



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

TEST REPORT #21

Compressor Calorimeter Test of R-404A Alternatives ARM-31a, D2Y-65, L-40, and R-32/R-134a (50/50)

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List of Tested Refrigerants' Compositions (Mass%)

ARM-31a	R-32/R-134a/R-1234yf (28/21/51)
D2Y-65	R-32/R-1234yf (35/65)
L-40	R-32/R-152a/R-1234yf/R-1234ze(E) (40/10/20/30)
R-32/R-134a	R-32/R-134a (50/50)

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Abstract

As a contribution to the AHRI Low-GWP Alternative Refrigerants Evaluation Program (AREP), this study compares the performance of four lower-GWP alternative refrigerants, ARM-31a, D2Y-65, L-40, and R-32 + R-134a mixture, to that of refrigerant R-404A (baseline) in a scroll compressor designed for medium temperature refrigeration applications. These comparisons were carried out via compressor calorimeter tests performed on a compressor designed for refrigerant R-404A and having a nominal rated capacity of 23,500 Btu/hr.

Tests were conducted over a suction dew point temperature range of -10°F to 35°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 10°F to 15°F was maintained for all the test conditions. However, the cooling capacities reported in this study are normalized for 0°F subcooling.

The tests showed that the compressor energy efficiency ratio (EER) and cooling capacity with all four alternative refrigerants tested are higher at higher saturation suction and saturation discharge temperature and lower at lower saturation suction and saturation discharge temperature, compared to that of R-404A. Discharge temperatures of all the alternative refrigerants were higher than that of R-404A at all test conditions.

1. Introduction

This report investigates the tested performance of lower-GWP candidate refrigerants ARM-31a, D2Y-65, L-40, and a 50.53% R-32 + 49.47% R-134a mixture (hereafter referred to as R-32 + R-134a mixture) as alternatives for the baseline refrigerant R-404A using a 36,000 Btu/hr compressor calorimeter located at the Heat Exchanger Advanced Testing Facility in building 5800 at Oak Ridge National Laboratory. These tests were conducted during January to March 2013.

R-404A is a near-azeotropic blend of R125, R-143a, and R-134a with 0.44/0.52/0.04 mass fraction and has a GWP of 3260¹. ARM-31a, D2Y-65, L-40, and a R-32 + R-134a mixture are new blends with lower GWP and are under development by Arkema, Daikin, Honeywell, and National Refrigerants, respectively.

This report compares various performance parameters, such as cooling capacity, compressor power, refrigerant mass flow rate, EER, isentropic efficiency and discharge temperature, of four alternative refrigerants to that of R-404A.

¹ Source: "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>.

2. Test Setup

a. Description of Test Refrigerant, Lubricant, and Charge

- Refrigerant or refrigerant blend tested
 - R-404A: R125, R-143a, and R-134a blend with 0.44/0.52/0.04 mass fraction
 - ARM-31a
 - D2Y-65
 - L-40
 - R-32 + R-134a mixture with 0.5053/0.4947 mass fraction
- Refrigerant charge: The refrigerant charge required to achieve similar subcooling after the condenser at identical test conditions is given as follows:
 - R-404A: 3 lbs 12 ounces
 - ARM-31a: 3 lbs 12 ounces
 - D2Y-65: 3 lbs 8 ounces
 - L-40: 4 lbs
 - R-32 + R-134a mixture: 3 lb 12 ounces
- 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 42 oz of polyolester oil (POE).

b. Description of the Compressor

The compressor used for this test was a Copeland hermetic scroll compressor ZS21KAE-PFV that has a 7/8" suction port and a 1/2" discharge port. This hermetic compressor uses a 208/230 volt, single phase, 60 Hz electric motor. The displacement volume of the compressor is 3.11 in³/rev or 377.71 ft³/hr. Table 1 shows the manufacturer-provided performance of the compressor at standard test conditions.

Table 1 Manufacturer's Compressor Performance Data

Evaporating (°F) / Condensing (°F)	20 / 120
Return Gas (°F) / Liquid to Expansion Valve (°F)	65 / 120
Capacity (Btu/hr)	23500
Power (Watts)	3320
Current (Amps)	15.60
EER (Btu/Wh)	7.10
Mass Flow (lbs/hr)	495

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 outlets about 1.5 ft above the compressor. Combined airflow rate of the two fans was 750 cfm. The compressor chamber air temperature was maintained at $95\pm 1^\circ\text{F}$ for all the tests.

To assure the accuracy of the test set-up, 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 (saturation suction temperature of 20°F , suction temperature of 65°F , saturation discharge temperature of 120°F , and liquid temperature of 120°F), the calculated EER and capacity from the test data were within $\pm 0.2\%$ and $\pm 2.7\%$, respectively, of the compressor manufacturer's data. This is well within the $\pm 5\%$ tolerance allowed in ANSI/AHRI 540-2004 for capacity and efficiency.

c. Description of the Compressor Calorimeter Test Loop

The compressor calorimeter test loop, shown in Figure 1, consists of a test 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 also shows the location of the various sensors in the compressor calorimeter test loop. Table 2 lists the accuracy of the test instruments used in the calorimeter.

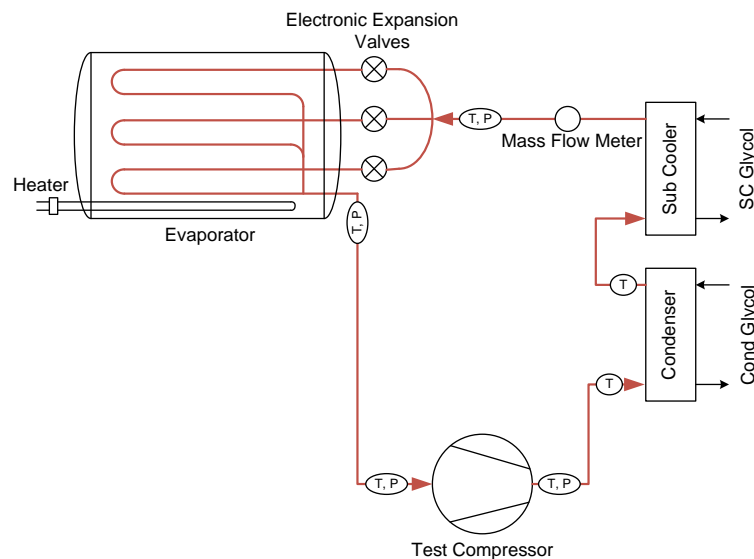


Figure 1 Location of various sensors in the compressor calorimeter test loop.

Table 2. Accuracy of the Instruments used in the Compressor Calorimeter Test Loop

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 ANSI/ASHRAE Standard 23.1-2010. Before testing each alternative refrigerant, performance of the test compressor was checked using the baseline refrigerant R-404A. The intermediate tests confirmed repeatability of cooling capacity within 0.45% and EER within 0.50% at the standard test condition.

Tests were conducted over a wide range of operating conditions. The suction dew point temperature was varied between -10°F and 35°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 10°F to 15°F subcooling and either 20°F or 40°F superheat. Tests were also conducted at a fixed 65°F suction temperature. The cooling capacities reported in this report are normalized for 0°F subcooling.

For compressor safety, the maximum discharge temperature was set at 275°F for all tests. Therefore refrigerants with higher discharge temperature yielded lower number of test data points compared to the refrigerants with lower discharge temperature. Test conditions with lower suction dew point temperature and higher discharge dew point temperature combinations were dropped due to the limit on discharge 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 for mass flow, capacity, power, EER and discharge temperature computed from the test results for each test refrigerant at standard rating conditions of 65°F suction temperature and 0°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 65°F suction temperature and 0°F subcooling for R-404A and each alternative refrigerant tested. The isentropic efficiency plots show the trends and shifts in compressor performance separately from the refrigerant property performance.

The properties of R-404A were calculated using REFPROP version 9.0 (Lemmon et al, 2010). Interaction parameters and “mixture” files provided by the refrigerant manufacturers were used in REFPROP to calculate properties of the alternative refrigerants tested.

Table 3 shows differences in EER, capacity, and discharge temperature of the four alternative refrigerants compared to that of R-404A at 0°F subcooling, 65°F suction temperature, 70°F to 140°F saturation discharge temperature and -10°F to 35°F saturation suction temperature. The table also shows the change in performance parameters at the standard test condition of 120°F discharge dew point temperature and 20°F suction dew point temperature.

Table 3. Performance of Alternative Refrigerants compared to that of R-404A

Refrigerant	Test Condition	Deviation from baseline (R-404A)		
		EER (%)	Capacity (%)	Discharge Temperature (°R)
ARM-31a	Evap 20°F/ Cond 120°F	+9.7%	-5.6%	+24
	Over the range	-4.4% to +22.8%	-18.5% to +6.5%	+16 to +36
	Average	+6.2%	-9.1%	+25
D2Y-65	Evap 20°F/ Cond 120°F	+6.5%	+0.6%	+26
	Over the range	-4.2% to +14.6%	-11.0% to +9.7%	+18 to +36
	Average	+3.2%	-2.9%	+27
L-40	Evap 20°F/ Cond 120°F	+9.8%	-4.9%	+37
	Over the range	-5.4% to +24.7%	-20.0% to +8.9%	+25 to +53
	Average	+5.3%	-9.7%	+37
R-32 + R-134a mixture	Evap 20°F/ Cond 120°F	+4.2%	+3.8%	+63
	Over the range	-7.6% to +15.2%	-12.6% to +18%	+38 to +74
	Average	+1.0%	-2.1%	+54

Figures 2 to 5 present the ratios of EER_{alt} and $EER_{Baseline}$ as a function of suction dew point temperature for given discharge dew point temperature at 65°F suction temperature and 0°F subcooling for each alternative refrigerant tested. At almost all suction dew point temperatures used in these tests the $EER_{alt}/EER_{Baseline}$ was greater at higher discharge dew point temperature (110 to 110°F or higher) for ARM-31a, D2Y-64, and L-40; however, for the R-32 + R-134a mixture this was true only for suction dew point temperature 15°F.

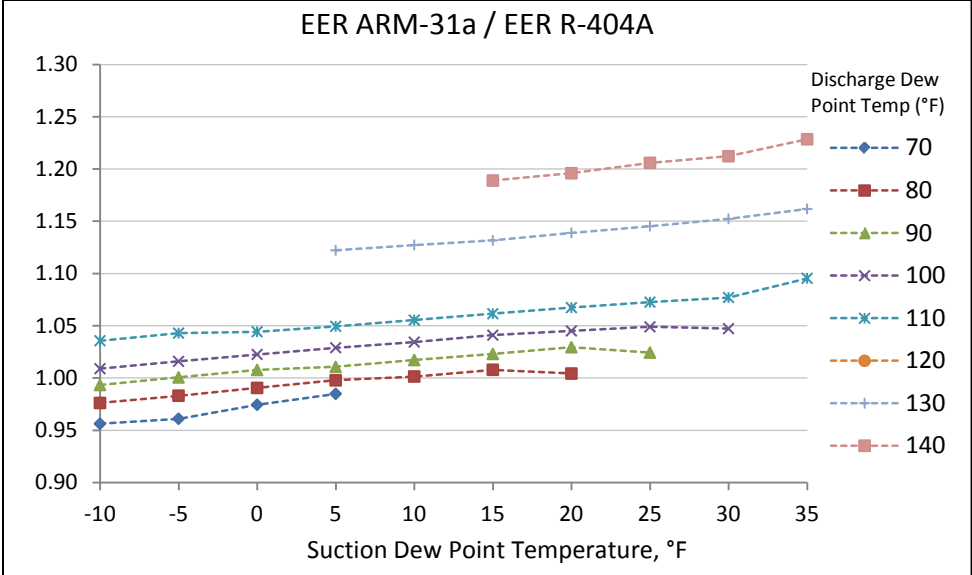


Figure 2 EER of ARM-31a compared to EER of R-404A.

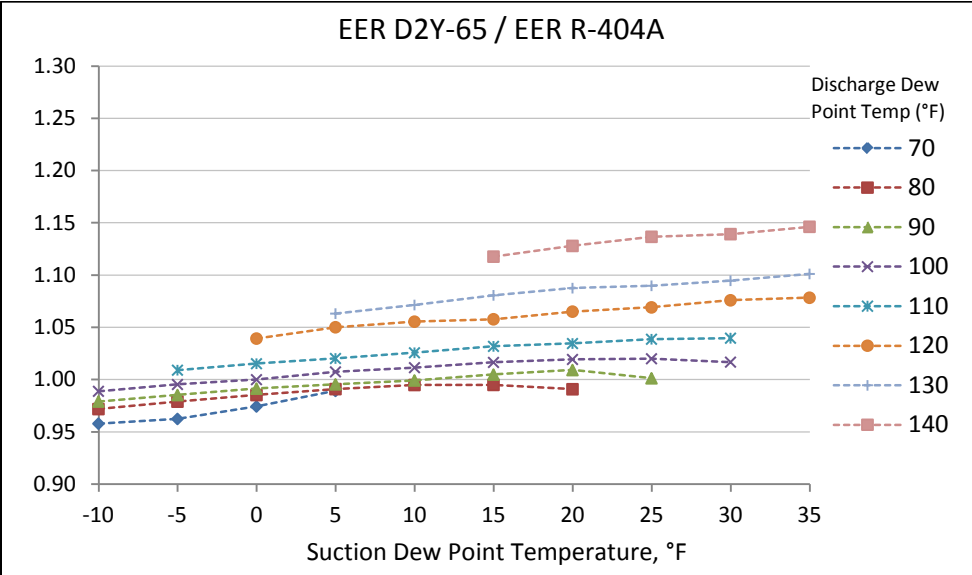


Figure 3 EER of D2Y-65 compared to EER of R-404A.

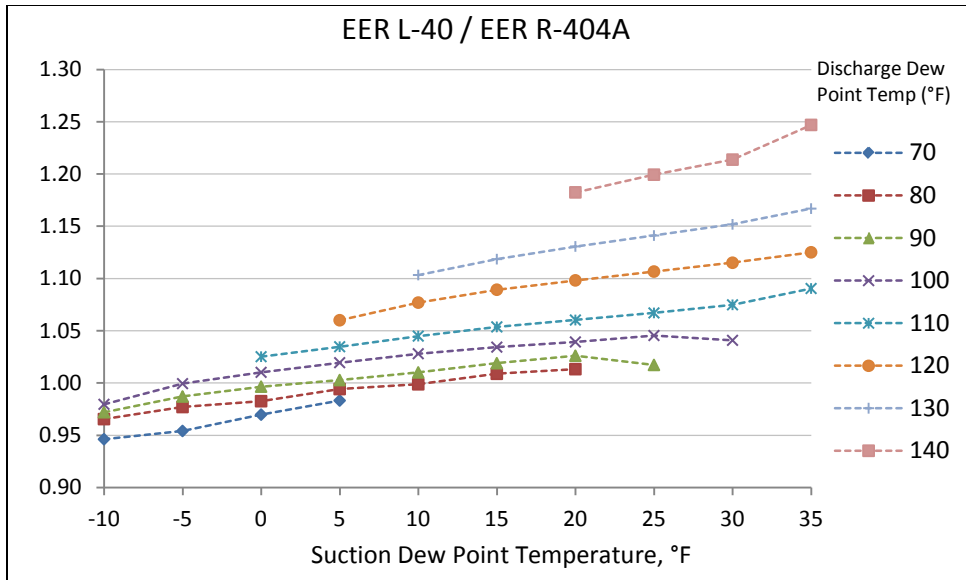


Figure 4 EER of L-40 compared to EER of R-404A.

