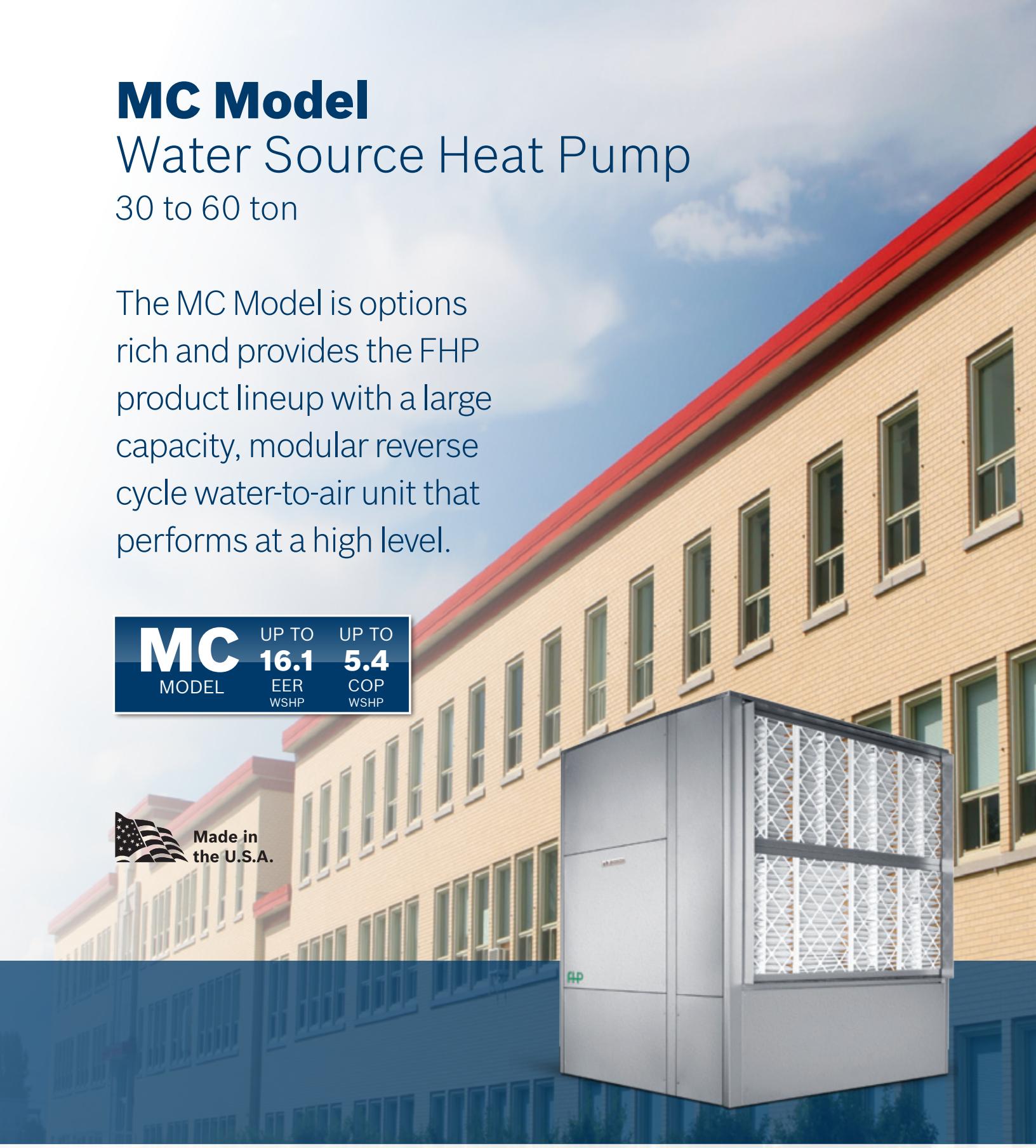
MC Model

Water Source Heat Pump

30 to 60 ton

The MC Model is options rich and provides the FHP product lineup with a large capacity, modular reverse cycle water-to-air unit that performs at a high level.

MC MODEL | UP TO **16.1** EER WSHP | UP TO **5.4** COP WSHP



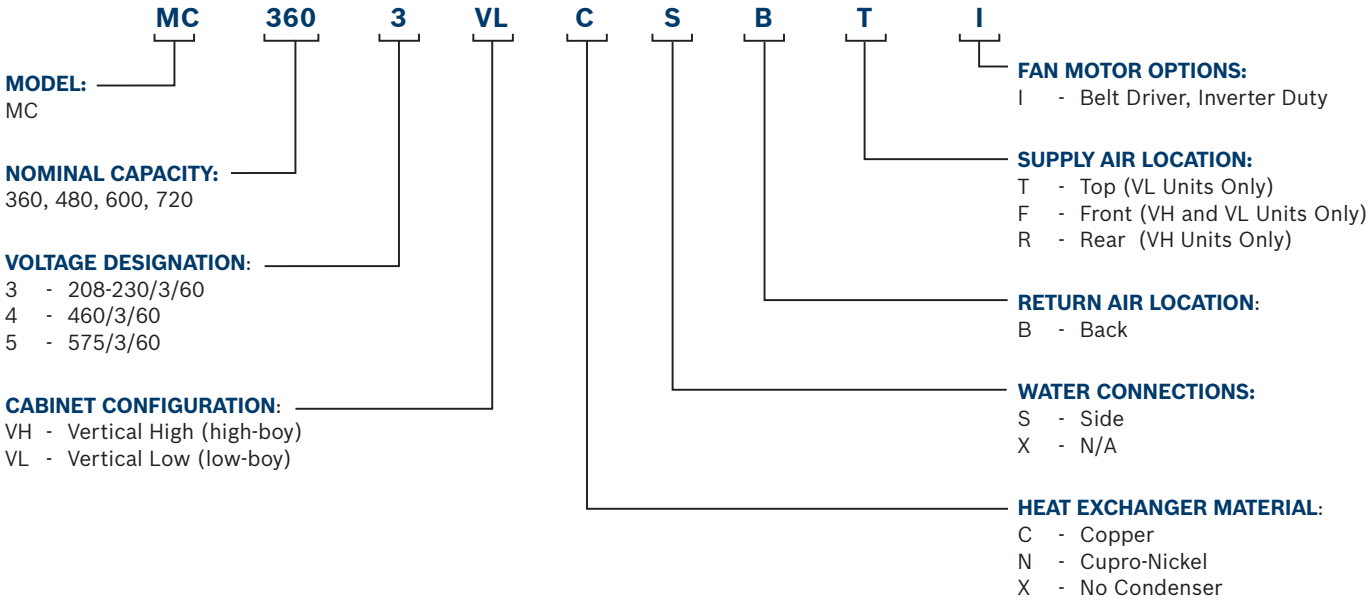
Made in the U.S.A.

