THERMOPHYSICAL PROPERTIES OF HFC-143a AND HFC-152a

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ABSTRACT

Numerous fluids have been identified as promising alternative refrigerants, but much of the information needed to predict their behavior as pure fluids and as components in mixtures does not exist. In particular, reliable thermophysical properties data and models are needed to predict the performance of the new refrigerants in heating and cooling equipment and to design and optimize equipment to be reliable and energy efficient. The objective of this project is to provide highly accurate, selected thermophysical properties data for refrigerants HFC-143a (CH_3CF_3) and HFC-152a (CH_3CHF_2) and to use these data to fit complex equations of state and detailed transport property models. The new data will fill gaps in the existing data sets and resolve problems and uncertainties that exist in and between the data sets. **This report describes progress during the second quarter of this twelve-month project, which was initiated on April 1, 1993.**

SCOPE

This project involves selected measurements of the thermodynamic properties of HFC-143a and HFC-152a and the development of high-accuracy modified Benedict-Webb-Rubin (MBWR) equations of state for each fluid. It also includes selected measurements of the transport properties (viscosity and thermal conductivity) of both HFC-143a and HFC-152a and the development of detailed correlations for same. The experimental thermodynamic property measurements will include, as appropriate, accurate determinations of the critical temperature, pressure, and density; vapor pressures and saturated densities; vapor-phase speed of sound and ideal-gas heat capacity; pressure-volume-temperature (PVT) behavior of the superheated vapor and compressed liquid; and isochoric heat capacity in the liquid and two-phase regions. The experimental transport property measurements will cover the one-phase and saturated liquid and vapor states over the temperature range of interest. Efforts during this second quarter focused primarily on measuring vapor pressures, vapor-phase and liquid-phase PVT behavior, and liquid-phase isochoric heat capacities of HFC-143a; on developing a preliminary MBWR equation of state for HFC-152a; and on using this equation to analyze the liquid-phase isochoric heat capacity data for HFC-152a.

SIGNIFICANT RESULTS**HFC-143a**

An isochoric PVT apparatus has been used to measure liquid-phase densities of HFC-143a at 154 state points at temperatures ranging from 164 to 400 K (-164 to 260°F) with pressures as

high as 35 MPa (5100 psia). Ten isochores have been completed at densities ranging from 8.5 to 15.7 mol/dm³ (45 to 83 lb-mass/ft³) on a sample of 0.9993 mole fraction purity. The pressure and temperature ranges covered are indicated in Figure 1, and the experimental temperatures, pressures, and densities are presented in both SI and PI units in Table 1 (see Appendix A, which includes all tables).

An ebulliometer has been used to measure the vapor pressure of HFC-143a at 32 temperatures between 236.1 and 279.5 K (-35 to 43°F); the corresponding pressures range from 161 to 751 kPa (23 to 109 psia). These data are presented in Table 2 and in Figure 2. At higher temperatures and pressures, the Burnett apparatus has been used for vapor pressure measurements on HFC-143a at 14 temperatures from 279.2 to 343.2 K (43 to 158°F); corresponding pressures range from 0.745 to 3.56 MPa (108 to 516 psia). These results are presented in Table 3 and in Figure 2.

Liquid isochoric heat capacity measurements have been initiated on HFC-143a at low temperatures. Measurements will be carried out on single-phase and saturated liquid samples at temperatures from 161 to 345 K (-170 to 161°F) with pressures as high as 35 MPa (5100 psia). Eight isochores have been measured, but the data have not been analyzed yet. They will be included in the next progress report.

Measurements have been initiated on the Burnett apparatus to determine the PVT behavior for the vapor phase of HFC-143a. So far, measurements have been conducted for four isochores at densities ranging from the critical density down to 0.17 times the critical density, as shown in Figure 3. These data will be reported in the next quarterly progress report.

HFC-152a

Isochoric heat capacity measurements have been carried out on liquid HFC-152a of 0.9996 mole fraction purity. Measurements were conducted on single-phase and saturated liquid samples at temperatures from 162.6 to 342.1 K (-167 to 156°F) with pressures up to 35 MPa (5100 psia). A total of eight isochores were measured. The preliminary results of these measurements are given in both SI and PI units in Tables 4 and 5.

A preliminary equation of state has been developed for HFC-152a to analyze the isochoric heat capacity results and to facilitate comparisons of literature results with the new experimental PVT data (reported in the last quarterly progress report) from this study. Literature data used in the development of the modified Benedict-Webb-Rubin (MBWR) equation for HFC-152a include vapor pressures, saturated liquid and vapor densities, and liquid- and vapor-phase pressure-volume-temperature (PVT) points; later fits will include the isochoric heat capacity and sound speed data from this project. This preliminary equation is valid at temperatures from 156 to 450 K (-179 to 350°F); maximum pressure is 35 MPa (5100 psia).

COMPLIANCE WITH AGREEMENT

NIST has complied with all terms of the grant agreement modulo small shifts in the estimated level of effort from one property and/or fluid to another.

PRINCIPAL INVESTIGATOR EFFORT

Dr. W.M. Haynes is the NIST Principal Investigator for the MCLR program. During the third quarter of calendar year 1993, Dr. Haynes devoted approximately one week to planning the project, monitoring and reviewing the research, and preparing the quarterly report. The project involves multiple researchers and capabilities in Gaithersburg, MD and Boulder, CO.

Figure 1. Range of measured temperatures and pressures for isochoric PVT study of HFC-143a.

Figure 2. Vapor pressure measurements for HFC-143a.

Figure 3. Plot of experimental temperatures and pressures showing current status of vapor phase PVT measurements for HFC-143a using Burnett apparatus.

APPENDIX A:
TABLES OF THERMOPHYSICAL PROPERTIES DATA

Table 1a. Liquid-Phase Isochoric PVT Data for HFC-143a in SI Units.

Temperature K	Pressure MPa	Density mol·dm ⁻³
164.000	1.951007	15.78793
165.999	3.133941	15.75083
167.998	6.289870	15.74413
169.999	9.561904	15.73935
172.000	12.853520	15.73520
174.000	16.131230	15.73139
176.000	19.412660	15.72777
177.999	22.676780	15.72431
179.999	25.936490	15.72094
181.999	29.173840	15.71765
183.998	32.385470	15.71444
180.001	1.923858	15.33153
182.000	2.996269	15.29475
183.999	5.750058	15.28836
186.000	8.604074	15.28381
187.999	11.472370	15.27988
190.001	14.340720	15.27626
191.999	17.205370	15.27286
194.002	20.057250	15.26957
195.999	22.899260	15.26639
197.999	25.737090	15.26328
200.000	28.560300	15.26023
201.999	31.372290	15.25723
204.001	34.168730	15.25427
200.000	1.462529	14.73830
202.001	2.873868	14.73084
204.002	4.725123	14.69521
206.001	7.104525	14.69078
207.999	9.506974	14.68702
209.999	11.915530	14.68358
212.001	14.324150	14.68035
213.999	16.725880	14.67726
215.999	19.121940	14.67427
217.999	21.506260	14.67135
220.000	23.888460	14.66850
222.000	26.260900	14.66568

