Microchannel

REMOTE AIR-COOLED CONDENSER WITH ELECTRONICALLY COMMUTATED FAN ASSEMBLIES

Technical Bulletin: MXCE_004_091020

Products that provide lasting solutions.

Microchannel Remote Air-Cooled Condenser

Krack, a Hussmann Corporation brand, has a long tradition of leadership and product innovation in the refrigeration industry.

Krack's new Microchannel Remote Air-Cooled Condenser incorporates a new patented modular assembly.

- Smaller size and less weight reduces cost in the building construction.
- The new coil has less internal volume resulting in a significant reduction in refrigerant charge. Less refrigerant is environmentally friendly.
- Coil slabs are easily replaced from the rear of the unit.

Environmentally Friendly Benefits

- **Reduced Coil Internal Volume –** Resulting in a significant reduction in condenser operating and flooding charge.
- **EC Fan Assemblies –** Move more air for increased capacity over standard fans and incorporate noise reduction features for reduced sound levels.
- **EC Motor –** Continuously variable speed, full speed to full stop, operation provides vastly greater energy savings compared to traditional fan cycling.
- **California Energy Commission –** Title 24 compliant models are offered with a reduced maximum speed to meet the regulations specific energy efficiency requirement.

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Microchannel Remote Air-Cooled Condenser

Benefits and Features

Modular Microchannel Condenser Assembly (Patent #6988538)

- Patented (#6988538) modular assembly for models from 2 to 12 fans.
- Multi-fan sections compartmented to allow individual fan cycling while preventing “wind milling.”
- Vertical air discharge with V shaped placement of micro-channel coil slabs for reduced footprint.
- Extruded aluminum coil construction and compact design reduces weight 35% compared to traditional condenser designs.
- Modular assembly requires fewer parts.

Serviceability

- Removeable end panels for easy service access for cleaning.
- Unit designed for coil replacement of damaged coil slabs.

Weather Resistant

- Mill galvanized fans sections, coil baffles and legs.
- Aluminum Microchannel slab is constructed from corrosion resistant alloy and has reduced galvanic corrosion for longer life than tube and fin coil.
- Electronic motor enclosures include cap with integrated seal and liquid tight connections that are internally sealed for all-weather operation.

Fan Assemblies and Electrical Rating

- Electronically commutated (EC) fan assemblies with variable speed operation, full speed 1020 RPM to full stop, results in significant energy savings.
- Increased air flow compared to standard fans provides more capacity.
- Advanced fan design integrated with the motor and fan guard reduce sound levels compared to standard fans.
- EC motors include integrated phase loss, locked rotor and overload protection for use with 208/3/60, 380/3/50 and 460/3/60 power.
- Default AIC rating of 10,000 amps (10kA) with ratings up to 100 kA available with standard fuses and addition of fused disconnect.

Optional Features

- Electronic control boards tested to provide variable speed fan control to work with most control systems or provide stand alone control.
- Electrofin on Microchannel slabs for increased corrosion protection.
- Mounted receivers.
- Reusable air filters.
- Fan module isolation valves.
- Extended legs.

Microchannel Remote Air-Cooled Condenser

System Selections

THR - Total Heat of Rejection

- Condenser total heat of rejection (BTU/h) is the sum of the evaporator refrigeration effect and the heat of compression which varies with compressor type and operating conditions.

THR Calculation Method

- THR = Open Reciprocating Compressor Capacity (BTU/h) + (2545 x BHP)
- THR = Suction Gas Cooled Hermetic Reciprocating Compressor Capacity (BTU/h) + (3413 x kW)

THR Estimated Method

- THR may be estimated by multiplying the rated compressor BTU/h capacity by the compressor operating condition factor shown in Table 1 or 2.
  Multiply result by altitude factor when applicable.

TABLE 2

EVAPORATOR TEMP (˚F)	OPEN COMPRESSOR CONDENSING TEMPERATURE (˚F) 90	100	110	120	130	140
-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

* Beyond the normal limits for single-stage compressor application.