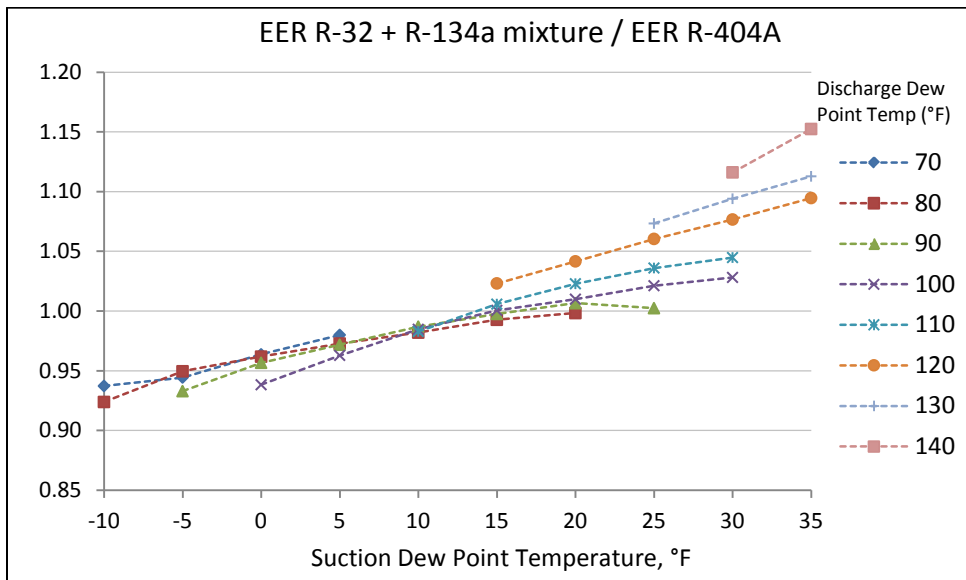


Figure 5 EER of R-32 + R-134a mixture compared to EER of R-404A.

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ANSI/ASHRAE Standard 23.1-2010, *Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant*

Appendix A

Tabular Data

Tables which follow 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-404A at 65°F Suction Temperature, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (38)	-5 (42)	0 (47)	5 (52)	10 (57)	15 (63)	20 (69)	25 (76)	30 (84)	35 (91)
140 (416)	C				13348	14815	16572	18338	20230	22247	24222
	P				3837	3889	3952	3998	4052	4104	4168
	A				17.65	17.87	18.16	18.36	18.60	18.83	19.11
	M				338.1	379.2	425.7	475.2	529.3	588.8	651.4
	E				3.48	3.81	4.19	4.59	4.99	5.42	5.81
	%				62.4	64.2	66.2	67.9	69.3	70.5	70.9
	T				251.5	240.6	229.3	219.6	210.9	202.9	196.5
130 (368)	C		12088	13630	15255	17012	18874	20879	23070	25377	27743
	P		3388	3403	3487	3523	3566	3617	3669	3714	3765
	A		15.73	15.80	16.16	16.32	16.52	16.73	16.96	17.17	17.38
	M		270.3	306.1	344.1	386.2	431.4	480.9	536.2	595.5	660.0
	E		3.57	4.01	4.38	4.83	5.29	5.77	6.29	6.83	7.37
	%		61.4	63.3	65.5	67.5	69.2	70.6	71.6	72.7	72.8
	T		259.2	246.2	234.2	223.3	213.5	204.8	196.8	189.3	183.0
120 (324)	C	12003	13509	15165	16937	18862	20945	23192	25611	28216	30992
	P	2955	3009	3063	3121	3175	3229	3278	3322	3364	3397
	A	13.94	14.17	14.40	14.64	14.87	15.10	15.31	15.50	15.67	15.82
	M	242.5	274.2	309.2	347.1	388.7	434.6	484.5	539.5	600.1	666.3
	E	4.06	4.49	4.95	5.43	5.94	6.49	7.07	7.71	8.39	9.12
	%	63.8	65.6	67.4	68.8	70.1	71.2	72.2	73.2	73.7	74.2
	T	251.0	239.0	227.6	217.5	208.2	199.5	191.4	183.8	176.8	170.1
110 (285)	C	13267	14942	16737	18687	20783	23084	25585	28285	31194	33875
	P	2738	2771	2804	2846	2892	2938	2977	3009	3035	3059
	A	13.06	13.20	13.33	13.50	13.70	13.90	14.05	14.19	14.30	14.41
	M	247.1	279.4	314.4	352.7	394.3	440.7	491.7	547.5	608.5	667.8
	E	4.85	5.39	5.97	6.57	7.19	7.86	8.60	9.40	10.28	11.07
	%	65.6	67.6	69.3	70.6	71.9	72.7	73.5	74.2	74.9	74.7
	T	235.7	223.6	212.9	203.4	194.4	186.3	178.5	171.2	164.1	158.7
100 (249)	C	14473	16241	18170	20270	22557	25052	27769	30702	33975	
	P	2469	2508	2548	2591	2630	2665	2692	2714	2734	
	A	11.98	12.15	12.31	12.49	12.64	12.79	12.90	12.99	13.07	
	M	250.9	282.5	317.4	355.7	397.8	444.2	495.3	551.3	615.4	
	E	5.86	6.48	7.13	7.82	8.58	9.40	10.31	11.31	12.43	
	%	68.3	69.8	70.9	71.8	72.6	73.4	73.9	74.5	74.7	
	T	219.0	208.4	199.0	190.2	181.9	174.0	166.6	159.3	152.4	
90 (217)	C	15569	17462	19509	21827	24256	26938	29836	33095		
	P	2242	2282	2318	2353	2383	2410	2431	2441		
	A	11.11	11.26	11.40	11.54	11.66	11.77	11.86	11.90		
	M	252.9	284.7	319.3	358.8	400.4	447.0	498.4	556.0		
	E	6.94	7.65	8.42	9.27	10.18	11.18	12.27	13.56		
	%	70.0	70.9	71.7	72.6	72.8	73.1	73.3	73.6		
	T	204.3	195.0	186.3	177.5	169.9	162.5	155.3	148.0		
80 (188)	C	16627	18625	20842	23245	25906	28735	31911			
	P	2043	2077	2108	2136	2157	2174	2180			
	A	10.34	10.47	10.58	10.70	10.78	10.84	10.86			
	M	254.6	286.1	321.4	359.8	402.7	449.1	501.2			
	E	8.14	8.97	9.89	10.88	12.01	13.22	14.64			
	%	70.8	71.3	71.5	71.7	72.0	72.0	71.2			
	T	191.1	182.5	174.3	166.4	158.6	151.5	144.4			
70 (162)	C	17722	19885	22142	24628						
	P	1856	1881	1910	1931						
	A	9.62	9.73	9.84	9.92						
	M	257.1	289.1	323.5	361.4						
	E	9.55	10.57	11.59	12.75						
	%	70.6	70.4	70.4	70.4						
	T	179.0	170.7	163.3	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 A2: R-404A at 20°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (38)	-5 (42)	0 (47)	5 (52.)	10 (57.)	15 (63.)	20 (69.)	25 (76.)	30 (84.)	35 (91.)
140 (416)	C				11444	12941	14756	16667	18742	21006	23458
	P				3804	3873	3930	3985	4043	4096	4159
	A				17.54	17.83	18.09	18.31	18.57	18.81	19.08
	M				372.1	412.6	458.1	506.6	557.8	612.9	672.7
	E				3.01	3.34	3.75	4.18	4.64	5.13	5.64
	%				58.8	61.0	62.8	64.9	66.8	68.6	70.2
T				214.5	208.8	202.7	197.7	193.5	190.0	187.2	
130 (368)	C		10290	11795	13437	15217	17179	19348	21706	24280	26885
	P		3338	3385	3454	3509	3560	3611	3662	3713	3757
	A		15.57	15.76	16.06	16.28	16.51	16.73	16.95	17.16	17.36
	M		301.9	337.9	377.4	419.2	463.9	512.6	565.2	621.2	677.4
	E		3.08	3.48	3.89	4.34	4.83	5.36	5.93	6.54	7.16
	%		56.9	59.0	61.4	63.4	65.4	67.3	69.1	70.7	72.3
T		213.1	205.6	198.0	192.4	187.3	183.0	179.3	176.2	174.1	
120 (324)	C	10339	11843	13494	15287	17287	19464	21847	24443	27335	30046
	P	2962	3022	3088	3137	3191	3238	3282	3321	3360	3396
	A	14.00	14.25	14.52	14.73	14.96	15.15	15.34	15.51	15.67	15.82
	M	272.8	306.4	343.2	381.8	424.0	469.1	518.1	570.4	627.8	679.9
	E	3.49	3.92	4.37	4.87	5.42	6.01	6.66	7.36	8.13	8.85
	%	56.3	59.0	61.6	63.4	65.3	67.1	68.9	70.7	72.3	74.0
T	205.3	196.6	188.5	183.0	177.7	173.4	169.5	166.0	163.0	161.5	
110 (285)	C	11656	13273	15087	17061	19248	21613	24250	27133	30342	
	P	2715	2767	2815	2863	2907	2946	2982	3012	3035	
	A	12.99	13.21	13.40	13.60	13.78	13.94	14.09	14.21	14.31	
	M	277.3	310.3	346.7	385.6	428.0	473.1	523.1	576.5	635.6	
	E	4.29	4.80	5.36	5.96	6.62	7.34	8.13	9.01	10.00	
	%	59.0	61.0	63.1	64.9	66.7	68.4	70.1	71.7	73.2	
T	187.5	180.4	174.1	168.9	164.3	160.1	156.5	153.3	150.5		
100 (249)	C	12893	14659	16639	18781	21152	23737	26555	29698	32835	
	P	2482	2531	2574	2612	2647	2679	2704	2722	2740	
	A	12.06	12.26	12.42	12.58	12.72	12.85	12.96	13.03	13.10	
	M	280.0	313.3	350.1	389.2	431.9	477.8	526.9	581.5	635.5	
	E	5.19	5.79	6.46	7.19	7.99	8.86	9.82	10.91	11.98	
	%	60.3	62.1	64.1	65.7	67.4	69.0	70.5	71.9	73.7	
T	172.9	166.4	160.4	155.6	151.2	147.5	144.3	141.3	139.1		
90 (217)	C	14105	16006	18126	20456	22992	25753	28834	31931		
	P	2278	2313	2353	2383	2409	2429	2444	2457		
	A	11.25	11.39	11.55	11.67	11.77	11.86	11.90	11.96		
	M	282.6	315.9	352.7	392.5	435.1	480.9	531.6	582.6		
	E	6.19	6.92	7.70	8.58	9.54	10.60	11.80	13.00		
	%	61.0	62.8	64.4	65.9	67.3	68.5	69.7	71.1		
T	158.8	152.8	147.6	142.9	139.1	135.8	132.7	130.3			
80 (188)	C	15276	17293	19574	22058	24784	27655	30848			
	P	2085	2116	2143	2168	2183	2200	2202			
	A	10.51	10.63	10.72	10.82	10.89	10.94	10.95			
	M	284.7	317.8	354.9	394.8	438.0	483.4	532.0			
	E	7.33	8.17	9.13	10.17	11.35	12.57	14.01			
	%	61.2	62.7	64.2	65.1	66.2	66.9	67.6			
T	145.7	140.3	135.4	131.4	127.6	125.2	121.8				
70 (162)	C	16428	18627	21026	23659						
	P	1905	1933	1956	1956						
	A	9.80	9.92	9.99	10.00						
	M	286.6	321.0	358.8	396.8						
	E	8.62	9.64	10.75	12.10						
	%	60.6	61.7	62.8	63.1						
T	133.4	128.4	123.9	120.2							

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-404A at 40°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (38)	-5 (42)	0 (47)	5 (52)	10 (57)	15 (63)	20 (69)	25 (76)	30 (84)	35 (91)
140 (416)	C				15109	17059	19211	21562	24136	26923	29925
	P				3812	3872	3931	3984	4044	4104	4172
	A				17.54	17.82	18.07	18.31	18.57	18.83	19.12
	M				354.5	392.8	435.9	481.2	529.6	581.5	635.6
	E				3.96	4.41	4.89	5.41	5.97	6.56	7.17
	%				60.8	63.2	65.1	67.2	69.0	70.8	72.4
	T				232.6	226.5	220.2	215.1	210.9	207.3	204.7
130 (368)	C		13061	14865	16828	18984	21319	23868	26654	29708	32993
	P		3340	3384	3445	3498	3554	3608	3662	3716	3770
	A		15.55	15.74	16.01	16.23	16.47	16.70	16.94	17.15	17.38
	M		289.0	323.0	360.3	399.7	441.7	486.9	536.0	588.6	643.6
	E		3.91	4.39	4.88	5.43	6.00	6.61	7.28	8.00	8.75
	%		59.1	61.5	63.8	65.8	67.9	69.7	71.4	73.0	74.6
	T		230.8	223.0	215.4	209.7	204.6	200.4	196.8	193.7	191.4
120 (324)	C	12697	14449	16346	18480	20800	23335	26092	29079	32396	35932
	P	2960	3013	3070	3125	3177	3230	3277	3318	3356	3398
	A	13.98	14.20	14.44	14.67	14.89	15.11	15.30	15.48	15.63	15.82
	M	262.1	293.5	327.5	364.6	404.0	446.8	492.4	541.4	594.9	650.7
	E	4.29	4.80	5.32	5.91	6.55	7.22	7.96	8.76	9.65	10.57
	%	59.7	61.7	64.0	66.1	68.0	69.8	71.5	73.0	74.7	76.5
	T	220.8	213.5	206.1	200.1	195.0	190.7	187.0	183.7	180.7	178.4
110 (285)	C	13890	15745	17826	20097	22555	25313	28246	31510	35066	
	P	2700	2748	2801	2847	2894	2935	2970	3003	3028	
	A	12.92	13.12	13.34	13.53	13.72	13.89	14.04	14.17	14.27	
	M	265.7	296.8	331.4	368.0	407.4	451.0	496.8	546.9	600.6	
	E	5.15	5.73	6.36	7.06	7.79	8.62	9.51	10.49	11.58	
	%	61.8	63.8	65.9	67.5	69.5	71.0	72.5	74.0	75.8	
	T	204.2	197.5	191.3	186.3	181.7	177.7	174.3	171.2	168.4	
100 (249)	C	15048	17029	19253	21656	24274	27205	30377	33842	37598	
	P	2464	2510	2556	2598	2633	2665	2691	2710	2731	
	A	11.98	12.17	12.35	12.51	12.67	12.79	12.90	12.97	13.06	
	M	268.7	299.9	334.5	371.4	410.7	454.4	501.1	551.5	605.4	
	E	6.11	6.78	7.53	8.34	9.22	10.21	11.29	12.49	13.77	
	%	63.3	65.1	66.8	68.5	70.1	71.7	72.8	74.2	75.8	
	T	189.2	183.2	177.8	173.2	169.1	165.3	162.2	159.4	156.9	
90 (217)	C	16142	18277	20599	23194	26016	29050	32442	36012		
	P	2254	2292	2329	2363	2390	2413	2428	2445		
	A	11.17	11.30	11.45	11.59	11.70	11.79	11.85	11.93		
	M	270.6	302.2	336.5	374.0	414.4	457.1	504.2	553.3		
	E	7.16	7.97	8.85	9.82	10.88	12.04	13.36	14.73		
	%	64.1	65.7	67.4	69.2	70.1	71.3	72.5	73.8		
	T	175.5	170.1	165.0	160.3	156.9	153.7	150.9	148.4		
80 (188)	C	17259	19497	21987	24677	27621	30979	34522	38180		
	P	2060	2092	2122	2146	2157	2190	2186	2199		
	A	10.41	10.54	10.66	10.75	10.79	10.91	10.88	10.93		
	M	273.0	304.5	339.3	376.4	416.3	461.4	508.6	556.8		
	E	8.38	9.32	10.36	11.50	12.80	14.14	15.79	17.37		
	%	64.5	65.8	67.3	68.3	69.5	70.1	70.6	71.3		
	T	162.4	157.4	152.6	148.9	145.2	143.2	139.7	137.8		
70 (162)	C	18367	20741	23266	26217						
	P	1880	1903	1915	1943						
	A	9.71	9.81	9.85	9.95						
	M	274.9	307.0	339.9	379.1						
	E	9.77	10.90	12.15	13.50						
	%	64.1	65.0	66.1	67.2						
	T	150.0	145.3	141.1	137.4						