Table 1a. Liquid-Phase Isochoric PVT Data for HFC-143a in SI Units.
(continued)

Temperature K	Pressure MPa	Density mol·dm ⁻³
224.000	28.620540	14.66291
225.998	30.976090	14.66016
227.999	33.322240	14.65745
220.002	2.159478	14.14756
222.000	3.042955	14.11153
223.999	5.019431	14.10632
225.999	7.039020	14.10242
228.000	9.069435	14.09900
230.000	11.100940	14.09585
232.002	13.128310	14.09286
234.000	15.154790	14.08999
236.000	17.174560	14.08720
238.001	19.194980	14.08447
240.001	21.207390	14.08180
242.002	23.215260	14.07916
243.999	25.211980	14.07656
246.001	27.207200	14.07399
247.999	29.194010	14.07144
250.001	31.177570	14.06891
252.000	33.154330	14.06640
254.000	35.125400	14.06390
240.001	1.409634	13.47696
244.000	3.827564	13.43540
247.999	7.150055	13.42805
251.999	10.495600	13.42215
256.000	13.842900	13.41677
260.000	17.178880	13.41167
264.001	20.500520	13.40673
267.999	23.805650	13.40192
272.002	27.099620	13.39717
276.000	30.377770	13.39248
279.998	33.634480	13.38784

Table 1a. Liquid-Phase Isochoric PVT Data for HFC-143a in SI Units.
(continued)

Temperature K	Pressure MPa	Density mol·dm ⁻³
260.000	1.983116	12.79862
264.000	4.064259	12.75843
268.000	6.808358	12.75197
272.001	9.572154	12.74654
276.000	12.336160	12.74155
280.001	15.093610	12.73679
284.002	17.842700	12.73218
288.001	20.584580	12.72767
292.000	23.316610	12.72323
295.998	26.037830	12.71883
300.001	28.753250	12.71446
304.000	31.453970	12.71012
308.000	34.148300	12.70580
280.000	2.360648	12.03960
283.999	4.117354	12.00088
288.001	6.336760	11.99513
292.000	8.563247	11.99017
295.999	10.792290	11.98556
300.002	13.022900	11.98115
304.001	15.249780	11.97687
307.999	17.472000	11.97267
312.000	19.682320	11.96858
316.000	21.898520	11.96444
320.000	24.108220	11.96036
324.000	26.310920	11.95630
328.001	28.505630	11.95227
331.999	30.694010	11.94824
336.000	32.877520	11.94422
340.001	35.050380	11.94020
299.999	2.459763	11.12760
304.000	3.883812	11.08992
307.999	5.592353	11.08478
312.000	7.311225	11.08027
316.001	9.032702	11.07607

Table 1a. Liquid-Phase Isochoric PVT Data for HFC-143a in SI Units.
(continued)

Temperature K	Pressure MPa	Density mol·dm ⁻³
320.000	10.754250	11.07203
324.001	12.476380	11.06821
328.002	14.202940	11.06448
332.000	15.928960	11.06078
335.999	17.655880	11.05705
340.002	19.379810	11.05336
344.000	21.102920	11.04966
348.000	22.822720	11.04595
351.999	24.542600	11.04225
355.999	26.255290	11.03855
359.999	27.964070	11.03485
363.999	29.667750	11.03115
367.999	31.369940	11.02744
372.000	33.066730	11.02373
376.001	34.760280	11.02001
320.000	3.721390	10.16849
323.998	5.026397	10.16416
328.000	6.339485	10.16029
332.000	7.661252	10.15653
336.000	8.987938	10.15286
340.001	10.318980	10.14927
344.002	11.653720	10.14575
348.000	12.990800	10.14228
351.999	14.329900	10.13884
356.000	15.671020	10.13541
360.000	17.009550	10.13201
364.000	18.348600	10.12862
368.002	19.689740	10.12523
372.001	21.028210	10.12185
375.998	22.364810	10.11847
379.999	23.701180	10.11509
384.001	25.036730	10.11170
387.999	26.368640	10.10831
392.000	27.701750	10.10491
395.998	29.032220	10.10151
400.000	30.360440	10.09810

Table 1a. Liquid-Phase Isochoric PVT Data for HFC-143a in SI Units.
(continued)

Temperature K	Pressure MPa	Density mol·dm ⁻³
340.000	4.075894	8.55629
344.000	4.886051	8.55295
348.000	5.707178	8.54978
352.000	6.537002	8.54672
356.001	7.374589	8.54374
359.999	8.217673	8.54080
363.999	9.065764	8.53790
368.000	9.918586	8.53503
372.001	10.772430	8.53217
375.998	11.629510	8.52932
380.001	12.490230	8.52649
384.000	13.352350	8.52366
388.000	14.216890	8.52083
391.999	15.081490	8.51800
396.000	15.948460	8.51518
399.999	16.816010	8.51235

Table 1b. Liquid-Phase Isochoric PVT Data for HFC-143a in PI Units.

Temperature °F	Pressure psia	Density lb-mass ft ⁻³
-164.47	282.970	82.832
-160.87	454.541	82.637
-157.27	912.270	82.602
-153.67	1386.839	82.577
-150.07	1864.249	82.555
-146.47	2339.641	82.535
-142.87	2815.573	82.516
-139.27	3288.995	82.498
-135.67	3761.776	82.480
-132.07	4231.315	82.463
-128.47	4697.124	82.446
-135.67	279.033	80.437
-132.07	434.573	80.244
-128.47	833.977	80.211
-124.87	1247.918	80.187
-121.27	1663.930	80.166
-117.67	2079.949	80.147
-114.07	2495.432	80.129
-110.47	2909.063	80.112
-106.87	3321.263	80.095
-103.27	3732.856	80.079
-99.67	4142.329	80.063
-96.07	4550.174	80.047
-92.47	4955.764	80.032
-99.67	212.122	77.325
-96.07	416.820	77.286
-92.47	685.322	77.099
-88.87	1030.426	77.075
-85.27	1378.872	77.056
-81.67	1728.205	77.038
-78.07	2077.546	77.021
-74.47	2425.888	77.004
-70.87	2773.408	76.989
-67.27	3119.225	76.973
-63.67	3464.734	76.958
-60.07	3808.828	76.944

Table 1b. Liquid-Phase Isochoric PVT Data for HFC-143a in PI Units.
(continued)

Temperature °F	Pressure psia	Density lb-mass·ft ⁻³
-56.47	4151.066	76.929
-52.87	4492.710	76.915
-49.27	4832.991	76.900
-63.67	313.206	74.225
-60.07	441.344	74.036
-56.47	728.008	74.009
-52.87	1020.925	73.989
-49.27	1315.413	73.971
-45.67	1610.058	73.954
-42.07	1904.104	73.938
-38.47	2198.020	73.923
-34.87	2490.964	73.909
-31.27	2784.001	73.894
-27.67	3075.877	73.880
-24.07	3367.095	73.866
-20.47	3656.695	73.853
-16.87	3946.078	73.839
-13.27	4234.241	73.826
-9.67	4521.932	73.813
-6.07	4808.638	73.800
-2.47	5094.518	73.786
-27.67	204.450	70.707
-20.47	555.142	70.489
-13.27	1037.030	70.450
-6.07	1522.261	70.419
1.13	2007.746	70.391
8.33	2491.590	70.364
15.53	2973.354	70.339
22.73	3452.724	70.313
29.93	3930.475	70.288
37.13	4405.931	70.264
44.33	4878.278	70.239

