 | 1287.3 | 1335.2 | 1383.8 | 1433.1 | 1483.4 | 1534.5 | 1586.4 |
|  | u | 1091.5           | 1109.6 | 1127.6 | 1145.6 | 1163.7 | 1181.8 | 1218.6 | 1256.1 | 1294.4 | 1333.6 | 1373.7 | 1414.6 |
|  | s | 1.7832           | 1.8157 | 1.8458 | 1.8741 | 1.9008 | 1.9263 | 1.9737 | 2.0175 | 2.0584 | 2.0967 | 2.1330 | 2.1674 |
| 100<br>(327.86)                        | v | .                | .      | 4.592  | 4.934  | 5.265  | 5.587  | 6.216  | 6.834  | 7.445  | 8.053  | 8.657  | 9.260  |
|  | h | .                | .      | 1200.4 | 1227.5 | 1253.6 | 1279.1 | 1329.3 | 1379.2 | 1429.6 | 1480.5 | 1532.1 | 1584.5 |
|  | u | .                | .      | 1115.4 | 1136.2 | 1156.2 | 1175.7 | 1214.2 | 1252.8 | 1291.8 | 1331.5 | 1371.9 | 1413.1 |
|  | s | .                | .      | 1.6191 | 1.6517 | 1.6812 | 1.7085 | 1.7582 | 1.8033 | 1.8449 | 1.8838 | 1.9204 | 1.9551 |
| 200<br>(381.86)                        | v | .                | .      | .      | 2.361  | 2.548  | 2.724  | 3.058  | 3.379  | 3.693  | 4.003  | 4.310  | 4.615  |
|  | h | .                | .      | .      | 1210.8 | 1240.7 | 1268.8 | 1322.1 | 1373.8 | 1425.3 | 1477.1 | 1529.3 | 1582.2 |
|  | u | .                | .      | .      | 1123.5 | 1146.4 | 1168.0 | 1208.9 | 1248.8 | 1288.6 | 1328.9 | 1369.8 | 1411.4 |
|  | s | .                | .      | .      | 1.5600 | 1.5938 | 1.6239 | 1.6767 | 1.7234 | 1.7660 | 1.8055 | 1.8425 | 1.8776 |
| 300<br>(417.43)                        | v | .                | .      | .      | .      | 1.6361 | 1.7662 | 2.004  | 2.227  | 2.442  | 2.653  | 2.860  | 3.066  |
|  | h | .                | .      | .      | .      | 1226.2 | 1257.5 | 1314.5 | 1368.3 | 1421.0 | 1473.6 | 1526.5 | 1579.8 |
|  | u | .                | .      | .      | .      | 1135.4 | 1159.5 | 1203.2 | 1244.6 | 1285.4 | 1326.3 | 1367.7 | 1409.6 |
|  | s | .                | .      | .      | .      | 1.5365 | 1.5701 | 1.6266 | 1.6751 | 1.7187 | 1.7589 | 1.7964 | 1.8317 |
| 400<br>(444.70)                        | v | .                | .      | .      | .      | 1.1745 | 1.2843 | 1.4760 | 1.6503 | 1.8163 | 1.9776 | 2.136  | 2.292  |
|  | h | .                | .      | .      | .      | 1209.6 | 1245.2 | 1306.6 | 1362.5 | 1416.6 | 1470.1 | 1523.6 | 1577.4 |
|  | u | .                | .      | .      | .      | 1122.6 | 1150.1 | 1197.3 | 1240.4 | 1282.1 | 1323.7 | 1365.5 | 1407.8 |
|  | s | .                | .      | .      | .      | 1.4901 | 1.5282 | 1.5892 | 1.6397 | 1.6844 | 1.7252 | 1.7632 | 1.7989 |
| 500<br>(467.13)                        | v | .                | .      | .      | .      | .      | 0.9924 | 1.1583 | 1.3040 | 1.4407 | 1.5723 | 1.7008 | 1.8271 |
|  | h | .                | .      | .      | .      | .      | 1231.5 | 1298.3 | 1356.7 | 1412.1 | 1466.5 | 1520.7 | 1575.1 |
|  | u | .                | .      | .      | .      | .      | 1139.7 | 1191.1 | 1236.0 | 1278.8 | 1321.0 | 1363.3 | 1406.0 |
