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Isochoric p–ρ–T Measurements for Binary Refrigerant Mixtures Containing Difluoromethane (R32), Pentafluoroethane (R125), 1,1,1,2-Tetrafluoroethane (R134a), and 1,1,1-Trifluoroethane (R143a) from 200 to 400 K at Pressures to 35 MPa

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The p–ρ–T relationships were measured for binary refrigerant mixtures by an isochoric method with gravimetric determinations of the amount of substance. Temperatures ranged from 200 to 400 K, while pressures extended up to 35 MPa. Measurements were conducted on compressed gas and liquid samples with the following mole fraction compositions: 0.4997 R32 + 0.5003 R134a, 0.3288 R32 + 0.6712 R134a, 0.4996 R32 + 0.5004 R125, 0.5001 R125 + 0.4999 R134a, and 0.5000 R125 + 0.5000 R143a. Most published p–ρ–T data are in good agreement with this study. The uncertainty is 0.03 K for temperature and is 0.01% for pressure at $p > 3$ MPa and 0.05% at $p < 3$ MPa. The principal source of uncertainty is the cell volume ($\sim$28.5 cm^3), with a standard uncertainty of 0.003 cm^3. When all components of experimental uncertainty are considered, the expanded relative uncertainty (with a coverage factor $k = 2$ and, thus, a two-standard deviation estimate) of the density measurements is estimated to be 0.05%.

KEY WORDS: density; difluoromethane; mixtures; p–ρ–T data; pentafluoroethane; R32; R125; R134a; R143a; 1,1,1,2-tetrafluoroethane; 1,1,1-trifluoroethane.

1. INTRODUCTION

In a recently published study, Lemmon [1] analyzed the available data for binary mixtures of R32, R125, R134a, and R143a and described a

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Helmholtz energy model which represents the thermodynamic properties for such mixtures. Lemmon noted that published p–ρ–T data in the saturated and compressed liquid phases for these mixtures were scarce, especially at temperatures below 243 K. Benchmark measurements were needed for selected mixture compositions which would supplement earlier p–ρ–T data reported by this group on the pure components R32 and R125 [2], R134a [3], and R143a [4].

In this paper, new p–ρ–T measurements for binary mixtures are reported for temperatures ranging from 200 K to a maximum temperature near 400 K and at pressures up to 35 MPa. Comparisons with published densities and a Helmholtz energy mixture model are also reported.

2. MEASUREMENTS

2.1. p–ρ–T Apparatus and Procedures

The apparatus used in this work has been used for studies of both pure fluids and mixtures. Details on the apparatus are available in previous publications [5, 6]. An isochoric technique was employed to measure the single-phase densities in this study. In this method, a sample of fixed mass is confined in a container of nearly fixed volume. Details of this method are available in recent publications [2, 3, 7].

2.2. Gas Mixture Preparation

The gas mixtures were prepared gravimetrically in thoroughly cleaned and dried aluminum cylinders, each with a free volume of about 16 dm^3 and a tare mass of about 14.5 kg. All gases were of high purity and were analyzed before use by gas chromatography/mass spectrometry (gc/ms). Each gas was added to the mixture sequentially, while the cylinder rested on a load cell having a resolution of 10^{-4} kg, followed by a precise weighing with an equal-arm balance with a capacity of 25 kg. The mass of each component added to a cylinder was determined by difference weighings using a Class S weight set and the equal-arm balance. An evacuated identical cylinder was used as a ballast on the opposite pan. Based on repetitive weighings, the expanded uncertainty in the amount of each substance was estimated to be 5×10^{-6} kg. Since the expanded uncertainty in the Class S weights is approximately 5×10^{-8} kg, the uncertainty depends primarily on the random scatter in the weighings. The expanded uncertainty in the mass fraction for each component of the mixtures is 10^{-5}.

A cylinder of gas was prepared for each nominal composition. The filling pressure of each cylinder was close to 90% of the estimated dew point

Table I. Compositions of Binary Mixtures Used in this Study

	Mixture			
Designation	Comp. 1	Comp. 2	Mole fraction, Comp. 1	Mass Fraction, Comp. 1
DOE1	R32	R134a	0.4997	0.33744
DOE2	R32	R125	0.4996	0.30208
DOE3	R32	R134a	0.3288	0.19987
DOE4	R125	R134a	0.5001	0.54062
ARTI1	R125	R143a	0.5000	0.58812

pressure for its gas composition. This dew point was calculated with an extended corresponding states model [8]. The amount of gas in each cylinder ranged between 3.6 and 7.3 mol. Table I gives the mole fraction and mass fraction compositions for each gas mixture. The mass fractions were calculated from the measured mass of each component and, thus, reflect the uncertainty of the mass determinations. The mole fraction compositions listed in Table I have uncertainties which also reflect the presence of impurities in each component used to make the mixtures.

The purities of the components used to make the mixtures are an important aspect of this study. The purity of the R32 sample was 0.998 mass fraction. The largest impurities were R22, with a concentration of 1045 parts per million by mass (ppm), and R41, with 689 ppm. Other impurities included 144 ppm of R23 and 121 ppm of R143a. The purity of the R125 sample used in the R32 + R125 and R134a + R125 mixtures was 0.9983 mole fraction. An in-house gc/ms analysis found the largest impurity at a concentration of 0.0017 mole fraction. The fragments observed in the mass spectra indicate that this impurity is R124, although a low signal intensity makes confirmation impossible. The purity of the R125 sample used to make the R125 + R143a mixture was determined from in-house gc/ms analysis to be 0.9997 mole fraction. The mass spectrum of the measured trace impurity (0.0003 mole fraction) is consistent with fluoroethane. The sample of R134a had a purity of 0.9991 mass fraction. The largest impurity was the isomer CHF_2CHF_2 (R134), with a mass fraction of 0.00085 (or 850 ppm). Other impurities, on a mass basis, were 36 ppm R114, 35 ppm R114a, and 13 ppm R124. The purity of the R143a sample was approximately 0.9993 mass fraction. An infrared spectrum and three types of chromatographic analyses were recorded for this sample. A small quantity (0.0007 mass fraction) of an unidentified impurity was detected in two of the three chromatographic analyses of R143a. The mass spectrum of

Table II. Expanded Uncertainties of the Temperature, Pressure, Mass, Volume, Composition, and Density

Temperature	0.03 K
Pressure	
<3 MPa	0.05%
>3 MPa	0.01%
Mass	0.002 g
Volume	0.003 cm^3
Composition	
Mass fraction	0.00002
Mole fraction	0.0002
Density	0.05%

the impurity is consistent with a substance of slightly higher molecular mass than R143a, but the pattern was too weak to identify the impurity.

2.3. Assessment of Uncertainties

A detailed discussion of the uncertainties in the measured quantities is available in recent publications [2, 3, 7]. We use a definition for the expanded uncertainty which is two times the standard uncertainty (a coverage factor $k = 2$ and, thus, a two-standard deviation estimate). The expanded uncertainties of the original measurements and the resulting combined uncertainties are listed in Table II.

3. p–ρ–T RESULTS

The experimental compositions, temperatures (ITS-90), pressures, and densities for single-phase liquid and gaseous mixtures are presented in Table III. The number of digits presented in Table III represents the measurement precision; they were retained to avoid round-off errors when modelling equations are fitted to them. For five binary mixtures, a total of 1238 p–ρ–T state conditions has been reported. To illustrate the range of measurements for each of the mixture, the isochoric data are plotted in Figs. 1 to 5.

