

## 6.1.3 Saturated Tertiary Amines

*N,N*-Dimethylmethanamine

[75-50-3]

 $\text{C}_3\text{H}_9\text{N}$ 

MW = 59.11

607

**Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):
 $\sigma_{c,w} = 4.2436 \cdot 10^{-1}$  (combined temperature ranges, weighted),  $\sigma_{c,uw} = 1.6050 \cdot 10^{-1}$  (combined temperature ranges, unweighted).

Coefficient	$T = 262.65 \text{ to } 308.15 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$
<i>A</i>	$7.21837 \cdot 10^2$
<i>B</i>	$5.98408 \cdot 10^{-1}$
<i>C</i>	$-3.07312 \cdot 10^{-3}$

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

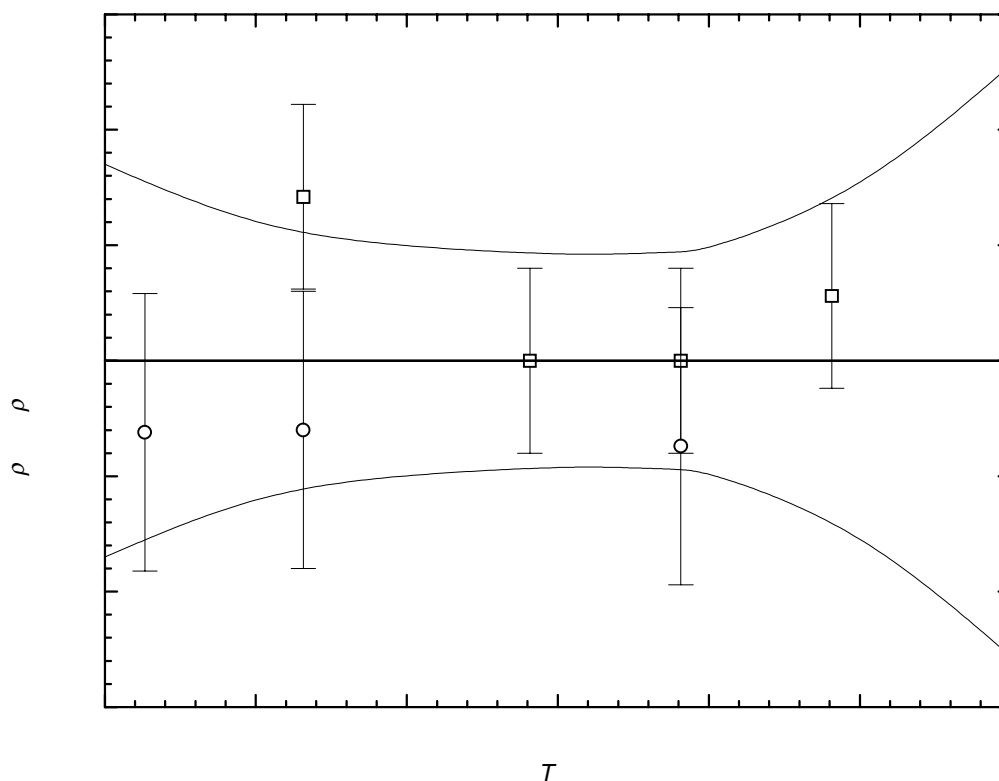
$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
273.15	$656.71 \pm 0.40$	0.71	1942-swi(□)	262.65	$666.70 \pm 0.60$	-0.31	1947-lef/rus(○)
288.15	$639.11 \pm 0.40$	0.00	1942-swi(□)	273.15	$655.70 \pm 0.60$	-0.30	1947-lef/rus(○)
298.15	$627.07 \pm 0.40$	-0.00	1942-swi(□)	298.15	$626.70 \pm 0.60$	-0.37	1947-lef/rus(○)
308.15	$614.70 \pm 0.40$	0.28	1942-swi(□)				

**Further references:** [1909-tsa-1].**Table 3.** Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$$

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
260.00	$669.68 \pm 0.85$	290.00	$636.93 \pm 0.46$	300.00	$624.78 \pm 0.48$
270.00	$659.38 \pm 0.57$	293.15	$633.17 \pm 0.46$	310.00	$612.02 \pm 0.72$
280.00	$648.46 \pm 0.49$	298.15	$627.07 \pm 0.47$	320.00	$598.64 \pm 1.28$

cont.

*N,N*-Dimethylmethanamine (cont.)

**Fig. 1.** The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

*N,N*-Dimethylethanamine

[598-56-1]

 $\text{C}_4\text{H}_{11}\text{N}$ 

MW = 73.14

608

**Table 1.** Fit with estimated  $B$  coefficient for 2 accepted points. Deviation  $\sigma_w = 0.350$ .

Coefficient	$\rho = A + BT$
$A$	967.90
$B$	-1.000

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	$675.1 \pm 0.6$	0.35	1957-spi/pap
298.15	$669.4 \pm 0.6$	-0.35	1957-spi/pap

cont.

**Table 3.** Recommended values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$
290.00	$677.9 \pm 0.9$
293.15	$674.7 \pm 0.7$
298.15	$669.7 \pm 0.7$

***N,N*-Diethylmethanamine****[616-39-7]****C<sub>5</sub>H<sub>13</sub>N****MW = 87.16****609****Table 1.** Fit with estimated  $B$  coefficient for 2 accepted points. Deviation  $\sigma_w = 0.050$ .

Coefficient	$\rho = A + BT$
$A$	975.85
$B$	-0.920

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	$706.1 \pm 0.7$	-0.05	1957-spi/pap
298.15	$701.6 \pm 0.7$	0.05	1957-spi/pap

**Table 3.** Recommended values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$
290.00	$709.0 \pm 0.8$
293.15	$706.2 \pm 0.7$
298.15	$701.6 \pm 0.7$

***N,N*-Dimethyl-1-propanamine****[926-63-6]****C<sub>5</sub>H<sub>13</sub>N****MW = 87.16****610****Table 1.** Experimental and recommended values with uncertainties.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	$706.8 \pm 2.0$	1951-amu/pit <sup>1)</sup>
293.15	$700.6 \pm 0.7$	1952-cam/fat
293.15	$700.6 \pm 0.7$	Recommended

<sup>1)</sup> Not included in calculation of recommended value.

***N,N*-Dimethyl-2-propanamine**

[996-35-0]

 $\text{C}_5\text{H}_{13}\text{N}$ 

MW = 87.16

611

**Table 1.** Fit with estimated  $B$  coefficient for 2 accepted points. Deviation  $\sigma_w = 0.050$ .

Coefficient	$\rho = A + BT$
$A$	984.85
$B$	-0.920

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	$715.1 \pm 1.0$	-0.05	1957-spi/pap
298.15	$710.6 \pm 1.0$	0.05	1957-spi/pap

**Table 3.** Recommended values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$
290.00	$718.0 \pm 1.1$
293.15	$715.1 \pm 0.9$
298.15	$710.5 \pm 0.9$

***N,N*-Diethylethanamine**

[121-44-8]

 $\text{C}_6\text{H}_{15}\text{N}$ 

MW = 101.19

612

**Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):  $\sigma_{c,w} = 5.7979 \cdot 10^{-1}$  (combined temperature ranges, weighted),  $\sigma_{c,uw} = 1.0163 \cdot 10^{-1}$  (combined temperature ranges, unweighted).