Table 1b. Liquid-Phase Isochoric PVT Data for HFC-143a in PI Units.
(continued)

Temperature °F	Pressure psia	Density lb-mass·ft ⁻³
8.33	287.627	67.148
15.53	589.472	66.937
22.73	987.471	66.903
29.93	1388.326	66.875
37.13	1789.212	66.849
44.33	2189.147	66.824
51.53	2587.869	66.800
58.73	2985.546	66.776
65.93	3381.794	66.753
73.13	3776.475	66.729
80.33	4170.314	66.707
87.53	4562.021	66.684
94.73	4952.801	66.661
44.33	342.384	63.166
51.53	597.173	62.963
58.73	919.071	62.933
65.93	1241.996	62.907
73.13	1565.292	62.882
80.33	1888.815	62.859
87.53	2211.798	62.837
94.73	2534.104	62.815
101.93	2854.684	62.793
109.13	3176.117	62.772
116.33	3496.608	62.750
123.53	3816.083	62.729
130.73	4134.399	62.708
137.93	4451.798	62.687
145.13	4768.490	62.665
152.33	5083.637	62.644
80.33	356.759	58.381
87.53	563.300	58.183
94.73	811.104	58.156
101.93	1060.405	58.133
109.13	1310.085	58.111

Table 1b. Liquid-Phase Isochoric PVT Data for HFC-143a in PI Units.
(continued)

Temperature °F	Pressure psia	Density lb-mass·ft ⁻³
116.33	1559.775	58.090
123.53	1809.549	58.069
130.73	2059.966	58.050
137.93	2310.304	58.031
145.13	2560.773	58.011
152.33	2810.809	57.992
159.53	3060.725	57.972
166.73	3310.162	57.953
173.93	3559.609	57.933
181.13	3808.015	57.914
188.33	4055.853	57.894
195.53	4302.951	57.875
202.73	4549.833	57.856
209.93	4795.932	57.836
217.13	5041.561	57.817
116.33	539.743	53.349
123.53	729.019	53.326
130.73	919.466	53.306
137.93	1111.173	53.286
145.13	1303.593	53.267
152.33	1496.644	53.248
159.53	1690.232	53.230
166.73	1884.160	53.212
173.93	2078.380	53.194
181.13	2272.893	53.176
188.33	2467.031	53.158
195.53	2661.244	53.140
202.73	2855.760	53.122
209.93	3049.889	53.104
217.13	3243.747	53.087
224.33	3437.572	53.069
231.53	3631.277	53.051
238.73	3824.455	53.033
245.93	4017.806	53.016
253.13	4210.775	52.998
260.33	4403.417	52.980

Table 1b. Liquid-Phase Isochoric PVT Data for HFC-143a in PI Units.
(continued)

Temperature °F	Pressure psia	Density lb-mass·ft ⁻³
152.33	591.159	44.891
159.53	708.663	44.873
166.73	827.758	44.857
173.93	948.114	44.840
181.13	1069.596	44.825
188.33	1191.875	44.809
195.53	1314.880	44.794
202.73	1438.572	44.779
209.93	1562.412	44.764
217.13	1686.721	44.749
224.33	1811.558	44.734
231.53	1936.598	44.719
238.73	2061.989	44.705
245.93	2187.389	44.690
253.13	2313.133	44.675
260.33	2438.960	44.660

Table 2. Vapor Pressure Data for HFC-143a Using Ebulliometer.

Temperature K	Pressure kPa	Temperature °F	Pressure psia
236.133	160.560	-34.631	23.287
237.565	170.605	-32.053	24.744
238.912	180.597	-29.629	26.193
240.210	190.627	-27.292	27.648
241.457	200.614	-25.047	29.097
242.659	210.636	-22.884	30.550
243.815	220.647	-20.804	32.002
246.011	240.665	-16.850	34.906
248.084	260.560	-13.118	37.791
248.076	260.674	-13.134	37.808
250.032	280.622	-9.612	40.701
251.875	300.682	-6.295	43.610
254.049	325.681	-2.382	47.236
254.050	325.718	-2.381	47.241
256.097	350.717	1.304	50.867
258.038	375.748	4.798	54.498
259.883	400.758	8.120	58.125
259.884	400.801	8.122	58.131
261.648	425.822	11.295	61.760
263.329	450.859	14.321	65.392
264.944	475.916	17.229	69.026
266.495	500.963	20.021	72.659
267.991	526.024	22.713	76.293
269.433	551.081	25.309	79.927
270.825	576.125	27.816	83.560
272.177	600.723	30.249	87.128
272.180	600.883	30.255	87.151
272.172	601.201	30.240	87.197
273.483	625.979	32.599	90.791
274.753	650.987	34.884	94.418
277.181	701.094	39.256	101.685
279.484	751.294	43.401	108.966

Table 3. Vapor Pressure Data for HFC-143a Using Burnett Apparatus.

Temperature K	Pressure MPa	Temperature °F	Pressure psia
279.171	0.7445	42.837	107.987
283.128	0.8370	49.960	121.400
288.221	0.9669	59.127	140.243
293.173	1.1071	68.041	160.572
298.165	1.2633	77.027	183.238
303.155	1.4357	86.000	208.235
308.131	1.6244	94.965	235.600
313.176	1.8344	104.046	266.058
318.118	2.0592	112.942	298.672
323.168	2.3103	122.032	335.088
328.172	2.5825	131.039	374.562
333.162	2.8779	140.021	417.406
337.997	3.1901	148.724	462.691
343.190	3.5576	158.072	515.988

Table 4a. Experimental Liquid Heat Capacity Data for HFC-152a in SI Units.