Comparisons of the isochoric p–ρ–T measurements were made with a Helmholtz energy formulation developed by Lemmon and Jacobsen [9]. This formulation is based, in part, on the results of this study along with selected data sets from other laboratories. Figures 6 to 9 graphically depict the deviations of the experimental density from the calculated density for these selected data and the results of this study. While most of the liquid-phase data of this work agree with the model within $\pm 0.05\%$, the scatter

Table III. Experimental p–ρ–T Data for Binary Refrigerant Mixtures

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
	0.4997 R32 + 0.5003 R134a	
200.001	2.9690	18.4713
200.998	4.5882	18.4685
202.000	6.2257	18.4660
203.000	7.8587	18.4635
203.999	9.5059	18.4612
206.000	12.7848	18.4568
208.000	16.0527	18.4526
210.000	19.3166	18.4485
211.999	22.5698	18.4444
214.001	25.8136	18.4405
215.999	29.0410	18.4367
218.001	32.2563	18.4328
220.000	35.4535	18.4291
214.000	2.9956	17.9836
214.999	4.4421	17.9810
215.999	5.9036	17.9786
216.999	7.3607	17.9764
218.002	8.8266	17.9742
219.999	11.7405	17.9700
222.001	14.6630	17.9660
223.999	17.5752	17.9621
226.001	20.4794	17.9583
228.001	23.3799	17.9546
229.999	26.2622	17.9509
232.000	29.1349	17.9473
234.001	32.0015	17.9437
236.001	34.8553	17.9401
230.001	3.0870	17.4087
231.002	4.3552	17.4064
231.999	5.6268	17.4042
233.000	6.9056	17.4021
234.000	8.1864	17.4000
235.999	10.7397	17.3961
238.001	13.2974	17.3924
240.000	15.8451	17.3887
242.000	18.3928	17.3851
243.999	20.9310	17.3816
246.002	23.4404	17.3782
248.002	25.9706	17.3747
249.999	28.4868	17.3713
252.001	30.9982	17.3680
254.002	33.5046	17.3646
248.001	2.9095	16.7251
248.999	3.9953	16.7230

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
250.000	5.0866	16.7209
250.999	6.1755	16.7190
251.999	7.2639	16.7171
254.001	9.4499	16.7135
256.000	11.6300	16.7100
257.999	13.8094	16.7066
260.001	15.9898	16.7032
261.999	18.1622	16.6999
264.000	20.3304	16.6967
265.999	22.4917	16.6935
267.999	24.6514	16.6903
270.000	26.8004	16.6871
272.001	28.9499	16.6840
273.999	31.0910	16.6809
276.001	33.2300	16.6778
278.000	35.3632	16.6747
263.999	2.8929	16.0846
265.000	3.8293	16.0827
265.998	4.7686	16.0808
267.001	5.7122	16.0790
267.999	6.6527	16.0772
270.002	8.5351	16.0738
271.998	10.4179	16.0706
274.002	12.3053	16.0673
276.000	14.1865	16.0642
277.999	16.0638	16.0611
280.001	17.9398	16.0580
282.000	19.8122	16.0550
284.000	21.6832	16.0520
286.000	23.5470	16.0490
288.001	25.4097	16.0461
290.002	27.2693	16.0431
291.998	29.1189	16.0402
294.000	30.9664	16.0373
296.002	32.8149	16.0344
297.998	34.6566	16.0315
280.001	2.9278	15.3952
282.001	4.5319	15.3917
284.001	6.1406	15.3884
285.999	7.7464	15.3853
288.002	9.3555	15.3822
290.000	10.9640	15.3792
292.002	12.5715	15.3763
294.002	14.1773	15.3734
296.000	15.7819	15.3705

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
298.000	17.3864	15.3677
300.001	18.9885	15.3649
302.001	20.5876	15.3620
304.001	22.1843	15.3593
306.002	23.7819	15.3565
308.000	25.3730	15.3537
310.001	26.9635	15.3510
312.001	28.5528	15.3482
314.001	30.1335	15.3455
316.001	31.7137	15.3428
318.002	33.2892	15.3400
300.001	2.9417	14.4307
302.000	4.2246	14.4276
303.999	5.5099	14.4247
305.999	6.7963	14.4219
307.999	8.0878	14.4191
310.000	9.3783	14.4164
312.000	10.6681	14.4137
314.001	11.9589	14.4110
316.001	13.2479	14.4084
318.000	14.5366	14.4058
320.001	15.8231	14.4032
324.001	18.4006	14.3981
328.001	20.9746	14.3930
332.002	23.5456	14.3879
336.000	26.1115	14.3829
340.000	28.6686	14.3778
344.001	31.2246	14.3728
347.999	33.7703	14.3678
320.002	2.9584	13.2622
322.000	3.9338	13.2595
323.998	4.9076	13.2570
326.001	5.8882	13.2545
328.001	6.8695	13.2520
332.001	8.8382	13.2472
336.000	10.8129	13.2424
340.000	12.7765	13.2383
344.002	14.7571	13.2337
348.001	16.7399	13.2291
351.999	18.7218	13.2245
356.000	20.7040	13.2200
360.001	22.6855	13.2154
364.000	24.6665	13.2108
368.000	26.6429	13.2063
372.001	28.6181	13.2017

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
376.000	30.5880	13.1972
380.000	32.5571	13.1926
384.000	34.5199	13.1880
339.999	3.3349	11.6920
342.001	3.9972	11.6898
343.999	4.6637	11.6878
345.999	5.3340	11.6857
348.001	6.0087	11.6836
351.998	7.3649	11.6796
356.000	8.7318	11.6756
360.001	10.1068	11.6716
364.000	11.4874	11.6676
368.000	12.8746	11.6637
371.999	14.2660	11.6597
375.999	15.6600	11.6558
380.001	17.0575	11.6519
383.999	18.4575	11.6479
388.002	19.8595	11.6440
391.998	21.2612	11.6400
395.998	22.6639	11.6361
400.000	24.0661	11.6321
360.000	4.8046	9.2120
361.999	5.1636	9.2105
363.999	5.5283	9.2091
366.000	5.8984	9.2076
368.000	6.2725	9.2061
370.000	6.6496	9.2046
371.999	7.0301	9.2032
375.999	7.7987	9.2002
379.999	8.5766	9.1972
384.001	9.3612	9.1943
388.000	10.1521	9.1913
392.000	10.9476	9.1883
396.002	11.7470	9.1853
400.001	12.5504	9.1823
370.001	5.9889	8.1780
372.002	6.2860	8.1767
373.999	6.5869	8.1754
376.002	6.8909	8.1741
378.000	7.1964	8.1728
380.002	7.5036	8.1715
383.999	8.1234	8.1690
388.001	8.7491	8.1664
391.999	9.3786	8.1638
396.000	10.0126	8.1612

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
400.000	10.6509	8.1586
369.998	5.5836	6.2679
372.000	5.7875	6.2670
373.998	5.9923	6.2660
376.001	6.1977	6.2651
377.999	6.4034	6.2642
380.002	6.6100	6.2632
384.000	7.0245	6.2614
388.001	7.4398	6.2594
392.000	7.8568	6.2575
396.000	8.2745	6.2556
400.001	8.6926	6.2537
370.001	5.1381	3.8259
372.000	5.2561	3.8254
373.999	5.3730	3.8249
375.999	5.4893	3.8243
377.999	5.6050	3.8238
380.000	5.7200	3.8232
384.000	5.9484	3.8222
388.002	6.1750	3.8211
391.999	6.3998	3.8200
396.000	6.6232	3.8190
400.001	6.8454	3.8180
370.001	4.0876	2.1302
371.998	4.1443	2.1299
376.001	4.2561	2.1294
380.000	4.3668	2.1289
384.000	4.4764	2.1285
387.999	4.5850	2.1281
391.999	4.6928	2.1299
396.001	4.7998	2.1293
400.000	4.9059	2.1287
372.001	2.7030	1.1030
376.001	2.7375	1.1027
380.000	2.7772	1.1024
384.000	2.8224	1.1020
388.000	2.8700	1.1017
392.000	2.9175	1.1014
396.001	2.9645	1.1010
400.002	3.0113	1.1007
	0.3288 R32 + 0.6712 R134a	
200.001	2.8877	17.0021
200.999	4.4947	16.9996
202.000	6.1092	16.9973

