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Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Low-GWP Alternative Refrigerants Evaluation Program (Low-GWP AREP)

TEST REPORT #11

Compressor Calorimeter Test of R-410A Alternatives R-32, DR-5, and L-41a

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This report has been made available to test companies of the AHRI Low-GWP AREP as part of the author company's participation in the AHRI's Low-GWP AREP.

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List of Tested Refrigerant’s Composition (Mass%)

R-32	R-32 (100)
DR-5	R-32/R-1234yf (72.5/27.5)
L-41a	R-32/R-1234yf/R-1234ze(E) (73/15/12)

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ABSTRACT

As a contribution to the AHRI Low-GWP Alternative Refrigerants Evaluation Program (AREP), this study compares performance of alternative refrigerants R32, DR-5, and L-41A to that of refrigerant R-410A (baseline) in a scroll compressor designed for air-conditioning and heat pump applications. Compressor calorimeter tests were performed to evaluate the performance of the lower-GWP alternative refrigerants in place of the common refrigerant R-410A in a 36,000 Btu/hr compressor calorimeter using a compressor having a nominal rated capacity of 21,300 Btu/hr.

Tests were conducted over a suction dew point temperature range of 10°F to 55°F in 5°F increments and a discharge dew point temperature range of 70°F to 140°F in 10°F increments. All the tests were performed with 20°F superheat, 40°F superheat and 65°F suction temperature. A liquid subcooling level of 15°F was maintained for all the test conditions.

The tests showed that performance of these three lower-GWP alternative refrigerants is comparable to that of R-410A. For the 20°F superheat and 15°F subcooling test conditions, EERs of R32, DR-5, and L-41A were 90% to 99%, 96% to 99%, and 94% to 101%, respectively, compared to that of R-410A. Similarly, cooling capacities of R32, DR-5, and L-41A were 98% to 103%, 92% to 96%, and 84% to 92%, respectively, compared to that of R-410A.

1. Introduction:

This report investigates the performance of lower-GWP candidate refrigerants R32, DR-5, and L-41A as alternatives for the baseline refrigerant R-410A using a 36,000 Btu/hr compressor calorimeter located at Heat Exchanger Advanced Testing Facility in building 5800 at Oak Ridge National Laboratory. These tests were conducted during August to October 2012.

R-410A is a near-azeotropic blend of R32 (difluoromethane) and R125 (pentafluoroethane) with 0.5/0.5 mass fraction and has a GWP of 2100. R32 is a pure fluid and has a GWP of 716[1]. DR-5 and L-41A are new blends with GWP < 500 and are under development by DuPont and Honeywell, respectively.

This report compares various performance parameters, such as cooling capacity, compressor power, refrigerant mass flow rate, EER, isentropic efficiency and discharge temperature, of alternative refrigerants to that of R-410A.

2. Details of Test Setup:

a. Description of Test Refrigerant, Lubricant, and Charge

[1] The GWPs given for R-410A and R32 are the latest scientific assessment values for a 100 year ITH (integration time horizon) given in the "*2010 Report of the refrigeration, air conditioning and heat pumps technical options committee; Chapter 2, Refrigerants.*" United Nations Environment Programme (UNEP) Ozone Secretariat, Nairobi, Kenya, http://ozone.unep.org/teap/Reports/RTOC/RTOC-Assessment-report-2010.pdf.

- Refrigerant or refrigerant blend tested
  - R-410A: R32 and R125 blend with 0.5/0.5 mass fraction
  - R32
  - DR-5
  - L-41A
  - Following is the refrigerant charge required to achieve similar subcooling after condenser at identical test conditions:
    R-410A – 4 lbs 6 ounces
    R32 – 4 lbs
    DR-5 – 4 lbs 2 ounces
    L-41A – 4 lbs

- Lubricant
  - The lubricant used for all the tests is the original lubricant charged in the scroll compressor used for the testing. As per the manufacturer's data sheet, the compressor was charged with 25 oz polyolester oil (POE).

b. Description of Compressor

The compressor used for this test was a Copeland scroll compressor ZP21K5E-PFV that has ¾" suction port and ½" discharge port. This hermetic compressor uses 208/230 volt, single phase, 60 Hz electric motor. Displacement volume of the compressor is 1.24 in^3/rev or 150.69 ft^3/hr. Table 1 shows the manufacturer provided performance of the compressor at standard test conditions.

Table 1. The Manufacturer Provided Performance of the Compressor

Evap (°F) / Cond (°F)	45 / 130	50 / 100
RG (°F) / Liq (°F)	65 / 115	70 / 85
Capacity (Btu/hr)	21300	29000
Power (Watts)	2170	1400
Current (Amps)	9.50	6.30
EER (Btu/Wh)	9.80	20.60
Mass Flow (lbs/hr)	314	357

No modification to the compressor or the lubricant was made for the tests documented in this report. The compressor was uninsulated and airflow to the compressor chamber was maintained by two small fans, circulating air from about 1.5' above the compressor. The compressor chamber air temperature was maintained at 95±1°F for all the tests.

To assure the accuracy of the test set-up and the data acquisition hardware and the software, performance of the test compressor calculated from the baseline test was compared with the compressor map provided by the compressor manufacturer. This confirmed that the test data are in good agreement with compressor manufacturer provided data. At standard test conditions (evaporating/condensing temperature

45°F/130°F and 50°F/100°F) calculated EER and capacity from the test data are within ±1% and ±2.3%, respectively, of the compressor manufacturer's data. This is well within the ±5% tolerance allowed in ANSI/AHRI 540-2004 for capacity and efficiency.

c. Description and Size of Test Loop

The calorimeter test loop consists of a compressor, a condenser, a sub-cooler, three electronic expansion valves, and an evaporator. Suction pressure, suction temperature, liquid temperature, compressor chamber air temperature, and discharge pressure are controlled independently by controlling the electronic expansion valve, evaporator heater output, secondary glycol temperature, heating or cooling the air within the compressor chamber, and temperature of the condenser, respectively. Figure 1 shows the schematic of the test loop and location of various sensors. Table 2 shows accuracy of various instrumentations used in the calorimeter.

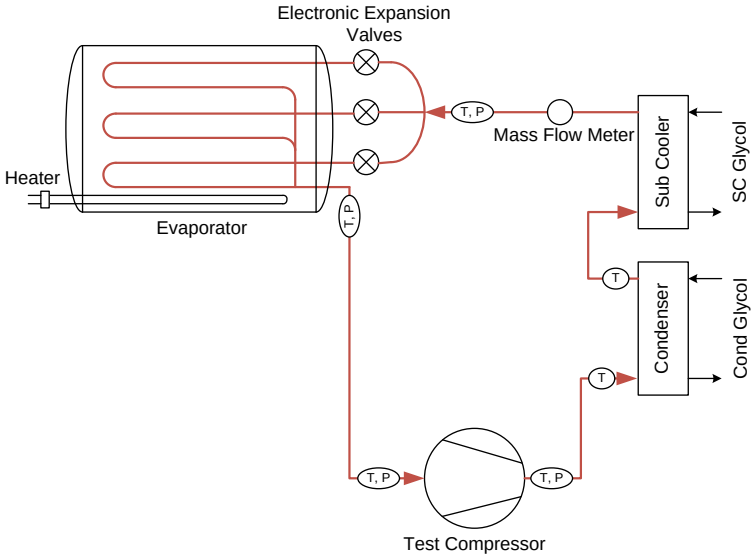

Figure 1 Location of various sensors in the test loop.

Table 2. Accuracy of Various Instrumentations

Instrument	Measured Parameter	Measurement Range	Accuracy
RTDs	Temperature		± 0.4°F
Micro Motion Elite® Sensor	Refrigerant mass flow rate		±0.10%
Yokogawa Power and Energy Meter PR300	Compressor power		±0.5%
Honeywell Pressure Transmitter 060-F444-02	Refrigerant pressure, high pressure side	750 psia	0.25% F.S.
Honeywell Pressure Transmitter 060-F443-05	Refrigerant pressure, low pressure side	200 psia	0.25% F.S.

d. Test Description

The compressor calorimetry was performed according to ASHRAE Standard 23-2010. Before testing each alternative refrigerant, performance of the test compressor was checked using the baseline refrigerant R-410A. The intermediate tests confirmed repeatability of cooling capacity within 1.5% and EER within 2% at standard test conditions.

Tests were conducted over a wide range of operating conditions. The suction dew point temperature was varied between 10°F and 55°F in 5°F increments while the discharge dew point temperature was varied between 70°F and 140°F in 10°F increments. These tests were performed with 15°F subcooling and 20°F and 40°F superheat. Tests were also conducted at a fixed 65°F suction temperature.

3. Results

Appendix A provides summary results of all the tests conducted for this study in a tabular form. Appendix B provides 10-Coefficient polynomial equations computed from the test results for each test refrigerant at standard rating conditions of 20°F superheat and 15°F subcooling. Appendix B also presents figures showing capacity, input power, EER, and isentropic efficiency as a function of suction dew point temperature for given discharge dew point temperature at 20°F superheat and 15°F subcooling for baseline and each alternative refrigerant tested. The isentropic performance plots show the trends and shifts in compressor performance separately from the refrigerant property performance.

Note that properties of the baseline refrigerants were calculated using REFPROP version 9.0 (Lemmon et al, 2010). Refrigerants properties of alternative refrigerants were calculated by using "mixture" files provided by the manufacturers in REFPROP.

Table 3 shows deviation in EER, Capacity and discharge temperature of alternative refrigerants compared to that of R-410A at 15°F subcooling, 20°F superheat, 70°F to 140°F saturated discharge temperature and 10°F to 55°F saturated suction temperature. The table also shows the deviations in performance parameters at two standard test conditions.

Table 3. Performance of Alternative Refrigerants compared to that of R-410A

Refrigerant	Test Condition	Deviation from baseline (R-410A)		
		EER (%)	Capacity (%)	Discharge Temperature (°R)
R-32	Evap 45°F/ Cond 130°F	-7.2%	+0.8%	+46.3
	Evap 50°F/ Cond 100°F	-4.1%	+0.8%	+24.2
	Over the range	-9.6% to -1%	-2.1% to +2.8%	+17 to +51
	Average	-3.7%	+0.8%	+34
DR-5	Evap 45°F/ Cond 130°F	-1.0%	-5.3%	+16.4
	Evap 50°F/ Cond 100°F	-3.7%	-7.3%	+10.6
	Over the range	-4.4% to -0.7%	-8.4% to -4.4 %	+8 to +26
	Average	-2.7%	-6.9%	+15
L-41A	Evap 45°F/ Cond 130°F	-0.4%	-9.7%	+18.3
	Evap 50°F/ Cond 100°F	-4.7%	-12.8%	+13.3
	Over the range	-6.4% to +0.9%	-15.9% to -8.3%	+9 to +32
	Average	-3.9%	-12.8%	+19

Figures 2 to 4 present $EER_{alt}/EER_{Baseline}$ as a function of suction dew point temperature for given discharge dew point temperature at 20°F superheat and 15°F subcooling for each alternative refrigerant tested.

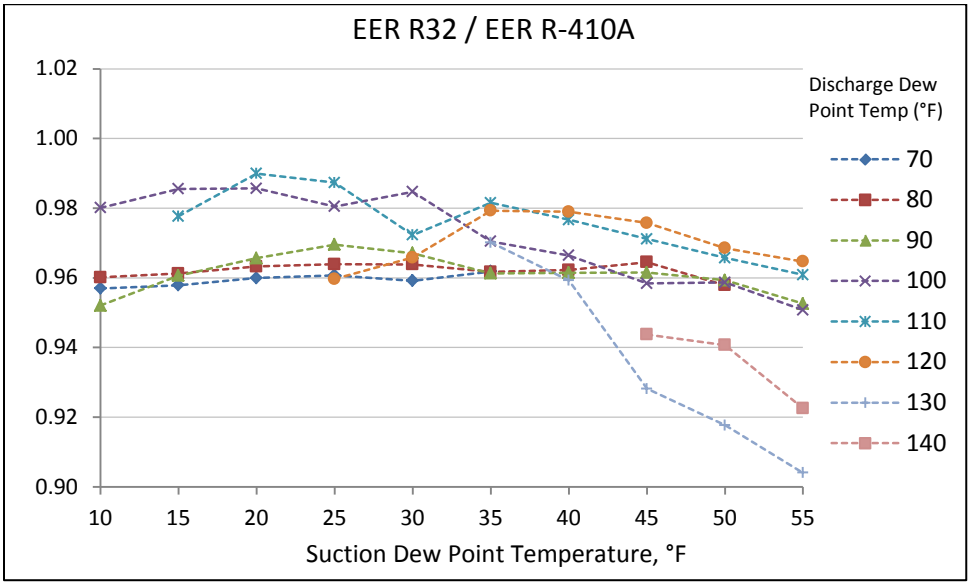

Figure 2 EER of R32 compared to EER of R-410A.