TABLE 1

EVAPORATOR TEMP (˚F)	HERMETIC COMPRESSOR 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
5	1.33	1.37	1.41	1.46	1.52	1.59
10	1.31	1.34	1.38	1.43	1.49	1.55
15	1.28	1.32	1.35	1.40	1.46	1.52
20	1.26	1.29	1.33	1.37	1.43	1.49
25	1.24	1.27	1.31	1.35	1.40	1.45
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

* Beyond the normal limits for single-stage compressor application.

TABLE 3

ALTITUDE FEET	FACTOR	FEET	FACTOR
1,000	1.02	5,000	1.12
2,000	1.05	6,000	1.15
3,000	1.07	7,000	1.17
4,000	1.10	8,000	1.24

Model Key

MX	H	-	06	M

UNIT TYPE:
MX - Microchannel

FAN/MOTOR COMBINATION:
H - 1020 RPM 3 HP EC

TOTAL NUMBER OF FANS:
02 10
04 12
06
08

MOTOR VOLTAGE:
K - 208/230/3/60
M - 460/3/60
U - 380/3/50

Specifications subject to change without notice.

Applications

- **Locate Condensers** no closer than their width from walls or other condensers. Avoid locations near exhaust fans, plumbing vents, flues or chimneys.
- **Parallel Condensers** should be the same model resulting in the same refrigerant side pressure drops. Compressor discharge lines should have equal pressure drops to each condenser.
- **Condenser Refrigerant Charge** for Summer conditions are listed on the Performance Data Table. The additional Winter Flooding charge required is difficult to predict with fan cycling and is maximized with holdback; however, the maximum additional refrigerant charge is also listed on the Performance Data Table for Winter conditions at -20˚F. The Summer operating and Winter maximum flooding charge is substantially less than that required for traditional tube and fin condensers due to the reduced internal volume of the microchannel coils.
- **Receiver Capacity** should be sized to store condenser winter charge.
- **Compressor Discharge** lines should be sized to minimize pressure drops and maintain oil return gas velocities. Each connection should be looped to the top of the condenser.
- **Gravity Liquid Drain Lines** should drop from each outlet as low as possible before headering or running horizontally. Pitch downhill to receiver.

Microchannel Remote Air-Cooled Condenser

Performance Data

MX MODEL	TOTAL HEAT OF REJECTION (MBH)								AIR FLOW (CFM)	CONDENSER CHARGE R-404A (LBS)		EST. SOUND 10'(dBA)	SHIP WEIGHT (LBS)
	R-404A / R-507A				R-407A, R-448A / R-449A								
	TEMP DIFFERENCE				TEMP DIFFERENCE								
	10° F	15° F	20° F	25° F	10° F	15° F	20° F	25 °F		SUMMER	WINTER		
MXH-02	171.1	256.7	342.2	427.8	167.0	250.5	334.0	417.5	27100	4	12	60	674
MXH-04	342.2	513.3	684.4	855.5	334.0	501.0	668.0	835.0	54200	15	26	63	1398
MXH-06	513.3	770.0	1026.6	1283.3	501.0	751.5	1002.0	1252.5	81300	23	40	65	2047
MXH-08	684.4	1026.6	1368.8	1711.0	668.0	1002.0	1336.0	1670.0	108400	40	55	66	2736
MXH-10	855.5	1283.3	1711.0	2138.8	835.0	1252.5	1670.0	2087.5	135500	52	77	67	3420
MXH-12	1026.6	1539.9	2053.2	2566.5	1002.0	1503.0	2004.0	2505.0	162600	80	88	68	4069

Capacity ratings are based on midpoint condensing temperature, 95˚F entering air temperature and 0˚F sub-cooling.
The temperature difference is between the midpoint condensing temp. and the entering air temp. to the condenser.

See Electrical Motor Amp Data Table on page 9.

CORRECTION FACTOR FOR OTHER REFRIGERANTS

REFRIGERANTS	MULTIPLY R-404A BY CAPACITY FACTOR	CHARGE CORRECTION FACTOR	
		SUMMER	WINTER
R-404A	1.00	1.00	1.00
R-134a	0.97	1.17	1.11
R-22	1.02	1.14	1.09
R-407A	See R-407A Chart	1.10	1.08
R-407C	0.98 x R-407A	1.09	1.07
R-448A / R-449A	See R-448A / R-449A Chart	1.06	1.04

1. Ship weight includes "ship loose" leg weights.
2. Sound data is an estimate only. It can be greatly affected by surroundings.