T	ρ	P	$C_{v,exp}$	$C_{v,cal}$	$\delta C_v, \%$	Run
K	mol dm^{-3}	MPa	$\text{J mol}^{-1} \text{K}^{-1}$			
164.2305	17.878	8.903	68.81	65.03	5.48	A
168.3638	17.857	16.441	69.33	68.49	1.21	A
172.4621	17.837	23.743	69.96	70.71	-1.06	A
174.7253	17.825	27.726	69.98	71.54	-2.24	B
176.5224	17.816	30.870	70.77	72.05	-1.82	A
186.6279	17.232	5.728	68.13	71.54	-5.00	A
190.7495	17.214	12.211	68.90	71.58	-3.88	A
192.5569	17.206	15.031	68.89	71.53	-3.83	B
194.8352	17.195	18.564	69.28	71.44	-3.12	A
196.6300	17.187	21.329	69.41	71.34	-2.78	B
198.8941	17.177	24.791	69.93	71.19	-1.81	A
200.6744	17.169	27.490	69.94	71.07	-1.60	B
202.9139	17.159	30.854	70.32	70.89	-0.82	A
212.0842	16.512	4.924	69.24	68.88	0.52	A
214.2033	16.503	7.750	69.34	68.77	0.82	B
216.1625	16.496	10.349	69.63	68.67	1.37	A
218.2660	16.487	13.122	69.79	68.57	1.74	B
220.2199	16.480	15.681	70.22	68.48	2.48	A
222.3026	16.472	18.391	70.19	68.39	2.56	B
224.2446	16.464	20.900	70.59	68.31	3.23	A
226.3064	16.456	23.544	70.71	68.23	3.50	B
228.2340	16.449	25.997	71.20	68.16	4.27	A
230.2770	16.441	28.578	71.32	68.10	4.52	B
232.2033	16.434	30.993	71.81	68.04	5.25	A
239.1601	15.714	4.192	70.58	67.09	4.94	B
241.1884	15.707	6.429	70.74	67.12	5.12	A
243.2038	15.701	8.641	71.13	67.15	5.60	B
245.2399	15.694	10.863	71.18	67.18	5.62	A
247.2244	15.687	13.018	71.75	67.21	6.32	B
249.2580	15.681	15.214	71.89	67.25	6.45	A
251.2208	15.674	17.322	72.38	67.29	7.03	B
253.2553	15.668	19.494	72.46	67.33	7.08	A
255.1956	15.661	21.554	72.78	67.38	7.43	B
257.2268	15.655	23.697	72.77	67.43	7.34	A
259.1340	15.648	25.697	73.20	67.48	7.82	B
261.1626	15.642	27.812	73.41	67.53	8.01	A
263.0467	15.636	29.764	73.82	67.59	8.44	B
265.0773	15.629	31.854	74.00	67.65	8.58	A
262.0871	15.012	4.112	72.55	67.31	7.23	A
263.9639	15.007	5.854	72.71	67.40	7.31	B
266.1362	15.001	7.865	72.94	67.51	7.45	A
267.9869	14.995	9.573	73.13	67.60	7.57	B
270.1639	14.989	11.573	73.34	67.70	7.69	A
271.9894	14.984	13.244	73.63	67.79	7.93	B
274.1650	14.978	15.227	73.78	67.89	7.98	A
275.9661	14.973	16.861	74.17	67.98	8.34	B
278.1458	14.967	18.830	74.49	68.09	8.60	A
279.9187	14.962	20.424	74.91	68.17	8.99	B
282.0988	14.955	22.375	74.82	68.28	8.74	A
283.8473	14.950	23.932	75.28	68.36	9.19	B
286.0329	14.944	25.869	75.18	68.47	8.93	A
287.7488	14.939	27.383	75.75	68.55	9.50	B

Table 4a. Experimental Liquid Heat Capacity Data for HFC-152a in SI Units.
(continued)

289.9306	14.933	29.298	75.80	68.66	9.42	A
291.6288	14.929	30.782	76.58	68.74	10.24	B
293.8240	14.922	32.691	76.34	68.85	9.81	A
288.0405	14.136	3.597	74.88	68.95	7.91	A
289.9902	14.131	5.057	75.55	69.08	8.56	B
292.0922	14.126	6.628	75.73	69.22	8.59	A
294.0453	14.122	8.085	75.88	69.34	8.61	B
296.1405	14.117	9.644	76.27	69.48	8.91	A
298.0813	14.112	11.085	76.06	69.59	8.50	B
300.1578	14.107	12.623	76.45	69.72	8.81	A
302.0982	14.103	14.055	76.74	69.84	9.00	B
304.1544	14.098	15.567	77.02	69.96	9.17	A
306.1020	14.093	16.996	76.84	70.07	8.82	B
308.1387	14.089	18.484	77.58	70.18	9.53	A
310.0922	14.084	19.906	77.04	70.29	8.76	B
312.1127	14.079	21.372	77.86	70.40	9.58	A
314.0604	14.075	22.780	77.61	70.51	9.15	B
316.0694	14.070	24.227	78.44	70.61	9.98	A
318.0247	14.066	25.631	78.39	70.72	9.79	B
320.0177	14.061	27.057	79.04	70.81	10.40	A
321.9742	14.056	28.451	78.67	70.91	9.87	B
323.9573	14.052	29.860	79.41	71.00	10.59	A
325.9102	14.047	31.243	79.31	71.09	10.37	B
327.8836	14.043	32.637	79.68	71.17	10.69	A
329.8431	14.038	34.016	79.89	71.24	10.83	B
306.1876	13.454	3.260	76.98	70.85	7.97	A
308.2253	13.450	4.549	77.26	70.99	8.12	B
310.3180	13.446	5.872	77.58	71.12	8.32	A
312.3627	13.442	7.162	77.73	71.25	8.34	B
314.4275	13.438	8.463	77.41	71.37	7.80	A
316.4948	13.434	9.764	78.08	71.50	8.43	B
318.5128	13.429	11.031	78.07	71.61	8.28	A
320.6222	13.425	12.353	78.06	71.72	8.12	B
322.5989	13.421	13.589	78.74	71.83	8.78	A
324.7398	13.417	14.926	78.43	71.93	8.29	B
326.6732	13.413	16.129	79.07	72.02	8.91	A
328.8479	13.409	17.480	79.52	72.11	9.31	B
330.7351	13.405	18.650	79.19	72.19	8.84	A
332.9423	13.400	20.014	80.03	72.26	9.71	B
334.7958	13.397	21.157	79.86	72.32	9.44	A
337.0356	13.392	22.534	80.55	72.36	10.16	B
338.8581	13.388	23.651	80.62	72.39	10.20	A
341.1235	13.384	25.035	80.80	72.41	10.39	B
342.9291	13.380	26.136	80.91	72.40	10.52	A
327.1226	12.558	3.027	79.60	73.76	7.34	A
329.3319	12.554	4.141	79.14	73.87	6.66	B
331.3742	12.551	5.171	79.98	73.96	7.53	A
333.5828	12.547	6.285	80.12	74.04	7.59	B
335.6247	12.544	7.314	80.24	74.11	7.65	A
337.8523	12.540	8.436	80.15	74.17	7.47	B
339.8725	12.537	9.454	80.61	74.20	7.95	A
342.1118	12.533	10.581	81.05	74.22	8.42	B

Table 4b. Experimental Liquid Heat Capacity Data for HFC-152a in PI Units.

