

CASCADE17-0231Y1



Performance Characteristics

CECOMAF LBP							12V	Test Temperatures	CECOMAF	SPEER
RPM	Cooling Capacity		Power	Current	Efficiency		COP	Condensing	Evaporator	Ambient
	BTU/hr	Watt	Watt	Amp	EER					
1800	168.91	49.50	42.60	3.55	3.97	1.16		55°C(131°F)	40.6°C(105°F)	
3000	260.31	76.29	68.40	5.70	3.81	1.12		-25°C(-13°F)	-23.3°C(-10°F)	
4200	352.15	103.20	95.40	7.95	3.69	1.08		32.2°C(90°F)	32.2°C(90°F)	
								Suction Gas	32.2°C(90°F)	32.2°C(90°F)
								Liquid	55°C(131°F)	32.2°C(90°F)

CECOMAF LBP							24V
RPM	Cooling Capacity		Power	Current	Efficiency		COP
	BTU/hr	Watt	Watt	Amp	EER		
1800	177.45	52.01	45.60	1.90	3.89	1.14	
3000	263.67	77.27	67.20	2.80	3.92	1.15	
4200	354.57	103.91	93.60	3.90	3.79	1.11	

SPEER							12V
rpm	Cooling Capacity		Power	Current	Efficiency		COP
	BTU/hr	Watt	Watt	Amp	EER		
1800	224.91	65.91	39.60	3.30	5.68	1.66	
3000	361.73	106.01	66.00	5.50	5.48	1.61	
4200	490.25	143.68	93.60	7.80	5.24	1.54	

SPEER							24V
rpm	Cooling Capacity		Power	Current	Efficiency		COP
	BTU/hr	Watt	Watt	Amp	EER		
1800	226.44	66.36	38.40	1.60	5.90	1.73	
3000	361.65	105.99	64.80	2.70	5.58	1.64	
4200	486.04	142.44	91.20	3.80	5.33	1.56	

*ALTERNATE MOUNTING: 6.7" [171] L x 2.8" [70] W, Ø.64" [16]

12/24VDC Controller Features

- 4 pole sensor-less variable speed BLDC motor controller
- 180W maximum output power
- 10-31 VDC input range
- 48V motor supply (voltage boost)
- 12V or 24V operation (auto detect on power up)
- 1800 – 4200 rpm speed
- 0.5 - 4.75V analog speed set input (resistor programmable for fixed speed)
- 0°C to 45°C operating temperature
- Under/Over voltage shutdown (resistor programmable under voltage thresholds)
- Locked rotor detection
- Thermal shutdown – for power devices
- Over current shutdown – for power devices
- Low speed shutdown
- TTL Fault output
- Pulsed Fault output (030F0182 & 030F0186 only)
- LED fault indicator
- Fan output, +12VDC @ 0.5A with voltage detection
- Reverse polarity protection

