# Enthalpies of Decalins and of *trans*-Decalin and *n*-Pentane Mixtures

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**Measured enthalpy values are reported for pure Decalins and four mixtures of *trans*-Decalin and *n*-pentane.**

With the use of a flow calorimeter the enthalpies of both *trans*- and *cis*-Decalin (decahydronaphthalene) have been measured from 75° to 620° F. with pressures up to 1400 p.s.i.a. In addition, enthalpy values have been determined for mixtures of *trans*-Decalin with *n*-pentane, containing 19.9, 40.0, 57.9, and 80.0 weight % pentane. Previously Seyer (*9*) presented thermal measurements of both pure *cis*- and pure *trans*-Decalin in the liquid state up to 275° F. Seyer and Mann (*10*) measured the latent heat of vaporization at atmospheric pressure. McCullough, Finke, Messerly, Todd, Kincheloe, and Waddington (*7*) presented enthalpy values for liquid and solid phases from very low temperatures up to 175° F. Vvendenskii and Maioron (*11*) show heat capacities for the pure Decalins in the ideal gas state of zero pressure. Findl, Brande, and Edwards (*4*) report enthalpy values and latent heats of vaporization for a commercially impure mixture containing *cis*- and *trans*-Decalins. In general, a more thorough measurement study of the enthalpy for the pure components is needed. Enthalpy measurements for the mixture of pentane with *trans*-Decalin have not previously been made.

A total of 955 measurements were made on the pure Decalins and the pentane-Decalin mixtures, and are available from the American Society for Information Science (ASIS). These deposited measurements show the enthalpy relative to 75° F. and the pressure of measurement. The calorimeter measurements were previously shown to give results with an average deviation of 1.5 B.t.u. per pound, as compared with literature values for pentane (*2*) and liquid water (*8*).

The Decalin was obtained as a mixture of cis and trans isomers. The mixture was purified by fractional distillation using a 40 to 1 reflux ratio with a laboratory column having approximately 20 theoretical stages. The portion of the distillate selected as pure *trans*-Decalin had a refractive index of $1.46934 n_D^{20}$ and a density of 0.8680 at 72° F. Corresponding values shown in the literature (*2*) are 1.4695 and 0.8682. For the *cis*-Decalin the measured values are $1.48037 n_D^{20}$ with a density of 0.9005 at 60° F., with literature values of 1.4810 and 0.9002. The purity of these Decalin components is considered to be better than 95%, with the majority impurity the other isomer. The *n*-pentane used has a purity determined by chromatograph to exceed 99.9%.

To place the measurements on the API data book (*1*) basis of −200° F. and the pure saturated liquid state, it is necessary to establish the enthalpy difference between −200° and 75° F. McCullough *et al.* (*7*) show enthalpy values

Table I. Properties of Liquid Phase at 75° F. and 1 Atm. for *trans*-Decalin Systems with *n*-Pentane

| Material | Wt. % *n*-Pentane | Liquid Density, G./Cm.$^3$ | Heat of Mixing, B.t.u./Lb. | Enthalpy to Add, B.t.u./Lb. |
|---|---|---|---|---|
| 100% *trans*-Decalin | 0 | 0.8664 | 0 | 91.1 |
| 32.2 Mole % pentane | 19.9 | 0.8105 | 0.16 | 98.4 |
| 56.1 Mole % pentane | 40.0 | 0.7577 | 0.21 | 106.1 |
| 72.5 Mole % pentane | 57.9 | 0.7094 | 0.17 | 112.9 |
| 88.4 Mole % pentane | 80.0 | 0.6639 | 0.08 | 121.5 |
| 100 % *cis*-Decalin | 0 | 0.8928 | 0 | 90.2 |
| 100 % *n*-Pentane | 100 | 0.6219 | 0 | 129.4 |

Table II. Smoothed Values of Enthalpy for *cis*-Decalin

Units. B.t.u. per lb.
Base level. Pure saturated liquid at −200° F.