T	ρ	P	$C_{v,exp}$	$C_{v,cal}$	$\delta C_v, \%$	Run
$^{\circ}\text{F}$	lb ft^{-3}	psia	$\text{Btu lb}^{-1} ^{\circ}\text{F}^{-1}$			
-164.055	152.32	1291.3	0.12050	0.11389	5.48	A
-156.615	152.14	2384.6	0.12141	0.11994	1.21	A
-149.238	151.97	3443.7	0.12253	0.12382	-1.06	A
-145.164	151.87	4021.3	0.12255	0.12529	-2.24	B
-141.930	151.79	4477.3	0.12393	0.12619	-1.82	A
-123.740	146.82	830.8	0.11932	0.12529	-5.00	A
-116.321	146.66	1771.1	0.12067	0.12535	-3.88	A
-113.068	146.59	2180.1	0.12065	0.12527	-3.83	B
-108.967	146.50	2692.5	0.12133	0.12511	-3.12	A
-105.736	146.43	3093.5	0.12156	0.12494	-2.78	B
-101.661	146.35	3595.6	0.12247	0.12468	-1.81	A
-98.456	146.28	3987.1	0.12249	0.12446	-1.60	B
-94.425	146.20	4475.1	0.12315	0.12415	-0.82	A
-77.918	140.68	714.1	0.12126	0.12063	0.52	A
-77.918	140.68	714.1	0.12126	0.12063	0.52	A
-70.577	140.54	1501.0	0.12194	0.12027	1.37	A
-70.577	140.54	1501.0	0.12194	0.12027	1.37	A
-63.274	140.41	2274.4	0.12297	0.11993	2.48	A
-63.274	140.41	2274.4	0.12297	0.11993	2.48	A
-56.030	140.27	3031.2	0.12363	0.11963	3.23	A
-56.030	140.27	3031.2	0.12363	0.11963	3.23	A
-48.849	140.14	3770.6	0.12469	0.11937	4.27	A
-48.849	140.14	3770.6	0.12469	0.11937	4.27	A
-41.704	140.01	4495.1	0.12576	0.11916	5.25	A
-41.704	140.01	4495.1	0.12576	0.11916	5.25	A
-29.182	133.88	608.0	0.12361	0.11750	4.94	B
-25.531	133.83	932.5	0.12389	0.11755	5.12	A
-21.903	133.77	1253.3	0.12457	0.11759	5.60	B
-18.238	133.71	1575.6	0.12466	0.11765	5.62	A
-14.666	133.66	1888.1	0.12565	0.11771	6.32	B
-11.006	133.60	2206.6	0.12590	0.11778	6.45	A
-7.473	133.54	2512.3	0.12675	0.11784	7.03	B
-3.811	133.49	2827.3	0.12690	0.11792	7.08	A
-0.318	133.43	3126.1	0.12747	0.11800	7.43	B
3.338	133.38	3436.9	0.12743	0.11809	7.34	A
6.771	133.32	3727.1	0.12820	0.11817	7.82	B
10.423	133.27	4033.8	0.12857	0.11827	8.01	A
13.814	133.21	4316.9	0.12928	0.11836	8.44	B
17.469	133.16	4620.0	0.12959	0.11847	8.58	A
12.087	127.90	596.4	0.12706	0.11788	7.23	A
15.465	127.86	849.1	0.12734	0.11804	7.31	B
19.375	127.80	1140.8	0.12774	0.11822	7.45	A
22.706	127.76	1388.4	0.12808	0.11838	7.57	B
26.625	127.71	1678.6	0.12844	0.11856	7.69	A
29.911	127.66	1920.9	0.12894	0.11872	7.93	B
33.827	127.61	2208.5	0.12921	0.11890	7.98	A
37.069	127.57	2445.6	0.12989	0.11906	8.34	B
40.992	127.51	2731.1	0.13046	0.11924	8.60	A
44.184	127.47	2962.3	0.13119	0.11939	8.99	B
48.108	127.42	3245.2	0.13102	0.11958	8.74	A
51.255	127.38	3471.1	0.13183	0.11972	9.19	B
55.189	127.32	3752.0	0.13166	0.11991	8.93	A
58.278	127.28	3971.5	0.13266	0.12006	9.50	B

Table 4b. Experimental Liquid Heat Capacity Data for HFC-152a in PI Units.
(continued)

62.205	127.23	4249.3	0.13275	0.12025	9.42	A
65.262	127.19	4464.5	0.13412	0.12039	10.24	B
69.213	127.14	4741.5	0.13369	0.12058	9.81	A
58.803	120.44	521.8	0.13113	0.12076	7.91	A
62.312	120.40	733.4	0.13231	0.12098	8.56	B
66.096	120.36	961.3	0.13262	0.12122	8.59	A
69.612	120.32	1172.6	0.13288	0.12144	8.61	B
73.383	120.27	1398.8	0.13357	0.12167	8.91	A
76.876	120.24	1607.8	0.13320	0.12188	8.50	B
80.614	120.19	1830.8	0.13389	0.12210	8.81	A
84.107	120.15	2038.5	0.13440	0.12230	9.00	B
87.808	120.11	2257.9	0.13488	0.12251	9.17	A
91.314	120.07	2465.0	0.13457	0.12271	8.82	B
94.980	120.03	2680.8	0.13586	0.12291	9.53	A
98.496	120.00	2887.1	0.13493	0.12310	8.76	B
102.133	119.96	3099.7	0.13636	0.12330	9.58	A
105.639	119.92	3304.0	0.13591	0.12348	9.15	B
109.255	119.88	3513.9	0.13737	0.12367	9.98	A
112.774	119.84	3717.4	0.13729	0.12384	9.79	B
116.362	119.80	3924.2	0.13842	0.12402	10.40	A
119.884	119.76	4126.5	0.13778	0.12418	9.87	B
123.453	119.72	4330.9	0.13907	0.12434	10.59	A
126.968	119.68	4531.5	0.13890	0.12449	10.37	B
130.521	119.64	4733.6	0.13955	0.12463	10.69	A
134.048	119.60	4933.6	0.13992	0.12476	10.83	B
91.468	114.63	472.8	0.13482	0.12408	7.97	A
95.135	114.60	659.8	0.13531	0.12432	8.12	B
98.902	114.56	851.7	0.13586	0.12455	8.32	A
102.583	114.52	1038.8	0.13613	0.12478	8.34	B
106.300	114.49	1227.5	0.13557	0.12500	7.80	A
110.021	114.45	1416.1	0.13674	0.12521	8.43	B
113.653	114.42	1599.9	0.13673	0.12541	8.28	A
117.450	114.38	1791.7	0.13671	0.12561	8.12	B
121.008	114.35	1971.0	0.13789	0.12579	8.78	A
124.862	114.31	2164.8	0.13735	0.12597	8.29	B
128.342	114.28	2339.4	0.13847	0.12613	8.91	A
132.256	114.24	2535.3	0.13926	0.12629	9.31	B
135.653	114.21	2704.9	0.13868	0.12642	8.84	A
139.626	114.17	2902.8	0.14016	0.12655	9.71	B
142.963	114.14	3068.5	0.13985	0.12664	9.44	A
146.994	114.10	3268.2	0.14107	0.12673	10.16	B
150.275	114.07	3430.3	0.14118	0.12678	10.20	A
154.352	114.03	3631.1	0.14150	0.12680	10.39	B
157.602	114.00	3790.7	0.14170	0.12679	10.52	A
129.151	106.99	439.0	0.13941	0.12918	7.34	A
133.127	106.96	600.6	0.13859	0.12936	6.66	B
136.804	106.93	750.0	0.14007	0.12952	7.53	A
140.779	106.90	911.5	0.14031	0.12967	7.59	B
144.454	106.87	1060.8	0.14053	0.12978	7.65	A
148.464	106.84	1223.6	0.14036	0.12988	7.47	B
152.100	106.81	1371.2	0.14117	0.12995	7.95	A
156.131	106.78	1534.7	0.14194	0.12998	8.42	B

Table 5a. Experimental Two-Phase Heat Capacity Data for HFC-152a in SI Units.

