AIR COOLED CONDENSERS

500MM ROUND TUBE COILS

ECO™ heat transfer coolers

MODINE®

CONTENTS & NOMENCLATURE

NOMENCLATURE

M C S 5 0 1 3 - 079 - 2 B

M = Modine	**1 = Fans Wide**
C = Product Type	**3 = Fans Long**
S = Fan Motor Type	**079 = Nominal Capacity**
5 = Fan Diameter	**2 = Supply Voltage**
0 = Fin Spacing	**B = Control Voltage**

Product Type
C - Condenser
F - Fluid Cooler

Fan Motor Type
S - Single Speed
V - Variable Speed EC

Fan Diameter
5 - 500mm (19.7")

Fin Spacing
0 - 10 FPI
8 - 8 FPI
2 - 12 FPI
M - Microchannel

Fans Wide

Fans Long

Nominal Capacity
(THR/10°F TD, R-404A, 10FPI)

Supply Voltage
2 - 208-230/3/60
3 - 208-230/1/60
4 - 460/3/60
5 - 575/3/60

Control Voltage
B - 115 Volts
C - 230 Volts
N - No Controls

All specifications subject to change without notice.

500MM

NO COMPROMISE

At Modine, we are not very good at compromise – not when it comes to product performance and quality anyway. With over 25 years experience designing, producing, and enhancing air-cooled condensers, we have learned that compromise is not needed to exceed market expectations. Rather, we have selected the highest quality, most technologically advanced materials and combined them with our expertise in engineering and manufacturing to produce startling performance results with unsurpassed quality and reliability.

Typical Performance Results (per 500mm 3 phase fan motor)

	MCS5 Models (1550 rpm)	MCV5 Models (VSEC*)
Energy Consumption (watts)	1035	845
Sound Pressure Level (dBA @ 3m)	60	62

ECO's 500mm Series air-cooled condensers are available in single wide configuration from 1 to 3 fans providing 1.5 to 25 nominal tons of capacity. All are optimized for application with modern, environmentally friendly refrigerants R-404A, R-507, R-410A, and R-134a. Each configuration is available with single speed single or 3 phase fan motors or with variable speed electronically commutated (EC) fan motors. Our standard features are impressive and our available options are extensive. Take a look at how Modine will make you unwilling to compromise also.

ABOUT MODINE

Modine is a world leader in metal fabrication, component manufacturing and related engineering and design services. We are committed to partnering with our customers to help them increase their competitiveness. Our products and services enable our customers to improve operational efficiency, improve products and reduce tied-up capital. Because we focus on our customers' results and are unfailingly reliable, we are the partner on which our customers base their future development.

We make every effort to develop and produce the finest and most complete line of air-cooled condensers available. Yet, we recognize that specific customer requirements are often more important than our published specifications. At Modine, we have a long tradition of meeting these unique needs with outstanding engineering support and flexible manufacturing processes. There is no need to compromise, simply give us a call and see how we can develop a solution that better meets your needs.

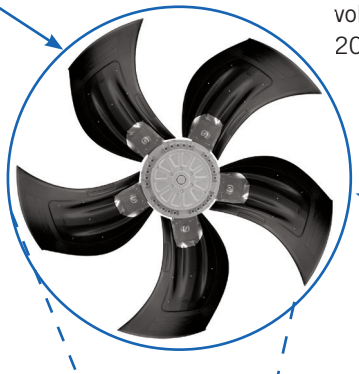
500MM

NO COMPROMISE STANDARD FEATURES

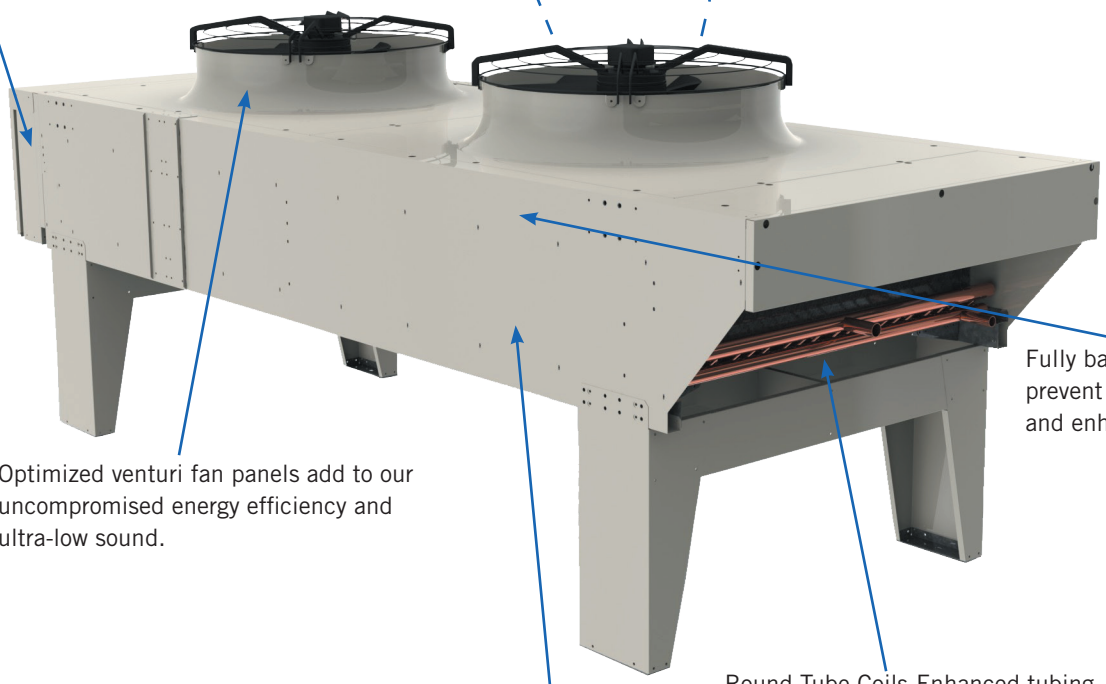
Direct drive external rotor motors offer uncompromised energy efficiency, low sound, and the longest trouble free life available.

Single speed 3 phase fan motors are dual voltage and can be easily changed between 208-230V and 460V in the field.