Optional Fixed Resistor Speed Chart

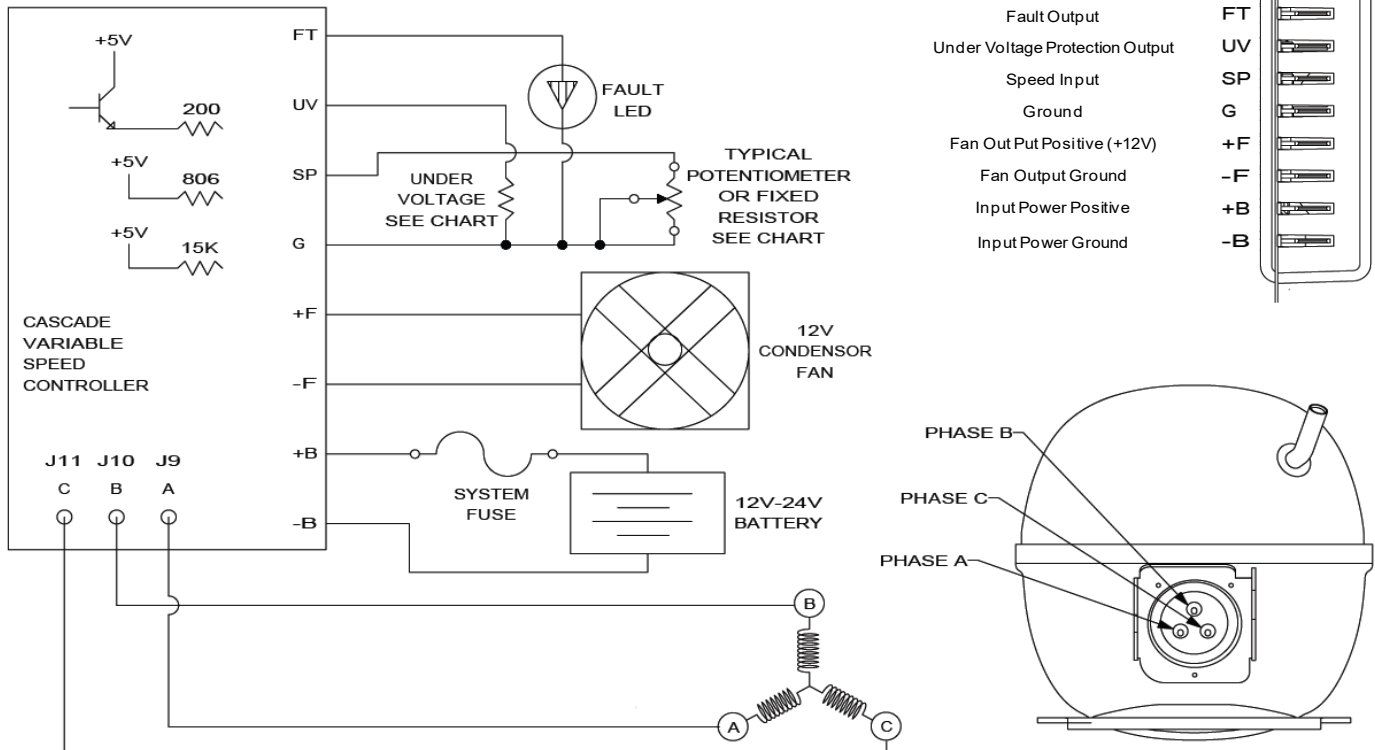
Resistor Value OHMS	Motor Speed [RPM]
200	1800
242	1900
287	2000
388	2200
510	2400
659	2600
847	2800
1090	3000
1.4k	3200
1.88k	3400
2.58k	3600
3.8k	3800
6.36k	4000
15.3k	4200

Use the formula below to find the resistor value needed to achieve a specific speed for the controller.

$$\frac{934960 - 806 \cdot \text{Speed_Desired}}{\text{Speed_Desired} - 4360}$$

LED Fault Indicator Output

Motor Fault	1 Flash
Under Voltage	2 Flashes
Over Voltage	3 Flashes
Over Temperature	4 Flashes
Over Current/Power	5 Flashes
Fan Voltage Error	6 Flashes
General Hardware Error	7 Flashes
System Integrity Fault	8 Flashes



48 VDC Controller Features

- 4 pole sensor-less variable speed BLDC motor controller
- 420W maximum output power
- 39-60 VDC input range
- 1800 – 4200 rpm speed
- 1.0 - 4.75V analog speed set input (resistor programmable for fixed speed)
- 0°C to 45°C operating temperature
- Up to 55°C operating temperature with airflow (min. 1.5 m/s)
- Under/Over voltage shutdown (resistor programmable under voltage thresholds)
- Locked rotor detection
- Thermal shutdown – for power devices
- Over current shutdown – for power devices
- Low speed shutdown
- TTL Fault output
- LED fault indicator
- Fan output, +12VDC @ 0.5A with voltage detection
- Reverse polarity protection

