

3.1.4 Saturated Monoethers, C₁₃ - C₂₂

Decyl propyl ether

[500004-40-0]

C₁₃H₂₈O

MW = 200.36

624

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.
293.15	797.3 ± 1.0	1927-tal
293.15	797.3 ± 1.0	1932-kom/tal

3-Methylbutyl octyl ether

[500029-00-5]

C₁₃H₂₈O

MW = 200.36

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.
293.15	793.8 ± 0.6	1953-dev/pan

1-Methylheptyl pentyl ether

[500004-27-3]

C₁₃H₂₈O

MW = 200.36

626

Table 1. Fit with estimated *B* coefficient for 6 accepted points. Deviation $\sigma_{\text{w}} = 1.009$.

Coefficient	$\rho = A + BT$
<i>A</i>	1037.61
<i>B</i>	-0.810

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.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	798.9 ± 1.0	-1.26	1923-ken/mcn	357.55	748.4 ± 1.0	0.41	1923-ken/mcn
315.65	782.0 ± 1.0	0.07	1923-ken/mcn	387.95	723.3 ± 1.0	-0.07	1923-ken/mcn
333.15	769.6 ± 1.0	1.84	1923-ken/mcn	412.75	702.3 ± 1.0	-0.98	1923-ken/mcn

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	802.7 ± 1.8	330.00	770.3 ± 1.4	380.00	729.8 ± 1.5
293.15	800.2 ± 1.8	340.00	762.2 ± 1.4	390.00	721.7 ± 1.6
298.15	796.1 ± 1.7	350.00	754.1 ± 1.3	400.00	713.6 ± 1.7
310.00	786.5 ± 1.6	360.00	746.0 ± 1.4	410.00	705.5 ± 1.8
320.00	778.4 ± 1.5	370.00	737.9 ± 1.4	420.00	697.4 ± 1.9

Octyl pentyl ether

[500028-99-9]

C₁₃H₂₈O

MW = 200.36

627

Table 1. Experimental value with uncertainty.

T	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$	Ref.
K	kg · m ⁻³	
293.15	796.5 ± 0.5	1953-dev/pan

Bis(1-propylbutyl) ether

[56762-01-7]

C₁₄H₃₀O

MW = 214.39

628

Table 1. Experimental value with uncertainty.

T	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$	Ref.
K	kg · m ⁻³	
293.15	804.8 ± 0.5	1954-naz/kak-3

Butyl decyl ether

[111082-32-7]

C₁₄H₃₀O

MW = 214.39

629

Table 1. Experimental values with uncertainties.

T	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$	Ref.
K	kg · m ⁻³	
293.15	800.9 ± 1.0	1927-tal
293.15	800.9 ± 1.0	1932-kom/tal

Diheptyl ether

[629-64-1]

C₁₄H₃₀O

MW = 214.39

630

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{\text{c,w}} = 5.8055 \cdot 10^{-1}$ (combined temperature ranges, weighted), $\sigma_{\text{c,uw}} = 1.4116 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 273.15 to 504.05 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$9.77012 \cdot 10^2$
B	$-5.02221 \cdot 10^{-1}$
C	$-3.34293 \cdot 10^{-4}$

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

T	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$	Ref. (Symbol in Fig. 1)	T	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$	$\rho_{\text{exp}} - \rho_{\text{calc}}$	Ref. (Symbol in Fig. 1)
K	kg · m ⁻³	kg · m ⁻³		K	kg · m ⁻³	kg · m ⁻³	
273.15	815.10 ± 1.00	0.21	1888-dob(◆)	504.05	638.60 ± 1.00	-0.34	1888-dob(◆)
337.85	767.90 ± 1.00	-1.28	1888-dob(◆)	273.15	815.20 ± 1.00	0.31	1888-dob-1(V)
351.75	757.90 ± 1.00	-1.09	1888-dob(◆)	293.15	800.80 ± 0.60	-0.26	1948-vog-8(O)
370.85	744.00 ± 1.00	-0.79	1888-dob(◆)	313.75	786.90 ± 0.60	0.37	1948-vog-8(O)
384.05	734.40 ± 1.00	-0.43	1888-dob(◆)	333.85	772.80 ± 0.80	0.71	1948-vog-8(O)
405.15	719.00 ± 1.00	0.34	1888-dob(◆)	360.05	753.70 ± 0.80	0.85	1948-vog-8(O)
414.85	711.70 ± 1.00	0.57	1888-dob(◆)	293.15	801.00 ± 0.50	-0.06	1963-van(□)
429.65	699.80 ± 1.00	0.28	1888-dob(◆)	273.15	815.60 ± 1.00	0.71	1963-zil/mic(Δ)
457.05	677.80 ± 1.00	0.16	1888-dob(◆)	293.15	800.80 ± 0.50	-0.26	1964-shu/poz(X)
473.45	664.30 ± 1.00	-0.00	1888-dob(◆)				

