GREENHECK
Building Value in Air.

Part #472695
Model MPX

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!

Model MPX

General Safety Information

Only qualified personnel should install and maintain this system. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. All moving parts must be free to rotate without striking or rubbing any stationary objects.
3. Unit must be securely and adequately grounded.
4. Do not spin wheel faster than maximum cataloged fan RPM. Adjustments to fan speed significantly affect motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Verify that the power source is compatible with the equipment.
6. Never open access doors to the unit while it is running.

DANGER

- Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch or breaker to prevent accidental power up.
- If this unit is equipped with optional gas accessories, turn off gas supply whenever power is disconnected.

CAUTION

This unit is equipped with a compressed refrigerant system. If a leak in the system should occur, immediately evacuate and ventilate the area. An EPA Certified Technician must be engaged to make repairs or corrections. Refrigerant leaks may also cause bodily harm.

CAUTION

When servicing the unit, the internal components may be hot enough to cause pain or injury. Allow time for cooling before servicing.

Receiving

Upon receiving the product, check to make sure all items are accounted for by referencing the Bill of Lading to ensure all items were received. Inspect each crate for shipping damage before accepting delivery. Notify the carrier if any damage is noticed. The carrier will make notification on the delivery receipt acknowledging any damage to the product. All damage should be noted on all copies of the Bill of Lading which is countersigned by the delivering carrier. A Carrier Inspection Report should be filled out by the carrier upon arrival and filed with the Traffic Department. If damaged upon arrival, file claim with the carrier. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the Bill of Lading.

Handling

Units are to be rigged and moved by the lifting brackets provided. This model is not designed for forklifting. Location and number of lifting brackets varies by model and size and all provided lifting brackets must be used to properly support the unit during handling. Handle each unit in such a way as to keep from scratching or chipping the coating. Damaged finish may reduce the ability of the unit to resist corrosion. See also Installation / Handling Concerns / Lifting in this manual.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and accessories during storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Inspection and Maintenance During Storage

While in storage, inspect units once per month. Keep a record of inspection and maintenance performed. If moisture or dirt accumulations are found on the parts, the source should be located and eliminated. At each inspection, rotate all moving parts by hand ten to fifteen revolutions to distribute lubricant on motor and bearings. If paint deterioration begins, consideration should be given to touch-up or repainting. Units with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventative should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventative coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from the surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean thoroughly with Tectyl® 506 (Ashland, Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventative or WD-40® or the equivalent.

Models and Capacities

The make-up air unit with packaged heating and cooling is manufactured in four different platform sizes, each of which has four different output tonnage options. Examine shipping documents to verify correct model as received and highlight the model and tonnage as shown below.

Platform	Tonnage
MPX-H14	5, 6, 8, 10
MPX-H24	11, 13, 16, 18
MPX-H34	20, 23, 26, 30
MPX-H34 (two furnaces)	20, 23, 26, 30

Serial Number

A metal plate with a unit serial number is located on the door to the control center. Record the unit serial number here:

_____

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Product Overview

This model is a horizontally configured make-up air unit designed for outdoor installations. It has an integral DX package for cooling and optionally contains either an electric heater or one or two highly efficient indirect gas-fired furnace(s) to provide a primary heat source for the building or to simply temper the air that is supplied to the building. The unit is designed to provide sufficient air to replace air that is exhausted from the building and also heat and cool as needed. The make-up air volume produced by the unit is constant, but can be optionally modulated to provide a variable volume (VAV).

The DX system comes fully charged with R-410A refrigerant from the factory and is ready for operation upon arrival.

All units are equipped with two compressors as standard. The smallest units may have only one compressor. If the digital scroll compressor option was selected, the lead circuit will have a digital scroll compressor and if a second compressor is present, that one will be a standard fixed scroll type. All units with multiple compressors allow for staging of compressors to meet a wider range of outdoor air loads while reducing the number of cycles per compressor.

Compressed Refrigerant

All of these make-up air models are charged with environmentally-friendly R-410A compressed refrigerant. Do not use tools or parts designed for other refrigerants on this unit.

Airflow Arrangement

This model is designed for 100% outdoor air and can be combined with a Variable Air Volume (VAV) capability for greater flexibility in response to building air handling needs. The optional VAV function involves a Variable Frequency Drive (VFD) controller for the blower motor.

Safety Listing

The models are listed per ANSI/UL 1995, Heating and Cooling Equipment and are ETL Certified.

Supplemental Installation, Operation and Maintenance Manuals

Refer to the following Installation, Operation and Maintenance manuals for additional information:

- Plenum and Plug
- Indirect Gas-Fired Furnace, Model PVF
- PCO3 Controller

MPX Subassemblies

Blower

Each unit has just one backward curved blower (centrifugal fan). For further information refer to the Plenum and Plug IOM.

Coils

Every unit is supplied with a single DX evaporator coil. If there is only one cooling circuit, then the DX coil is not divided. If two cooling circuits are specified, then the DX coil will be an interlaced design. A reheat coil may be optionally installed in the unit and is connected to the lead compressor. Multiple condenser coils are attached to the exterior of the model.

Dampers

There is only one damper that may be found in the unit. It is an optional low-leakage motorized damper located inside the cabinet in the intake airstream, near the air intake weatherhood.

DX System

The DX system in the model is a complete, sealed unit with compressed R-410A refrigerant. It consists of one or two compressors (digital scroll optional), evaporator and condenser coils and the following integral components:

- expansion valves
- liquid line filter driers
- service / charging valves
- moisture indicating sight glass
- hot gas bypass (not present on optional digital scroll compressors)
- crankcase heater on each compressor

Each DX system incorporates the following:

- high pressure manual reset cutout
- low pressure auto-reset cutout
- time delays for compressor protection

Electric Heater

An electric heater is optionally available for the model and is used for tempering of the make-up air.

Filters

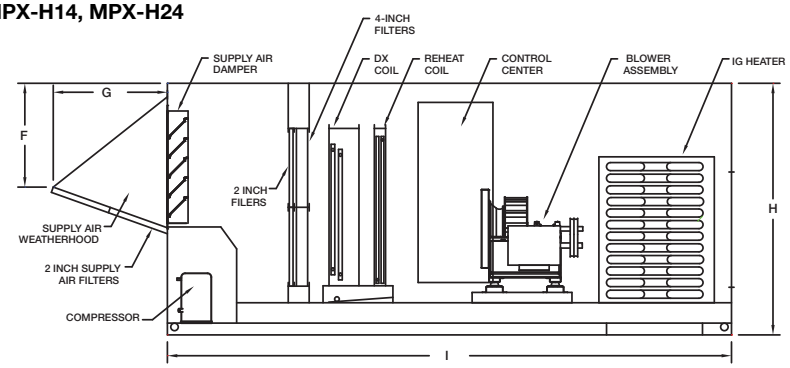
Each unit is optionally equipped with washable metal filters in the outdoor air intake and with pleated papers filters in the air intake stream. Paper filters may be MERV 8 only, or the MERV 8 filters may be installed as pre-filters for the optional MERV 13 paper filters or optional MERV 15 filters.

Indirect Gas-Fired Furnace

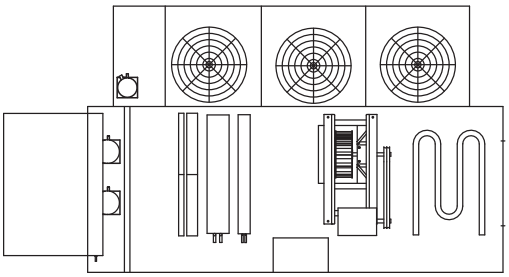
The model may optionally include as many as two indirect gas-fired furnaces. See also Indirect Gas-Fired Furnace, Model PVF Installation, Operation and Maintenance Manual.

Unit Weights and Dimensions - *dimensions are in inches*

MPX-H14, MPX-H24

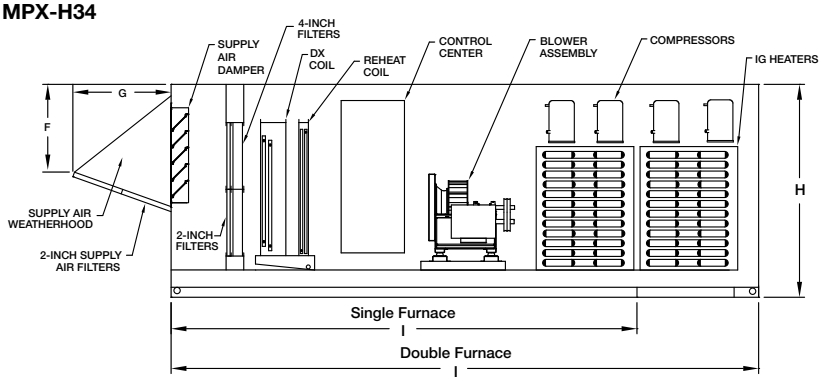


ELEVATION



TOP VIEW

MPX-H34



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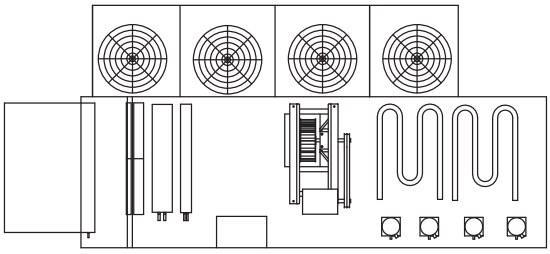
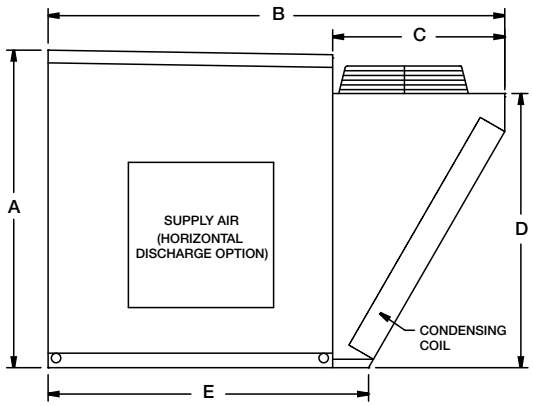


TOP VIEW

Unit Size	Dimensions			
	MPX-H14	MPX-H24	MPX-H34	MPX-H34
Furnaces	Single Furnace			Double Furnace
A	54.3	67.2	72.2	76.2
B	86.6	96.7	97.7	97.7
C	34.0	36.4	33.2	33.2
D	48.1	58.1	72.7	72.7
E	62.6	67.9	70.8	70.8
F	21.6	27.7	38.8	38.8
G	23.5	30.5	37.0	37.0
H	54.3	67.2	76.2	76.2
I	132.4	150.8	148.0	182.7
Nominal weight (lbs)*	3194	3575	4831	5635

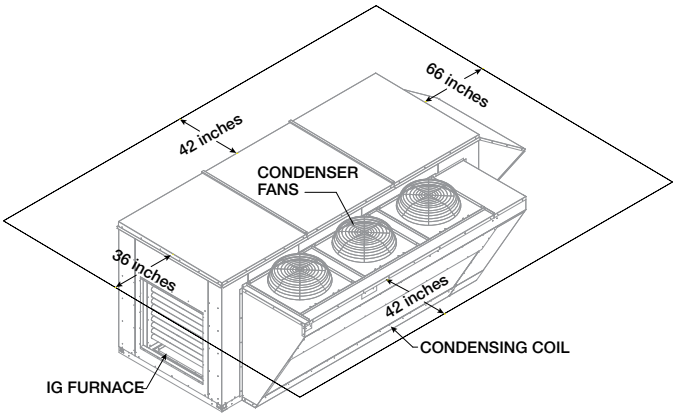


SUPPLY

**Actual weights will vary based on the unit configuration.*
Refer to the submittal for exact unit weight.

Service Clearances

The units require minimum clearances for access on all sides for routine maintenance. Filter replacement, drain pan inspection and cleaning, fan bearing lubrication and belt adjustment are examples of routine maintenance that must be performed. Blower and motor assemblies, coil and filter sections are always provided with a service door or panel for proper component access. Clearances for component removal may be greater than the service clearances, refer to drawings for these dimensions.



Additional clearances for units with Packaged DX

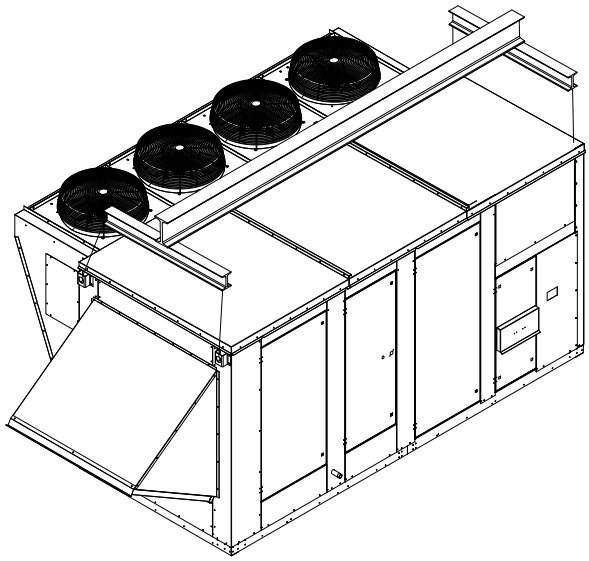
Clearances must be maintained on all sides of this model. This especially is true with the top of this unit. Hot air is being discharged through the condensing fans during operation, and the more clearance available, the better the chance of avoiding recirculation or coil starvation. This unit should never be placed under an overhang or inside a building. A minimum of 48 inches over the condensing fans is recommended.