Large, weather proof electrical enclosure is amply sized to fit even the most advanced controls. Standard equipment includes a main disconnect switch with door interlock and a main terminal block for motor lead termination. Standard control panels are rated at 10 kA SCCR.



Swept fan blades are designed as part of the motor, not an addition to it. Precise matching of these two components increases energy efficiency and reduces sound pressure to unheard of levels.



Fully baffled fan cells prevent “wind milling” and enhance performance.

Optimized venturi fan panels add to our uncompromised energy efficiency and ultra-low sound.

Pre-painted galvanized steel cabinet provides years of durable finish protection and ascetics.

Round Tube Coils-Enhanced tubing, advanced sinusoidal fin design for optimal performance. Exclusive use of 5/16” diameter tubing keeps refrigerant charge to a minimum. Microchannel is more compact than round tube coils and tremendously reduces refrigerant charge.

C ETL US LISTED

Intertek
4002117

Conforms to UL Std. 1995
Certified to CAN/CSA Std. C22.2 No. 236-05

500MM

NO COMPROMISE AVAILABLE OPTIONS

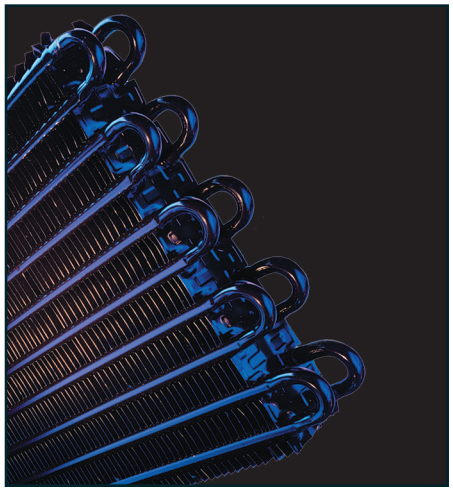
- Ambient or Pressure fan cycling control. Our preferred controller is the Johnson Controls System 450 for uncompromised performance, reliability and precision. Easily programmed, the System 450 is also used to control our variable speed EC fan motors
- Variable speed EC header fans are available on models MCS5 to fill in the airflow gaps created by on/off fan cycling. Variable speed is controlled by pressure only and may be used in conjunction with pressure or ambient on/off fan cycling
- Variable speed control for MCV5 models to maximize performance
- Microprocessor interface boards to communicate with your rack controller or building management system
- 230VAC or 115VAC control circuit includes branch fusing and transformer (as required)
- Main power supply fusing
- Multi-circuiting of coils at no additional charge
- Condenser flooding valves
- 8 or 12 fins per inch spacing (round tube models)
- ElectroFin® E-Coat coil protection
- Extended mounting legs for increased ground clearance

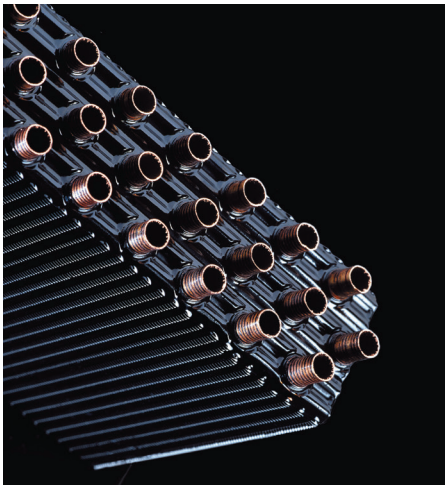
NO COMPROMISE PROTECTION

Many features have been built into the Modine 500mm Series air-cooled condensers to protect your investment – pre-painted galvanized cabinet, high reliability motors, special design coil mounting – to name a few. But what about the coil? Aluminum fins exposed to corrosive environments will prematurely deteriorate resulting in performance loss and eventual failure. Ocean salt spray, acid rain, and aggressive contaminants from nearby incinerators, power plants, and industrial smoke stacks all contribute to this process. For these situations, Modine recommends and offers only the finest coil protection available: ElectroFin® E-Coat.

ElectroFin® E-Coat provides a uniform, flexible coating over the entire coil with immeasurable impact on thermal conductivity. 100% coverage is assured by the application process, even in the hard to reach center portions of the coil, without bridging between the fins.

Modine offers ElectroFin® E-Coat at an affordable price and with minimum impact on lead times. We recommend the application anytime an air-cooled condenser is located near a salt water coast or a potential source of corrosive airborne particles.





500MM

MCS5 Performance Data

Single Speed, 500mm Fan Diameter							
Model	Fan Arrangement	Total Heat of Rejection (MBH/1°F TD)			Air Flow (CFM)	Sound Pressure (dBA @ 3m)	Maximum Number of Circuits
		R-404A/R-507	R-410A	R-134a			
MCS5011-008	1X1	0.77	0.79	0.71	2,843	49.5	2
MCS5011-013	1X1	1.29	1.33	1.22	2,636	48.8	4
MCS5011-018	1X1	1.77	1.82	1.67	2,427	48.0	5
MCS5011-024	1X1	2.43	2.50	2.25	5,879	60.5	6
MCS5011-032	1X1	3.22	3.32	2.92	5,659	60.0	8
MCS5011-039	1X1	3.91	4.03	3.60	5,450	59.5	10
MCS5012-051	1X2	5.07	5.22	4.56	10,447	62.0	11
MCS5012-063	1X2	6.29	6.48	5.72	9,847	61.5	12
MCS5012-067	1X2	6.74	6.94	6.18	11,441	63.0	14
MCS5012-079	1X2	7.92	8.16	7.29	11,049	62.5	16
MCS5013-099	1X3	9.88	10.18	9.04	16,978	65.0	20
MCS5013-113	1X3	11.34	11.68	10.46	16,339	64.5	24

MCV5 Performance Data

Variable Speed EC, 500mm Fan Diameter							
Model	Fan Arrangement	Total Heat of Rejection (MBH/1°F TD)			Air Flow (CFM)	Sound Pressure (dBA @ 3m)	Maximum Number of Circuits
		R-404A/R-507	R-410A	R-134a			
MCV5011-024	1X1	2.41	2.48	2.22	5,433	64.3	6
MCV5011-033	1X1	3.28	3.38	3.04	5,319	62.0	8
MCV5011-039	1X1	3.93	4.05	3.63	5,202	63.0	10
MCV5012-051	1X2	5.11	5.26	4.59	10,134	65.4	11
MCV5012-063	1X2	6.32	6.51	5.68	9,743	64.6	12
MCV5012-069	1X2	6.94	7.15	6.34	10,704	66.8	14
MCV5012-081	1X2	8.09	8.33	7.41	10,492	66.3	16
MCV5013-100	1X3	9.96	10.26	9.07	15,967	67.0	20
MCV5013-114	1X3	11.44	11.78	10.49	15,605	68.0	24

For 8 FPI Models, multiply MBH by 0.893, CFM by 1.016, and watts by 0.993.
For 12 FPI Models, multiply MBH by 1.090, CFM by 0.982, and watts by 1.007.