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
203.001	7.7203	16.9951
204.000	9.3457	16.9930
206.001	12.5769	16.9890
210.000	16.5958	16.9831
212.000	19.7695	16.9794
214.000	22.9314	16.9757
216.000	26.0810	16.9722
217.999	29.2179	16.9687
220.001	32.3403	16.9652
222.000	35.4488	16.9618
218.001	2.8659	16.4750
219.000	4.2515	16.4728
220.000	5.6371	16.4707
221.000	7.0327	16.4687
221.999	8.4195	16.4668
224.001	11.2046	16.4630
226.000	13.9800	16.4594
228.001	16.7563	16.4559
230.001	19.5164	16.4525
232.000	22.2654	16.4491
234.000	25.0107	16.4458
235.999	27.7450	16.4425
238.000	30.4694	16.4393
239.999	33.1867	16.4361
236.000	2.9524	15.8879
236.999	4.1470	15.8858
238.002	5.3426	15.8839
238.999	6.5304	15.8820
240.000	7.7310	15.8803
242.000	10.1216	15.8768
243.999	12.5116	15.8734
246.001	14.8949	15.8702
248.000	17.2756	15.8669
249.999	19.6484	15.8638
252.000	22.0178	15.8607
253.999	24.3811	15.8576
255.998	26.7392	15.8546
257.999	29.0844	15.8515
260.002	31.4279	15.8485
262.001	33.7588	15.8456
258.002	2.8986	15.1236
258.998	3.8765	15.1218
260.001	4.8635	15.1201
261.001	5.8479	15.1184
262.000	6.8252	15.1168

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
264.000	8.7982	15.1136
266.000	10.7653	15.1105
268.000	12.7291	15.1075
270.000	14.6932	15.1045
272.001	16.6528	15.1016
274.001	18.6062	15.0988
276.000	20.5570	15.0959
278.002	22.5038	15.0931
279.999	24.4474	15.0903
282.002	26.3881	15.0875
284.001	28.3248	15.0847
285.999	30.2533	15.0820
288.000	32.1786	15.0793
290.002	34.0998	15.0765
278.002	2.8429	14.3692
279.002	3.6568	14.3676
280.000	4.4637	14.3660
281.000	5.2791	14.3645
282.002	6.0886	14.3630
284.001	7.7130	14.3601
286.000	9.3403	14.3573
288.000	10.9635	14.3545
290.000	12.5857	14.3518
292.000	14.2074	14.3491
294.001	15.8246	14.3464
296.000	17.4408	14.3438
298.001	19.0556	14.3411
300.002	20.6685	14.3385
303.999	23.8855	14.3334
308.000	27.0958	14.3282
312.001	30.2927	14.3231
315.999	33.4741	14.3180
296.000	2.8700	13.6205
297.001	3.5391	13.6190
298.001	4.2068	13.6176
299.002	4.8786	13.6162
300.001	5.5459	13.6149
302.000	6.8880	13.6122
304.000	8.2306	13.6096
306.002	9.5729	13.6070
308.001	10.9159	13.6045
310.001	12.2562	13.6020
312.000	13.5971	13.5995
316.000	16.2757	13.5946
320.000	18.9526	13.5898

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
324.001	21.6279	13.5850
328.002	24.2957	13.5802
332.001	26.9527	13.5755
335.999	29.6027	13.5707
340.001	32.2501	13.5660
344.002	34.8716	13.5613
314.000	2.8741	12.7570
314.999	3.4083	12.7557
316.000	3.9464	12.7545
317.002	4.4836	12.7532
318.001	5.0189	12.7520
320.001	6.0947	12.7496
322.001	7.1717	12.7472
324.000	8.2480	12.7449
327.998	10.3953	12.7408
332.001	12.5563	12.7363
335.999	14.7160	12.7318
340.001	16.8760	12.7274
343.999	19.0362	12.7230
347.999	21.1949	12.7186
351.998	23.3517	12.7141
355.998	25.5045	12.7097
359.999	27.6538	12.7054
364.001	29.8008	12.7010
367.999	31.9413	12.6966
371.999	34.0763	12.6921
330.000	2.8320	11.8090
331.000	3.2466	11.8079
332.002	3.6656	11.8068
332.999	4.0804	11.8057
334.000	4.5004	11.8046
335.999	5.3375	11.8024
338.000	6.1784	11.8003
339.999	7.0210	11.7982
344.000	8.7109	11.7940
348.000	10.4085	11.7899
352.001	12.1105	11.7858
356.000	13.8166	11.7818
360.001	15.5244	11.7777
363.999	17.2337	11.7737
368.001	18.9403	11.7697
371.999	20.6500	11.7657
376.000	22.3632	11.7617
380.000	24.0746	11.7577
384.002	25.7831	11.7536

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
388.001	27.4884	11.7496
392.001	29.1927	11.7456
396.000	30.8928	11.7415
399.999	32.5906	11.7375
346.002	3.5891	10.6968
346.999	3.8955	10.6959
348.002	4.2042	10.6949
349.002	4.5194	10.6940
350.001	4.8304	10.6930
352.001	5.4556	10.6912
354.000	6.0837	10.6893
356.001	6.7128	10.6875
358.001	7.3491	10.6857
360.001	7.9845	10.6839
364.001	9.2626	10.6802
368.000	10.5474	10.6766
372.000	11.8333	10.6731
375.999	13.1280	10.6695
379.999	14.4268	10.6659
384.001	15.7269	10.6623
388.002	17.0312	10.6587
392.000	18.3355	10.6551
395.999	19.6423	10.6516
399.998	20.9530	10.6479
361.999	4.7077	9.2039
363.001	4.9149	9.2031
363.999	5.1232	9.2024
365.002	5.3327	9.2017
365.998	5.5428	9.2009
367.999	5.9665	9.1994
369.999	6.3937	9.1979
372.001	6.8240	9.1964
375.999	7.6893	9.1934
380.000	8.5664	9.1904
384.000	9.4488	9.1874
387.998	10.3384	9.1844
391.999	11.2326	9.1814
396.001	12.1300	9.1784
400.000	13.0318	9.1754
376.002	6.5951	8.4636
377.001	6.7751	8.4630
378.000	6.9538	8.4624
379.001	7.1348	8.4617
379.999	7.3148	8.4610
382.000	7.6782	8.4597

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
384.002	8.0438	8.4583
386.000	8.4107	8.4570
388.000	8.7791	8.4556
390.000	9.1487	8.4543
392.001	9.5202	8.4529
395.999	10.2651	8.4502
400.001	11.0147	8.4474
376.000	5.7794	7.2210
377.000	5.9102	7.2205
378.002	6.0414	7.2200
379.000	6.1730	7.2195
380.002	6.3052	7.2189
381.999	6.5706	7.2178
384.000	6.8384	7.2167
386.000	7.1070	7.2156
388.002	7.3773	7.2144
389.999	7.6479	7.2133
392.000	7.9209	7.2122
395.999	8.4683	7.2099
399.999	9.0194	7.2076
375.999	5.2484	4.6532
377.000	5.3237	4.6529
378.002	5.3986	4.6526
379.000	5.4737	4.6523
380.000	5.5484	4.6519
381.999	5.6976	4.6512
384.002	5.8467	4.6505
386.001	5.9956	4.6498
387.999	6.1434	4.6492
390.000	6.2915	4.6485
392.001	6.4392	4.6478
396.000	6.7340	4.6464
399.998	7.0278	4.6451
376.000	4.2510	2.3378
377.000	4.2837	2.3377
377.999	4.3159	2.3376
379.001	4.3483	2.3375
379.998	4.3802	2.3373
382.001	4.4443	2.3370
384.000	4.5080	2.3368
385.999	4.5715	2.3365
388.002	4.6348	2.3362
389.999	4.6977	2.3360
391.999	4.7603	2.3357
396.000	4.8845	2.3353