T	δT	ρ_σ	P_σ	$C_v^{(2)}$	$\delta C_v^{(2)}$	$\delta C_v^{(2)}, \%$	C_σ	δC_σ	$\delta C_\sigma, \%$	Run
K		mol dm ⁻³	MPa	J mol ⁻¹ K ⁻¹						
162.6371	0.0030	17.770	0.0002	99.48	0.07	0.07	99.47	0.07	0.07	C
164.8155	0.0030	17.711	0.0002	99.66	0.07	0.07	99.65	0.07	0.07	D
166.9061	0.0030	17.655	0.0003	99.77	0.07	0.07	99.75	0.07	0.07	C
169.0700	0.0029	17.597	0.0004	99.74	0.07	0.07	99.73	0.07	0.07	D
171.1473	0.0030	17.541	0.0005	100.09	0.08	0.08	100.07	0.08	0.08	C
173.2928	0.0030	17.484	0.0006	99.98	0.08	0.08	99.95	0.08	0.08	D
175.3744	0.0030	17.428	0.0007	99.88	0.08	0.08	99.86	0.08	0.08	C
177.4762	0.0029	17.371	0.0009	100.61	0.07	0.07	100.58	0.08	0.07	D
179.5738	0.0030	17.314	0.0011	100.25	0.08	0.08	100.21	0.08	0.08	C
181.6327	0.0029	17.258	0.0013	100.62	0.08	0.08	100.58	0.08	0.08	D
183.7548	0.0031	17.201	0.0016	100.43	0.08	0.08	100.39	0.08	0.08	C
185.7637	0.0030	17.146	0.0019	100.73	0.08	0.08	100.68	0.08	0.08	D
187.8901	0.0030	17.088	0.0023	101.10	0.08	0.08	101.05	0.08	0.08	C
189.8629	0.0030	17.034	0.0028	100.97	0.08	0.08	100.91	0.08	0.08	D
191.9879	0.0030	16.975	0.0033	101.10	0.08	0.08	101.03	0.08	0.08	C
193.9657	0.0039	16.921	0.0038	100.17	0.10	0.10	100.09	0.10	0.10	D
196.0482	0.0030	16.863	0.0045	101.43	0.08	0.08	101.34	0.08	0.08	C
197.9851	0.0030	16.810	0.0052	100.49	0.08	0.08	100.39	0.08	0.08	D
200.0957	0.0030	16.751	0.0061	101.61	0.08	0.08	101.51	0.09	0.09	C
202.0482	0.0030	16.696	0.0071	101.89	0.08	0.08	101.78	0.09	0.09	D
204.1358	0.0031	16.638	0.0082	102.07	0.08	0.08	101.94	0.09	0.09	C
206.0734	0.0030	16.584	0.0094	102.33	0.08	0.08	102.20	0.09	0.09	D
208.1465	0.0030	16.525	0.0108	102.48	0.08	0.08	102.33	0.10	0.09	C
210.0544	0.0030	16.471	0.0123	102.54	0.08	0.08	102.38	0.10	0.10	D
212.1332	0.0031	16.412	0.0141	103.10	0.08	0.08	102.93	0.10	0.10	C
213.9907	0.0030	16.359	0.0158	102.94	0.08	0.08	102.75	0.11	0.10	D
216.0952	0.0030	16.299	0.0180	103.36	0.08	0.08	103.16	0.11	0.11	C
217.9074	0.0030	16.247	0.0201	103.58	0.08	0.08	103.36	0.11	0.11	D
220.0072	0.0032	16.186	0.0228	103.69	0.09	0.09	103.46	0.12	0.12	C
221.8175	0.0031	16.133	0.0254	103.61	0.08	0.08	103.37	0.12	0.12	D
223.8995	0.0030	16.073	0.0286	104.26	0.08	0.08	104.00	0.13	0.12	C
225.7149	0.0031	16.020	0.0317	104.32	0.09	0.08	104.06	0.13	0.13	D
227.7714	0.0030	15.959	0.0355	104.76	0.09	0.08	104.48	0.14	0.13	C
229.5773	0.0030	15.906	0.0391	104.99	0.09	0.08	104.70	0.14	0.14	D
231.6096	0.0032	15.845	0.0435	105.42	0.09	0.09	105.12	0.15	0.14	C
233.3990	0.0030	15.792	0.0478	105.47	0.09	0.08	105.15	0.15	0.15	D
235.4249	0.0030	15.731	0.0530	105.92	0.09	0.08	105.59	0.16	0.15	C
237.2013	0.0030	15.678	0.0579	105.97	0.09	0.08	105.63	0.17	0.16	D
239.2215	0.0031	15.616	0.0639	106.40	0.09	0.09	106.05	0.17	0.16	C
240.9800	0.0030	15.563	0.0696	106.97	0.09	0.08	106.60	0.18	0.17	D
242.9877	0.0031	15.501	0.0766	106.82	0.09	0.08	106.45	0.19	0.18	C
244.7449	0.0030	15.447	0.0831	107.62	0.09	0.08	107.24	0.19	0.18	D
246.7364	0.0032	15.385	0.0910	107.47	0.10	0.09	107.09	0.20	0.19	C
248.4897	0.0031	15.330	0.0985	108.13	0.09	0.08	107.74	0.21	0.19	D
250.4687	0.0031	15.268	0.1075	108.19	0.09	0.08	107.79	0.21	0.20	C
252.2114	0.0030	15.213	0.1159	108.51	0.09	0.08	108.11	0.22	0.20	D
254.1822	0.0031	15.150	0.1261	108.75	0.09	0.09	108.35	0.23	0.21	C
255.9141	0.0030	15.095	0.1356	109.32	0.09	0.08	108.92	0.23	0.21	D
257.8719	0.0031	15.032	0.1470	109.58	0.09	0.09	109.18	0.24	0.22	C
259.5977	0.0031	14.976	0.1577	109.83	0.10	0.09	109.43	0.24	0.22	D
261.5485	0.0031	14.912	0.1705	109.95	0.10	0.09	109.56	0.25	0.23	C
263.2630	0.0031	14.856	0.1823	110.53	0.10	0.09	110.15	0.25	0.23	D
265.1908	0.0031	14.792	0.1965	110.65	0.10	0.09	110.28	0.26	0.24	C
266.9124	0.0031	14.735	0.2098	111.42	0.10	0.09	111.07	0.26	0.24	D
268.8353	0.0031	14.670	0.2255	111.49	0.10	0.09	111.16	0.27	0.24	C