Coefficient	$T = 213.15 \text{ to } 393.15 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$
$A$	$9.81045 \cdot 10^2$
$B$	$-8.02451 \cdot 10^{-1}$
$C$	$-2.11594 \cdot 10^{-4}$

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref. (Symbol in Fig. 1)	$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref. (Symbol in Fig. 1)
362.15	$662.10 \pm 1.00$	-0.59	1886-sch(X)	288.15	$732.02 \pm 0.20$	-0.23	1942-swi(O)
273.15	$746.20 \pm 0.20$	0.13	1932-tim/hen(X)	288.15	$731.91 \pm 0.20$	-0.34	1942-swi(O)
288.15	$732.55 \pm 0.20$	0.30	1932-tim/hen(X)	298.15	$722.69 \pm 0.20$	-0.29	1942-swi(O)
303.15	$718.99 \pm 0.20$	0.65	1932-tim/hen(X)	298.15	$722.74 \pm 0.20$	-0.24	1942-swi(O)
273.15	$745.65 \pm 0.20$	-0.42	1942-swi(O)	308.15	$713.49 \pm 0.20$	-0.19	1942-swi(O)
273.15	$745.53 \pm 0.20$	-0.54	1942-swi(O)	308.15	$713.38 \pm 0.20$	-0.30	1942-swi(O)

cont.

**Table 2.** (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
285.67	734.80 ± 0.40	0.26	1944-fri/har-2 <sup>1)</sup>	233.15	782.90 ± 0.50	0.45	1959-cos/bow(X)
322.75	699.90 ± 0.40	-0.11	1944-fri/har-2(X)	253.15	765.00 ± 0.50	0.66	1959-cos/bow(X)
333.85	690.00 ± 0.40	0.44	1944-fri/har-2(X)	273.15	746.50 ± 0.50	0.43	1959-cos/bow <sup>1)</sup>
343.65	679.40 ± 0.40	-0.89	1944-fri/har-2(X)	293.15	727.70 ± 0.50	0.08	1959-cos/bow <sup>1)</sup>
353.15	670.40 ± 0.40	-0.87	1944-fri/har-2(X)	313.15	709.10 ± 0.50	0.09	1959-cos/bow <sup>1)</sup>
293.15	727.50 ± 0.60	-0.12	1948-vog-4 <sup>1)</sup>	333.15	690.30 ± 0.50	0.08	1959-cos/bow(X)
295.45	725.50 ± 0.60	0.01	1948-vog-4 <sup>1)</sup>	353.15	671.00 ± 0.50	-0.27	1959-cos/bow(X)
314.85	708.70 ± 0.60	1.28	1948-vog-4 <sup>1)</sup>	373.15	651.30 ± 0.50	-0.85	1959-cos/bow(X)
315.35	708.30 ± 0.60	1.35	1948-vog-4 <sup>1)</sup>	393.15	631.00 ± 0.50	-1.86	1959-cos/bow(X)
333.65	691.20 ± 0.60	1.45	1948-vog-4(X)	413.15	609.70 ± 0.50	-3.69	1959-cos/bow <sup>1)</sup>
335.15	689.90 ± 0.60	1.56	1948-vog-4(X)	433.15	586.40 ± 0.50	-7.36	1959-cos/bow <sup>1)</sup>
288.15	732.32 ± 0.20	0.07	1954-koh/rot(◆)	298.15	722.71 ± 0.20	-0.27	1960-cop/fin(X)
298.15	722.88 ± 0.20	-0.10	1954-koh/rot(◆)	298.15	722.82 ± 0.10	-0.16	1970-nak/shi(□)
293.15	728.80 ± 0.60	1.18	1955-kus <sup>1)</sup>	298.15	723.03 ± 0.20	0.05	1971-let/bay(Δ)
298.15	724.10 ± 0.60	1.12	1955-kus <sup>1)</sup>	293.15	727.70 ± 0.20	0.08	1978-pat(∇)
303.15	719.40 ± 0.60	1.06	1955-kus <sup>1)</sup>	313.15	709.59 ± 0.40	0.58	1980-pit/sur(X)
313.15	709.90 ± 0.60	0.89	1955-kus <sup>1)</sup>	313.15	709.32 ± 0.40	0.31	1980-sur(X)
323.15	700.50 ± 0.60	0.86	1955-kus(X)	293.15	727.27 ± 0.20	-0.35	1981-koh/atr(X)
333.15	691.00 ± 0.60	0.78	1955-kus(X)	313.15	708.62 ± 0.20	-0.39	1981-koh/atr(X)
343.15	681.50 ± 0.60	0.73	1955-kus(X)	303.15	718.40 ± 0.20	0.06	1985-osw/rao(X)
213.15	800.50 ± 0.50	0.11	1959-cos/bow(X)	298.15	722.91 ± 0.20	-0.07	1987-sur/nao(X)

<sup>1)</sup> Not included in Fig. 1.

**Further references:** [1879-bru, 1880-bru-3, 1884-gla, 1889-hof, 1889-per, 1891-gla, 1895-bru-1, 1919-eyk, 1923-her/neu, 1947-wat/ott, 1950-bar/lef-1, 1956-shi, 1967-dav/fin, 1967-dei, 1967-kar, 1967-mat/san-1, 1968-ano, 1972-let, 1972-let-1, 1981-cam, 1981-kum/pra, 1982-dut/kah, 1990-dut/kah, 1991-gro/rou].

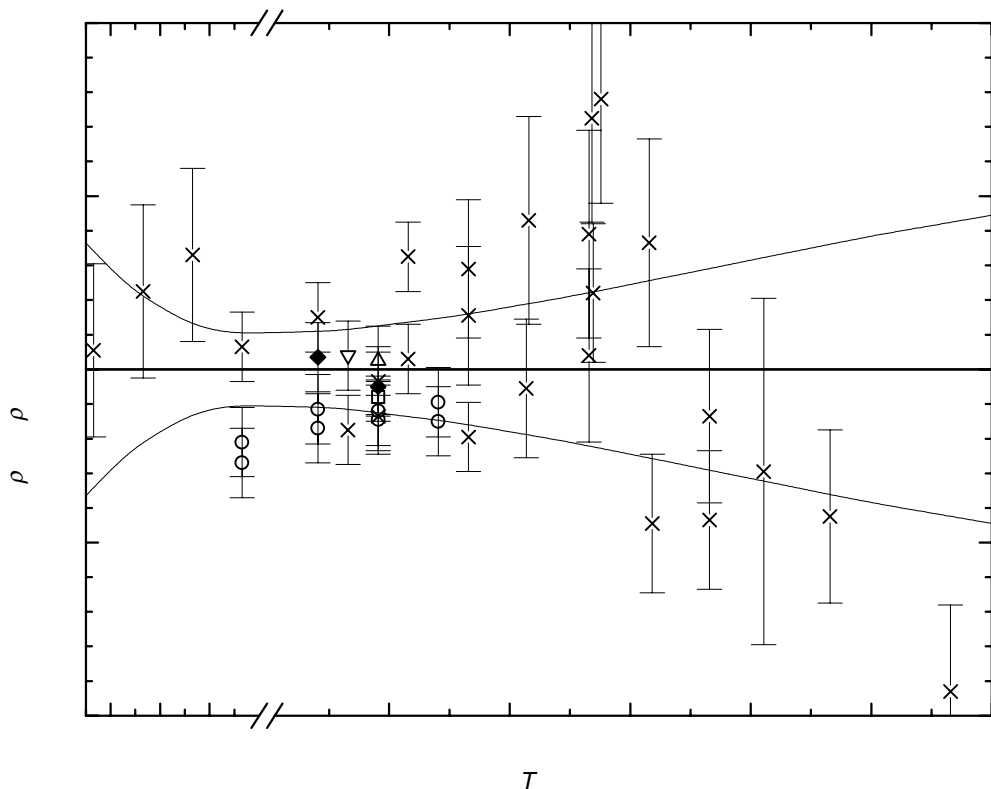
**Table 3.** Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$$