California Energy Commission (CEC) Title 24 Regulations

- Title 24 regulations require a specific energy efficiency and variable speed fan operation for condensers for commercial refrigeration and refrigerated warehouses.
- To meet the specific efficiency (65 btuh/watt) for full speed operation, the max speed is reduced with capacity and sound data shown in the table below.
- Controls to vary the speed of all fans in relation to the ambient dry bulb temperature are required.

California Energy Commission Title 24 Performance Data

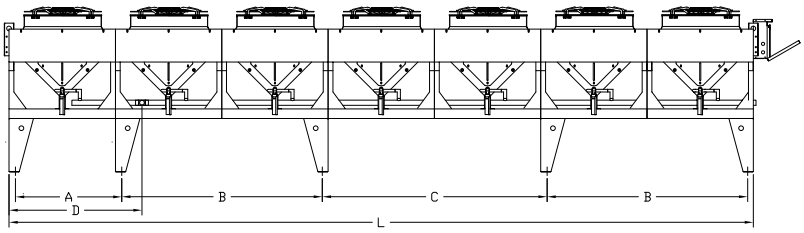
MX MODEL	TOTAL HEAT OF REJECTION (MBH)								AIR FLOW (CFM)	CONDENSER CHARGE R-404A (LBS)		EST. SOUND 10'(dBA)	SHIP WEIGHT (LBS)
	R-404A / R-507A				R-407A, R-448A / R-449A								
	TEMP DIFFERENCE				TEMP DIFFERENCE								
	10° F	15° F	20° F	25° F	10° F	15° F	20° F	25° F		SUMMER	WINTER		
MXH-02	159.1	238.7	318.2	397.8	155.8	233.7	311.6	389.5	24255	4	12	58	674
MXH-04	318.2	477.3	636.4	795.5	311.6	467.4	623.2	779.0	48510	15	26	61	1398
MXH-06	477.3	716.0	954.6	1193.3	467.4	701.1	934.8	1168.5	72765	23	40	63	2047
MXH-08	636.4	954.6	1272.8	1591.0	623.2	934.8	1246.4	1558.0	97020	40	55	64	2736
MXH-10	795.5	1193.3	1591.0	1988.8	779.0	1168.5	1558.0	1947.5	121275	52	77	65	3420
MXH-12	934.8	954.6	1431.9	1909.2	2386.5	1402.2	1869.6	2337.0	145530	80	88	66	4069

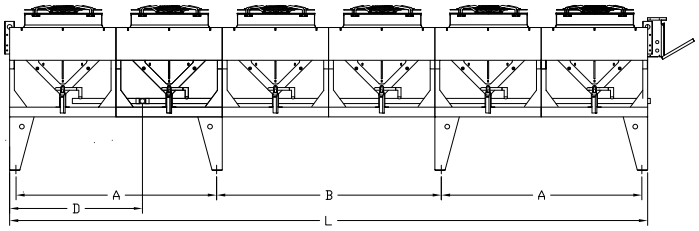
Capacity ratings are based on midpoint condensing temperature, 95˚F entering air temperature and 0˚F sub-cooling. The temperature difference is between the midpoint condensing temp. and the entering air temp. to the condenser. Units compliant with Title 24 are programmed to run their motors at a lessened top speed, significantly reducing their energy usage with a minimal impact on capacity. At full speed, each motor consumes 1169 watts. However, as these motors are continuously variable speed they will use significantly less energy during standard operation.

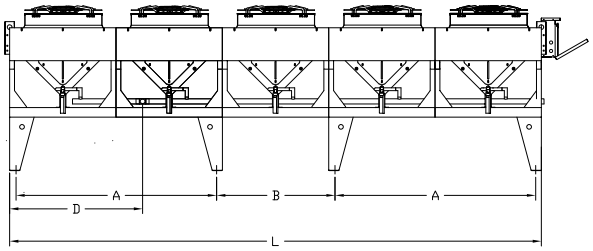
See Corrections Factor Table on page 4. See Electrical Motor Amp Data Table on page 9.