Optional Fixed Resistor Speed Chart

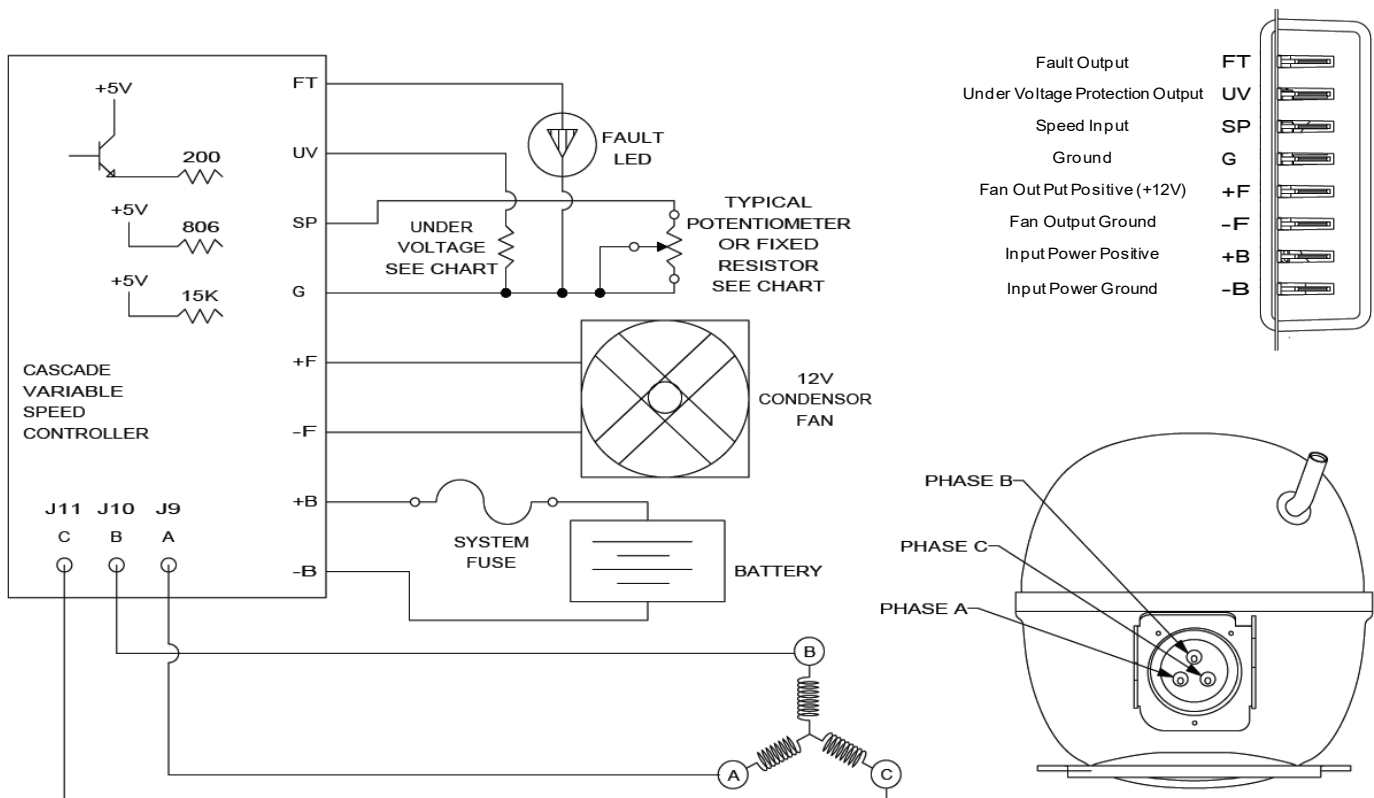
Resistor Value OHMS	Motor Speed [RPM]
0	3000
200	1800
242	1900
287	2000
388	2200
510	2400
659	2600
847	2800
1090	3000
1.4k	3200
1.88k	3400
2.58k	3600
3.8k	3800
6.36k	4000
15.3k	4200

Use the formula below to find the resistor value needed to achieve a specific speed for the controller.