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
210.00	803.20 ± 0.73	290.00	730.54 ± 0.22	350.00	674.27 ± 0.56
220.00	794.26 ± 0.58	293.15	727.62 ± 0.23	360.00	664.74 ± 0.63
230.00	785.29 ± 0.45	298.15	722.98 ± 0.25	370.00	655.17 ± 0.70
240.00	776.27 ± 0.36	300.00	721.27 ± 0.26	380.00	645.56 ± 0.77
250.00	767.21 ± 0.28	310.00	711.95 ± 0.30	390.00	635.91 ± 0.83
260.00	758.10 ± 0.23	320.00	702.59 ± 0.36	400.00	626.21 ± 0.89
270.00	748.96 ± 0.21	330.00	693.19 ± 0.42		
280.00	739.77 ± 0.21	340.00	683.75 ± 0.49		

cont.

*N,N*-Diethylethanamine (cont.)



**Fig. 1.** The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

*N,N*-Dimethyl-2-butanamine [921-04-0] C<sub>6</sub>H<sub>15</sub>N MW = 101.19 613

**Table 1.** Experimental value with uncertainty.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m <sup>-3</sup>	Ref.
298.15	734.0 ± 1.0	1957-cop/leb

*N,N*-Dimethyl-2-methyl-2-propanamine [918-02-5] C<sub>6</sub>H<sub>15</sub>N MW = 101.19 614

**Table 1.** Fit with estimated *B* coefficient for 2 accepted points. Deviation  $\sigma_w = 0.100$ .

Coefficient	$\rho = A + BT$
<i>A</i>	999.97
<i>B</i>	-0.880

cont.

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$735.0 \pm 2.0$	-2.60	1956-bor/lus <sup>1)</sup>
298.15	$735.0 \pm 2.0$	-2.60	1958-mei/bol <sup>1)</sup>
293.15	$741.9 \pm 1.0$	-0.10	1957-spi/pap
298.15	$737.7 \pm 1.0$	0.10	1957-spi/pap

<sup>1)</sup> Not included in calculation of linear coefficients.**Table 3.** Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	$744.8 \pm 0.7$
293.15	$742.0 \pm 0.5$
298.15	$737.6 \pm 0.5$

***N*-Ethyl-*N*-methyl-1-propanamine**

[4458-32-6]

 $\text{C}_6\text{H}_{15}\text{N}$ 

MW = 101.19

615

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$718.0 \pm 1.0$	1957-cop/leb

***N*-Ethyl-*N*-methyl-2-propanamine**

[39198-07-7]

 $\text{C}_6\text{H}_{15}\text{N}$ 

MW = 101.19

616

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$721.4 \pm 1.0$	1957-cop/leb

***N,N*-Diethyl-1-propanamine**

[4458-31-5]

 $\text{C}_7\text{H}_{17}\text{N}$ 

MW = 115.22

617

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	$742.0 \pm 1.5$	1948-leo/kra

***N,N*-Dimethyl-3-pentanamine** [18636-94-7]  $\text{C}_7\text{H}_{17}\text{N}$  MW = 115.22 618

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$750.7 \pm 1.0$	1957-cop/leb

***N*-Ethyl-*N*-methyl-1-butanamine** [66225-40-9]  $\text{C}_7\text{H}_{17}\text{N}$  MW = 115.22 619

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$732.0 \pm 1.0$	1957-cop/leb

***N*-Ethyl-*N*-methyl-2-methyl-1-propanamine** [60247-14-5]  $\text{C}_7\text{H}_{17}\text{N}$  MW = 115.22 620

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$729.3 \pm 1.0$	1957-cop/leb

***N*-Ethyl-*N*-methyl-2-methyl-2-propanamine** [52841-28-8]  $\text{C}_7\text{H}_{17}\text{N}$  MW = 115.22 621

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$744.4 \pm 1.0$	1957-cop/leb

***N*-Methyl-*N*-(1-methylethyl)-2-propanamine** [10342-97-9]  $\text{C}_7\text{H}_{17}\text{N}$  MW = 115.22 622

**Table 1.** Fit with estimated  $B$  coefficient for 2 accepted points. Deviation  $\sigma_w = 0.050$ .

Coefficient	$\rho = A + BT$
$A$	993.93
$B$	-0.820

cont.

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	$753.5 \pm 1.0$	-0.05	1957-spi/pap
298.15	$749.5 \pm 1.0$	0.05	1957-spi/pap

**Table 3.** Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	$756.1 \pm 1.1$
293.15	$753.6 \pm 0.9$
298.15	$749.5 \pm 0.9$

***N,N*-Diethyl-1-butanamine**

[4444-68-2]

 $\text{C}_8\text{H}_{19}\text{N}$ 

MW = 129.25

623

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	$742.0 \pm 0.5$	1948-leo/kra

***N*-Ethyl-*N*-(1-methylethyl)-2-methylethanamine**

[7087-68-5]

 $\text{C}_8\text{H}_{19}\text{N}$ 

MW = 129.25

624

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
313.15	$749.0 \pm 1.5$	1977-bur/lee

***N*-Methyl-*N*-(2-methylpropyl)-1-propanamine**

[500002-78-8]

 $\text{C}_8\text{H}_{19}\text{N}$ 

MW = 129.25

625

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$732.7 \pm 1.0$	1957-cop/leb

***N*-Methyl-*N*-propyl-1-butanamine** [24551-99-3]  $\text{C}_8\text{H}_{19}\text{N}$  MW = 129.25 626

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$742.0 \pm 1.0$	1957-cop/leb

***N*-Butyl-*N*-methyl-1-butanamine** [3405-45-6]  $\text{C}_9\text{H}_{21}\text{N}$  MW = 143.27 627

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	$759.3 \pm 0.4$	1956-ano-14

***N*-Butyl-*N*-methyl-2-methyl-1-propanamine** [500002-80-2]  $\text{C}_9\text{H}_{21}\text{N}$  MW = 143.27 628

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$743.2 \pm 1.0$	1957-cop/leb

***N,N*-Diethyl-1-pentanamine** [2162-91-6]  $\text{C}_9\text{H}_{21}\text{N}$  MW = 143.27 629

**Table 1.** Experimental values with uncertainties.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
288.15	$776.0 \pm 2.0$	1956-gla/gau <sup>1)</sup>	293.15	$766.3 \pm 1.0$	1935-cof
293.15	$770.2 \pm 2.0$	1956-gol/ibr <sup>1)</sup>	293.15	$766.3 \pm 1.0$	1938-car
290.15	$761.0 \pm 2.0$	1957-gla/ber <sup>1)</sup>	293.15	$766.3 \pm 1.0$	Recommended

<sup>1)</sup> Not included in calculation of recommended value.