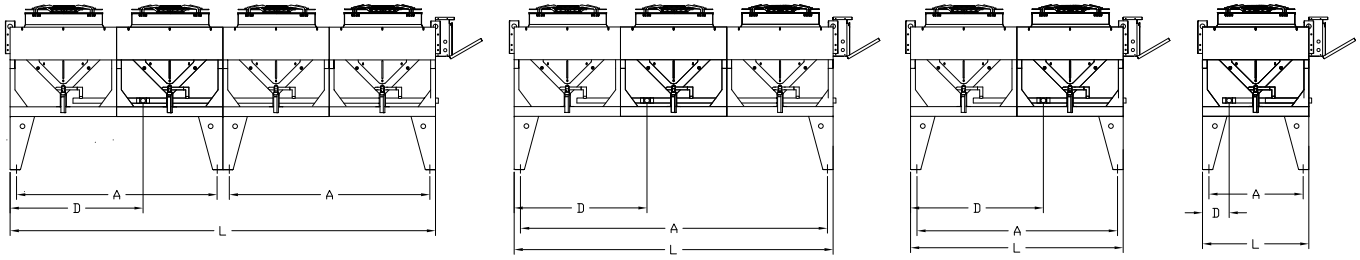
Microchannel Remote Air-Cooled Condenser

Dimensional Data - Standard Model



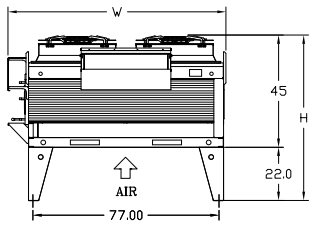






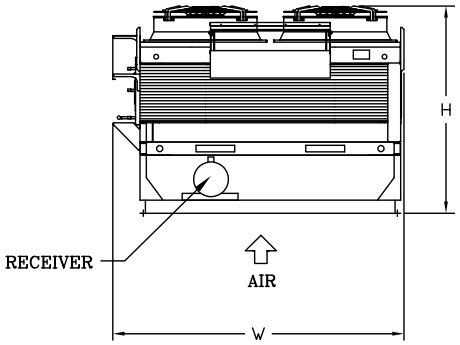
MODEL DIMENSIONS

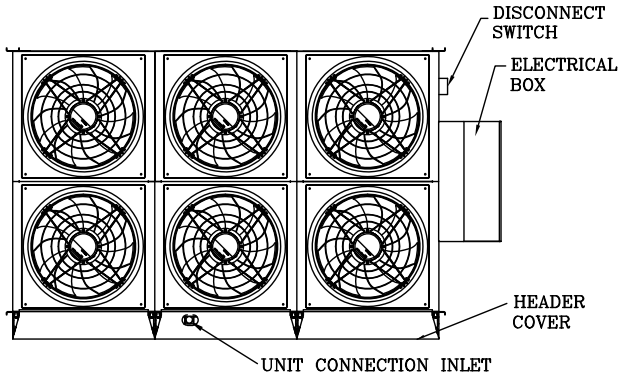
MODEL	L	W	H	A	B	C	D
MXH-02	44	95	67	39	-	-	11
MXH-04	88	95	67	83	-	-	55
MXH-06	132	95	67	127	-	-	55
MXH-08	176	95	67	83	-	-	55
MXH-10	220	95	67	83	49	-	55
MXH-12	264	95	67	83	93	-	55

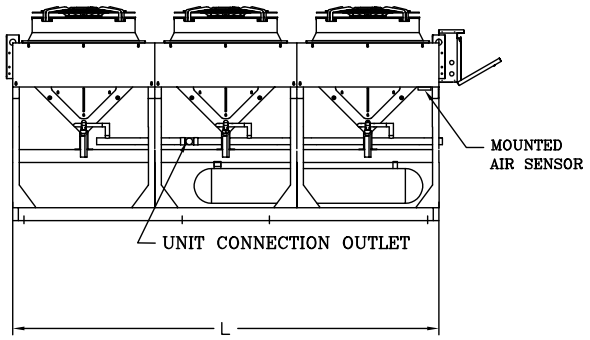


Specifications subject to change without notice.