| Temp., ° F. | P.S.I.A. 0 | 25 | 40 | 70 | 100 | 1400 |
|---|---|---|---|---|---|---|
| 75 | | 90.2 | 90.2 | 90.3 | 90.4 | 93.6 |
| 120 | | 108.4 | | | | 112.1 |
| 160 | | 125.6 | | | | 129.4 |
| 200 | | 143.9 | | | | 148.0 |
| 240 | | 163.2 | | | | 167.6 |
| 280 | | 184.7 | | | | 188.2 |
| 320 | | 206.7 | | | | 209.7 |
| 360 | | 229.3 | | | | 232.3 |
| 400 | | 253.3 | | | | 256.1 |
| 420 | | 265.8 | | | | 268.5 |
| 431.2 | | 272.8[a] | | | | |
| 431.2 | | 390.0[a] | | | | |
| 440 | | 395.0 | 278.3 | | | 281.1 |
| 460 | 409.1 | 406.3 | 291.2 | | | 293.7 |
| 479.5 | | | 304.3[a] | | | |
| 479.5 | | | 415.5[a] | | | |
| 480 | 420.5 | 417.8 | 415.7 | 306.3 | | 304.7 |
| 500 | 432.4 | 429.8 | 427.7 | 318.6 | | 319.1 |
| 520 | 444.4 | 442.2 | 439.9 | 332.3 | | 332.3 |
| 532.2 | | | | 341.5[a] | | |
| 532.2 | | | | 443.1[a] | | |
| 540 | 457.2 | 454.6 | 452.3 | 448.2 | 346.2 | 346.2 |
| 560 | 470.1 | | | 461.4 | 360.0 | 359.8 |
| 574.8 | | | | | 370.1[a] | |
| 574.8 | | | | | 465.3[a] | |
| 580 | 483.6 | | | 475.3 | 468.7 | 373.5 |
| 600 | 497.2 | | | | 481.6 | 387.4 |

[a] Enthalpy value on two-phase boundary.

Table III. Smoothed Values of Enthalpy for *trans*-Decalin

Units. B.t.u. per lb.
Base level. Pure saturated liquid at −200° F.

| Temp., °F. | P.S.I.A. 0 | 22 | 40 | 70 | 100 | 150 | 1000 | 1400 |
|---|---|---|---|---|---|---|---|---|
| 75 | | 91.1 | 91.1 | 91.2 | 91.3 | 91.5 | 93.9 | 95.1 |
| 120 | | 109.1 | | | | 109.4 | | 112.8 |
| 160 | | 126.8 | | | | 127.1 | | 130.0 |
| 200 | | 145.3 | | | | 145.6 | | 148.7 |
| 240 | | 164.8 | | | | 165.1 | | 167.7 |
| 280 | | 185.2 | | | | 185.4 | | 187.2 |
| 320 | | 206.3 | | | | 206.5 | | 208.2 |
| 360 | | 228.7 | | | | 228.8 | | 230.0 |
| 380 | | 240.3 | | | | 240.4 | | 241.3 |
| 399.5 | | 252.0[a] | | | | | | |
| 399.5 | | 372.4[a] | | | | | | |
| 400 | | 372.6 | 252.2 | | | 252.3 | | 252.9 |
| 420 | | | 264.4 | | | 264.5 | 265.3 | |
| 440 | | | 276.8 | | | 276.9 | 277.8 | |
| 455 | | | 286.6[a] | | | | | |
| 455 | | | 391.6[a] | | | | | |
| 460 | 398.8 | | 394.0 | 289.7 | | 289.8 | 290.3 | |
| 480 | 408.3 | | 404.0 | 302.4 | | 302.5 | 302.9 | |
| 500 | 418.7 | | 414.2 | 315.5 | | 315.5 | 315.5 | |
| 515 | | | | 325.0[a] | | | | |
| 515 | | | | 417.3[a] | | | | |
| 520 | 429.3 | | 424.5 | 420.1 | 328.4 | 328.4 | 328.4 | |
| 540 | 440.1 | | 435.3 | 431.1 | 341.7 | 341.7 | 341.7 | |
| 557.6 | | | | | 353.8[a] | | | |
| 557.6 | | | | | 437.2[a] | | | |
| 560 | 451.2 | | 446.5 | 442.2 | 438.7 | 355.3 | 355.0 | |
| 580 | 462.5 | | 457.2 | 453.2 | 449.8 | 369.6 | 369.0 | |
| 600 | 473.7 | | 468.0 | 464.2 | 460.8 | 384.0 | 383.2 | |
| 609 | | | | | | 391.2[a] | | |
| 609 | | | | | | 461.2[a] | | |
| 620 | 483.9 | | | 475.3 | 472.1 | 467.3 | 397.9 | |

[a] Enthalpy value on two-phase boundary.