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: ARM-31a at 65°F Suction Temperature, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (28)	-5 (31)	0 (35)	5 (39)	10 (43)	15 (48)	20 (53)	25 (59)	30 (65)	35 (72)
140 (361)	C						16877	18867	21058	23350	25802
	P						3385	3440	3498	3553	3614
	A						15.72	15.96	16.21	16.45	16.72
	M						270.4	303.7	340.9	380.2	423.5
	E						4.99	5.49	6.02	6.57	7.14
	%						66.8	68.4	69.8	70.9	71.2
T						260.9	248.4	237.1	226.8	218.1	
130 (317)	C				14513	16350	18325	20455	22804	25304	27929
	P				2956	3004	3060	3111	3166	3214	3263
	A				13.93	14.14	14.37	14.59	14.82	15.02	15.24
	M				215.4	243.5	274.1	307.4	344.5	384.4	427.3
	E				4.91	5.44	5.99	6.57	7.20	7.87	8.56
	%				66.5	68.2	69.5	70.8	71.8	72.8	72.8
T				267.6	254.3	242.2	231.1	220.7	211.1	203.1	
120 (277)	C			13790	15582	17480	19591	21891	24379	27086	29892
	P			2625	2674	2723	2777	2822	2866	2906	2942
	A			12.59	12.79	12.98	13.21	13.40	13.58	13.75	13.91
	M			191.9	217.6	245.0	275.7	309.4	346.1	386.6	429.5
	E			5.25	5.83	6.42	7.06	7.76	8.51	9.32	10.16
	%			67.7	69.2	70.4	71.4	72.4	73.2	73.8	73.3
T			261.4	248.4	236.7	225.8	215.3	205.6	196.5	189.2	
110 (241)	C	11538	13151	14876	16731	18798	21011	23462	26120	29027	32113
	P	2299	2339	2386	2428	2478	2519	2557	2591	2622	2647
	A	11.30	11.45	11.65	11.81	12.01	12.18	12.33	12.47	12.60	12.70
	M	151.2	172.7	196.0	221.0	249.2	279.6	313.4	350.6	391.6	435.9
	E	5.02	5.62	6.23	6.89	7.59	8.34	9.17	10.08	11.07	12.13
	%	66.5	68.7	69.8	70.9	71.8	72.5	73.4	73.8	74.1	73.7
T	271.5	255.8	243.3	231.6	220.7	210.5	200.6	191.5	182.8	175.1	
100 (209)	C	12353	14009	15816	17798	19954	22331	24940	27749	30722	
	P	2088	2129	2169	2211	2250	2282	2314	2338	2360	
	A	10.49	10.65	10.80	10.96	11.13	11.25	11.38	11.47	11.56	
	M	153.9	174.9	198.0	223.5	251.4	282.3	316.6	353.7	393.8	
	E	5.91	6.58	7.29	8.05	8.87	9.78	10.78	11.87	13.02	
	%	68.7	70.3	71.2	72.0	72.6	73.1	73.5	73.4	72.9	
T	252.2	238.7	227.0	216.1	205.8	196.1	186.8	178.2	170.6		
90 (180)	C	13131	14833	16739	18824	21100	23601	26323	29216		
	P	1904	1937	1973	2008	2038	2064	2083	2104		
	A	9.79	9.91	10.04	10.18	10.31	10.41	10.49	10.57		
	M	156.1	176.7	199.9	225.5	253.5	284.5	318.5	355.2		
	E	6.90	7.66	8.48	9.37	10.35	11.44	12.63	13.89		
	%	70.8	71.2	71.9	72.3	72.5	72.7	72.7	71.8		
T	233.7	222.8	211.7	201.5	191.9	182.6	173.8	166.2			
80 (155)	C	13800	15585	17582	19744	22151	24749	27488			
	P	1737	1768	1795	1818	1841	1858	1870			
	A	9.15	9.29	9.38	9.46	9.55	9.63	9.66			
	M	157.1	177.8	201.0	226.4	254.7	285.4	318.3			
	E	7.95	8.82	9.79	10.86	12.03	13.32	14.70			
	%	71.1	71.2	71.4	71.5	71.3	70.7	70.3			
T	218.6	208.3	198.0	188.3	179.1	170.4	162.2				
70 (132)	C	14448	16314	18389	20635						
	P	1582	1606	1628	1643						
	A	8.62	8.70	8.78	8.83						
	M	157.9	178.6	201.8	226.9						
	E	9.13	10.16	11.30	12.56						
	%	70.1	69.8	69.7	69.2						
T	205.4	195.4	185.6	176.4							

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 A5: ARM-31a at 20°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (28)	-5 (31)	0 (35)	5 (39)	10 (43)	15 (48)	20 (53)	25 (59)	30 (65)	35 (72)
140 (361)	C				12366	14119	15996	18097	20331	22762	25388
	P				3276	3326	3380	3440	3498	3555	3615
	A				15.28	15.49	15.72	15.98	16.23	16.48	16.73
	M				227.4	256.2	286.4	320.0	354.9	392.6	433.0
	E				3.77	4.24	4.73	5.26	5.81	6.40	7.02
	%				58.1	60.8	63.0	65.1	67.0	68.7	70.0
	T				255.5	244.0	234.8	226.7	219.8	213.8	209.2
130 (317)	C		10353	11934	13657	15514	17514	19738	22124	24754	27555
	P		2859	2906	2955	3011	3064	3118	3170	3218	3266
	A		13.55	13.75	13.95	14.18	14.40	14.63	14.85	15.05	15.25
	M		180.7	205.6	232.3	260.6	290.6	323.7	358.6	396.7	437.0
	E		3.62	4.11	4.62	5.15	5.72	6.33	6.98	7.69	8.44
	%		56.0	58.7	61.2	63.3	65.3	67.1	68.8	70.4	71.5
	T		258.5	245.0	233.8	224.5	216.7	209.6	203.6	198.2	194.1
120 (277)	C	9809	11313	12943	14753	16718	18849	21202	23774	26578	29608
	P	2544	2584	2635	2685	2735	2786	2830	2873	2911	2947
	A	12.27	12.43	12.65	12.85	13.05	13.27	13.45	13.62	13.79	13.93
	M	161.4	183.8	207.8	234.1	262.2	292.2	325.1	360.5	398.8	440.0
	E	3.86	4.38	4.91	5.49	6.11	6.77	7.49	8.27	9.13	10.05
	%	56.5	58.9	61.1	63.1	64.9	66.7	68.4	69.9	71.3	72.3
	T	248.4	235.7	224.9	215.6	207.5	200.5	194.1	188.6	183.6	179.7
110 (241)	C	10753	12305	14055	15933	18039	20299	22803	25550	28503	
	P	2305	2350	2398	2448	2493	2531	2568	2601	2629	
	A	11.33	11.53	11.71	11.92	12.10	12.25	12.40	12.53	12.65	
	M	165.8	187.5	211.8	237.4	265.9	296.0	329.0	365.0	403.3	
	E	4.67	5.24	5.86	6.51	7.23	8.02	8.88	9.82	10.84	
	%	58.7	60.6	62.5	64.3	65.9	67.5	68.9	70.2	71.2	
	T	227.2	216.8	207.3	199.1	191.8	185.3	179.5	174.4	170.1	
100 (209)	C	11571	13222	15041	17061	19235	21639	24289	27179	30280	
	P	2100	2146	2191	2231	2267	2295	2323	2346	2360	
	A	10.54	10.72	10.90	11.05	11.20	11.31	11.43	11.51	11.58	
	M	168.2	190.1	213.9	240.1	267.9	298.3	331.6	367.5	405.6	
	E	5.51	6.16	6.86	7.65	8.48	9.43	10.45	11.58	12.83	
	%	60.0	61.6	63.2	64.8	66.3	67.7	68.8	69.9	70.7	
	T	208.9	199.9	191.5	183.8	177.0	170.9	165.6	160.8	156.8	
90 (180)	C	12371	14124	16034	18163	20480	23018	25784	28680		
	P	1925	1965	2001	2032	2058	2082	2097	2114		
	A	9.88	10.03	10.17	10.28	10.38	10.49	10.54	10.61		
	M	170.3	192.4	216.2	242.5	270.8	301.5	334.4	368.9		
	E	6.43	7.19	8.01	8.94	9.95	11.06	12.30	13.57		
	%	60.5	61.9	63.2	64.8	66.1	67.1	67.9	66.7		
	T	192.7	184.2	176.6	169.1	162.7	157.2	152.4	150.2		
80 (155)	C	13144	14974	16991	19210	21641	24310	27225	30493		
	P	1763	1795	1823	1843	1863	1874	1884	1893		
	A	9.28	9.39	9.48	9.56	9.64	9.67	9.73	9.75		
	M	172.0	194.1	218.1	244.2	272.6	303.4	336.7	374.3		
	E	7.46	8.34	9.32	10.42	11.61	12.97	14.45	16.11		
	%	60.3	61.5	62.8	64.0	64.9	65.6	66.0	66.5		
	T	177.4	169.5	161.9	155.2	149.4	144.2	139.6	135.6		
70 (132)	C	13868	15785	17896	20159						
	P	1609	1635	1657	1669						
	A	8.70	8.79	8.88	8.92						
	M	173.2	195.3	219.4	244.9						
	E	8.62	9.66	10.80	12.08						
	%	59.3	60.3	61.2	61.8						
	T	163.5	155.9	148.9	143.0						

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 A6: ARM-31a at 40°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (28)	-5 (31)	0 (35)	5 (39)	10 (43)	15 (48)	20 (53)	25 (59)	30 (65)	35 (72)
140 (361)	C				13775	15696	17750	20013	22519	25163	27997
	P				3282	3329	3379	3440	3498	3556	3615
	A				15.28	15.49	15.72	15.97	16.21	16.46	16.72
	M				218.9	246.3	275.1	306.6	340.9	376.6	414.3
	E				4.20	4.72	5.25	5.82	6.44	7.08	7.74
	%				60.5	63.1	65.5	67.6	69.8	71.4	72.8
	T				272.9	261.7	252.4	244.4	237.1	231.4	226.8
130 (317)	C		11464	13160	15017	17029	19189	21602	24219	27029	30044
	P		2858	2904	2949	3004	3060	3114	3166	3215	3263
	A		13.53	13.72	13.92	14.15	14.38	14.60	14.82	15.03	15.23
	M		174.7	198.3	223.4	250.4	279.2	310.7	344.5	380.5	418.4
	E		4.01	4.53	5.09	5.67	6.27	6.94	7.65	8.41	9.21
	%		58.7	61.4	63.9	66.0	68.0	69.9	71.8	73.3	74.5
	T		274.5	261.8	250.8	241.8	234.0	227.1	220.7	215.7	211.6
120 (277)	C	10764	12379	14153	16109	18177	20473	22977	25742	28732	31979
	P	2535	2576	2628	2678	2726	2780	2822	2866	2902	2940
	A	12.23	12.41	12.61	12.81	13.02	13.23	13.41	13.58	13.74	13.89
	M	156.3	177.7	200.9	226.0	252.1	281.2	312.0	346.1	382.4	421.3
	E	4.25	4.81	5.39	6.02	6.67	7.37	8.14	8.98	9.90	10.88
	%	59.5	61.8	64.0	66.1	68.0	69.6	71.5	73.2	74.4	75.5
	T	263.6	251.6	241.2	232.2	224.4	217.6	211.4	205.6	201.1	197.3
110 (241)	C	11710	13365	15208	17224	19433	21850	24527	27452	30573	34000
	P	2297	2344	2390	2436	2480	2523	2559	2591	2620	2644
	A	11.30	11.48	11.67	11.85	12.02	12.20	12.35	12.47	12.59	12.70
	M	160.7	181.6	204.4	228.9	255.8	284.5	316.3	350.6	386.5	425.8
	E	5.10	5.70	6.36	7.07	7.84	8.66	9.58	10.60	11.67	12.86
	%	62.0	63.8	65.7	67.5	69.1	70.7	72.3	73.8	74.7	75.7
	T	242.2	232.5	223.5	215.6	208.6	202.3	196.6	191.5	187.4	183.7
100 (209)	C	12500	14232	16171	18290	20582	23136	25934	29070	32250	
	P	2090	2136	2177	2216	2255	2284	2311	2338	2352	
	A	10.50	10.68	10.84	10.98	11.15	11.26	11.37	11.47	11.54	
	M	163.0	183.8	206.5	231.3	257.8	286.9	318.5	353.7	388.9	
	E	5.98	6.66	7.43	8.25	9.13	10.13	11.22	12.43	13.71	
	%	63.4	65.0	66.7	68.3	69.7	71.1	72.3	73.4	74.2	
	T	224.1	215.4	207.3	200.1	193.8	187.9	182.8	178.2	174.5	
90 (180)	C	13290	15128	17151	19353	21807	24462	27392	30546		
	P	1913	1949	1985	2015	2044	2065	2086	2104		
	A	9.84	9.95	10.09	10.21	10.33	10.41	10.50	10.57		
	M	165.3	186.0	209.0	233.7	260.8	289.8	321.6	355.2		
	E	6.95	7.76	8.64	9.60	10.67	11.84	13.13	14.52		
	%	64.1	65.6	67.1	68.4	69.7	70.7	71.5	71.8		
	T	207.7	199.6	192.1	185.6	179.6	174.4	169.7	166.2		
80 (155)	C	14035	15959	18075	20400	22906	25715	28725			
	P	1745	1778	1807	1829	1847	1862	1873			
	A	9.19	9.31	9.42	9.51	9.59	9.65	9.68			
	M	166.7	187.8	210.7	235.7	262.3	291.9	323.2			
	E	8.04	8.98	10.01	11.16	12.40	13.81	15.34			
	%	64.2	65.4	66.6	67.7	68.4	69.2	69.3			
	T	192.3	184.9	178.0	171.8	166.6	161.5	157.9			
70 (132)	C	14671	16660	18847	21260						
	P	1594	1619	1640	1653						
	A	8.65	8.75	8.82	8.86						
	M	168.1	189.2	212.1	237.1						
	E	9.20	10.29	11.49	12.86						
	%	63.3	64.2	65.1	65.8						
	T	178.5	171.4	165.0	159.0						