***N,N*-Dimethyl-1-heptanamine** [5277-11-2]  $\text{C}_9\text{H}_{21}\text{N}$  MW = 143.27 630

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	$758.0 \pm 0.7$	1952-cam/fat

***N,N*-Dipropyl-1-propanamine****[102-69-2]****C<sub>9</sub>H<sub>21</sub>N****MW = 143.27****631**

**Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):  $\sigma_{c,w} = 8.6070 \cdot 10^{-1}$  (combined temperature ranges, weighted),  $\sigma_{c,uw} = 1.6452 \cdot 10^{-1}$  (combined temperature ranges, unweighted).

Coefficient	T = 213.15 to 473.15 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$9.53730 \cdot 10^2$
B	$-5.51205 \cdot 10^{-1}$
C	$-4.10712 \cdot 10^{-4}$

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
277.15	$768.10 \pm 0.60$	-1.32	1889-per(×)	253.15	$788.20 \pm 0.50$	0.33	1959-cos/bow(◆)
283.15	$763.20 \pm 0.60$	-1.53	1889-per(×)	273.15	$772.40 \pm 0.50$	-0.13	1959-cos/bow(◆)
288.15	$759.30 \pm 0.60$	-1.50	1889-per(×)	293.15	$756.40 \pm 0.50$	-0.45	1959-cos/bow(◆)
293.15	$755.40 \pm 0.60$	-1.45	1889-per(×)	313.15	$740.40 \pm 0.50$	-0.44	1959-cos/bow(◆)
298.14	$751.70 \pm 0.60$	-1.19	1889-per(×)	333.15	$724.20 \pm 0.50$	-0.31	1959-cos/bow(◆)
277.55	$770.30 \pm 1.00$	1.20	1891-gla(×)	353.15	$708.40 \pm 0.50$	0.55	1959-cos/bow(◆)
295.95	$753.50 \pm 1.00$	-1.13	1891-gla <sup>1)</sup>	373.15	$691.70 \pm 0.50$	0.84	1959-cos/bow(◆)
293.15	$757.10 \pm 0.50$	0.25	1910-tur/mer(×)	393.15	$674.40 \pm 0.50$	0.86	1959-cos/bow(◆)
303.15	$749.30 \pm 0.50$	0.41	1910-tur/mer(×)	413.15	$657.00 \pm 0.50$	1.11	1959-cos/bow(◆)
318.15	$737.30 \pm 0.50$	0.51	1910-tur/mer(×)	433.15	$638.80 \pm 0.50$	0.88	1959-cos/bow(◆)
333.15	$725.20 \pm 0.50$	0.69	1910-tur/mer(×)	453.15	$619.40 \pm 0.50$	-0.21	1959-cos/bow(◆)
348.15	$713.00 \pm 0.50$	0.95	1910-tur/mer(×)	473.15	$599.00 \pm 0.50$	-1.98	1959-cos/bow(◆)
273.15	$773.00 \pm 1.00$	0.47	1917-jae(×)	493.15	$576.50 \pm 0.50$	-5.52	1959-cos/bow <sup>1)</sup>
298.75	$753.00 \pm 1.00$	0.60	1917-jae <sup>1)</sup>	298.15	$752.34 \pm 0.30$	-0.54	1972-let(○)
323.15	$733.00 \pm 1.00$	0.28	1917-jae(×)	298.15	$752.32 \pm 0.30$	-0.56	1972-let-1(□)
293.15	$756.70 \pm 0.50$	-0.15	1952-cow(×)	303.15	$749.70 \pm 0.40$	0.81	1985-osw/rao(▽)
213.15	$818.90 \pm 0.50$	1.32	1959-cos/bow(◆)	298.15	$752.27 \pm 0.40$	-0.61	1987-sur/nao(Δ)
233.15	$803.80 \pm 0.50$	0.91	1959-cos/bow(◆)				

<sup>1)</sup> Not included in Fig. 1.**Further references:** [1882-zan, 1889-gla/per, 1895-bru-1, 1948-vog-4].**Table 3.** Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$$

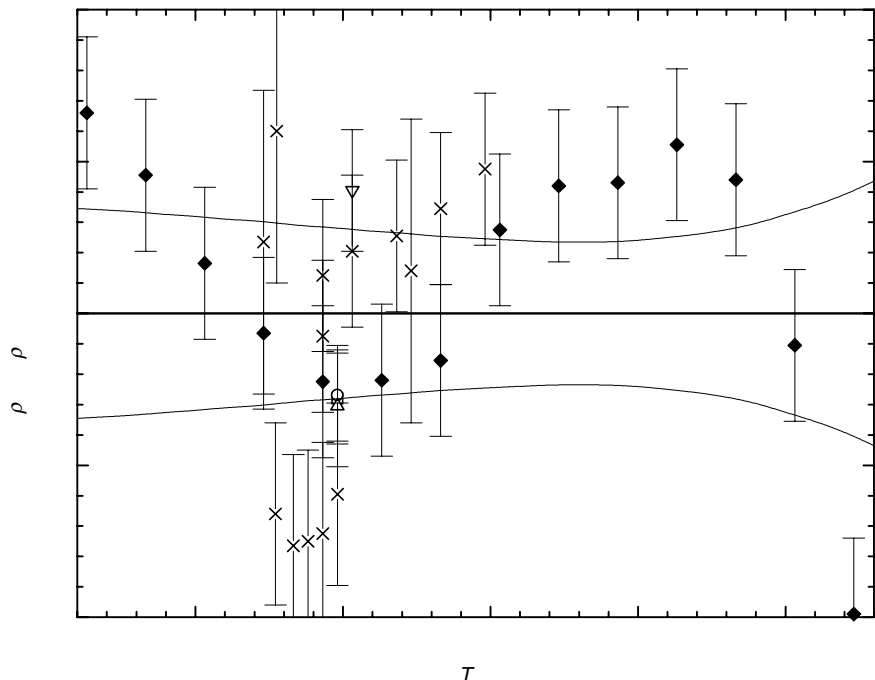
$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
210.00	$819.86 \pm 0.69$	250.00	$790.26 \pm 0.64$	290.00	$759.34 \pm 0.57$
220.00	$812.59 \pm 0.68$	260.00	$782.65 \pm 0.62$	293.15	$756.85 \pm 0.57$
230.00	$805.23 \pm 0.67$	270.00	$774.96 \pm 0.61$	298.15	$752.88 \pm 0.56$
240.00	$797.78 \pm 0.65$	280.00	$767.19 \pm 0.59$	300.00	$751.40 \pm 0.56$

cont.

*N,N*-Dipropyl-1-propanamine (cont.)

**Table 3.** (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
310.00	$743.39 \pm 0.54$	370.00	$693.56 \pm 0.47$	430.00	$640.77 \pm 0.55$
320.00	$735.29 \pm 0.53$	380.00	$684.97 \pm 0.47$	440.00	$631.69 \pm 0.59$
330.00	$727.11 \pm 0.51$	390.00	$676.29 \pm 0.47$	450.00	$622.52 \pm 0.65$
340.00	$718.84 \pm 0.50$	400.00	$667.53 \pm 0.48$	460.00	$613.27 \pm 0.71$
350.00	$710.50 \pm 0.49$	410.00	$658.70 \pm 0.50$	470.00	$603.94 \pm 0.78$
360.00	$702.07 \pm 0.48$	420.00	$649.77 \pm 0.52$	480.00	$594.52 \pm 0.87$



**Fig. 1.** The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

*N*-Methyl-*N*-(3-methylbutyl)-1-propanamine [500002-82-4] C<sub>9</sub>H<sub>21</sub>N MW = 143.27 632

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$751.3 \pm 1.0$	1957-cop/leb