Table IV. Smoothed Values of Enthalpy for Mixture of 32.2 Mole % Pentane and 67.8 Mole % *trans*-Decalin

Units. B.t.u. per lb.
Base Level. Pure saturated liquid components at −200° F.

| Temp., °F. | P.S.I.A. 0 | 20 | 40 | 70 | 100 | 150 | 200 | 300 | 400 | 600 | 1000 | 1400 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75 | | 98.4 | 98.4 | 98.5 | 98.6 | 98.7 | 98.9 | 99.1 | 99.4 | 99.9 | 100.9 | 102.0 |
| 120 | | 118.0 | | | | | | | 119.0 | | 120.7 | 121.6 |
| 160 | | 136.4 | | | | | | | 137.2 | | 138.5 | 139.4 |
| 187 | | 149.3[a] | | | | | | | | | | |
| 200 | | 161.0 | 155.9 | | | | | | 156.6 | | 157.8 | 158.6 |
| 220 | | 177.8 | 166.4 | | | | | | 167.0 | | 168.1 | 168.8 |
| 240 | | 194.4 | 177.0 | | | | | | 177.6 | | 178.6 | 179.3 |
| 244.8 | | | 179.6[a] | | | | | | | | | |
| 260 | | | 194.1 | 187.8 | | | | | 188.4 | | 189.5 | 190.2 |
| 280 | | | 210.3 | 198.7 | | | | | 199.3 | | 200.4 | 201.1 |
| 300 | | | | 210.0 | | | | | 210.5 | | 211.5 | 212.2 |
| 301.6 | | | | 211.6[a] | | | | | | | | |
| 320 | | | | 228.2 | 221.4 | | | | 221.8 | | 222.7 | 223.3 |
| 340 | | | | 243.7 | 233.0 | | | | 233.4 | | 234.2 | 234.7 |
| 344.2 | | | | | 235.5[a] | | | | | | | |
| 360 | | 332.5 | 278.7 | 260.8 | 249.9 | 244.7 | | | 245.1 | | 246.0 | 246.6 |
| 371.8 | | 369.8[a] | | | | | | | | | | |
| 380 | | 373.6 | 302.7 | | 267.4 | 256.6 | | | 256.9 | | 257.8 | 258.3 |
| 389.1 | | | | | | 262.2[a] | | | | | | |
| 400 | | 383.1 | 334.6 | | 285.0 | 271.6 | 268.8 | | 269.0 | | 269.7 | 270.1 |
| 420 | | 393.2 | 388.0 | 313.0 | 303.2 | 288.9 | 281.8 | | 282.0 | | 282.5 | 282.9 |
| 421.3 | | | 392.2[a] | | | | | | | | | |
| 436.3 | | | | | | | 292.4[a] | | | | | |
| 440 | | 403.6 | 402.0 | 345.5 | 323.0 | 306.8 | 296.2 | 294.8 | 294.7 | | 294.2 | 295.9 |
| 460 | 416.1 | 414.3 | 412.7 | 383.6 | 345.7 | 325.7 | 313.9 | 308.3 | 308.2 | | 307.4 | 308.8 |
| 470 | 421.2 | 419.8 | 418.4 | 407.4 | 358.7 | 335.5 | 323.0 | 314.8 | 314.7 | | 313.9 | 315.2 |
| 474.3 | | | | 419.3[a] | | | | | | | | |
| 480 | 426.6 | 425.4 | 424.0 | 422.5 | 372.8 | 345.4 | 332.1 | 321.7 | 321.5 | | 320.8 | 321.7 |

(*continued*)

Table IV. (*Continued*)