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: D2Y-65 at 65°F Suction Temperature, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (32)	-5 (36)	0 (40)	5 (45)	10 (50)	15 (55)	20 (61)	25 (67)	30 (74)	35 (81)
140 (394)	C						17604	19677	21897	24195	26568
	P						3756	3803	3858	3917	3988
	A						17.31	17.53	17.76	18.02	18.33
	M						292.5	328.9	368.3	409.8	454.7
	E						4.69	5.17	5.68	6.18	6.66
	%						66.0	67.8	69.3	70.4	70.2
T						265.0	251.9	240.2	230.0	222.0	
130 (346)	C				15295	17229	19292	21514	23860	26422	29107
	P				3288	3330	3373	3427	3482	3533	3587
	A				15.34	15.52	15.71	15.94	16.17	16.40	16.63
	M				233.7	264.4	297.5	333.6	372.0	414.8	461.1
	E				4.65	5.17	5.72	6.28	6.85	7.48	8.11
	%				65.3	67.3	69.1	70.5	71.6	72.5	73.0
T				272.7	258.1	245.2	233.7	223.3	213.6	204.9	
120 (304)	C			14909	16765	18776	20943	23337	25907	28700	31662
	P			2898	2942	2995	3052	3097	3143	3180	3218
	A			13.73	13.91	14.13	14.37	14.56	14.76	14.92	15.08
	M			212.7	240.0	270.0	302.5	338.7	378.0	421.3	468.1
	E			5.15	5.70	6.27	6.86	7.54	8.24	9.03	9.84
	%			67.5	69.1	70.3	71.1	72.4	73.2	74.0	74.3
T			264.0	250.7	238.8	228.2	217.2	207.5	198.1	189.7	
110 (265)	C		14044	15893	17888	20020	22363	24882	27630	30567	
	P		2581	2622	2670	2716	2759	2798	2830	2860	
	A		12.45	12.61	12.81	13.00	13.17	13.34	13.47	13.60	
	M		188.3	213.6	241.3	271.1	304.1	339.9	379.5	422.3	
	E		5.44	6.06	6.70	7.37	8.11	8.89	9.76	10.69	
	%		67.5	69.3	70.7	71.7	72.6	73.3	73.8	74.0	
T		260.3	246.2	233.7	222.6	212.1	202.3	193.0	184.4		
100 (230)	C	13278	15055	16998	19092	21348	23813	26514	29409	32459	
	P	2290	2335	2384	2423	2461	2492	2522	2548	2569	
	A	11.30	11.48	11.68	11.83	11.99	12.11	12.22	12.34	12.41	
	M	168.2	191.2	216.6	244.1	273.9	306.7	343.1	382.4	424.7	
	E	5.80	6.45	7.13	7.88	8.67	9.55	10.51	11.54	12.64	
	%	68.4	69.9	71.0	72.1	72.6	73.2	73.4	73.6	73.2	
T	254.6	241.2	228.9	217.5	207.3	197.5	188.2	179.4	171.7		
90 (199)	C	14163	16028	18049	20236	22633	25249	28073	31061		
	P	2083	2126	2163	2192	2225	2248	2267	2288		
	A	10.52	10.67	10.83	10.92	11.07	11.15	11.23	11.31		
	M	170.8	193.8	218.9	246.1	276.3	309.4	345.4	384.5		
	E	6.80	7.54	8.35	9.23	10.17	11.23	12.39	13.57		
	%	70.2	71.1	72.0	72.4	72.6	72.8	72.7	72.0		
T	236.4	224.4	213.0	202.8	193.0	183.6	174.9	167.3			
80 (172)	C	15006	16948	19067	21366	23876	26591	29567			
	P	1897	1930	1957	1981	1998	2022	2039			
	A	9.80	9.92	10.02	10.11	10.18	10.28	10.34			
	M	172.9	195.8	220.8	248.2	278.1	311.4	348.2			
	E	7.91	8.78	9.74	10.78	11.95	13.15	14.50			
	%	71.0	71.7	72.0	72.0	71.5	71.3	70.7			
T	220.2	208.9	198.4	188.8	179.6	171.0	163.1				
70 (147)	C	15773	17784	19988	22490						
	P	1724	1748	1769	1782						
	A	9.16	9.25	9.33	9.37						
	M	174.2	196.9	221.8	250.4						
	E	9.15	10.17	11.30	12.62						
	%	70.1	70.2	70.1	70.1						
T	206.5	196.0	186.0	176.1							

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: D2Y-65 at 20°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (32)	-5 (36)	0 (40)	5 (45)	10 (50)	15 (55)	20 (61)	25 (67)	30 (74)	35 (81)
140 (394)	C				12936	14725	16688	18780	21075	23533	26153
	P				3638	3680	3733	3790	3850	3910	3978
	A				16.82	16.99	17.20	17.47	17.73	17.99	18.27
	M				248.8	279.4	312.4	346.9	384.3	423.9	466.2
	E				3.56	4.00	4.47	4.96	5.47	6.02	6.57
	%				57.3	60.3	62.7	64.7	66.6	68.2	69.5
	T				260.0	247.0	237.3	229.4	222.5	216.6	212.2
130 (346)	C		10918	12626	14414	16334	18412	20690	23156	25833	28667
	P		3177	3217	3259	3312	3367	3426	3479	3529	3579
	A		14.86	15.03	15.21	15.44	15.67	15.92	16.15	16.36	16.58
	M		197.8	225.7	254.5	284.7	316.9	351.9	389.3	429.3	471.7
	E		3.44	3.93	4.42	4.93	5.47	6.04	6.66	7.32	8.01
	%		55.3	58.4	61.1	63.3	65.2	67.0	68.7	70.1	71.3
	T		262.4	247.6	235.7	226.3	218.5	211.7	205.6	200.3	196.3
120 (304)	C	10503	12131	13896	15755	17794	20015	22451	24764	27805	30809
	P	2813	2859	2899	2949	3000	3054	3099	3142	3181	3219
	A	13.37	13.56	13.73	13.94	14.15	14.37	14.56	14.74	14.90	15.06
	M	178.4	203.5	230.1	257.9	287.8	320.1	355.0	387.3	430.3	472.4
	E	3.73	4.24	4.79	5.34	5.93	6.55	7.24	7.88	8.74	9.57
	%	55.9	58.6	61.2	63.3	65.1	66.8	68.4	69.9	71.2	72.6
	T	251.6	237.9	226.1	216.6	208.7	201.8	195.6	190.2	185.3	181.0
110 (265)	C	11606	13275	15089	17058	19238	21610	24176	26990	30022	
	P	2538	2583	2634	2680	2726	2769	2804	2835	2865	
	A	12.26	12.44	12.65	12.84	13.02	13.20	13.34	13.47	13.60	
	M	183.8	207.8	233.5	261.0	291.2	323.6	358.1	395.8	435.9	
	E	4.57	5.14	5.73	6.36	7.06	7.80	8.62	9.52	10.48	
	%	58.8	60.9	62.8	64.6	66.3	67.8	69.2	70.4	71.4	
	T	228.3	217.3	208.0	199.8	192.5	186.2	180.6	175.6	171.5	
100 (230)	C	12528	14307	16209	18302	20593	23105	25831	28843	32112	
	P	2307	2358	2401	2442	2475	2506	2531	2553	2567	
	A	11.35	11.55	11.72	11.89	12.02	12.15	12.25	12.33	12.39	
	M	186.3	210.5	235.9	263.6	293.5	325.9	360.8	399.0	440.3	
	E	5.43	6.07	6.75	7.50	8.32	9.22	10.20	11.30	12.51	
	%	60.3	62.0	63.7	65.3	66.7	68.0	69.1	70.1	70.7	
	T	209.5	199.9	191.7	184.0	177.5	171.6	166.5	161.7	157.8	
90 (199)	C	13361	15227	17269	19506	21921	24582	27462	30551		
	P	2110	2153	2187	2220	2245	2266	2279	2291		
	A	10.63	10.79	10.92	11.05	11.14	11.23	11.29	11.33		
	M	187.6	211.6	237.5	265.6	295.5	328.3	363.3	400.6		
	E	6.33	7.07	7.90	8.79	9.77	10.85	12.05	13.34		
	%	60.5	62.2	63.8	65.2	66.3	67.3	67.9	68.3		
	T	193.6	184.6	176.5	169.4	163.3	157.8	153.2	149.3		
80 (172)	C	14241	16198	18338	20694	23254	26011	29131	32207		
	P	1929	1962	1990	2008	2023	2032	2043	2051		
	A	9.95	10.05	10.18	10.23	10.29	10.32	10.37	10.40		
	M	189.6	213.6	239.4	267.7	297.7	329.8	366.5	402.5		
	E	7.38	8.25	9.21	10.31	11.49	12.80	14.26	15.70		
	%	60.6	62.0	63.3	64.4	65.2	65.8	66.3	66.5		
	T	177.7	169.4	162.0	155.3	149.7	144.5	140.0	137.0		
70 (147)	C	15105	17152	19381	21872						
	P	1757	1781	1800	1810						
	A	9.29	9.38	9.44	9.47						
	M	191.5	215.4	241.1	269.6						
	E	8.60	9.63	10.76	12.09						
	%	59.7	60.8	61.7	62.6						
	T	163.4	155.5	148.7	142.3						

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 A9: D2Y-65 at 40°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (32)	-5 (36)	0 (40)	5 (45)	10 (50)	15 (55)	20 (61)	25 (67)	30 (74)	35 (81)
140 (394)	C					17114	19346	21743	24366	27170	30321
	P					3693	3738	3790	3858	3911	3968
	A					17.02	17.22	17.44	17.76	17.98	18.22
	M					268.2	299.6	332.7	368.3	406.4	448.3
	E					4.63	5.18	5.74	6.32	6.95	7.64
	%					62.3	65.0	67.1	69.3	71.0	73.7
	T					265.8	255.5	247.2	240.2	234.2	227.7
130 (346)	C			14483	16472	18615	20961	23488	26219	29213	32420
	P			3216	3257	3307	3365	3419	3482	3524	3577
	A			15.01	15.20	15.41	15.65	15.88	16.17	16.33	16.56
	M			217.5	244.5	273.1	304.0	337.0	372.0	410.4	450.7
	E			4.50	5.06	5.63	6.23	6.87	7.53	8.29	9.06
	%			60.9	63.5	65.7	67.7	69.6	71.6	72.8	74.1
	T			264.9	253.6	244.3	236.3	229.5	223.3	218.2	214.2
120 (304)	C	11971	13765	15698	17737	19987	22464	25135	28028	31233	34647
	P	2800	2848	2893	2942	2993	3047	3089	3142	3175	3213
	A	13.30	13.50	13.69	13.89	14.11	14.32	14.51	14.75	14.86	15.02
	M	172.8	196.5	221.7	247.9	276.2	307.3	340.2	375.5	414.5	455.1
	E	4.28	4.83	5.43	6.03	6.68	7.37	8.14	8.92	9.84	10.78
	%	58.9	61.5	64.0	66.0	67.8	69.6	71.3	73.0	74.2	75.6
	T	267.2	254.2	243.1	234.0	226.3	219.3	213.0	207.7	203.0	199.0
110 (265)	C	13040	14869	16861	18988	21382	23978	26784	29874	33222	36850
	P	2530	2577	2624	2671	2718	2760	2793	2830	2854	2874
	A	12.22	12.42	12.59	12.80	12.98	13.15	13.30	13.47	13.54	13.62
	M	177.9	200.8	225.3	251.1	279.8	310.8	343.7	379.5	418.2	459.6
	E	5.15	5.77	6.43	7.11	7.87	8.69	9.59	10.55	11.64	12.82
	%	61.8	64.0	65.9	67.5	69.3	70.8	72.3	73.8	74.6	76.1
	T	244.3	233.6	224.5	217.0	209.9	203.6	198.1	193.0	188.9	184.7
100 (230)	C	13944	15843	17917	20174	22674	25407	28357	31619	35025	
	P	2296	2342	2388	2426	2462	2495	2517	2548	2556	
	A	11.30	11.48	11.67	11.82	11.96	12.09	12.18	12.34	12.34	
	M	180.6	203.0	227.4	253.4	282.1	313.2	346.4	382.4	419.8	
	E	6.07	6.77	7.50	8.31	9.21	10.18	11.26	12.41	13.70	
	%	63.6	65.4	66.9	68.3	69.9	71.2	72.3	73.6	74.2	
	T	225.1	216.0	208.2	201.3	194.7	189.0	183.9	179.4	175.9	
90 (199)	C	14731	16733	18915	21317	23935	26795	29924	33439		
	P	2094	2136	2171	2203	2228	2252	2268	2282		
	A	10.55	10.72	10.86	10.98	11.08	11.17	11.23	11.28		
	M	181.6	204.4	228.9	255.4	284.2	315.3	349.0	386.5		
	E	7.04	7.83	8.71	9.68	10.74	11.90	13.19	14.65		
	%	64.1	65.8	67.2	68.5	69.7	70.7	71.6	73.2		
	T	209.0	200.4	193.0	186.5	180.5	175.4	170.6	165.8		
80 (172)	C	15256	17300	19534	21986	24663	27537	30973	34191		
	P	1914	1944	1972	1992	2005	2029	2040	2029		
	A	9.89	9.98	10.11	10.18	10.21	10.32	10.34	10.30		
	M	183.8	206.5	231.0	257.7	286.4	316.8	353.0	386.4		
	E	7.97	8.90	9.90	11.04	12.30	13.57	15.18	16.85		
	%	64.4	65.9	66.8	67.8	68.7	69.4	71.6	69.9		
	T	192.9	185.0	178.6	172.5	166.9	162.7	157.0	154.5		
70 (147)	C	15971	18084	20392	23001						
	P	1740	1763	1782	1795						
	A	9.22	9.31	9.38	9.42						
	M	185.5	208.1	232.6	260.1						
	E	9.18	10.26	11.44	12.82						
	%	63.6	64.7	65.4	66.5						
	T	178.8	171.6	165.3	159.1						