Table 5a. Experimental Two-Phase Heat Capacity Data for HFC-152a in SI Units.
(continued)

270.5443	0.0031	14.612	0.2402	111.53	0.10	0.09	111.22	0.27	0.25	D
272.4806	0.0031	14.546	0.2578	112.16	0.10	0.09	111.88	0.28	0.25	C
274.1565	0.0031	14.489	0.2738	111.88	0.10	0.09	111.62	0.28	0.25	D
276.1095	0.0031	14.421	0.2933	112.84	0.10	0.09	112.61	0.28	0.25	C
277.7558	0.0030	14.364	0.3106	112.80	0.10	0.09	112.61	0.29	0.25	D
279.7196	0.0032	14.295	0.3323	113.67	0.10	0.09	113.51	0.29	0.26	C
281.3531	0.0031	14.237	0.3512	114.28	0.10	0.09	114.17	0.29	0.26	D
283.3177	0.0030	14.167	0.3750	114.58	0.10	0.09	114.52	0.29	0.25	C
284.9340	0.0031	14.108	0.3955	114.87	0.10	0.09	114.86	0.29	0.26	D
286.8977	0.0031	14.037	0.4215	115.14	0.10	0.09	115.19	0.29	0.26	C
288.5131	0.0030	13.978	0.4439	115.76	0.10	0.09	115.87	0.29	0.25	D
290.4594	0.0031	13.906	0.4720	116.40	0.10	0.09	116.58	0.29	0.25	C
292.0801	0.0032	13.845	0.4965	116.14	0.11	0.09	116.39	0.29	0.25	D
293.9998	0.0031	13.773	0.5267	116.88	0.11	0.09	117.21	0.29	0.25	C
295.6262	0.0031	13.711	0.5533	116.88	0.11	0.09	117.30	0.29	0.24	D
297.5080	0.0031	13.638	0.5854	117.53	0.11	0.09	118.04	0.28	0.24	C
299.1478	0.0030	13.575	0.6145	118.10	0.11	0.09	118.70	0.28	0.23	D
301.0038	0.0032	13.502	0.6488	118.72	0.11	0.09	119.44	0.27	0.23	C
302.6614	0.0031	13.436	0.6806	119.06	0.11	0.09	119.89	0.27	0.22	D
304.4901	0.0031	13.363	0.7170	119.60	0.11	0.09	120.55	0.26	0.22	C
306.1538	0.0030	13.295	0.7514	120.20	0.11	0.09	121.28	0.25	0.21	D
307.9723	0.0031	13.221	0.7903	119.67	0.11	0.09	120.90	0.25	0.20	C
309.6370	0.0031	13.152	0.8273	121.14	0.11	0.09	122.51	0.24	0.20	D
311.4236	0.0031	13.077	0.8685	120.93	0.11	0.09	122.46	0.23	0.19	C
313.0962	0.0031	13.006	0.9084	121.29	0.11	0.09	122.98	0.23	0.18	D
314.8787	0.0031	12.930	0.9524	121.94	0.12	0.10	123.82	0.22	0.18	C
316.5542	0.0031	12.857	0.9952	121.48	0.12	0.10	123.54	0.22	0.18	D
318.3188	0.0032	12.780	1.0419	123.24	0.12	0.10	125.51	0.22	0.17	C
319.9846	0.0032	12.705	1.0874	115.78	4.24	3.66	118.26	4.24	3.59	D
321.7554	0.0032	12.626	1.1374	116.04	4.25	3.67	118.73	4.26	3.59	C

Table 5b. Experimental Two-Phase Heat Capacity Data for HFC-152a in PI Units.