¹⁾ Not included in Fig. 1.

Further references: [1919-sch-5, 1937-rog/dvo-1, 1964-dyk/shi, 1967-kar/bys].

cont.

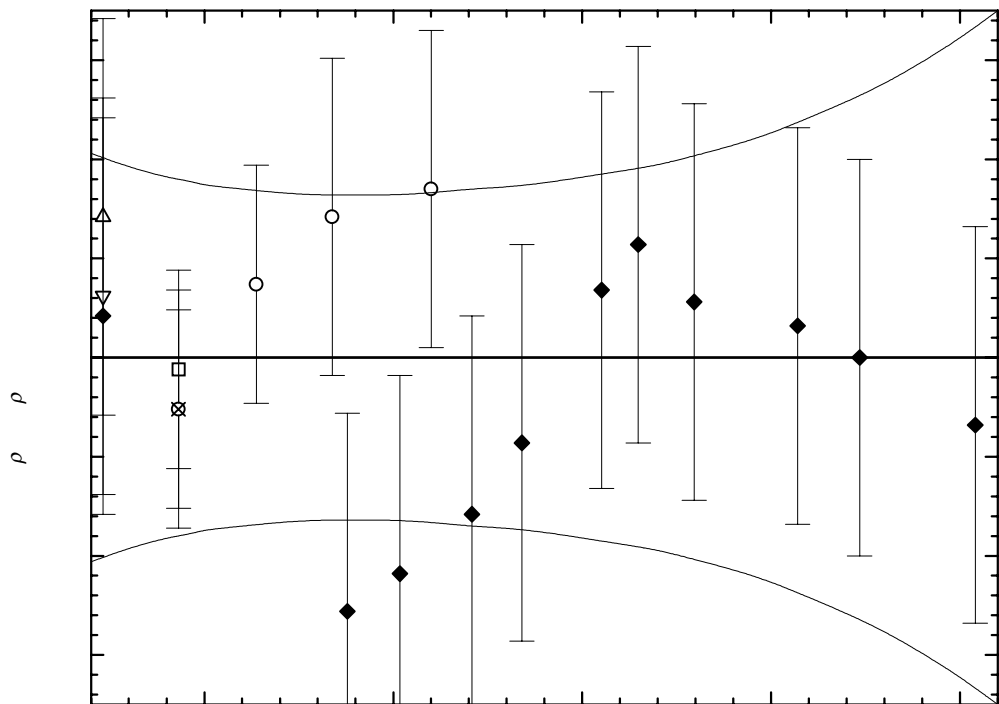


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the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

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

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	817.04 ± 1.03	340.00	767.61 ± 0.82	430.00	699.25 ± 1.02
280.00	810.18 ± 0.96	350.00	760.28 ± 0.82	440.00	691.32 ± 1.07
290.00	803.25 ± 0.91	360.00	752.89 ± 0.83	450.00	683.32 ± 1.13
293.15	801.06 ± 0.90	370.00	745.43 ± 0.85	460.00	675.25 ± 1.21
298.15	797.56 ± 0.88	380.00	737.90 ± 0.86	470.00	667.12 ± 1.29
300.00	796.26 ± 0.87	390.00	730.30 ± 0.88	480.00	658.93 ± 1.38
310.00	789.20 ± 0.85	400.00	722.64 ± 0.91	490.00	650.66 ± 1.49
320.00	782.07 ± 0.83	410.00	714.91 ± 0.94	500.00	642.33 ± 1.61
330.00	774.87 ± 0.82	420.00	707.11 ± 0.97	510.00	633.93 ± 1.75