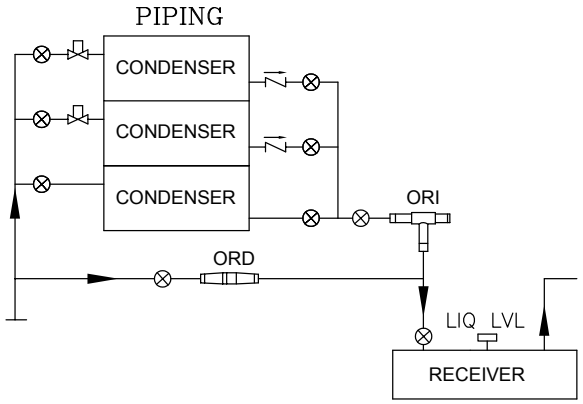
Dimensional Data - Receiver Model (If Applicable)







TYPICAL PIPING
WITH ONE RECEIVER



MODEL DIMENSIONS

MODEL	L	W	H	MODEL	L	W	H
MXH-02	44	95	64-3/16	MXH-08	176	95	64-3/16
MXH-04	88	95	64-3/16	MXH-10	220	95	64-3/16
MXH-06	132	95	64-3/16	MXH-12	264	95	64-3/16

Receiver Data

Microchannel is available with a mounted receiver for applications where a remote receiver is desired. Included in the option are extended legs, receiver, 3-way valve, relief valve, rotalocks, ball valves, and ORI/ORD valves. Optional heated and insulated receivers are available.

RECEIVER CAPACITIES @ 80% FULL

SIZE	R-404A (LBS)	R-407A (LBS)	R-448A / R-449A (LBS)
10-3/4" x 48"	114	126	121
10-3/4" x 60"	144	159	153
12-3/4" x 72"	245	270	260
14-3/4" x 96"	395	435	419

ADDITIONAL UNIT WEIGHT

NUMBER OF FANS	NUMBER OF RECEIVERS 1
02	220
04	290
06	360
08	440
10	600
12	680

CONNECTION SIZES

NUMBER OF FANS	INLET	OUTLET
2	1-3/8"	1-3/8"
4	1-3/8"	1-3/8"
6	2-1/8"	2-1/8"
8	2-1/8"	2-1/8"
10	2-5/8"	2-5/8"
12	3-1/8"	3-1/8"

Includes ORI /ORD flooding valve, isolation ball valves, gauge-type liquid level indicator and dual relief valve. Optional heat tape and insulation.

FACTORY MOUNTED RECEIVERS

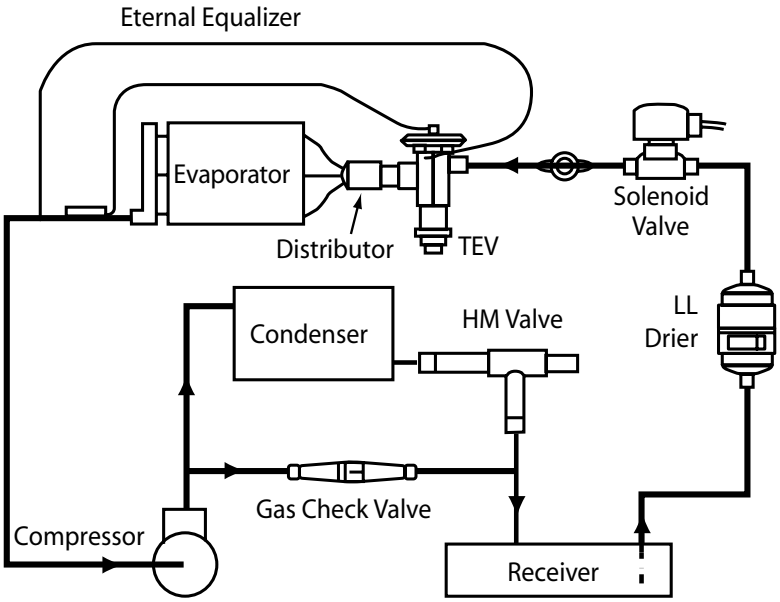
MICROCHANNEL MODEL	SIZE	RECEIVER SIZE
MX* FAN MODEL 1 Receiver	MX*-06	10.75" x 60"
	MX*-04	10.75" x 60"
	MX*-06	12.75" x 72"
	MX*-08	12.75" x 72"
	MX*-10	12.75" x 72"
	MX*-12	12.75" x 72"