$$\frac{934960 - 806 \cdot \text{Speed_Desired}}{\text{Speed_Desired} - 4360}$$

LED Fault Indicator Output

Motor Fault	1 Flash
Under Voltage	2 Flashes
Over Voltage	3 Flashes
Over Temperature	4 Flashes
Over Current/Power	5 Flashes
Fan Voltage Error	6 Flashes
General Hardware Error	7 Flashes
System Integrity Fault	8 Flashes



CASCADE17-0231Y1



Cooling Capacity (12V) - ASHRAE LBP BTU/hr (Watt)

RPM	Evaporator Temperature													
	-30°F (-34°C)	-20°F (-29°C)	-10°F (-23°C)	-5°F (-21°C)	0°F (-18°C)	5°F (-15°C)	10°F (-12°C)							
1800	132 (39)	174 (51)	236 (69)	275 (81)	320 (94)	371 (109)	429 (126)							
2400	156 (46)	218 (64)	302 (88)	353 (103)	411 (120)	475 (139)	548 (160)							
3000	179 (52)	259 (76)	363 (106)	425 (124)	494 (145)	571 (167)	657 (192)							
3600	205 (60)	300 (88)	422 (124)	494 (145)	575 (168)	664 (194)	761 (223)							
4200	239 (70)	347 (102)	485 (142)	566 (166)	656 (192)	756 (221)	865 (253)							

Power Consumption (12V) - ASHRAE LBP Watt Current (12V) - ASHRAE LBP Amp

RPM	Evaporator Temperature							Evaporator Temperature						
	-30°F	-20°F	-10°F	-5°F	0°F	5°F	10°F	-30°F	-20°F	-10°F	-5°F	0°F	5°F	10°F
1800	27.4	36.1	45.3	50.0	54.7	59.4	63.8	2.29	3.00	3.78	4.17	4.56	4.95	5.32
2400	38.2	48.3	59.5	65.4	71.4	77.4	83.4	3.18	4.03	4.96	5.45	5.95	6.45	6.95
3000	47.0	59.1	72.8	80.1	87.6	95.3	103.0	3.91	4.93	6.07	6.68	7.30	7.94	8.58
3600	55.2	69.9	86.5	95.5	104.8	114.3	124.0	4.60	5.82	7.21	7.96	8.73	9.52	10.34
4200	64.4	82.0	102.1	113.0	124.3	136.0	148.0	5.36	6.83	8.51	9.42	10.36	11.33	12.33

Efficiency (12V) - ASHRAE LBP BTU/hr/W (W/W)

RPM	Evaporator Temperature													
	-30°F (-34°C)	-20°F (-29°C)	-10°F (-23°C)	-5°F (-21°C)	0°F (-18°C)	5°F (-15°C)	10°F (-12°C)							
1800	4.80 (1.40)	4.84 (1.42)	5.21 (1.53)	5.50 (1.61)	5.85 (1.71)	6.26 (1.83)	6.73 (1.97)							
2400	4.08 (1.20)	4.51 (1.32)	5.07 (1.48)	5.39 (1.58)	5.75 (1.68)	6.14 (1.80)	6.57 (1.92)							
3000	3.82 (1.12)	4.38 (1.28)	4.98 (1.46)	5.30 (1.55)	5.64 (1.65)	6.00 (1.76)	6.38 (1.87)							
3600	3.72 (1.09)	4.30 (1.26)	4.88 (1.43)	5.18 (1.52)	5.49 (1.61)	5.81 (1.70)	6.14 (1.80)							
4200	3.71 (1.09)	4.23 (1.24)	4.75 (1.39)	5.01 (1.47)	5.28 (1.55)	5.56 (1.63)	5.84 (1.71)							

* all points are at 32.2°C (90°F) ambient, 32.2°C (90°F) suction temperature, 22.2°C (40°F) subcooling, 54.4°C (130°F) condenser