Variable Speed EC data shown at full speed.

Performance data is accurate in the range of 80° F to 110° F ambient temperature and 10° F to 30° F TD.
Consult factory for operation outside of this range.

500MM

MCS5 Electrical Data

Single Speed, 500mm Fan Diameter															
Model		208-230/1/60			208-230/3/60				460/3/60				Total Watts		SCCR
	HP	FLA	MCA	MOPD	HP	FLA	MCA	MOPD	HP	FLA	MCA	MOPD	1 Phase	3 Phase	
MCS5011-008	0.2	0.86	2.0	3	--	--	--	--	--	--	--	--	170	--	10kA
MCS5011-013	0.2	0.86	2.0	3	--	--	--	--	--	--	--	--	175	--	10kA
MCS5011-018	0.2	0.86	2.0	3	--	--	--	--	--	--	--	--	180	--	10kA
MCS5011-024	1	4.5	7.0	11	1.1	3.3	5.0	9	1.1	2.0	4.0	6	921	1010	10kA
MCS5011-032	1	4.5	7.0	11	1.1	3.3	5.0	9	1.1	2.0	4.0	6	925	1035	10kA
MCS5011-039	1	4.5	7.0	11	1.1	3.3	5.0	9	1.1	2.0	4.0	6	929	1055	10kA
MCS5012-051	1	9.2	11.0	16	1.1	6.6	9.0	12	1.1	4.0	6.0	8	1863	2150	10kA
MCS5012-063	1	9.0	11.0	16	1.1	6.6	9.0	12	1.1	4.0	6.0	8	1871	2200	10kA
MCS5012-067	1	9.0	11.0	16	1.1	6.6	9.0	12	1.1	4.0	6.0	8	1848	2060	10kA
MCS5012-079	1	9.0	11.0	16	1.1	6.6	9.0	12	1.1	4.0	6.0	8	1855	2100	10kA
MCS5013-099	1	13.5	16.0	20	1.1	9.9	12.0	15	1.1	6.0	8.0	10	2775	3110	10kA
MCS5013-113	1	13.5	16.0	20	1.1	9.9	12.0	15	1.1	6.0	8.0	10	2785	3165	10kA