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-40 at 65°F Suction Temperature, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (27)	-5 (30)	0 (34)	5 (38)	10 (43)	15 (47)	20 (53)	25 (58)	30 (64)	35 (71)
140 (362)	C							18978	21243	23662	26389
	P							3499	3547	3596	3641
	A							16.21	16.42	16.64	16.82
	M							262.4	295.2	330.8	371.4
	E							5.42	5.99	6.58	7.25
	% T							70.5	72.6	74.1	76.2
130 (317)	C					16283	18336	20521	22914	25495	28246
	P					3057	3098	3144	3193	3239	3285
	A					14.38	14.55	14.75	14.97	15.17	15.37
	M					209.3	236.7	266.2	298.8	334.3	372.7
	E					5.33	5.92	6.53	7.18	7.87	8.60
	% T					70.2	71.8	73.4	74.7	75.9	76.7
120 (277)	C				15600	17585	19728	22052	24585	27322	30298
	P				2712	2749	2792	2838	2882	2921	2952
	A				12.98	13.13	13.32	13.50	13.69	13.85	13.98
	M				188.7	213.4	240.5	270.0	302.4	337.8	376.8
	E				5.75	6.40	7.07	7.77	8.53	9.35	10.26
	% T				71.9	73.5	74.8	75.7	76.7	77.5	78.2
110 (241)	C			14682	16580	18649	20891	23348	26025	28968	31984
	P			2399	2440	2483	2524	2562	2595	2622	2649
	A			11.73	11.90	12.07	12.24	12.39	12.53	12.64	12.75
	M			168.2	190.5	215.1	241.8	271.3	303.9	339.9	377.5
	E			6.12	6.79	7.51	8.28	9.11	10.03	11.05	12.08
	% T			72.0	73.4	74.5	75.4	76.2	76.8	77.3	76.2
100 (209)	C	12075	13849	15641	17629	19808	22173	24750	27582	30483	
	P	2103	2140	2172	2211	2247	2281	2309	2332	2356	
	A	10.58	10.74	10.85	11.01	11.15	11.29	11.40	11.49	11.58	
	M	131.2	150.9	170.8	193.1	217.7	244.5	274.0	306.7	341.0	
	E	5.74	6.47	7.20	7.97	8.82	9.72	10.72	11.83	12.94	
	% T	71.2	74.0	74.8	75.7	76.3	76.7	76.9	76.8	74.8	
90 (180)	C	12833	14613	16517	18598	20877	23380	26096	28878		
	P	1901	1935	1969	1999	2030	2053	2072	2094		
	A	9.83	9.95	10.07	10.18	10.33	10.40	10.48	10.56		
	M	133.5	152.3	172.6	194.9	219.5	246.6	276.3	307.5		
	E	6.75	7.55	8.39	9.30	10.28	11.39	12.59	13.79		
	% T	73.3	75.4	75.7	76.2	76.3	76.4	75.9	73.4		
80 (154)	C	13590	15379	17351	19546	21932	24568	27407			
	P	1729	1755	1786	1806	1828	1842	1848			
	A	9.18	9.27	9.41	9.48	9.58	9.62	9.63			
	M	135.7	153.9	174.0	196.6	221.2	248.6	278.2			
	E	7.86	8.76	9.72	10.82	12.00	13.34	14.83			
	% T	75.5	75.7	75.7	75.8	75.5	74.6	73.8			
70 (131)	C	14185	16053	18122	20401						
	P	1570	1592	1612	1627						
	A	8.61	8.70	8.76	8.82						
	M	136.3	154.6	174.9	197.4						
	E	9.04	10.08	11.24	12.54						
	% T	74.0	73.9	73.5	72.9						
	T	217.4	206.4	195.9	185.6						

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 A11: L-40 at 20°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (27)	-5 (30)	0 (34)	5 (38)	10 (43)	15 (47)	20 (53)	25 (58)	30 (64)	35 (71)
140 (362)	C					14282	16282	18440	20753	23255	25918
	P					3405	3447	3494	3541	3594	3655
	A					15.84	16.03	16.22	16.43	16.66	16.92
	M					219.0	247.0	276.7	308.3	342.1	378.0
	E					4.19	4.72	5.28	5.86	6.47	7.09
	%					62.4	65.2	67.9	70.0	72.1	73.8
	T					266.2	253.9	243.3	235.0	227.6	221.7
130 (317)	C			11948	13766	15721	17796	20040	22543	25222	28052
	P			2952	3011	3053	3095	3138	3187	3238	3290
	A			13.92	14.21	14.38	14.56	14.74	14.95	15.16	15.38
	M			174.4	198.8	224.7	251.7	280.6	312.7	346.6	382.4
	E			4.05	4.57	5.15	5.75	6.39	7.07	7.79	8.53
	%			60.0	63.2	65.9	68.3	70.5	72.3	74.2	75.6
	T			270.1	254.8	242.7	232.7	224.2	216.7	210.0	205.1
120 (277)	C		11437	13134	15030	17052	19239	21640	24265	27120	30132
	P		2611	2652	2715	2751	2791	2837	2880	2918	2956
	A		12.55	12.71	13.00	13.15	13.31	13.50	13.68	13.83	14.00
	M		158.0	179.6	203.6	228.7	255.6	284.8	316.5	350.7	386.7
	E		4.38	4.95	5.54	6.20	6.89	7.63	8.43	9.29	10.19
	%		61.1	63.3	66.0	68.3	70.4	72.0	73.9	75.4	76.9
	T		257.6	245.5	232.7	222.6	214.0	206.7	199.8	194.0	189.2
110 (241)	C	10761	12429	14181	16153	18239	20578	23119	25910	28861	
	P	2315	2358	2395	2445	2486	2529	2563	2595	2626	
	A	11.38	11.56	11.70	11.93	12.09	12.26	12.40	12.53	12.65	
	M	141.5	161.9	183.0	206.5	231.0	258.3	287.7	319.7	353.4	
	E	4.65	5.27	5.92	6.61	7.34	8.14	9.02	9.98	10.99	
	%	61.0	63.8	65.6	68.0	69.7	71.4	73.1	74.4	75.5	
	T	249.0	234.4	224.0	213.2	205.1	197.4	190.4	184.3	179.5	
100 (209)	C	11643	13309	15139	17212	19412	21869	24528	27461	30611	
	P	2102	2139	2181	2222	2256	2286	2314	2337	2350	
	A	10.58	10.72	10.90	11.05	11.19	11.30	11.40	11.50	11.56	
	M	145.1	164.3	185.2	208.7	233.3	260.6	289.9	322.0	356.2	
	E	5.54	6.22	6.94	7.75	8.60	9.57	10.60	11.75	13.03	
	%	63.3	65.2	66.9	68.5	70.1	71.5	72.8	73.8	74.3	
	T	225.9	215.0	205.6	196.6	188.8	181.9	175.7	170.2	165.5	
90 (180)	C	12321	14075	15963	18137	20436	22988	25757	28750		
	P	1911	1948	1984	2018	2041	2063	2081	2100		
	A	9.86	10.00	10.15	10.27	10.35	10.44	10.52	10.59		
	M	146.0	165.3	185.9	209.4	234.0	261.1	290.3	322.0		
	E	6.45	7.23	8.05	8.99	10.01	11.14	12.38	13.69		
	%	63.9	65.3	66.7	68.1	69.3	70.4	71.2	71.3		
	T	208.0	198.4	189.7	181.5	174.1	167.7	161.9	157.8		
80 (154)	C	13051	14857	16890	19114	21556	24187	27110	30289		
	P	1743	1774	1802	1824	1845	1854	1864	1863		
	A	9.24	9.35	9.46	9.53	9.62	9.65	9.70	9.67		
	M	147.6	166.7	187.9	211.0	236.1	262.8	292.3	324.2		
	E	7.49	8.38	9.37	10.48	11.69	13.04	14.55	16.26		
	%	63.8	64.9	66.2	67.3	68.1	68.7	69.3	69.4		
	T	191.2	182.5	173.9	166.2	159.5	153.5	147.9	143.2		
70 (131)	C	13819	15738	17872	20238						
	P	1588	1614	1635	1650						
	A	8.67	8.76	8.83	8.89						
	M	149.7	169.1	190.5	214.1						
	E	8.70	9.75	10.93	12.27						
	%	62.8	63.6	64.7	65.8						
	T	176.0	167.5	159.4	151.6						

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 A12: L-40 at 40°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (27)	-5 (30)	0 (34)	5 (38)	10 (43)	15 (47)	20 (53)	25 (58)	30 (64)	35 (71)
140 (362)	C						18336	20714	23253	26045	29030
	P						3448	3487	3547	3590	3651
	A						16.01	16.19	16.42	16.63	16.89
	M						237.6	265.6	295.2	328.0	362.1
	E						5.32	5.94	6.56	7.26	7.95
	%						67.6	70.4	72.6	74.7	76.4
130 (317)	T						271.9	261.2	253.1	245.5	239.7
	C				15404	17498	19802	22297	24883	27944	31080
	P				3001	3045	3087	3133	3193	3232	3288
	A				14.15	14.34	14.52	14.71	14.97	15.13	15.36
	M				192.1	215.9	242.3	270.3	298.8	332.9	366.8
	E				5.13	5.75	6.41	7.12	7.79	8.65	9.45
120 (277)	%				66.0	68.6	71.1	73.4	74.7	77.0	78.4
	T				271.6	260.5	250.1	241.5	235.4	227.8	223.1
	C		12731	14548	16608	18807	21174	23779	26478	29681	33021
	P		2606	2649	2698	2739	2784	2830	2882	2910	2948
	A		12.55	12.69	12.92	13.10	13.27	13.46	13.69	13.79	13.95
	M		153.3	173.8	196.4	220.6	246.1	273.8	302.4	336.3	371.0
110 (241)	E		4.88	5.49	6.16	6.87	7.61	8.40	9.19	10.20	11.20
	%		64.0	66.4	69.2	71.5	73.5	75.4	76.7	78.4	79.7
	T		273.8	261.4	249.2	239.3	231.3	224.0	218.0	211.8	207.2
	C		13723	15735	17696	19973	22469	25194	27892	31427	34921
	P		2357	2394	2434	2481	2522	2559	2595	2618	2641
	A		11.53	11.68	11.87	12.06	12.22	12.37	12.53	12.61	12.71
100 (209)	M		157.3	178.7	199.5	223.0	248.9	276.8	303.9	339.6	374.5
	E		5.82	6.57	7.27	8.05	8.91	9.85	10.75	12.01	13.22
	%		67.5	71.2	71.2	72.8	74.5	76.2	76.8	78.9	80.0
	T		249.0	235.6	230.1	222.3	214.9	208.2	203.4	197.0	192.4
	C	12733	14568	16544	18713	21076	23703	26543	29402	33022	
	P	2089	2127	2171	2211	2246	2279	2306	2332	2353	
90 (180)	A	10.52	10.68	10.84	11.00	11.14	11.28	11.38	11.49	11.57	
	M	140.7	159.5	179.7	201.6	225.3	251.3	279.1	306.7	341.9	
	E	6.10	6.85	7.62	8.46	9.39	10.40	11.51	12.61	14.03	
	%	66.5	69.0	70.6	72.2	73.8	75.1	76.3	76.8	77.8	
	T	242.0	230.1	221.1	212.8	205.3	198.7	192.8	188.3	183.7	
	C	13512	15362	17410	19696	22184	24899	27816	30707		
80 (154)	P	1903	1939	1974	2004	2033	2054	2076	2094		
	A	9.85	9.96	10.10	10.21	10.33	10.41	10.49	10.56		
	M	143.0	161.3	181.4	203.6	227.4	253.3	280.8	307.5		
	E	7.10	7.92	8.82	9.83	10.91	12.12	13.40	14.66		
	%	68.3	69.5	71.0	72.5	73.6	74.5	74.8	73.4		
	T	221.7	213.0	204.6	196.8	190.1	184.2	180.0	177.2		
70 (131)	C	14192	16123	18257	20617	23189	26021	29078	32295		
	P	1735	1764	1790	1812	1832	1845	1857	1858		
	A	9.20	9.31	9.41	9.50	9.56	9.60	9.65	9.66		
	M	144.2	162.7	182.8	204.8	228.7	254.6	282.6	311.4		
	E	8.18	9.14	10.20	11.38	12.66	14.11	15.66	17.38		
	%	67.9	69.3	70.5	71.6	72.3	72.7	72.5	72.6		
70 (131)	T	206.2	197.0	189.1	182.0	176.0	170.5	166.4	161.6		
	C	14410	16370	18540	20917						
	P	1576	1600	1621	1635						
	A	8.63	8.72	8.79	8.83						
	M	145.2	163.6	183.9	205.8						
	E	9.14	10.23	11.44	12.79						
70 (131)	%	67.1	67.9	68.7	69.4						
	T	190.5	182.7	175.5	168.8						

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 A13: R-32 + R-134a mixture at 65°F Suction Temperature, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (31)	-5 (34)	0 (39)	5 (43)	10 (48)	15 (54)	20 (59)	25 (66)	30 (73)	35 (80)
Discharge Dew Point Temp, °F (Discharge Pressure, psia)	140 (410)									25559 4224 19.34 328.6 6.05 68.0 271.4	28589 4268 19.54 369.9 6.70 70.0 256.2
	130 (360)								25057 3712 17.14 301.2 6.75 70.5 261.6	28040 3751 17.30 339.1 7.48 72.0 247.6	31186 3803 17.53 380.1 8.20 73.5 234.9
	120 (314)						21433 3229 15.08 241.7 6.64 70.6 268.5	24070 3266 15.25 272.6 7.37 71.9 254.1	26994 3302 15.40 307.3 8.17 73.4 240.2	30136 3337 15.55 345.0 9.03 74.4 227.6	33613 3366 15.67 387.1 9.99 76.0 214.7
	110 (273)					20137 2851 13.50 215.3 7.06 71.0 263.0	22760 2880 13.63 244.3 7.90 72.6 247.8	25633 2915 13.78 276.4 8.79 73.9 233.9	28674 2945 13.90 310.8 9.74 74.6 221.9	31944 2975 14.03 348.1 10.74 75.2 210.3	
	100 (237)			16589 2480 12.02 168.4 6.69 70.4 272.5	18958 2517 12.18 193.1 7.53 71.9 256.3	21491 2545 12.28 219.6 8.44 73.4 241.1	24186 2572 12.40 248.1 9.41 74.3 227.9	27143 2606 12.53 279.6 10.42 74.9 215.7	30397 2631 12.64 314.6 11.55 75.5 203.9	33944 2656 12.74 353.5 12.78 76.8 191.9	
	90 (204)		15614 2187 10.92 151.6 7.14 72.0 263.8	17825 2213 11.01 173.6 8.05 73.5 248.3	20237 2245 11.14 197.7 9.01 74.4 234.1	22835 2273 11.23 223.8 10.05 74.9 221.4	25656 2301 11.36 252.3 11.15 75.1 209.5	28693 2323 11.44 283.3 12.35 74.7 198.8	31809 2341 11.52 315.9 13.59 72.6 190.8		
	80 (175)	14540 1933 9.93 135.5 7.52 73.2 256.5	16659 1956 10.01 155.6 8.52 74.4 241.2	18903 1988 10.14 177.0 9.51 74.6 228.1	21343 2016 10.25 200.4 10.59 74.8 215.8	24024 2037 10.34 226.3 11.80 74.7 204.0	26914 2051 10.38 254.4 13.12 74.0 193.4	30124 2061 10.43 286.0 14.61 73.8 182.5			
	70 (149)	15573 1740 9.22 140.0 8.95 74.3 235.9	17618 1765 9.33 158.7 9.98 74.0 223.6	19933 1784 9.38 180.0 11.17 73.9 211.2	22529 1802 9.44 204.0 12.50 74.8 197.9						