***N,N*-Dimethyl-2-ethyl-1-hexanamine** [28056-87-3]  $\text{C}_{10}\text{H}_{23}\text{N}$  MW = 157.3 633

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	$768.6 \pm 0.4$	1955-ano-13

***N,N*-Dimethyl-1-octanamine** [7378-99-6]  $\text{C}_{10}\text{H}_{23}\text{N}$  MW = 157.3 634

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	$768.7 \pm 0.7$	1960-zak/gav

***N,N*-Dimethyl-1,1,3,3-tetramethyl-1-butanamine** [500044-72-4]  $\text{C}_{10}\text{H}_{23}\text{N}$  MW = 157.3 635

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$787.7 \pm 1.0$	1956-bor/lus

***N,N*-Diethyl-3-heptanamine** [500003-42-9]  $\text{C}_{11}\text{H}_{25}\text{N}$  MW = 171.33 636

**Table 1.** Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
287.15	$781.0 \pm 1.5$	1956-gla/gau

***N*-Dibutyl-1-butanamine** [102-82-9]  $\text{C}_{12}\text{H}_{27}\text{N}$  MW = 185.35 637

**Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):

$\sigma_{\text{c,w}} = 7.5711 \cdot 10^{-1}$  (combined temperature ranges, weighted),  $\sigma_{\text{c,uw}} = 1.3379 \cdot 10^{-1}$  (combined temperature ranges, unweighted).

Coefficient	$T = 253.15 \text{ to } 493.15 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$
<i>A</i>	$9.59978 \cdot 10^2$
<i>B</i>	$-5.12706 \cdot 10^{-1}$
<i>C</i>	$-3.63146 \cdot 10^{-4}$

cont.

***N*-Dibutyl-1-butanamine** (cont.)**Table 2.** Experimental values with uncertainties and deviation from calculated values.

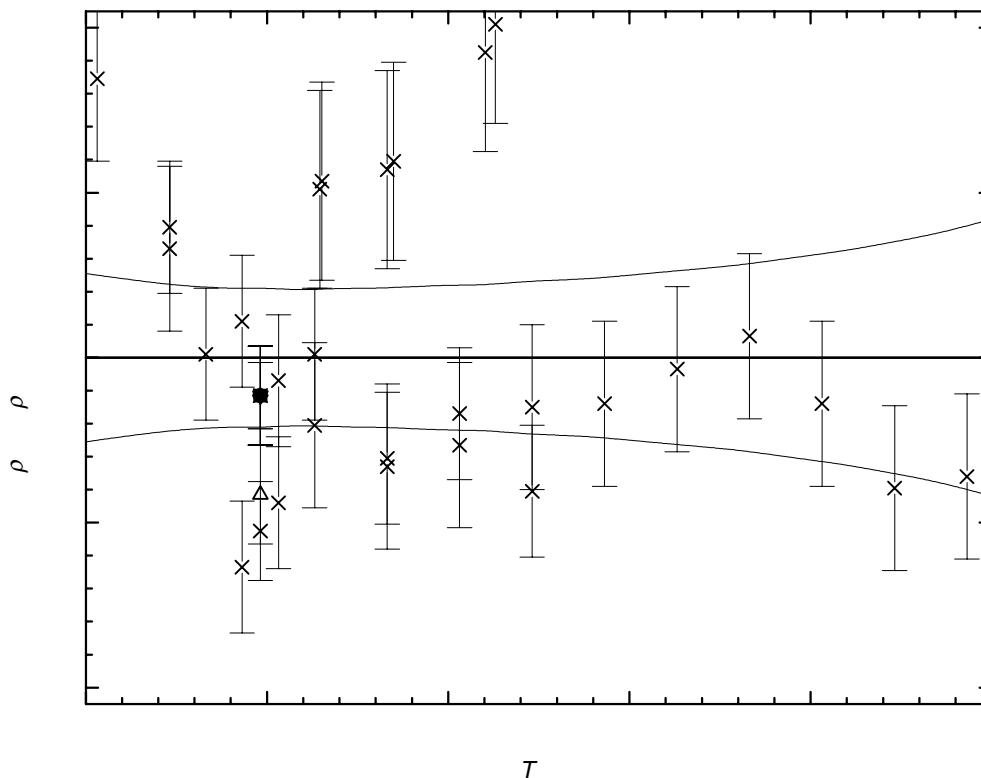
$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
273.15	793.63 ± 0.40	0.79	1932-bin/spo(×)	373.15	717.80 ± 0.50	-0.30	1959-cos/bow(×)
283.15	785.71 ± 0.40	0.02	1932-bin/spo(×)	393.15	702.00 ± 0.50	-0.28	1959-cos/bow(×)
293.15	778.69 ± 0.40	0.22	1932-bin/spo(×)	413.15	686.10 ± 0.50	-0.07	1959-cos/bow(×)
303.15	771.04 ± 0.40	-0.14	1932-bin/spo(×)	433.15	669.90 ± 0.50	0.13	1959-cos/bow(×)
313.15	763.83 ± 0.40	0.02	1932-bin/spo(×)	453.15	652.80 ± 0.50	-0.28	1959-cos/bow(×)
333.15	748.25 ± 0.40	-0.61	1932-bin/spo(×)	473.15	635.30 ± 0.50	-0.79	1959-cos/bow(×)
353.15	733.29 ± 0.40	-0.34	1932-bin/spo(×)	493.15	618.10 ± 0.50	-0.72	1959-cos/bow(×)
373.15	717.29 ± 0.40	-0.81	1932-bin/spo(×)	513.15	597.80 ± 0.50	-3.46	1959-cos/bow <sup>1)</sup>
293.15	778.10 ± 0.60	-0.37	1948-vog-4 <sup>1)</sup>	533.15	577.40 ± 0.60	-6.00	1959-cos/bow <sup>1)</sup>
296.05	776.10 ± 0.60	-0.26	1948-vog-4 <sup>1)</sup>	553.15	555.90 ± 0.60	-9.36	1959-cos/bow <sup>1)</sup>
314.55	763.80 ± 0.60	1.02	1948-vog-4(×)	298.15	773.78 ± 0.30	-1.05	1972-let(×)
315.15	763.40 ± 0.60	1.07	1948-vog-4(×)	298.15	774.00 ± 0.30	-0.83	1972-let-1(Δ)
333.15	750.00 ± 0.60	1.14	1948-vog-4(×)	293.15	777.20 ± 0.40	-1.27	1977-rat/sal(×)
334.95	748.70 ± 0.60	1.19	1948-vog-4(×)	298.15	774.60 ± 0.30	-0.23	1982-phi/del(×)
360.25	730.00 ± 0.60	1.85	1948-vog-4(×)	298.15	774.60 ± 0.20	-0.23	1982-phi/del-1(□)
363.05	728.00 ± 0.60	2.02	1948-vog-4(×)	298.15	774.60 ± 0.20	-0.23	1982-phi/del-2(○)
233.15	823.70 ± 0.50	3.00	1959-cos/bow <sup>1)</sup>	298.15	774.60 ± 0.30	-0.23	1982-phi/del-3(×)
253.15	808.60 ± 0.50	1.69	1959-cos/bow(×)	298.15	774.60 ± 0.30	-0.23	1982-phi/del-4(∇)
273.15	793.50 ± 0.50	0.66	1959-cos/bow(×)	298.15	774.60 ± 0.30	-0.23	1982-phi/del-5(×)
293.15	778.40 ± 0.50	-0.07	1959-cos/bow <sup>1)</sup>	298.15	774.60 ± 0.30	-0.23	1982-phi/del-6(◆)
313.15	763.40 ± 0.50	-0.41	1959-cos/bow(×)	298.15	774.60 ± 0.30	-0.23	1982-phi/del-7(×)
333.15	748.20 ± 0.50	-0.66	1959-cos/bow(×)	303.15	770.30 ± 0.40	-0.88	1985-osw/rao(×)
353.15	733.10 ± 0.50	-0.53	1959-cos/bow(×)				