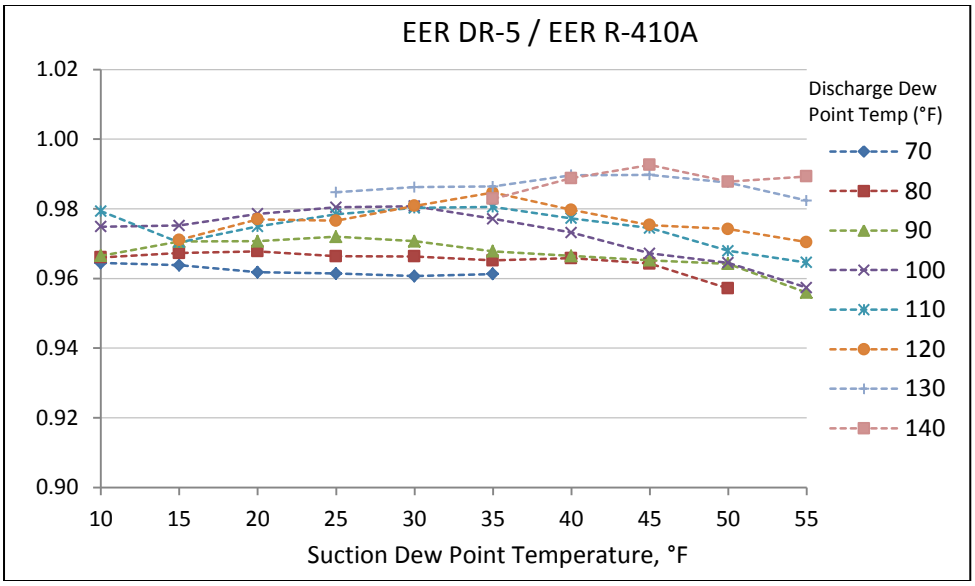

Figure 3 EER of DR-5 compared to EER of R-410A.

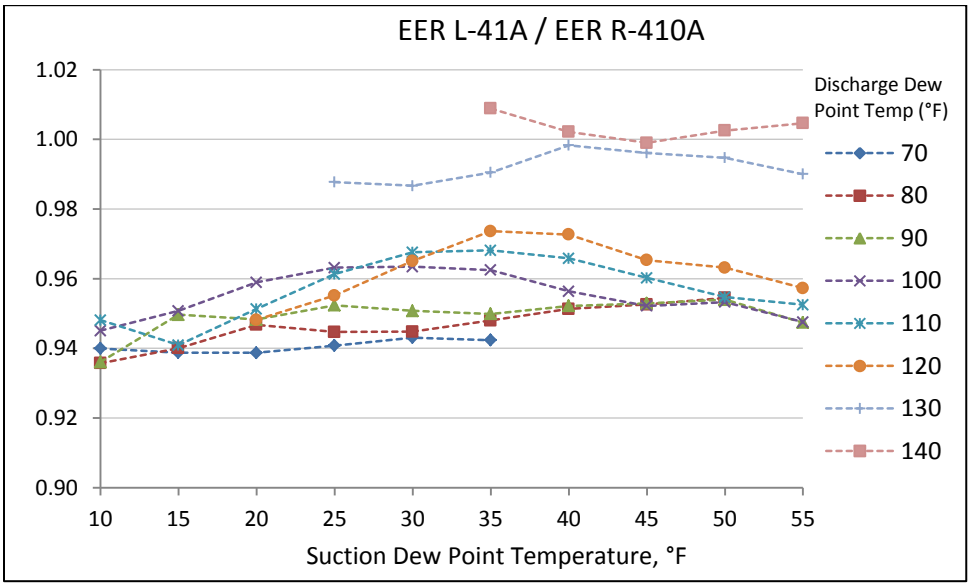

Figure 4 EER of L-41A compared to EER of R-410A.

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REFERENCES

Lemmon, E.W. Huber, M.L., and McLinden, M. O., 2010, *NIST Standard Reference Database 23, NIST Reference Fluid Thermodynamic and Transport Properties—REFPROP. Version 9.0 User's Guide*, November 2010.

Appendix A

Tabular Data

Tables below provide summary data of all tests conducted for this study. Applicable superheat and subcooling levels for each test are provided in each table heading. Performance parameters such as cooling capacity, compressor power, compressor current, refrigerant mass flow rate, EER, isentropic efficiency, and discharge temperature are tabulated as a function of discharge dew point temperature and suction dew point temperature for fixed degree of superheat or fixed suction temperature. Since EER values are provided, COP values are not included in these tables.