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
400.000	5.0077	2.3351
375.999	2.7023	1.1246
376.999	2.7151	1.1246
378.001	2.7278	1.1245
379.001	2.7404	1.1244
380.000	2.7530	1.1243
382.001	2.7781	1.1241
383.998	2.8032	1.1240
386.000	2.8284	1.1238
388.000	2.8533	1.1236
389.998	2.8781	1.1235
392.000	2.9028	1.1233
395.998	2.9522	1.1230
400.001	3.0011	1.1226
	0.4996 R32 + 0.5004 R125	
200.000	4.2710	17.3520
201.001	5.6950	17.3484
201.999	7.1510	17.3454
203.001	8.6248	17.3427
204.000	10.1061	17.3403
205.001	11.5960	17.3380
205.999	13.0846	17.3358
208.001	16.0679	17.3316
210.000	19.0414	17.3276
211.999	22.0140	17.3237
213.999	24.9773	17.3200
215.999	27.9309	17.3163
218.000	30.8785	17.3127
220.001	33.8162	17.3092
216.000	4.0488	16.7761
217.000	5.2771	16.7726
218.000	6.5433	16.7698
219.000	7.8225	16.7673
219.999	9.1081	16.7650
222.000	11.6885	16.7607
223.999	14.2690	16.7567
226.000	16.8537	16.7529
227.999	19.4377	16.7493
230.002	22.0129	16.7458
232.000	24.5839	16.7423
234.001	27.1498	16.7389
235.998	29.7053	16.7356
238.002	32.2560	16.7323
240.000	34.7959	16.7290

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
232.001	4.2446	16.1871
233.001	5.3254	16.1841
233.999	6.4247	16.1816
234.999	7.5340	16.1792
236.001	8.6494	16.1771
238.000	10.8822	16.1731
240.000	13.1227	16.1694
242.000	15.3608	16.1658
244.000	17.5957	16.1624
245.999	19.8287	16.1591
248.000	22.0618	16.1558
249.999	24.2891	16.1526
252.000	26.5098	16.1495
254.001	28.7240	16.1464
255.999	30.9346	16.1433
258.002	33.1418	16.1402
259.998	35.3407	16.1372
249.999	4.2102	15.4770
251.000	5.1230	15.4743
252.001	6.0494	15.4719
253.000	6.9859	15.4698
253.998	7.9192	15.4678
255.999	9.7988	15.4641
258.002	11.6857	15.4606
259.999	13.5702	15.4573
264.000	17.3346	15.4510
268.001	21.0952	15.4450
272.001	24.8434	15.4391
276.000	28.5794	15.4333
280.000	32.3009	15.4276
282.002	34.1577	15.4248
282.000	4.1622	14.0424
283.000	4.8117	14.0403
284.000	5.4709	14.0383
285.001	6.1305	14.0365
286.000	6.7933	14.0348
288.001	8.1196	14.0315
290.002	9.4503	14.0285
291.999	10.7822	14.0256
294.001	12.1179	14.0228
295.998	13.4487	14.0201
298.001	14.7846	14.0174
300.002	16.1201	14.0148
304.001	18.7862	14.0096
308.000	21.4467	14.0046

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
312.001	24.1116	13.9995
316.001	26.7684	13.9946
324.001	32.0614	13.9847
328.000	34.6971	13.9798
265.999	4.1378	14.7922
267.000	4.9158	14.7897
268.002	5.7030	14.7875
268.999	6.4928	14.7855
270.000	7.2871	14.7837
271.998	8.8759	14.7802
274.000	10.4749	14.7769
276.001	12.0734	14.7738
278.000	13.6712	14.7708
280.002	15.2676	14.7679
284.001	18.4594	14.7622
288.001	21.6463	14.7567
292.001	24.8264	14.7513
296.000	27.9948	14.7459
300.001	31.1573	14.7406
303.998	34.3069	14.7354
300.001	4.1180	13.0617
300.999	4.6317	13.0598
302.000	5.1489	13.0581
302.999	5.6679	13.0565
304.001	6.1890	13.0549
306.000	7.2339	13.0520
308.002	8.2789	13.0493
310.000	9.3308	13.0467
311.999	10.3791	13.0441
314.000	11.4334	13.0416
316.001	12.4882	13.0391
320.002	14.5994	13.0343
324.000	16.7112	13.0297
327.999	18.8214	13.0250
331.991	20.9170	13.0209
332.002	20.9239	13.0209
336.001	23.0364	13.0163
340.001	25.1481	13.0118
343.999	27.2571	13.0073
348.001	29.3643	13.0028
352.002	31.4686	12.9983
356.001	33.5669	12.9939
316.000	4.1436	11.9775
317.000	4.5371	11.9759
318.000	4.9323	11.9744

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
319.002	5.3296	11.9730
320.001	5.7270	11.9716
322.000	6.5251	11.9691
324.001	7.3271	11.9666
325.999	8.1317	11.9642
328.000	8.9370	11.9619
332.002	10.5579	11.9574
336.002	12.1840	11.9531
339.999	13.8143	11.9488
344.000	15.4483	11.9446
348.000	17.0854	11.9405
352.001	18.7253	11.9363
356.000	20.3650	11.9322
360.000	22.0052	11.9282
364.001	23.6471	11.9241
367.999	25.2856	11.9200
372.001	26.9250	11.9160
375.999	28.5623	11.9119
380.001	30.1988	11.9078
383.999	31.8328	11.9037
387.999	33.4652	11.8996
332.002	4.2319	10.3587
333.001	4.4922	10.3575
333.999	4.7527	10.3563
335.000	5.0156	10.3552
336.000	5.2787	10.3541
338.000	5.8089	10.3520
339.998	6.3426	10.3500
344.000	7.4194	10.3461
348.000	8.5071	10.3423
352.000	9.6034	10.3386
356.000	10.7061	10.3350
359.999	11.8156	10.3315
363.999	12.9287	10.3279
367.998	14.0462	10.3244
372.001	15.1678	10.3209
376.000	16.2913	10.3174
380.000	17.4172	10.3140
384.000	18.5446	10.3105
388.002	19.6737	10.3070
391.999	20.8041	10.3035
396.001	21.9354	10.3001
399.999	23.0661	10.2966
359.999	8.8216	9.2379
363.998	9.6699	9.2348

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
368.000	10.5244	9.2316
371.999	11.3829	9.2285
376.002	12.2462	9.2254
379.999	13.1119	9.2223
384.001	13.9813	9.2193
388.002	14.8536	9.2162
392.001	15.7260	9.2131
395.998	16.6012	9.2101
399.999	17.4772	9.2070
360.000	7.5905	8.3657
364.001	8.2769	8.3628
368.001	8.9687	8.3600
371.999	9.6648	8.3573
376.000	10.3652	8.3545
380.000	11.0690	8.3517
384.000	11.7745	8.3489
388.000	12.4826	8.3462
392.000	13.1928	8.3434
396.000	13.9049	8.3407
400.000	14.6180	8.3379
360.000	6.5825	6.8621
364.002	7.0688	6.8599
368.001	7.5585	6.8576
372.002	8.0504	6.8554
375.998	8.5444	6.8531
379.999	9.0404	6.8509
384.001	9.5375	6.8487
388.000	10.0356	6.8464
391.998	10.5346	6.8442
395.998	11.0341	6.8420
399.998	11.5343	6.8398
360.001	5.8387	4.7275
363.999	6.1379	4.7260
368.001	6.4358	4.7245
372.000	6.7328	4.7229
376.002	7.0286	4.7215
379.999	7.3233	4.7200
384.000	7.6168	4.7185
387.998	7.9095	4.7171
392.001	8.2014	4.7156
395.999	8.4921	4.7142
400.000	8.7822	4.7127
359.999	4.5534	2.5075
364.001	4.6894	2.5068
368.001	4.8238	2.5065

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
372.000	4.9570	2.5065
376.000	5.0890	2.5059
380.001	5.2198	2.5052
384.001	5.3497	2.5044
388.000	5.4788	2.5036
392.000	5.6070	2.5028
395.999	5.7345	2.5020
400.002	5.8612	2.5012
359.999	2.5735	1.0664
363.998	2.6194	1.0660
367.999	2.6649	1.0655
372.002	2.7102	1.0651
375.999	2.7550	1.0646
380.000	2.7997	1.0642
383.998	2.8440	1.0637
387.998	2.8882	1.0632
391.999	2.9319	1.0628
396.000	2.9755	1.0623
399.999	3.0192	1.0618
	0.5001 R125 + 0.4999 R134a	
199.999	2.8441	14.1099
201.000	4.2625	14.1073
202.001	5.6913	14.1051
203.001	7.1260	14.1031
203.998	8.5634	14.1012
206.001	11.4584	14.0977
208.001	14.3523	14.0944
210.001	17.2371	14.0912
212.000	20.1177	14.0882
214.000	22.9828	14.0852
216.001	25.8494	14.0823
218.002	28.7012	14.0794
220.002	31.5413	14.0765
222.000	34.3663	14.0738
218.000	3.0241	13.6274
219.000	4.2478	13.6251
219.999	5.4776	13.6231
221.000	6.7092	13.6212
222.002	7.9496	13.6195
223.999	10.4242	13.6162
226.001	12.9041	13.6132
228.001	15.3721	13.6102
230.000	17.8411	13.6074