Performance Coefficients (12V) - ASHRAE LBP

Coefficient	Capacity (BTU/Hr)	Power (Watts)	Current (Amperes)	Mass Flow (Lbs/Hr)
C1	-5.865171E+02	-3.347988E+02	-2.721882E+01	-1.746902E+01
C2	7.795594E-01	-1.275935E-02	-7.072414E-04	7.341712E-03
C3	-7.949066E-05	-6.686773E-06	-2.843992E-07	-7.088148E-07
C4	3.028116E-09	1.096798E-09	5.782336E-11	2.220380E-11
C5	-3.291130E+01	3.174785E+00	8.142317E-02	-6.612940E-01
C6	3.131571E-01	-2.627319E-03	-5.459108E-04	6.732191E-04
C7	5.535162E-04	-8.019912E-05	-4.315361E-06	4.286384E-06
C8	5.273172E+00	8.740374E+00	7.030556E-01	3.051492E-01
C9	3.865635E-03	-7.889288E-02	-6.183306E-03	-1.824531E-03
C10	-8.957615E-05	2.364701E-04	1.830999E-05	3.529671E-06
C11	-1.201233E-04	3.696316E-05	1.654576E-06	-1.947497E-06
C12	1.317918E-08	8.693983E-10	8.834997E-11	8.741471E-11
C13	7.464576E-07	4.978994E-08	1.664768E-09	6.848875E-09
C14	2.028097E-07	-1.681933E-07	-9.129773E-09	7.130796E-09
C15	1.771582E-02	-1.807141E-03	-5.432554E-05	2.197611E-04
C16	-4.746823E-03	9.393491E-04	6.072191E-05	-4.223870E-05
C17	5.317662E-01	-6.513896E-02	-2.749166E-03	1.029480E-02
C18	-1.987500E-06	-4.415242E-08	-4.703083E-09	-1.664229E-08
C19	-7.387996E-05	-2.617428E-06	1.396118E-07	-4.634496E-07
C20	3.697482E-07	-1.433335E-08	-8.416611E-10	2.986327E-09
C21	4.739311E-06	-3.566268E-06	-2.408828E-07	7.435882E-08
C22	-1.747337E-03	-4.553707E-05	-1.412274E-06	-7.733993E-07
C23	-2.110522E-03	3.386957E-04	1.896068E-05	-4.198871E-05

Performance Equation

$$Y = C_1 + C_2 X_1 + C_3 X_1^2 + C_4 X_1^3 + C_5 X_2 + C_6 X_2^2 + C_7 X_2^3 + C_8 X_3 + C_9 X_3^2 + C_{10} X_3^3 + C_{11} X_1 X_2 X_3 + C_{12} X_1^2 X_2 X_3 + C_{13} X_1 X_2^2 X_3 + C_{14} X_1 X_2 X_3^2 + C_{15} X_1^2 X_2 X_3 + C_{16} X_1 X_2^2 X_3 + C_{17} X_2 X_3^2 + C_{18} X_1^2 X_2 + C_{19} X_1 X_2^2 + C_{20} X_1^2 X_3 + C_{21} X_1 X_3^2 + C_{22} X_2^2 X_3 + C_{23} X_2 X_3^2$$

$X_1 = \text{RPM}$
 $X_2 = E_t \text{ (°F)}$
 $X_3 = C_t \text{ (°F)}$

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Cooling Capacity (24V) - ASHRAE LBP BTU/hr (Watt)

RPM	Evaporator Temperature													
	-30°F (-34°C)	-20°F (-29°C)	-10°F (-23°C)	-5°F (-21°C)	0°F (-18°C)	5°F (-15°C)	10°F (-12°C)							
1800	132 (39)	174 (51)	236 (69)	275 (81)	320 (94)	371 (109)	429 (126)							
2400	156 (46)	218 (64)	302 (88)	353 (103)	411 (120)	475 (139)	548 (160)							
3000	179 (52)	259 (76)	363 (106)	425 (124)	494 (145)	571 (167)	657 (192)							
3600	205 (60)	300 (88)	422 (124)	494 (145)	575 (168)	664 (194)	761 (223)							
4200	239 (70)	347 (102)	485 (142)	566 (166)	656 (192)	756 (221)	865 (253)							