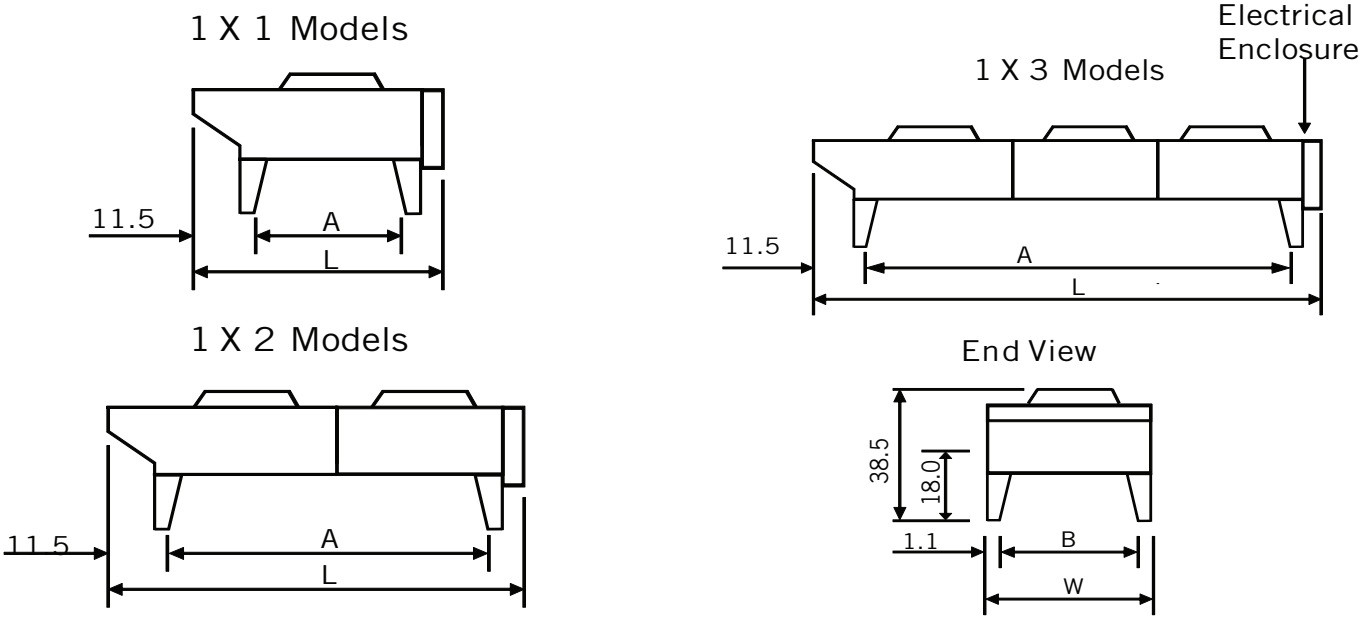
MCV5 Electrical Data

Variable Speed EC, 500mm Fan Diameter															
Model		208-230/1/60			208-230/3/60				460/3/60				Total Watts		SCCR
	HP	FLA	MCA	MOPD	HP	FLA	MCA	MOPD	HP	FLA	MCA	MOPD	1 Phase	3 Phase	
MCV5011-024	--	--	--	--	0.8	3.0	5.0	8	0.8	1.7	3.0	5	--	810	10kA
MCV5011-033	--	--	--	--	0.8	3.0	5.0	8	0.8	1.7	3.0	5	--	845	10kA
MCV5011-039	--	--	--	--	0.8	3.0	5.0	8	0.8	1.7	3.0	5	--	870	10kA
MCV5012-051	--	--	--	--	0.8	6.0	8.0	11	0.8	3.4	5.0	7	--	1786	10kA
MCV5012-063	--	--	--	--	0.8	6.0	8.0	11	0.8	3.4	5.0	7	--	1836	10kA
MCV5012-069	--	--	--	--	0.8	6.0	8.0	11	0.8	3.4	5.0	7	--	1688	10kA
MCV5012-081	--	--	--	--	0.8	6.0	8.0	11	0.8	3.4	5.0	7	--	1730	10kA
MCV5013-100	--	--	--	--	0.8	9.0	11.0	14	0.8	5.1	7.0	8	--	2535	10kA
MCV5013-114	--	--	--	--	0.8	9.0	11.0	14	0.8	5.1	7.0	8	--	2615	10kA

500MM

MC*5 Dimensional Data

Round Tube Models								
Models		Overall Dimensions (In.)		Mntg. Dim. (In.)		Connections (In.)		Approx. Net Weight (Lbs.)
MCS5*	MCV5*	L	W	A	B	Inlet	Outlet	
11-008	---	54.5	28.3	28	26.2	3/8	3/8	199
11-013	---	54.5	28.3	28	26.2	7/8	5/8	208
11-018	---	54.5	28.3	28	26.2	7/8	5/8	215
11-024	11-024	54.5	37.3	28	35.2	1 1/8	7/8	236
11-032	11-033	54.5	37.3	28	35.2	1 1/8	7/8	243
11-039	11-039	54.5	37.3	28	35.2	1 1/8	7/8	253
12-051	12-051	90.5	28.3	64	26.2	1 1/8	7/8	315
12-063	12-063	90.5	28.3	64	26.2	1 1/8	7/8	329
12-067	12-069	94.5	37.3	68	35.2	1 1/8	7/8	369
12-079	12-081	94.5	37.3	68	35.2	1 3/8	1 1/8	390
13-099	13-100	126.5	37.3	100	35.2	1 5/8	1 1/8	480
13-113	13-114	126.5	37.3	100	35.2	1 5/8	1 1/8	509



500MM

MC*5 Refrigerant Charge

Round Tube Models							
Models		Summer Refrigerant Charge (Lbs. R-404A)	Additional Refrigerant Charge Required for Flooded Condenser Operation (Lbs. R-404A @ 20°F TD)				
			Minimum Ambient Temperature (°F)				
MCS5*	MCV5*		+60	+40	+20	0	-20
11-008	---	1.1	0.6	0.7	0.7	0.8	0.8
11-013	---	2.3	1.1	1.3	1.3	1.5	1.6
11-018	---	3.4	1.8	2.0	2.0	2.4	2.4
11-024	11-024	3.0	1.5	1.7	1.7	2.0	2.1
11-032	11-033	4.4	2.3	2.7	2.7	3.1	3.2
11-039	11-039	5.9	3.1	3.6	3.5	4.1	4.2
12-051	12-051	6.4	3.8	4.3	4.3	5.0	5.0
12-063	12-063	8.6	5.0	5.7	5.7	6.6	6.7
12-067	12-069	9.2	4.8	5.6	5.5	6.5	6.6
12-079	12-081	12.3	6.4	7.4	7.4	8.6	8.8
13-099	13-100	13.0	6.9	7.9	7.9	9.2	9.3
13-113	13-114	17.4	9.1	10.5	10.4	12.2	12.4

For R-507, multiply values by 1.035
For R-410A, multiply values by 1.026
For R-134a, multiply values by 1.088

Flooded Charge Adjustment Factors for Alternate Conditions

Design	Minimum Ambient Temperature (°F)				
TD (°F)	60	40	20	0	-20
10	2.46	1.4	1.25	1.16	1.13
15	1.74	1.19	1.13	1.07	1.05
20	1	1	1	1	1
25	0.38	0.80	0.88	0.91	0.93
30	---	0.59	0.76	0.84	0.88

Control Panels

The standard control panel for MC*5 air-cooled condensers include a non-fused disconnect switch with door interlock and a terminal board for the motor leads. A wide variety of optional controls are also available for circuit protection, fan cycling, variable speed, and micro-processor controller interfaces.

Circuit Protection

Available options include primary fusing and motor branch circuit fusing or circuit breakers. All models utilize individual motor fusing/circuit breakers.

Motor Contactors

Motor contactors are required as part of the fan motor protection system for all single speed motors. Variable speed EC motors do not require contactors and they are not recommended for use with these motors. For these reasons, motor contactors are supplied as "optional" accessories and are offered as one contactor per each fan motor.

Fan Cycling

Optional electronic controls are available to cycle single speed fans on ambient temperature or condensing pressure inputs with the following features:

- Fans closest to the headers run continuously.
- All single speed fan motors are cycled with contactors (ordered separately).
- Standard control circuits are 230 volts. 115 volt is available upon request.
- Control branch circuit fusing is included with all fan cycling options.
- A control circuit transformer is available, as needed, with all fan cycling options.
- All fan cycling options include an ambient temperature sensor or pressure transducer.
- A controller is provided with all fan cycling options. Modine uses only electronic fan cycle controllers to economically provide the most accurate and reliable system.

Ambient Fan Cycling

Ambient fan cycling is recommended for multi-circuited condensers or where there is little variation in condenser load. It is limited in its ability to control head pressure at colder temperatures (see Table 1) and should be combined with another means of head pressure control, such as condenser flooding and/or variable speed, in these situations. See Table 2 for recommended controller settings.