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol·dm^{-3})
232.002	20.3041	13.6046
233.999	22.7579	13.6018
236.001	25.2075	13.5991
238.001	27.6480	13.5965
240.002	30.0832	13.5938
241.998	32.5046	13.5913
244.001	34.9252	13.5887
240.000	3.0043	13.0036
241.001	4.0080	13.0016
241.999	5.0152	12.9998
243.000	6.0302	12.9981
244.000	7.0444	12.9965
246.001	9.0755	12.9935
247.999	11.1030	12.9907
250.000	13.1358	12.9879
252.002	15.1622	12.9853
254.000	17.1806	12.9827
256.001	19.2042	12.9802
258.000	21.2123	12.9777
260.002	23.2279	12.9752
262.002	25.2326	12.9728
263.999	27.2332	12.9704
265.999	29.2297	12.9680
268.000	31.2228	12.9656
270.000	33.2079	12.9632
272.000	35.1860	12.9608
259.999	3.1179	12.4002
261.001	3.9504	12.3984
262.001	4.7850	12.3968
262.999	5.6215	12.3953
264.001	6.4597	12.3938
265.998	8.1345	12.3911
268.002	9.8148	12.3885
269.999	11.4913	12.3859
272.001	13.1675	12.3835
274.001	14.8432	12.3811
276.001	16.5163	12.3787
277.999	18.1849	12.3764
280.000	19.8528	12.3741
282.002	21.5183	12.3718
283.999	23.1793	12.3696
285.999	24.8397	12.3673
287.999	26.4954	12.3651
289.999	28.1490	12.3629

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
292.000	29.7998	12.3606
294.001	31.4457	12.3584
296.000	33.0866	12.3563
298.000	34.7255	12.3541
280.000	3.0590	11.7334
281.000	3.7369	11.7319
282.000	4.4117	11.7304
283.001	5.0893	11.7290
284.000	5.7670	11.7277
286.001	7.1260	11.7252
287.999	8.4855	11.7228
290.000	9.8461	11.7205
292.000	11.2067	11.7182
294.002	12.5665	11.7159
295.999	13.9231	11.7138
297.999	15.2817	11.7116
300.002	16.6406	11.7095
304.000	19.3522	11.7053
308.001	22.0573	11.7011
312.000	24.7564	11.6970
316.002	27.4485	11.6929
320.001	30.1285	11.6888
324.002	32.8004	11.6847
328.002	35.4507	11.6807
300.001	3.0632	10.9752
301.000	3.5978	10.9739
302.000	4.1268	10.9726
302.999	4.6581	10.9714
304.001	5.1928	10.9702
306.001	6.2614	10.9680
308.000	7.3311	10.9658
309.999	8.4022	10.9636
312.000	9.4742	10.9616
316.000	11.6204	10.9575
320.001	13.7659	10.9535
324.001	15.9137	10.9497
328.001	18.0559	10.9458
332.002	20.1995	10.9420
336.002	22.3405	10.9382
336.001	22.3266	10.9386
340.000	24.4651	10.9348
344.001	26.5985	10.9311
348.000	28.7274	10.9273
351.998	30.8488	10.9236

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
355.999	32.9649	10.9198
360.001	35.0776	10.9161
320.001	3.1412	10.0599
321.001	3.5360	10.0587
322.000	3.9316	10.0577
323.001	4.3278	10.0566
323.999	4.7236	10.0556
326.000	5.5192	10.0536
328.000	6.3179	10.0516
329.998	7.1177	10.0497
332.001	7.9212	10.0479
334.001	8.7251	10.0460
336.002	9.5306	10.0442
340.001	11.1437	10.0407
344.002	12.7608	10.0372
348.001	14.3795	10.0337
352.000	15.9999	10.0302
355.999	17.6207	10.0268
359.999	19.2427	10.0234
364.001	20.8640	10.0200
367.999	22.4847	10.0166
372.001	24.1040	10.0131
376.000	25.7212	10.0098
380.001	27.3368	10.0063
384.000	28.9484	10.0029
387.999	30.5590	9.9995
392.001	32.1676	9.9961
395.999	33.7705	9.9927
340.000	3.5012	8.8172
340.000	3.5013	8.8172
340.998	3.7626	8.8163
342.001	4.0259	8.8155
343.001	4.2892	8.8146
343.999	4.5534	8.8138
346.001	5.0845	8.8122
348.001	5.6190	8.8106
349.999	6.1548	8.8090
352.001	6.6950	8.8074
354.000	7.2356	8.8059
356.001	7.7788	8.8043
358.000	8.3231	8.8028
360.000	8.8698	8.8013
364.002	9.9670	8.7983
368.001	11.0688	8.7953

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
372.000	12.1745	8.7923
376.001	13.2833	8.7894
380.000	14.3917	8.7864
383.999	15.5066	8.7835
388.001	16.6222	8.7805
392.001	17.7404	8.7775
395.999	18.8574	8.7746
400.000	19.9760	8.7716
350.000	4.4614	8.2518
351.000	4.6811	8.2511
352.001	4.9028	8.2503
352.999	5.1234	8.2496
354.000	5.3467	8.2489
355.999	5.7941	8.2474
358.000	6.2432	8.2460
359.998	6.6945	8.2446
362.000	7.1479	8.2432
364.000	7.6043	8.2418
365.999	8.0613	8.2404
368.002	8.5211	8.2390
372.002	9.4441	8.2362
376.000	10.3712	8.2334
380.000	11.3025	8.2307
383.999	12.2374	8.2279
387.999	13.1750	8.2252
392.000	14.1153	8.2224
396.000	15.0571	8.2197
399.999	16.0001	8.2170
360.001	5.4151	7.6746
361.999	5.7875	7.6734
363.999	6.1635	7.6721
366.001	6.5411	7.6708
368.002	6.9211	7.6695
370.001	7.3029	7.6682
372.000	7.6858	7.6669
373.999	8.0708	7.6657
376.000	8.4568	7.6644
380.001	9.2332	7.6618
384.000	10.0132	7.6593
388.000	10.7972	7.6567
392.000	11.5847	7.6542
396.000	12.3743	7.6517
400.001	13.1664	7.6491
360.001	4.9919	7.3667

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol·dm^{-3})
362.001	5.3278	7.3654
364.000	5.6658	7.3642
366.000	6.0068	7.3630
368.000	6.3501	7.3617
370.001	6.6949	7.3605
372.000	7.0418	7.3593
376.000	7.7401	7.3568
380.002	8.4439	7.3544
384.001	9.1522	7.3520
387.999	9.8638	7.3496
391.999	10.5790	7.3471
396.000	11.2975	7.3447
400.000	12.0177	7.3423
359.999	4.4417	6.6193
361.998	4.7029	6.6182
363.999	4.9676	6.6171
366.000	5.2350	6.6161
368.001	5.5049	6.6150
370.001	5.7770	6.6139
372.000	6.0503	6.6128
375.999	6.6025	6.6107
380.000	7.1600	6.6085
384.002	7.7223	6.6064
388.000	8.2878	6.6042
391.999	8.8558	6.6021
395.999	9.4271	6.5999
399.998	10.0009	6.5978
360.000	4.1814	5.3241
362.001	4.3640	5.3233
364.000	4.5483	5.3225
366.000	4.7347	5.3217
367.998	4.9223	5.3209
370.002	5.1104	5.3200
371.999	5.2996	5.3192
376.002	5.6803	5.3175
379.999	6.0633	5.3159
384.000	6.4480	5.3142
388.000	6.8346	5.3125
392.001	7.2221	5.3108
396.001	7.6108	5.3091
400.000	8.0006	5.3075
360.000	3.9800	3.2509
362.000	4.0867	3.2504
364.001	4.1922	3.2499