Power Consumption (24V) - ASHRAE LBP Watt Current (24V) - ASHRAE LBP Amp

RPM	Evaporator Temperature							Evaporator Temperature						
	-30°F	-20°F	-10°F	-5°F	0°F	5°F	10°F	-30°F	-20°F	-10°F	-5°F	0°F	5°F	10°F
1800	27.4	36.1	45.3	50.0	54.7	59.4	63.8	1.14	1.50	1.89	2.08	2.28	2.47	2.66
2400	38.2	48.3	59.5	65.4	71.4	77.4	83.4	1.59	2.01	2.48	2.73	2.98	3.23	3.48
3000	47.0	59.1	72.8	80.1	87.6	95.3	103.0	1.96	2.46	3.03	3.34	3.65	3.97	4.29
3600	55.2	69.9	86.5	95.5	104.8	114.3	124.0	2.30	2.91	3.61	3.98	4.36	4.76	5.17
4200	64.4	82.0	102.1	113.0	124.3	136.0	148.0	2.68	3.42	4.26	4.71	5.18	5.66	6.16

Efficiency (24V) - ASHRAE LBP BTU/hr/W (W/W)

RPM	Evaporator Temperature													
	-30°F (-34°C)	-20°F (-29°C)	-10°F (-23°C)	-5°F (-21°C)	0°F (-18°C)	5°F (-15°C)	10°F (-12°C)							
1800	4.80 (1.40)	4.84 (1.42)	5.21 (1.53)	5.50 (1.61)	5.85 (1.71)	6.26 (1.83)	6.73 (1.97)							
2400	4.08 (1.20)	4.51 (1.32)	5.07 (1.48)	5.39 (1.58)	5.75 (1.68)	6.14 (1.80)	6.57 (1.92)							
3000	3.82 (1.12)	4.38 (1.28)	4.98 (1.46)	5.30 (1.55)	5.64 (1.65)	6.00 (1.76)	6.38 (1.87)							
3600	3.72 (1.09)	4.30 (1.26)	4.88 (1.43)	5.18 (1.52)	5.49 (1.61)	5.81 (1.70)	6.14 (1.80)							
4200	3.71 (1.09)	4.23 (1.24)	4.75 (1.39)	5.01 (1.47)	5.28 (1.55)	5.56 (1.63)	5.84 (1.71)							

* all points are at 32.2°C (90°F) ambient, 32.2°C (90°F) suction temperature, 22.2°C (40°F) subcooling, 54.4°C (130°F) condenser

Performance Coefficients (24V) - ASHRAE LBP

Coefficient	Capacity (BTU/Hr)	Power (Watts)	Current (Amperes)	Mass Flow (Lbs/Hr)
C1	-5.865171E+02	-3.347988E+02	-8.922523E+00	-1.746902E+01
C2	7.795594E-01	-1.275935E-02	-4.858300E-04	7.341712E-03
C3	-7.949066E-05	-6.686773E-06	-3.650428E-07	-7.088148E-07
C4	3.028116E-09	1.096798E-09	5.262470E-11	2.220380E-11
C5	-3.291130E+01	3.174785E+00	5.216845E-02	-6.612940E-01
C6	3.131571E-01	-2.627319E-03	-1.921928E-04	6.732191E-04
C7	5.535162E-04	-8.019912E-05	-3.252522E-06	4.286384E-06
C8	5.273172E+00	8.740374E+00	2.278861E-01	3.051492E-01
C9	3.865635E-03	-7.889288E-02	-2.109810E-03	-1.824531E-03
C10	-8.957615E-05	2.364701E-04	6.551682E-06	3.529671E-06
C11	-1.201233E-04	3.696316E-05	1.117980E-06	-1.947497E-06
C12	1.317918E-08	8.693983E-10	8.321954E-11	8.741471E-11
C13	7.464576E-07	4.978994E-08	1.839319E-09	6.848875E-09
C14	2.028097E-07	-1.681933E-07	-6.499587E-09	7.130796E-09
C15	1.771582E-02	-1.807141E-03	-3.182424E-05	2.197611E-04
C16	-4.746823E-03	9.393491E-04	4.236551E-05	-4.223870E-05
C17	5.317662E-01	-6.513896E-02	-1.803235E-03	1.029480E-02
C18	-1.987500E-06	-4.415242E-08	-7.613239E-09	-1.664229E-08
C19	-7.387996E-05	-2.617428E-06	-8.034082E-08	-4.634496E-07
C20	3.697482E-07	-1.433335E-08	-3.585203E-10	2.986327E-09
C21	4.739311E-06	-3.566268E-06	-1.686833E-07	7.435882E-08
C22	-1.747337E-03	-4.553707E-05	-6.611748E-07	-7.733993E-07
C23	-2.110522E-03	3.386957E-04	1.220805E-05	-4.198871E-05