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 A15: R-32 + R-134a mixture at 40°F Superheat, 0°F Subcooling

		Suction Dew Point Temp, °F (Suction Pressure, psia)									
		-10 (31)	-5 (34)	0 (39)	5 (43)	10 (48)	15 (54)	20 (59)	25 (66)	30 (73)	35 (80)
Discharge Dew Point Temp, °F (Discharge Pressure, psia)	140 (410)									28072 4203 19.23 326.6 6.68 69.2 274.6	31564 4256 19.47 364.4 7.42 72.2 263.7
	130 (360)							24177 3638 16.82 271.3 6.65 69.1 270.2	27069 3712 17.14 301.2 7.29 70.5 261.6	30498 3730 17.21 337.1 8.18 73.0 251.4	34062 3780 17.42 373.7 9.01 74.7 243.9
	120 (314)					20156 3151 14.78 218.4 6.40 67.2 270.8	22943 3203 14.99 247.0 7.16 69.7 258.6	25887 3241 15.16 276.5 7.99 71.9 248.0	28973 3302 15.40 307.3 8.77 73.4 240.2	32400 3323 15.51 341.4 9.75 75.0 232.2	36054 3360 15.67 377.3 10.73 76.3 225.7
	110 (273)			16653 2742 13.10 175.2 6.07 65.2 272.7	19101 2789 13.30 199.4 6.85 68.0 258.7	21670 2830 13.46 224.5 7.66 70.0 247.5	24461 2868 13.62 251.8 8.53 71.9 237.5	27465 2906 13.78 280.7 9.45 73.4 229.2	30604 2945 13.90 310.8 10.39 74.6 221.9	34277 2967 14.03 345.7 11.55 76.1 214.6	
	100 (237)			17899 2461 11.98 180.4 7.27 68.4 247.3	20346 2501 12.15 203.7 8.14 70.4 236.0	22990 2535 12.28 228.4 9.07 71.8 226.7	25867 2569 12.42 255.3 10.07 73.2 218.3	28999 2597 12.53 284.4 11.17 74.4 210.5	32300 2631 12.64 314.6 12.28 75.5 203.9	36063 2648 12.74 349.1 13.62 76.0 198.6	
	90 (204)		16727 2179 10.88 163.0 7.68 68.2 237.2	19025 2217 11.04 184.2 8.58 70.1 225.8	21478 2246 11.13 206.6 9.56 71.2 216.8	24213 2276 11.26 231.2 10.64 72.2 208.7	27218 2304 11.37 258.3 11.81 73.1 201.2	30402 2328 11.47 286.7 13.06 73.2 195.8	33703 2341 11.52 315.9 14.40 72.6 190.8		
	80 (175)	15458 1931 9.93 146.1 8.00 68.0 226.9	17619 1970 10.09 165.5 8.95 69.1 216.8	19931 1996 10.19 185.8 9.98 70.2 207.5	22521 2018 10.27 208.5 11.16 70.9 199.3	25375 2038 10.35 233.5 12.45 71.6 191.6	28545 2056 10.42 261.1 13.88 72.2 184.4	31847 2061 10.43 289.2 15.45 72.5 178.5	35586 2065 10.46 321.8 17.23 71.5 173.8		
	70 (149)	16001 1745 9.24 148.0 9.17 67.4 209.4	18188 1767 9.32 167.2 10.29 68.3 199.7	20603 1790 9.40 188.2 11.51 69.0 191.0	23270 1808 9.48 211.2 12.87 69.4 183.2						

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

- Capacity, Input Power, and EER

Figures B1 to B20 present measured capacity, input power, EER, and isentropic efficiency as a function of suction dew point temperature for given discharge dew point temperature at 65°F suction temperature and 0°F subcooling for baseline and each alternative refrigerant tested. Note that some irregular variations in isentropic efficiency are observed, particularly in Figures B19 and B20. This is due to small variations in discharge pressure, which is within the 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 $\pm 0.5^\circ\text{F}$.

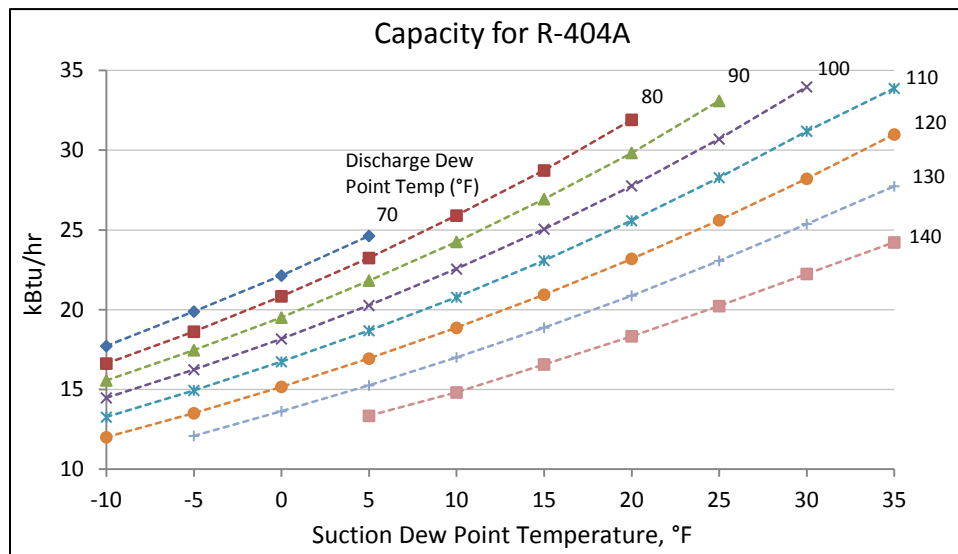


Figure B1 Capacity for R-404A.

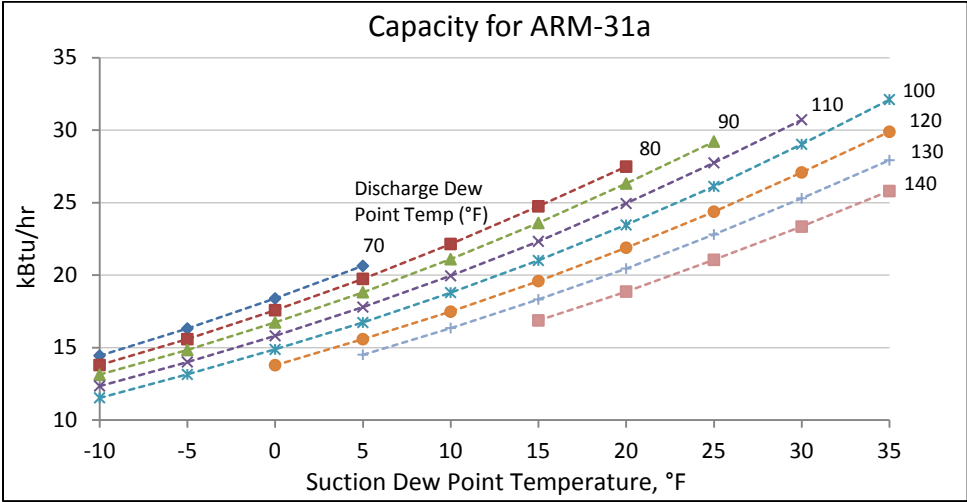


Figure B2 Capacity for ARM-31a.

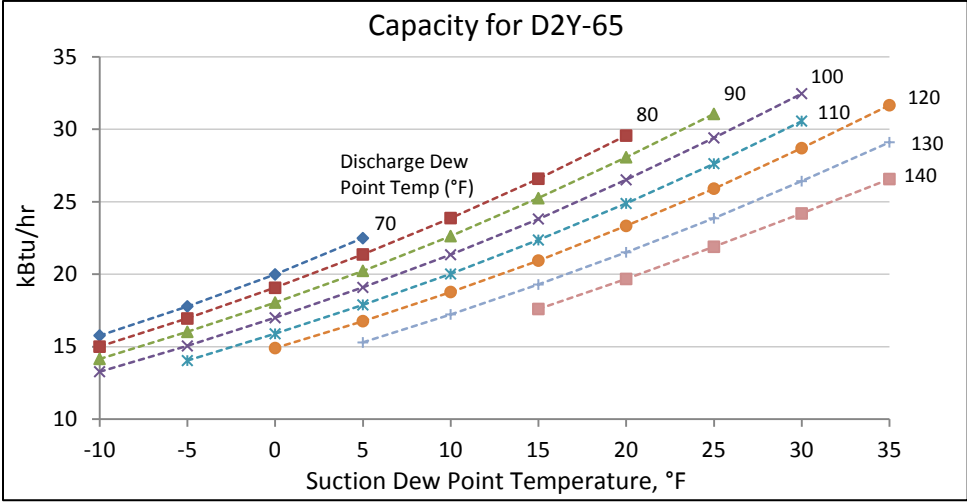


Figure B3 Capacity for D2Y-65.

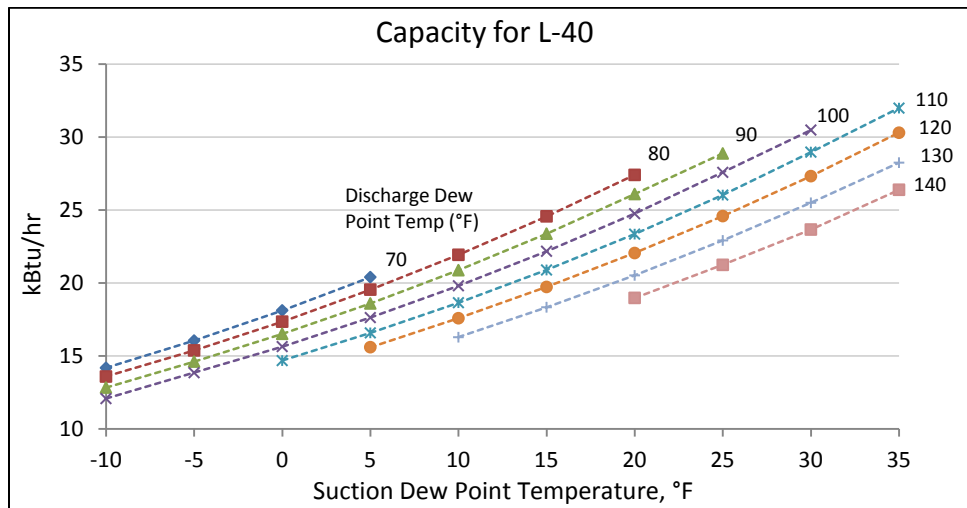


Figure B4 Capacity for L-40.

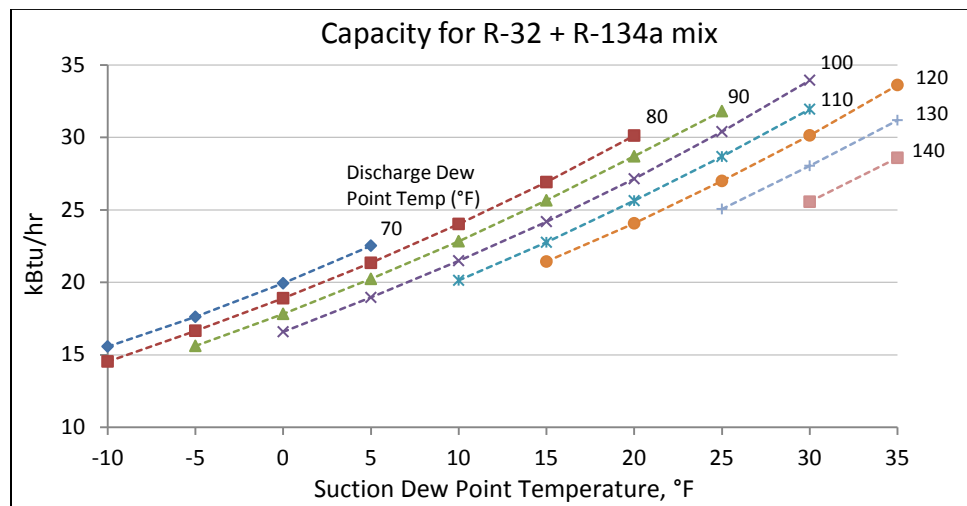


Figure B5 Capacity for R-32 + R-134a mixture.

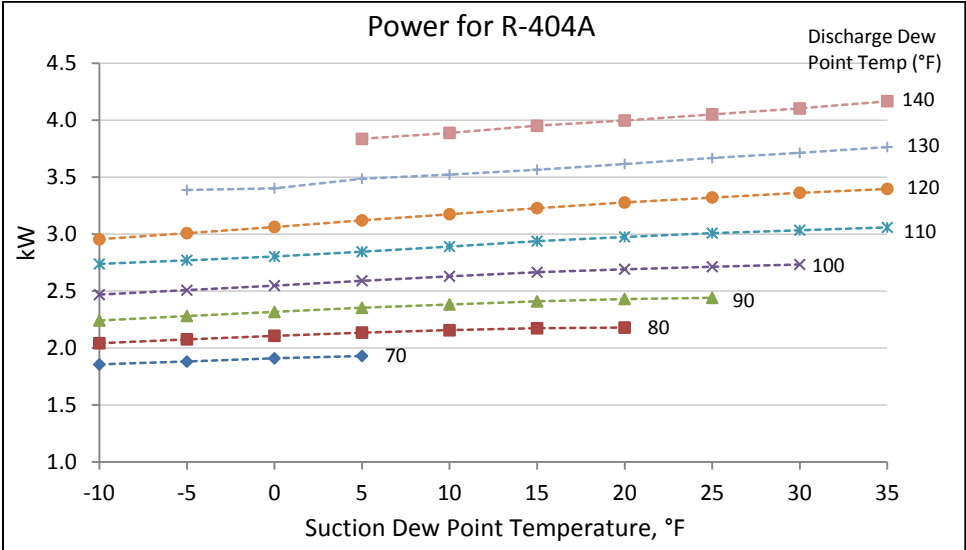


Figure B6 Power for R-404A.