Commercial Sales Catalog
fhp-mfg.com

BOSCH
Invented for life

Table of Contents

Model Nomenclature



Performance Data

PERFORMANCE IN ACCORDANCE WITH ARI/ISO 13256-1 ISO corrected (w/ fan & pump pwr)						
Model	GPM	CFM	Water Loop Heat Pump			
			Cooling 86° F		Heating 68° F	
			CAP	EER	CAP	COP
MC360	90	12,000	395,246	13.1	475,212	4.7
MC480	120	16,000	555,796	16.1	622,608	5.2
MC600	150	20,000	642,387	15.4	751,701	5.4
MC720	180	24,000	790,649	13.1	950,439	4.7

NOTE: The performance data results alter depending on application design; use Bosch Selection Tools software for specific performance data per the application, selection and specifications. http://bst.fhp-mfg.com/eRep/

Efficiency and Environmentally Friendly

With the MC Model, Bosch Thermotechnology Corp. can satisfy your needs up to 60 tons with these large R-410A capacity units. The unit is available in cooling only or with reverse cycle heating along with either constant or variable air volume discharge to provide a highly efficient operating system. Waterside economizer packages are available to take advantage of free cooling. Hot gas bypass allows the unit to operate under a wide variation of conditions. The hot gas reheat option provides a means of controlling humidity, a major concern in the interior environment of a building. The MC unit is available from 30 to 60 nominal tons in two-stage or four-stage compressor configurations. These highly efficient units not only will reduce your operating costs but play their part in reducing CO_2 emissions.

FHP Equipment

Specializing in efficient green technology for commercial heating and cooling products. FHP products are one of the leading Geothermal and Water Source heat pumps in the market, which assures that you are buying a unit that you can trust. Bosch Thermotechnology Corp. is dedicated to providing highly efficient heating and cooling solutions to the private and public sectors.

Bosch Thermotechnology Corp. is always on the forefront of product development and innovative design to optimize the performance of FHP units. Our products are designed and manufactured to the highest quality, reflecting the no-compromise standards for which FHP and Bosch are renowned in order to provide our customers with the highest level of satisfaction and comfort. The variety of options, energy efficiency and uncompromising quality of all FHP products makes them the ideal choice for the commercial new construction market and the ease of designing into tight retrofit spaces of buildings.

FHP's engineering efforts have been focused on providing a greener world for future generations. Faced with today's tough environmental challenges and with global warming, Bosch Thermotechnology Corp. is more committed than ever to develop solutions which utilize sustainable energy sources in order to conserve our planet's resources. With our heat pumps, you not only will save money on energy bills but also help create a better world.

The MC Model water-to-air heat pump is the result of our almost 40+ years of research and development experience in the US heat pump market. It is the most flexible geothermal technology available today, designed to improve reliability, reduce installation costs and provide your building with the cost savings and comfort you expect from FHP.

About Bosch Thermotechnology Corp. in North America

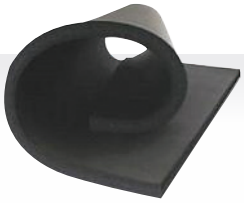
Bosch Thermotechnology Corp. is a leading source of high quality heating and cooling systems in North America. The company offers tankless, point-of-use water heaters, solar thermal systems, Bosch and Buderus conventional and condensing boilers, heat pump water heaters, Bosch and FHP geothermal heat pumps as well as controls and accessories for every product line. Bosch Thermotechnology Corp. is committed to reinventing energy efficiency by offering smart products that work together as integrated systems, which enhance quality of life in an ultra efficient and environmentally friendly manner.

Proven and Tested Technologies

FHP heat pumps are made by highly trained and skilled workers in the FHP factory based in Fort Lauderdale, Florida. They are manufactured with rigorous standards and factory testing ensuring trustworthy operation over the life of the unit. Bosch's ISO 9001 and ISO 14001 certified facilities provide consistent quality in every unit built.

Made in the U.S.A.

Scroll Compressors



Closed Cell
Foam Insulation

MC Model

This large capacity water-to-air heat pumps offer high efficiency, value added features and multi-levels of capacity with standard features like scroll compressors, variable air volume and 100% outside air capability giving you the flexibility, performance and quiet operation needed to exceed the expectations of your clients.

Quality

Rigorous factory testing helps to ensure no hassles from the start while FHP's 40+ years of experience in designing heat pumps is your assurance of the highest quality product. Multiple refrigerant circuits provide redundancy in the event of component failure. FHP's ISO 9001 certified facilities provide consistent quality in every unit we build.

Advantages of FHP Technology

- Optimum comfort
- Scroll compressor
- Simple installation and operation
- Low installation costs
- Lower operating costs
- Flexibility in designing and installation
- Energy efficiency
- Modular design
- Superior quality
- Quiet operation

Flexible Installation

All units are available in two different configurations.

Vertical High Configuration (high-boy): The VH design concept is to provide a unit that will facilitate on site handling and can be installed in locations difficult to access. All units can be broken down into separate sections that can pass through a 36" wide standard size door or service elevator. The MC360 ships in two sections and can be easily broken down into three separate sections; the fan section, main heating/cooling section and the economizer/filter bank section. The MC480 through MC720 ships in four sections and can be broken into six separate sections, two each as previously mentioned. Very few competitive equipment manufacturers have this capability.

Vertical Low Configuration (low-boy): The VL is designed for those applications where there is a restriction in the height of the unit. In this unit the blower is dropped into the main coil section reducing the unit's overall height and increasing unit depth. The MC360 ships in one section and can be separated into two sections, the main refrigeration and blower sections and the filter/economizer section. Unit sizes MC480 through MC720 ships in two sections and can be separated into four sections for transportation and access into the plant room.

Quiet Operation

Proper acoustical considerations are a critical part of every systems design and operation. Multiple scroll compressors, equipment liners, balanced fans, and heavy-duty construction make the MC Model heat pumps inherently quiet. Each system design and installation should be reviewed for its own unique requirements. For job specific requirements, contact an acoustical consultant for guidance and recommendations.

Serviceability

All units are designed to be serviced from the front of the unit. Schrader valves for the high and low pressure gauges are standard, along with easily accessible electrical box components, allow diagnosing and servicing the unit a simple task. Insulated bulkheads are in all MC Models, separate the compressor section from the blower section, allowing the unit to be serviced during operation.

The large removable panels aid in servicing the unit, when necessary. All components are located for ease of inspection and service. Major components are out of the units airstream to allow maintenance while the unit is in operation allowing for zero down time and no disruption to the comfort levels in the building. Separate electrical knockouts on the unit allow for easy and safe routing of high and low voltage lines to the inside of the cabinet. These service features allow for the benefit of quicker and easier service access to the unit which in turn equals saving time and saving money.