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
366.000	4.2968	3.2494
367.998	4.4006	3.2490
369.999	4.5044	3.2485
372.001	4.6068	3.2481
376.001	4.8104	3.2471
379.998	5.0116	3.2462
384.001	5.2118	3.2452
387.999	5.4105	3.2443
391.999	5.6080	3.2434
396.001	5.8046	3.2424
400.001	6.0001	3.2415
360.000	3.1503	1.6669
362.000	3.1949	1.6667
364.000	3.2391	1.6665
366.001	3.2832	1.6663
368.000	3.3272	1.6661
370.000	3.3710	1.6660
371.999	3.4142	1.6678
375.999	3.5000	1.6673
379.999	3.5851	1.6668
384.001	3.6694	1.6663
387.999	3.7528	1.6657
392.001	3.8362	1.6652
396.000	3.9185	1.6647
400.000	4.0006	1.6642
	0.5000 R125 + 0.5000 R143a	
200.002	3.7506	14.0768
200.999	4.9935	14.0736
202.001	6.2613	14.0711
203.000	7.5391	14.0690
204.001	8.8261	14.0670
205.001	10.1129	14.0651
206.000	11.4026	14.0633
206.999	12.6913	14.0617
207.998	13.9760	14.0600
208.999	15.2691	14.0584
210.000	16.5530	14.0569
212.000	19.1238	14.0539
213.998	21.6852	14.0509
216.001	24.2425	14.0481
218.002	26.7839	14.0453
220.001	29.3202	14.0425
222.001	31.8491	14.0398

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
224.001	34.3699	14.0371
218.001	3.8638	13.5662
218.999	4.9311	13.5635
219.999	6.0153	13.5612
220.999	7.1022	13.5592
222.000	8.1999	13.5573
224.000	10.3918	13.5540
226.001	12.5889	13.5509
228.001	14.7813	13.5479
230.000	16.9714	13.5451
232.000	19.1605	13.5423
234.000	21.3446	13.5396
235.999	23.5209	13.5370
238.001	25.6902	13.5344
239.999	27.8520	13.5318
241.998	30.0112	13.5293
244.002	32.1628	13.5268
246.000	34.3048	13.5243
232.002	3.7217	13.1451
233.002	4.6604	13.1425
233.998	5.6055	13.1403
235.000	6.5633	13.1384
236.000	7.5240	13.1366
237.000	8.4877	13.1349
238.000	9.4505	13.1334
238.999	10.4114	13.1319
240.000	11.3791	13.1304
242.001	13.3040	13.1276
244.001	15.2293	13.1249
246.000	17.1485	13.1222
248.001	19.0670	13.1197
250.001	20.9836	13.1171
252.000	22.8948	13.1147
253.999	24.8013	13.1122
256.002	26.7048	13.1098
258.000	28.5988	13.1074
260.000	30.4875	13.1050
262.000	32.3738	13.1027
263.999	34.2556	13.1003
250.001	3.6410	12.5769
250.999	4.4309	12.5744
252.001	5.2340	12.5724
253.000	6.0320	12.5706
253.999	6.8381	12.5690

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
256.000	8.4547	12.5659
257.999	10.0704	12.5631
259.998	11.6861	12.5605
262.002	13.3063	12.5579
263.998	14.9208	12.5555
265.998	16.5348	12.5530
268.002	18.1484	12.5506
269.999	19.7557	12.5483
271.998	21.3602	12.5460
273.999	22.9642	12.5437
276.002	24.5672	12.5415
278.001	26.1621	12.5392
280.001	27.7544	12.5370
282.000	29.3470	12.5348
284.002	30.9361	12.5326
286.002	32.5217	12.5304
288.001	34.1018	12.5282
263.999	3.7705	12.1110
264.998	4.4605	12.1088
266.000	5.1538	12.1070
266.999	5.8503	12.1053
268.001	6.5504	12.1038
270.000	7.9488	12.1009
272.000	9.3522	12.0983
274.000	10.7530	12.0958
276.001	12.1586	12.0933
277.998	13.5561	12.0910
279.998	14.9587	12.0887
284.000	17.7592	12.0842
287.999	20.5526	12.0798
291.999	23.3373	12.0755
295.999	26.1108	12.0713
300.000	28.8753	12.0671
304.000	31.6335	12.0629
308.001	34.3803	12.0587
280.001	3.6831	11.5211
281.001	4.2625	11.5191
282.000	4.8396	11.5175
283.000	5.4219	11.5159
284.000	6.0052	11.5145
286.001	7.1726	11.5118
288.001	8.3444	11.5093
290.001	9.5156	11.5069
292.000	10.6859	11.5047

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol·dm^{-3})
294.000	11.8569	11.5024
296.002	13.0286	11.5003
297.999	14.1973	11.4982
300.001	15.3698	11.4961
302.002	16.5391	11.4940
304.001	17.7094	11.4919
306.000	18.8757	11.4899
308.002	20.0449	11.4879
310.001	21.2109	11.4859
311.999	22.3755	11.4839
316.000	24.7019	11.4799
319.999	27.0204	11.4759
324.001	29.3345	11.4720
328.000	31.6369	11.4681
332.000	33.9380	11.4642
296.001	3.3401	10.8265
296.999	3.8033	10.8246
298.000	4.2701	10.8230
298.998	4.7359	10.8215
300.000	5.2037	10.8201
302.000	6.1457	10.8176
304.000	7.0887	10.8152
306.001	8.0369	10.8130
308.001	8.9843	10.8109
310.000	9.9300	10.8088
312.002	10.8795	10.8067
316.001	12.7777	10.8028
320.001	14.6770	10.7989
324.002	16.5700	10.7952
328.001	18.4665	10.7917
332.002	20.3606	10.7881
336.000	22.2523	10.7844
340.000	24.1464	10.7807
344.000	26.0347	10.7771
347.999	27.9191	10.7734
352.000	29.8009	10.7698
355.999	31.6740	10.7661
359.998	33.5435	10.7625
364.000	35.4096	10.7588
312.000	3.7918	10.0837
313.000	4.1628	10.0823
313.999	4.5353	10.0810
315.000	4.9070	10.0798
316.000	5.2799	10.0786

Table III. *(Continued)*

T (K)	p (MPa)	ρ $(\mathrm{mol \cdot dm^{-3}})$
318.001	6.0293	10.0764
320.002	6.7805	10.0743
323.999	8.2885	10.0703
327.999	9.8011	10.0665
332.001	11.3174	10.0629
335.998	12.8365	10.0593
340.000	14.3596	10.0558
344.000	15.8825	10.0524
348.000	17.4077	10.0489
352.001	18.9314	10.0455
356.000	20.4540	10.0421
360.000	21.9768	10.0387
363.999	23.4986	10.0353
367.999	25.0183	10.0319
372.000	26.5365	10.0285
376.000	28.0523	10.0252
380.001	29.5659	10.0218
383.999	31.0747	10.0184
388.001	32.5831	10.0150
392.001	34.0861	10.0116
328.002	3.7130	9.0092
329.001	3.9760	9.0080
329.998	4.2397	9.0069
331.001	4.5041	9.0059
331.999	4.7706	9.0049
334.002	5.3040	9.0029
335.999	5.8395	9.0011
340.001	6.9193	8.9976
344.001	8.0054	8.9943
348.001	9.0986	8.9910
352.001	10.1956	8.9879
355.999	11.2964	8.9848
360.002	12.4010	8.9817
363.999	13.5094	8.9786
368.001	14.6199	8.9756
372.000	15.7311	8.9726
376.002	16.8436	8.9695
380.002	17.9569	8.9665
383.999	19.0718	8.9635
388.000	20.1849	8.9605
391.999	21.2995	8.9575
396.001	22.4140	8.9545
399.998	23.5269	8.9515
344.000	4.5684	7.7241