|  | s | .                | .      | .      | .      | .      | 1.4923 | 1.5585 | 1.6112 | 1.6571 | 1.6987 | 1.7371 | 1.7731 |
| 600<br>(486.33)                        | v | .                | .      | .      | .      | .      | 0.7947 | 0.9456 | 1.0727 | 1.1900 | 1.3021 | 1.4108 | 1.5173 |
|  | h | .                | .      | .      | .      | .      | 1216.2 | 1289.5 | 1350.6 | 1407.6 | 1462.9 | 1517.8 | 1572.7 |
|  | u | .                | .      | .      | .      | .      | 1128.0 | 1184.5 | 1231.5 | 1275.4 | 1318.4 | 1361.2 | 1404.2 |
|  | s | .                | .      | .      | .      | .      | 1.4592 | 1.5320 | 1.5872 | 1.6343 | 1.6766 | 1.7155 | 1.7519 |
| 700<br>(503.23)                        | v | .                | .      | .      | .      | .      | .      | 0.7929 | 0.9073 | 1.0109 | 1.1089 | 1.2036 | 1.2960 |
|  | h | .                | .      | .      | .      | .      | .      | 1280.2 | 1344.4 | 1402.9 | 1459.3 | 1514.9 | 1570.2 |
|  | u | .                | .      | .      | .      | .      | .      | 1177.5 | 1226.9 | 1272.0 | 1315.6 | 1358.9 | 1402.4 |
|  | s | .                | .      | .      | .      | .      | .      | 1.5081 | 1.5661 | 1.6145 | 1.6576 | 1.6970 | 1.7337 |
| 800<br>(518.36)                        | v | .                | .      | .      | .      | .      | .      | 0.6776 | 0.7829 | 0.8764 | 0.9640 | 1.0482 | 1.1300 |
|  | h | .                | .      | .      | .      | .      | .      | 1270.4 | 1338.0 | 1398.2 | 1455.6 | 1511.9 | 1567.8 |
|  | u | .                | .      | .      | .      | .      | .      | 1170.1 | 1222.1 | 1268.5 | 1312.9 | 1356.7 | 1400.5 |
|  | s | .                | .      | .      | .      | .      | .      | 1.4861 | 1.5471 | 1.5969 | 1.6408 | 1.6807 | 1.7178 |
| 900<br>(532.12)                        | v | .                | .      | .      | .      | .      | .      | 0.5871 | 0.6859 | 0.7717 | 0.8513 | 0.9273 | 1.0009 |
|  | h | .                | .      | .      | .      | .      | .      | 1260.0 | 1331.4 | 1393.4 | 1451.9 | 1508.9 | 1565.4 |
|  | u | .                | .      | .      | .      | .      | .      | 1162.2 | 1217.1 | 1264.9 | 1310.1 | 1354.5 | 1398.7 |
|  | s | .                | .      | .      | .      | .      | .      | 1.4652 | 1.5297 | 1.5810 | 1.6257 | 1.6662 | 1.7036 |
| 1000<br>(544.75)                       | v | .                | .      | .      | .      | .      | .      | 0.5140 | 0.6080 | 0.6878 | 0.7610 | 0.8305 | 0.8976 |
|  | h | .                | .      | .      | .      | .      | .      | 1248.8 | 1324.6 | 1388.5 | 1448.1 | 1505.9 | 1562.9 |
|  | u | .                | .      | .      | .      | .      | .      | 1153.7 | 1212.0 | 1261.2 | 1307.3 | 1352.2 | 1396.8 |
|  | s | .                | .      | .      | .      | .      | .      | 1.4450 | 1.5135 | 1.5664 | 1.6120 | 1.6530 | 1.6908 |