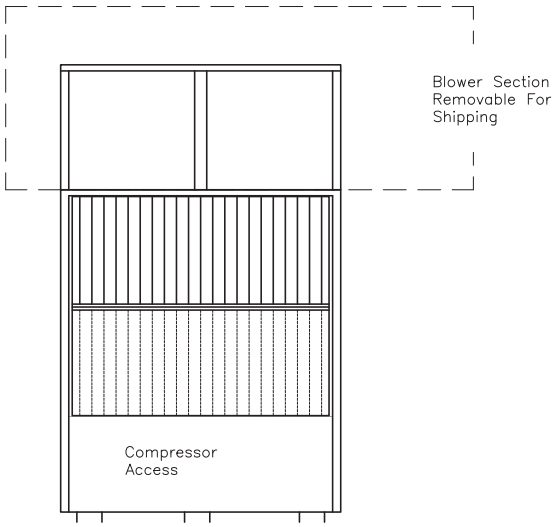
MC Model 360-720

- 4 Models from 30 through 60 tons
- Available in cooling only or with reverse cycle heating with either constant or variable air volume discharge to provide a highly efficient operating system.
- Waterside economizer packages are available to take advantage of free cooling.
- Optional field installed hot water coils provide preheating or heating. Hot gas bypass allows the unit to operate under a wide variation of conditions and the hot gas reheat option provides a means of controlling humidity, a major concern in the interior environment of a building.

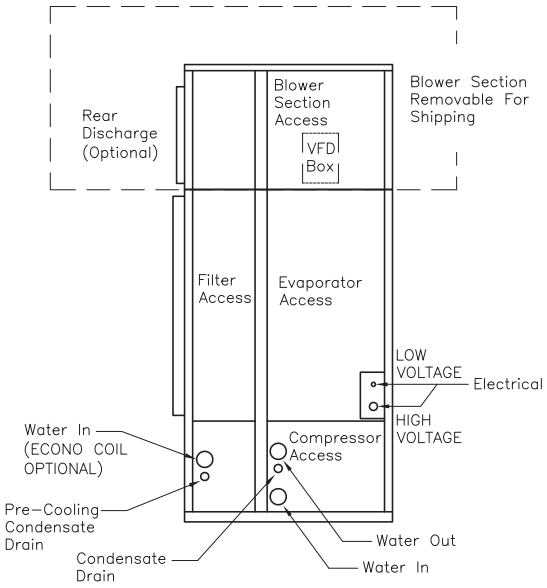
Unit Configurations

Vertical High – Horizontal Discharge (high-boy)

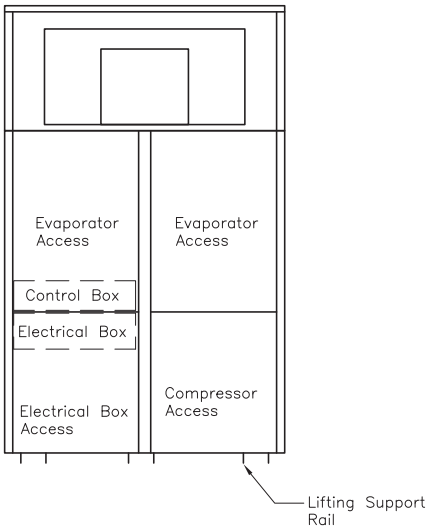
MC360 – Rear View



MC360 – Left Side View (Rear Discharge)



MC360 – Front View



MC360 – Left Side View (Front Discharge)

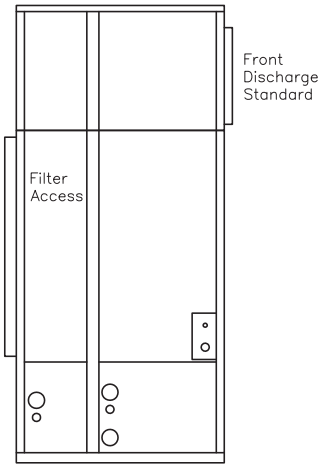


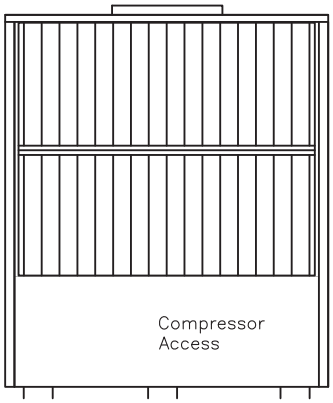
Figure 1

Bosch Thermotechnology Corp. reserves the right to make continuous improvements that may affect the dimensions above.
NOTE: Filter access section is field removable.

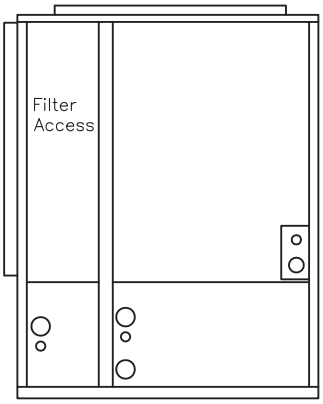
Unit Configurations

Vertical Low – Top & Front Discharge (low-boy)

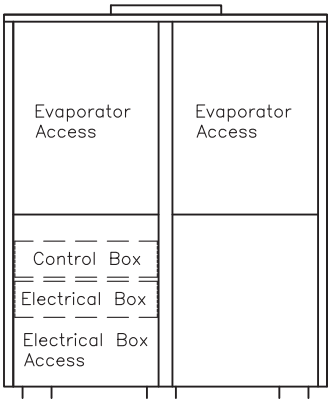
MC360 – Rear View



MC360 – Left Side View (Top Discharge)



MC360 – Front View



MC360 – Left Side View (Front Discharge)

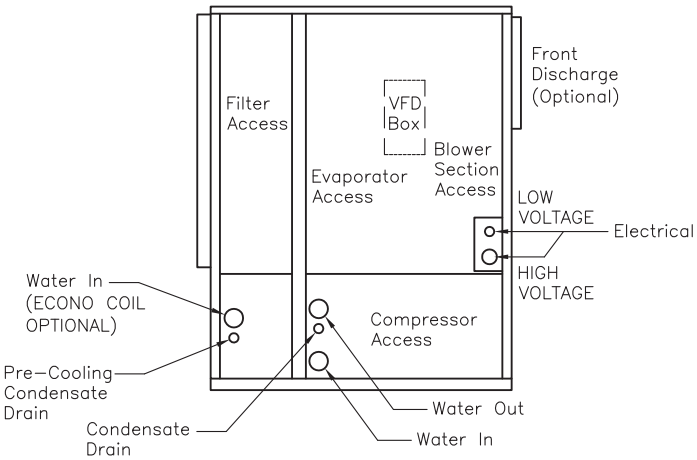
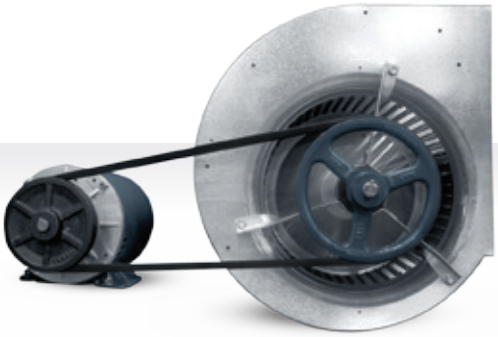


Figure 2

Bosch Thermotechnology Corp. reserves the right to make continuous improvements that may affect the dimensions above.
NOTE: Filter access section is field removable.