Dodecyl ethyl ether

[7289-37-4]

C₁₄H₃₀O

MW = 214.39

631

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	799.2 ± 1.0	1935-van/adk

Ethyl 1-(3-methylbutyl)heptyl ether

[500020-98-4]

C₁₄H₃₀O

MW = 214.39

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.
293.15	810.0 ± 1.0	1940-gri

1-Ethylheptyl pentyl ether

[500004-28-4]

C₁₄H₃₀O

MW = 214.39

633

Table 1. Fit with estimated *B* coefficient for 6 accepted points. Deviation σ_w = 0.386.

Coefficient	$\rho = A + BT$
<i>A</i>	1022.76
<i>B</i>	-0.750

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.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
294.15	801.7 ± 1.0	-0.45	1924-ken/bar	353.15	758.0 ± 1.0	0.10	1924-ken/bar
313.15	787.7 ± 1.0	-0.20	1924-ken/bar	379.15	739.0 ± 1.0	0.60	1924-ken/bar
334.15	772.5 ± 1.0	0.35	1924-ken/bar	403.15	720.0 ± 1.0	-0.40	1924-ken/bar

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	805.3 ± 1.5	330.00	775.3 ± 1.0	380.00	737.8 ± 1.2
293.15	802.9 ± 1.4	340.00	767.8 ± 1.0	390.00	730.3 ± 1.3
298.15	799.2 ± 1.4	350.00	760.3 ± 1.0	400.00	722.8 ± 1.5
310.00	790.3 ± 1.2	360.00	752.8 ± 1.0	410.00	715.3 ± 1.6
320.00	782.8 ± 1.1	370.00	745.3 ± 1.1		

3-Ethylheptyl 3-methylbutyl ether

[500003-81-6]

C₁₄H₃₀O

MW = 214.39

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	782.9 ± 1.0	1953-zei-1

Hexyl 1-methylheptyl ether

[500004-29-5]

C₁₄H₃₀O

MW = 214.39

635

Table 1. Fit with estimated *B* coefficient for 5 accepted points. Deviation $\sigma_w = 0.546$.

Coefficient	$\rho = A + BT$
<i>A</i>	1023.06
<i>B</i>	-0.750

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.
290.15	804.7 ± 1.0	-0.75	1923-ken/mcn
313.55	788.1 ± 1.0	0.20	1923-ken/mcn
335.15	772.3 ± 1.0	0.60	1923-ken/mcn
355.65	756.8 ± 1.0	0.48	1923-ken/mcn
410.15	714.9 ± 1.0	-0.55	1923-ken/mcn

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	805.6 ± 1.5	330.00	775.6 ± 1.1	380.00	738.1 ± 1.3
293.15	803.2 ± 1.4	340.00	768.1 ± 1.0	390.00	730.6 ± 1.4
298.15	799.4 ± 1.4	350.00	760.6 ± 1.1	400.00	723.1 ± 1.6
310.00	790.6 ± 1.2	360.00	753.1 ± 1.1	410.00	715.6 ± 1.7
320.00	783.1 ± 1.1	370.00	745.6 ± 1.2	420.00	708.1 ± 1.9

Hexyl octyl ether

[17071-54-4]

C₁₄H₃₀O

MW = 214.39

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.
293.15	803.0 ± 0.6	1953-dev/pan

1-Ethylheptyl hexyl ether

[500004-38-6]

C₁₅H₃₂O

MW = 228.42

637

Table 1. Fit with estimated *B* coefficient for 6 accepted points. Deviation $\sigma_w = 0.721$.

Coefficient	$\rho = A + BT$
<i>A</i>	1029.52
<i>B</i>	-0.760

cont.