## SUPERHEATED STEAM TABLES (cont'd)<sup>†</sup>

| Pressure (psia)<br>(T <sub>sat</sub> ) |   | Temperature (°F) |        |        |        |        |        |        |        |        |        |        |        |
|--|---|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|  |   | 600              | 700    | 800    | 900    | 1000   | 1100   | 1200   | 1300   | 1400   | 1600   | 1800   | 2000   |
| 1100<br>(556.45)                       | v | 0.4532           | 0.5441 | 0.6190 | 0.6871 | 0.7513 | 0.8131 | 0.8731 | 0.9319 | 0.9898 | 1.1037 | 1.2161 | 1.3276 |
|  | h | 1236.7           | 1317.5 | 1383.5 | 1444.3 | 1502.8 | 1560.4 | 1617.6 | 1674.8 | 1732.2 | 1848.2 | 1966.3 | 2087.0 |
|  | u | 1144.5           | 1206.7 | 1257.5 | 1304.4 | 1349.9 | 1394.9 | 1439.9 | 1485.1 | 1530.7 | 1623.5 | 1718.8 | 1816.7 |
|  | s | 1.4252           | 1.4982 | 1.5529 | 1.5993 | 1.6409 | 1.6790 | 1.7146 | 1.7481 | 1.7798 | 1.8390 | 1.8937 | 1.9449 |
| 1200<br>(567.37)                       | v | 0.4017           | 0.4906 | 0.5617 | 0.6255 | 0.6853 | 0.7426 | 0.7982 | 0.8525 | 0.9059 | 1.0107 | 1.1141 | 1.2167 |
|  | h | 1223.6           | 1310.2 | 1378.4 | 1440.4 | 1499.7 | 1557.9 | 1615.5 | 1673.1 | 1730.7 | 1847.1 | 1965.4 | 2086.2 |
|  | u | 1134.4           | 1201.3 | 1253.7 | 1301.5 | 1347.5 | 1393.0 | 1438.3 | 1483.8 | 1529.6 | 1622.6 | 1718.0 | 1816.0 |
|  | s | 1.4054           | 1.4837 | 1.5402 | 1.5876 | 1.6297 | 1.6682 | 1.7040 | 1.7377 | 1.7696 | 1.7999 | 1.8838 | 1.9350 |
| 1400<br>(587.25)                       | v | 0.3175           | 0.4059 | 0.4713 | 0.5285 | 0.5815 | 0.6319 | 0.6805 | 0.7277 | 0.7740 | 0.8647 | 0.9539 | 1.0423 |
|  | h | 1193.1           | 1294.8 | 1367.9 | 1432.5 | 1493.5 | 1552.8 | 1611.4 | 1669.6 | 1727.8 | 1844.8 | 1963.6 | 2084.7 |
|  | u | 1110.9           | 1189.6 | 1245.8 | 1295.6 | 1342.8 | 1389.1 | 1435.1 | 1481.1 | 1527.2 | 1620.8 | 1716.5 | 1814.7 |
|  | s | 1.3642           | 1.4562 | 1.5168 | 1.5661 | 1.6094 | 1.6487 | 1.6851 | 1.7192 | 1.7513 | 1.8111 | 1.8662 | 1.9175 |
| 1600<br>(605.06)                       | v | .                | 0.3415 | 0.4032 | 0.4557 | 0.5036 | 0.5488 | 0.5921 | 0.6341 | 0.6752 | 0.7553 | 0.8338 | 0.9115 |
|  | h | .                | 1278.1 | 1357.0 | 1424.4 | 1487.1 | 1547.7 | 1607.1 | 1666.1 | 1724.8 | 1842.6 | 1961.9 | 2083.2 |
|  | u | .                | 1177.0 | 1237.7 | 1289.5 | 1338.0 | 1385.2 | 1431.8 | 1478.3 | 1524.9 | 1619.0 | 1715.0 | 1813.3 |
|  | s | .                | 1.4299 | 1.4953 | 1.5468 | 1.5913 | 1.6315 | 1.6684 | 1.7029 | 1.7354 | 1.7955 | 1.8508 | 1.9022 |
| 1800<br>(621.21)                       | v | .                | 0.2905 | 0.3500 | 0.3989 | 0.4430 | 0.4842 | 0.5235 | 0.5614 | 0.5983 | 0.6701 | 0.7404 | 0.8098 |
|  | h | .                | 1259.9 | 1345.7 | 1416.1 | 1480.7 | 1542.5 | 1602.9 | 1662.5 | 1721.8 | 1840.4 | 1960.1 | 2081.7 |
|  | u | .                | 1163.1 | 1229.1 | 1283.2 | 1333.1 | 1381.2 | 1428.5 | 1475.5 | 1522.5 | 1617.2 | 1713.5 | 1811.9 |
|  | s | .                | 1.4042 | 1.4753 | 1.5291 | 1.5749 | 1.6159 | 1.6534 | 1.6883 | 1.7211 | 1.7817 | 1.8371 | 1.8887 |
| 2000<br>(636.00)                       | v | .                | 0.2487 | 0.3071 | 0.3534 | 0.3945 | 0.4325 | 0.4685 | 0.5031 | 0.5368 | 0.6020 | 0.6656 | 0.7284 |
|  | h | .                | 1239.8 | 1333.8 | 1407.6 | 1474.1 | 1537.2 | 1598.6 | 1659.0 | 1718.8 | 1838.2 | 1958.3 | 2080.2 |
|  | u | .                | 1147.7 | 1220.1 | 1276.8 | 1328.1 | 1377.2 | 1425.2 | 1472.7 | 1520.2 | 1615.4 | 1712.0 | 1810.6 |
|  | s | .                | 1.3782 | 1.4562 | 1.5126 | 1.5598 | 1.6017 | 1.6398 | 1.6751 | 1.7082 | 1.7692 | 1.8249 | 1.8765 |
| 2500<br>(668.31)                       | v | .                | 0.1684 | 0.2291 | 0.2712 | 0.3069 | 0.3393 | 0.3696 | 0.3984 | 0.4261 | 0.4795 | 0.5312 | 0.5820 |
|  | h | .                | 1176.6 | 1301.7 | 1385.4 | 1457.2 | 1523.8 | 1587.7 | 1650.0 | 1711.3 | 1832.6 | 1954.0 | 2076.4 |
|  | u | .                | 1098.7 | 1195.7 | 1259.9 | 1315.2 | 1366.8 | 1416.7 | 1465.7 | 1514.2 | 1610.8 | 1708.2 | 1807.2 |
|  | s | .                | 1.3073 | 1.4112 | 1.4752 | 1.5262 | 1.5704 | 1.6101 | 1.6465 | 1.6804 | 1.7424 | 1.7986 | 1.8506 |
| 3000<br>(695.52)                       | v | .                | 0.0977 | 0.1757 | 0.2160 | 0.2485 | 0.2772 | 0.3036 | 0.3285 | 0.3524 | 0.3978 | 0.4416 | 0.4844 |
|  | h | .                | 1058.1 | 1265.2 | 1361.7 | 1439.6 | 1510.1 | 1576.6 | 1640.9 | 1703.7 | 1827.1 | 1949.6 | 2072.8 |
|  | u | .                | 1003.9 | 1167.6 | 1241.8 | 1301.7 | 1356.2 | 1408.0 | 1458.5 | 1508.1 | 1606.3 | 1704.5 | 1803.9 |
|  | s | .                | 1.1944 | 1.3675 | 1.4414 | 1.4967 | 1.5434 | 1.5848 | 1.6224 | 1.6571 | 1.7201 | 1.7769 | 1.8291 |