Belt Drive and Motor

Variable Frequency Drive (Optional)

Features, Functions and Benefits

Cabinet, Casing and Frame

The MC Model cabinetry is constructed using heavy-gauge G90 galvanized steel sheet metal. This type of steel provides superior protection for units installed indoors. In addition, the framework utilizes heavy-duty internal angle iron for structural support. The angle iron members are attached using 1/2" bolts and locking nuts for ease of disassembly and reassembly.

All interior surfaces are lined with ½" thick, 1.5 lb./cu.ft. density, micromat multi-density coated fiberglass insulation for thermal insulation and acoustical attenuation. As an option, the closed cell foam insulation is available. This is a ½" thick high density, closed cell foam insulation which is fiber free, cleanable and further benefits indoor air quality. The closed cell foam insulation adds the benefit of quiet operation by reducing casing radiated noise levels from the unit.

Protection against corrosion is a feature with the MC Model. The main cooling & heating section and the filter/waterside economizer section shall employ a galvanized steel drain pan coated with archem type paint for corrosion resistance. The stainless steel drain pan (special option) will last the lifetime of the unit while helping to resist corrosion and will avoid cracking that may occur with inferior steel or plastic materials.

Filter Racks

Four sided enclosed filter racks, accommodating a 4" thick filter, are standard on all MC Models. Four sided filter racks minimize unfiltered air from entering the unit allowing for cleaner, healthier air.

Quality filter doors allow for easy routine maintenance and changing of the air filter collar that is integral to the filter rack by eliminating the need for field mounted duct collars. Units are shipped with a 4" pleated filters for premium HVAC projects.

Blower Housing and Motors

The units contain either one or two forward curved high pressure class II fan assemblies depending on the model size. The fans are double width, double inlet (DWDI), welded assemblies statically and precisely balanced. In the VH Series, the fan module is isolated from the main module by the use of gaskets providing excellent vibration isolation and quiet operation. The modules are bolted together with 1/2 inch diameter bolts and locking nuts. Each fan is powered by its own motor and drive assembly. Motors are mounted on individual motor platforms for stable operation and belt tension adjustment. All assemblies include 150,000-hour re-greaseable pillow block bearings with large diameter solid steel shafts for high torque/speed operation. Drive packages comprise multiple belt, fixed pitch blower pulleys and motor sheaves sized for specific application requirements of CFM, external static pressures, and motor horsepower. All components are easily accessible for general maintenance. Motors are open drip proof NEMA T-Frame E high efficiency EPACT rated with sealed ball bearings. Precisely balanced to ensure smooth operation and designed for quiet, low velocity operation which keeps noise to a minimum.

Optional factory installed variable frequency drives are available for variable air volume systems. The drives are located in the fan section and may be controlled by the optional DDC. A static pressure sensor is field installed in the supply duct plenum dictating motor speed based on an increase or decrease in the supply duct static pressure. VFD's are field programmed per job specific design criteria.

Coax Coil

Evaporator Coil

Four-way Reversing Valve

Evaporator Coil

Evaporators are enhanced fin, rifled tube type for maximum performance. Large face areas ensure low airside pressure drops and reduced face velocities to prevent condensate carry over and maximum moisture removal. Depending on the model capacity, the coils are three or four rows deep. They are mounted in a sealed drain pan to inhibit condensate build up.

The direct expansion air coil has a minimum of 3 rows fabricated with seamless copper tubing mechanically bonded to rippled and corrugated aluminum fins. Each individual evaporator coil shall be removable for replacement without disturbing the remaining refrigerant circuits. Each evaporator coil circuit shall be fed by an adjustable TXV, with external equalizer, sized to provide efficient operation at full and at part load operating points in the cooling and heating modes.

Refrigerant Circuit

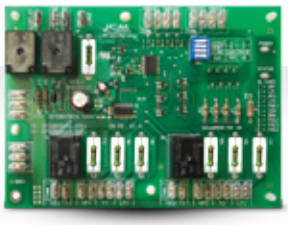
MC Models are designed using the optimum combination of compressor, water and air coils to provide peak performance.

Each refrigerant circuit is independently piped allowing part load operation in the event of a component failure. Compressor/evaporator staging is such that air stratification is kept to a minimum. The lower evaporators on each module are staged first to keep coils wet and enhance condensate removal. In the event of an evaporator failure only the individual coil need be changed compared to the full face evaporators utilized by some manufacturers. All units utilize high efficiency scroll compressors. The MC360 has two compressors while the MC480 through MC720 units employ four compressors for efficient part load control, quiet operation and system redundancy. Scroll compressors are considered by many in the industry to be the best in durability and efficiency. Standard in all MC Models, this ensures that each unit will be equipped to give many years of trustworthy performance.

Each compressor has its own independent refrigerant circuit and is protected by individual branch fusing. Additional protection is provided by thermal overloads and high and low pressure safety switches. Suction and discharge schrader valves are provided for manifold gauge connections to facilitate servicing. Compressors are mounted on vibration isolators. The entire condensing section is isolated from the air-handling compartment by the use of an insulated bulkhead partition designed to minimize sound transmission. Externally equalized balanced port thermostatic expansion valves are utilized for wide range refrigerant metering control. Superheat shifts are minimal from cooling to heating operation ensuring stable operation in both the heating and cooling modes. All TXV's are factory set and are field adjustable for specific operating conditions. Reversing valves are large bodied to minimize refrigerant pressure drop. All refrigerant components are accessible from the front of the unit for service and maintenance.

All water to refrigerant heat exchangers (condensers) are coaxial tube-in-tube for maximum heat transfer efficiency and performance. Inner water tubes are either copper or optional cupro-nickel with large internal diameters for reduced water-side pressure drops. Outer tubes are steel, painted for corrosion protection. All condensers are rated at 600 PSIG operating refrigerant pressures and 400 PSIG water-side pressures. Condensers are individually leak tested.

Schrader Charging Valves for Servicing



UPM Control Board

All condensers are chemically cleanable. Please consult Applications Engineering or After Sales Support for proper cleaning procedures. Units are designed for single water supply/return connections with modules being connected by the use of heavy-duty bronze unions.

Refrigerant to water heat exchangers are coaxial tube-in-tube type providing a robust construction, ensuring years of trouble free operation. Coaxial coils are selected and designed for peak performance, offering the best combination of low water pressure drop and maximum heat transfer in both the cooling and heating modes. Standard coaxial coils have a copper interior water tube and a steel outer shell. Cupro-nickel coils are available as an excellent option for applications where the water is of low quality.