Table 1 - Minimum Ambient Temperature for Ambient Fan Cycling

Number of Fans Long	Design TD °F				
	10	15	20	25	30
2	70	60	55	45	35
3	65	55	40	30	15

Pressure Fan Cycling

Since these controls sense actual condenser pressure, they will cycle fans at any ambient temperature. This makes them ideal for colder climates and systems with widely varying condenser loads. They may also be combined with additional forms of head pressure control, such as condenser flooding and/or variable speed, to further enhance performance. See Table 2 for recommended controller settings.

Table 2 - Fan Cycle Control Temperature & Pressure Settings

Header End	M1	M2		M3	
Stage	---	1		2	
Contactor	C1	C2		C3	
# Fans Long	Always On	On	Off	On	Off
Temperature Control (°F)					
2		70	65		
3		70	65	80	75
R-404A Pressure Control (PSIG)					
2		220	185		
3		220	185	245	210
R-410A Pressure Control (PSIG)					
2		300	255		
3		300	255	330	285
R-134a Pressure Control (PSIG)					
2		115	90		
3		115	90	130	105

Note: Motor contactor to be wired to "NO" contact of fan cycle control.

Variable Speed EC Fan Motors (VSEC)

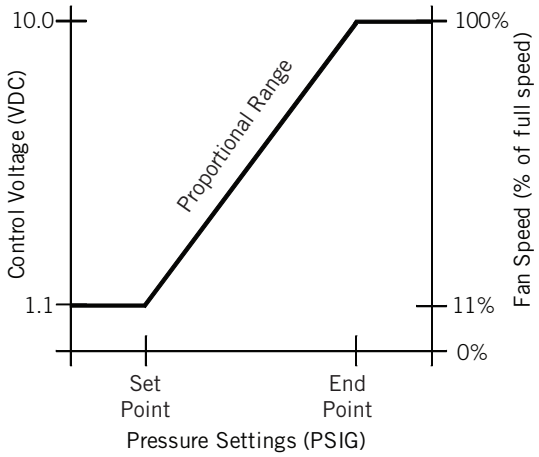
VSEC fan motors offer the opportunity for ultra-high energy efficiency, extremely quiet operation and precise head pressure control. These three phase motors will operate in the range of 10% to 100% of their full speed rating in response to a 1 to 10 VDC proportional signal supplied by a pressure transducer and speed controller. Head pressure is controlled by speeding up and slowing down the fans causing air flow across the coil to increase and decrease.

Modine VSEC fan motors are controlled under the following specifications:

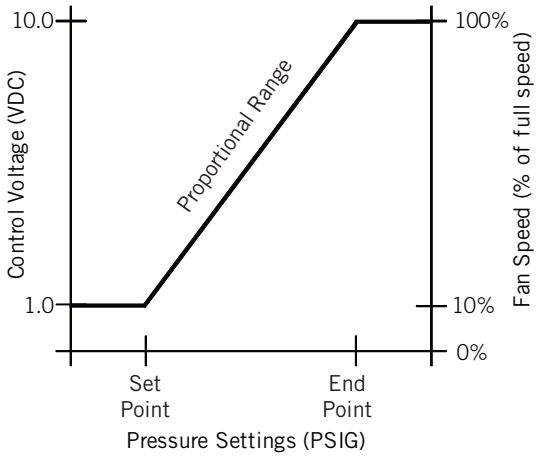
< 1.0 VDC	motor turns off
1.0 VDC	motor operates at 10% of full speed
1.5 VDC	motor restarts after falling below 1.0 VDC
10.0 VDC	motor operates at 100% of full speed

Header fans should never be allowed to turn off any time a compressor is running. It is recommended that header fans always receive a minimum control voltage of 1.1 VDC. Down stream fan motors may be allowed to turn off by allowing control voltage to drop below 1.0 VDC.

VSEC Header Fan Control



VSEC Non-Header Fan Control



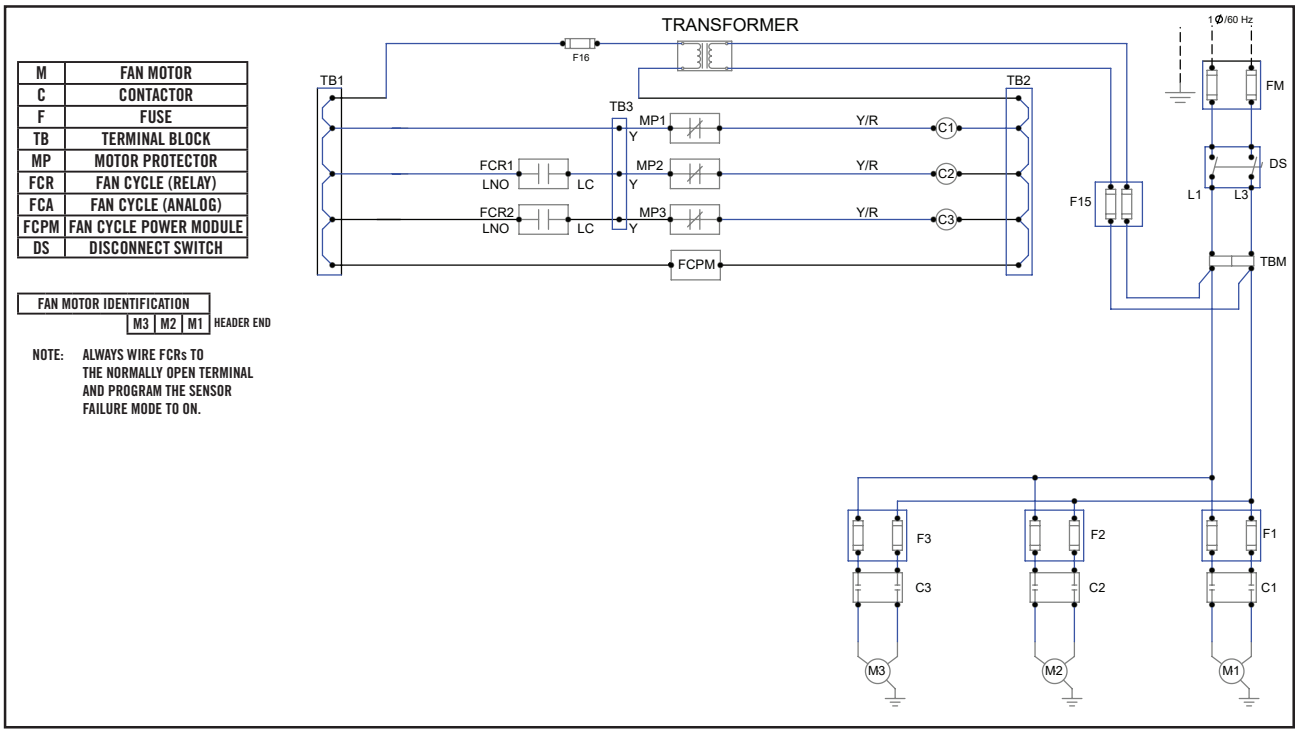
Variable speed EC fan motors are offered in two versions - full VSEC and VSEC header fans. MCV5 models are equipped with all VSEC fan motors, providing the ultimate in control technology. All fans are ramped up and down in speed together. Header fans will always operate at a minimum of 11% of full speed while downstream fans are allowed to turn off.