Handling Concerns for Units with Packaged DX

While this unit was constructed with quality and dependability in mind, damage still may occur during handling of the unit for installation. Exercise extreme caution to prevent any damage from occurring to the refrigerant system. This unit contains a system that is pressurized with refrigerant and if it is damaged, the refrigerant could leak into the atmosphere or cause bodily harm due to the extreme cold nature of expanding refrigerant. Use protective equipment such as gloves and safety glasses to minimize or prevent injury in case of a system leak during installation.

Lifting

1. Before lifting, be sure that all shipping material has been removed from unit.
2. To assist in determining rigging requirements, weights are provided in the Unit Weights & Dimensions section on page 5.
3. Unit must be lifted by all lifting lugs provided at the top of the unit.
4. Rigger to use suitable mating hardware to attach to unit lifting lugs.
5. Spreader bar(s) must span the unit to prevent damage to the cabinet by the lift cables.



6. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7. Never lift units by weatherhoods.
8. Never lift units in windy conditions.
9. Preparation of curb and roof openings should be completed prior to lifting unit to the roof.
10. Check to be sure that gasketing has been applied to the curb prior to lifting the unit and setting on curb.
11. Do not use fork lifts for handling unit.

Rail and Roof Curb Mounting

Rail Mounting and Layout

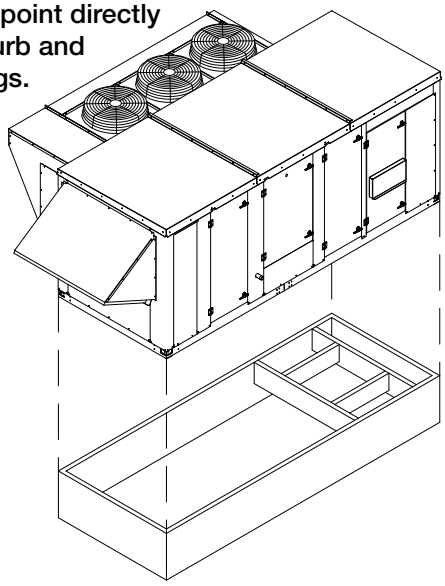
- The unit may be installed on rails provided and installed by others. Ensure that rails are designed to handle the weight of the unit and provide proper load distribution on building supports.
- Make sure that rail positioning does not interfere with the supply air discharge opening on the unit.
- Rails should run the width of the unit and extend beyond the unit a minimum of 12 inches on each side.
- Set unit on rails.

Roof Curb Mounting

Roof curb details, including duct location dimensions, are available on the model's roof curb assembly instructions.

Rooftop units require curbs to be mounted first. The duct connections must be located so they will be clear of structural members of the building.

1. **Factory Supplied Roof Curbs**
   Roof curbs are model GKD which are shipped in a knockdown kit (includes duct adapter) and require field assembly (by others). Assembly instructions are included with the curb.
2. **Install Curb**
   Locate curb over roof opening and fasten in place. (Refer to Recommended Roof Openings). Check that the diagonal dimensions are within ±1/8 inch of each other and adjust as necessary. For proper coil drainage and unit operation, it is important that the installation be level. Shim as required to level.
3. **Install Ductwork**
   Installation of all ducts should be done in accordance with SMACNA and AMCA guidelines. Duct adapter provided to support ducts prior to setting the unit.
4. **Set the Unit**
   Lift unit to a point directly above the curb and duct openings. Guide unit while lowering to align with duct openings. Roof curbs fit inside the unit base. Make sure the unit is properly seated on the curb and is level.



Ductwork Connections

The supply fan in this unit is a plenum-type fan. The discharge opening dimensions are provided in the chart below. For proper fan performance, match the duct size to the dimensions indicated. Installation of all ducts should be done in accordance with Best Practices and SMACNA.

Supply Air Duct Opening Dimensions (height x width; inches)				
Model	Downblast Discharge		Horizontal Discharge	
	Indirect Gas	Electric Heat	Indirect Gas	Electric Heat
MPX-H14	28.9 x 25.9	24.9 x 25.9	28.5 x 27.5	28.5 x 27.5
MPX-H24	33.9 x 25.9	33.9 x 25.9	38 x 38	35.9 x 27
MPX-H34	33.9 x 25.9	36.3 x 28.9	38 x 38	39 x 40

NOTE

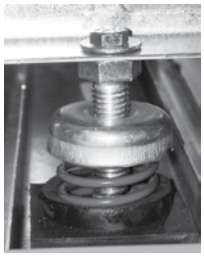
Downblast Discharge Ductwork - whenever downblast discharge is used, the ductwork directly beneath the unit must be connected with either a "T" or an "L" configuration and the area directly beneath the heat source **must not have any openings** such as louvers or grates.

No openings directly beneath the unit discharge.

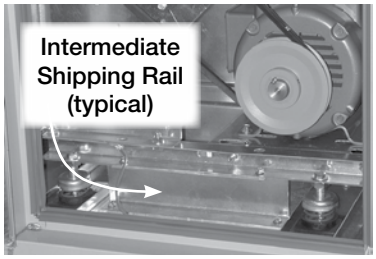
Vibration Isolators

NOTE

Many motor / blower assemblies include optional spring vibration isolation devices. When these isolation springs are used, the motor / blower assembly is secured for shipment by compressing the springs and securing the assembly to intermediate rails (see photo).



Spring Isolation Device



Motor / Blower Assembly in Shipping Position

After the unit is set in its final location, visually inspect motor / blower assembly to verify presence of spring isolation devices. If they are present, carefully remove shipping restraints to allow for free movement of the assembly.

NOTE

These assemblies are shipped with the springs in a compressed state and when shipping restraints are removed, the assembly will bounce upward. Do not position hands or fingers where they may be pinched or injured by sudden movement of the assembly.

The method of compressing and restraining the motor / blower assembly varies with each product. If sheet metal screws or bolts are used, they are installed with an equal number on both the front and the rear of each assembly. Screws or bolts used on the rear rail are difficult to see. It is recommended that the rear screws or bolts be removed before the front ones in order to reduce the chance of injury. If restraining bands are used instead of screws or bolts, carefully cut and remove the bands.

Plumbing / Piping Overview

The only piping connections required are the condensate drain trap and gas connections for the optional gas furnace(s).

Condensate Drain Trap

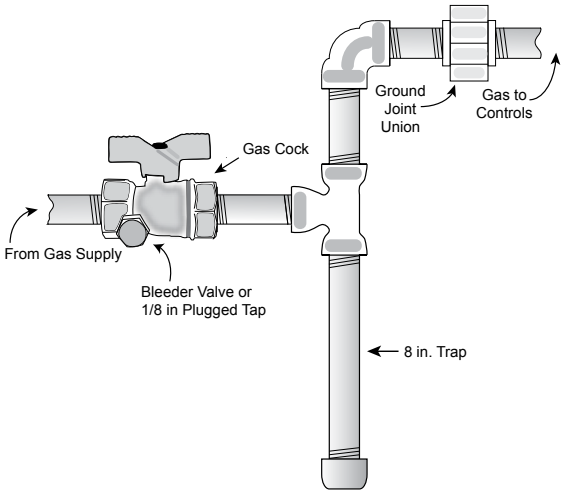
This unit is equipped with a stainless steel condensate pan with a stainless steel drain connection. It is important that the drain connection be fitted with a P trap to ensure proper drainage while maintaining internal static pressures and to prevent migration of sewer gas back into the unit. A P trap assembly (kit) is supplied with the unit and is to be assembled and installed as local conditions require and according to the assembly instructions provided with the P trap. If local and area building codes permit, the condensate may be drained from the P trap onto the roof, but a drip pad should be provided beneath the outlet. If local and area codes require a permanent drain line, it should be fabricated and installed in accordance with Best Practices and all codes.

In some climates it will be necessary to provide freeze protection for the P trap and drain line. The P trap should be kept filled with water or glycol solution at all times and it should be protected from freezing to protect the P trap from damage. If severe weather conditions occur, it may be necessary to fabricate a P trap and drain line of metal and install a heat tape to prevent freezing.

Gas Connections

If the model is equipped with an indirect gas-fired furnace, connection to an appropriate gas supply line will be required. For complete information on installation procedures for the optional gas furnace(s), refer to Indirect Gas-Fired Furnace, Model PVF.

Typical Gas Supply Connection



Electrical Information

The unit must be electrically grounded in accordance with the current National Electrical Code, ANSI/NFPA 70. In Canada, use the current CSA Standard C22.1, Canadian Electrical Code, Part 1. In addition, the installer should be aware of any local ordinances or electrical company requirements that might apply. System power wiring must be properly fused and conform to the local and national electrical codes. System power wiring is to the unit main disconnect (door interlocking disconnect switch standard on most units) or distribution block and must be compatible with the ratings on the nameplate: supply power voltage, phase and amperage (Minimum Circuit Amps - MCA; Maximum Overcurrent Protection - MOP). All wiring beyond this point has been done by the manufacturer and cannot be modified without affecting the unit's agency / safety certification. If field installing an additional disconnect switch, it is recommended that there is at least four feet of service room between the switch and system access panels. When providing or replacing fuses in a fusible disconnect, use dual element time delay fuses and size according to the rating plate.

Field Power Connection

All power and control connections should be run through the floor or side panel of the unit.

WARNING

The roof lining contains high voltage wiring. To prevent electrocution, do not puncture the interior or exterior panels of the roof.

If power supply is desired through bottom of unit, run the wiring through the curb, cut a hole in the cabinet bottom and run wires to the disconnect switch. Seal the penetration in cabinet bottom to prevent leakage.

The electric supply to the unit must meet stringent requirements for the system to operate properly. Voltage supply and voltage imbalance between phases should be within the following tolerances.

If the power is not within these voltage tolerances, contact the power company prior to operating the system.

Voltage Supply

See Voltage Use Range on the rating plate. Measure and record each supply leg voltage at all line disconnect switches. Readings must fall within the allowable range on the rating plate.

Voltage Imbalance

In a 3-phase system, excessive voltage imbalance between phases will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2%. To determine voltage imbalance, use recorded voltage measurements in this formula.

Key: V1, V2, V3 = line voltages as measured

VA (average) = (V1 + V2 + V3) / 3

VD = Line voltage (V1, V2 or V3) that deviates farthest from average (VA)

Formula: % Voltage Imbalance = [100 x (VA-VD)] / VA

CAUTION

If any of the original wire as supplied with the unit must be replaced, it must be replaced with wiring material having a temperature rating of at least 105ºC.

WARNING

To prevent injury or death due to electrocution or contact with moving parts, lock disconnect switch open.
For units with a gas furnace, if you turn off the power supply, turn off the gas.

Low Voltage Controller Circuitry

Manufacturer recommends that all low voltage wiring be run in conduit wherever it may be exposed to the weather.

Most factory-supplied electrical components are pre-wired. To determine what electrical accessories require additional field wiring, refer to the unit-specific wiring diagram located on the inside of the control center access door.

Field Control Wiring Length/Gauge	
Total Wire Length	Minimum Wire Gauge
125 ft.	18
200 ft.	16
300 ft.	14
450 ft.	12

The low voltage control circuit is 24 VAC and control wiring should not exceed 0.75 ohms.

Refer to Field Control Wiring Length/Gauge table for wire length maximums for a given wire gauge.

Control wires should not be run inside the same conduit as that carrying the supply power. Make sure that field-supplied conduit does not interfere with access panel operation. All low voltage wiring should be run in conduit wherever it may be exposed to the weather.

If wire resistance exceeds 0.75 ohms, an industrial-style, plug-in relay should be added to the unit control center and wired in place of the remote switch (typically between terminal blocks R and G on the terminal strip (refer to Typical Control Center Components). The relay must be rated for at least 5 amps and have a 24 VAC coil. Failure to comply with these guidelines may cause motor starters to "chatter" or not pull in which can cause contactor failures and/ or motor failures.

Discharge Air Temperature Sensor

All units are supplied with a Discharge Air Temperature Sensor that is to be field-installed prior to unit start-up. The sensor is to be installed at least three duct diameters downstream of the heat exchanger, or where good mixed average temperature occurs. The sensor must be connected directly to the DDC controller. All other sensors and low voltage devices are to be connected to the low voltage terminal strip in the control center. The discharge air temperature sensor is shipped loose and can be found in the unit's control center. See the unit-specific wiring diagram for connection locations.