Table A1. R-410A at 20°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (76)	15 (84)	20 (93)	25 (102)	30 (111)	35 (122)	40 (133)	45 (144)	50 (157)	55 (170)
140 (556)	C						14938	16949	18959	21142	23453
	P						2439	2413	2396	2376	2367
	A						10.62	10.52	10.44	10.35	10.32
	M						237.6	268.0	297.8	329.8	363.5
	E						6.12	7.02	7.91	8.90	9.91
	%						62.2	65.4	68.7	71.7	74.8
	T						241.4	230.8	222.5	215.2	209.6
130 (491)	C				12933	14718	16628	18655	**20813**	23128	25741
	P				2175	2147	2133	2119	2103	2084	2062
	A				9.48	9.36	9.30	9.24	9.16	9.09	8.98
	M				194.3	219.5	246.4	274.5	304.4	336.3	372.1
	E				5.95	6.85	7.80	8.80	9.90	11.10	12.48
	%				59.3	62.9	66.1	69.0	71.9	74.9	78.0
	T				242.0	229.9	219.9	211.6	204.5	198.2	192.3
120 (432)	C		11071	12721	14477	16315	18199	20357	22673	25131	27792
	P		1936	1910	1893	1880	1870	1855	1836	1815	1800
	A		8.44	8.34	8.26	8.21	8.16	8.09	8.01	7.92	7.86
	M		158.4	180.8	204.2	228.6	253.3	281.7	311.9	343.8	378.1
	E		5.72	6.66	7.65	8.68	9.73	10.97	12.35	13.85	15.44
	%		57.1	61.2	64.5	67.2	69.7	71.9	74.3	76.8	79.3
	T		241.7	226.8	215.4	206.4	199.3	192.4	186.2	180.9	176.6
110 (380)	C	10651	12251	13979	15734	17626	19727	21952	24359	26984	29905
	P	1711	1686	1679	1669	1659	1646	1630	1611	1591	1573
	A	7.48	7.38	7.34	7.30	7.26	7.20	7.14	7.05	6.97	6.89
	M	144.5	164.9	187.0	209.1	232.8	258.9	286.5	316.4	348.6	384.6
	E	6.23	7.27	8.32	9.43	10.62	11.98	13.46	15.12	16.96	19.01
	%	58.1	60.9	63.9	66.6	69.0	71.0	73.1	74.9	76.7	78.4
	T	230.1	217.4	205.9	196.9	189.2	182.4	176.5	171.0	166.2	161.8
100 (332)	C	11710	13360	15111	16884	18876	21088	23426	25992	**28707**	31751
	P	1495	1490	1480	1470	1457	1444	1427	1407	1391	1376
	A	6.57	6.54	6.50	6.45	6.40	6.34	6.28	6.19	6.12	6.06
	M	150.5	170.7	191.9	212.9	236.6	262.8	290.4	320.5	352.2	387.7
	E	7.83	8.97	10.21	11.48	12.96	14.61	16.41	18.47	20.64	23.08
	%	61.7	64.4	66.4	68.4	70.2	71.7	72.7	73.7	74.6	74.9
	T	204.5	193.6	184.9	177.9	171.4	165.6	160.5	155.7	151.8	148.3
90 (289)	C	12827	14457	16242	18172	20254	22518	24999	27649	30485	33787
	P	1324	1317	1307	1296	1283	1267	1252	1238	1221	1204
	A	5.84	5.81	5.77	5.72	5.67	5.60	5.54	5.48	5.41	5.34
	M	156.8	175.5	195.9	218.0	241.5	267.2	294.9	324.7	356.2	393.2
	E	9.69	10.98	12.42	14.02	15.79	17.77	19.96	22.33	24.97	28.06
	%	63.2	64.8	66.5	68.1	69.4	70.1	70.5	69.9	69.2	67.6
	T	184.5	176.5	168.9	161.9	156.2	150.9	146.4	142.5	139.0	135.7
80 (250)	C	13774	15481	17306	19312	21478	23842	26382	29134	32231	
	P	1169	1161	1150	1139	1124	1110	1095	1079	1065	
	A	5.19	5.15	5.11	5.07	5.00	4.94	4.88	4.81	4.75	
	M	160.6	179.5	199.5	221.3	244.9	270.4	297.6	327.1	360.4	
	E	11.78	13.34	15.05	16.95	19.10	21.49	24.10	26.99	30.27	
	%	63.7	65.1	66.2	66.5	66.7	66.2	64.9	62.9	59.8	
	T	166.1	158.2	152.0	146.3	141.2	136.8	133.2	129.8	126.8	
70 (215)	C	14626	16377	18297	20409	22715	25135				
	P	1033	1027	1015	1001	988	976				
	A	4.62	4.61	4.55	4.50	4.44	4.40				
	M	163.3	181.7	201.9	224.0	248.0	273.2				
	E	14.17	15.94	18.02	20.38	22.98	25.75				
	%	62.3	62.6	62.9	62.5	61.3	59.2				
	T	150.0	144.2	138.1	132.7	128.3	124.8				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A2. R-410A at 40°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (76)	15 (84)	20 (93)	25 (102)	30 (111)	35 (122)	40 (133)	45 (144)	50 (157)	55 (170)
140 (556)	C						15250	17189	19279	21450	23754
	P						2449	2429	2412	2391	2384
	A						10.67	10.59	10.51	10.42	10.39
	M						225.3	251.9	280.8	310.0	340.8
	E						6.23	7.08	7.99	8.97	9.96
	%						64.8	68.1	70.9	74.0	76.7
	T						260.8	250.7	242.2	234.9	229.4
130 (491)	C				13262	15019	16892	18939	21115	23419	25920
	P				2180	2153	2142	2127	2112	2095	2076
	A				9.51	9.38	9.34	9.27	9.21	9.13	9.04
	M				186.2	209.1	233.4	259.8	287.7	317.1	348.6
	E				6.08	6.98	7.88	8.90	10.00	11.18	12.49
	%				62.2	65.9	69.2	72.2	75.0	77.7	80.2
	T				260.2	248.3	238.8	230.3	223.2	217.2	211.9
120 (432)	C		11275	12923	14731	16549	18541	20556	22872	25292	27902
	P		1935	1906	1895	1884	1873	1859	1844	1824	1811
	A		8.44	8.31	8.27	8.22	8.17	8.12	8.05	7.96	7.90
	M		151.5	172.3	194.9	217.4	241.9	266.3	294.4	323.5	354.5
	E		5.83	6.78	7.77	8.78	9.90	11.06	12.41	13.87	15.41
	%		60.4	64.6	67.8	70.7	73.2	75.5	77.7	79.8	81.8
	T		259.3	244.7	233.5	224.7	217.1	210.9	205.0	199.9	196.0
110 (380)	C	10894	12450	14134	15899	17831	19901	22119	24487	27068	29903
	P	1698	1683	1678	1669	1660	1648	1634	1618	1599	1581
	A	7.43	7.37	7.34	7.31	7.27	7.22	7.15	7.08	7.00	6.93
	M	139.3	157.9	178.1	198.8	221.6	245.6	271.2	298.4	328.0	360.2
	E	6.42	7.40	8.42	9.52	10.74	12.08	13.54	15.14	16.93	18.91
	%	62.0	64.7	67.7	70.5	72.8	75.2	77.2	78.9	80.2	81.1
	T	245.6	234.4	223.7	214.8	207.1	200.4	194.6	189.8	185.3	181.4
100 (332)	C	11838	13454	15135	16997	18990	21099	23442	25922	28676	31642
	P	1489	1484	1477	1468	1456	1443	1429	1411	1395	1382
	A	6.53	6.51	6.48	6.45	6.39	6.34	6.28	6.21	6.13	6.09
	M	144.0	162.4	181.3	202.4	224.8	247.9	273.9	301.1	331.1	363.3
	E	7.95	9.07	10.24	11.58	13.04	14.62	16.41	18.37	20.56	22.89
	%	65.8	68.5	70.6	72.5	74.1	75.9	76.7	77.4	77.4	77.3
	T	220.6	210.8	203.0	195.5	189.2	183.8	178.9	174.7	171.1	168.1
90 (289)	C	12894	14552	16298	18251	20345	22540	25018	27549	30395	33486
	P	1318	1311	1303	1293	1282	1268	1253	1239	1225	1207
	A	5.82	5.79	5.75	5.71	5.66	5.61	5.54	5.49	5.42	5.35
	M	149.4	167.3	186.2	207.2	229.5	252.8	278.9	305.4	335.1	367.4
	E	9.78	11.10	12.51	14.12	15.88	17.78	19.97	22.23	24.82	27.74
	%	67.8	69.3	71.1	72.6	73.8	74.7	74.9	74.4	73.1	70.9
	T	201.3	193.7	186.4	179.8	174.2	169.4	165.0	161.6	158.4	155.6
80 (250)	C	13781	15567	17398	19344	21503	23825	26325	29124		
	P	1162	1154	1145	1136	1122	1108	1092	1077		
	A	5.16	5.13	5.09	5.05	5.00	4.94	4.88	4.82		
	M	152.8	171.6	190.4	210.5	232.5	256.2	281.4	309.6		
	E	11.86	13.48	15.20	17.03	19.17	21.51	24.10	27.04		
	%	68.5	69.4	70.6	71.0	71.2	70.7	69.3	67.0		
	T	182.7	175.5	169.4	164.2	159.4	155.2	151.6	148.4		
70 (215)	C	14587	16422	18267	20395	22689					
	P	1024	1020	1009	998	988					
	A	4.59	4.57	4.53	4.48	4.45					
	M	155.0	173.4	191.7	212.9	235.5					
	E	14.24	16.10	18.10	20.44	22.96					
	%	67.3	67.6	67.9	67.6	66.3					
	T	167.2	161.2	155.8	150.7	146.6					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A3. R-410A at 65°F Suction Temperature, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (76)	15 (84)	20 (93)	25 (102)	30 (111)	35 (122)	40 (133)	45 (144)	50 (157)	55 (170)
140 (556)	C						15057	16881	18888	20938	23122
	P						2454	2427	2407	2390	2379
	A						10.69	10.57	10.48	10.42	10.37
	M						230.0	260.7	295.8	332.9	373.4
	E						6.14	6.95	7.85	8.76	9.72
	%						63.3	66.1	68.3	70.7	72.8
	T						251.6	236.6	223.0	210.8	200.2
130 (491)	C				13149	14817	16655	18653	20716	22982	25522
	P				2179	2154	2142	2130	2115	2094	2068
	A				9.50	9.40	9.34	9.28	9.21	9.13	9.02
	M				184.2	209.4	237.8	269.1	302.5	340.1	384.0
	E				6.03	6.88	7.78	8.76	9.80	10.98	12.34
	%				61.8	64.8	66.7	68.9	70.9	73.2	75.5
	T				261.1	244.4	230.6	217.2	205.4	194.0	182.9
120 (432)	C		11269	12976	14619	16399	18305	20351	22581	25000	27572
	P		1929	1914	1895	1886	1875	1861	1842	1820	1808
	A		8.42	8.35	8.28	8.23	8.18	8.13	8.05	7.95	7.90
	M		146.6	170.0	193.0	218.2	245.8	276.2	309.9	347.7	388.8
	E		5.84	6.78	7.71	8.70	9.76	10.94	12.26	13.74	15.25
	%		61.7	65.8	68.1	69.6	71.4	72.6	74.0	75.5	76.8
	T		268.8	248.5	233.6	220.9	208.6	197.4	186.6	176.4	167.5
110 (380)	C	10907	12407	14061	15822	17713	19695	21859	24246	26815	29683
	P	1706	1687	1679	1672	1663	1652	1637	1618	1594	1577
	A	7.46	7.38	7.35	7.31	7.28	7.24	7.16	7.09	6.98	6.91
	M	133.6	153.0	174.4	197.7	223.1	250.2	280.3	314.2	351.8	394.8
	E	6.39	7.35	8.38	9.46	10.65	11.92	13.36	14.98	16.82	18.82
	%	63.9	65.4	67.8	69.4	70.9	71.9	73.0	73.7	75.0	75.8
	T	259.4	244.5	229.2	215.9	203.6	192.6	181.9	171.9	161.8	152.7
100 (332)	C	11972	13551	15213	17022	19005	21121	23371	25876	28605	31734
	P	1488	1483	1476	1469	1458	1443	1429	1410	1393	1374
	A	6.53	6.51	6.48	6.45	6.41	6.34	6.28	6.20	6.13	6.05
	M	139.7	159.0	179.5	202.3	227.4	254.9	284.7	318.5	356.1	400.3
	E	8.05	9.14	10.31	11.59	13.03	14.63	16.36	18.35	20.54	23.09
	%	69.3	70.6	72.4	72.9	73.4	73.9	73.6	73.7	73.0	72.6
	T	232.1	219.0	206.4	195.4	184.8	174.6	165.3	156.0	147.4	138.4
90 (289)	C	12910	14500	16224	18149	20187	22391	24799	27435	30356	33607
	P	1314	1309	1303	1295	1285	1271	1256	1239	1218	1198
	A	5.80	5.77	5.75	5.72	5.68	5.61	5.55	5.48	5.40	5.31
	M	143.8	162.4	182.9	205.8	230.6	257.8	287.9	321.6	359.8	403.3
	E	9.83	11.07	12.45	14.02	15.71	17.62	19.75	22.14	24.92	28.04
	%	71.0	70.6	71.1	71.4	71.4	71.2	70.3	69.2	67.4	65.2
	T	213.4	203.0	191.7	181.0	170.8	161.1	152.1	143.3	134.5	126.0
80 (250)	C	13888	15499	17409	19319	21468	23777	26323	29090	32118	
	P	1159	1153	1146	1136	1124	1108	1093	1076	1058	
	A	5.15	5.11	5.09	5.05	5.00	4.94	4.88	4.80	4.73	
	M	148.3	166.2	187.9	209.7	234.7	261.9	292.3	326.2	363.8	
	E	11.99	13.44	15.19	17.00	19.11	21.45	24.08	27.04	30.36	