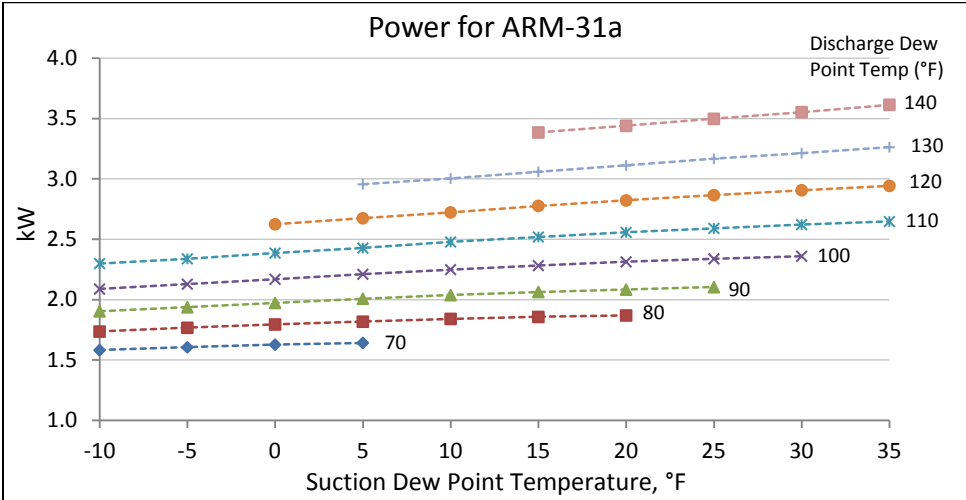


Figure B7 Power for ARM-31a.

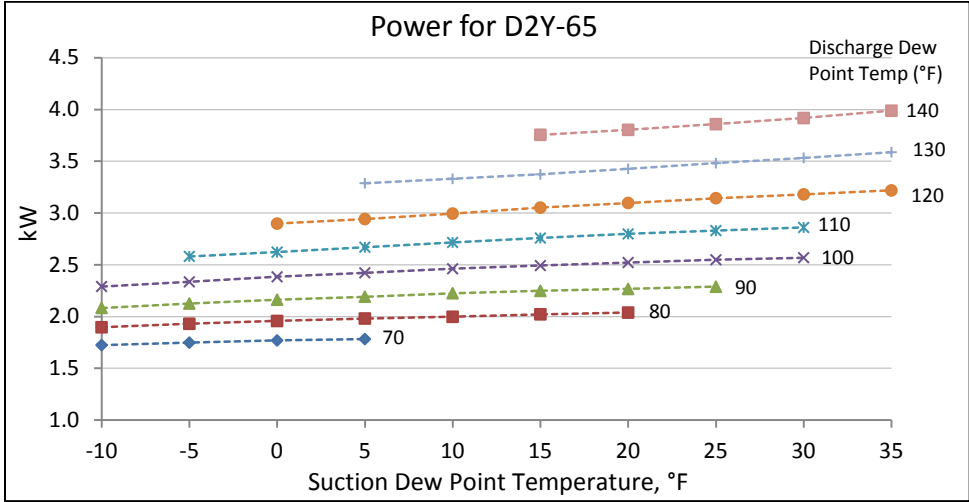


Figure B8 Power for D2Y-65.

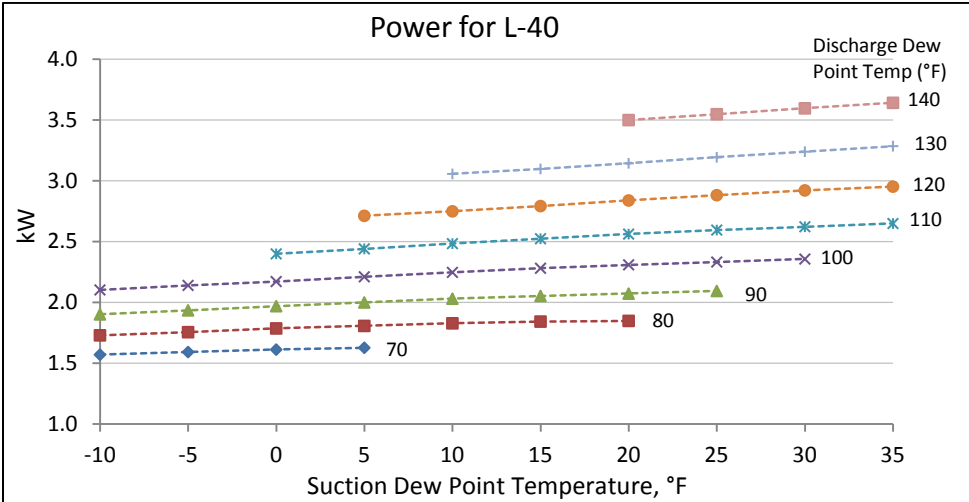


Figure B9 Power for L-40.

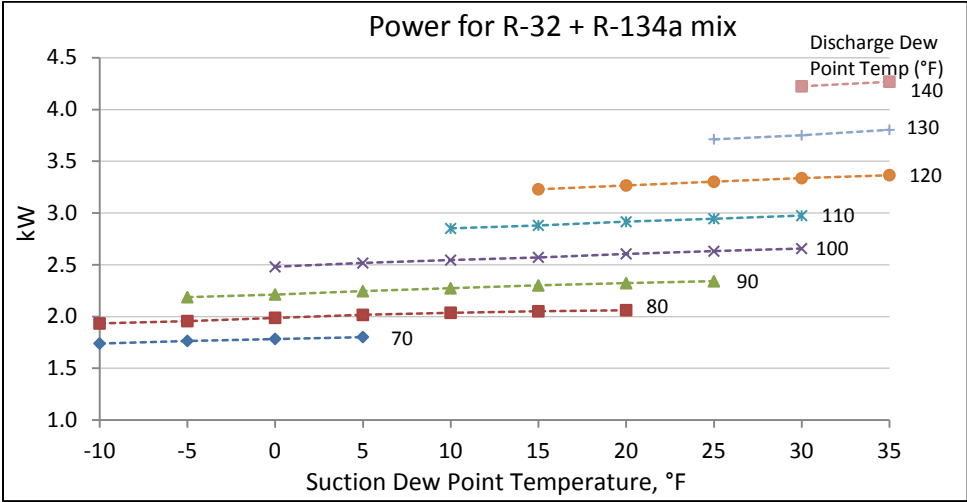


Figure B10 Power for R-32 + R-134a mixture.

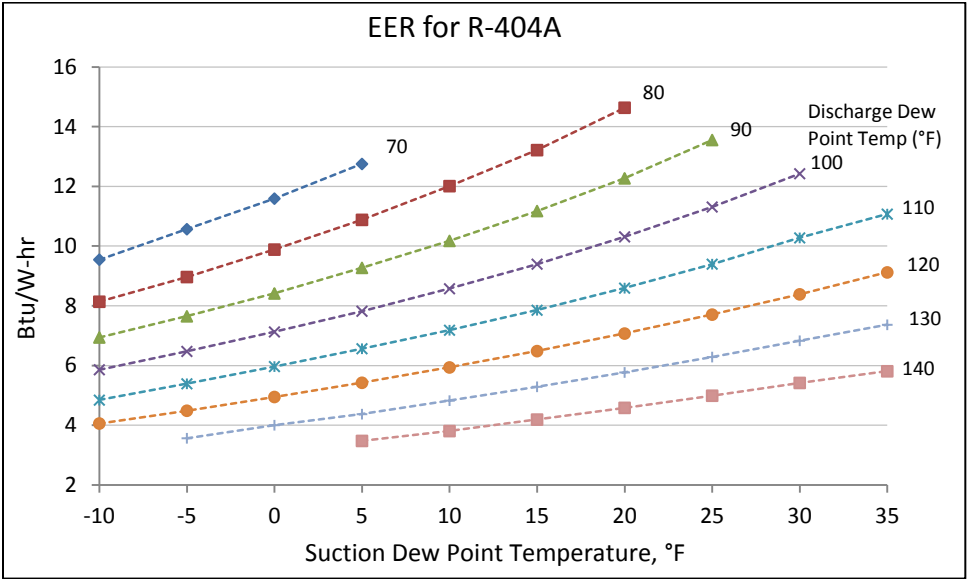


Figure B11 EER for R-404A.

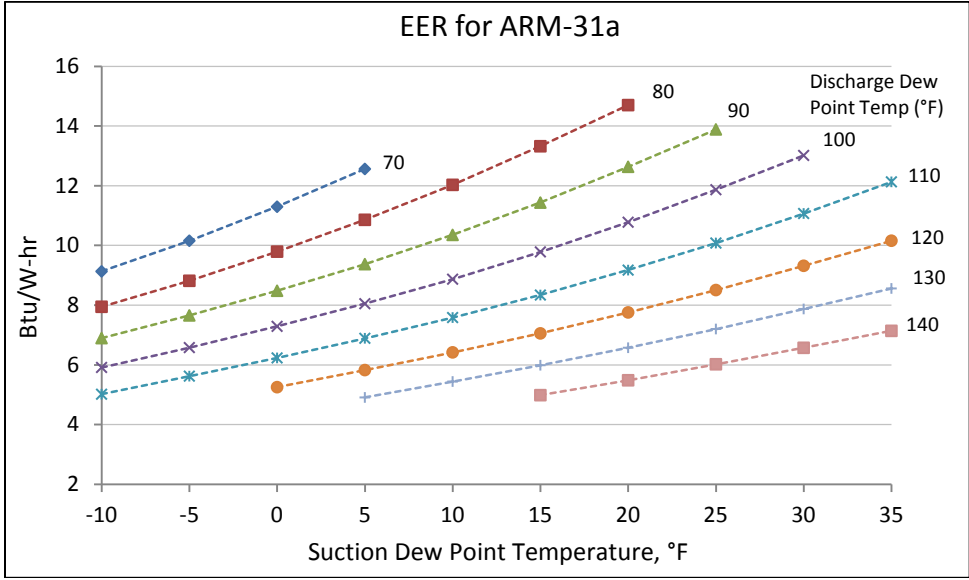


Figure B12 EER for ARM-31a.

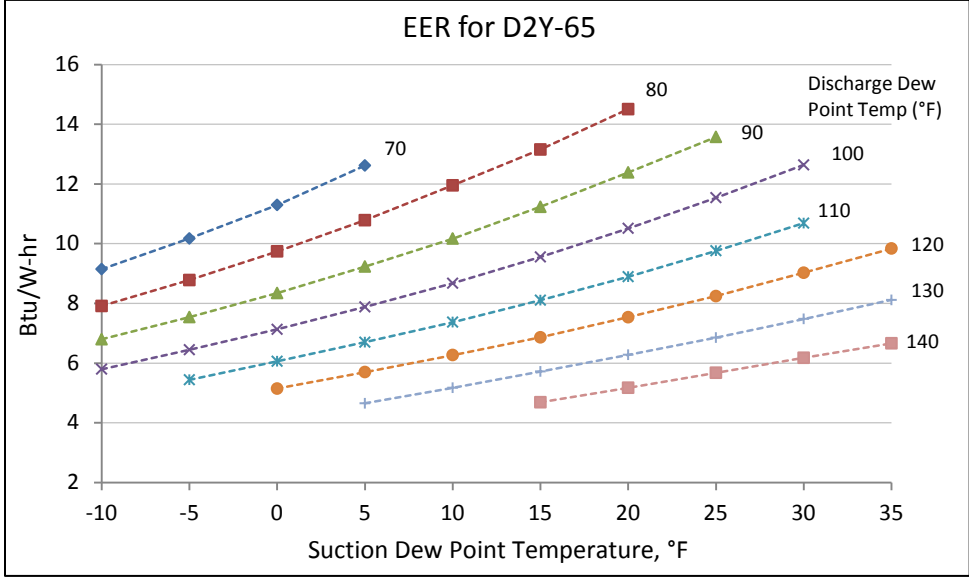


Figure B13 EER for D2Y-65.

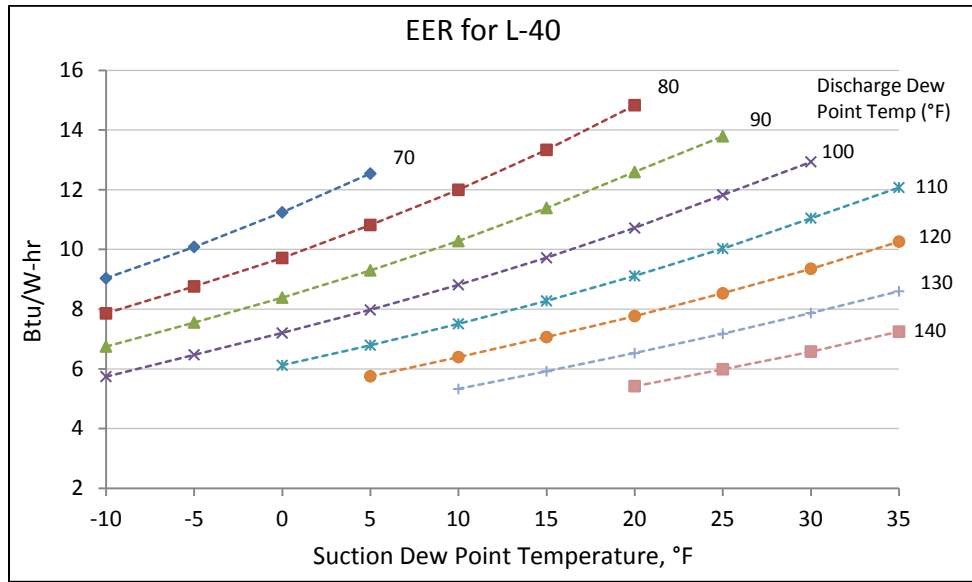


Figure B14 EER for L-40.

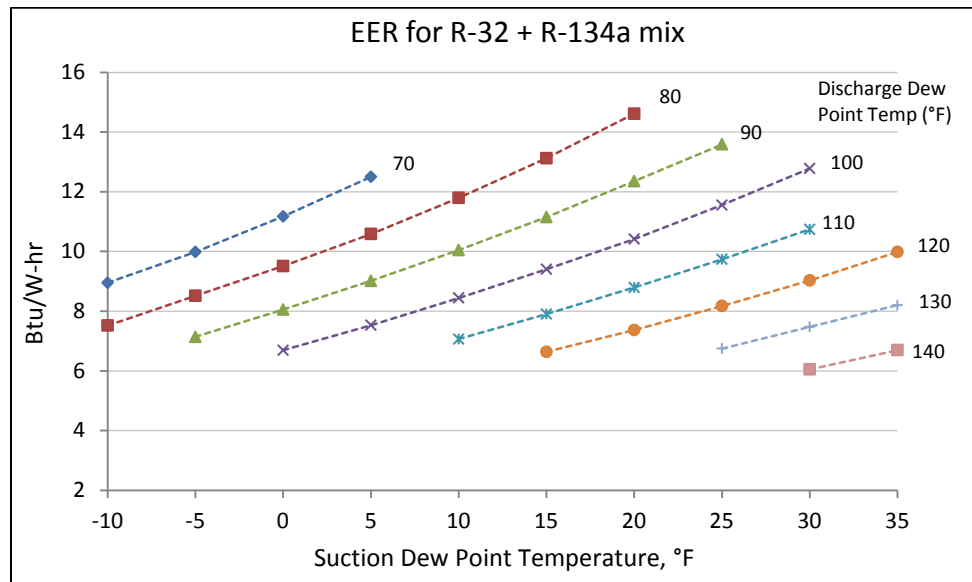


Figure B15 EER for R-32 + R-134a mixture.