Typical Discharge Air Temperature Sensor

Recommended Electrical and Gas Connection Locations

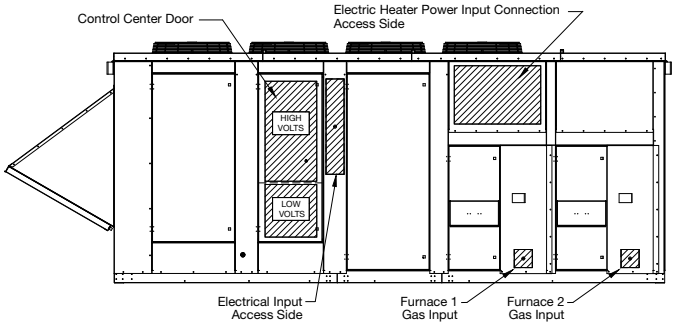
Installation requires penetrations into the cabinet for high voltage electrical supply, low voltage controller circuitry and for gas supply.

WARNING

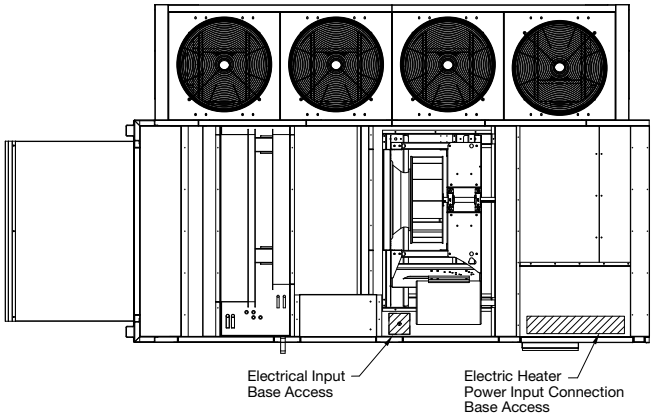
Do not make penetrations in the roof of the MPX for any reason. High voltage wiring is located between the inner and outer shells of the roof. Damage to the roof wiring circuitry could result in serious bodily harm.

Gas supply connections are made through the side of each unit in the factory-provided openings. Penetrations for electrical connections are to be made in the field as job conditions may require. High voltage supply wiring and low voltage controller circuitry access may be made either through the side of the unit or through the bottom. See illustrations below.

Recommended side access.



Recommended locations for access through the base of the cabinet are as shown.



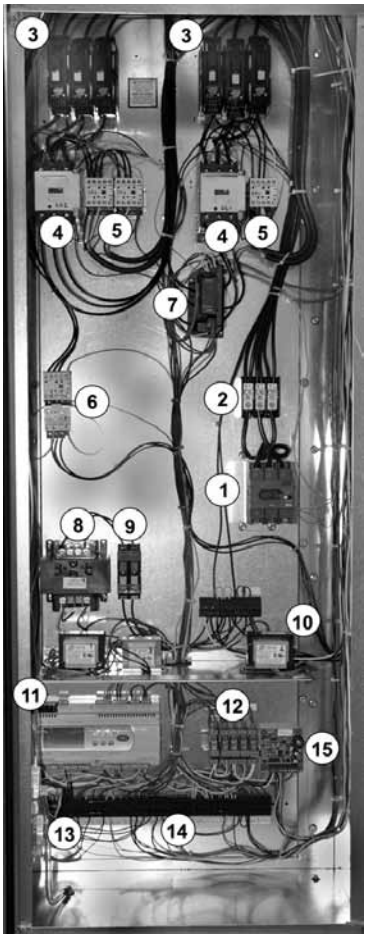
Control Centers

Each model has a main control center where high voltage supply wiring and low voltage controller circuitry is terminated. In addition, if the electric heat option was selected, there will be a separate control center for the electric heater where the dedicated high voltage supply is terminated. If the optional indirect gas-fired furnace option was selected, there will be a furnace control center for each furnace.

Main Control Center Components
(locations vary by model)

High Voltage Side

1. Lockable Main Disconnect (terminate high voltage supply here)
2. Power Distribution Blocks
3. Fuse Holders
4. Compressor Motor Contactors
5. Condensing Fan Motor Contactors
6. Supply Fan Motor Starter
7. Digital Compressor Controller (optional)
8. Indirect Gas Furnace Transformer (optional)
9. Fuse Blocks
10. Step-Down Transformers (number varies)



Low Voltage Side

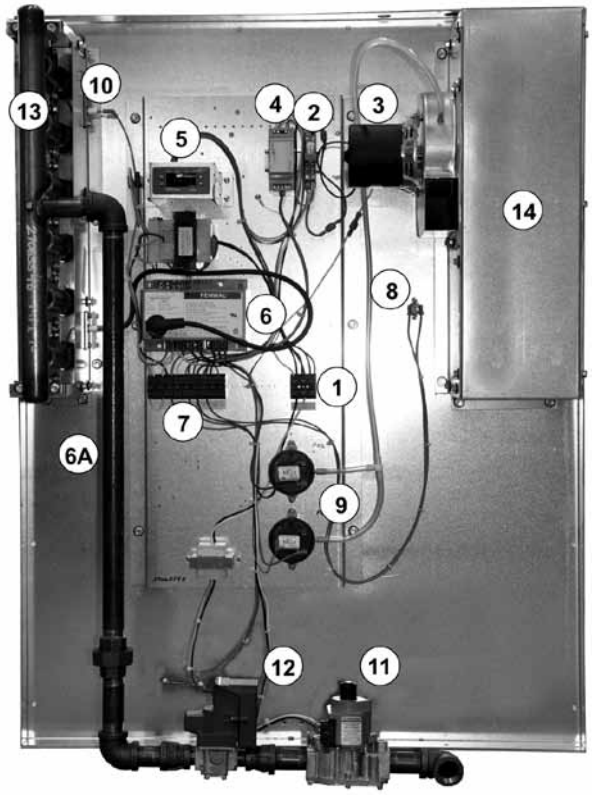
11. DDC Controller
12. Relays
13. Fan Proving Switch/Dirty Filter Switch (on side wall)
14. Low Voltage Terminal Strip
15. Hot Gas Reheat Controller (optional)

NOT SHOWN: Phase Monitor (see page 13)

In all cases, refer to the unit-specific wiring diagram located on the control center door.

Furnace Control Center Components
(component locations will vary)

Components shown are for a typical 4:1 turndown configuration.



High Voltage Side

1. Power Distribution Block
2. Inducer Relay (controls combustion fan)
3. Combustion Blower

Low Voltage Side

4. Input Converter
5. FX05 Controller (modulates heat and switches entire unit on/off
6. Spark Generator (also has high voltage present)

6A. Spark Igniter

7. 24 volt Terminal Strip

Control Sensors

8. Hi Temp Sensor (auto reset)
9. Air Flow Switches
10. Flame Sensor

Gas Train

11. Combination Valve
12. EXA Valve
13. Burner Manifold
14. Collector Box

Control Center Components

DDC Control Package

Typical DDC Controller

Each unit is equipped with a microprocessor controller commonly called a DDC, located in the main control center. Depending on settings put in by the user and the optional sensors ordered with the unit, the DDC will control the operation of the unit and respond to changing ambient conditions. The DDC will sense outdoor air temperature and room temperature (optional) and then regulate both heating and cooling. It will switch from heating mode to cooling mode, as needed. If an optional dehumidistat is ordered, the DDC will also sense humidity levels in the space and will adjust operation of the reheat coil during cooling mode operation. All needed settings for the unit are entered directly into the controller by means of push buttons and both settings and operating conditions can be easily viewed on the large LCD screen. An optional remote interface panel is also available to allow set points and other controller settings to be adjusted from a remote location (see also Optional Field-Installed Control Sensor. Microprocessor (DDC Remote Interface. For further information on the DDC controller, refer to the control catalog and the Installation, Operation and Maintenance manual provided with the controller.

Digital Scroll Compressor Controller

If the optional digital scroll compressor was ordered, the main control center is also equipped with a dedicated controller that monitors and controls the operation of the digital scroll compressor. The controller has LED indicator lights to verify correct operation and also various alarm conditions.

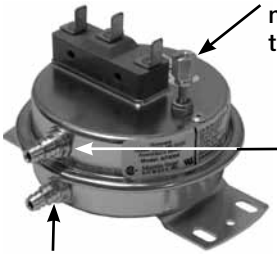
Typical Digital Scroll Compressor Controller (optional)

Fan Proving Switch

The unit uses a pressure switch to prove fan operation before operating any heating or cooling sequence. It does this by verifying a difference in air pressure on both sides of the air supply fan. While the operation of the switch is verified at the factory, the pressure switch should be adjusted to meet field conditions.

To adjust the switch, the supply fan must be running with all of the access doors closed in order to maintain normal operating pressures within the unit. The control center door may be left open to access the proving switch (see Proving Switch Location, Electrical Information / Control Center Components).

The adjusting screw is located on the top of the switch. Turning the screw clockwise will increase the amount of pressure difference required to pull the switch in, and turning it counterclockwise will decrease the pressure difference required. Adjustment to the switch is made while viewing the Supply Fan Status screen on the DDC. Consult the DDC unit control manual on how to view the Fan Proving screen. While viewing the Fan Input Proving screen, adjust the pressure switch so that the fan status changes from “Open” to “Closed” or from “Closed” to “Open”. Slightly decrease the set point by turning the adjustment screw counterclockwise three rotations to allow for pressure fluctuations and air density changes. The supply fan alarm may require resetting before the unit can operate normally.



Setscrew (on front of switch) must be manually adjusted after the system is in operation.

Negative pressure connection is toward the ‘front or top’ of the switch. *Senses pressure on the blower side of filters.*

Positive pressure connection is toward the ‘back or bottom’ of the switch. *Senses pressure at air inlet side of filters.*

Note that similar pressure switches may be found as part of optional devices such as a dirty filter sensor.

Variable Frequency Drive (VFD)

An optional VFD may be installed at the factory for purposes of controlling the speed of the blower motors. Its purpose is to constantly regulate the speed of the blower motor, in response to various optional sensors. When the VFD receives a predetermined signal, it will adjust the frequency (hertz) of the AC power supply to any connected motor, thus changing the speed of rotation.

Typical Variable Frequency Drive (VFD)
Refer to unit-specific documentation.

The VFD is preset at the factory to respond to conditions specified by the owner. In some cases, the VFD will be controlled by owner-installed sensors and controlling devices such as CO2 sensors, dehumidistats or pressure sensors.

Refer to the VFD manufacturer's information and unit-specific wiring diagram supplied with the unit. For additional downloadable documentation regarding the VFD installed in this unit, visit the manufacturer's website.

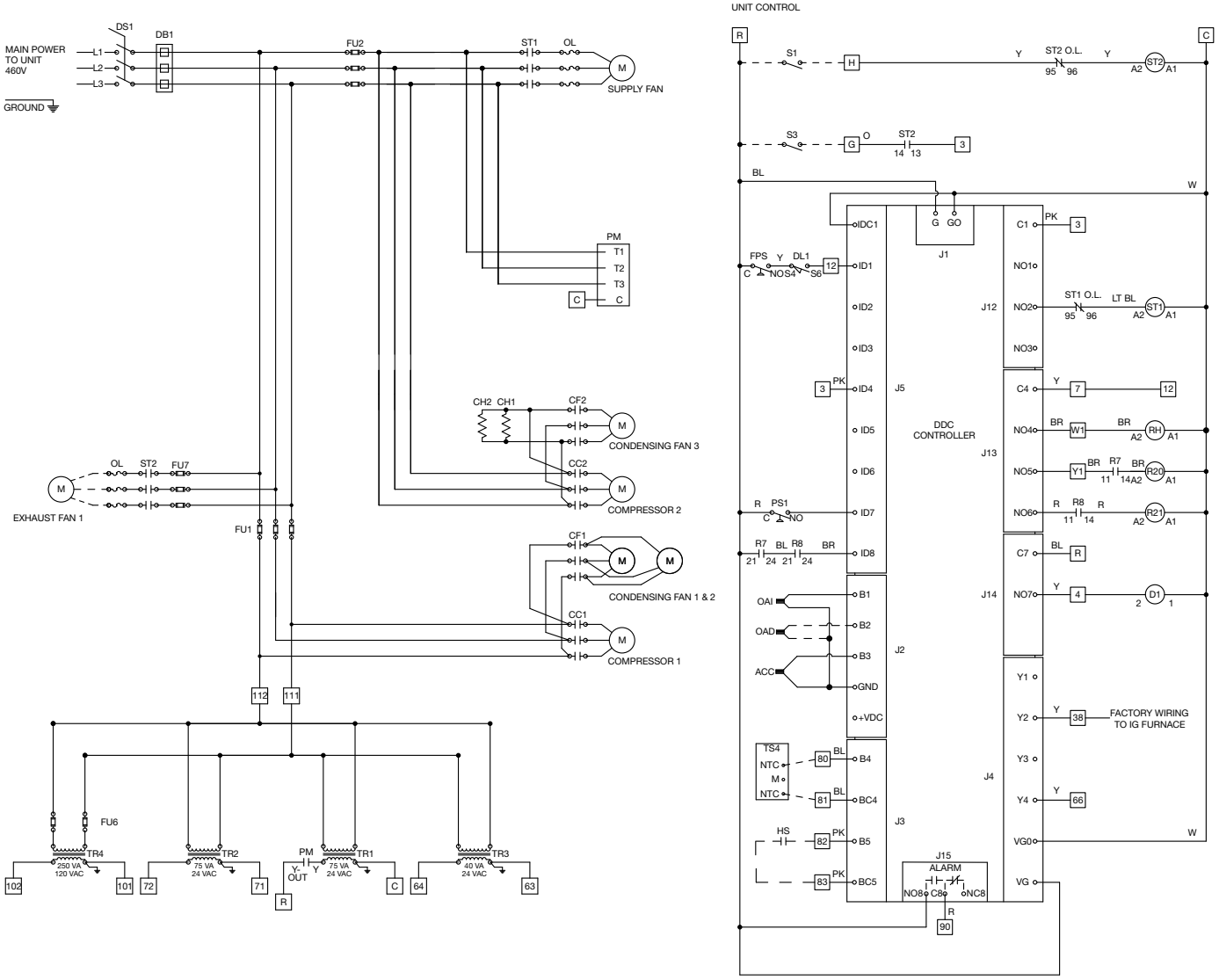
Phase Monitor

A phase monitor constantly checks for loss of a phase, phase unbalance or phase reversal. It requires 24 VAC to operate. When a fault is detected, it cuts off the power supply to the low voltage terminal strip, disabling all motors. It has two LED indicator lights, showing "on" and "fault".