	%	72.6	72.7	72.0	71.4	70.2	68.5	66.0	62.4	58.5	
	T	194.1	183.8	173.7	164.1	154.9	146.1	137.8	129.7	122.2	
70 (215)	C	14664	16374	18249	20329	22600	24963				
	P	1023	1021	1011	999	988	973				
	A	4.59	4.58	4.54	4.50	4.45	4.39				
	M	150.5	168.8	189.2	211.9	237.1	263.8				
	E	14.33	16.04	18.06	20.34	22.86	25.65				
	%	71.1	69.0	68.0	66.4	64.5	61.0				
	T	179.2	170.5	160.7	151.4	142.5	134.4				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A4. R32 at 20°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (78)	15 (86)	20 (94)	25 (103)	30 (113)	35 (124)	40 (135)	45 (147)	50 (160)	55 (174)
140 (570)	C								19286	21545	23831
	P								2583	2574	2607
	A								11.26	11.22	11.37
	M								194.9	217.0	239.4
	E								7.47	8.37	9.14
	%								65.0	66.7	67.4
	T								273.7	262.8	254.8
130 (504)	C						17048	18917	**20985**	23325	25851
	P						2254	2240	2284	2291	2290
	A						9.82	9.76	9.95	9.99	9.99
	M						164.4	181.8	201.1	223.0	246.6
	E						7.56	8.44	9.19	10.18	11.29
	%						66.8	66.6	66.9	68.1	69.3
	T						266.3	259.1	250.8	241.3	232.6
120 (444)	C				14624	16571	18661	20875	23262	25713	28412
	P				1992	1977	1958	1943	1930	1917	1907
	A				8.69	8.62	8.54	8.48	8.42	8.37	8.33
	M				135.5	153.0	171.8	191.5	213.0	234.8	258.9
	E				7.34	8.38	9.53	10.74	12.05	13.41	14.90
	%				65.1	67.8	70.1	72.0	73.3	74.5	75.5
	T				266.6	252.2	240.2	229.8	220.6	212.8	205.9
110 (389)	C		12448	14333	16169	17945	20200	22408	24833	27435	30298
	P		1752	1739	1737	1737	1718	1704	1691	1675	1658
	A		7.66	7.61	7.61	7.60	7.52	7.46	7.39	7.33	7.26
	M		111.1	127.4	143.3	158.5	177.9	196.8	217.5	239.7	264.3
	E		7.10	8.24	9.31	10.33	11.76	13.15	14.69	16.38	18.27
	%		63.2	66.7	68.5	69.7	73.0	72.5	73.9	74.7	74.6
	T		268.7	251.1	239.5	229.0	216.4	209.3	201.0	193.7	187.2
100 (340)	C	11804	13565	15469	17211	19352	21336	23700	26184	**28945**	31864
	P	1538	1535	1537	1529	1517	1505	1494	1479	1463	1452
	A	6.76	6.73	6.74	6.70	6.66	6.61	6.56	6.50	6.43	6.39
	M	101.5	116.2	132.0	146.4	164.1	180.5	199.9	220.3	243.2	267.1
	E	7.68	8.84	10.06	11.26	12.76	14.18	15.86	17.70	19.78	21.95
	%	63.6	66.3	69.8	69.8	72.1	71.3	71.9	72.0	71.4	70.3
	T	256.0	240.3	224.9	215.4	203.9	197.6	189.6	182.5	176.0	170.8
90 (296)	C	12552	14291	16182	18224	20377	22598	25093	27706	30540	33573
	P	1361	1355	1349	1341	1335	1323	1307	1290	1275	1256
	A	6.00	5.98	5.94	5.92	5.89	5.84	5.78	5.71	5.63	5.56
	M	103.8	117.7	132.9	149.2	166.3	184.0	203.7	224.4	246.9	270.9
	E	9.22	10.55	12.00	13.59	15.27	17.08	19.19	21.47	23.96	26.73
	%	64.7	65.9	67.5	68.7	69.4	69.7	69.5	68.6	67.0	64.4
	T	231.2	218.9	206.6	196.1	186.8	178.8	171.6	165.2	159.4	154.3
80 (256)	C	13556	15326	17231	19305	21485	23818	26344	29103	31960	
	P	1199	1195	1189	1181	1167	1153	1136	1118	1102	
	A	5.32	5.31	5.28	5.25	5.19	5.12	5.06	4.99	4.92	
	M	108.1	121.8	136.5	152.5	169.3	187.1	206.5	227.5	249.3	
	E	11.31	12.82	14.50	16.34	18.41	20.66	23.19	26.03	29.00	
	%	65.0	66.7	67.0	67.0	66.6	66.2	64.5	62.1	58.8	
	T	206.5	194.5	184.8	175.9	167.6	160.6	154.3	148.5	143.9	
70 (220)	C	14394	16136	18132	20259	22529	24957				
	P	1062	1057	1048	1035	1022	1007				
	A	4.75	4.74	4.69	4.64	4.59	4.53				
	M	110.9	123.9	138.8	154.6	171.4	189.5				
	E	13.56	15.27	17.30	19.58	22.05	24.77				
	%	64.0	63.8	63.4	63.2	61.8	59.7				
	T	185.3	176.1	166.9	158.2	151.2	144.8				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A5. R32 at 40°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (78)	15 (86)	20 (94)	25 (103)	30 (113)	35 (124)	40 (135)	45 (147)	50 (160)	55 (174)
140 (556)	C										24199
	P										2556
	A										11.14
	M										230.0
	E										9.47
	%										73.0
	T										271.7
130 (504)	C							19368	21602	23942	26299
	P							2228	2220	2223	2219
	A							9.72	9.69	9.70	9.68
	M							177.3	197.0	217.5	238.0
	E							8.69	9.73	10.77	11.85
	%							72.2	74.3	76.2	76.5
	T							274.1	263.6	255.3	248.2
120 (444)	C					16544	18556	20745	23017	25461	28058
	P					1983	1973	1961	1952	1942	1932
	A					8.66	8.61	8.56	8.52	8.48	8.43
	M					145.8	163.0	181.5	200.7	221.3	243.1
	E					8.34	9.41	10.58	11.79	13.11	14.52
	%					70.8	72.4	74.2	75.7	76.7	77.7
	T					272.5	261.5	251.0	242.1	234.2	227.4
110 (389)	C			14029	15813	17783	19921	22165	24542	27121	29803
	P			1752	1745	1736	1727	1719	1706	1695	1677
	A			7.65	7.63	7.60	7.55	7.52	7.46	7.42	7.34
	M			119.5	134.1	150.1	167.6	185.9	205.2	226.1	247.6
	E			8.01	9.06	10.24	11.53	12.90	14.38	16.00	17.77
	%			69.5	69.6	71.9	74.2	75.8	76.7	77.1	77.4
	T			271.5	262.7	250.4	239.1	229.8	221.8	214.7	208.4
100 (340)	C	11638	13352	15131	17022	19086	21208	23499	25936	28573	31432
	P	1552	1541	1536	1528	1519	1510	1499	1486	1470	1458
	A	6.80	6.76	6.74	6.69	6.67	6.63	6.58	6.53	6.46	6.41
	M	96.1	109.8	123.9	138.8	155.1	171.8	189.8	208.7	229.3	251.5
	E	7.50	8.67	9.85	11.14	12.56	14.04	15.67	17.46	19.44	21.56
	%	68.0	70.2	72.4	73.8	75.1	75.6	75.9	75.7	75.1	74.0
	T	271.5	256.8	244.5	234.2	224.5	216.3	208.8	202.2	196.1	191.1
90 (296)	C	12561	14211	16075	18089	20151	22376	24764	27307	30172	33072
	P	1362	1357	1351	1342	1335	1324	1309	1294	1279	1262
	A	6.00	5.99	5.96	5.92	5.89	5.85	5.78	5.72	5.66	5.59
	M	99.9	112.5	126.8	142.2	157.8	174.7	192.6	211.8	233.4	255.2
	E	9.22	10.47	11.89	13.48	15.09	16.90	18.92	21.11	23.59	26.21
	%	69.8	70.1	71.6	72.9	73.7	74.0	73.8	72.8	70.5	67.7
	T	246.0	236.5	225.0	214.6	205.9	198.0	191.0	185.0	179.5	174.8
80 (256)	C	13485	15216	17104	19079	21210	23509	25980	28607		
	P	1199	1195	1189	1180	1168	1153	1139	1122		
	A	5.32	5.30	5.28	5.25	5.19	5.14	5.07	5.00		
	M	103.6	116.5	130.4	144.9	160.6	177.4	195.4	214.5		
	E	11.24	12.74	14.38	16.16	18.16	20.39	22.82	25.50		
	%	71.0	71.7	71.9	71.9	71.3	70.3	68.4	65.8		
	T	220.9	211.1	202.0	193.8	186.5	179.7	173.9	168.5		
70 (220)	C	14295	16028	17946	19979	22259					
	P	1061	1056	1046	1033	1023					
	A	4.75	4.73	4.69	4.64	4.60					
	M	106.2	118.6	132.3	146.8	163.0					
	E	13.47	15.18	17.16	19.34	21.75					
	%	69.3	68.5	67.9	67.4	66.1					
	T	201.3	193.6	185.3	177.3	170.3					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A6. R32 at 65°F Suction Temperature, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (78)	15 (86)	20 (94)	25 (103)	30 (113)	35 (124)	40 (135)	45 (147)	50 (160)	55 (174)
140 (556)	C								19773	22093	24583
	P								2547	2529	2517
	A								11.12	11.05	10.97
	M								199.6	225.8	254.7
	E								7.76	8.74	9.77
	%								67.2	69.0	70.1
	T								269.6	252.6	237.7
130 (504)	C							19253	21555	24016	26700
	P							2242	2222	2203	2185
	A							9.79	9.69	9.62	9.52
	M							182.7	206.7	233.0	262.6
	E							8.59	9.70	10.90	12.22
	%							68.6	70.0	71.7	72.6
	T							262.2	245.6	229.7	215.3
120 (444)	C					16811	18805	20996	23360	25905	28653
	P					1972	1960	1946	1935	1923	1904
	A					8.61	8.56	8.50	8.45	8.40	8.32
	M					149.8	168.8	190.3	213.8	239.7	268.4
	E					8.52	9.59	10.79	12.07	13.47	15.05
	%					71.6	72.1	73.4	73.9	73.8	73.7
	T					264.7	249.6	234.1	220.2	207.6	195.2
110 (389)	C			14261	16137	17980	20092	22411	24901	27585	30485
	P			1744	1736	1732	1722	1712	1700	1682	1660
	A			7.64	7.60	7.58	7.53	7.49	7.45	7.37	7.27
	M			120.2	136.8	153.5	172.9	194.5	218.2	244.2	273.1
	E			8.18	9.30	10.38	11.67	13.09	14.65	16.40	18.36
	%			71.9	73.1	71.7	72.7	73.1	73.1	73.2	72.5
	T			273.2	255.8	244.2	228.9	214.8	201.7	188.8	176.9
100 (340)	C		13514	15293	17276	19329	21547	23897	26459	29277	32330
	P		1534	1529	1521	1513	1503	1492	1477	1460	1445
	A		6.73	6.70	6.68	6.63	6.60	6.55	6.48	6.43	6.35
	M		109.0	123.9	140.9	158.7	178.2	199.3	222.7	248.8	278.0
	E		8.81	10.00	11.36	12.77	14.33	16.02	17.91	20.05	22.38
	%		74.0	73.8	74.8	75.2	74.9	74.2	73.1	71.4	69.0
	T		262.6	248.4	232.4	218.4	205.2	193.0	181.2	170.2	159.6
90 (296)	C	12679	14279	16177	18212	20339	22623	25111	27832	30794	33992
	P	1355	1351	1344	1337	1331	1321	1306	1290	1274	1256
	A	5.96	5.95	5.93	5.89	5.87	5.83	5.77	5.70	5.63	5.56
	M	98.1	111.0	126.5	143.1	161.0	180.3	201.6	225.5	252.0	281.1
	E	9.36	10.57	12.03	13.62	15.28	17.12	19.23	21.58	24.18	27.06
	%	73.1	71.7	72.7	73.2	72.7	72.0	70.5	68.5	65.8	62.2
	T	257.8	245.7	229.3	214.3	201.0	188.5	176.7	165.2	154.2	144.0
80 (256)	C	13646	15432	17316	19323	21508	23918	26496	29303	32388	
	P	1191	1187	1182	1174	1162	1148	1135	1118	1105	
	A	5.29	5.27	5.25	5.22	5.18	5.11	5.05	4.99	4.94	
	M	102.1	115.9	130.7	146.8	164.3	184.0	205.4	229.1	255.6	
	E	11.46	13.00	14.65	16.46	18.51	20.83	23.35	26.22	29.30	
	%	75.9	75.0	74.9	73.5	71.8	69.3	66.3	62.7	57.6	
	T	231.1	217.9	204.1	192.0	180.2	169.0	158.1	147.7	138.7	
70 (220)	C	14403	16126	18099	20149	22489	24934				
	P	1052	1047	1039	1029	1020	1005				
	A	4.71	4.69	4.66	4.61	4.57	4.52				
	M	104.3	117.3	132.3	148.1	166.3	185.6				
	E	13.69	15.40	17.42	19.58	22.06	24.82				
	%	73.8	71.3	69.5	67.4	64.6	62.1				
	T	212.5	201.2	188.8	177.0	165.6	154.0				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A7. DR-5 at 20°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)