Performance Equation

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$X_1 = \text{RPM}$
 $X_2 = E_t \text{ (°F)}$
 $X_3 = C_t \text{ (°F)}$

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Cooling Capacity (48V) - ASHRAE LBP BTU/hr (Watt)

RPM	Evaporator Temperature													
	-30°F (-34°C)	-20°F (-29°C)	-10°F (-23°C)	-5°F (-21°C)	0°F (-18°C)	5°F (-15°C)	10°F (-12°C)							
1800	132 (39)	174 (51)	236 (69)	275 (81)	320 (94)	371 (109)	429 (126)							
2400	156 (46)	218 (64)	302 (88)	353 (103)	411 (120)	475 (139)	548 (160)							
3000	179 (52)	259 (76)	363 (106)	425 (124)	494 (145)	571 (167)	657 (192)							
3600	205 (60)	300 (88)	422 (124)	494 (145)	575 (168)	664 (194)	761 (223)							
4200	239 (70)	347 (102)	485 (142)	566 (166)	656 (192)	756 (221)	865 (253)							

Power Consumption (48V) - ASHRAE LBP Watt Current (48V) - ASHRAE LBP Amp

RPM	Evaporator Temperature							Evaporator Temperature						
	-30°F	-20°F	-10°F	-5°F	0°F	5°F	10°F	-30°F	-20°F	-10°F	-5°F	0°F	5°F	10°F
1800	25.2	33.2	41.7	46.0	50.4	54.6	58.7	0.53	0.69	0.87	0.96	1.05	1.14	1.22
2400	35.1	44.4	54.8	60.2	65.7	71.2	76.7	0.73	0.93	1.14	1.25	1.37	1.48	1.60
3000	43.2	54.4	67.0	73.7	80.6	87.6	94.8	0.90	1.13	1.40	1.54	1.68	1.83	1.97
3600	50.8	64.3	79.6	87.8	96.4	105.2	114.1	1.06	1.34	1.66	1.83	2.01	2.19	2.38
4200	59.2	75.4	94.0	103.9	114.3	125.1	136.1	1.23	1.57	1.96	2.17	2.38	2.61	2.84

Efficiency (48V) - ASHRAE LBP BTU/hr/W (W/W)

RPM	Evaporator Temperature													
	-30°F (-34°C)	-20°F (-29°C)	-10°F (-23°C)	-5°F (-21°C)	0°F (-18°C)	5°F (-15°C)	10°F (-12°C)							
1800	5.22 (1.53)	5.26 (1.54)	5.66 (1.66)	5.98 (1.75)	6.35 (1.86)	6.80 (1.99)	7.31 (2.14)							
2400	4.44 (1.30)	4.91 (1.44)	5.51 (1.61)	5.86 (1.72)	6.25 (1.83)	6.67 (1.95)	7.14 (2.09)							
3000	4.15 (1.21)	4.76 (1.39)	5.41 (1.58)	5.76 (1.69)	6.13 (1.80)	6.52 (1.91)	6.93 (2.03)							
3600	4.04 (1.18)	4.67 (1.37)	5.30 (1.55)	5.63 (1.65)	5.96 (1.75)	6.31 (1.85)	6.67 (1.95)							
4200	4.03 (1.18)	4.60 (1.35)	5.16 (1.51)	5.45 (1.59)	5.74 (1.68)	6.04 (1.77)	6.35 (1.86)							