MCS5 models are available with VSEC header fans where the remaining of downstream fans are standard single speed fans that may be equipped with on/off pressure fan cycling. As downstream fans cycle on/off, the VSEC header fans ramp up/down in speed to more precisely control head pressure. Header fans will always operate at a minimum 11% of full speed.

In addition to variable speed operation, Modine VSEC fan motors include many advanced technology features including inherent overheating protection, phase loss protection, over/under voltage protection, and rotation correction (regardless how they are wired, they always rotate the correct direction).

500MM

Typical Wiring Diagram with Single Phase Motors



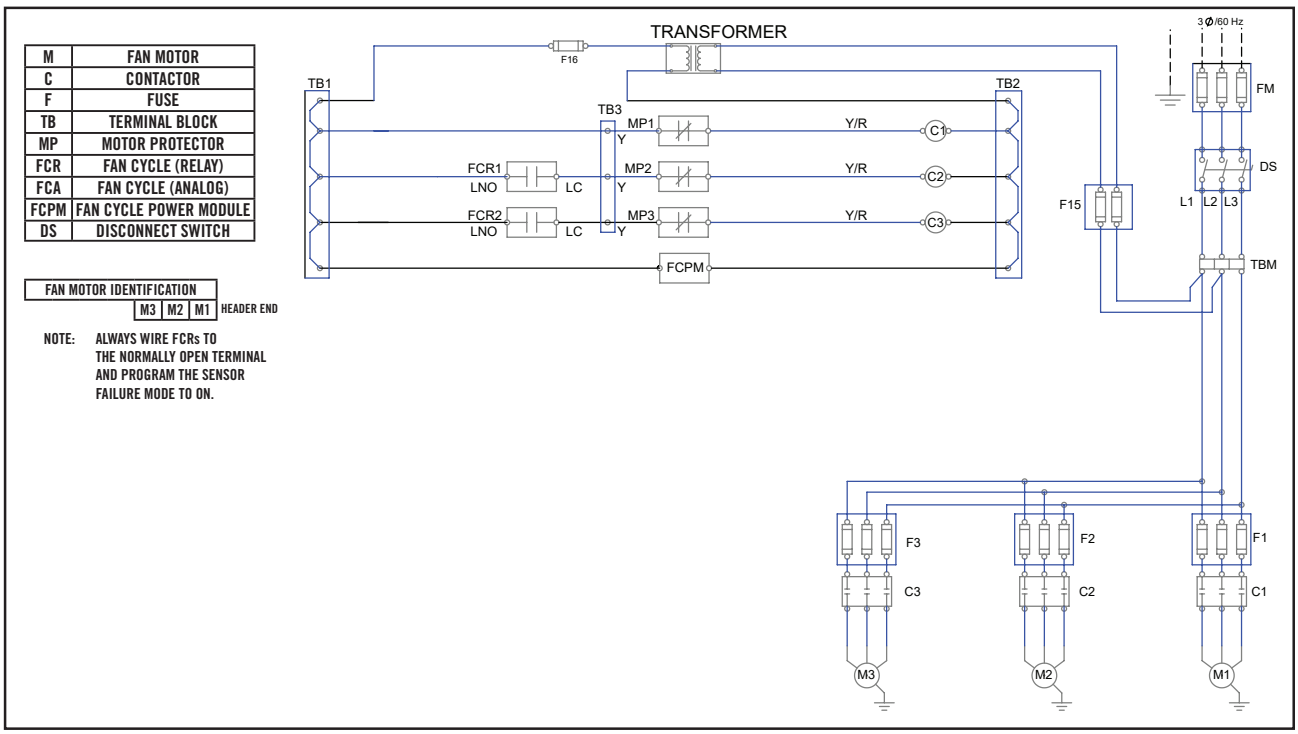
M	FAN MOTOR
C	CONTACTOR
F	FUSE
TB	TERMINAL BLOCK
MP	MOTOR PROTECTOR
FCR	FAN CYCLE (RELAY)
FCA	FAN CYCLE (ANALOG)
FCPM	FAN CYCLE POWER MODULE
DS	DISCONNECT SWITCH

FAN MOTOR IDENTIFICATION

M3 | M2 | M1 HEADER END

NOTE: ALWAYS WIRE FCRs TO THE NORMALLY OPEN TERMINAL AND PROGRAM THE SENSOR FAILURE MODE TO ON.