		10 (72)	15 (79)	20 (87)	25 (95)	30 (104)	35 (114)	40 (124)	45 (135)	50 (147)	55 (160)
140 (524)	C						14275	16090	18060	20097	22285
	P						2371	2317	2300	2286	2273
	A						10.32	10.10	10.04	9.96	9.92
	M						177.4	199.1	222.5	246.1	271.6
	E						6.02	6.94	7.85	8.79	9.80
	%						60.1	64.0	67.0	69.5	72.2
	T						267.9	252.8	241.8	233.6	226.1
130 (463)	C				12212	13903	15704	17659	**19713**	21882	24249
	P				2085	2057	2042	2027	2012	1997	1977
	A				9.09	8.96	8.91	8.84	8.79	8.72	8.64
	M				144.6	163.7	183.9	205.9	228.6	252.7	279.0
	E				5.86	6.76	7.69	8.71	9.80	10.96	12.26
	%				60.3	62.2	65.1	68.0	70.5	73.0	74.9
	T				263.6	252.2	240.3	229.6	220.9	213.3	206.5
120 (407)	C		10409	11869	13517	15292	17114	19088	21200	23542	25993
	P		1875	1824	1810	1797	1785	1775	1760	1745	1735
	A		8.18	7.96	7.92	7.85	7.81	7.76	7.69	7.63	7.59
	M		118.2	134.0	151.8	170.9	190.2	211.2	233.5	258.0	283.8
	E		5.55	6.51	7.47	8.51	9.59	10.75	12.05	13.49	14.99
	%		58.0	61.1	64.1	66.7	68.8	70.8	72.7	74.4	75.6
	T		265.0	249.5	236.1	224.9	216.0	208.1	200.8	194.5	189.3
110 (357)	C	9926	11358	12961	14661	16488	18450	20503	22783	25126	27749
	P	1628	1611	1597	1589	1583	1570	1558	1546	1530	1513
	A	7.12	7.06	6.99	6.96	6.94	6.88	6.84	6.77	6.71	6.64
	M	107.7	122.6	139.1	156.4	175.2	195.0	215.7	238.6	262.2	288.5
	E	6.10	7.05	8.12	9.22	10.41	11.75	13.16	14.74	16.42	18.34
	%	58.4	60.3	63.5	66.1	68.0	70.1	71.9	73.1	74.2	74.5
	T	253.0	240.2	226.1	215.3	206.0	197.3	190.1	183.7	178.2	173.0
100 (312)	C	10871	12372	14070	15754	17674	19677	21838	24146	**26602**	29284
	P	1424	1414	1408	1399	1391	1378	1367	1352	1336	1325
	A	6.26	6.22	6.19	6.16	6.12	6.06	6.02	5.96	5.89	5.84
	M	112.7	127.5	144.3	160.7	179.4	198.9	219.6	241.9	265.5	291.2
	E	7.63	8.75	9.99	11.26	12.71	14.27	15.97	17.86	19.90	22.10
	%	61.7	64.1	66.3	67.9	69.4	70.4	71.0	71.5	71.4	70.5
	T	225.1	213.4	202.1	193.8	185.8	178.8	172.9	167.3	162.5	158.6
90 (271)	C	11773	13312	14977	16804	18794	20851	23123	25534	28159	30960
	P	1257	1249	1242	1233	1226	1213	1198	1184	1169	1154
	A	5.57	5.53	5.50	5.46	5.44	5.38	5.31	5.26	5.19	5.13
	M	116.8	131.3	147.0	164.2	182.8	202.0	222.9	245.2	269.4	295.2
	E	9.36	10.66	12.06	13.62	15.33	17.20	19.29	21.56	24.08	26.82
	%	63.3	64.3	65.9	67.3	68.1	68.6	68.8	68.0	66.5	64.1
	T	203.0	194.1	184.9	176.3	169.3	162.8	157.2	152.4	148.1	144.4
80 (235)	C	12621	14228	15992	17847	19853	22006	24338	26845	29536	
	P	1109	1103	1098	1089	1076	1061	1046	1031	1019	
	A	4.95	4.92	4.89	4.86	4.81	4.74	4.69	4.62	4.58	
	M	120.3	134.9	150.9	167.6	185.7	204.9	225.7	248.1	271.8	
	E	11.38	12.90	14.56	16.38	18.46	20.74	23.27	26.03	28.98	
	%	63.7	64.7	65.2	65.7	65.5	64.7	63.2	60.6	58.0	
	T	182.4	173.8	166.2	159.0	152.6	147.2	142.4	138.2	135.0	
70 (202)	C	13411	15052	16810	18772	20869	23109				
	P	982	980	970	958	945	933				
	A	4.42	4.42	4.38	4.34	4.28	4.24				
	M	123.1	137.4	152.7	169.7	187.9	207.3				
	E	13.66	15.36	17.33	19.60	22.08	24.76				
	%	61.9	61.7	62.0	61.4	60.0	57.9				
	T	165.0	158.1	150.7	144.1	138.6	133.9				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A8. DR-5 at 40°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (72)	15 (79)	20 (87)	25 (95)	30 (104)	35 (114)	40 (124)	45 (135)	50 (147)	55 (160)
140 (524)	C							16303	18358	20417	22665
	P							2363	2307	2297	2287
	A							10.30	10.06	10.01	9.97
	M							189.4	212.2	234.8	259.1
	E							6.90	7.96	8.89	9.91
	%							66.4	70.8	73.0	75.2
	T							273.8	260.3	252.2	245.1
130 (463)	C					14476	16025	17981	20039	22180	24563
	P					2046	2045	2031	2016	2001	1986
	A					8.93	8.91	8.86	8.79	8.74	8.68
	M					161.1	177.2	197.7	219.1	241.3	265.8
	E					7.07	7.84	8.85	9.94	11.08	12.37
	%					67.8	69.5	72.0	74.6	76.9	78.7
	T					265.7	256.9	247.3	238.7	231.5	225.1
120 (407)	C			12144	13803	15580	17406	19404	21556	23774	26166
	P			1837	1803	1792	1784	1774	1760	1745	1737
	A			8.02	7.88	7.83	7.79	7.76	7.69	7.63	7.60
	M			129.9	146.9	164.7	183.0	203.1	224.4	246.3	269.6
	E			6.61	7.66	8.70	9.76	10.94	12.25	13.63	15.07
	%			64.2	68.4	71.2	73.7	75.6	77.3	78.8	80.1
	T			268.3	252.7	242.2	233.2	225.2	218.4	212.5	207.9
110 (357)	C	10234	11688	13225	14957	16775	18683	20745	23013	25362	27922
	P	1622	1604	1590	1583	1578	1567	1556	1544	1529	1513
	A	7.10	7.03	6.96	6.93	6.92	6.86	6.82	6.77	6.71	6.64
	M	105.8	120.0	135.0	151.8	169.1	187.4	207.0	228.5	250.7	274.7
	E	6.31	7.29	8.32	9.45	10.63	11.92	13.33	14.90	16.59	18.45
	%	62.9	66.6	68.4	71.0	73.3	75.4	77.2	78.4	79.1	79.2
	T	267.0	251.8	241.6	230.9	222.0	214.0	207.3	201.2	196.0	191.5
100 (312)	C	11013	12532	14168	15935	17814	19773	21869	24140	26576	29158
	P	1416	1410	1405	1397	1388	1377	1365	1352	1334	1324
	A	6.23	6.20	6.18	6.15	6.11	6.07	6.01	5.95	5.89	5.85
	M	108.8	123.2	138.4	154.8	172.2	190.1	209.1	229.8	251.8	274.9
	E	7.78	8.89	10.09	11.41	12.83	14.36	16.02	17.86	19.92	22.01
	%	66.2	68.7	70.9	72.7	74.1	75.3	76.0	76.2	75.8	75.2
	T	240.4	228.8	218.9	210.0	202.7	196.2	190.6	185.5	181.0	177.7
90 (271)	C	11893	13402	15087	16875	18859	20901	23096	25519	28059	30767
	P	1253	1245	1237	1229	1224	1210	1198	1183	1168	1152
	A	5.55	5.51	5.48	5.45	5.42	5.37	5.31	5.25	5.19	5.13
	M	112.7	126.2	141.4	157.3	174.9	192.8	212.1	233.3	255.3	278.8
	E	9.49	10.76	12.19	13.73	15.41	17.27	19.29	21.58	24.02	26.71
	%	68.0	69.6	71.2	72.6	73.4	74.0	74.0	72.9	71.3	68.7
	T	218.5	209.7	200.7	193.0	186.4	180.3	175.2	170.7	166.9	163.6
80 (235)	C	12707	14304	16079	17866	19848	21962	24268	26764		
	P	1103	1096	1092	1084	1071	1058	1043	1033		
	A	4.92	4.89	4.88	4.84	4.79	4.73	4.67	4.63		
	M	115.9	129.8	145.1	160.5	177.4	195.3	214.8	235.7		
	E	11.52	13.05	14.72	16.49	18.53	20.76	23.27	25.92		
	%	69.0	70.1	70.5	70.8	70.6	69.9	68.4	66.2		
	T	197.6	189.3	182.2	175.9	170.1	165.0	160.5	156.9		
70 (202)	C	13457	15097	16880	18778	20842					
	P	977	975	964	954	941					
	A	4.40	4.39	4.35	4.31	4.26					
	M	118.4	132.0	146.8	162.6	179.5					
	E	13.78	15.49	17.50	19.69	22.16					
	%	67.5	67.4	67.2	66.8	65.6					
	T	180.6	174.1	167.2	161.2	155.8					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A9. DR-5 at 65°F Suction Temperature, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (72)	15 (79)	20 (87)	25 (95)	30 (104)	35 (114)	40 (124)	45 (135)	50 (147)	55 (160)
140 (524)	C						14977	16721	18060	20249	22759
	P						2351	2346	2300	2401	2285
	A						10.26	10.23	10.04	10.46	9.96
	M						180.5	203.6	222.5	252.6	287.6
	E						6.37	7.13	7.85	8.43	9.96
	%						64.3	66.0	67.0	64.3	71.2
	T						271.1	255.7	241.8	234.2	215.2
130 (463)	C					14676	16411	18273	20341	22434	24739
	P					2040	2027	2016	2003	1990	1975
	A					8.90	8.85	8.80	8.74	8.67	8.62
	M					165.5	186.7	209.9	236.0	263.4	294.2
	E					7.20	8.10	9.06	10.15	11.27	12.53
	%					68.1	69.4	70.9	72.3	73.5	74.1
	T					259.2	245.1	231.5	218.5	206.8	195.8
120 (407)	C			12607	13803	16009	17813	19724	21200	23693	26146
	P			1825	1803	1783	1774	1772	1760	1737	1719
	A			7.98	7.88	7.79	7.75	7.75	7.69	7.60	7.52
	M			133.2	146.9	171.4	192.4	214.8	233.5	263.6	294.6
	E			6.91	7.66	8.98	10.04	11.13	12.05	13.64	15.21
	%			66.3	68.4	72.4	73.6	73.9	72.7	74.3	74.2
	T			269.6	252.7	234.5	221.6	210.8	200.8	189.0	178.8
110 (357)	C			13262	14957	16617	18615	20646	22783	25244	27891
	P			1595	1583	1575	1564	1554	1546	1522	1503
	A			6.99	6.93	6.91	6.86	6.81	6.77	6.68	6.60
	M			133.8	151.8	169.8	191.7	214.3	238.6	267.3	299.0
	E			8.31	9.45	10.55	11.90	13.29	14.74	16.58	18.56
	%			69.4	71.0	70.6	72.3	73.0	73.1	73.1	72.9
	T			245.5	230.9	219.8	206.0	194.5	183.7	173.1	162.8
100 (312)	C	11220	12740	14382	15935	17909	19894	22037	24146	26809	29556
	P	1411	1404	1400	1397	1385	1374	1361	1352	1332	1318
	A	6.21	6.18	6.16	6.15	6.09	6.05	5.99	5.96	5.87	5.81
	M	107.2	122.3	138.8	154.8	175.1	195.9	218.9	241.9	271.3	302.5
	E	7.95	9.07	10.27	11.41	12.93	14.48	16.19	17.86	20.12	22.43
	%	70.6	72.5	74.2	72.7	74.1	74.1	73.7	71.5	70.9	69.0
	T	250.0	234.5	220.2	210.0	197.4	186.5	175.8	167.3	157.3	148.1
90 (271)	C	12062	13570	15173	16875	18860	20955	23199	25534	28330	31210
	P	1248	1241	1235	1229	1223	1211	1196	1184	1165	1149
	A	5.52	5.49	5.46	5.45	5.41	5.36	5.30	5.26	5.18	5.10
	M	110.7	125.1	140.7	157.3	177.0	198.1	220.9	245.2	274.7	306.0
	E	9.67	10.93	12.29	13.73	15.42	17.31	19.40	21.56	24.32	27.17
	%	72.4	71.7	72.1	72.6	71.2	70.9	69.6	68.0	65.6	62.0
	T	228.9	217.4	205.1	193.0	183.1	172.0	162.0	152.4	143.0	134.2
80 (235)	C	12892	14461	16216	17866	19985	22133	24496	26845	29753	
	P	1099	1094	1089	1084	1072	1058	1044	1031	1016	
	A	4.90	4.87	4.86	4.84	4.78	4.72	4.67	4.62	4.56	
	M	114.0	128.4	144.8	160.5	180.4	201.2	224.4	248.1	277.4	
	E	11.73	13.22	14.89	16.49	18.65	20.91	23.47	26.03	29.27	
	%	74.4	74.0	73.8	70.8	70.4	68.4	65.7	60.6	56.6	
	T	207.2	195.8	184.4	175.9	165.0	155.4	145.9	138.2	129.8	
70 (202)	C	13610	15200	16982	18778	20911	23170				
	P	971	971	963	954	942	929				
	A	4.37	4.37	4.34	4.31	4.26	4.21				
	M	116.2	130.3	146.3	162.6	182.2	203.1				
	E	14.02	15.66	17.64	19.69	22.19	24.94				
	%	72.2	69.8	68.1	66.8	63.2	60.2				
	T	191.2	182.0	171.5	161.2	152.4	142.8				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A10. L-41A at 20°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (65)	15 (72)	20 (79)	25 (87)	30 (96)	35 (105)	40 (115)	45 (125)	50 (136)	55 (148)
140 (498)	C						13663	15489	17282	19371	21507
	P						2211	2201	2187	2171	2161
	A						9.63	9.59	9.53	9.46	9.43
	M						162.7	183.5	203.6	227.3	251.0
	E						6.18	7.04	7.90	8.92	9.95
	%						61.9	65.2	68.3	70.8	73.2
	T						269.0	255.5	245.1	235.6	228.3
130 (438)	C				11546	13177	14921	16868	**18801**	20918	23240
	P				1965	1948	1932	1920	1907	1895	1880
	A				8.58	8.50	8.43	8.37	8.33	8.27	8.20
	M				131.3	149.0	167.7	188.8	209.4	231.8	256.5
	E				5.87	6.76	7.72	8.79	9.86	11.04	12.36
	%				60.3	62.7	66.1	69.1	71.7	74.0	75.8
	T				269.4	256.4	243.5	231.9	222.8	215.4	208.5
120 (385)	C			10942	12531	14261	16077	18025	20006	22213	24532
	P			1733	1715	1703	1696	1689	1678	1666	1660
	A			7.57	7.50	7.45	7.42	7.39	7.34	7.29	7.27
	M			118.8	135.2	153.1	171.9	191.7	211.7	234.2	257.4
	E			6.32	7.31	8.38	9.48	10.67	11.92	13.34	14.78
	%			59.9	63.1	66.3	68.6	70.6	72.3	73.8	74.9
	T			258.8	244.2	230.9	220.5	211.7	204.6	197.8	192.6
110 (337)	C	9071	10399	11970	13654	15428	17329	19305	21407	23664	26181
	P	1537	1521	1511	1507	1501	1494	1485	1474	1461	1446
	A	6.75	6.68	6.63	6.62	6.59	6.56	6.52	6.48	6.43	6.36
	M	94.9	108.2	123.8	140.5	157.8	176.5	195.7	216.0	237.8	262.1
	E	5.90	6.84	7.92	9.06	10.28	11.60	13.00	14.52	16.19	18.11
	%	57.3	59.6	62.6	65.5	67.8	69.6	71.3	72.7	73.5	73.9
	T	262.8	248.1	233.4	220.5	210.3	201.4	193.8	187.1	181.3	175.8
100 (293)	C	9963	11422	13066	14696	16486	18427	20445	22651	**25043**	27603
	P	1346	1339	1335	1329	1321	1311	1302	1288	1273	1262
	A	5.94	5.91	5.89	5.86	5.83	5.79	5.75	5.69	5.63	5.58
	M	99.6	113.6	129.3	144.8	161.6	179.8	198.6	219.1	241.3	264.9
	E	7.40	8.53	9.79	11.06	12.48	14.06	15.70	17.58	19.67	21.87
	%	61.4	63.7	65.6	67.7	69.2	70.2	70.6	70.9	70.7	70.1
	T	232.2	219.5	208.0	198.0	189.6	182.2	176.2	170.4	165.1	161.0
90 (254)	C	10790	12343	13881	15645	17520	19496	21683	23961	26460	29107
	P	1190	1184	1178	1172	1167	1155	1141	1126	1111	1095
	A	5.28	5.25	5.22	5.20	5.18	5.13	5.07	5.01	4.95	4.89
	M	103.5	117.8	131.7	147.7	164.7	182.5	202.1	222.4	244.7	268.2
	E	9.07	10.43	11.78	13.35	15.01	16.88	19.01	21.28	23.83	26.58
	%	63.1	63.8	65.5	66.8	67.6	68.2	68.1	67.7	66.2	64.2
	T	209.0	199.0	189.9	180.9	173.3	166.4	160.2	155.0	150.4	146.5
80 (220)	C	11587	13128	14872	16597	18504	20577	22810	25194	27810	
	P	1051	1047	1044	1036	1025	1010	995	980	962	
	A	4.70	4.69	4.67	4.64	4.59	4.53	4.48	4.41	4.34	
	M	106.8	120.5	135.9	151.0	167.5	185.5	204.8	225.3	247.7	
	E	11.02	12.54	14.25	16.01	18.05	20.37	22.92	25.71	28.90	
	%	63.3	64.4	64.6	65.0	64.9	64.3	62.7	60.6	57.1	
	T	188.4	178.7	170.1	162.9	156.3	150.3	145.2	140.6	136.5	
70 (188)	C	12398	13941	15615	17496	19498	21604				
	P	931	932	923	912	900	890				
	A	4.23	4.23	4.20	4.15	4.10	4.06				
	M	110.2	123.2	137.3	153.2	170.0	187.7				
	E	13.32	14.96	16.92	19.18	21.68	24.27				
	%	61.3	61.1	61.3	60.7	59.6	57.8				
	T	170.3	162.9	155.1	147.9	141.7	136.9				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A11. L-41A at 40°F Superheat, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (65)	15 (72)	20 (79)	25 (87)	30 (96)	35 (105)	40 (115)	45 (125)	50 (136)	55 (148)
140 (498)	C							15774	17693	19709	21838
	P							2198	2186	2178	2172
	A							9.58	9.53	9.50	9.47
	M							176.2	196.5	217.7	239.9
	E							7.18	8.09	9.05	10.06
	%							69.0	72.2	74.6	77.0
	T							273.5	262.8	254.0	246.5
130 (438)	C						15276	17165	19081	21238	23417
	P						1939	1922	1914	1902	1889
	A						8.46	8.39	8.35	8.30	8.25
	M						162.7	181.7	200.9	222.5	244.0
	E						7.88	8.93	9.97	11.17	12.39
	%						70.7	73.6	76.1	78.2	80.0
	T						259.4	249.0	240.8	233.1	226.9
120 (385)	C			11536	13116	14857	16582	18521	20620	22739	25086
	P			1727	1714	1701	1694	1686	1676	1665	1656
	A			7.55	7.50	7.44	7.40	7.37	7.32	7.28	7.24
	M			119.1	134.5	151.6	168.2	186.9	207.0	227.1	249.3
	E			6.68	7.65	8.73	9.79	10.98	12.30	13.66	15.15
	%			66.0	69.0	72.2	74.8	76.6	78.2	79.8	81.0
	T			269.3	256.7	244.5	235.5	227.6	220.4	214.4	209.3
110 (337)	C	9411	11021	12489	14143	15929	17812	19761	21926	24202	26565
	P	1533	1521	1510	1505	1499	1492	1483	1471	1459	1443
	A	6.72	6.67	6.63	6.60	6.57	6.54	6.51	6.46	6.41	6.33
	M	93.9	109.3	123.1	138.6	155.2	172.6	190.5	210.4	231.0	252.5
	E	6.14	7.25	8.27	9.40	10.63	11.94	13.32	14.90	16.58	18.40
	%	62.7	67.3	68.7	71.5	74.0	76.0	77.9	79.1	79.7	80.2
	T	273.9	255.7	246.1	234.8	224.8	216.5	209.5	203.2	197.8	193.2
100 (293)	C	10342	11792	13344	14983	16836	18751	20746	22940	25275	27773
	P	1343	1336	1333	1327	1319	1310	1303	1289	1273	1262
	A	5.92	5.89	5.87	5.85	5.82	5.78	5.75	5.69	5.62	5.58
	M	98.9	112.1	126.1	140.8	157.5	174.5	192.1	211.4	231.8	253.4
	E	7.70	8.83	10.01	11.30	12.76	14.31	15.93	17.79	19.85	22.01
	%	67.2	69.3	71.3	73.5	74.8	75.9	76.5	76.7	76.4	75.7
	T	243.8	232.5	222.7	213.2	205.2	198.5	192.7	187.4	182.7	179.1
90 (254)	C	11102	12604	14212	15958	17810	19778	21864	24168	26597	29243
	P	1184	1181	1176	1170	1165	1154	1141	1126	1111	1094
	A	5.25	5.24	5.21	5.19	5.17	5.13	5.07	5.01	4.95	4.88
	M	102.0	115.1	129.0	144.1	160.1	176.8	194.6	214.1	234.6	256.9
	E	9.37	10.67	12.09	13.64	15.29	17.13	19.16	21.46	23.93	26.73
	%	68.4	69.8	71.7	73.1	73.9	74.2	74.3	73.6	71.9	69.2
	T	222.8	213.4	204.0	195.8	188.8	182.7	177.3	172.4	168.4	164.8
80 (220)	C	11917	13445	15125	16839	18732	20779	22968	25347		
	P	1049	1044	1040	1034	1022	1010	994	977		
	A	4.69	4.66	4.65	4.63	4.59	4.53	4.47	4.40		
	M	105.4	118.4	132.4	146.7	162.4	179.2	197.1	216.7		
	E	11.36	12.88	14.55	16.29	18.32	20.58	23.11	25.95		
	%	69.6	70.6	71.0	71.2	70.9	70.1	68.9	66.1		
	T	200.9	192.3	185.0	178.5	172.5	167.1	162.3	158.1		
70 (188)	C	12693	14253	15884	17642	19614					
	P	929	928	921	910	899					
	A	4.21	4.21	4.18	4.13	4.09					
	M	108.3	121.0	134.1	148.3	164.1					
	E	13.67	15.36	17.24	19.40	21.82					
	%	69.4	67.7	67.5	66.9	65.8					
	T	181.3	176.5	170.1	163.9	158.4					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Table A12. L-41A at 65°F Suction Temperature, 15°F Subcooling