<sup>1)</sup> Not included in Fig. 1.**Further references:** [1872-lie/ros, 1961-bel/shu-1, 1981-koh/atr].**Table 3.** Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4].$$

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
250.00	809.10 ± 0.51	330.00	751.24 ± 0.42	430.00	672.37 ± 0.56
260.00	802.13 ± 0.48	340.00	743.68 ± 0.43	440.00	664.08 ± 0.59
270.00	795.07 ± 0.45	350.00	736.05 ± 0.44	450.00	655.72 ± 0.62
280.00	787.95 ± 0.43	360.00	728.34 ± 0.44	460.00	647.29 ± 0.65
290.00	780.75 ± 0.42	370.00	720.56 ± 0.46	470.00	638.79 ± 0.69
293.15	778.47 ± 0.42	380.00	712.71 ± 0.47	480.00	630.21 ± 0.73
298.15	774.83 ± 0.42	390.00	704.79 ± 0.48	490.00	621.56 ± 0.78
300.00	773.48 ± 0.42	400.00	696.79 ± 0.50	500.00	612.84 ± 0.84
310.00	766.14 ± 0.41	410.00	688.72 ± 0.52		
320.00	758.73 ± 0.42	420.00	680.58 ± 0.54		

cont.



**Fig. 1.** The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

***N*-Methyl-*N*-propyl-1-decanamine**      [88090-09-9]       $C_{14}H_{31}N$       MW = 213.41      638

**Table 1.** Experimental value with uncertainty.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
298.15	$780.8 \pm 1.0$	1957-cop/leb

***N,N*-Bis(2-methylbutyl)-2-methyl-1-butanamine**      [620-43-9]       $C_{15}H_{33}N$       MW = 227.43      639

**Table 1.** Experimental value with uncertainty.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
286.15	$788.2 \pm 1.0$	1881-pli

**(*R*)-*N,N*-Bis(2-methylbutyl)-2-methyl-1-butanamine** [500003-35-0]  $C_{15}H_{33}N$  MW = 227.43 640

**Table 1.** Experimental value with uncertainty.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
286.15	$796.4 \pm 2.0$	1881-pli

***N,N*-Bis(3-methylbutyl)-3-methyl-1-butanamine** [645-41-0]  $C_{15}H_{33}N$  MW = 227.43 641

**Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):

$\sigma_{c,w} = 9.4676 \cdot 10^{-1}$  (combined temperature ranges, weighted),  $\sigma_{c,uw} = 3.3965 \cdot 10^{-1}$  (combined temperature ranges, unweighted).

Coefficient	$T = 273.15 \text{ to } 373.15 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$
<i>A</i>	$9.37619 \cdot 10^2$
<i>B</i>	$-3.56391 \cdot 10^{-1}$
<i>C</i>	$-5.77272 \cdot 10^{-4}$

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

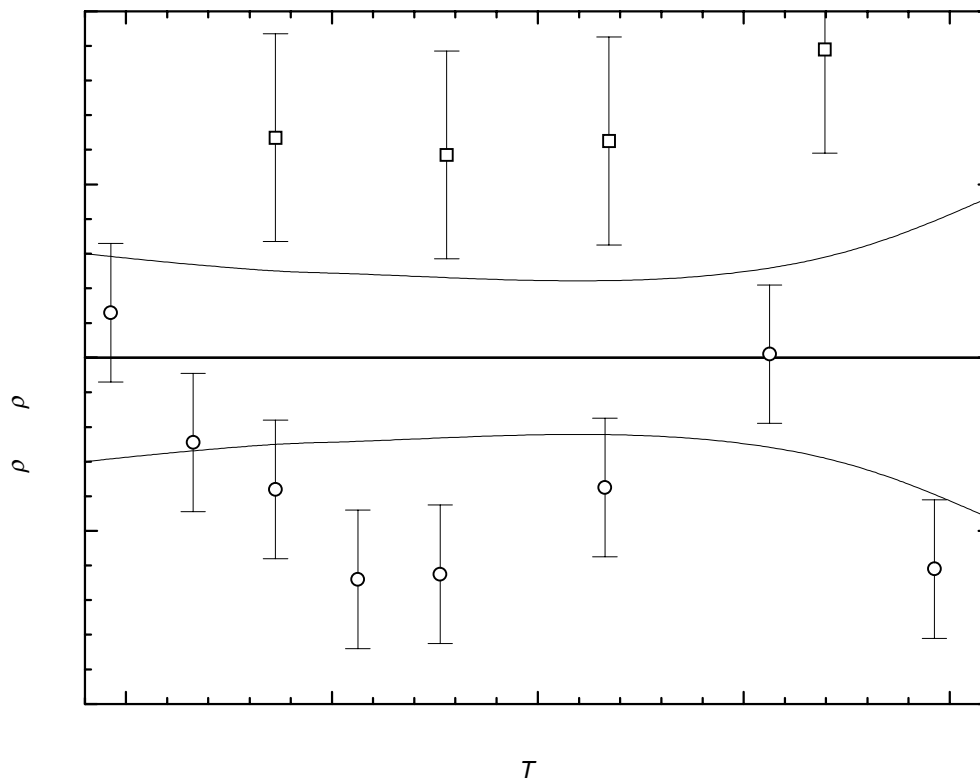
$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref. (Symbol in Fig. 1)	$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref. (Symbol in Fig. 1)
273.15	$797.46 \pm 0.40$	0.26	1932-bin/spo(○)	353.15	$739.79 \pm 0.40$	0.02	1932-bin/spo(○)
283.15	$789.93 \pm 0.40$	-0.49	1932-bin/spo(○)	373.15	$723.03 \pm 0.40$	-1.22	1932-bin/spo(○)
293.15	$782.77 \pm 0.40$	-0.76	1932-bin/spo(○)	293.15	$784.80 \pm 0.60$	1.27	1948-vog-4(□)
303.15	$775.25 \pm 0.40$	-1.28	1932-bin/spo(○)	313.95	$770.00 \pm 0.60$	1.17	1948-vog-4(□)
313.15	$768.16 \pm 0.40$	-1.25	1932-bin/spo(○)	333.65	$755.70 \pm 0.60$	1.25	1948-vog-4(□)
333.15	$754.07 \pm 0.40$	-0.75	1932-bin/spo(○)	359.85	$736.40 \pm 0.60$	1.78	1948-vog-4(□)

**Table 3.** Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$$

$T$ K	$\rho \pm \sigma_{\text{fit}}$ $\text{kg} \cdot \text{m}^{-3}$	$T$ K	$\rho \pm \sigma_{\text{fit}}$ $\text{kg} \cdot \text{m}^{-3}$	$T$ K	$\rho \pm \sigma_{\text{fit}}$ $\text{kg} \cdot \text{m}^{-3}$
270.00	$799.31 \pm 0.60$	300.00	$778.75 \pm 0.49$	350.00	$742.17 \pm 0.49$
280.00	$792.57 \pm 0.55$	310.00	$771.66 \pm 0.47$	360.00	$734.50 \pm 0.57$
290.00	$785.72 \pm 0.51$	320.00	$764.46 \pm 0.45$	370.00	$726.73 \pm 0.72$
293.15	$783.53 \pm 0.50$	330.00	$757.15 \pm 0.44$	380.00	$718.83 \pm 0.93$
298.15	$780.05 \pm 0.49$	340.00	$749.71 \pm 0.45$		

cont.