In geothermal applications where fluid temperatures can drop below the dew point of the surrounding air, the MC models are geothermal ready with insulation on the coaxial heat exchangers and refrigerant piping. A pilot operated four-way reversing valve in the refrigeration circuit allows the unit to operate in either the heating or cooling mode. All FHP units have the reversing valve energized in cooling mode, which allows the unit to fail to heating mode for building protection. This will ensure you are not left without heat in the middle of winter should the reversing valve coil fail

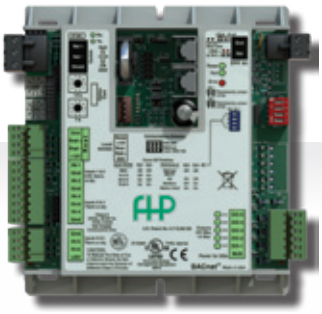
High and low pressure switches are factory installed in the refrigerant circuit, protecting the unit against high pressure conditions or loss of refrigerant charge. Schrader service valves are standard on the high and low pressure lines of all units, allowing connection to gauges for service diagnostics and to either evacuate, reclaim or recharge refrigerant into the system.

Unit Protection Module (UPM)

Each MC Model is built in the factory with a Unit Protection Module (UPM) that controls the unit operation and monitors the safety controls that protect the unit. The UPM interfaces with the thermostat or human-machine interface (HMI). The main purpose of the UPM is to protect the compressors by monitoring the different states of switches and sensors. This module provides time delays and protects the unit against freezing of the water to refrigerant and air to refrigerant heat exchangers as well as condensate overflow when the appropriate sensors are installed. This level of protection helps provide the piece of mind that comes with offering an FHP product to the customer.

UPM Control Board Features

- **Condensate Overflow Protection**—The UPM controller continuously monitors the drain pan for high condensate water level, and if this exceeds normal operating levels, the compressor operation is interrupted to protect against drain pan overflow.
- **Anti-Short Cycle Timer**—5 minute delay on break timer to prevent compressor short cycling.
- **Random Start**—Each controller has a unique random start delay ranging from 270 to 300 seconds after power is applied to the board. This will prevent the simultaneous start of multiple units after a power outage.
- **Low Pressure Bypass Timer**—The low pressure switch is bypassed for 120 seconds after a call for compressor operation to prevent nuisance low pressure lockouts during cold start-up in the heating mode.
- **Brownout/Surge/Power Interruption Protection**—Prevents compressor operation should the voltage drop below 10% of unit rated value. The unit will restart once the voltage is within tolerance and the random start has timed out.



DDC Control Board

RS Base DDC Sensor

RS Plus DDC Sensor

RS Pro DDC Sensor

- **Malfunction (Alarm) Output**—The controller has a set of contacts for remote fault indication. This can be either a steady output or can be set to pulse with the fault code. Two connections are available; one to provide a 24 volt output, the other to provide a dry contact.
- **Test Service Mode**—A dip switch setting is provided to reduce all time delay settings to 10 seconds maximum during troubleshooting for verification of unit operation.
- **LED Fault Indication**—Two LED indicators are provided as follows:
  - **Green**: Power LED indicates 18 – 30 VAC present at the board.
  - **Red**: Fault indicator with blink codes identifying the particular fault. This information is available via the malfunction (alarm) output contacts.

    1 Blink - High Pressure
    2 Blinks - Low Pressure
    3 Blinks - High Pressure (2-stage)
    4 Blinks - Low Pressure (2-stage)
    5 Blinks - Low Fluid Temperature
    6 Blinks - Condensate Overflow
    7 Blinks - Brownout condition
  - **Intelligent Reset**–If a fault condition is initiated, the 5 minute delay on break time period is initiated and the unit will restart after this delay expires. The UPM is configurable for either 2 or 4 fault occurrences before going into a hard lockout. The selection is made through a dip switch setting on the board. If the fault condition still exists or reoccurs twice or four times within one hour, the unit will go into a hard lockout and requires a manual lockout reset. A condensate overflow fault will, however, put the unit into a hard lockout immediately.
- **Lockout Reset**–A hard lockout can be reset by turning the unit thermostat off and then back on or by shutting off unit power at the circuit breaker. The method of reset is selectable by the dip switch on the board.

DDC Controls (Option)

The optional FHP factory mounted DDC Controller is preprogrammed and installed on the unit with the Unit Protection Module (UPM) to be job site ready. The unit will operate in a 100% stand-alone control mode or connect to a Building Automation System (BAS) using open protocols BACnet™, Modbus, N2 or LonWorks® (with an optional Lon card). Stand-alone DDC modules must use remote intelligent sensors and are to be programmed by the FHP BACview® controller only.

Zone temperatures, leaving air temperatures and water temperatures can be monitored from the central control computer and unit fault indication displayed.

Available inputs/outputs include:

- Discharge air temperature
- Leaving water temperature
- Fan run time
- Override time remaining
- Night setback status
- Percent of units cooling
- Percent of units heating
- Cooling set point
- Heating set point
- Status of all the alarms
- Space temperature
- Occupied heating and cooling set points
- Continuous or cycle fan during occupied mode
- Command for occupied or unoccupied mode
- Command for override of the unoccupied mode (unit resorts to occupied set points)
- Set point adjustment

ZS Base
DDC Zone Sensor (ZS)

ZS Plus
DDC Zone Sensor (ZS)

ZS Pro
DDC Zone Sensor (ZS)

DDC Room Sensors

To complement the controller, Bosch offers a line of intelligent space sensors, which provide precision measurement and communication capabilities in an attractive low profile enclosure. A hidden communications jack provides access to the HVAC control system for commissioning and maintenance.

Models available include:

- **The RS Pro** has a large LCD display and easy-to-use occupant controls for set point adjustment.
- **The RS Plus** offers a local set point adjustment and override to an occupied mode and LED indication of current status.
- **The RS Standard** which has no local temperature set point adjustment.

A BACview® handheld diagnostic tool is available to allow local access to display and modify user defined properties without any computer software. These space sensors will monitor, sense and provide local control for the room.

BACview® Handheld Diagnostic Tool

DDC Zone Sensors*

The Pro Zone Sensor (ZS) has an LCD screen that can display the current temperature and set temperature. It can also display relative humidity and CO_2 settings as well as their current readings. It comes with a button for additional information that can be displayed.

The Pro ZS can be ordered in any of the following combinations:

- Temperature setting only
- Temperature with relative humidity settings
- Temperature, relative humidity, and CO_2 settings

The Plus Zone Sensor (ZS) has a little different look to it. It has a occupied indicator that identifies the sensor to be operating in occupied conditions. It comes with a slide bar of for some manual temperature control in the occupied mode +/- setting can be adjusted during commissioning.

The Plus ZS can be ordered in any of the following combinations:

- Temperature setting only

The Base Zone Sensor (ZS) is limited to only sensing capabilities without local controllability.

The Base ZS can be ordered in any of the following combinations:

- Temperature sensor
- Temperature and relative humidity sensor

* DDC Zone Sensors available through Applications Special Handling Sheet. When the Zone Sensors (ZS) are available as a standard option they will replace the Room Sensors (RS).