Suction Dew Point Temp, °F (Suction Pressure, psia)

Discharge Dew Point Temp, °F (Discharge Pressure, psia)		10 (65)	15 (72)	20 (79)	25 (87.)	30 (96.)	35 (105)	40 (115)	45 (125)	50 (136)	55 (148)
140 (498)	C							15486	17381	19374	21479
	P							2190	2176	2159	2150
	A							9.54	9.48	9.41	9.38
	M							180.6	204.8	230.9	259.2
	E							7.07	7.99	8.97	9.99
	%							66.3	68.6	70.9	72.0
	T							260.3	244.5	229.7	217.8
130 (438)	C						15030	16889	18817	20933	23167
	P						1930	1918	1906	1892	1876
	A						8.42	8.37	8.32	8.26	8.20
	M						164.4	186.4	209.5	235.6	263.8
	E						7.79	8.81	9.87	11.06	12.35
	%						68.6	70.1	71.6	73.0	73.8
	T						251.2	236.6	223.2	210.4	199.0
120 (385)	C			11589	13172	14884	16658	18530	20546	22730	25047
	P			1721	1708	1698	1692	1682	1672	1657	1647
	A			7.52	7.47	7.42	7.39	7.36	7.31	7.26	7.20
	M			118.2	135.1	153.7	173.3	194.3	217.4	243.1	270.8
	E			6.73	7.71	8.77	9.85	11.01	12.29	13.72	15.21
	%			66.9	69.3	71.7	73.5	74.3	75.1	75.4	74.9
	T			273.8	256.2	240.0	225.7	213.4	201.6	190.7	181.1
110 (337)	C		11046	12611	14247	15903	17813	19732	21874	24195	26659
	P		1517	1507	1503	1499	1492	1482	1470	1455	1439
	A		6.66	6.61	6.59	6.58	6.54	6.51	6.46	6.40	6.32
	M		107.1	122.9	139.6	156.9	177.0	197.5	220.8	246.7	274.7
	E		7.28	8.37	9.48	10.61	11.94	13.31	14.88	16.63	18.53
	%		68.8	71.0	72.4	72.7	73.3	74.0	74.0	73.6	73.0
	T		264.6	247.6	233.0	220.8	208.1	196.6	185.6	175.2	165.2
100 (293)	C	10472	11953	13537	15184	16950	18853	20883	23079	25472	28078
	P	1338	1333	1331	1325	1320	1309	1301	1286	1270	1255
	A	5.89	5.88	5.87	5.85	5.82	5.78	5.74	5.68	5.61	5.55
	M	97.0	111.1	126.5	142.7	160.2	179.5	200.3	223.1	248.6	276.9
	E	7.83	8.97	10.17	11.46	12.84	14.40	16.05	17.94	20.06	22.38
	%	70.5	72.5	74.2	74.8	75.0	74.8	74.0	73.1	71.8	69.5
	T	255.7	239.1	224.1	211.5	199.9	188.8	178.5	168.5	158.7	149.9
90 (254)	C	11284	12717	14285	16048	17843	19824	21965	24255	26823	29648
	P	1183	1179	1174	1170	1167	1157	1144	1127	1111	1093
	A	5.24	5.24	5.22	5.19	5.18	5.14	5.09	5.02	4.95	4.87
	M	100.5	113.8	128.4	145.0	162.2	181.4	202.3	225.1	251.4	280.6
	E	9.54	10.78	12.17	13.71	15.29	17.14	19.21	21.51	24.15	27.13
	%	73.2	72.4	72.6	72.6	72.2	71.3	70.2	68.5	65.5	61.9
	T	232.1	220.7	208.2	196.0	185.1	174.4	164.2	154.6	145.3	136.3
80 (220)	C	12084	13615	15235	16967	18840	20914	23155	25576	28194	
	P	1045	1043	1039	1034	1023	1011	996	981	968	
	A	4.68	4.66	4.65	4.63	4.59	4.54	4.48	4.42	4.37	
	M	103.8	117.4	132.0	147.8	165.0	184.2	205.4	228.7	254.3	
	E	11.57	13.06	14.66	16.41	18.41	20.69	23.24	26.06	29.13	
	%	75.2	74.8	73.9	72.4	70.7	68.6	65.8	62.0	56.7	
	T	210.0	198.4	187.6	177.4	167.3	157.5	148.1	139.3	131.8	
70 (188)	C	12717	14228	15891	17706	19673	21856				
	P	925	925	920	911	898	888				
	A	4.19	4.20	4.17	4.14	4.10	4.05				
	M	105.5	118.5	132.9	148.8	166.3	185.9				
	E	13.74	15.38	17.28	19.43	21.90	24.63				
	%	72.7	70.1	68.4	66.5	63.8	61.0				
	T	194.2	185.0	174.5	164.3	154.3	144.6				

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps) at 230V, M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr)
%: Isentropic Efficiency (%), T: Discharge Temperature (°F)

Appendix B
Performance Maps

- 10-Coefficient polynomial equation for each test refrigerant

Tables B1 to B4 provide 10 coefficients for mass flow rate, capacity, power, EER, and discharge temperature for each refrigerant as a function of suction dew point temperature and discharge dew point temperature. These coefficients are derived from the test data at 20°F superheat and 15°F subcooling.

$$X = C_1 + C_2*S + C_3*D + C_4*S^2 + C_5*S*D + C_6*D^2 + C_7*S^3 + C_8*D*S^2 + C_9*S*D^2 + C_{10}*D^3$$

Where:

C = Equation coefficient, represents compressor performance
S = Suction dew point temperature. °F
D = Discharge dew point temperature. °F
X = Compressor performance (mass flow rate, capacity, power, EER)

Table B1: 10 Coefficients for R-410A

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C_1	1.664E+02	1.846E+04	1.317E+02	3.882E+01	8.325E+01
C_2	3.078E+00	3.296E+02	-3.788E+00	9.300E-01	-1.089E+00
C_3	-9.208E-01	-1.284E+02	1.750E+01	-6.643E-01	8.330E-01
C_4	2.394E-02	3.508E+00	-4.397E-02	8.095E-03	3.046E-03
C_5	-2.357E-03	-5.056E-01	7.012E-02	-1.327E-02	4.893E-03
C_6	9.135E-03	6.195E-01	-1.251E-01	4.834E-03	1.907E-03
C_7	3.102E-04	2.726E-02	-1.203E-04	2.976E-05	-2.302E-04
C_8	-1.589E-04	-2.708E-02	3.459E-04	-7.582E-05	3.666E-04
C_9	7.647E-05	1.449E-03	-4.962E-04	5.938E-05	-2.402E-04
C_{10}	-5.191E-05	-3.120E-03	8.889E-04	-1.491E-05	4.617E-05

Table B2: 10 Coefficients for R32

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C_1	1.457E+02	2.037E+04	-1.340E+02	3.884E+01	4.790E+01
C_2	2.291E+00	3.614E+02	9.858E+00	9.253E-01	-1.659E+00
C_3	-1.846E+00	-2.346E+02	2.344E+01	-7.197E-01	2.902E+00
C_4	1.222E-02	2.735E+00	-1.489E-01	8.854E-03	1.631E-02
C_5	2.255E-03	-5.592E-01	-1.714E-01	-1.394E-02	-5.321E-03
C_6	1.974E-02	2.017E+00	-1.586E-01	5.895E-03	-1.571E-02
C_7	2.024E-04	2.540E-02	8.798E-04	2.688E-05	-3.194E-04
C_8	-7.444E-05	-2.161E-02	3.222E-04	-8.579E-05	3.854E-04
C_9	1.218E-05	1.146E-03	9.477E-04	6.727E-05	-2.112E-04
C_{10}	-8.419E-05	-8.532E-03	9.066E-04	-2.024E-05	1.129E-04

Table B3: 10 Coefficients for DR5

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C_1	1.174E+02	1.534E+04	5.396E+01	3.584E+01	7.059E+01
C_2	2.387E+00	3.015E+02	-8.285E+00	9.093E-01	-1.564E+00
C_3	-4.308E-01	-7.280E+01	2.099E+01	-6.053E-01	1.705E+00
C_4	1.589E-02	2.798E+00	-1.395E-01	7.985E-03	2.118E-03
C_5	4.353E-04	-1.475E-01	2.372E-01	-1.324E-02	1.084E-02
C_6	3.643E-03	1.085E-01	-1.981E-01	4.488E-03	-7.019E-03
C_7	1.546E-04	1.730E-02	-6.469E-04	2.522E-05	-1.998E-04
C_8	-4.577E-05	-1.594E-02	1.882E-03	-7.443E-05	3.708E-04
C_9	2.488E-05	-1.734E-03	-1.852E-03	6.110E-05	-2.840E-04
C_{10}	-2.626E-05	-1.126E-03	1.281E-03	-1.458E-05	8.483E-05

Table B4: 10 Coefficients for L-41A

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C_1	8.274E+01	1.306E+04	1.812E+02	3.422E+01	1.049E+02
C_2	2.284E+00	2.952E+02	-6.345E+00	9.161E-01	-1.182E+00
C_3	3.577E-01	-2.999E+01	1.513E+01	-5.742E-01	6.077E-01
C_4	2.249E-02	3.306E+00	-1.050E-01	8.863E-03	-7.583E-03
C_5	-6.649E-03	-8.006E-01	1.697E-01	-1.403E-02	7.835E-03
C_6	-4.301E-03	-2.722E-01	-1.260E-01	4.336E-03	5.212E-03
C_7	1.357E-04	1.605E-02	-4.979E-04	2.896E-05	-2.075E-04
C_8	-1.206E-04	-2.162E-02	1.280E-03	-8.660E-05	5.013E-04
C_9	8.830E-05	4.470E-03	-1.222E-03	6.909E-05	-3.228E-04
C_{10}	-2.247E-06	-1.309E-04	9.270E-04	-1.481E-05	4.851E-05

- Capacity, Input Power and EER

  Figures B1 to B16 present measured capacity, input power, EER, and isentropic efficiency as a function of suction dew point temperature for given discharge dew point temperature at 20°F superheat and 15°F subcooling for baseline and each alternative refrigerant tested. Note that, some irregular variation in isentropic efficiency is observed, particularly in Figure B14. This is caused by small variations in discharge pressure, which is within specified tolerance for the calorimeter. Steady state conditions for saturated suction temperature, suction temperature, saturated discharge temperature, and expansion valve inlet temperature were specified as setpoint temperature ±0.5°F.

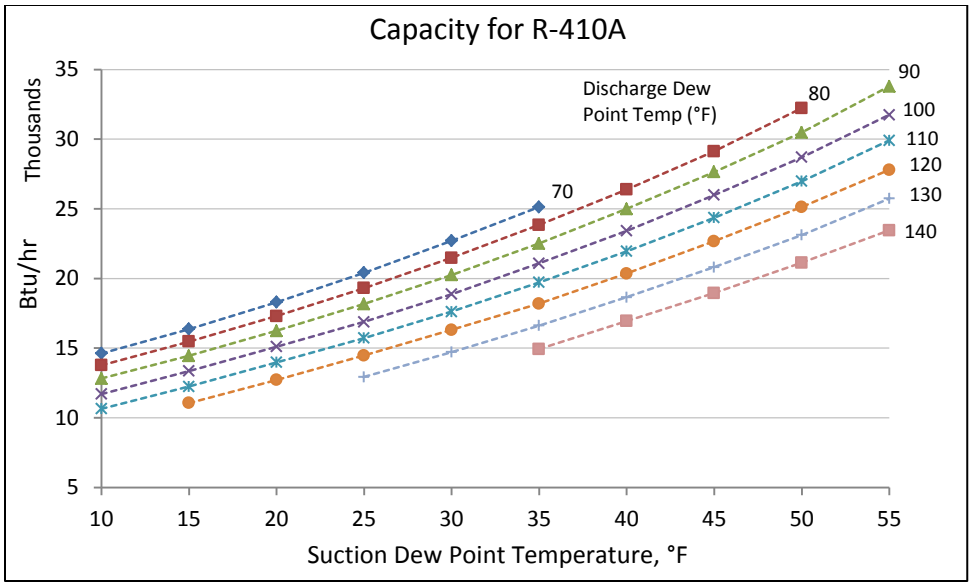

Figure B1 Capacity for R-410A.