1-Ethylheptyl hexyl ether (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.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
295.15	804.8 ± 1.0	-0.40	1924-ken/bar	353.15	759.9 ± 1.0	-1.22	1924-ken/bar
313.15	791.7 ± 1.0	0.18	1924-ken/bar	372.15	747.4 ± 1.0	0.72	1924-ken/bar
334.15	776.5 ± 1.0	0.94	1924-ken/bar	410.15	717.6 ± 1.0	-0.20	1924-ken/bar

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	809.1 ± 1.6	330.00	778.7 ± 1.2	380.00	740.7 ± 1.3
293.15	806.7 ± 1.6	340.00	771.1 ± 1.2	390.00	733.1 ± 1.4
298.15	802.9 ± 1.5	350.00	763.5 ± 1.2	400.00	725.5 ± 1.6
310.00	793.9 ± 1.4	360.00	755.9 ± 1.2	410.00	717.9 ± 1.7
320.00	786.3 ± 1.3	370.00	748.3 ± 1.2	420.00	710.3 ± 1.9

Heptyl 2-methylheptyl ether [500004-35-3] C₁₅H₃₂O MW = 228.42 638

Table 1. Fit with estimated B coefficient for 5 accepted points. Deviation σ_w = 1.077.

Coefficient	$\rho = A + BT$
A	1019.12
B	-0.730

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.
295.15	803.4 ± 1.0	-0.26	1923-ken/mcn
332.15	777.6 ± 1.0	0.95	1923-ken/mcn
346.15	767.2 ± 1.0	0.77	1923-ken/mcn
374.15	744.0 ± 1.0	-1.99	1923-ken/mcn
398.15	729.0 ± 1.0	0.53	1923-ken/mcn

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	807.4 ± 1.8	330.00	778.2 ± 1.5	370.00	749.0 ± 1.5
293.15	805.1 ± 1.8	340.00	770.9 ± 1.4	380.00	741.7 ± 1.5
298.15	801.5 ± 1.7	350.00	763.6 ± 1.4	390.00	734.4 ± 1.6
310.00	792.8 ± 1.6	360.00	756.3 ± 1.4	400.00	727.1 ± 1.7
320.00	785.5 ± 1.5				

Heptyl octyl ether

[32357-84-9]

C₁₅H₃₂O

MW = 228.42

639

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{c,w} = 1.1661$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 3.2968 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 273.15 to 503.65 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$9.56192 \cdot 10^2$
B	$-3.99749 \cdot 10^{-1}$
C	$-4.14574 \cdot 10^{-4}$

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)
273.15	818.10 ± 1.00	2.03	1888-dob(□)	429.45	708.40 ± 1.00	0.34	1888-dob(□)
301.55	799.30 ± 1.00	1.35	1888-dob(□)	466.85	678.70 ± 2.00	-0.51	1888-dob(□)
338.95	773.60 ± 1.00	0.53	1888-dob(□)	485.25	664.00 ± 2.00	-0.60	1888-dob(□)
371.15	750.50 ± 1.00	-0.22	1888-dob(□)	503.65	648.60 ± 2.00	-1.10	1888-dob(□)
384.45	741.00 ± 1.00	-0.23	1888-dob(□)	293.15	801.80 ± 0.60	-1.58	1953-dev/pan(O)
404.15	726.90 ± 1.00	-0.02	1888-dob(□)				

¹⁾ Not included in Fig. 1.

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	818.04 ± 1.15	340.00	772.35 ± 1.05	430.00	707.65 ± 1.11
280.00	811.76 ± 1.14	350.00	765.49 ± 1.02	440.00	700.04 ± 1.23
290.00	805.40 ± 1.13	360.00	758.55 ± 1.00	450.00	692.35 ± 1.39
293.15	803.38 ± 1.13	370.00	751.53 ± 0.98	460.00	684.58 ± 1.60
298.15	800.15 ± 1.12	380.00	744.42 ± 0.97	470.00	676.73 ± 1.86
300.00	798.96 ± 1.12	390.00	737.23 ± 0.96	480.00	668.79 ± 2.17
310.00	792.43 ± 1.10	400.00	729.96 ± 0.96	490.00	660.78 ± 2.55
320.00	785.82 ± 1.09	410.00	722.61 ± 0.99	500.00	652.67 ± 2.97
330.00	779.13 ± 1.07	420.00	715.17 ± 1.03	510.00	644.49 ± 3.47

cont.