**Fig. 1.** The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

*N,N*-Dipentyl-1-pentanamine

[621-77-2]

$C_{15}H_{33}N$

MW = 227.43

642

**Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):  $\sigma_{c,w} = 8.1014 \cdot 10^{-1}$  (combined temperature ranges, weighted),  $\sigma_{c,uw} = 2.2726 \cdot 10^{-1}$  (combined temperature ranges, unweighted).

Coefficient	T = 273.15 to 373.15 K
	$\rho = A + BT + CT^2 + DT^3 + \dots$
A	$9.50979 \cdot 10^2$
B	$-4.01876 \cdot 10^{-1}$
C	$-5.02093 \cdot 10^{-4}$

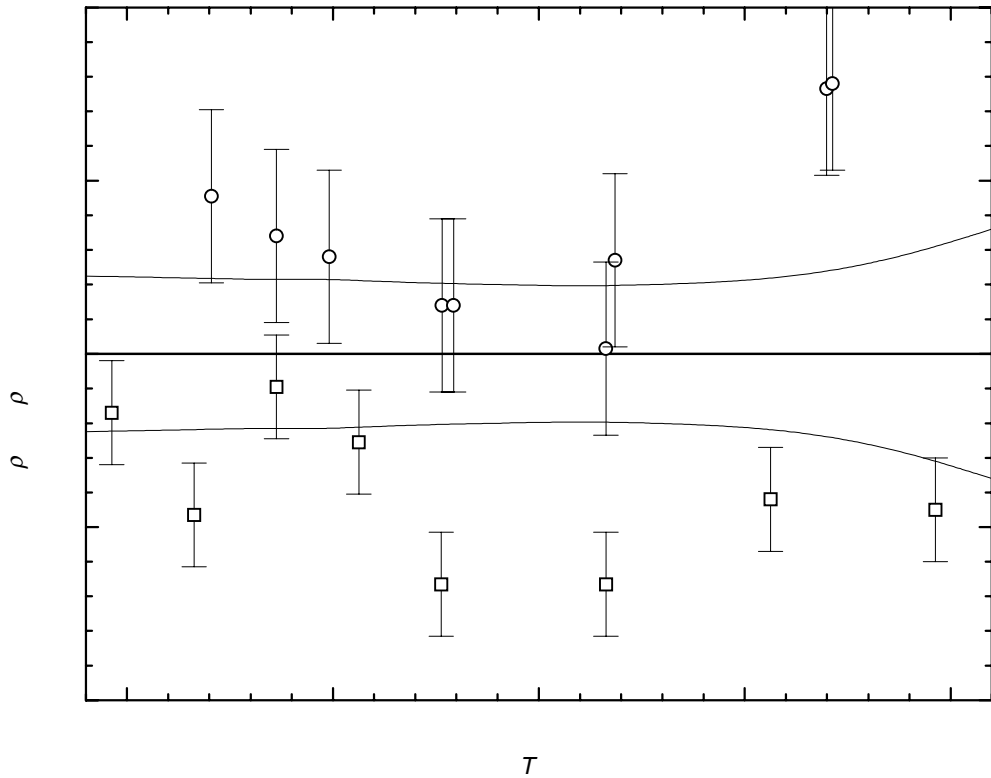
cont.

*N,N*-Dipentyl-1-pentanamine (cont.)

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
273.15	$803.40 \pm 0.30$	-0.34	1932-bin/spo( $\square$ )	293.15	$789.70 \pm 0.30$	-0.19	1932-bin/spo( $\square$ )
283.15	$796.00 \pm 0.30$	-0.93	1932-bin/spo( $\square$ )	299.55	$786.10 \pm 0.50$	0.56	1948-vog-4( $\circ$ )
293.15	$789.83 \pm 0.30$	-0.19	1932-bin/spo( $\square$ )	313.25	$776.10 \pm 0.50$	0.28	1948-vog-4( $\circ$ )
303.15	$782.50 \pm 0.30$	-0.51	1932-bin/spo( $\square$ )	314.65	$775.10 \pm 0.50$	0.28	1948-vog-4( $\circ$ )
313.15	$774.56 \pm 0.30$	-1.33	1932-bin/spo( $\square$ )	333.15	$761.40 \pm 0.50$	0.03	1948-vog-4( $\circ$ )
333.15	$760.04 \pm 0.30$	-1.33	1932-bin/spo( $\square$ )	334.25	$761.10 \pm 0.50$	0.54	1948-vog-4( $\circ$ )
353.15	$745.60 \pm 0.30$	-0.84	1932-bin/spo( $\square$ )	359.95	$742.80 \pm 0.50$	1.53	1948-vog-4( $\circ$ )
373.15	$730.21 \pm 0.30$	-0.90	1932-bin/spo( $\square$ )	360.65	$742.30 \pm 0.50$	1.56	1948-vog-4( $\circ$ )
285.25	$796.40 \pm 0.50$	0.91	1948-vog-4( $\circ$ )				

**Further references:** [1910-tur/mer].



**Fig. 1.** The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

cont.

**Table 3.** Recommended values (fit to the reliable experimental values according to the equations  $\rho = A + BT + CT^2 + DT^3 + \dots$  or  $\rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$ ).

$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	805.87 $\pm$ 0.45	300.00	785.23 $\pm$ 0.43	350.00	748.82 $\pm$ 0.42
280.00	799.09 $\pm$ 0.44	310.00	778.15 $\pm$ 0.41	360.00	741.23 $\pm$ 0.47
290.00	792.21 $\pm$ 0.43	320.00	770.96 $\pm$ 0.40	370.00	733.55 $\pm$ 0.57
293.15	790.02 $\pm$ 0.43	330.00	763.68 $\pm$ 0.39	380.00	725.76 $\pm$ 0.72
298.15	786.53 $\pm$ 0.43	340.00	756.30 $\pm$ 0.40		

***N,N*-Dimethyl-2-pentyl-1-nonanamine** [99916-30-0]  $\text{C}_{16}\text{H}_{35}\text{N}$  MW = 241.46 643

**Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):  $\sigma_{c,w} = 3.0549 \cdot 10^{-1}$  (combined temperature ranges, weighted),  $\sigma_{c,uw} = 2.3287 \cdot 10^{-1}$  (combined temperature ranges, unweighted).