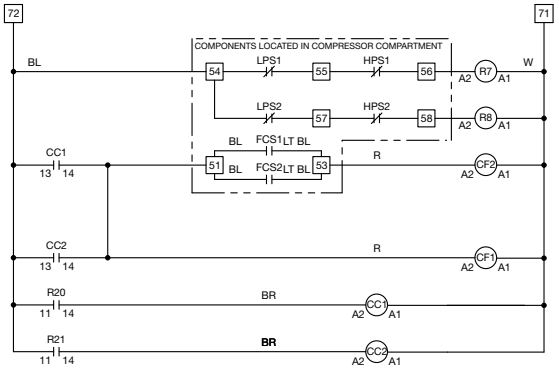
Phase Monitor

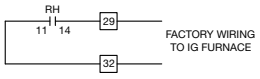
Typical Wiring Diagram

This is a typical wiring diagram for this unit. A model-specific wiring diagram is attached to the inside of the control center door of each unit. The wiring diagram includes a legend highlighting which accessories or options are provided by the factory. Factory wiring and required field wiring are also indicated.

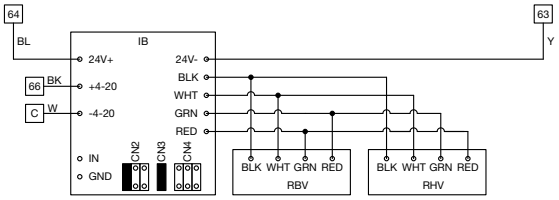


COMPRESSOR/CONDENSER FAN CONTROL

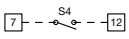




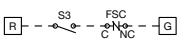
HOT GAS REHEAT CONTROLLER



Tempering Switch on Remote Panels
For remote panels with tempering switches, the jumper between terminals 7 and 12 should be removed for proper switch operation.



Typical Fire System Wiring
If unit is to be wired to a fire system, the normally closed contacts shall be placed in series with terminals R & G and the supply fan switch S3 to shut down the supply fan.



GREENHECK
Building Value in Air.

Wiring Diagram Code:

GI1CA61B2A02D31AP01

CAUTION

UNIT SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C.
POWER MUST BE OFF WHILE SERVICING.

NOTES

USE COPPER CONDUTORS ONLY
60° C FOR TERMINALS RATED LESS THAN 100 AMPS.
75° C FOR TERMINALS RATED 100 AMPS OR MORE.

FIELD CONTROL WIRING RESISTANCE SHOULD NOT EXCEED 0.75 OHM.

FIELD WIRED – – – – –
FACTORY SUPPLIED AND WIRED ————————

WIRE COLOR CODE

BK	BLACK	BL	BLUE	BR	BROWN
GY	GRAY	LT BL	LIGHT BLUE	O	ORANGE
PK	PINK	PR	PURPLE	R	RED
W	WHITE	Y	YELLOW		

LEGEND

ACC	COLD COIL TEMP SENSOR
CC#	COMPRESSOR CONTACTOR
CF#	CONDENSING FAN CONTACTOR
CH#	CRANKCASE HEATER
D1	INLET DAMPER
DB1	DISTRIBUTION BLOCK
DL1	INLET DAMPER LIMIT SWITCH
DS1	DISCONNECT SWITCH - UNIT
FCS#	FAN CYCLING SWITCH
FPS	FAN PROVING SWITCH
FU#	FUSE
HPS#	HIGH PRESSURE SWITCH
HS	DEHUMIDISTAT
IB#	INTERFACE BOARD
LPS#	LOW PRESSURE SWITCH
M	MOTOR
OAD	SUPPLY DISCHARGE TEMP SENSOR
OAI	INLET AIR TEMP SENSOR
OL	OVERLOAD
PM	PHASE MONITOR
PS1	DIRTY FILTER SWITCH
R7	COMPRESSOR INTERLOCK RELAY CIRCUIT A
R8	COMPRESSOR INTERLOCK RELAY CIRCUIT B
R20	COMPRESSOR RELAY CIRCUIT A
R21	COMPRESSOR RELAY CIRCUIT B
RBV	REHEAT VALVE - CONDENSER
RH	HEAT RELAY
RHV	REHEAT VALVE - HOT GAS REHEAT
S1	EXHAUST SWITCH
S3	SUPPLY SWITCH
S4	TEMPERING SWITCH
ST1	SUPPLY FAN CONTACTOR
ST#	EXHAUST FAN CONTACTOR
TR#	TRANSFORMER
TS4	ZONE TEMPERATURE SENSOR

DDC Code: TAP - Version 1.04

GMY2S000B00

Wiring Template: P00

Direct Digital Control (DDC) Sequence of Operation

Microprocessor Controller

This unit is equipped with a DDC controller that is factory programmed, mounted and tested. The controller has an LCD screen for easy monitoring of unit operation and has a set of push buttons for changing set points. Factory-installed sensors are already mounted and wired, but there are several optional sensors and control devices that must be field-installed. Refer to the unit-specific wiring diagram and the manual supplied with the DDC controller.

Typical DDC Controller

Unit Start Command:

- Factory mounted and wired Outdoor Air actuator is powered
- Supply fan starts
- Heating and cooling operation

Unit Stop Command (or De-energized):

- Supply fan and tempering options are de-energized.
- Outdoor Air damper actuators are de-energized and damper will close.

Remote On / Off

Unit DDC may have an input allowing the unit to be started or stopped by others.

Occupied / Unoccupied Modes:

These modes are based on a 7-day time clock that is internal to the DDC. The schedule must be set by the end user. When the user initiates an override input, the DDC would switch from unoccupied to occupied mode. The DDC will return to the scheduled occupied / unoccupied mode after the override time has expired (60 minutes, adjustable). If the internal time clock is disabled, a remote contact or a BMS can control the occupied / unoccupied mode.

- **Occupied Mode**
  1. Supply Fan ON
  2. Heating
  3. Cooling
- **Unoccupied Mode (Unit Off)**
  Default setting when there is no room temperature sensor.

Cooling Sequence

The DDC controller will power the compressed refrigerant system to maintain the supply temperature set point. The mechanical cooling will be locked out when the outside air is less than 55° - 2°F hysteresis, adjustable.

Dehumidification Sequence

The cooling is controlled to maintain the cooling-coil set point. The dehumidification sequence will be locked out when the OA is less than 10°F above the cold-coil set point. The mechanical cooling will be locked out when the outside air is less than 55° - 2°F hysteresis, adjustable.

Reheat Sequence

While the unit is in dehumidification mode, the outdoor air can be reheated for space neutral applications.

Heating Sequence

The heating is controlled to maintain the supply temperature set point. The heating will be locked out when the outside air is greater than 70° + 2°F hysteresis, adjustable.

This unit may be optionally equipped with either an indirect gas-fired furnace or an SCR controlled electric heater.

- **Indirect Gas-Fired Furnace**
  The DDC will energize and modulate the heating capacity of the furnace to maintain the Supply Air temperature set point.
- **Electric Heater**
  The DDC will energize and modulate the heating capacity of the electric heater to maintain the Supply Air temperature set point.

Supply Set Point Reset Function

Either a room temperature sensor or the outdoor air reset function (if there is no room temperature sensor wired to the DDC) will determine the supply temperature of the unit.

- **Outdoor Air Reset Function**
  Without a room temperature sensor available, the DDC will default to discharge temperature control, based on outdoor air temperature. The DDC will monitor the OA temperature and reset the supply temperature set point based upon the outdoor air reset function.
- **Optional Room Temperature Sensor**
  With a room temperature sensor, the DDC will adjust the supply temperature set point up / down accordingly to satisfy the desired room temperature. Cooling and heating are determined by a difference in temperature of the room temperature sensor compared to the desired room temperature set point (adjustable).

Building Freeze Protection

If the supply air temperature drops below 35°F (adjustable), the DDC will de-energize the unit and activate the alarm output after a preset time delay.

Alarms Indication

The DDC has a single digital output for remote indication of an alarm condition. Possible alarms include:

- **Dirty Filter Alarm**
  If the outside air or return air filter differential pressure rises above the switch set point (adjustable), the differential pressure switch signals the DDC to activate the alarm.
- **Supply Air Alarm**
  The DDC monitors the proving switch on the supply air blower and displays an alarm in case of blower failure.
- **DX Alarm**
  The DDC monitors the refrigerant pressure and shuts off the refrigeration circuit in the case of high or low refrigerant pressure.
- **Temperature Sensor Alarm**
  The DDC will send an alarm in the case of a failed air temperature sensor.

BMS Interfacing

A BMS serial card is provided with the DDC controller for field interfacing with a Building Management System (BMS). Each card is sent out with the default parameters and the controls contractor must change the appropriate addresses to match the BMS settings. See also the detailed instructions provided by the DDC manufacturer.

Optional Controller Accessories

This unit can be ordered with a number of optional accessories to expand the functionality or usability of the DDC controller. When these options are ordered from the factory, the DDC controller is pre-configured to incorporate the accessory. All factory-supplied accessories are shown on the unit-specific wiring diagram included with the unit.

Optional Field-Installed Control Sensors

The following sensors and control devices are all options that may be ordered. They are shipped loose with the unit and are to be field-installed in a location selected by the A/E or the owner. Each device is to be installed in accordance with the manufacturer's instructions that are shipped with the unit. In all cases, retain the additional instructions for future use by the owner.

Dehumidistat

The optional dehumidistat is a passive device, requiring no supply voltage. It works in a Make/Break manner. It can be installed in either a vertical or a horizontal position and the two wires found on the back of the sensor are to be connected to terminals B5 and BC5 on the DDC controller. Also see the unit-specific wiring diagram.

Typical Dehumidistat

Fire Stat Type III

The optional Fire Stat as provided by the factory is to be connected as shown on the unit-specific wiring diagram. See also the Fire Stat installation instructions provided by the manufacturer and included with the unit shipment.

Typical Fire Stat Type III

Industrial Remote Panel

The industrial remote panel has a number of options that must be selected by the owner. The panel may function as an indicator of current operating conditions or it may also be used as a master switch to enable or disable specific functions of the unit. A unit-specific wiring diagram is included with each panel. If specified by the owner, the remote panel may have a Remote Interface factory-installed inside to allow remote adjustment or new settings on the DDC controller.

Typical Industrial Remote Panel

Microprocessor (DDC) Remote Interface

The optional remote interface panel permits viewing of settings that are present on the DDC controller and also permits inputting of new settings. It is to be field-installed and is connected to terminal J10 of the DDC controller. Follow the unit manufacturer's instructions regarding the type of wiring cable and connectors to be used. See also the unit-specific wiring diagram and the unit Installation and Operating Instructions provided by the manufacturer and included with the unit. If specified, the remote panel may be factory-installed inside the optional Industrial Remote Panel.

Typical DDC Remote Interface

Room Temperature Sensor

The optional room temperature sensor is a simple thermistor-type sensor that provides an analog signal to the DDC controller. It is to be wired directly to terminals B4 and BC4 of the DDC controller.