Specifications subject to change without notice.

Control System

Piping Schematic for Winter Control

Head pressure control for systems with air cooled condenser is accomplished with two pressure regulating valves designed specifically for this type of application. When low ambient conditions are encountered during winter operation on air cooled systems with a resultant drop in condensing pressure, the Head pressure control's purpose is to hold back enough of the condenser liquid refrigerant so that some of the condenser surface is rendered inactive. This reduction of active condensing surface results in a rise in the condensing pressure and sufficient liquid line pressure for normal system operation.



Microchannel Remote Air-Cooled Condenser

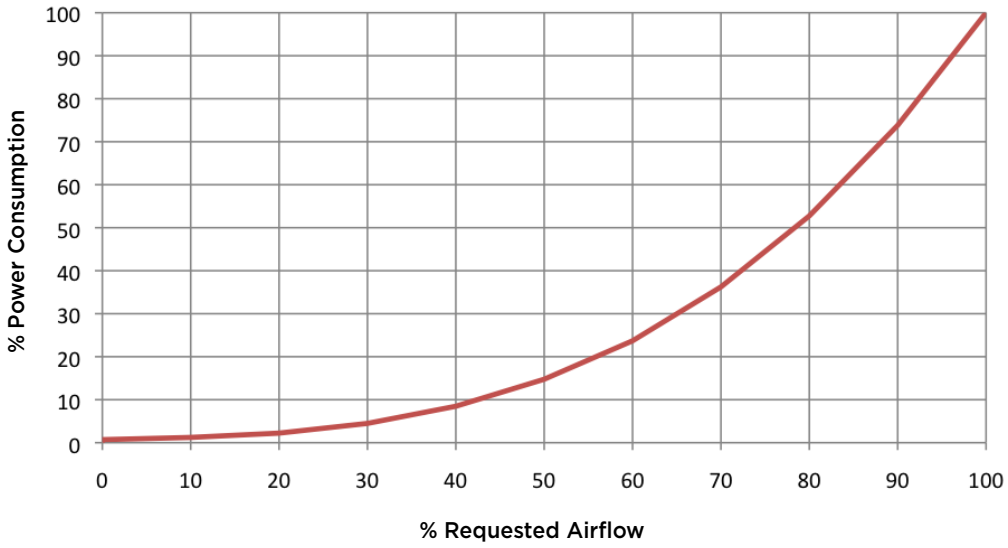
Electrical Data

FAN MOTOR TOTAL FULL LOAD AMPS/MCA/MOPD

MODEL	208/3/60, AMPS			460/3/60, AMPS			380/3/60, AMPS		
	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP
MXH-02	22.1	24.55	30	12.3	13.53	15	15.7	17.35	20
MXH-04	41.7	44.15	50	22.1	23.33	25	28.9	30.55	35
MXH-06	61.3	63.75	70	31.9	33.13	35	42.1	43.75	50
MXH-08	80.9	83.35	90	41.7	42.93	45	55.3	56.95	60
MXH-10	100.5	102.95	110	51.5	52.73	60	68.5	70.15	80
MXH-12	120.1	122.55	130	61.3	62.53	70	81.7	83.35	90

FOR MOP, USE THE FOLLOWING CALCULATIONS:
Total FLA = Fan FLA x No. of Fans + Control Amps (2.5A).
Minimum Unit Circuit Amps = 1.25 x Fan FLA + (Remaining Fan FLA + Control Amps).
Maximum Unit Overload Protection = 2.25 x Fan FLA + (Remaining Fan FLA + Control Amps). Then Round down to next Breaker size.