Heptyl octyl ether (cont.)

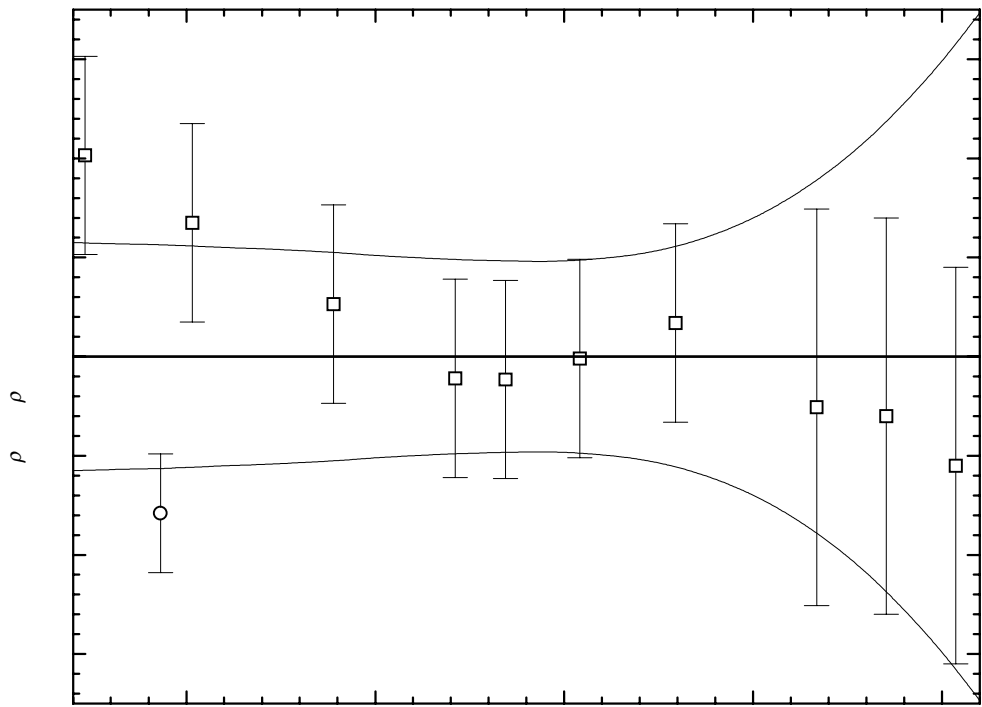


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the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

Methyl 2-pentylnonyl ether [500003-98-5] C₁₅H₃₂O MW = 228.42 640

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.
290.15	818.1 ± 2.0	1938-mas

Bis(1-methylheptyl) ether [500003-82-7] C₁₆H₃₄O MW = 242.45 641

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.
288.15	807.0 ± 2.0	1924-sen

Butyl dodecyl ether

[7289-38-5]

C₁₆H₃₄O

MW = 242.45

642

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	796.4 ± 1.0	1935-van/adk

Diocetyl ether

[629-82-3]

C₁₆H₃₄O

MW = 242.45

643

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{\text{c,w}} = 4.2684 \cdot 10^{-1}$ (combined temperature ranges, weighted), $\sigma_{\text{c,uw}} = 1.1681 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 273.15 to 414.05 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.00944 \cdot 10^3$
B	$-6.91224 \cdot 10^{-1}$