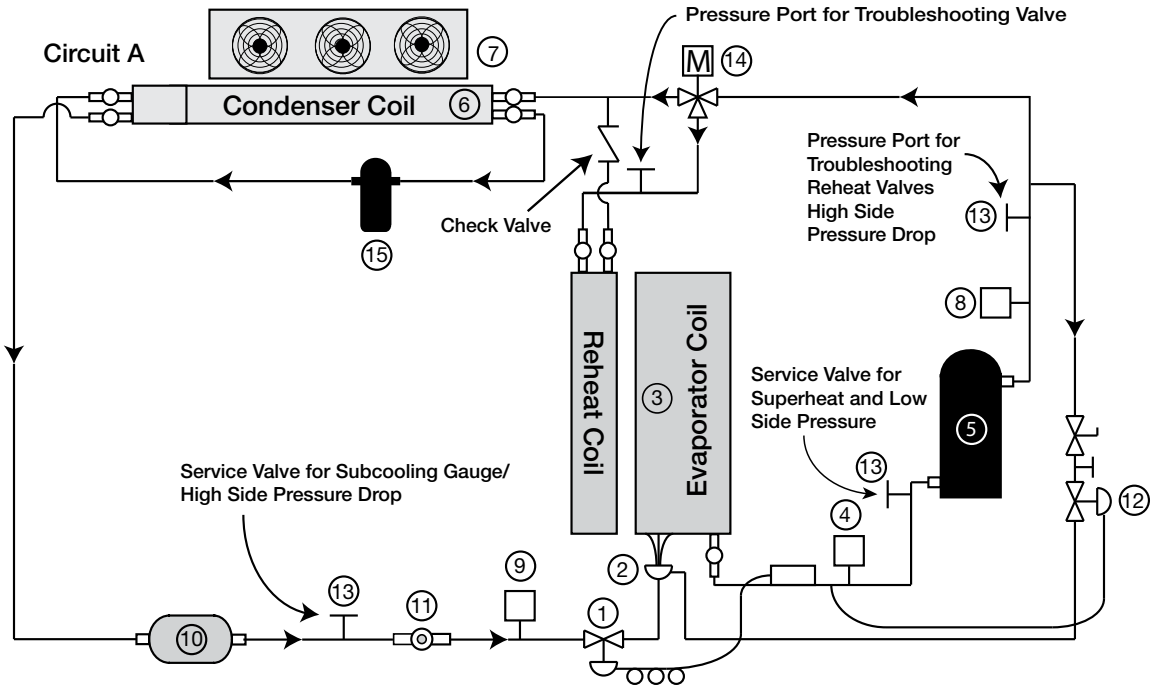
Typical Room Temperature Sensor

Smoke Detector

The optional smoke detector is to be field-installed in a location selected by the A/E or the owner, typically in the supply air duct. The detector requires periodic inspection and should be installed in accordance with the IOM supplied by the unit manufacturer. It is powered by 24 VAC from the MPX unit control center and is to be wired in accordance with the unit-specific wiring diagram, See the unit-specific wiring diagram provided with the unit.

Typical Smoke Detector with Sampling Tubes

Factory Installed Refrigeration System Components



1. Thermostatic Expansion Valve (TXV)

Each unit is equipped with a Thermal Expansion Valve on each refrigerant circuit. The valve controls the flow of liquid refrigerant entering the evaporator coil by maintaining a constant, factory set superheat of 10°F. The valve is adjustable and is located on the side of the evaporator coil and can be accessed through the coil panel access door.

2. Refrigerant Distributor

Attached to the TXV is a refrigerant distributor. The refrigerant distributor evenly distributes the refrigerant to each circuit of the evaporator coil to provide optimum performance.

3. Evaporator Coil

The coil is located in the supply airstream. In the DX system, the liquid refrigerant is expanded in the TXV and it then flows through the evaporator coil. The refrigerant enters the coil as a low temperature liquid/gas where it eventually boils into a low temperature, low pressure gas prior to going into the compressor. As the refrigerant passes through the evaporator coil, it absorbs heat from the airstream. To ensure proper operation, the coil surface must be cleaned so that air movement over the coil provides the necessary heat transfer.

4. Low Limit Pressure Switch

The unit includes a low limit pressure switch (located in the compressor compartment). The switch is installed in the suction line and shuts off the DX system when the suction pressure drops to 50 psi for R-410A. The switch has a built in auto-reset, which will close the circuit and allow the system to run when the pressure increases back to 90 psi for R-410A.

5. Compressors

Each unit will have either one or two high efficiency scroll-type compressors. The scroll in each compressor compresses the refrigerant in a gaseous state to a high temperature, high pressure gas.

Compressor Protective Devices:

Thermal Overload: Each compressor is equipped with an auto reset thermal overload.

High Temp Protection: Internal devices within the compressor protect it against excessively high discharge gas temperatures.

Crankcase Heater: Liquid refrigerant is incompressible. Therefore, a crankcase heater is installed around each compressor to boil off any liquid refrigerant that may be absorbed into the oil during idle periods. System power energizes the heater; the heater should be allowed to run 24 hours prior to compressor start-up. See Start-Up Checklist, page 23.

6. Condensing Coil

Each unit contains a condensing coil mounted on the exterior of the unit. High temperature, high pressure gas from the compressor enters the coil and is eventually cooled into a high temperature, high pressure liquid. The condensing fans move air over the coil which pulls the heat out of the refrigerant. To ensure proper operation, the coil must be cleaned so that air movement over the coil provides the necessary heat transfer.

Factory Installed Components
(continued)

7. Condenser Fans

The unit is equipped with multiple direct-drive condensing fans. The fans provide the necessary airflow to cool the refrigerant in the condensing coil. Depending on head pressure, some fans may not be running, which is normal operation for this unit and does not indicate a problem. The motors are equipped with sling protection to guard against water penetration, and are thermally protected. The thermal overloads shut down the condensing fans and will automatically reset.

8. High Limit Pressure Switch

To safely shut down the DX system in case of an increase in refrigerant pressure, a high limit pressure switch is included. The switch is located in the compressor compartment. It trips when refrigerant pressure increases to 575 psi for R-410A in the liquid line and can only be manually reset when the pressure drops below 420 psi. Typically, if the high pressure limit switch trips, a failure in the system has occurred and more investigation is needed to determine the underlying problem.

9. Head Pressure Cycle Switch

To maintain proper refrigerant pressures, a Fan-Cycle switch that operates on head pressure is installed in the liquid line. When liquid line refrigerant pressure increases to 400 psi for R-410A, the switch closes and turns on an additional condensing fan to aid in cooling the refrigerant. After turning on, the fan will run until liquid line pressure drops down to 300 psi for R-410A and then it cycles off.

10. Liquid Line Filter Drier

The liquid line filter drier prevents moisture and foreign matter from entering the expansion valve.

11. Moisture Indicating Sight Glass

Moisture in a DX system can freeze in the system or dilute the compressor oil. A moisture indicating sight glass is provided for each refrigerant circuit. During normal operating conditions, the sight glass should typically be liquid. Some gas is acceptable, but excessive bubbles may indicate improper charge or a leak in the system. A green dot means that moisture is below a safe operation level in the refrigerant, while a yellow dot indicates moisture has been introduced into the system and needs to be dealt with.

For an Emerson brand sight glass, the color purple indicates dry and the color pink indicates wet.

11. Hot Gas Bypass Valve (optional)

On units equipped with hot gas bypass, hot gas from the compressor is injected into the liquid line of the evaporator coil after the TXV. This process starts to occur when suction gas temperatures drop below 28°F, which is 32°-34°F coil surface temperature. Hot gas helps the evaporator coil from freezing up and the compressor from cycling. The valve is factory set, but can be adjusted to exact specifications once installed in the field.

Valve Adjustment - To adjust the valve, connect a pressure gauge to the suction line and block the entering air to the evaporator coil. The valve should begin to open when the suction pressure drops to approximately 115 PSIG for R-410A (the valve will feel warm to the touch). Adjustments are made by first removing the cap on the valve and then turning the adjusting stem clockwise to increase the setting pressure. Allow several minutes between adjustments for the system to stabilize. When adjustment is complete, replace the cap on the valve.

13. Access Ports

For easy measurement and charging access, several ports are provided through the system. These can be used to measure system pressure and also charge or evacuate the system. Most ports are located in the compressor compartment for easy access.

14. Reheat Valve (optional)

Units equipped with a reheat coil use a three-way valve with actuator to control the supply air discharge temperature of the unit during dehumidfication mode. The unit controller provides a 0 - 10 VDC signal to control the amount of reheat to meet the supply temperature set point or easy measurement and charging access.

15. Liquid Receiver (optional)

Acts as a reservoir for liquid refrigerant.

Digital Scroll Compressor

If the digital scroll compressor option was selected for this unit, it is equipped with a Copeland Scroll Digital™ compressor.

Refrigeration Modulation

Digital scroll compressors modulate the refrigeration system, producing significant performance benefits. The compressor output can be modulated from 10% to 100% of capacity by means of "loading" or "unloading" the refrigerant compression scroll.

A conventional fixed scroll compressor runs at full load and then shuts down when user set points are reached. The digital scroll compressor modulates its cooling capacity by means of cycling through rapid load/no-load cycles without shutting down the compressor motor (digital control). Because it can operate at less than full load, evaporator coil temperatures are much more constant as hysteresis is improved and humidity control is enhanced.

Compressor Cycling

The use of a Copeland Scroll Digital™ compressor in the refrigeration circuit provides energy savings during normal operation of the unit and also improves the life expectancy of the system by avoiding on/off cycling. One of the primary causes of early failure of a refrigeration system is excessive cycling on and off. The digital scroll compressor eliminates excessive cycling by allowing the compressor to continue to run, but internal compression is eliminated in brief cycles. Depending on the control signal received from the digital scroll controller, each 15 second interval is assigned a varying load/no load run time.

Configuration

In units with more than one compressor, only the lead compressor will be digital scroll type. Digital scroll compressors can be identified by the label on the compressor.

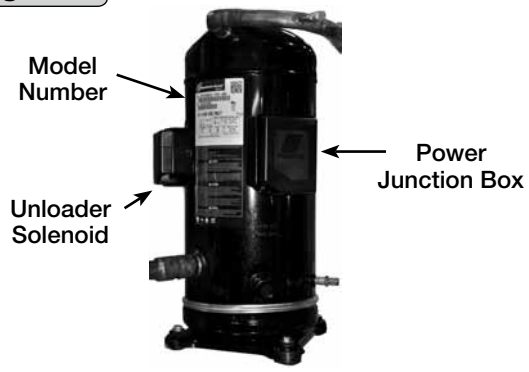
If the third character of the model number is a "D", the compressor is digital scroll type. **(See Figure 1)**.

Figure 1

Typical Compressor Label

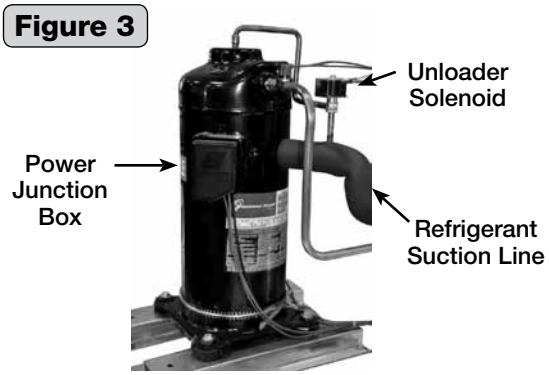
Digital scroll compressors are very similar in appearance to conventional scroll compressors, but they will also have an unloader solenoid mounted either on the side of the compressor **(see Figure 2)** or on a tube connected to the refrigerant suction line **(see Figure 3)**. When the unloader solenoid is energized, the compressor will go into an unloaded state.

Figure 2



Typical Copeland Scroll Digital™ Compressor with Surface Mounted Unloader Solenoid

Figure 3



Typical Digital Scroll Compressor with External Unloader Solenoid

Digital Scroll Compressors *(continued)*

Electronic Control

A Copeland Scroll Digital™ compressor also requires the use of a digital scroll compressor controller (see Figure 4). This controller may be found in either the compressor compartment of the unit or in the main control center. The digital controller works in conjunction with a DDC controller or possibly with a BMS and it requires an analog input. The controller is already programmed and wired and does not require any further servicing by the owner. Detailed information on the electronic control circuitry will be found on the unit-specific wiring diagram found in the control center. The digital scroll controller constantly monitors and controls the operation of the digital scroll compressor. LED indicator lights verify the presence of power, operation of the unloader solenoid and also indicate various alarm conditions.

Figure 4

Copeland Scroll Digital™ Compressor Controller

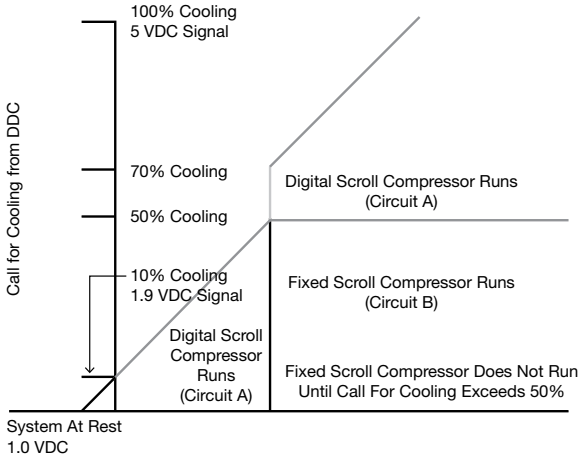
See the Fault Code chart below. The Fault Code chart is also printed on the back of the controller. Note that if the controller generates either a Code 2 or a Code 4 Lockout, a manual reset must be performed. Manual Reset is accomplished by shutting off main power to the unit and then turning it back on.

Copeland Scroll Digital™ Compressor Controller Fault Codes			
Alert Code	System Condition	Diagnostic Alert Light	Action
Code 2*	High Discharge Temperature Trip	Blinks 2 Times	Lockout
Code 3	Compressor Protector Trip	Blinks 3 Times	Lockout
Code 4*	Locked Rotor	Blinks 4 Times	Lockout
Code 5	Demand Signal Loss	Blinks 5 Times	Lockout
Code 6	Discharge Thermistor Fault	Blinks 6 Times	Reduce Capacity
Code 7	Future	N/A	N/A
Code 8	Welded Contactor	Blinks 8 Times	Unload Compressor
Code 9	Low Voltage	Blinks 9 Times	Trip Compressor

*Protective faults that require manual reset.