Additional Features

- 100VA transformer
- Belt drive, inverter duty fan motor
  - HP 7.5, 10, 15, 20
  - Up to sixteen different direct drives selectable
- TXV
- Dual freeze sensor for airside and waterside
- Condensate over flow switch
- Reverse cycle
- Hot gas bypass

Water Connections

All water connections are heavy-duty bronze FPT fittings. This allows connecting to a flexible hose kit without the use of a backup wrench making for easier, faster installation. Hose kits are recommended between the unit and system loop piping. This will help eliminate the transmission of vibration and noise from the unit to the space. Insure hoses are fire rated fiber, reinforced EPDM Stainless Steel braided hoses with swivel connections.

Additional Options

- VFD controlled VAV
- 100% outside air capability
- EMS relay
- Blower monitor relay
- Compressor monitor relay
- Phase monitor
- Pump/valve relay
- Boilerless control
- Flow proving switch
- Fire alarm relay/dual power
- Wire to 208V
- Hot gas reheat, on/off
- Hot gas bypass
- Hot gas reheat, modulating
- Inverter
- DDC – multi-protocol
- DDC – LonWorks
- Economizer with 3 way valve and controls
- Hot water coil

Flow Proving Switch
(Fluid Differential Pressure Switch)

Flow Proving Switch (DPS)

The function of the low proving switch (differential pressure switch) is to prevent or stop compressor operation should the water supply fail. This will prevent the unit from locking out on a safety requiring a manual reset to restart. This will minimize any unneeded service calls and allow for your unit to be protected. This optional control is internally mounted and factory installed. The switch is piped between the water entering and leaving connections. Should the pressure drop across the water to refrigerant heat exchanger fall below set value, the switch will open de-energizing the compressor. The blower operation will not be affected by this option.

Energy Management Switch (EMS)

This switch allows you to connect to an energy management system that can turn the unit off and on. Energy management systems are commonly used by individual commercial entities to monitor, measure, and control their electrical building loads. Energy management systems can be used to centrally control devices like HVAC units and lighting systems across multiple commercial applications sites.

Boilerless Control

This option will activate an electric heater (internal or external of the unit) and disable the compressor should water temperature drop below set point. This will provide the unit to function without a boiler heating the water for space heating.

MC Model, VL Configuration (low-boy)
Side View (SBF) with Panels Removed

Variable Air Volume (VAV)

MC Models are available with a factory installed variable frequency drive package for modulating the airflow in response to changes in the system duct static pressure. VAV units have the ability to control temperatures in areas of different loading such as the interior and exterior zones of a building. Only the volume of air that is required to satisfy the space load is delivered providing significant savings in energy. Typically the system is designed to provide supply air at a constant temperature through the control of discharge air temperature. VAV terminals in the space modulate open or closed as the load varies increasing or reducing the airflow to satisfy the demand.

Hot Gas Reheat

Hot gas reheat (HGR) allows the user to not only control space temperature, but also humidity levels within the conditioned space. Excessive moisture in the space can promote mold growth leading to damage in the structure or interior surfaces, as well as reducing the air quality and creating an unhealthy environment.

Possible causes of excess humidity could be by the unit having to operate under a widely varying load, an over- sized short cycling unit, a high percentage of unconditioned outside air being introduced into the space, a high latent load in the space or any location where humidity infiltration is a problem.

Typical unit control is by a wall mounted thermostat that senses temperature in the occupied space. By utilizing a humidistat in addition to the thermostat, we are able to monitor the humidity levels in the space as well. The HGR option allows cooling and dehumidification to satisfy both the thermostat and humidistat while preventing over cooling of the space while in the dehumidification mode.

Once the thermostat reaches set point temperature and the humidity is above set point, the unit controller will energize the reheat valve operating the unit in hot gas reheat mode, first cooling and dehumidifying, then reheating the air using hot refrigerant gas before delivering it to the space, usually 2° to 5° F below room temperature. The unit is operating as a dehumidifier. By reheating the air along a constant sensible heat line, the relative humidity of the leaving air is reduced. This option offers significant energy savings over the traditional means of reheating air with electric heating coils.

The moisture removal capacity of a specific heat pump is determined by the unit latent capacity rating. A heat pump's latent capacity can be determined by reviewing the heat pump specification data sheets. Depending upon the entering water and air conditions, a total and sensible capacity can be interpolated from the data sheets. Subtracting sensible capacity from total capacity yields latent capacity. Dividing the latent capacity by 1069 (BTU/LB of water vapor at 80° DB and 67° WB) yields the amount of moisture removal in pounds per hour.

Refrigerant Flow Path

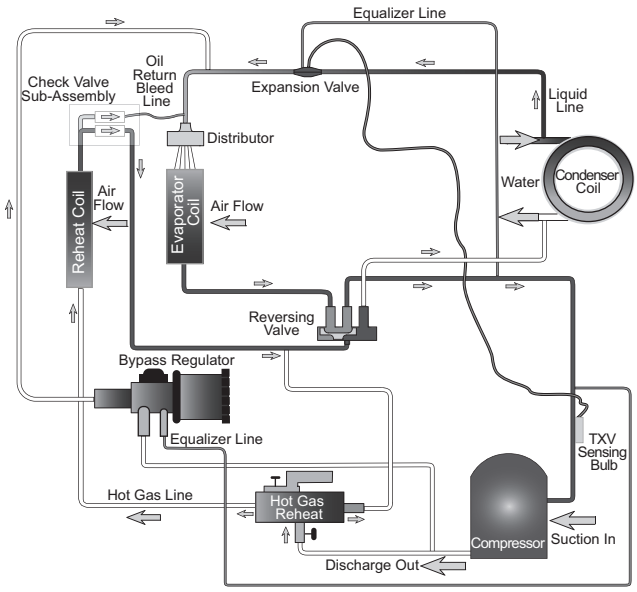


Figure 3

A hot gas reheat valve and a reheat coil are included in the refrigerant circuit. The refrigerant circuit in the cooling and heating mode is identical to a standard heat pump.

In the reheat mode, the compressor discharge gas is diverted through the reheat valve to the reheat coil which is located downstream of the cooling coil. The superheated refrigerant gas reheats the air leaving the cooling coil. The hot refrigerant gas then passes though the water to refrigerant coil where it is condensed to a liquid. From this point the rest of the cooling cycle is completed as in a regular heat pump. There are two check valves to prevent refrigerant flow into the reheat coil during standard cooling/heating cycles. A small copper bleeder line is connected to the outlet line of the reheat coil and between the expansion valve outlet and distributor to the air coil. This line is necessary to let any liquid/oil that may have migrated to the reheat coil during reheat to escape during standard cooling/heating modes. (See Figure 3).

Hot Gas Reheat Sequence of Operation – On/Off Control

The sequence of operation in the cooling and heating mode is the same as a regular heat pump.

In the reheat mode, on a call from the humidistat, the reheat relay coil is energized through the “H” circuit. The cooling relay remains de-energized enabling the reheat solenoid. The blower relay, reversing valve and compressor contactor are energized through contacts on the reheat relay. (Note: The reheat mode always operates in the cooling mode.) Should the temperature in the space increase above set point, the compressor terminal Y is energized, which will de-energize the reheat valve putting the unit into straight cooling mode. A call for cooling or heating will always take precedence over hot gas reheat.