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	820.24 ± 1.00	-0.39	1888-dob(◆)	273.15	820.35 ± 1.00	-0.28	1888-dob-1(∇)
337.75	776.10 ± 1.00	0.12	1888-dob(◆)	314.65	792.00 ± 0.60	0.06	1948-vog-8(Δ)
351.65	766.60 ± 1.00	0.23	1888-dob(◆)	335.45	778.10 ± 0.80	0.54	1948-vog-8(Δ)
370.55	753.40 ± 1.00	0.10	1888-dob(◆)	359.75	761.20 ± 0.80	0.43	1948-vog-8(Δ)
384.05	744.00 ± 1.00	0.03	1888-dob(◆)	293.15	806.40 ± 0.60	-0.40	1953-dev/pan(○)
414.05	722.40 ± 1.00	-0.83	1888-dob(◆)	293.15	807.20 ± 0.60	0.40	1964-dyk/shi(□)

¹⁾ Not included in Fig. 1.

Further references: [1877-mos, 1949-set/kur, 1950-set, 1967-kar/bys].

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

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	822.81 ± 1.18	310.00	795.16 ± 0.70	370.00	753.68 ± 1.00
280.00	815.89 ± 1.00	320.00	788.24 ± 0.67	380.00	746.77 ± 1.13
290.00	808.98 ± 0.86	330.00	781.33 ± 0.68	390.00	739.86 ± 1.27
293.15	806.80 ± 0.82	340.00	774.42 ± 0.72	400.00	732.95 ± 1.42
298.15	803.35 ± 0.77	350.00	767.51 ± 0.79	410.00	726.03 ± 1.58
300.00	802.07 ± 0.76	360.00	760.60 ± 0.88	420.00	719.12 ± 1.74

cont.

Dioctyl ether (cont.)

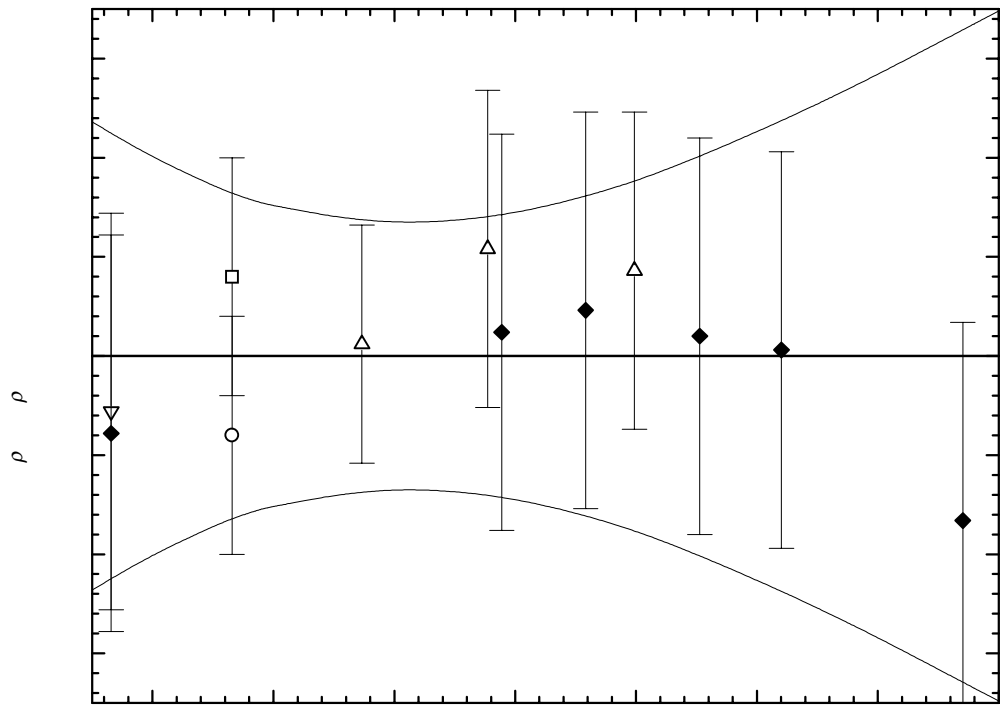


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the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

Ethyl 2-pentylnonyl ether [500003-93-0] C₁₆H₃₄O MW = 242.45 644

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.
290.65	810.1 ± 2.0	1938-mas

1-Ethylheptyl heptyl ether [500004-36-4] C₁₆H₃₄O MW = 242.45 645

Table 1. Fit with estimated *B* coefficient for 6 accepted points. Deviation $\sigma_w = 0.917$.