Coefficient	T = 298.15 to 423.25 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$9.84614 \cdot 10^2$
B	$-5.88316 \cdot 10^{-1}$
C	$-1.94038 \cdot 10^{-4}$

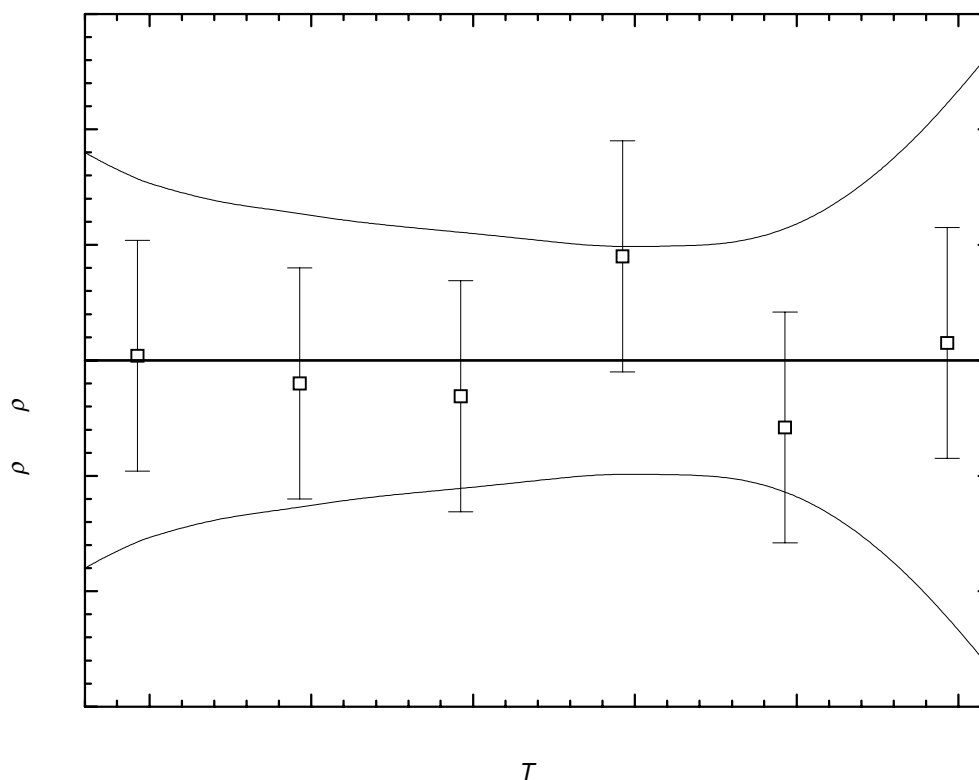
**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
298.15	792.00 $\pm$ 1.00	0.04	1987-mil/fen(□)	373.10	739.00 $\pm$ 1.00	0.90	1987-mil/fen(□)
323.20	774.00 $\pm$ 1.00	-0.20	1987-mil/fen(□)	398.20	719.00 $\pm$ 1.00	-0.58	1987-mil/fen(□)
348.10	756.00 $\pm$ 1.00	-0.31	1987-mil/fen(□)	423.25	701.00 $\pm$ 1.00	0.15	1987-mil/fen(□)

**Table 3.** Recommended values (fit to the reliable experimental values according to the equations  $\rho = A + BT + CT^2 + DT^3 + \dots$  or  $\rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$ ).

$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	797.68 $\pm$ 1.80	330.00	769.34 $\pm$ 1.21	390.00	725.66 $\pm$ 1.00
293.15	795.47 $\pm$ 1.70	340.00	762.16 $\pm$ 1.15	400.00	718.24 $\pm$ 1.15
298.15	791.96 $\pm$ 1.57	350.00	754.93 $\pm$ 1.10	410.00	710.79 $\pm$ 1.49
300.00	790.66 $\pm$ 1.53	360.00	747.67 $\pm$ 1.04	420.00	703.29 $\pm$ 2.00
310.00	783.59 $\pm$ 1.37	370.00	740.37 $\pm$ 0.98	430.00	695.76 $\pm$ 2.67
320.00	776.48 $\pm$ 1.30	380.00	733.03 $\pm$ 0.99		

cont.

*N,N*-Dimethyl-2-pentyl-1-nonanamine (cont.)

**Fig. 1.** The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

*N,N*-Diethyl-1-hexanamine

[102-86-3]

 $C_{18}H_{39}N$ 

MW = 269.51

644

**Table 1.** Fit with estimated  $B$  coefficient for 2 accepted points. Deviation  $\sigma_w = 0.200$ .

Coefficient	$\rho = A + BT$
$A$	968.46
$B$	-0.560

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	$804.1 \pm 0.6$	-0.20	1963-sud/phr
298.15	$801.7 \pm 0.6$	0.20	1963-sud/phr

cont.

**Table 3.** Recommended values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$
290.00	$806.1 \pm 0.6$
293.15	$804.3 \pm 0.6$
298.15	$801.5 \pm 0.6$

***N,N*-Diheptyl-1-heptanamine****[2411-36-1]****C<sub>21</sub>H<sub>45</sub>N****MW = 311.6****645****Table 1.** Fit with estimated  $B$  coefficient for 3 accepted points. Deviation  $\sigma_w = 0.419$ .

Coefficient	$\rho = A + BT$
$A$	985.22
$B$	-0.600

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
288.15	$811.9 \pm 0.6$	-0.43	1963-sud/phr
293.15	$809.9 \pm 0.6$	0.57	1963-sud/phr
298.15	$806.2 \pm 0.6$	-0.13	1963-sud/phr

**Table 3.** Recommended values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$
280.00	$817.2 \pm 0.9$
290.00	$811.2 \pm 0.7$
293.15	$809.3 \pm 0.7$
298.15	$806.3 \pm 0.7$

***N,N*-Dioctyl-1-octanamine****[1116-76-3]****C<sub>24</sub>H<sub>51</sub>N****MW = 353.68****646****Table 1.** Fit with estimated  $B$  coefficient for 3 accepted points. Deviation  $\sigma_w = 0.804$ .

Coefficient	$\rho = A + BT$
$A$	1109.45
$B$	-1.000

cont.

***N,N*-Dioctyl-1-octanamine** (cont.)**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m <sup>-3</sup>	$\rho_{\text{exp}} - \rho_{\text{calc}}$ kg · m <sup>-3</sup>	Ref.
293.15	817.4 ± 0.6	1.10	1963-sud/phr
298.15	811.0 ± 0.6	-0.30	1963-sud/phr
298.15	810.5 ± 0.6	-0.80	1996-ste/chi-2

**Table 3.** Recommended values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m <sup>-3</sup>
290.00	819.5 ± 1.2
293.15	816.3 ± 1.0
298.15	811.3 ± 1.0

***N,N*-Dinonyl-1-nonanamine**

[2044-22-6]

C27H57N

MW = 395.76

647

**Table 1.** Fit with estimated  $B$  coefficient for 3 accepted points. Deviation  $\sigma_w = 0.804$ .

Coefficient	$\rho = A + BT$
$A$	1083.04
$B$	-0.900

**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m <sup>-3</sup>	$\rho_{\text{exp}} - \rho_{\text{calc}}$ kg · m <sup>-3</sup>	Ref.
288.15	824.0 ± 0.6	0.30	1963-sud/phr
293.15	818.1 ± 0.6	-1.10	1963-sud/phr
298.15	815.5 ± 0.6	0.80	1963-sud/phr

**Table 3.** Recommended values.

$T$ K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m <sup>-3</sup>
280.00	831.0 ± 1.6
290.00	822.0 ± 1.0
293.15	819.2 ± 1.0
298.15	814.7 ± 1.1

***N,N*-Didecyl-1-decanamine** [1070-01-5]  $C_{30}H_{63}N$  MW = 437.84 648

**Table 1.** Experimental value with uncertainty.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$815.1 \pm 0.3$	1982-phi/del-8

***N,N*-Didodecyl-1-dodecanamine** [102-87-4]  $C_{36}H_{75}N$  MW = 522 649

**Table 1.** Experimental value with uncertainty.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	$821.1 \pm 0.4$	1982-phi/del-14