POWER CONSUMPTION COMPARED TO REQUESTED UNIT AIRFLOW



Control Panel Nomenclature

NC	H	2	6	M	B	4	6	1	N

Actual Part Number (NCH26MB461N)

RELAY BOARD CONTROLS:
- NC - No Controls
- CPC2 - Multiflex 88AO
- DAN - Danfoss MX06D
- HSM - Hussmann Controller

FAN/MOTOR COMBINATION:
- H - 2.5 HP 1020 RPM EC

FANS WIDE:
- 1 or 2

FANS IN LINE:
- 1 to 6

POWER VOLTAGE:
- K - 208/230/3/60
- L - 380/3/60
- M - 460/3/60
- U - 380/3/50

CONTROL VOLTAGE:
- A - 208/230 V
- B - 115 V
- C - No Control Voltage
- D - 24 V
- E - 208/230 V Without Transformer
- F - 115 V Without Transformer
- G - No Control Voltage Without Transformer
- H - 24 V Without Transformer

CONTROL MANUFACTURER:
- 3 - Johnson Electronic
- 4 - No Controls

FUSES and BREAKERS:
- 4 - Terminal Blocks Only
- 6 - Individual Fuses

TYPE OF APPLICATON:
- 2 - 50% Winter Reduction (Split Condenser)
- 3 - 50/50 Split Dual Panel (for Two Indep. Slabs)
- 4 - No Control Operation (Terminal Blocks Only)

AMBIENT AIR SENSOR:
- T - Ambient Air Sensor Provided
- N - Sensor Not Required

Condenser Control Panel

Standard Fan Control Panel Arrangement

- All fans will continuously vary their speed according to the control signal, providing precise capacity control and energy cost savings.
- Internal motor programming allows fans to cycle off individually as system demand decreases.
- For full customer control, a no controls option provides individual control connections for each motor.