Sequence of Operation - Modulating Hot Gas Reheat (MHGRH)

Modulating Hot Gas Reheat differs from On/Off in that the reheat function is always active. The purpose of MHGRH is to deliver air at or close to neutral conditions. Air is cooled and dehumidified by the cooling coil to around 55° F DB/54° F WB. The reheat coil raises the air stream temperature to a specified temperature (adjustable) and reduces relative humidity; delivering neutral air to the space. A sensor located in the supply air stream is set at the required leaving dry bulb temperature and will send a signal to the modulating hot gas reheat valve to direct the flow of hot gas to maintain that temperature. See psychrometric chart diagram (Figure 4). A typical application for this would be in treating 100% outside air. This air would be ducted directly into the space relieving the unit handling the zone of any outside air load. This can result in a smaller zone unit, less air flow and a savings in both initial and operating costs. Control of the hot gas modulation is by the wall mounted thermostat or the unit mounted DDC. A separate controller is used to control the unit itself.

Hot Gas Reheat Control Options

There are several ways to control heat pumps with hot gas reheat. You should choose the means that best suits your specific application. Please refer to the Hot Gas Reheat wiring diagrams for typical thermostat wiring. Most heat pump compatible thermostats in conjunction with a humidistat are acceptable for use, (Note: “O” output for reversing valve energized in cooling mode is required.) Combination thermostat/humidistat are also available.

Special Considerations

Some applications require special attention to maximize the performance of the hot gas reheat function:

- Low Temperature Well Water
- Indoor Pool Dehumidifying During Winter Months (Re: Heating Mode)

Consult Bosch Thermotechnology Corp. for special application considerations.

Low Temperature Well Water

When low temperature well water is utilized as the water source (below 55°F), a means of establishing two flow rates, one for the cooling/reheat mode and one for heating mode is recommended. In the cooling mode at low entering water temperatures and standard flow rates, discharge pressures and corresponding discharge gas temperatures are relatively low. At these conditions, when the reheat mode is initiated, the low temperature discharge gas can reduce reheat capacity. A means to reduce the water flow rate and elevate the discharge pressure/ temperature in cooling/reheat mode should be provided. Conversely, at low entering water temperatures in the heating mode, system suction pressure is reduced causing a loss in heating capacity. A means of providing higher flow in the heating mode should be provided. The simplest way to accomplish the above is to install water regulating valves.

Indoor Pool Dehumidifying During Winter Months

It is important to remember that when in the reheat/ dehumidification mode the heat pump is cooling and reheating. A secondary means of heating the space during the dehumidification mode should be provided. The indoor space temperature should be kept at least 2° F above the pool water temperature. If this is not done the warm pool water attempts to heat the space and the humidity levels increase exponentially. The heat pump is normally sized to handle the design latent load moisture removal. A second heat pump or resistance heat should be provided to handle the structures shell loss load.

Protective coatings are highly recommended for all pool applications, due to the highly corrosive chemical environment.

Psychrometric Chart

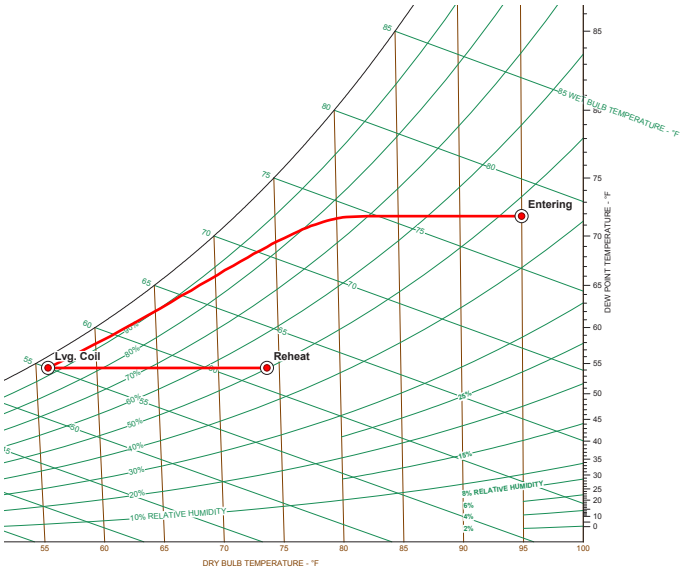


Figure 4

Hot Gas Bypass

The function of the hot gas bypass valve is to prevent icing of the air coil when the unit is operating at low load conditions or low airflow conditions (i.e. VAV). This situation could arise if the space experiences widely different loads, for example a conference center. Without a hot gas bypass circuit the evaporating temperature will fall and ice could form on the coil restricting air flow and aggravating the situation. Eventually the coil could be totally blocked resulting in possible refrigerant liquid entering the compressor and failure of the system. The hot gas bypass valve located in the compressor discharge line diverts hot gas to the inlet of the air coil. The valve is factory set to open when the evaporating pressure falls to 75 PSI and will modulate to prevent the pressure falling any lower. This setting is field adjustable and this set point may be adjusted as required.

Thermostats

Waterside Economizer

A Couple Common Waterside Economizer Applications

- **Commercial application** where perimeter heating is taking place while core cooling is required. Perimeter heat pumps operating in the heating mode extract heat from the building loop, thus dropping the building loop fluid temperature. Internal core cooling requirements are usually high even in the winter months due to people, lighting, and equipment loads. The moderate temperature loop water circulated through a core heat pump's waterside economizer coil can provide free-cooling without the use of mechanical cooling (Compressors). Also, there are many areas where local code requires some type of economizer cycle. Waterside Economizers in lieu of air side economizers are an inexpensive way to satisfy code requirements in commercial applications.

- **Tenant build out commercial applications** where the central chilled water fluid loop serves as a individual zoned heat pump condenser water. In this application low temperature fluid is always available for free-cooling.

- **Hot Water Heating or Chilled Water Cooling**
  The standard Waterside Economizer package is fully piped and wired internal to the unit. In special applications, the coil internal economizer piping an diverting valve can be designed out and removed, enabling the coil to be connected to an external hot or chilled fluid supply.

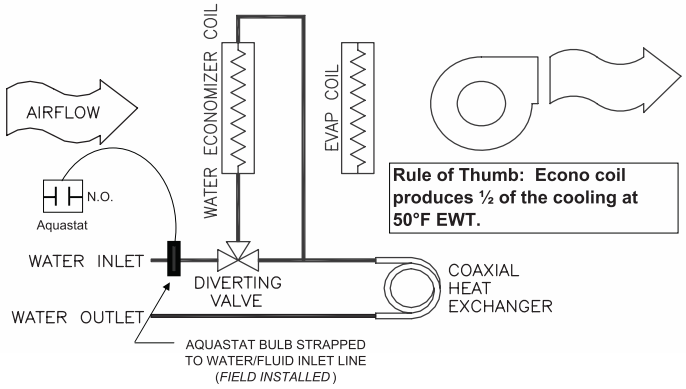


Figure 6

Accessories

Thermostats

The MC Model control may be as simple as lone multi-stage thermostat or the unit may have a DDC controller integrated into the building management system. All external low voltage control wiring is made to the thermostat terminal located in the unit electrical box. Thermostats may be manual change over, auto change over, programmable or non-programmable depending on the requirements of the project. A full line of thermostats are available from Bosch.