Table III. *(Continued)*

T (K)	p (MPa)	ρ (mol · dm^{-3})
344.999	4.7457	7.7233
346.000	4.9244	7.7225
347.000	5.1033	7.7218
348.001	5.2827	7.7211
350.001	5.6438	7.7196
351.999	6.0069	7.7182
356.000	6.7392	7.7154
359.999	7.4781	7.7127
364.002	8.2235	7.7100
368.001	8.9734	7.7073
372.000	9.7269	7.7047
376.001	10.4834	7.7021
380.000	11.2428	7.6995
384.002	12.0050	7.6970
388.000	12.7683	7.6944
392.000	13.5340	7.6918
396.001	14.3007	7.6893
399.999	15.0681	7.6867
359.999	6.3326	7.0281
361.999	6.6333	7.0269
364.001	6.9356	7.0257
365.999	7.2384	7.0245
368.000	7.5426	7.0233
370.000	7.8479	7.0221
372.000	8.1541	7.0210
375.999	8.7690	7.0186
380.000	9.3875	7.0162
384.000	10.0079	7.0139
388.002	10.6302	7.0116
391.999	11.2548	7.0092
396.000	11.8807	7.0069
399.999	12.5078	7.0046
360.001	5.4741	5.9773
362.001	5.6949	5.9763
364.002	5.9167	5.9753
366.000	6.1395	5.9743
368.001	6.3631	5.9733
370.001	6.5877	5.9723
371.998	6.8122	5.9713
376.000	7.2640	5.9693
380.002	7.7179	5.9673
384.000	8.1732	5.9653
388.000	8.6302	5.9634
392.000	9.0882	5.9614

Table III. *(Continued)*

T (K)	p (MPa)	ρ ($mol \cdot dm^{-3}$)
396.000	9.5472	5.9595
399.998	10.0079	5.9575
360.000	4.8317	4.1772
362.001	4.9666	4.1765
364.000	5.1014	4.1758
365.999	5.2360	4.1752
367.999	5.3703	4.1745
369.999	5.5042	4.1738
372.002	5.6386	4.1731
376.001	5.9060	4.1718
380.001	6.1729	4.1704
383.999	6.4393	4.1691
388.000	6.7051	4.1677
392.002	6.9705	4.1664
396.000	7.2353	4.1651
400.000	7.4996	4.1637
360.002	3.8467	2.2021
361.999	3.9073	2.2020
364.000	3.9676	2.2017
365.999	4.0278	2.2014
368.001	4.0875	2.2011
369.999	4.1467	2.2008
372.000	4.2059	2.2004
376.000	4.3232	2.1997
379.999	4.4398	2.1990
384.000	4.5556	2.1982
388.000	4.6706	2.1975
392.000	4.7848	2.1968
396.001	4.8984	2.1960
400.000	5.0114	2.1953
359.999	2.1310	0.8852
362.000	2.1501	0.8851
364.002	2.1691	0.8849
366.000	2.1881	0.8847
367.999	2.2070	0.8845
370.000	2.2258	0.8843
372.002	2.2443	0.8842
375.999	2.2815	0.8838
379.999	2.3185	0.8834
384.001	2.3553	0.8830
388.000	2.3919	0.8827
392.000	2.4282	0.8823
395.999	2.4644	0.8819
400.000	2.5004	0.8814

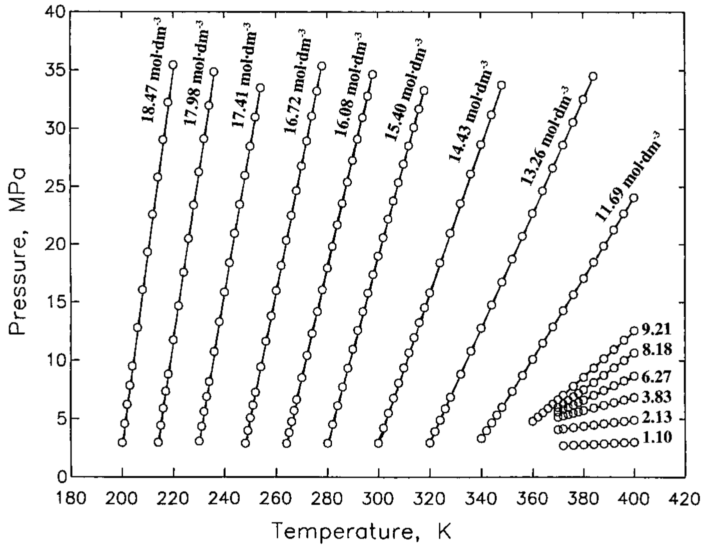

Fig. 1. Range of p–ρ–T measurements (○) for 0.4997 R32 + 0.5003 R134a (designated DOE1).

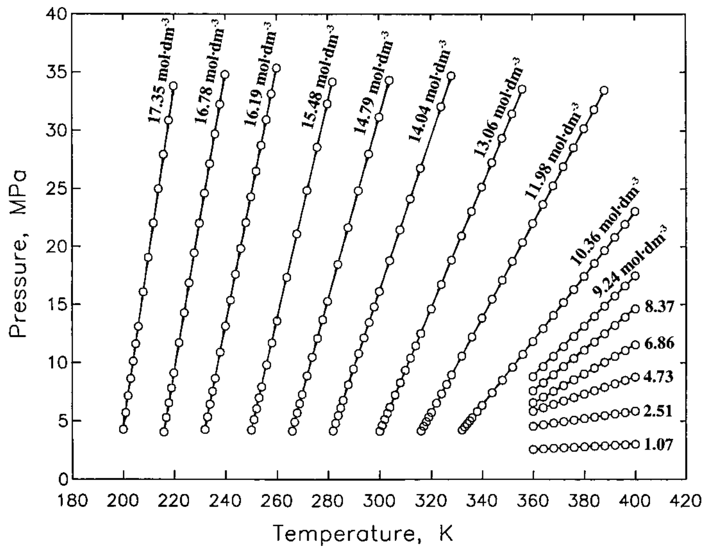

Fig. 2. Range of p–ρ–T measurements (○) for 0.4996 R32 + 0.5004 R125 (designated DOE2).

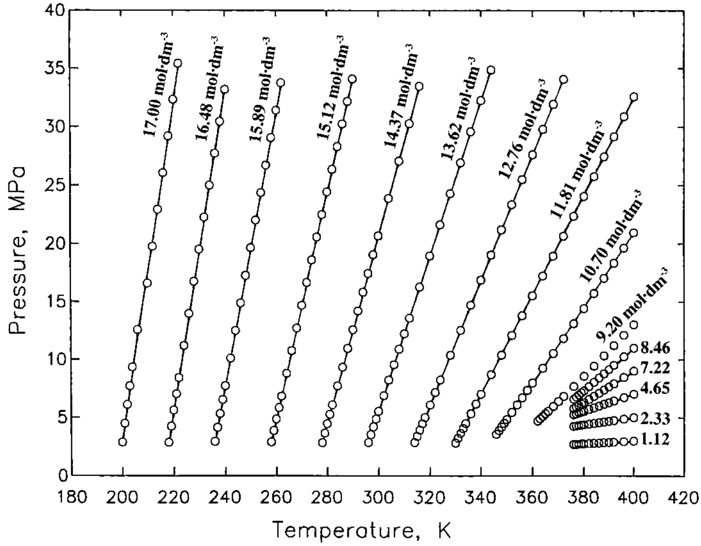

Fig. 3. Range of p–ρ–T measurements (○) for 0.3288 R32 + 0.6712 R134a (designated DOE3).