Units. B.t.u. per lb.
Base Level. Pure saturated liquid components at −200° F.

| Temp., | P.S.I.A. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° F. | 0 | 20 | 40 | 70 | 100 | 150 | 200 | 300 | 400 | 600 | 1000 | 1400 |
| 500 | 437.4 | | 435.5 | 434.2 | 411.6 | 366.5 | 351.0 | 335.5 | 333.2 | | 333.7 | 334.4 |
| 509 | | | | | | | | 341.8[a] | | | | |
| 509.8 | | | | | 438.8[a] | | | | | | | |
| 520 | 448.4 | | | 445.9 | 444.3 | 392.6 | 372.1 | 353.1 | 349.7 | 348.6 | 347.8 | 348.0 |
| 540 | 459.8 | | | 457.2 | 455.7 | 426.3 | 395.2 | 373.2 | 364.3 | 362.9 | 361.7 | 361.3 |
| 557.2 | | | | | | 462.2[a] | | | | | | |
| 560 | 471.3 | | | | 467.0 | 463.8 | 421.7 | 393.7 | 380.3 | 377.6 | 376.1 | 374.9 |
| 580 | 482.6 | | | | 478.3 | 475.2 | 459.3 | 415.0 | 398.2 | 392.7 | 390.7 | 388.2 |
| 588.8 | | | | | | | 477.6[a] | | | | | |
| 590 | 488.0 | | | | 483.6 | 480.9 | 478.3 | 426.6 | 406.7 | 400.4 | 398.3 | 394.8 |
| 600 | 493.7 | | | | 489.3 | 486.7 | 484.4 | 439.3 | 416.0 | 408.2 | 405.9 | 401.5 |

[a] Enthalpy value on two-phase boundary.

Table V. Smoothed Values of Enthalpy for Mixture of 56.1 Mole % Pentane and 43.9 Mole % *trans*-Decalin

Units. B.t.u. per lb.
Base level. Pure saturated liquid components at −200° F.

| Temp., | P.S.I.A. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° F. | 0 | 70 | 100 | 200 | 300 | 400 | 500 | 540 | 600 | 800 | 1000 | 1400 |
| 75 | | 106.1 | 106.2 | 106.5 | 106.8 | 107.1 | 107.3 | 107.4 | 107.7 | 108.3 | 108.9 | 110.1 |
| 120 | | 126.7 | | | | 127.8 | | | | 129.1 | | 131.0 |
| 160 | | 146.8 | | | | 147.6 | | | | 148.6 | | 150.1 |
| 200 | | 167.5 | | | | 168.2 | | | | 169.0 | | 170.2 |
| 240 | | 189.0 | | | | 189.7 | | | | 190.5 | | 191.7 |
| 246.6 | | 192.8[a] | | | | | | | | | | |
| 260 | | 217.7 | 200.6 | | | 201.1 | | | | 201.8 | | 202.9 |
| 280 | | 241.0 | 212.7 | | | 213.1 | | | | 213.6 | | 214.4 |
| 282.3 | | | 214.0[a] | | | | | | | | | |
| 300 | | 261.6 | 241.0 | 224.7 | | 224.9 | | | | 225.5 | | 226.2 |
| 320 | | 279.8 | 263.2 | 237.0 | | 237.2 | | | | 237.6 | | 238.2 |
| 340 | | 297.0 | 282.8 | 249.7 | | 249.8 | | | | 250.2 | | 250.6 |
| 358.6 | | | | 262.0[a] | | | | | | | | |
| 360 | | 315.5 | 300.9 | 264.2 | 263.0 | 263.0 | | | | 263.0 | | 263.0 |
| 380 | | 336.4 | 319.8 | 288.4 | 275.8 | 275.8 | | | | 275.7 | | 275.5 |
| 400 | | 360.8 | 340.2 | 308.7 | 288.7 | 288.7 | | | | 288.5 | | 288.2 |
| 420 | | 390.2 | 362.9 | 328.2 | 301.9 | 301.8 | | | | 301.4 | | 301.2 |
| 423.5 | | | | | 304.4[a] | | | | | | | |
| 435.7 | | 415.0[a] | | | | | | | | | | |
| 440 | | 417.4 | 388.8 | 347.8 | 324.6 | 315.7 | | | | 315.3 | | 314.6 |
| 460 | 433.3 | 428.5 | 418.5 | 368.6 | 346.7 | 321.1 | | | | 319.9 | | 318.0 |
| 463.2 | | | | | | 331.3[a] | | | | | | |
| 467.6 | | | 430.1[a] | | | | | | | | | |
| 480 | 444.2 | 439.9 | 437.5 | 390.6 | 369.0 | 349.4 | 342.7 | | | 342.4 | | 341.7 |
| 493.2 | | | | | | | 351.7[a] | | | | | |
| 500 | 455.5 | 451.7 | 449.7 | 414.8 | 390.0 | 370.3 | 359.0 | 357.2 | 357.2 | 356.8 | 356.5 | 355.3 |
| 520 | 467.0 | 463.8 | 461.7 | 442.3 | 410.8 | 391.9 | 380.0 | 375.8 | 373.0 | 371.8 | 370.7 | 369.4 |
| 532 | | | | 461.5[a] | | | | | | | | |
| 540 | 478.7 | 475.8 | 473.8 | 466.7 | 435.0 | 414.4 | 401.2 | 395.8 | 391.6 | 386.9 | 385.4 | 384.0 |
| 560 | 490.6 | 487.7 | 485.8 | 479.8 | 462.1 | 437.8 | 422.9 | 417.7 | 410.7 | 402.7 | 400.7 | 399.0 |
| 575.8 | | | | | 484.1[a] | | | | | | | |
| 580 | 502.4 | 499.6 | 498.0 | 492.8 | 487.0 | 462.6 | 445.2 | 440.4 | 433.0 | 420.2 | 416.7 | 414.2 |
| 600 | 514.7 | 511.7 | 510.3 | 506.0 | 500.0 | 488.0 | 469.7 | 464.3 | 456.0 | 438.8 | 433.0 | 430.2 |