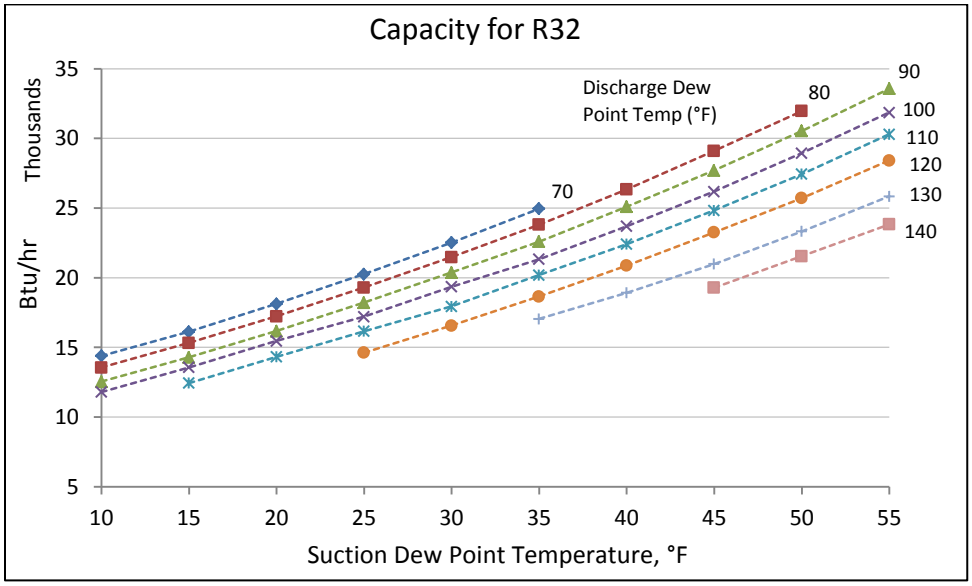

Figure B2 Capacity for R32.

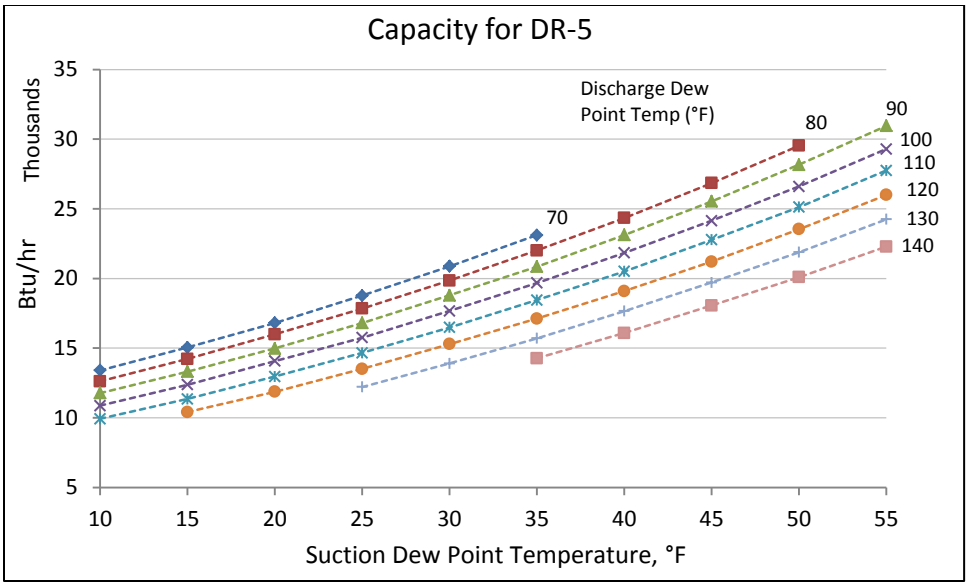

Figure B3 Capacity for DR-5.

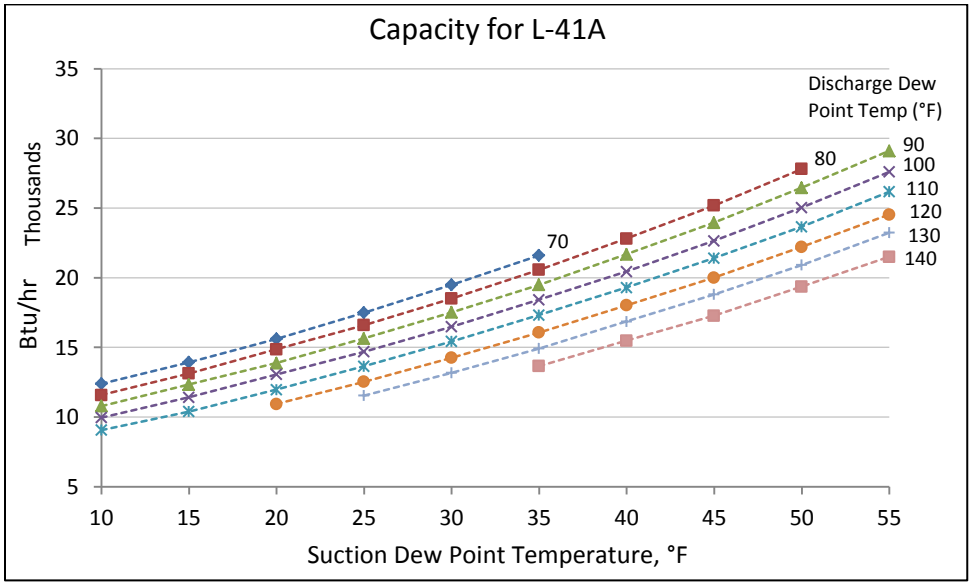

Figure B4 Capacity for L-41A.

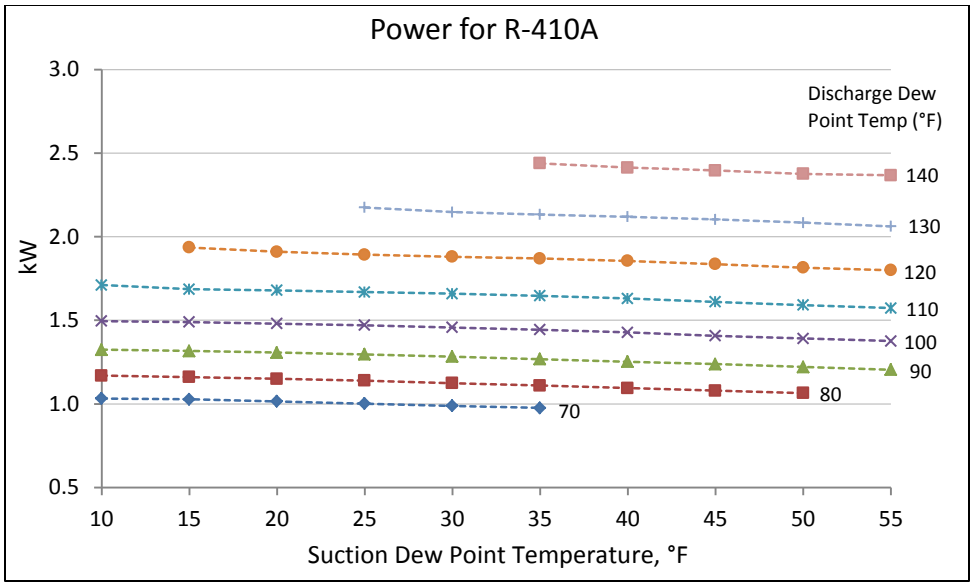

Figure B5 Power for R-410A.

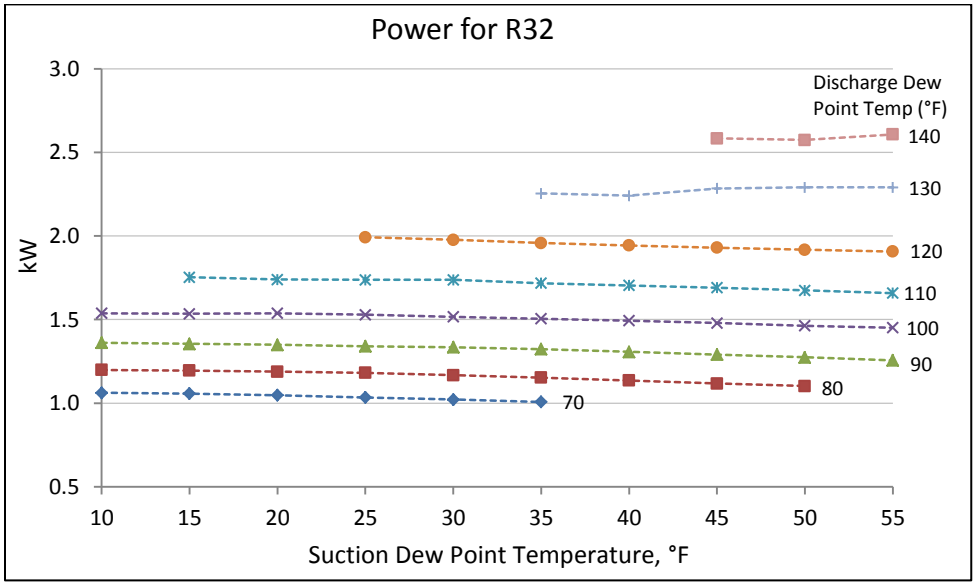

Figure B6 Power for R32.

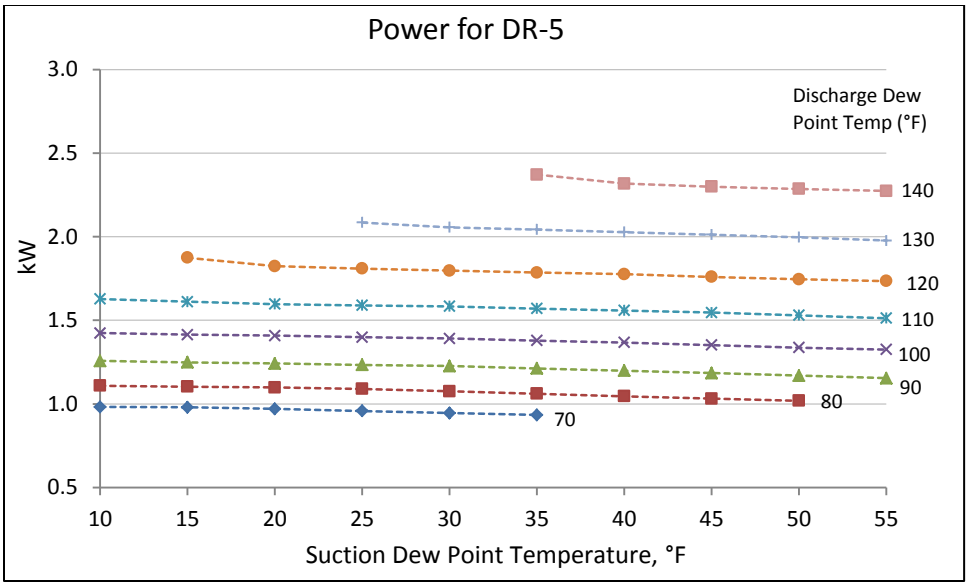

Figure B7 Power for DR-5.

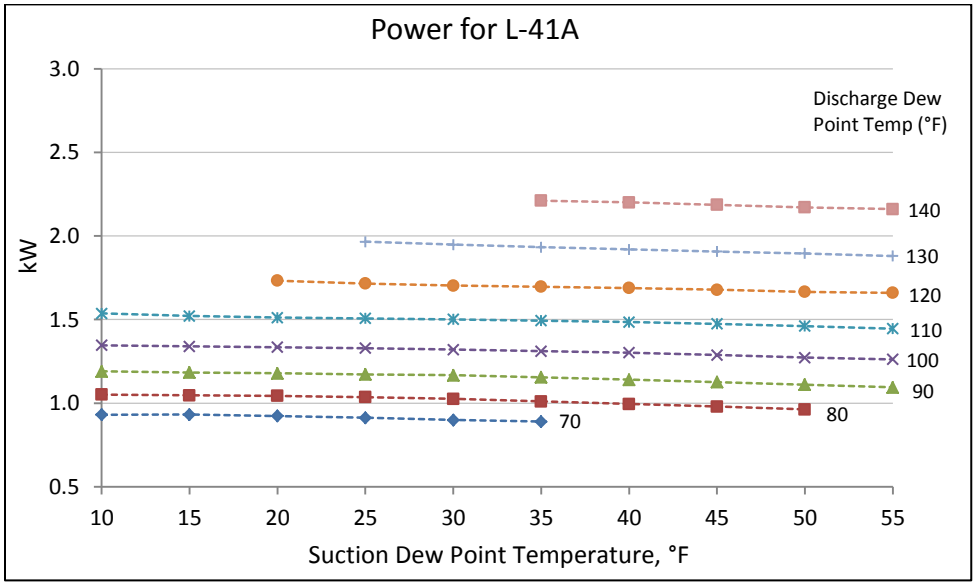

Figure B8 Power for L-41A.

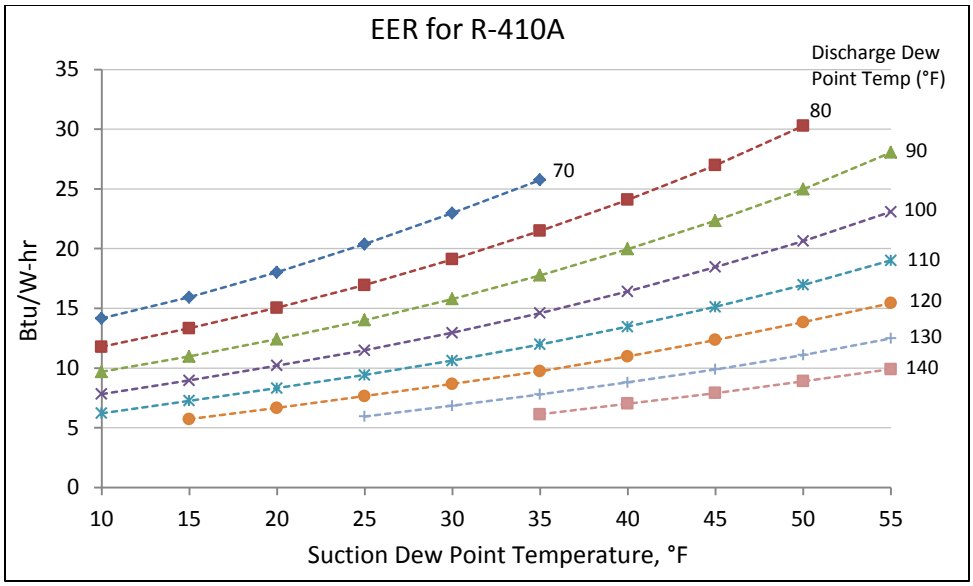

Figure B9 EER for R-410A.