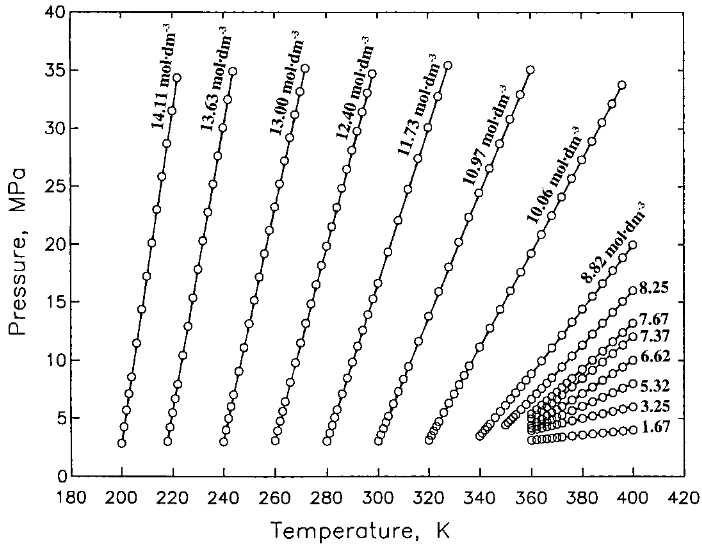

Fig. 4. Range of p–ρ–T measurements (○) for 0.5001 R125 + 0.4999 R134a (designated DOE4).

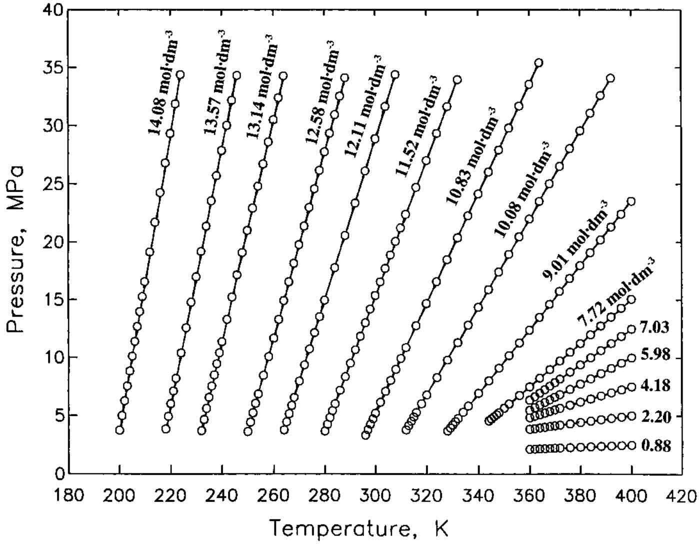

Fig. 5. Range of p–ρ–T measurements (○) for 0.5000 R125 + 0.5000 R143a (designated ARTI1).

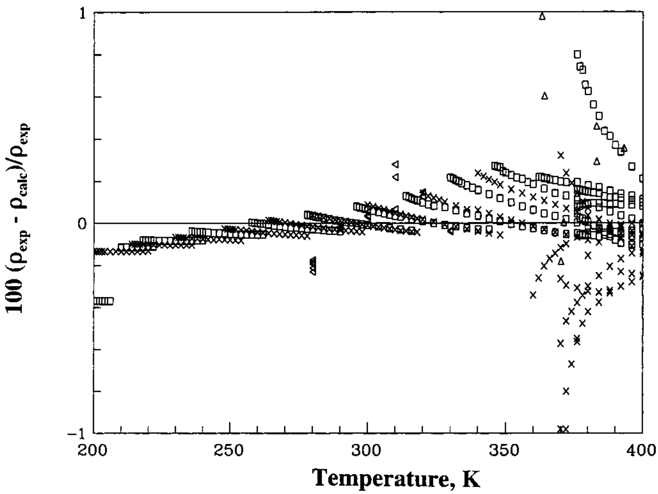

Fig. 6. Percentage deviations of the experimental densities for 0.4997 R32 + 0.5003 R134a (DOE1) (×) and 0.3288 R32 + 0.6712 R134a (DOE 3) (□) obtained in this work, by Oguchi et al. [10] (△), and by Widiatmo et al. [11] (◁) from the values calculated with the Helmholtz energy model of Lemmon and Jacobsen [9].

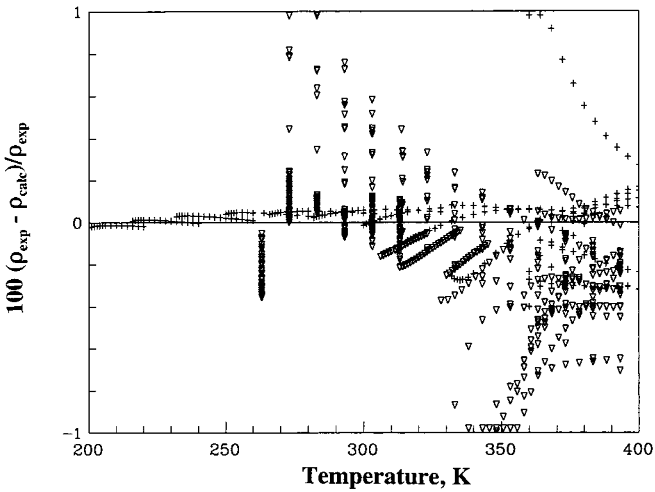

Fig. 7. Percentage deviations of the experimental densities for 0.4996 R32 + 0.5004 R125 (DOE2) (+) obtained in this work and by Piao et al. [12] (▽) from the values calculated with the Helmholtz energy model of Lemmon and Jacobsen [9].

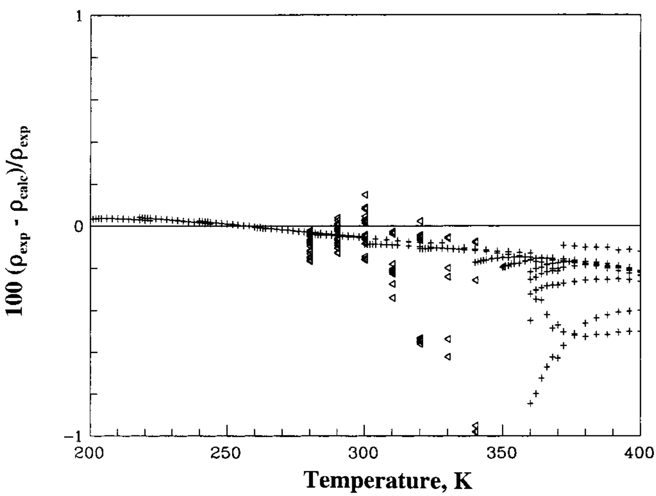

Fig. 8. Percentage deviations of the experimental densities for 0.5001 R125 + 0.4999 R134a (DOE4) (⊕) obtained in this work and by Widiatmo et al. [13] (◁) from the values calculated with the Helmholtz energy model of Lemmon and Jacobsen [9].

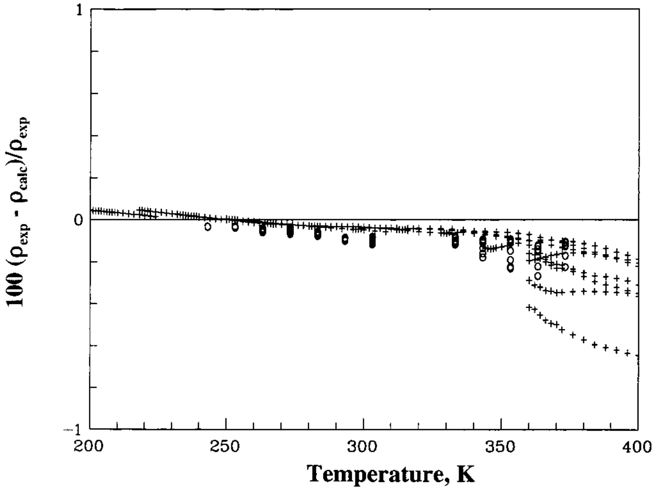

Fig. 9. Percentage deviations of the experimental densities for 0.5000 R125 + 0.5000 R143a (ARTI1) (+) obtained in this work and by Kleemis [14] (○) from the values calculated with the Helmholtz energy model of Lemmon and Jacobsen [9].

of the supercritical gas data is considerably larger, probably as a result of deficiencies in the pure fluid equations of state. With few exceptions, notably the R32 + R125 data of Piao et al. [12], the figures show that agreement with published data is within ±0.2%.

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