* all points are at 32.2°C (90°F) ambient, 32.2°C (90°F) suction temperature, 22.2°C (40°F) subcooling, 54.4°C (130°F) condenser

Performance Coefficients (48V) - ASHRAE LBP

Coefficient	Capacity (BTU/Hr)	Power (Watts)	Current (Amperes)	Mass Flow (Lbs/Hr)
C1	-5.865171E+02	-3.080149E+02	-6.416976E+00	-1.746902E+01
C2	7.795594E-01	-1.173860E-02	-2.445542E-04	7.341712E-03
C3	-7.949066E-05	-6.151831E-06	-1.281631E-07	-7.088148E-07
C4	3.028116E-09	1.009054E-09	2.102195E-11	2.220380E-11
C5	-3.291130E+01	2.920802E+00	6.085004E-02	-6.612940E-01
C6	3.131571E-01	-2.417133E-03	-5.035694E-05	6.732191E-04
C7	5.535162E-04	-7.378319E-05	-1.537150E-06	4.286384E-06
C8	5.273172E+00	8.041144E+00	1.675238E-01	3.051492E-01
C9	3.865635E-03	-7.258145E-02	-1.512113E-03	-1.824531E-03
C10	-8.957615E-05	2.175525E-04	4.532344E-06	3.529671E-06
C11	-1.201233E-04	3.400611E-05	7.084606E-07	-1.947497E-06
C12	1.317918E-08	7.998464E-10	1.666347E-11	8.741471E-11
C13	7.464576E-07	4.580675E-08	9.543072E-10	6.848875E-09
C14	2.028097E-07	-1.547378E-07	-3.223705E-09	7.130796E-09
C15	1.771582E-02	-1.662569E-03	-3.463686E-05	2.197611E-04
C16	-4.746823E-03	8.642012E-04	1.800419E-05	-4.223870E-05
C17	5.317662E-01	-5.992784E-02	-1.248497E-03	1.029480E-02
C18	-1.987500E-06	-4.062022E-08	-8.462546E-10	-1.664229E-08
C19	-7.387996E-05	-2.408034E-06	-5.016737E-08	-4.634496E-07
C20	3.697482E-07	-1.318669E-08	-2.747226E-10	2.986327E-09
C21	4.739311E-06	-3.280966E-06	-6.835347E-08	7.435882E-08
C22	-1.747337E-03	-4.189410E-05	-8.727938E-07	-7.733993E-07
C23	-2.110522E-03	3.116000E-04	6.491667E-06	-4.198871E-05

Performance Equation

$$Y = C_1 + C_2 X_1 + C_3 X_1^2 + C_4 X_1^3 + C_5 X_2 + C_6 X_2^2 + C_7 X_2^3 + C_8 X_3 + C_9 X_3^2 + C_{10} X_3^3 + C_{11} X_1 X_2 X_3 + C_{12} X_1^2 X_2 X_3 + C_{13} X_1 X_2^2 X_3 + C_{14} X_1 X_2 X_3^2 + C_{15} X_1 X_2^2 X_3 + C_{16} X_1 X_3 + C_{17} X_2 X_3 + C_{18} X_1^2 X_2 + C_{19} X_1 X_2^2 + C_{20} X_1^2 X_3 + C_{21} X_1 X_3^2 + C_{22} X_2^2 X_3 + C_{23} X_2 X_3^2$$

$X_1 = \text{RPM}$
 $X_2 = E_t (\text{°F})$
 $X_3 = C_t (\text{°F})$