[a] Enthalpy value on two-phase boundary.

for this temperature range. Both isomers solidify as the temperature reduces to −200° F. By extrapolation of the *trans*-Decalin data, the condition of the supercooled liquid at −200° F. was determined to be 91.1 B.t.u. per pound less than the saturated liquid at 75° F. For the *cis*-Decalin, the difference was 90.2 B.t.u. per pound. These values are believed to be within 1.5 B.t.u. per pound of the true value. The choice of the supercooled liquid at −200° F. introduces some small uncertainty of base level, but is consistent with the base level used by the API data book for the hydrocarbons. For the mixtures of *n*-pentane and *trans*-Decalin, the enthalpy needed for addition to the measured enthalpies is a weight average of 91.1 and 129.4 for *trans*-Decalin and *n*-pentane, respectively, plus the heat of mixing at 75° F. The heats of mixing were evaluated from the results of Lundberg (*6*) and Brandt (*3*). In addition, the small change in enthalpy from the saturated pressure to the operating pressure at 75° F. was added to the measured values. This small enthalpy change was computed as previously described (*5*). It was also established that the zero pressure enthalpies for various isotherms plotted linearly against weight fraction pentane. Table I shows the compositions studied, with density and heat of mixing at 75° F., and the enthalpy needed to convert the saturated

Table VI. Smoothed Values of Enthalpy for Mixture of 72.5 Mole % Pentane and 27.5 Mole % *trans*-Decalin

Units. B.t.u. per lb.
Base level. Pure saturated liquid components at −200° F.