Typical Wiring Diagram with Three Phase Motors



M	FAN MOTOR
C	CONTACTOR
F	FUSE
TB	TERMINAL BLOCK
MP	MOTOR PROTECTOR
FCR	FAN CYCLE (RELAY)
FCA	FAN CYCLE (ANALOG)
FCPM	FAN CYCLE POWER MODULE
DS	DISCONNECT SWITCH

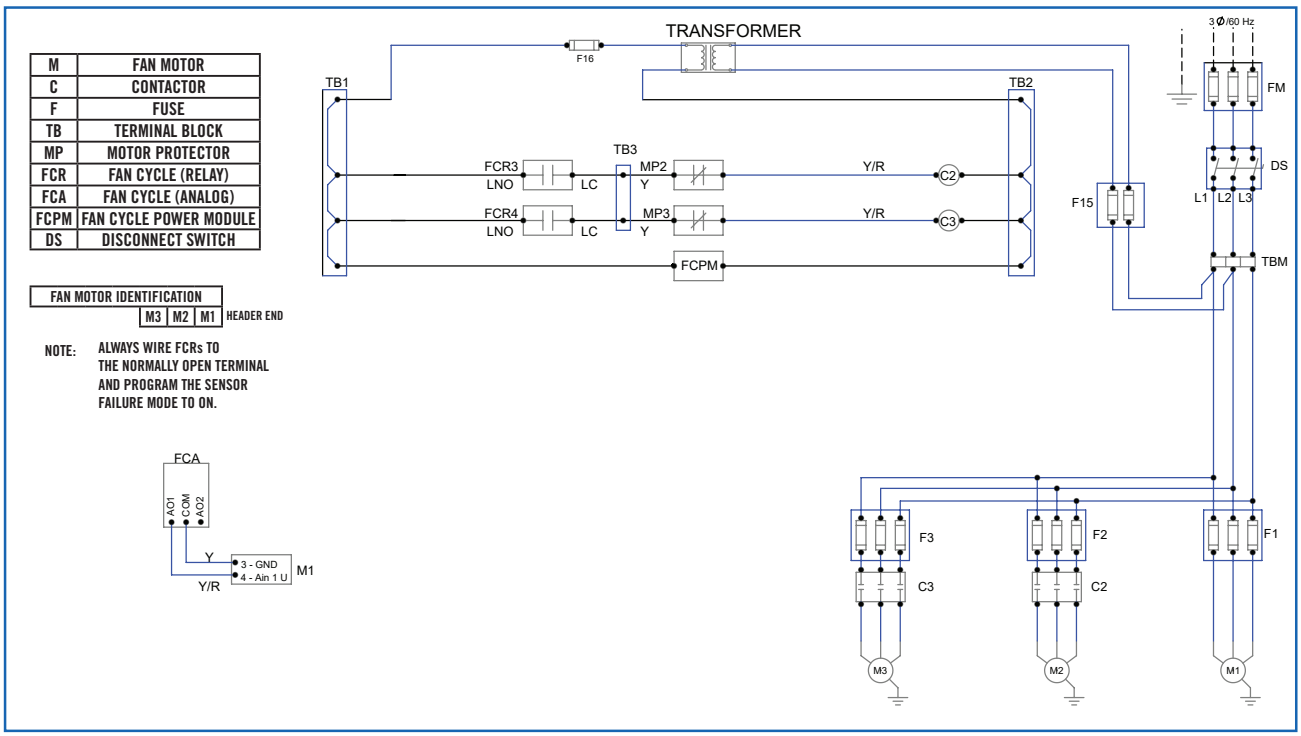
FAN MOTOR IDENTIFICATION

M3 | M2 | M1 HEADER END

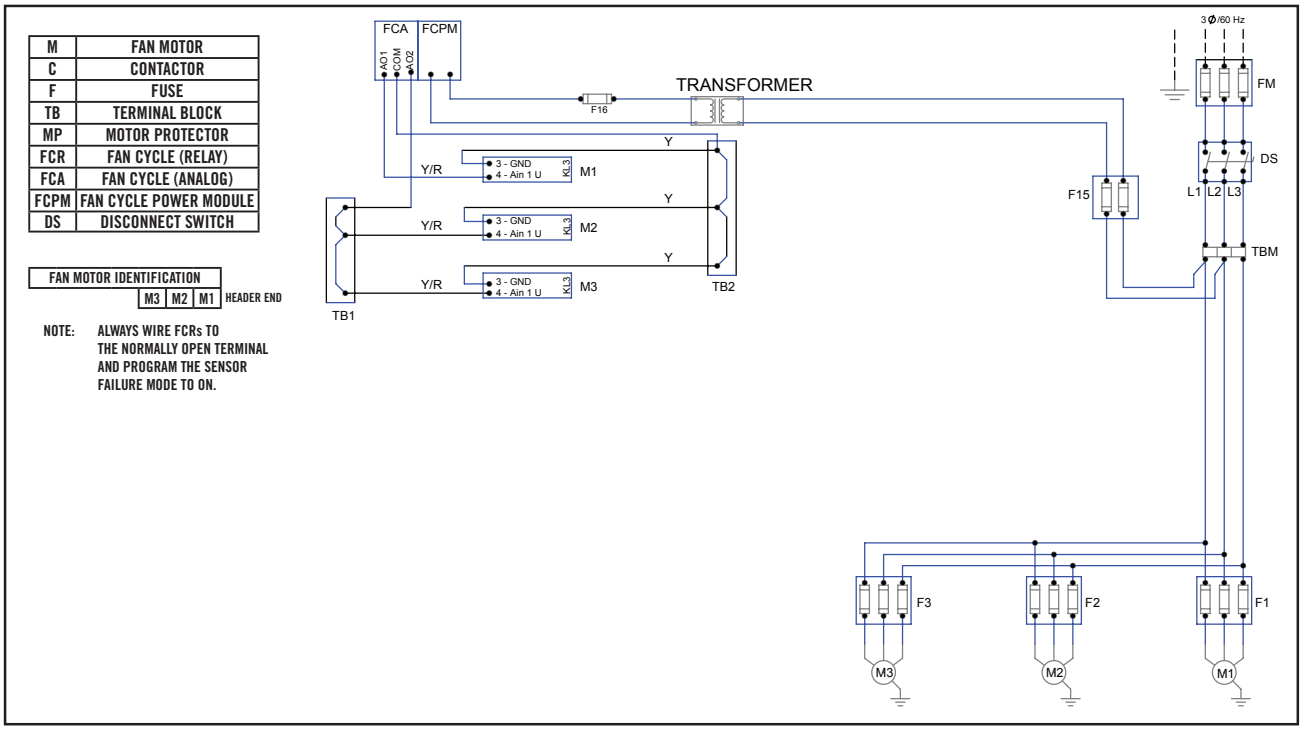
NOTE: ALWAYS WIRE FCRs TO THE NORMALLY OPEN TERMINAL AND PROGRAM THE SENSOR FAILURE MODE TO ON.