T	δT	ρ_G	P_G	$C_v^{(2)}$	$\delta C_v^{(2)}$	$\delta C_v^{(2)}, \%$	C_G	δC_G	$\delta C_G, \%$	Run
$^{\circ}\text{F}$		lb ft ⁻³	psia	Btu lb ⁻¹ $^{\circ}\text{F}^{-1}$						
-166.923	0.005	73.27	0.03	0.35998	0.00027	0.07	0.35994	0.00027	0.07	C
-163.002	0.005	73.03	0.03	0.36061	0.00027	0.07	0.36057	0.00027	0.07	D
-159.239	0.005	72.80	0.04	0.36100	0.00027	0.07	0.36096	0.00027	0.07	C
-155.344	0.005	72.56	0.06	0.36093	0.00027	0.07	0.36087	0.00027	0.07	D
-151.605	0.005	72.33	0.07	0.36217	0.00027	0.08	0.36210	0.00027	0.08	C
-147.743	0.005	72.09	0.09	0.36176	0.00027	0.08	0.36168	0.00027	0.08	D
-143.996	0.005	71.86	0.11	0.36142	0.00027	0.08	0.36133	0.00028	0.08	C
-140.213	0.005	71.63	0.13	0.36405	0.00027	0.07	0.36395	0.00027	0.07	D
-136.437	0.005	71.39	0.16	0.36275	0.00027	0.08	0.36263	0.00028	0.08	C
-132.731	0.005	71.16	0.20	0.36408	0.00027	0.08	0.36395	0.00028	0.08	D
-128.911	0.006	70.93	0.24	0.36342	0.00028	0.08	0.36326	0.00029	0.08	C
-125.295	0.005	70.70	0.28	0.36449	0.00028	0.08	0.36431	0.00028	0.08	D
-121.468	0.005	70.46	0.34	0.36585	0.00028	0.08	0.36564	0.00029	0.08	C
-117.917	0.005	70.24	0.40	0.36538	0.00028	0.08	0.36515	0.00029	0.08	D
-114.092	0.005	70.00	0.48	0.36585	0.00029	0.08	0.36559	0.00030	0.08	C
-110.532	0.007	69.77	0.56	0.36246	0.00035	0.10	0.36217	0.00036	0.10	D
-106.783	0.005	69.53	0.66	0.36703	0.00029	0.08	0.36672	0.00031	0.08	C
-103.297	0.005	69.31	0.76	0.36362	0.00028	0.08	0.36328	0.00031	0.08	D
-99.498	0.005	69.07	0.89	0.36769	0.00029	0.08	0.36730	0.00032	0.09	C
-95.983	0.005	68.85	1.03	0.36869	0.00029	0.08	0.36827	0.00032	0.09	D
-92.226	0.005	68.61	1.19	0.36934	0.00029	0.08	0.36888	0.00033	0.09	C
-88.738	0.005	68.38	1.36	0.37029	0.00029	0.08	0.36979	0.00034	0.09	D
-85.006	0.005	68.14	1.57	0.37083	0.00029	0.08	0.37029	0.00035	0.09	C
-81.572	0.005	67.92	1.78	0.37106	0.00030	0.08	0.37047	0.00036	0.10	D
-77.830	0.006	67.67	2.04	0.37307	0.00030	0.08	0.37244	0.00038	0.10	C
-74.487	0.005	67.46	2.29	0.37248	0.00030	0.08	0.37180	0.00039	0.10	D
-70.699	0.005	67.21	2.62	0.37400	0.00030	0.08	0.37327	0.00040	0.11	C
-67.437	0.005	66.99	2.92	0.37479	0.00030	0.08	0.37402	0.00041	0.11	D
-63.657	0.006	66.74	3.31	0.37519	0.00032	0.09	0.37437	0.00044	0.12	C
-60.398	0.005	66.53	3.68	0.37493	0.00030	0.08	0.37406	0.00044	0.12	D
-56.651	0.005	66.28	4.15	0.37726	0.00030	0.08	0.37634	0.00046	0.12	C
-53.383	0.006	66.06	4.59	0.37749	0.00031	0.08	0.37652	0.00048	0.13	D
-49.682	0.005	65.81	5.14	0.37908	0.00031	0.08	0.37806	0.00050	0.13	C
-46.431	0.005	65.59	5.67	0.37991	0.00031	0.08	0.37885	0.00052	0.14	D
-42.773	0.006	65.34	6.31	0.38147	0.00033	0.09	0.38036	0.00055	0.14	C
-39.552	0.005	65.12	6.93	0.38163	0.00031	0.08	0.38048	0.00056	0.15	D
-35.905	0.005	64.87	7.68	0.38328	0.00032	0.08	0.38208	0.00058	0.15	C
-32.708	0.005	64.65	8.40	0.38344	0.00032	0.08	0.38221	0.00060	0.16	D
-29.071	0.006	64.39	9.27	0.38503	0.00033	0.09	0.38375	0.00063	0.16	C
-25.906	0.005	64.17	10.10	0.38705	0.00032	0.08	0.38574	0.00065	0.17	D
-22.292	0.006	63.92	11.10	0.38653	0.00033	0.08	0.38518	0.00067	0.18	C
-19.129	0.005	63.69	12.05	0.38942	0.00032	0.08	0.38805	0.00069	0.18	D
-15.544	0.006	63.44	13.20	0.38889	0.00034	0.09	0.38749	0.00073	0.19	C
-12.389	0.006	63.21	14.28	0.39128	0.00033	0.08	0.38986	0.00074	0.19	D
-8.826	0.006	62.96	15.58	0.39149	0.00033	0.08	0.39005	0.00077	0.20	C
-5.689	0.005	62.73	16.81	0.39264	0.00033	0.08	0.39120	0.00079	0.20	D
-2.142	0.006	62.47	18.28	0.39352	0.00034	0.09	0.39207	0.00082	0.21	C
0.975	0.005	62.24	19.66	0.39557	0.00033	0.08	0.39413	0.00083	0.21	D
4.499	0.006	61.98	21.32	0.39652	0.00034	0.09	0.39508	0.00086	0.22	C
7.606	0.006	61.75	22.87	0.39741	0.00034	0.09	0.39599	0.00088	0.22	D
11.117	0.006	61.49	24.72	0.39785	0.00035	0.09	0.39645	0.00090	0.23	C
14.203	0.006	61.26	26.45	0.39994	0.00035	0.09	0.39857	0.00092	0.23	D
17.673	0.006	60.99	28.50	0.40038	0.00036	0.09	0.39906	0.00094	0.24	C
20.772	0.006	60.76	30.43	0.40316	0.00036	0.09	0.40189	0.00096	0.24	D
24.234	0.006	60.49	32.71	0.40342	0.00036	0.09	0.40223	0.00098	0.24	C
27.310	0.006	60.25	34.84	0.40357	0.00035	0.09	0.40245	0.00099	0.25	D

Table 5b. Experimental Two-Phase Heat Capacity Data for HFC-152a in PI Units.
(continued)

30.795	0.006	59.98	37.39	0.40587	0.00036	0.09	0.40483	0.00100	0.25	C
33.812	0.006	59.74	39.71	0.40483	0.00036	0.09	0.40389	0.00102	0.25	D
37.327	0.006	59.46	42.54	0.40830	0.00036	0.09	0.40747	0.00103	0.25	C
40.290	0.005	59.23	45.06	0.40817	0.00035	0.09	0.40747	0.00104	0.25	D
43.825	0.006	58.94	48.20	0.41131	0.00038	0.09	0.41075	0.00105	0.26	C
46.766	0.006	58.70	50.94	0.41352	0.00037	0.09	0.41311	0.00105	0.26	D
50.302	0.005	58.41	54.39	0.41461	0.00036	0.09	0.41439	0.00106	0.25	C
53.211	0.006	58.17	57.36	0.41566	0.00037	0.09	0.41561	0.00106	0.26	D
56.746	0.006	57.88	61.14	0.41663	0.00038	0.09	0.41680	0.00106	0.26	C
59.654	0.005	57.64	64.38	0.41889	0.00037	0.09	0.41927	0.00106	0.25	D
63.157	0.006	57.34	68.46	0.42118	0.00038	0.09	0.42183	0.00106	0.25	C
66.074	0.006	57.09	72.01	0.42024	0.00039	0.09	0.42114	0.00105	0.25	D
69.530	0.006	56.79	76.39	0.42293	0.00039	0.09	0.42414	0.00104	0.25	C
72.457	0.006	56.53	80.25	0.42294	0.00039	0.09	0.42443	0.00103	0.24	D
75.844	0.006	56.24	84.91	0.42528	0.00039	0.09	0.42714	0.00102	0.24	C
78.796	0.005	55.97	89.13	0.42733	0.00039	0.09	0.42952	0.00100	0.23	D
82.137	0.006	55.67	94.10	0.42958	0.00040	0.09	0.43218	0.00099	0.23	C
85.121	0.006	55.40	98.71	0.43082	0.00040	0.09	0.43381	0.00097	0.22	D
88.412	0.006	55.10	103.99	0.43276	0.00041	0.09	0.43622	0.00095	0.22	C
91.407	0.005	54.82	108.98	0.43493	0.00040	0.09	0.43884	0.00092	0.21	D
94.680	0.006	54.52	114.63	0.43304	0.00041	0.09	0.43748	0.00090	0.20	C
97.677	0.006	54.23	120.00	0.43836	0.00041	0.09	0.44331	0.00087	0.20	D
100.893	0.006	53.92	125.97	0.43757	0.00041	0.09	0.44311	0.00085	0.19	C
103.903	0.006	53.63	131.75	0.43889	0.00041	0.09	0.44502	0.00082	0.18	D
107.112	0.006	53.32	138.14	0.44124	0.00042	0.10	0.44803	0.00080	0.18	C
110.128	0.006	53.02	144.35	0.43958	0.00042	0.10	0.44705	0.00078	0.18	D
113.304	0.006	52.70	151.11	0.44595	0.00044	0.10	0.45416	0.00079	0.17	C
116.302	0.006	52.39	157.72	0.41895	0.01534	3.66	0.42791	0.01536	3.59	D
119.490	0.006	52.06	164.97	0.41990	0.01539	3.67	0.42962	0.01541	3.59	C

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