<sup>†</sup> J.H. Keenan, F.G. Keyes *et al.*, Steam Tables, John Wiley and Sons, NY, 1969 [QC311.S79]

## Physical Properties of Liquid Water<sup>†</sup>

| Temp.<br>(°F) | Specific Heat<br>$c_p$ (BTU/lbm·°R) |               |               | Thermal Conductivity<br>$k$ (BTU/hr.ft.°F) |               |               | Viscosity<br>$\mu$ (lbm/hr.ft) |               |               |
|---------------|-------------------------------------|---------------|---------------|--|---------------|---------------|--------------------------------|---------------|---------------|
|               | Satur.<br>Liquid                    | 1,000<br>psia | 2,000<br>psia | Satur.<br>Liquid                           | 1,000<br>psia | 2,000<br>psia | Satur.<br>Liquid               | 1,000<br>psia | 2,000<br>psia |
| 80            | 0.9975                              | 0.9943        | 0.9912        | 0.3532                                     | 0.3537        | 0.3570        | 2.084                          | 2.084         | 2.083         |
| 100           | 0.9976                              | 0.9932        | 0.9897        | 0.3641                                     | 0.3659        | 0.3680        | 1.650                          | 1.654         | 1.658         |
| 200           | 1.0047                              | 1.0008        | 0.9958        | 0.3935                                     | 0.3957        | 0.3980        | 0.738                          | 0.748         | 0.757         |
| 300           | 1.0289                              | 1.0232        | 1.0166        | 0.3952                                     | 0.3981        | 0.4013        | 0.425                          | 0.460         | 0.468         |
| 400           | 1.0794                              | 1.074         | 1.062         | 0.3809                                     | 0.3840        | 0.3880        | 0.327                          | 0.330         | 0.335         |
| 420           | 1.0941                              | 1.087         | 1.075         | 0.3753                                     | 0.3787        | 0.3833        | 0.310                          | 0.312         | 0.317         |
| 440           | 1.1114                              | 1.105         | 1.091         | 0.3693                                     | 0.3728        | 0.3776        | 0.294                          | 0.296         | 0.301         |
| 460           | 1.1319                              | 1.124         | 1.109         | 0.3640                                     | 0.3664        | 0.3713        | 0.280                          | 0.282         | 0.286         |
| 480           | 1.1345                              | 1.149         | 1.131         | 0.3575                                     | 0.3595        | 0.3642        | 0.267                          | 0.270         | 0.273         |
| 500           | 1.1861                              | 1.176         | 1.154         | 0.3494                                     | 0.3510        | 0.3562        | 0.256                          | 0.257         | 0.260         |
| 520           | 1.23                                | 1.21          | 1.188         | 0.3397                                     | 0.3410        | 0.3475        | 0.246                          | 0.246         | 0.249         |
| 540           | 1.28                                | .             | 1.225         | 0.3298                                     | .             | 0.3371        | 0.235                          | .             | 0.239         |
| 560           | 1.34                                | .             | 1.278         | 0.3189                                     | .             | 0.3256        | 0.225                          | .             | 0.231         |
| 580           | 1.41                                | .             | 1.341         | 0.3064                                     | .             | 0.3118        | 0.217                          | .             | 0.222         |
| 600           | 1.51                                | .             | 1.448         | 0.2919                                     | .             | 0.2962        | 0.210                          | .             | 0.212         |
| 620           | 1.65                                | .             | 1.62          | 0.2753                                     | .             | 0.2778        | 0.200                          | .             | 0.202         |
| 640           | 1.88                                | .             | .             | 0.2565                                     | .             | .             | 0.190                          | .             | .             |
| 660           | 2.34                                | .             | .             | 0.2335                                     | .             | .             | 0.177                          | .             | .             |
| 680           | 3.5                                 | .             | .             | 0.2056                                     | .             | .             | 0.161                          | .             | .             |