500MM

Typical Wiring Diagram with Variable Speed Header Fans



Typical Wiring Diagram with VSEC Fan Motors



Air-Cooled Condenser Selection

Required condenser Total Heat of Rejection (THR) is equal to the sum of the evaporator load(s) and the heat of compression created by the compressor(s). Heat of compression will vary based on the type of compressor and the compressor operating conditions.

THR Calculation Method

Open Type Compressors (air cooled):

THR = Compressor Capacity (MBH) + 2.545 X BHP

Refrigerant Cooled Compressors:

THR = Compressor Capacity (MBH) + 3.413 X kW

THR Estimation Method

Open Type Compressors (air cooled):

THR = Compressor Capacity (MBH) X Table 4 Factor

Refrigerant Cooled Compressors:

THR = Compressor Capacity (MBH) X Table 3 Factor

Table 3: Heat of Compression Factors for Suction Cooled Compressors

Evaporator Temp (°F)	Condensing Temperature (°F)					
	90	100	110	120	130	140
-40	1.66	1.73	1.80	2.00	---	---
-30	1.57	1.62	1.68	1.80	---	---
-20	1.49	1.53	1.58	1.65	---	---
-10	1.42	1.46	1.50	1.57	1.64	---
0	1.36	1.40	1.44	1.50	1.56	1.62
10	1.31	1.34	1.38	1.43	1.49	1.55
20	1.26	1.29	1.33	1.37	1.43	1.49
30	1.22	1.25	1.28	1.32	1.37	1.42
40	1.18	1.21	1.24	1.27	1.31	1.35
50	1.14	1.17	1.20	1.23	1.26	1.29

Table 4: Heat of Compression Factors for Open Type Compressors

Evaporator Temp (°F)	Condensing Temperature (°F)					
	90	100	110	120	130	140
-40	---	---	---	---	---	---
-30	1.37	1.42	1.47	---	---	---
-20	1.33	1.37	1.42	1.47	---	---
-10	1.28	1.32	1.37	1.42	1.47	---
0	1.24	1.28	1.32	1.37	1.41	1.47
10	1.21	1.24	1.28	1.32	1.36	1.42
20	1.17	1.20	1.24	1.28	1.32	1.37
30	1.14	1.17	1.20	1.24	1.27	1.32
40	1.12	1.15	1.17	1.20	1.23	1.28
50	1.09	1.12	1.14	1.17	1.20	1.24

Lower air density at higher elevations reduces the performance of air-cooled condensers and is accounted for by increasing the required THR using the factors in Table 5.

Table 5: Altitude Correction Factors for Air-Cooled Condensers

Altitude (FL)	1000	2000	3000	4000	5000	6000	7000	8000
Factor	1.02	1.05	1.07	1.10	1.12	1.15	1.17	1.24

Selection Example

Compressor Capacity	60 MBH
Evaporating Temp.	-20°F
Ambient Temp.	95°F
Design TD	10°F
Altitude	3000 Feet
Refrigerant	R-404A
Compressor Type	Ref. Cooled

From Table 3, the heat of compression factor for +20°F evaporating and 105°F condensing (= ambient temp + TD) is 1.555 From Table 5, the altitude correction factor is 1.07.

Required THR = 60 X 1.555 X 1.07 = 99.83 MBH
or 99.83/10 = 9.98 MBH/1°F TD

Possible solutions are

Model	Fans	Rated MBH/1°F TD	Actual TD*
MCS5013-099	1 X 3	9.88	10.1°F
MCV5013-100	1 X 3 VSEC	9.96	10.0°F

* Actual TD = Required THR/Rated THR X Design TD

Each of these models will work properly for the application. Final selection should be based upon the desired features and capabilities of the various model designs.

Multi-Circuit Condenser Selection

Air-cooled condenser coils may be divided into multiple independent circuits: each sized for a specific THR, TD, and refrigerant. Each circuit is supplied with its own inlet and outlet connections and are identified from left to right when facing the header end of the unit.

The THR calculation for each circuit uses the same method outlined in the preceding section except that Refrigerant Capacity Factors (Table 8) are applied when using refrigerants other than R-404A. The individual circuit THRs are then added together to determine the overall unit THR required and selecting a specific air-cooled condenser model. The final step is to determine how to divide the total number of available feeds into individual circuits.

Guidelines for multi-circuiting:

- Avoid locating high TD circuits next to low TD circuits.
- Add excess feeds to low TD circuits located near high TD circuits.
- The refrigerant charge for each circuit may be calculated as actual feeds ÷ total feeds X refrigerant charge for unit.

Table 6: Method of Selecting Model for Multi-Circuiting

Circuit #	Refrig	Design Ambient (°F)	Evap Temp (°F)	Cond Temp (°F)	Compressor Capacity (MBH)	x	Heat of Compr. Factor	x	Altitude Factor	÷	Refgnt Factor	÷	Design TD (°F)	=	Required THR (MBH/1°F)
1	R-404A	95	+25	105	40	x	1.2875	x	1.02	÷	1.00	÷	10	=	5.25
2	R-410A	95	+30	110	30	x	1.2800	x	1.02	÷	1.03	÷	15	=	2.54
													Total	=	7.79

Select Model MCS5012-079 with 16 available feeds. R-404A = 7.92 MBH/1°F
R-410A = 8.16 MBH/1°F

Table 7: Method of Specifying the Number of Feeds per Circuit

Circuit #	Required THR (MBH/1°F)	÷	Available THR (MBH/1°F)	x	Available #Feeds	=	Required # Feeds	Actual # Feeds	% Total # Feeds	x	Available THR (MBH/1°F)	=	Actual THR (MBH/1°F)	Actual TD (°F)
1	5.25	÷	7.92	x	16	=	10.6	11	68.8%	x	7.92	=	5.45	9.6
2	2.54	÷	8.16	x	16	=	13.0	5	31.2%	x	8.16	=	2.55	14.9
								16	100.0%				8.00	

Table 8: Refrigerant Capacity Factors

Refrigerant Capacity Factors	
Refrigerant	**Factor**
R-404A	1.00
R-410A	1.03
R-134a	0.89

Modine Grenada LLC
Tel: 800-225-4328
Fax: 662-229-4212
Grenada, MS
Email: coils@modine.com