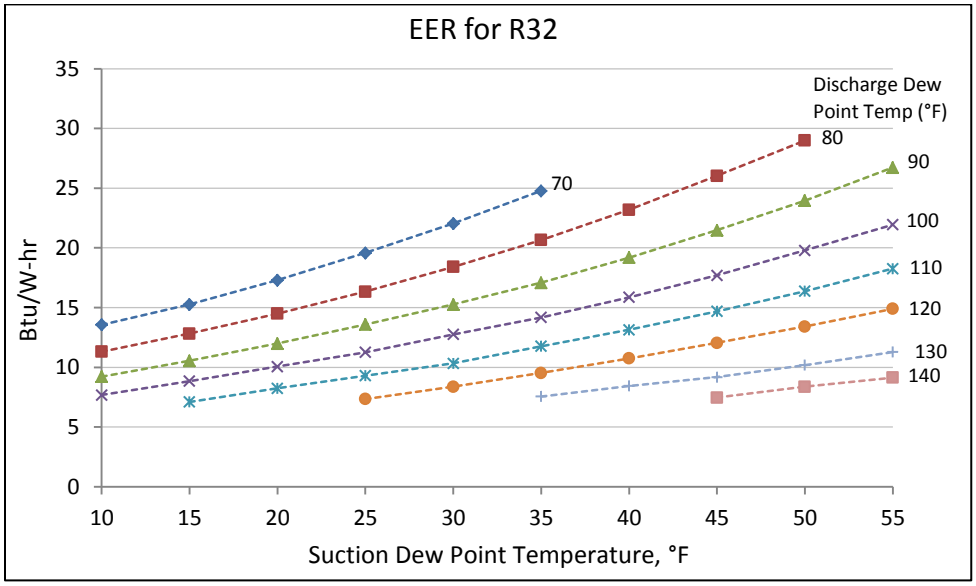

Figure B10 EER for R32.

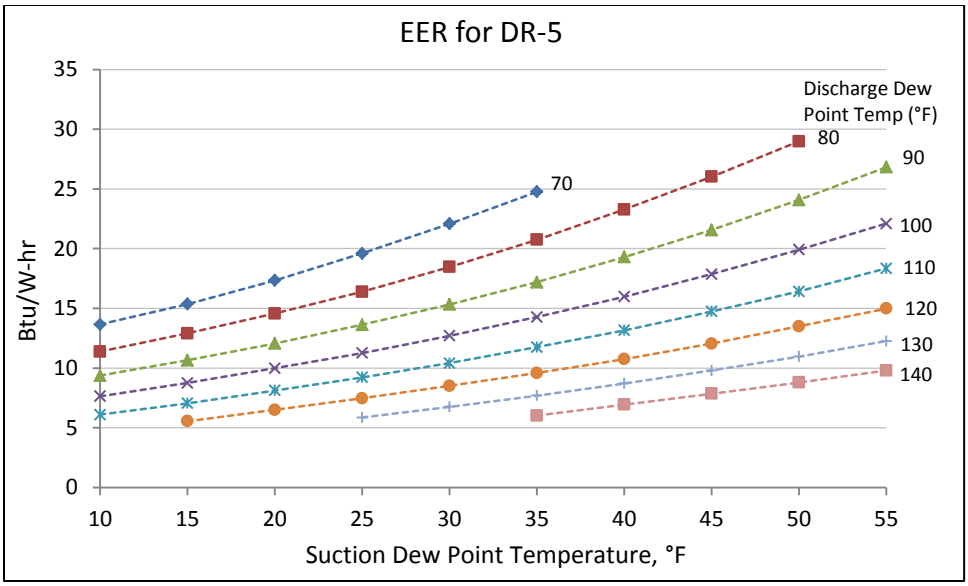

Figure B11 EER for DR-5.

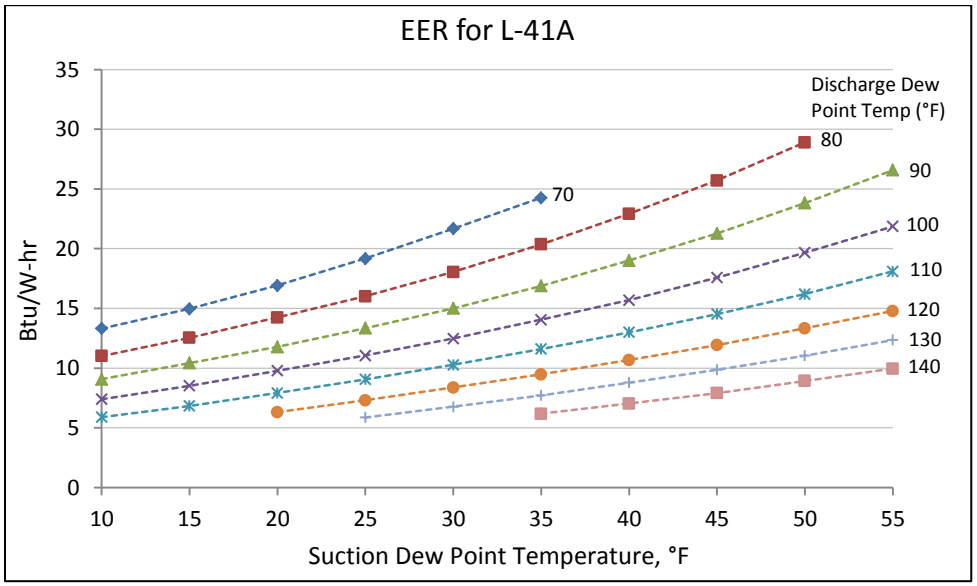

Figure B12 EER for L-41A.

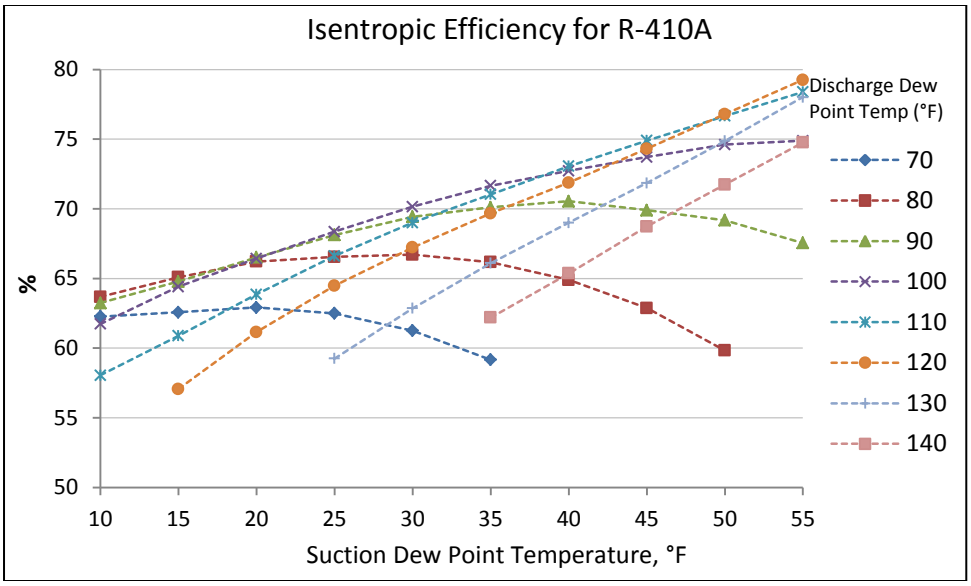

Figure B13 Isentropic efficiency for R-410A.

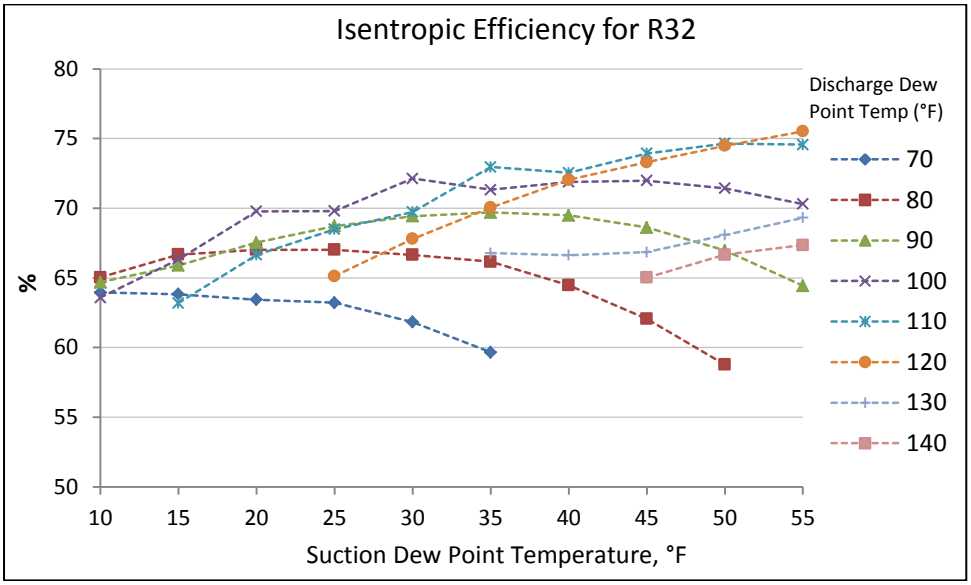

Figure B14 Isentropic efficiency for R32.

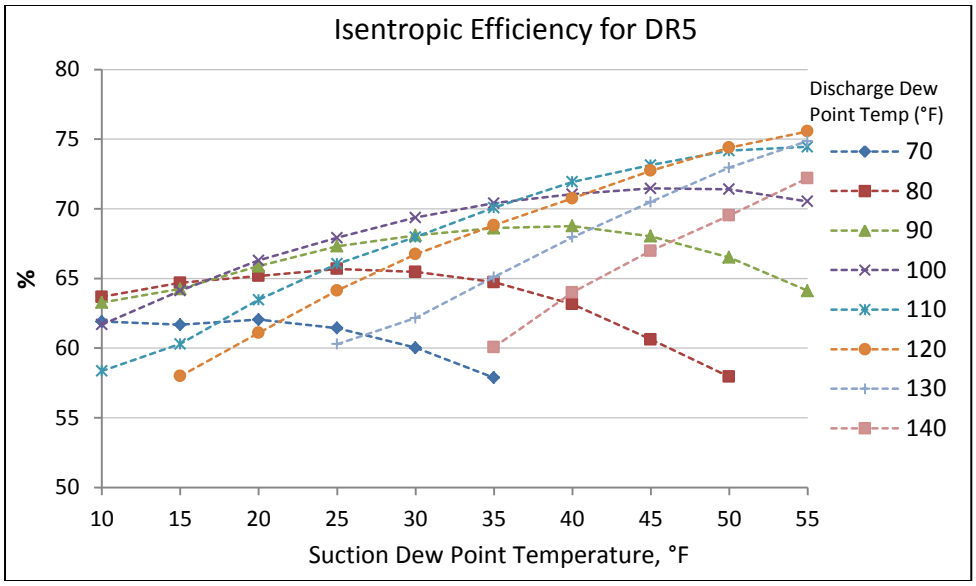

Figure B15 Isentropic efficiency for DR5.

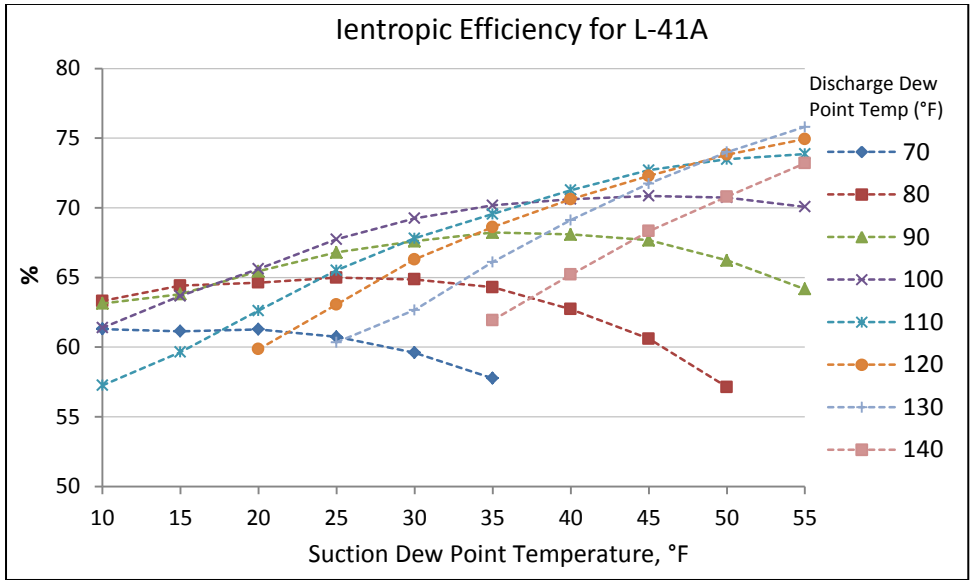

Figure B16 Isentropic efficiency for L-41A.