Two Compressor Operation Concept

Whenever two compressors are used in a unit, the digital scroll compressor is part of refrigerant circuit "A". A conventional fixed scroll compressor is used for circuit "B". When the unit is at rest and there is no call for cooling, a constant 1.0 volt signal is sent to the digital scroll controller from the DDC to keep it from going into lockup mode. The minimum input signal that will cause the compressor to run is 1.9 volts and the maximum is 5 volts (100% cooling). Whenever there is a call for cooling, circuit A will be activated first. Circuit A will provide all necessary cooling until the call for cooling exceeds 50%. When the call for cooling reaches 50%, the digital scroll will shut down and the fixed scroll compressor will begin running. Once the call for cooling exceeds 70%, then the digital scroll will begin running again, in conjunction with the fixed scroll compressor (see below).



Multiple Compressor Operation

System Start-Up

During unit start-up, amperage draw readings are to be taken on all three electric supply phases when the unit is running. Because the digital scroll can run without compressing the refrigerant, this can lead to false amperage-draw readings during start-up of the unit. Make certain that the amperage readings are taken when the compressor is actually running under load. Refer to the Refrigeration Start-Up portion of the unit Installation, Operation and Maintenance manual (IOM). All other temperature and pressure readings should be taken as shown in the IOM, taking care that refrigerant temperature and pressure readings on the digital scroll compressor are taken while the compressor is loaded.

Troubleshooting

If it is necessary to troubleshoot the refrigeration system, the first step is always to check the alarm indicators on both the DDC and the digital scroll compressor controller. Remember that the digital scroll compressor may be running in a "no-load" state.

Pre Start-Up Checklist – complete prior to application of power

- ☐ Verify proper drain trap installation (refer to Condensate Drain section).
- ☐ Look over the piping system. Inspect for oil at all tubing connections. Oil typically highlights a leak in the system. If a leak is present, refer to the Maintenance section in this manual.
- ☐ Inspect all coils within the unit. Fins may get damaged in transit or during construction. Carefully straighten fins with a fin comb.
- ☐ If there is an indirect gas-fired furnace in this unit, refer to the PVF IOM provided with this unit for Pre Start-Up information.
- ☐ Check the radial gap and overlap on the plenum-type fan(s). Adjust if necessary.
- ☐ Check condensing fans for any damage or misalignment. Spin the blades and make sure they are free turning without any resistance.
- ☐ If this unit has packaged DX, each compressor will have a crankcase heater which must have power supplied to it at least 24 hours prior to start-up. If start-up is scheduled in 24 hours, unlock the power disconnect and energize the unit.

SPECIAL TOOLS REQUIRED

- Voltage Meter (with wire probes)
- Amperage Meter
- Pressure Gauges – (refrigerant)
- Tachometer
- Thermometer
- Incline manometer or equivalent

Start-Up Checklist

The unit will be in operational mode during start-up. Use necessary precautions to avoid injury. All data must be collected while the unit is running. In order to measure volts and amps, the control center door must be open, and the unit energized using an adjustable wrench to turn the disconnect handle.

After power has been applied for 24 hours, verify that all crankcase heaters are heating properly. Either check the amp draw on each heater or touch the compressor near the top to verify that the heater is warming the compressor.

Crankcase Heater (silver colored band)

WARNING

Do not touch the crankcase heater! It will cause burns. See image.

WARNING

All motor(s) / compressor(s) have been checked for rotation. If blower rotation is incorrect, wiring must be changed at the disconnect to ensure all motor(s) / compressor(s) are corrected.

Operation of scroll compressor(s) in this unit are directional and will be damaged if run in the wrong direction.

Electrical Start-Up Checklist

Crankcase Heaters Working Yes / No

Check line voltage at unit disconnect

_____ L1-L2 volts
_____ L2-L3 volts
_____ L1-L3 volts

Motor Amp Draw

Supply Fan	Relief Fan (if present)
_____ L1 amps	_____ L1 amps
_____ L2 amps	_____ L2 amps
_____ L3 amps	_____ L3 amps

Fan RPM

_____ Supply Fan
_____ Relief Fan (if present)

Correct fan rotation

Supply Fan Yes / No
Relief Fan Yes / No

Start-Up Checklist
(continued)

NOTE

Refrigeration System Start-Up Checklist must be performed by a Qualified Refrigeration Technician.

If a digital scroll compressor is installed in the unit, make certain that all current readings are taken when compressors are running under load. See the **Digital Scroll Compressors** section in this manual for further information.

Outdoor Air Temperature _____ Deg. F.

Wet Bulb Reading or Dew Point or Outdoor Air Relative Humidity (indicate which) _____

Condensing Fans

Each unit having DX is equipped with 2 or 3 condensing fans.

☐ Condensing Fan 1:
_____ L1 amps
_____ L2 amps
_____ L3 amps

☐ Condensing Fan 2:
_____ L1 amps
_____ L2 amps
_____ L3 amps

☐ Condensing Fan 3: *if present*
_____ L1 amps
_____ L2 amps
_____ L3 amps

☐ Condensing Fan 4: *if present*
_____ L1 amps
_____ L2 amps
_____ L3 amps

Compressors

Each DX unit is equipped with either one or two compressors. Each compressor is part of a separate refrigeration circuit.

CIRCUIT A

☐ Compressor:
_____ L1 amps
_____ L2 amps
_____ L3 amps
_____ Crankcase Heater

Superheat _____Deg. F.
Should be between 8º and 12ºF.

Subcooling _____Deg. F.
Should be between 12º and 18ºF.

Discharge Pressure _____ PSIG

Discharge Line Temperature _____Deg. F.

Suction Line Pressure _____ PSIG

Suction Line Temperature _____Deg. F.

Moisture Indicating Sight Glass located on copper tube liquid line

Bubbles Visible Yes / No

If bubbles are visible in sight glass, stop the start-up process. Refrigerant charge may not be adequate. Consult factory.

Color of Center Dot Green / Yellow

Hot Gas Bypass Operational Yes / No

(Not present on digital scroll compressors)

CIRCUIT B - if present

☐ Compressor:
_____ L1 amps
_____ L2 amps
_____ L3 amps
_____ Crankcase Heater

Superheat _____Deg. F.
Should be between 8º and 12ºF.

Subcooling _____Deg. F.
Should be between 12º and 18ºF.

Discharge Pressure _____ PSIG

Discharge Line Temperature _____Deg. F.

Suction Line Pressure _____ PSIG

Suction Line Temperature _____Deg. F.

Moisture Indicating Sight Glass located on copper tube liquid line

Bubbles Visible Yes / No

If bubbles are visible in sight glass, stop the start-up process. Refrigerant charge may not be adequate. Consult factory.

Color of Center Dot Green / Yellow

Hot Gas Bypass Operational Yes / No

(Not present on digital scroll compressors)

Unit Start-Up

Refer to Component section for component locations.

Fan

The fan should be checked for free rotation. If any binding occurs, check for concealed damage and foreign objects in the fan housing.

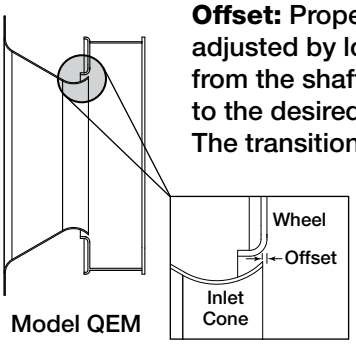
CAUTION

When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult manufacturer to determine if the unit can operate safely at the new conditions.

Supply Fan (Plenum Type)

The unit contains one plenum supply fan located on the end of the unit opposite the outdoor air intake (see beginning of Unit Start-Up section for diagram of unit layout). Be sure to check the belt drives per the start-up recommendations in the following section. Efficient fan performance can be maintained by having the correct offset. These items should be checked before start-up and after the fan has been in operation for 24 hours.

Plenum Supply Fan



Model QEM

Offset: Proper offset, or overlap, is adjusted by loosening the wheel hub from the shaft and moving the wheel to the desired position along the shaft. The transition between the inlet cone and the wheel should be as shown; there is a smooth feel to the profile when moving one component to the other.

QEM Model Size	Wheel Cone to Inlet Cone			
	Offset ± Tolerance (inches)		Offset ± Tolerance (millimeters)	
12	7/16	± 1/16	11	± 1.5
15	7/16	± 1/16	11	± 1.5
16	7/16	± 1/16	11	± 1.5
18	7/16	± 1/16	11	± 1.5
20	7/16	± 1/16	11	± 1.5
22	7/16	± 1/16	11	± 1.5
24	7/16	± 1/16	11	± 1.5

Refer to Plenum and Plug Fan IOM for additional start-up and maintenance information regarding the QEM Plenum Supply Fan.

Fan Performance Modifications

Due to job specification revisions, it may be necessary to adjust or change the sheave or pulley to obtain the desired airflow at the time of installation. Start-up technician must check blower amperage to ensure that the amperage listed on the motor nameplate is not exceeded. Amperage to be tested with access doors closed and ductwork installed.

Fan Belt Drives

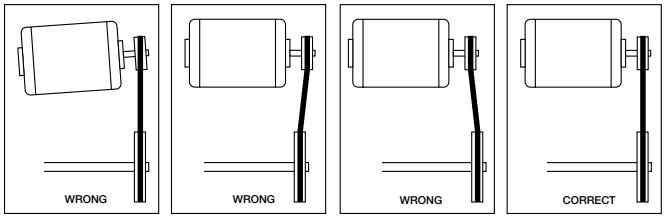
The fan belt drive components, when supplied by manufacturer, have been carefully selected for the unit's specific operating condition. Utilizing different components than those supplied could result in unsafe operating conditions which may cause personal injury or failure of the following components:

- Fan Shaft
- Bearings
- Motor
- Fan Wheel
- Belt

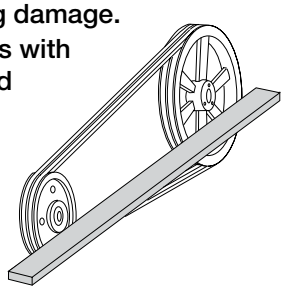
Tighten all fasteners and set screws securely and realign drive pulleys after adjustment. Check pulleys and belts for proper alignment to avoid unnecessary belt wear, noise, vibration and power loss. Motor and drive shafts must be parallel and pulleys in line (see diagrams in this section).

Belt Drive Installation

1. Remove the protective coating from the end of the fan shaft and assure that it is free of nicks and burrs.
2. Check fan and motor shafts for parallel and angular alignment.



3. Slide sheaves on shafts. Do not drive sheaves on as this may result in bearing damage.
4. Align fan and motor sheaves with a straight-edge or string and tighten.
5. Place belts over sheaves. Do not pry or force belts, as this could result in damage to the cords in the belts.



6. With the fan off, adjust the belt tension by moving the motor base. (See belt tensioning procedures in the Routine Maintenance section of this manual). When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.

Fan Wheel Rotation Direction

Blower access is labeled on unit. Check for proper wheel rotation by momentarily energizing the fan. Rotation is determined by viewing the wheel from the drive side and should match the rotation decal affixed to the fan housing.

Centrifugal Airfoil Rotation Direction

If the wheel is rotating the wrong way, direction can be reversed by interchanging any two of the three electrical leads. Check for unusual noise, vibration or overheating of the bearings. Refer to the Troubleshooting portion of this manual if a problem develops.

Fan RPM

The supply fan has been set at the factory for optimum speed to meet specified air volume. The fan is belt-driven and the basic configuration includes fixed pulleys. To adjust fan RPM, it is necessary to replaced the fixed pulleys with other fixed pulleys or with adjustable multi-groove pulleys.

Some units are supplied with an optional variable frequency drive (VFD) to control the fan motor speed. To change motor RPM, consult the VFD manual supplied with the unit.

Any increase in fan speed represents a substantial increase in load on the motor. Always check the motor nameplate when changing the fan RPM and verify that the amp draw resulting from the change does not exceed the motor rating. All access doors, except the control center door, must be installed during testing.

Do not operate units with access doors open or without proper ductwork in place as the fan motors will overload.

Vibration

Excessive vibration may be experienced during initial start-up. Left unchecked, excessive vibration can cause a multitude of problems, including structural and / or component failure.

The most common sources of vibration are listed.

Vibration Causes
Wheel Unbalance
Drive Pulley Misalignment
Incorrect Belt Tension
Bearing Misalignment
Mechanical Looseness
Faulty Belts
Drive Component Unbalance
Poor Inlet / Outlet Conditions
Foundation Stiffness

Many of these conditions can be discovered by careful observation. Refer to the Troubleshooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified technician using vibration analysis equipment should be consulted. If the problem is wheel unbalance, in-place balancing can be done.

Generally, fan vibration and noise is transmitted to other parts of the building by the ductwork. To eliminate this undesirable effect, the use of heavy canvas connectors is recommended.

Spring Vibration Isolators

Verify that any optional spring vibration isolators have been removed. See Installation portion of this manual.