| Temp., | P.S.I.A. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° F. | 0 | 40 | 70 | 100 | 200 | 300 | 400 | 500 | 600 | 800 | 1000 | 1400 |
| 75 | | 112.9 | 113.0 | 113.1 | 113.3 | 113.6 | 113.9 | 114.2 | 114.5 | 115.0 | 115.6 | 116.7 |
| 120 | | 135.3 | | | | | 136.2 | | | 137.2 | | 138.8 |
| 160 | | 156.4 | | | | | 157.2 | | | 158.2 | | 159.6 |
| 176.4 | | 165.3[a] | | | | | | | | | | |
| 180 | | 177.5 | 167.3 | | | | 168.0 | | | 169.2 | | 170.3 |
| 200 | | 228.5 | 178.3 | | | | 179.0 | | | 180.2 | | 181.4 |
| 218.4 | | | 188.7[a] | | | | | | | | | |
| 220 | | | 193.1 | 189.7 | | | 190.4 | | | 191.3 | | 192.7 |
| 240 | | | 240.7 | 201.2 | | | 201.9 | | | 203.0 | | 204.4 |
| 251.7 | | | | 208.2[a] | | | | | | | | |
| 260 | | | | 232.0 | 213.3 | | 213.8 | | | 214.9 | | 216.6 |
| 280 | | | | 269.4 | 226.0 | | 226.5 | | | 227.4 | | 228.8 |
| 300 | | 327.3 | | | 238.9 | | 239.3 | | | 240.1 | | 241.4 |
| 320 | | 349.2 | | | 252.0 | | 252.4 | | | 253.1 | | 254.2 |
| 325.7 | | | | | 255.7[a] | | | | | | | |
| 340 | | 370.7 | 345.8 | | 287.9 | 265.3 | 265.5 | | | 266.1 | | 267.1 |
| 359 | | 390.1[a] | | | | | | | | | | |
| 360 | | 390.7 | 367.8 | 353.4 | | 278.5 | 278.6 | | | 279.2 | | 280.0 |
| 377.8 | | | | | | 290.3[a] | | | | | | |
| 380 | | 401.6 | 392.5 | 373.4 | | 296.3 | 291.6 | | | 292.1 | | 292.9 |
| 390 | | | 405.3[a] | | | | | | | | | |
| 400 | | 412.7 | 411.0 | 397.4 | | 330.9 | 305.2 | | | 305.6 | | 306.3 |
| 414.2 | | | | | | | 314.8[a] | | | | | |
| 418.5 | | | | 419.3[a] | | | | | | | | |
| 420 | | 424.0 | 422.1 | 420.1 | 382.5 | 356.4 | 326.9 | 319.0 | | 319.3 | | 319.9 |
| 440 | | 435.3 | 433.6 | 431.7 | 404.2 | | 356.4 | 334.2 | | 334.1 | | 334.0 |
| 444.1 | | | | | | | | 337.6[a] | | | | |
| 460 | 448.8 | 446.7 | 445.2 | 443.4 | 427.4 | | 382.2 | 358.8 | 350.3 | 349.8 | | 348.3 |
| 477 | | | | | 447.1[a] | | | | | | | |
| 480 | 460.0 | 458.4 | 456.9 | 455.3 | 449.0 | 423.0 | 406.0 | 384.7 | 368.8 | 367.3 | | 363.0 |
| 500 | 471.7 | | 469.0 | 467.4 | 461.6 | 445.3 | 428.7 | 409.8 | 393.9 | 382.1 | 380.1 | 377.7 |
| 517 | | | | | | 465.0[a] | | | | | | |
| 520 | 483.6 | | 481.2 | 479.7 | 474.1 | 467.0 | 450.8 | 434.5 | 418.2 | 400.6 | 396.8 | 392.8 |
| 539 | | | | | | | 472.6[a] | | | | | |
| 540 | 495.6 | | 493.5 | 491.8 | 486.6 | 480.1 | 473.3 | 458.1 | 442.0 | 420.2 | 414.0 | 408.1 |
| 550 | 501.7 | | | 498.0 | 492.8 | 486.7 | 479.9 | 470.0[a] | 454.0 | 430.6 | 422.7 | 415.8 |
| 560 | 507.8 | | | 504.2 | 499.2 | 493.3 | 486.3 | 477.4 | 465.1 | 440.8 | 431.7 | 423.7 |
| 600 | 532.8 | | | 528.9 | 524.4 | 519.0 | 512.2 | 506.0 | 498.4 | 481.1 | 466.8 | 455.8 |

[a] Enthalpy value on two-phase boundary.