Coefficient	$\rho = A + BT$
<i>A</i>	1025.34
<i>B</i>	-0.740

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.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
290.15	810.1 ± 1.0	-0.53	1924-ken/bar	347.15	769.5 ± 1.0	1.05	1924-ken/bar
293.15	806.9 ± 1.0	-1.51	1924-ken/bar	377.15	747.4 ± 1.0	1.15	1924-ken/bar
315.15	791.9 ± 1.0	-0.23	1924-ken/bar	407.15	724.1 ± 1.0	0.05	1924-ken/bar

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	810.7 ± 1.6	330.00	781.1 ± 1.3	380.00	744.1 ± 1.5
293.15	808.4 ± 1.6	340.00	773.7 ± 1.3	390.00	736.7 ± 1.6
298.15	804.7 ± 1.5	350.00	766.3 ± 1.3	400.00	729.3 ± 1.8
310.00	795.9 ± 1.4	360.00	758.9 ± 1.4	410.00	721.9 ± 1.9
320.00	788.5 ± 1.3	370.00	751.5 ± 1.4		

2-Ethylhexyl octyl ether [500004-30-8] C₁₆H₃₄O MW = 242.45 646

Table 1. Fit with estimated *B* coefficient for 6 accepted points. Deviation σ_w = 0.986.

Coefficient	$\rho = A + BT$
<i>A</i>	1026.68
<i>B</i>	-0.730

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.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
297.15	808.5 ± 1.0	-1.26	1924-ken/bar	358.15	766.7 ± 1.0	1.47	1924-ken/bar
314.15	796.7 ± 1.0	-0.65	1924-ken/bar	381.15	748.6 ± 1.0	0.16	1924-ken/bar
340.15	779.4 ± 1.0	1.03	1924-ken/bar	407.15	728.7 ± 1.0	-0.76	1924-ken/bar

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	815.0 ± 1.8	330.00	785.8 ± 1.4	380.00	749.3 ± 1.5
293.15	812.7 ± 1.7	340.00	778.5 ± 1.3	390.00	742.0 ± 1.6
298.15	809.0 ± 1.7	350.00	771.2 ± 1.3	400.00	734.7 ± 1.7
310.00	800.4 ± 1.5	360.00	763.9 ± 1.3	410.00	727.4 ± 1.8
320.00	793.1 ± 1.5	370.00	756.6 ± 1.4		

1-Methylheptyl octyl ether [20012-47-9] C₁₆H₃₄O MW = 242.45 647

Table 1. Fit with estimated *B* coefficient for 5 accepted points. Deviation σ_w = 1.067.

Coefficient	$\rho = A + BT$
<i>A</i>	1003.68
<i>B</i>	-0.670

cont.

1-Methylheptyl octyl ether (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.
288.15	809.9 ± 1.0	-0.72	1923-ken/mcn
316.15	792.9 ± 1.0	1.04	1923-ken/mcn
338.15	778.0 ± 1.0	0.88	1923-ken/mcn
382.15	745.9 ± 1.0	-1.74	1923-ken/mcn
416.15	725.4 ± 1.0	0.54	1923-ken/mcn

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
280.00	816.1 ± 1.9	330.00	782.6 ± 1.4	380.00	749.1 ± 1.5
290.00	809.4 ± 1.8	340.00	775.9 ± 1.4	390.00	742.4 ± 1.6
293.15	807.3 ± 1.8	350.00	769.2 ± 1.4	400.00	735.7 ± 1.7
298.15	803.9 ± 1.7	360.00	762.5 ± 1.4	410.00	729.0 ± 1.9
310.00	796.0 ± 1.6	370.00	755.8 ± 1.5	420.00	722.3 ± 2.0
320.00	789.3 ± 1.5				

1-Methylethyl 2-pentynonyl ether [500003-94-1] C₁₇H₃₆O MW = 256.47 648

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	825.5 ± 2.0	1938-mas

1-Methylheptyl nonyl ether [500004-31-9] C₁₇H₃₆O MW = 256.47 649

Table 1. Fit with estimated *B* coefficient for 5 accepted points. Deviation σ_w = 0.975.