Coils

Leak test the thermal system to ensure tight connections.

Condensate Drain

Check the condensate drain to ensure proper installation and that it is filled with water before start-up. See Installation portion of this manual.

Troubleshooting – Airflow

Test and Balance Report

The Test and Balance Report (TAB) is used to determine whether the appropriate amount of outdoor air and exhaust air is being supplied and removed from a building, respectively. There are no set rules on what information must be included in a TAB report. As such, if a TAB report indicates that the airflow on a unit is low, prior to contacting the factory, please determine the following information:

	Unit #1	Unit #2	Unit #3	Unit #4
Model Number				
Serial Number				
Nameplate Information				
Voltage				
Hertz				
Phase				
Outdoor Air Fan Amps				
Outdoor Air Fan Horsepower				
Design Airflow				
Outdoor Air				
Measured Airflow				
Outdoor Air				
Measured Data				
Blower Rotation				
Outdoor Air Fan RPM				
Outdoor Air Fan Amp Draw				

Airflow problems can often be tied back to improper ductwork installation. Be sure to install ductwork in accordance with SMACNA and AMCA guidelines.

Troubleshooting - Alarms

The first step in troubleshooting the unit is to check the on-board alarm indicators. Several of the electronic controls in the unit monitor the system for faults and will go into alarm, shutting down the unit or a single function within the unit. All these devices are discussed further in the Control Center Components portion of this IOM.

DDC Controller

Check the screen on the DDC for an alarm condition. If the DDC is in an alarm condition, a message will show on the DDC screen. The DDC is located in the main control center. If the DDC is in alarm condition, the Alarm button will blink red.

Press the Alarm button to see the specific condition or to reset the DDC. Refer to the DDC IOM for detailed information on fault codes and see the unit-specific wiring diagram.

Phase Monitor

The phase monitor has two LED indicator lights, one red and one green. Green indicates proper operational status, red indicates the unit has detected a fault and is in alarm condition. The phase monitor is self-resetting once the alarm condition is corrected. It is located in the main control center.

Variable Frequency Drive (VFD)

Variable Frequency Drives may be installed at the factory for purposes of controlling the speed of the blower motors. A VFD will adjust the frequency (hertz) of the AC power supply to any connected motor, thus changing the speed of rotation. VFDs are pre-set at the factory for optimum motor speed and they should not normally be adjusted by the user. In a Constant Air Volume (CAV) system, the pre-set motor speed remains unchanged during operation. In a Variable Air Volume (VAV) system, the DDC controller will constantly change the settings on the VFD to regulate fan speed in response to various optional sensors such as dehumidistats, pressure sensors or CO2 sensors. These may be factory-installed or they may be provided and installed by the owner as part of a BMS. See also the DDC Sequence of Operations in this manual.

Typical Variable Frequency Drive
(refer to unit-specific documenation)

The VFD is preset at the factory to respond to conditions specified by the owner. There is a status screen on each VFD that indicates current settings and also any alarm conditions. Some alarm conditions (such as a voltage spike) may disable the VFD, shutting off power to the connected motor. If a disabling alarm condition should occur, a hard reset must be performed by the user. That is done by disconnecting power to the entire unit for at least one minute and then going through a start-up procedure. In all cases, refer the VFD manufacturer's information supplied with the unit and also see the unit-specific wiring diagram supplied with the unit.

A copy of the manufacturer's manual can be found online.

The following components may not be present on all units. They are specific to indirect gas-fired furnaces or to units with packaged DX cooling.

Digital Scroll Compressor Controller — *present only if packaged DX with digital scroll option is present*

The controller has three LED indicator lights. One is green, indicating that it has power and there are two more that will flash a code for various alarm conditions. See the manufacturer's unit-specific manual for further information.

FX05 Furnace Controller — *present only if an indirect gas-fired furnace option is present*

The FX05 furnace controller will display an alarm condition if present. The controller will be found in the furnace control center. See the controller manufacturer's unit-specific manual for further information.

Troubleshooting - Unit

Symptom	Possible Cause	Corrective Action
Blower fails to operate	Blown fuse or open circuit breaker.	Replace fuse or reset circuit breaker and check amps.
	Defective motor or capacitor.	Replace.
	Motor starter overloaded.	Reset starter and check amps.
	Electrical	Check for On/Off switches. Check for correct supply voltage. Check Control wiring.
	Drive	Check for broken or loose belts. Tighten loose pulleys.
Motor starters “chatter” or do not pull in	Control power (24 VAC) wiring run is too long. (Resistance should not exceed 0.75 ohms).	Shorten wiring run to mechanical room or install a relay to turn unit on/off. Consult factory for relay information. Increase wire gauge size so that resistance is 0.75 ohms or less.
	Incoming supply power is less than anticipated. Voltage supplied to starter coil must be within +10% / -15% of nominal voltage stated on the coil.	Need to increase supply power or use a special control transformer which is sized for the actual supply power.
Motor over amps	CFM too high.	Check rpm and adjust drives if needed.
	Static pressures are higher than design.	Check for dirty filters. Improve ductwork.
	Motor voltage incorrect.	Check motor wiring. Check motor nameplate versus supplied voltage.
	Motor horsepower too low.	See specifications and catalog for fan curves to determine if horsepower is sufficient.
	Shorted windings in motor.	Replace motor.
Low airflow (cfm)	Unit damper not fully open.	Adjust damper linkage or replace damper motor.
	System static pressure too high.	Improve ductwork to eliminate losses using good duct practices.
	Blower speed too low.	Check for correct drives and RPM with catalog data.
	Fan wheels are operating backwards.	For 3-phase, see Direction of Fan Wheel Rotation in Unit Start-Up section.
	Dirty filter.	Replace filters or follow cleaning procedures in Routine Maintenance section of this manual.
	Leaks in ductwork.	Repair.
	Elbows or other obstructions may be obstructing fan outlet.	Correct or improve ductwork.
	Belt slippage.	Adjust belt tension.
High airflow (cfm)	Blower fan speed too high.	Check for correct fan RPM. Decrease fan speed if necessary.
	Filter(s) not in place.	Install filters.
	Insufficient static pressure (Ps). (airflow resistance)	Induce Ps into system ductwork. Make sure grilles and access doors are installed. Decrease fan speed if necessary.

Always have a completed Pre Start-Up Checklist, Unit Start-Up Checklist and Optional Accessories Checklist prior to requesting parts or service information.

Troubleshooting - Unit

Symptom	Possible Cause	Corrective Action
Excessive noise or vibration	Fan wheel rubbing on inlet.	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	Bearings.	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Wheel out of balance.	Replace or rebalance.
	Loose wheel on shaft.	Tighten wheel hub.
	Loose blower or motor sheave.	Tighten sheave setscrew.
	Belts too loose.	Adjust belt tension after 24 hours of operation.
	Belts too tight.	Loosen to maintain a 1/64-inch deflection per foot of span between sheaves.
	Worn belt.	Replace.
	Motor base or blower loose.	Tighten mounting bolts.
	Bearing and drive misaligned.	Realign.
	Noise being transmitted by duct.	Make sure ductwork is supported properly. Make sure ductwork metal thickness is sized for proper stiffness. Check duct size at discharge to ensure that air velocities are not too high.
	Intermediate shipping rails attached to blower assembly.	Remove intermediate shipping rails. See assembly page 8 of this document.

Always have a completed Pre Start-Up Checklist, Unit Start-Up Checklist and Optional Accessories Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

TROUBLESHOOTING NOTE

Before any components are changed on the refrigeration system, the cause of the failure must be identified. Further problems will exist unless the true cause or problem is identified and corrected.

IMPORTANT

Do not release refrigerant to the atmosphere! If required service procedures include the adding or removing of refrigerant, the service technician must comply with all federal, state and local laws. The procedures discussed in this manual should only be performed by a qualified EPA Certified Technician.

NOTE: Unit is equipped with a phase loss/phase reversal control. If system does not start, check phase of electrical supply.

The first step in troubleshooting a refrigeration circuit is to examine the DDC and digital scroll compressor controller (if present) and see if there is a fault code. The next step is to check airflow conditions (e.g. improper ductwork, atypical wet bulb / dry bulb, etc.). After these steps have been eliminated, proceed with troubleshooting by following this guide.

Symptom	Possible Cause	Corrective Action
Compressor will not run or does not start	Open disconnect switch or circuit breaker.	Close switch and/or breaker.
	Compressor contactor not closing.	Check voltage to contactor coil, transformer, slave relay, system. Replace parts as necessary.
	Blown fuse or tripped breaker.	Check for reason and repair. Replace fuse after correcting problem.
	Low line voltage.	Check line voltage. If more than 10% from compressor marking, correcting is necessary.
	Compressor motor protector open.	Motor thermal protector automatically resets. Allow time (2 hours) for compressor to cool down so protector will reset. Restart and check for reason overheat occurred.
	Compressor defective.	Check motor for open circuit, short circuit, grounded windings, or burn out. Compressor may be seized; check refrigerant. If necessary, replace compressor.
	High or low pressure switch open or defective.	If manual reset (high pressure), reset switch. (Switch opens at 600 psi and will not reset above 420 psi for R-410A). If auto reset (low pressure) does not reset and everything else is okay, replace switch.
	Open room thermostat or control. (No cooling required).	Check room temperature. If temperature is proper, wait for thermostat to close.
	Loose wiring.	Check all wire terminals and tighten as necessary.
Compressor starts but cuts out on low pressure *Low pressure switch activates at 50 PSIG*	Low or loss of refrigerant charge.	Check refrigerant pressures.
	Airflow restricted.	Check for dirty evaporator coil, dirty filters, dampers closed, iced evaporator coil, improper belt, check motor amps, check duct design.
	Restriction in refrigerant line.	Check refrigerant pressure, check and adjust thermal expansion valve. If not functioning properly, check for pressure drop across the filter drier.
	Defective low pressure switch.	Replace.

Always have a completed Pre Start-Up Checklist, Unit Start-Up Checklist and Optional Accessories Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Compressor starts but cuts out on high pressure switch *High pressure activates at 600 PSIG*	Refrigerant overcharge.	Check pressures, charge by subcooling.
	Condenser fan motor defective.	Check fan motor.
	Condenser coil inlet obstructed or dirty.	Check coil and inlet clearances.
	Air or non-condensables in system.	Check high side equalized pressures, check thermal expansion valves.
	Defective high pressure switch.	Replace.
	Restriction in discharge or liquid line.	Check refrigerant line pressures, check thermal expansion valves, replace any defective component.
	Condensing fan relay not pulling in.	Replace.
	Reheat valve and bypass valve not opening.	Check valves or valve circuit board.
Compressor cuts out on thermal overload	Low voltage.	Check voltage.
	Sustained high discharge pressure.	Check running amperage and conditions described under “low suction pressure” symptoms.
	High suction and discharge pressures.	Check thermal expansion valve setting, check for air in system. Check air conditions and cfm.
	Defective compressor overload.	If compressor is hot, allow compressor to cool for two hours. Recheck for open circuit.
	Improper refrigerant charge.	Check subcooling.
	Improperly wired.	Review wiring schematics.
	Loose wiring.	Check all connections.
	Defective start relay.	Replace relay.
	Motor windings damaged.	Verify amp draw.
Compressor hums, but will not start	Improperly wired.	Review wiring schematics.
	Low line voltage.	Check voltage.
	Loose wiring.	Check all connections.
	Defective start relay.	Replace relay.
	Motor winding damaged.	Verify amp draws. Replace compressor if necessary.
	Internal compressor mechanical damage.	Replace.
Compressor noisy or vibrating	Refrigerant overcharge.	Check pressures and subcooling.
	Liquid floodback.	Check thermal expansion valve setting. Check for refrigerant overcharge.
	Tubing rattle.	Dampen tubing vibration by taping or clamping. Carefully bend tubing away from contact where possible.
	Scroll compressor rotating in reverse. (3-phase)	Rewire for opposite rotation.
	Worn or damaged compressor.	Replace the compressor.
	Improper mounting on unit base.	Check that compressor is properly isolated.

Always have a completed Pre Start-Up Checklist, Unit Start-Up Checklist and Optional Accessories Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
High suction pressure	Excessive load on evaporator coil.	Check for high entering wet bulb temperature, check for excessive air.
	Compressor is unloaded. (digital scroll)	Check digital scroll controller signal and solenoid valve.
	Expansion valve sensing bulb not secured to suction line.	Check the thermal expansion valve, ensure bulb is insulated. Check superheat. If superheat is high, then valve is choking refrigerant flow. • Check bulb for contact. • Adjust valve for superheat ~10°F. • Replace valve power head or valve.
	Thermostatic expansion valve pressure limit feature incorrect or inoperative. Overfeeding.	Check bulb location and clamping. Adjust superheat. Replace expansion valve power head.
	Room load too large.	Reduce the load or add more equipment.
	Overcharged.	Check pressures and subcooling.
High discharge pressure	Thermal expansion valve setting.	Check thermal expansion setting and calibrate superheat / subcooling.
	Air inlet to condenser dirty or obstructed.	Check for proper clearances and possible air recirculating.
	Condenser fan motor defective.	Check condenser fan motor.
	Too much refrigerant.	Remove excess refrigerant.
	Non-condensable in system.	Remove non-condensable from system.
	Dirty condenser coil.	Clean condenser coil.
	Condenser fan not running or running backwards.	Check electrical circuit and fuse. Check fan cycling controls.
	High load conditions.	Add more equipment or reduce load.
Low suction pressure	Refrigerant undercharge/loss of refrigerant charge.	Check pressures and subcooling.
	Blower running backward.	Interchange any two wires from 3-phase disconnect.
	Loose blower, pulley or belts.	Check drive pulley alignment, belt tension.
	Low entering air temperature. (Low load conditions).	Check entering air wet bulb conditions.
	Refrigerant leak.	Check system for leaks. Repair leaks and add refrigerant.
	Evaporator dirty or iced-up, or airflow restricted.	Clean the coil. Check fan operation. Check airflow.
	Plugged liquid line filter-drier.	Replace filter-drier, check psi across filter.
	Improper hot gas bypass setting.	Check setting and correct as required.
	Expansion valve defective, superheat too high or valve too small.	Adjust valve for proper superheat or replace the expansion valve if too small or defective.
	Moisture in system, check sight-glass.	Reclaim refrigerant, check for leaks, recharge.