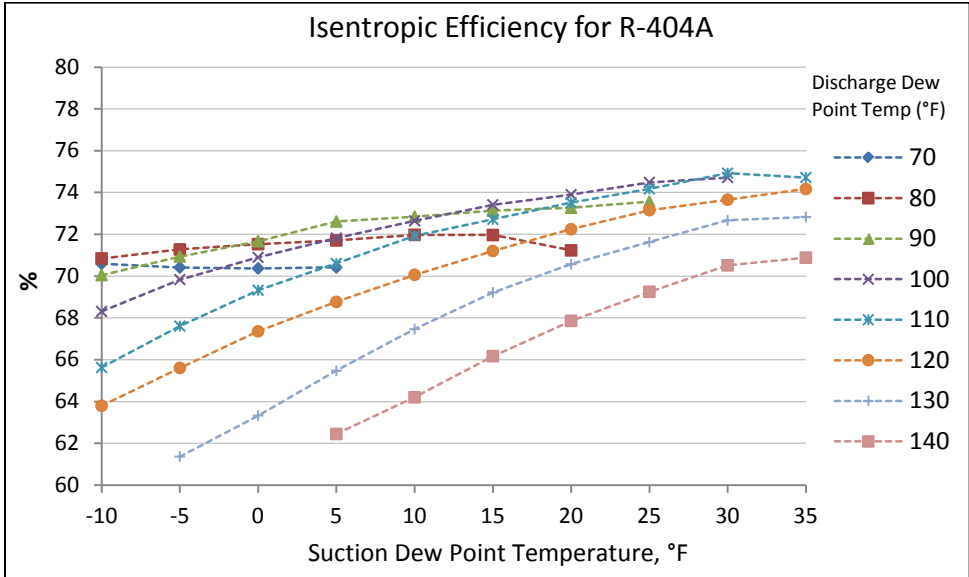


Figure B16 Isentropic efficiency for R-404A.

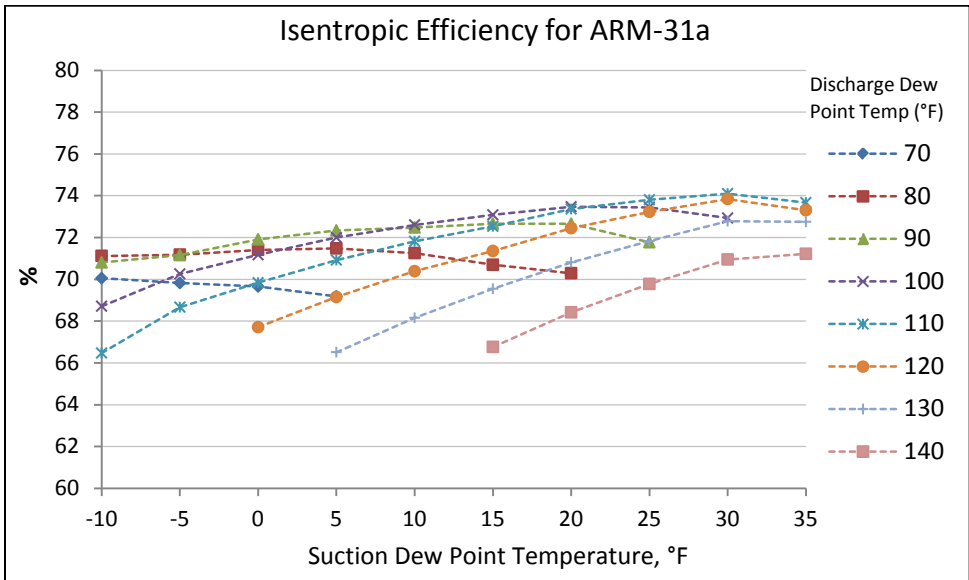


Figure B17 Isentropic efficiency for ARM-31a.

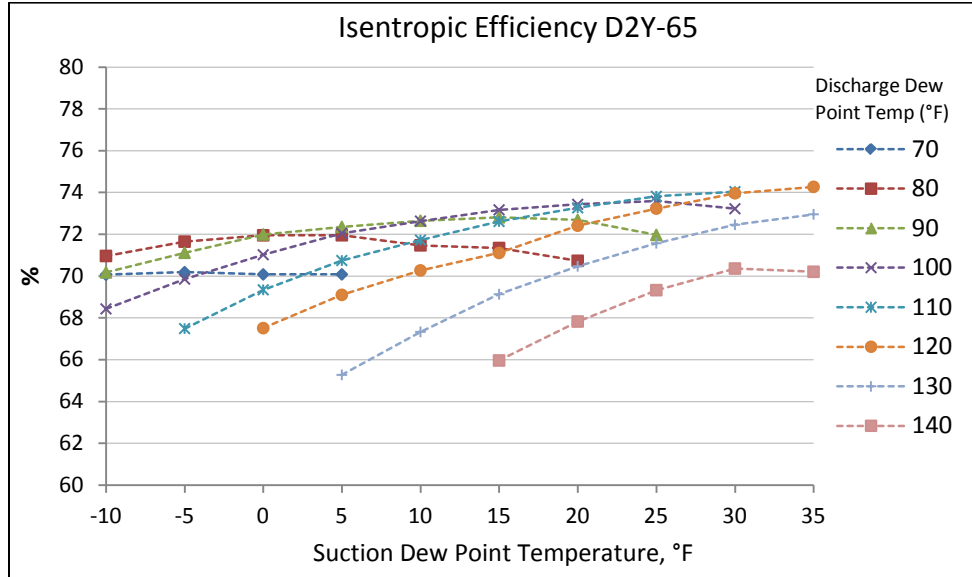


Figure B18 Isentropic efficiency for D2Y-65.

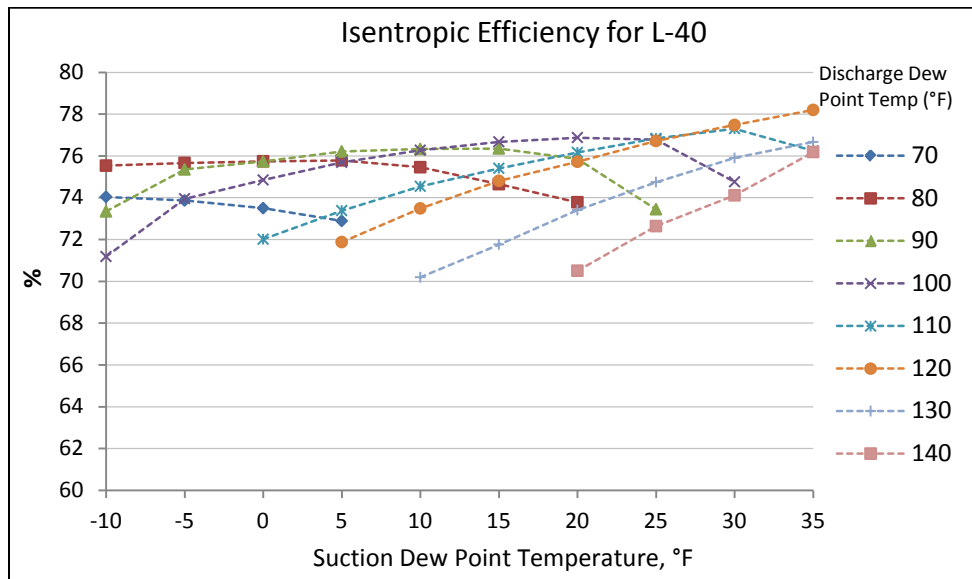


Figure B19 Isentropic efficiency for L-40.

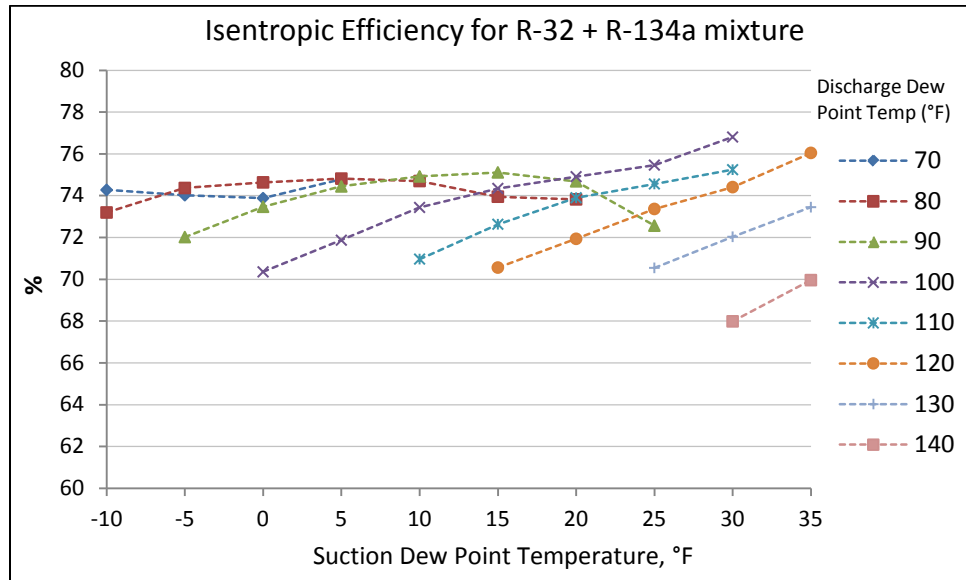


Figure B20 Isentropic efficiency for R-32 + R-134a mixture.

- 10-Coefficient polynomial equation for each test refrigerant

Tables B1 to B5 provide the 10 coefficients for mass flow rate, capacity, power, EER, and discharge temperature polynomials 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 65°F suction temperature and 0°F subcooling. The standard form of the 10-coefficient polynomial is given as follows:

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

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, discharge temperature)

Table B1: 10 Coefficients for R-404A

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C ₁	3.099E+02	3.088E+04	6.263E+01	3.309E+01	8.626E+01
C ₂	7.418E+00	6.221E+02	-1.650E+01	6.356E-01	-1.971E+00
C ₃	5.118E-01	-1.316E+02	3.893E+01	-4.589E-01	1.295E+00
C ₄	8.551E-02	7.741E+00	-2.541E-01	4.534E-03	-1.423E-02
C ₅	-1.984E-03	-1.477E+00	3.893E-01	-7.585E-03	1.722E-02
C ₆	-5.002E-03	2.145E-01	-2.707E-01	2.597E-03	-5.451E-03
C ₇	5.737E-04	1.660E-02	-1.536E-03	9.910E-06	-1.127E-04
C ₈	-1.864E-04	-4.320E-02	2.238E-03	-3.433E-05	2.741E-04
C ₉	8.731E-06	-7.036E-03	-1.395E-03	2.563E-05	-1.584E-04
C ₁₀	6.149E-06	-1.725E-03	1.302E-03	-6.071E-06	3.780E-05

Table B2: 10 Coefficients for ARM-31a

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C ₁	1.526E+02	1.961E+04	2.245E+02	2.934E+01	1.156E+02
C ₂	4.571E+00	5.097E+02	-1.570E+01	6.692E-01	-2.214E+00
C ₃	1.580E+00	5.332E+01	2.817E+01	-3.785E-01	9.551E-01
C ₄	5.283E-02	6.148E+00	-2.625E-01	5.159E-03	-1.447E-02
C ₅	5.484E-03	-7.381E-01	3.731E-01	-8.233E-03	1.811E-02
C ₆	-1.572E-02	-1.259E+00	-1.840E-01	2.066E-03	-1.569E-03
C ₇	2.893E-04	1.431E-02	-1.758E-03	1.288E-05	-1.425E-04
C ₈	-5.338E-05	-2.616E-02	2.539E-03	-4.003E-05	3.194E-04
C ₉	-2.728E-05	-5.676E-03	-1.349E-03	3.001E-05	-1.884E-04
C ₁₀	4.436E-05	3.451E-03	9.676E-04	-4.868E-06	3.143E-05

Table B3: 10 Coefficients for D2Y-65

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C ₁	2.836E+02	3.022E+04	-1.242E+02	3.434E+01	9.208E+01
C ₂	5.828E+00	6.132E+02	-2.490E+01	7.155E-01	-2.418E+00
C ₃	-1.849E+00	-2.130E+02	4.246E+01	-5.268E-01	1.669E+00
C ₄	6.560E-02	7.160E+00	-3.695E-01	5.467E-03	-1.497E-02
C ₅	-1.450E-02	-2.341E+00	5.711E-01	-9.296E-03	2.258E-02
C ₆	1.893E-02	1.326E+00	-3.278E-01	3.492E-03	-8.719E-03
C ₇	4.389E-04	2.389E-02	-1.397E-03	1.564E-05	-1.881E-04
C ₈	-2.102E-04	-3.973E-02	3.391E-03	-4.482E-05	3.507E-04
C ₉	8.741E-05	2.311E-03	-2.377E-03	3.559E-05	-2.195E-04
C ₁₀	-7.123E-05	-5.177E-03	1.536E-03	-9.443E-06	5.704E-05

Table B4: 10 Coefficients for L-40

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C ₁	1.956E+02	2.434E+04	7.809E+01	3.234E+01	1.326E+02
C ₂	4.965E+00	5.720E+02	-2.279E+01	7.407E-01	-2.086E+00
C ₃	-6.128E-01	-1.077E+02	3.334E+01	-4.776E-01	5.810E-01
C ₄	4.285E-02	5.664E+00	-3.688E-01	5.702E-03	1.945E-03
C ₅	-1.537E-02	-2.115E+00	5.530E-01	-9.813E-03	1.311E-02
C ₆	6.863E-03	4.378E-01	-2.543E-01	3.129E-03	2.927E-03
C ₇	2.891E-04	1.694E-02	-2.139E-03	1.693E-05	-1.486E-04
C ₈	-3.857E-05	-2.336E-02	3.875E-03	-4.763E-05	1.969E-04
C ₉	8.369E-05	2.218E-03	-2.517E-03	3.910E-05	-1.790E-04
C ₁₀	-3.213E-05	-2.310E-03	1.304E-03	-8.669E-06	2.182E-05

Table B5: 10 Coefficients for R-32 + R-134a mixture

Coefficient	Mass Flow, lbs/hr	Capacity, Btu/hr	Power, W	EER, Btu/W-hr	Discharge Temperature, °F
C ₁	2.054E+02	2.727E+04	-4.130E+01	3.526E+01	1.187E+02
C ₂	3.382E+00	4.569E+02	-2.751E+01	7.456E-01	-1.913E+00
C ₃	-4.053E-01	-9.822E+01	4.213E+01	-5.604E-01	1.131E+00
C ₄	4.129E-02	5.798E+00	-4.901E-01	6.785E-03	-1.516E-02
C ₅	2.083E-02	1.351E+00	7.279E-01	-1.032E-02	1.279E-02
C ₆	1.278E-03	-1.063E-01	-3.700E-01	3.900E-03	-7.791E-04
C ₇	4.074E-04	2.998E-02	-2.598E-03	2.738E-05	-2.853E-04
C ₈	-3.919E-05	-2.456E-02	5.610E-03	-6.443E-05	4.768E-04
C ₉	-8.525E-05	-1.467E-02	-3.951E-03	4.538E-05	-2.689E-04
C ₁₀	-8.186E-06	2.934E-04	2.010E-03	-1.151E-05	4.746E-05