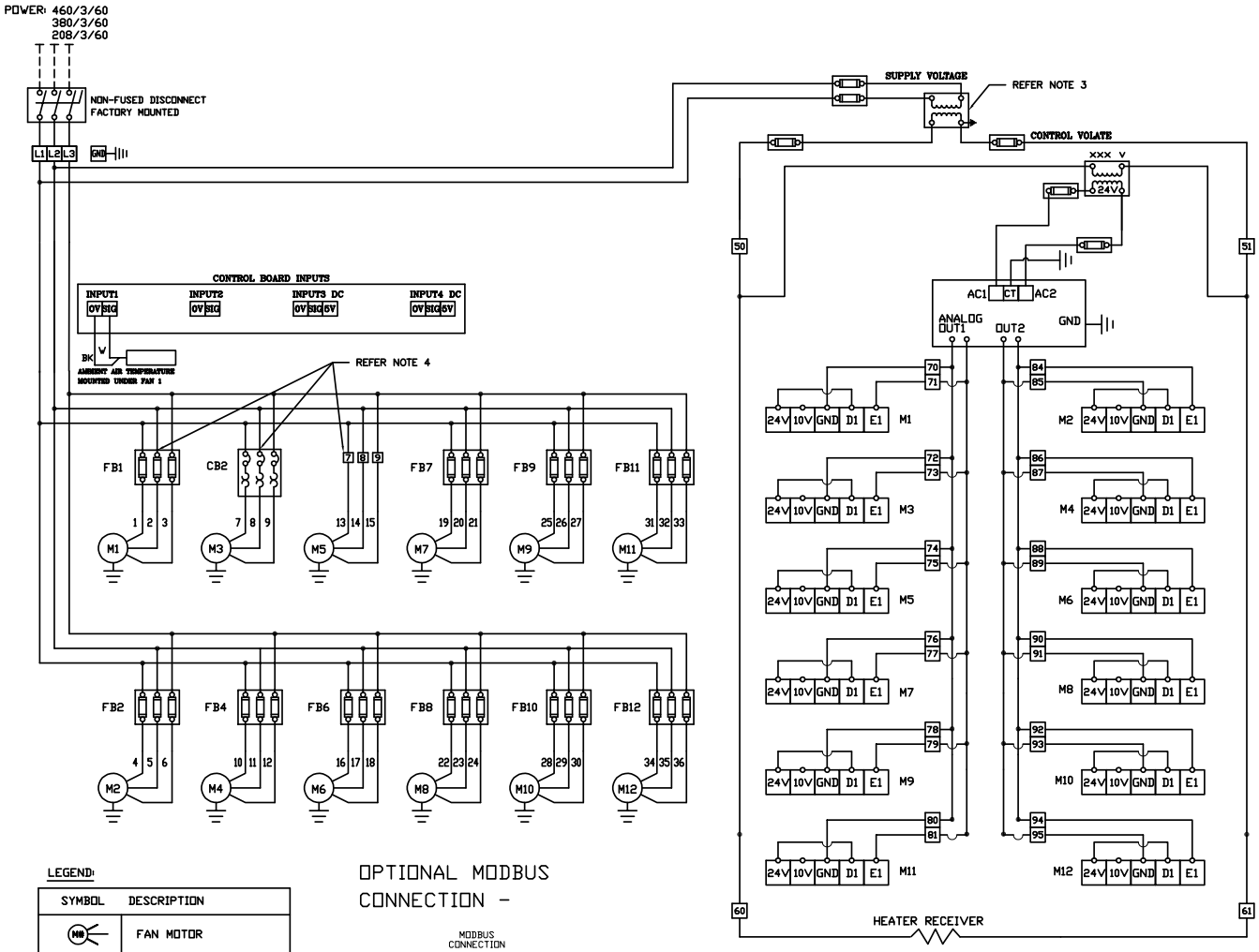
Control Panel

- Standard weather resistant enclosure is mounted on the right side of the unit when looking at the headers.
- Control power is 24, 115 or 230 volts. A transformer is factory installed when required.
- Each motor protected by fuses.

Optional Arrangements

- Winter reduction available on models with 4 or more fans.
- Relay boards with analog outputs are also offered to allow speed control of these motors.
- Disconnect not included, but may be required to meet local codes.

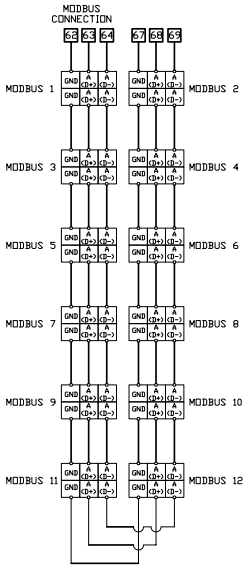
Condenser Control Panel - Standard Wiring Drawing



LEGEND:

SYMBOL	DESCRIPTION
M#	FAN MOTOR
	CIRCUIT BREAKER
#	TERMINAL BLOCK
MC#	MOTOR CONTACTOR
MC#	MOTOR CONTACTOR COIL
FB#	FUSE BLOCK
	TRANSFORMER
	HEATER RECEIVER

OPTIONAL MODBUS CONNECTION -



NOTE:

1. WINTER REDUCTION ENABLED VIA FLEXIBLE COMBINER ON CONTROLLER. (10V OUTPUT SIGNAL ON AO2).
2. EACH MOTOR'S SPEED IS LINEARLY CONTROLLED WITH 0–10V ANALOG SIGNAL.
   0V IS SEEN AS A COMMAND TO GO TO FULL SPEED
   10V IS SEEN AS A COMMAND TO GO TO ZERO SPEED.
3. CONTROL VOLTAGE CAN BE 208V & 230V/120V/24V, TRANSFORMER SIZED BASED ON PRIMARY, SECONDARY VOLTAGE AND AMPS REQUIRED. 208V & 230V/120V/24V WITHOUT TRANSFORMER OPTION IS ALSO AVAILABLE.
4. PRIMARY PROTECTION TO INDIVIDUAL CAN BE FUSE OR CIRCUIT BREAKER. TERMINAL PIN ONLY OPTION IS ALSO AVAILABLE.

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