Always have a completed Pre Start-Up Checklist, Unit Start-Up Checklist and Optional Accessories Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Low discharge pressure	Insufficient refrigerant charge.	Check subcooling, check for leak. Repair leak and add refrigerant.
	Defective or improperly adjusted expansion valve.	Check superheating and adjust thermal expansion valve.
	Low suction pressure.	See “low suction pressure”.
	Faulty condenser temperature controls. (Condensing fan cycle switch).	Check condenser controls and reset to obtain desired condensing temperature.
Compressor short cycles	Thermostat location or controls malfunction.	Check thermostat, check heat anticipator setting.
	Improper refrigerant charge.	Check subcooling, verify superheat.
	Defective high or low pressure control.	Check high or low pressure switch.
	Liquid floodback.	Possible tight bearings, see page 30.
	Defective expansion valve.	Check thermal expansion valve and superheat.
	Poor air distribution.	Check ductwork for recirculating.
	High discharge pressure.	See “high discharge pressure”.
	Leaking discharge valves in compressor.	See “high suction pressure”.
	Low airflow at evaporator(s).	Check blower operation and airstream restrictions.
	Incorrect unit selection (oversized).	Contact factory.
Compressor loses oil	Refrigerant leak.	Check system for leaks. Repair leaks and add refrigerant.
	Short cycling.	Check low pressure control settings.
	Refrigerant flood back.	Check thermal expansion valve setting. Check for refrigerant overcharge. Check crankcase heaters.
	Improper piping or traps.	Verify proper piping slopes.
	Reheat flush cycle inadequate.	Contact factory.
Not enough cooling or lack of cooling	Refrigeration undercharged.	Check subcooling. Adjust charge, if necessary.
	Dirty filter or evaporator coil.	Check filter, coil and airflow.
	Dirty or clogged condenser coil.	Check coil and airflow.
	Air or other non-condensables in system.	Check equalized high side pressure with equivalent outdoor temperature.
	Defective compressor.	See “high suction pressure”.
	Restriction in suction and liquid line.	Check for restrictions in refrigerant circuit.
	Control contacts stuck.	Check wiring.
	Excessive load.	Add more equipment or reduce room load.
Liquid line is frosted or wet	Restriction in liquid line.	Clear restriction upstream of point of frosting.

Always have a completed Pre Start-Up Checklist, Unit Start-Up Checklist and Optional Accessories Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Suction line is frosting	Insufficient evaporator airflow.	Check airflow, check filters, check drive for loose parts or belts.
	Malfunctioning or defective expansion valve.	Check bulb of thermal expansion valve.
Frost on evaporator coil	Hot gas bypass valve not functioning properly.	Check valve. If defective, replace.
	Manual hot gas bypass valve closed.	Open valve.
	Low load or airflow.	Increase airflow, check filters.

Always have a completed Pre Start-Up Checklist, Unit Start-Up Checklist and Optional Accessories Checklist prior to requesting parts or service information.

Routine Maintenance

DANGER

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to the unit to OFF at disconnect switch(es). Unit may have multiple power supplies.

CAUTION

Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

This unit requires minimal maintenance to operate properly. To ensure proper operation and longevity, the following items should be completed. The items in this list assume a relatively clean air environment, and may require attention more frequently in a dusty or dirty area. If this unit contains an indirect gas-fired heater, refer to the Installation, Operation and Maintenance manual provided with the unit for maintenance purposes. A Certified Technician should complete all refrigerant systems checks.

Maintenance Frequency:

Monthly

1. External Filter
   Check for cleanliness – clean if required
2. Internal Filters
   Check for cleanliness – replace if required
3. Condensate Drain (if applicable)
   Inspect and clean – refill with water
4. Bearings
   Lubricate per the schedule in the Fan Bearings section

Semi-Annually

1. Fan Belts
   Check for wear, tension, alignment
2. Check pulleys, bearings and motor for wear
3. Bearings
   Lubricate per the schedule in the Fan Bearings section

Annually

It is recommended that the annual inspection and maintenance occur at the start of the cooling season. After completing the checklist, follow the unit start-up checklist provided in the manual to ensure the refrigeration system operates in the intended matter.

1. Lubrication
   Apply lubrication where required
2. Dampers
   Check for unobstructed operation
3. Motors
   Check for cleanliness
4. Fan Belts
   Check for wear, tension, alignment
5. Blower Wheel & Fasteners
   Check for wear, tension, alignment
   Check all fasteners for tightness
   Check for fatigue, corrosion, wear
6. Bearings
   Lubricate per the schedule in the Fan Bearings section
7. Door Seal
   Check if intact and pliable
8. Wiring Connections
   Check all connections for tightness
9. Cabinet
   Check entire cabinet—inside and out—for dirt buildup or corrosion. Remove accumulated dirt, remove any surface corrosion and coat the area with appropriate finish.

Units with Packaged DX

1. Evaporator Coil Maintenance
   Check for cleanliness - clean if required
2. Condenser Coil Maintenance
   Check for cleanliness - clean if required
3. Condensate Drain
   Inspect and clean - refill with water
4. Condensing Fan Blades and Motors
   Check for cleanliness
   Check all fasteners for tightness
   Check for fatigues, corrosion and wear

Maintenance Procedures:

Lubrication

Check all moving components for proper lubrication. Apply lubricant where required. Any components showing excessive wear should be replaced to maintain the integrity of the unit and ensure proper operation.

Dampers

Check all dampers to ensure they open and close properly and without binding. Backdraft dampers can be checked by hand to determine if blades open and close freely. Apply power to motorized dampers to ensure the actuator opens and closes the damper as designed.

Fan Belts

Belts must be checked on a regular basis for wear, tension, alignment and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and / or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage and overheated sheaves. Both loose and tight belts can cause fan vibration.

When replacing belts on multiple groove drives, all belts should be changed to provide uniform drive loading. Do not pry belts on or off the sheave. Loosen belt tension until the belts can be removed by simply lifting the belts off the sheaves. After replacing belts, insure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.

The proper belt setting is the lowest tension at which the belts will not slip under peak load operation. For initial tensioning, set the belt deflection at 1/64-inch for each inch of belt span (measured half-way between sheave centers). For example, if the belt span is 16 inches, the belt deflection should be 16/64-inch, or 1/4-inch (using moderate thumb pressure at mid-point of the drive). Check belt tension two times during the first 24 hours of operation and periodically thereafter.

Fan Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper cooling. Never wash-down the motor with high pressure spray. Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication.

Fan Wheel and Fasteners

Wheels require very little attention when moving clean air. Occasionally oil and dust may accumulate on the wheel causing imbalance. When this occurs, the wheel and housing should be cleaned to assure smooth and safe operation. Inspect fan impeller and housing for fatigue, corrosion or wear.

Routinely check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness. A proper maintenance program will help preserve the performance and reliability designed into the fan.

Fan Bearings

Most bearings are permanently lubricated and require no further lubrication under normal use. Normal use being considered -20°F to 120°F and in a relatively clean environment. Some bearings are relubricatable and will need to be re-greased depending on fan use. Check your bearings for grease zerk fittings to find out what type of bearing you have. If your fan is not being operated under normal use, bearings should be checked monthly for lubrication. Shaft bearings are the most critical moving part of a fan. Therefore, special attention should be given to keeping the bearings clean and well-lubricated. Proper lubrication provides for reduction in friction and wear, transmission and dissipation of heat, extended bearing life and prevention of rust.

In order for a lubricant to fulfill these tasks, the proper grease applied at regular intervals is required. Refer to the recommended bearing lubrication schedule:

Plenum Fan Bearing Lubrication Schedule (Relubrication Schedule in Months)

Fan RPM	Shaft Diameter in Inches			
	½ to 1	1⅛ to 1½	1⅝ to 1⅞	1 15/16 to 2 3/16
To 250	6	6	6	6
500	6	6	6	5
750	6	5	4	3
1000	6	4	3	2
1250	5	3	2	1
1500	5	2	1	1
2000	5	1	1	.5
2500	4	.5	.5	.25
3000	4	.5	.25	.25
4000	3	.25	.25	.25
5000	2	.25	.25	.25

If unusual conditions exist - temperatures below 32°F or above 200°F, moisture or contaminants - more frequent lubrication is required.

With the unit turning, add grease very slowly with a manual grease gun until a slight bead of grease appears at the seal.

Be careful not to unseat the seal by overlubricating or using excessive pressure. A guide to the amount of grease to be used is to fill 30% to 60% of available space in the bearing and housing.

A high quality lithium grease conforming to NLGI Grade 2 consistency, such as those listed below should be used:

Mobil 532	Texaco Premium #2	B Shell Alvania #2
Mobilux #2	Texaco Multifak #2	Unirex 2

In addition to lubricating the bearings at specified intervals, set screws in the bearing collars should be checked for tightness. A bearing collar which has loosened will cause premature failure of the fan shaft. Fasteners attaching the bearings to the drive frame should also be checked. See bearing lubrication schedule.

Internal Filter Maintenance

The unit will typically be provided with 2-inch thick pleated paper filters in the airstream. These filters should be checked according to a routine maintenance schedule and replaced as necessary to ensure proper airflow through the unit. See table below for pleated paper filter size and quantity for each unit. Replacement filters shall be of same performance and quality as factory installed filters. Filter must be pleated design with integral metal grid. Two acceptable filter replacements are Aerostat Series 400 or Farr 30/30®.

The standard 2-inch thick pleated paper filter is rated at MERV 8, but 2-inch thick MERV 13 filters can be substituted, if desired.

Filter Size (Quantities)		
Model	**2-inch aluminum mesh (weatherhood)**	**2- and 4-inch pleated filters**
MPX-H14	20 x 25 (2)	20 x 25 (2)
MPX-H24	16 x 25 (4)	20 x 25 (4)
MPX-H34	20 x 25 (4)	16 x 25 (6)

Outdoor Air Filters: Access to the outdoor air filters is through the door labeled “Filter Access” on the access side of the unit.

Refer to Access Door Descriptions section of this manual for additional information on filter locations and access.

WARNING

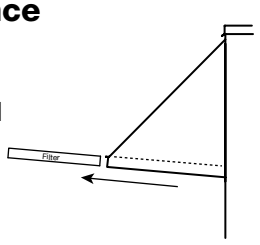
REFER TO GENERAL SAFETY INFORMATION

Do not operate this unit without the filters and birdscreen installed. They prevent the entry of foreign objects such as leaves, birds, etc.

Do not remove access panels or other unit components while standing on a ladder or other unsteady base. Access panels and unit components are heavy and serious injury may occur.

External Filter Maintenance

Aluminum mesh, 2-inch thick filters are located in the supply weatherhood (if the weatherhood option was purchased). These filters should be checked and cleaned on a regular basis for best efficiency. The frequency of cleaning depends upon the cleanliness of the incoming air. These filters should be cleaned by rinsing with a mild detergent in warm water prior to start-up.



Outdoor Air Intake Hood Mesh Filter Access

Coil Maintenance

Coils must be cleaned to maintain maximum performance. Check coils once per year under normal operating conditions and if dirty, brush or vacuum clean. Soiled fins reduce the capacity of the coil, demand more energy from the fan and create an environment for odor and bacteria to grow and spread through the conditioned zone. High pressure water (700 psi or less) may be used to clean coils with a fin thickness over 0.0095 inches thick. TEST THE SPRAY PRESSURE over a small corner of the coil to determine if the fins will withstand the spray pressure.

For coils with fragile fins or high fin density, foaming chemical sprays and washes are available. Many coil cleaners use harsh chemicals, so they must be used with caution by qualified personnel only. Care must be taken not to damage the coils, including the fins, while cleaning. **Caution: Fin edges are sharp!**

WARNING

Biological hazard. May cause disease. Cleaning should be performed by qualified personnel.

Drain pans in any air conditioning unit will have some moisture in them, therefore, algae and other organisms will grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Inspect twice a year to avoid the possibility of overflow. Also, drain pans should be kept clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

Maintenance Log

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Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the shipment date. Any units or parts which prove to be defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Greenheck Model MPX catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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