<sup>†</sup> M.M. El-Wakil, Nuclear Energy Conversion, Intext Educational Publishers, 1971 [TK9202.E46].

### Physical Properties of Helium

| Temp. (°F) | Density, $\rho$ (lbm/ft <sup>3</sup> ) | Viscosity, $\mu$ (lbm/ft.hr) | Specific Heat $c_p$ (Btu/lbm.°F) | Thermal Conductivity $k$ (Btu/ft.hr.°F) |
|------------|--|------------------------------|----------------------------------|---|
| 32         | 0.1117                                 | 0.0457                       | 1.248                            | 0.083                                   |
| 100        | 0.0974                                 | 0.0495                       | 1.248                            | 0.090                                   |
| 200        | 0.0827                                 | 0.0555                       | 1.248                            | 0.100                                   |
| 300        | 0.0718                                 | 0.0605                       | 1.248                            | 0.110                                   |
| 400        | 0.0635                                 | 0.0653                       | 1.248                            | 0.119                                   |
| 500        | 0.0569                                 | 0.0700                       | 1.248                            | 0.128                                   |
| 600        | 0.0516                                 | 0.0743                       | 1.248                            | 0.136                                   |
| 700        | 0.0475                                 | 0.0780                       | 1.248                            | 0.145                                   |
| 800        | 0.0430                                 | 0.0821                       | 1.248                            | 0.153                                   |
| 900        | 0.0399                                 | 0.0859                       | 1.248                            | 0.160                                   |
| 1000       | 0.0373                                 | 0.0889                       | 1.248                            | 0.167                                   |
| 1100       | 0.0351                                 | 0.0918                       | 1.248                            | 0.175                                   |

### Physical Properties of Carbon Dioxide

| Temp. (°F) | Density, $\rho$ (lbm/ft <sup>3</sup> ) | Viscosity, $\mu$ (lbm/ft.hr) | Specific Heat $c_p$ (Btu/lbm.°F) | Thermal Conductivity $k$ (Btu/ft.hr.°F) |
|------------|--|------------------------------|----------------------------------|---|
| 32         | 1.3190                                 | 0.03318                      | 0.2187                           | 0.008415                                |
| 100        | 1.1277                                 | 0.03739                      | 0.2202                           | 0.009962                                |
| 200        | 0.9373                                 | 0.04332                      | 0.2262                           | 0.01261                                 |
| 300        | 0.8051                                 | 0.04892                      | 0.2342                           | 0.01533                                 |
| 400        | 0.7071                                 | 0.05419                      | 0.2423                           | 0.01818                                 |
| 500        | 0.6310                                 | 0.05920                      | 0.2503                           | 0.02117                                 |
| 600        | 0.5701                                 | 0.06397                      | 0.2476                           | 0.02425                                 |
| 700        | 0.5202                                 | 0.06851                      | 0.2643                           |   |
| 800        | 0.4784                                 | 0.07288                      | 0.2704                           |   |
| 900        | 0.4428                                 | 0.07709                      | 0.2760                           |   |
| 1000       | 0.4125                                 | 0.0811                       | 0.2812                           |   |
| 1100       | 0.3860                                 | 0.08511                      | 0.2858                           |   |
| 1200       | 0.3626                                 | 0.08891                      | 0.2901                           |   |