Coefficient	$\rho = A + BT$
<i>A</i>	1032.60
<i>B</i>	-0.760

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.
290.15	811.0 ± 1.0	-1.09	1923-ken/mcn
320.15	791.1 ± 1.0	1.81	1923-ken/mcn
339.15	774.7 ± 1.0	-0.15	1923-ken/mcn
362.15	757.3 ± 1.0	-0.07	1923-ken/mcn
383.15	740.9 ± 1.0	-0.51	1923-ken/mcn

cont.

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	812.2 ± 1.6	320.00	789.4 ± 1.4	360.00	759.0 ± 1.4
293.15	809.8 ± 1.6	330.00	781.8 ± 1.3	370.00	751.4 ± 1.5
298.15	806.0 ± 1.6	340.00	774.2 ± 1.3	380.00	743.8 ± 1.6
310.00	797.0 ± 1.4	350.00	766.6 ± 1.3	390.00	736.2 ± 1.7

Nonyl octyl ether

[500029-01-6]

C₁₇H₃₆O

MW = 256.47

650

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	806.8 ± 0.6	1953-dev/pan

Butyl 2-pentynonyl ether

[500004-00-2]

C₁₈H₃₈O

MW = 270.5

651

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.
295.15	811.5 ± 2.0	1938-mas

Decyl octyl ether

[17088-93-6]

C₁₈H₃₈O

MW = 270.5

652

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	809.5 ± 0.6	1953-dev/pan

Ethyl hexadecyl ether

[13933-61-4]

C₁₈H₃₈O

MW = 270.5

653

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.
293.15	818.2 ± 1.0	1950-mum/phi
298.15	815.0 ± 1.0	1950-mum/phi

1-Ethylheptyl nonyl ether

[500004-37-5]

C₁₈H₃₈O

MW = 270.5

654

Table 1. Fit with estimated B coefficient for 6 accepted points. Deviation σ_w = 1.220.

Coefficient	$\rho = A + BT$
A	1023.94
B	-0.720

cont.

1-Ethylheptyl nonyl ether (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.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
297.15	808.2 ± 1.0	-1.79	1924-ken/bar	355.15	769.4 ± 1.0	1.17	1924-ken/bar
315.15	796.2 ± 1.0	-0.83	1924-ken/bar	379.15	752.2 ± 1.0	1.25	1924-ken/bar
338.15	781.6 ± 1.0	1.13	1924-ken/bar	406.15	730.6 ± 1.0	-0.91	1924-ken/bar

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
290.00	815.1 ± 1.9	330.00	786.3 ± 1.6	380.00	750.3 ± 1.6
293.15	812.9 ± 1.9	340.00	779.1 ± 1.5	390.00	743.1 ± 1.7
298.15	809.3 ± 1.8	350.00	771.9 ± 1.5	400.00	735.9 ± 1.8
310.00	800.7 ± 1.7	360.00	764.7 ± 1.5	410.00	728.7 ± 1.9
320.00	793.5 ± 1.6	370.00	757.5 ± 1.6		

Didecyl ether [2456-28-2] C₂₀H₄₂O MW = 298.55 655

Table 1. Experimental and recommended values with uncertainties.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	818.7 ± 1.0	1927-tal
293.15	818.7 ± 1.0	1932-kom/tal
293.15	818.8 ± 1.0	1949-set/kur
293.15	818.8 ± 1.0	1950-set
293.15	817.3 ± 1.0	1967-kar/bys
293.15	818.5 ± 1.1	Recommended

Dodecyl octyl ether [36339-51-2] C₂₀H₄₂O MW = 298.55 656

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	811.2 ± 0.6	1953-dev/pan

Octyl tetradecyl ether [500029-02-7] C₂₂H₄₆O MW = 326.61 657

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	818.6 ± 0.6	1953-dev/pan