Table VII. Smoothed Values of Enthalpy for Mixture of 88.4 Mole % Pentane and 11.6 Mole % *trans*-Decalin

Units. B.t.u. per lb.
Base level. Pure saturated liquid components at −200° F.

| Temp., | P.S.I.A. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° F. | 0 | 40 | 70 | 100 | 200 | 300 | 400 | 500 | 600 | 800 | 1000 | 1400 |
| 75 | | 121.5 | 121.6 | 121.7 | 121.9 | 122.2 | 122.4 | 122.7 | 122.9 | 123.5 | 124.0 | 125.0 |
| 120 | | 145.2 | | | | | 146.2 | | | 147.2 | | 148.8 |
| 160.4 | | 168.4[a] | | | | | | | | | | |
| 170 | | 214.0 | 174.0 | | | | 174.4 | | | 174.9 | | 175.7 |
| 180 | | 254.4 | 180.0 | | | | 180.3 | | | 180.7 | | 181.2 |
| 200 | | 284.4 | 191.8 | | | | 191.9 | | | 192.1 | | 192.3 |
| 203.2 | | | 193.8[a] | | | | | | | | | |
| 210 | | 294.7 | 223.0 | 198.2 | | | 198.2 | | | 198.2 | | 198.2 |
| 220 | | 304.3 | 263.7 | 204.2 | | | 204.2 | | | 204.2 | | 204.2 |
| 235.1 | | | | 213.6[a] | | | | | | | | |
| 240 | | 322.6 | 297.7 | 237.7 | 216.7 | | 216.7 | | | 216.7 | | 216.7 |
| 250 | | 331.0 | 309.0 | 279.2 | 223.1 | | 223.1 | | | 223.1 | | 223.1 |
| 260 | | 339.8 | 319.5 | 299.3 | 229.7 | | 229.7 | | | 229.7 | | 229.7 |
| 280 | | 356.8 | 339.7 | 327.0 | 242.7 | | 242.7 | | | 242.7 | | 242.7 |
| 298.9 | | | | | 255.4[a] | | | | | | | |
| 300 | | 372.3 | 358.7 | 347.6 | 258.7 | 256.2 | 256.2 | | | 256.2 | | 256.2 |
| 316 | | 384.( | | | | | | | | | | |
| 320 | | 386.8 | 377.4 | 366.0 | 317.7 | 269.8 | 269.8 | | | 269.7 | | 269.6 |
| 337.8 | | | 394.5[a] | | | | | | | | | |
| 340 | | 397.2 | 395.7 | 384.4 | 350.6 | 284.6 | 284.5 | | | 384.1 | | 283.6 |
| 348.9 | | | | | | 291.4[a] | | | | | | |

(*continued*)

Table VII. (*Continued*)

Units. B.t.u. per lb.
Base level. Pure saturated liquid components at −200° F.

| Temp., | P.S.I.A. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ° F. | 0 | 40 | 70 | 100 | 200 | 300 | 400 | 500 | 600 | 800 | 1000 | 1400 |
| 360 | | 408.1 | 406.3 | 404.0 | 373.0 | 324.0 | 300.2 | | | 299.2 | | 297.6 |
| 361.2 | | | | 405.4[a] | | | | | | | | |
| 380 | | 419.2 | 417.2 | 415.5 | 393.8 | 364.8 | 316.0 | | | 314.0 | | 311.8 |
| 381 | | | | | | | 316.7[a] | | | | | |
| 400 | 432.7 | 430.3 | 428.4 | 426.6 | 414.5 | 389.7 | 358.3 | 331.8 | | 329.0 | 327.4 | 326.1 |
| 409 | | | | | | | | 338.0[a] | | | | |
| 412.3 | | | | | 427.5[a] | | | | | | | |
| 420 | 443.7 | 441.8 | 439.8 | 438.1 | 431.7 | 411.3 | 394.0 | 358.3 | 347.7 | 344.4 | 342.7 | 341.2 |
| 430 | 449.7 | 447.7 | 445.8 | 443.9 | 437.6 | 421.7 | 407.1 | 377.2 | 356.7 | 352.4 | 350.3 | 348.8 |
| 440 | 455.6 | 453.5 | 451.8 | 449.9 | 443.6 | 431.6 | 418.4 | 394.7 | 366.7 | 360.7 | 358.2 | 356.6 |
| 452.7 | | | | | | 444.5[a] | | | | | | |
| 460 | 468.0 | 465.6 | 463.9 | 462.0 | 455.8 | 449.0 | 437.7 | 421.7 | 396.7 | 379.3 | 374.2 | 372.2 |
| 470 | 474.0 | 471.8 | 470.2 | 468.1 | 462.1 | 455.4 | 446.7 | 433.3 | 412.3 | 389.0 | 382.4 | 380.1 |
| 478.4 | | | | | | | 454.4[a] | | | | | |
| 480 | 480.0 | 477.9 | 476.4 | 474.3 | 468.3 | 462.0 | 455.6 | 444.2 | 427.4 | 399.3 | 390.7 | 388.0 |
| 493 | | | | | | | | 456.5[a] | | | | |
| 500 | 492.3 | 490.4 | 489.0 | 487.0 | 481.3 | 475.0 | 468.9 | 461.6 | 448.4 | 421.4 | 408.3 | 404.4 |
| 520 | 504.5 | 502.9 | 501.3 | 499.7 | 494.2 | 488.3 | 482.5 | 476.0 | 465.9 | 445.0 | 427.6 | 421.2 |
| 560 | 529.8 | | | 525.6 | 522.9 | 515.4 | 509.7 | 504.6 | 498.3 | 483.8 | 466.4 | 454.6 |
| 600 | 555.3 | | | 552.0 | 547.3 | 543.0 | 537.2 | 532.8 | 527.7 | 516.4 | 502.7 | 488.8 |

[a] Enthalpy value on two-phase boundary.

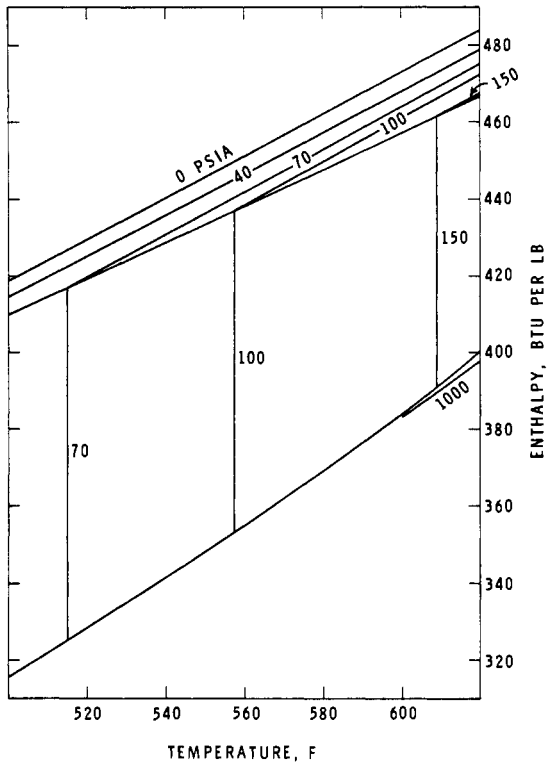


Figure 1. Enthalpy of *trans*-Decalin

liquid condition at 75° F. to the −200° F. API data book basis.

Smoothed values of enthalpy for *cis*-Decalin are presented in Table II. Table III shows the results for *trans*-Decalin, with Figure 1 graphically showing the *trans*-Decalin results. Tables IV, V, VI, and VII show the enthalpy values for the mixtures containing, respectively, 32.2, 56.1, 72.5, and 88.4 mole % *n*-pentane. The smoothed values deviate from the measured values by an arithmetic average of 0.7 B.t.u. per pound, negligible trend, and a statistical deviation of 1.1 B.t.u. per pound. For the pure Decalins the results agree well with the results presented by Seyer (*9*) and McCullough *et al.* (*7*). The agreement is not so satisfactory compared with the results of Vvendenskii and Maioron (*11*). The results of Findl, Brande, and Edwards (*4*) on the commercial mixture of Decalins lie generally between the enthalpy values reported here for the pure isomers.

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