Systems

The MC Model may be used in a variety of different applications depending on the system design. An overview of tower/boiler and geothermal systems is given below. There could be several variations and combinations of these systems.

Cooling Tower/Boiler Systems

Water source heat pumps with cooling tower/boiler systems have been used for many years and are recognized as having a low installation cost and providing more energy efficient operation than most other systems on the market.

In a typical building, each office or space would receive its own heat pump. This ensures that the unit will independently satisfy the heating or cooling requirements for that space irrespective of the requirements of any other space. Unlike some other systems, this offers individual control and enhanced comfort in all areas.

All the units are connected to a common water loop containing, in addition to the heat pumps, a cooling tower, boiler, a primary and standby pump and a loop water temperature controller. In the summer cooling mode, the units are cooling and rejecting heat to the water loop. This heat is then rejected to the atmosphere through a cooling tower. In winter, heat is taken from the loop and, together with the compressor's heat of compression, used to heat the space. The heat removed from the loop is then replenished by the boiler. The loop water temperature controller will keep the fluid within certain temperature limits typically 70° F in winter and 85° F in summer by cycling either the cooling tower or boiler operation.

In today's modern buildings the interior core usually has a net cooling requirement year round irrespective of the outside temperature. This is due to the internal heat gains from people, office equipment and lighting. The heat from heat pumps operating in cooling is rejected to the common water loop and is absorbed by heat pumps on the building's perimeter that are in the heating mode. In effect the system is transferring energy around the building areas from where it is in excess to those areas where it is needed. In many instances we find a balanced system where the heat generated in the interior space is sufficient to heat the perimeter, resulting in neither the cooling tower nor boiler operating. This concept, unique to a water source system, provides the most energy efficient system on the market.

Geothermal Systems

The earth has a tremendous capacity of storing thermal energy, which can be utilized to heat or cool a building.

A geothermal system offers all the benefits of a cooling tower and boiler system with the additional advantage of having overall greater energy efficiency. As the cost of energy increases, geothermal installations are becoming the system of choice by developers and design engineers.

There are several alternative methods of utilizing the energy contained in a geothermal system, giving the design engineer several options for selecting the one that is right for a particular application.

Earth Coupling Options

Ground Loop Systems (Closed Loop)

Lengths of high density polyethylene piping are buried in the earth either in vertical bore holes or horizontal trenches depending on the space available.

Fluid from the loop inside the building circulates through these pipes either rejecting heat to the ground when there is a net cooling requirement or absorbing heat from the ground when heating is the dominant requirement.

The temperature of the earth below 6 feet is relatively constant and is not affected by the ambient temperature. For this reason, the ground temperature is cooler than the summer ambient and warmer than the winter ambient in most regions. Geothermal systems are able to operate effectively in extreme ambient conditions exceeding 100°F in summer and -30°F in winter. This is one of the reasons why geothermal systems have such an advantage over other systems. An additional advantage is that no fossil fuels are used, reducing the carbon emission of the building.

Even in areas which are cooling or heating dominant a hybrid system can be used with a downsized cooling tower or boiler. This system will reduce the installed cost significantly with only a modest impact on overall operating efficiency.

Geothermal systems may cost more to install but the savings in energy and low maintenance costs more than off set this with payback times typically five years or even less.

Vertical Ground Loop System

This method is used mainly in commercial buildings or where space for a loop field is limited. Vertical holes 100 to 400 feet deep are drilled in the ground, and a single loop of high density polyethylene pipe with a U-tube at the bottom is installed. The bore hole is then sealed with grout to ensure good contact for heat transfer with the soil. The size of the project will determine how many bore holes are required. The vertical ground loops are then connected to a horizontal header pipe that carries fluid to the building and circulated to each heat pump. The Earth's temperature is stable below the surface which is an advantage for this system and provides for the greater efficiency. Vertical ground loop fields may be located under buildings or parking lots. The life expectancy is in excess of 50 years.

Horizontal Ground Loop System

This type is cost effective on smaller projects or where there is sufficient space for the loop field. Trenches, three to six feet deep are dug in which a series of high density polyethylene pipes are laid. These loops are manifolded and connected to the loop inside the building which feeds the heat pumps. The fluid is then circulated, absorbing or rejecting heat to the earth depending on the requirement for heating or cooling.

Typical Heat Pump System

Surface Water, Lake or Pond System

This type of design is economical when a project is located near a body of water. Fluid circulates through polyethylene piping in a closed system, just as it does through ground loops, but in this case, underwater. The pipes may be coiled in a slinky to fit more surface into a given amount of space. The lake needs to be a minimum size and depth depending on the building load. Lake loops have no adverse impact on the aquatic system. Specialized lake heat exchangers are also available for this application. New technology is emerging for stainless steel and titanium heat exchangers.

Well Water System

This type of installation is only possible if there is sufficient ground water available in a well. The water must be of good quality. Local codes may limit the use of this system in certain areas. The arrangement is referred to as an open system which means that water is pumped directly from the source into the geothermal unit and then discharged either into a return well or a body of water. The water quality is unaffected other than a change in the temperature. Refer to the installation manuals for water quality guidelines.

Typical Heat Pump Operation

Cooling Mode

In the cooling mode, hot high pressure refrigerant gas is pumped from the compressor to the water-to-refrigerant heat exchanger via the reversing valve. Water, or an anti-freeze solution, flowing through the water-to-refrigerant heat exchanger transfers heat from the refrigerant to the fluid raising the fluid temperature while condensing the hot gas into a liquid. This liquid refrigerant then flows through a metering device, where the refrigerant is expanded to a cold liquid, to the air-to-refrigerant heat exchanger coil.

The air-to-refrigerant heat exchanger cools and dehumidifies air by evaporating the liquid refrigerant. The cooling cycle is completed when the refrigerant flows as a low pressure gas through the reversing valve and back to the suction side of the compressor. Cool dehumidified air is circulated to the space maintaining comfort conditions.

Heating Mode

During the heating mode, the high pressure refrigerant gas is pumped from the compressor to the air-to-refrigerant heat exchanger coil via the reversing valve. In the air-to-refrigerant heat exchanger coil, the heat is removed by the air that passes over the coil surface, and the hot gas condenses into a liquid.

The heated air is ducted to the space and provides heating for the building. The refrigerant liquid then flows through a metering device to the water-to-refrigerant heat exchanger. Water, or an anti-freeze solution, circulates through this heat exchanger and is cooled by the evaporating refrigerant which evaporates into a gas. The heating cycle is completed when the refrigerant flows as a low pressure gas through the reversing valve and back to the suction side of the compressor.

Typical Unit Installation

Water-to-Air Heat Pump Cycle — Cooling

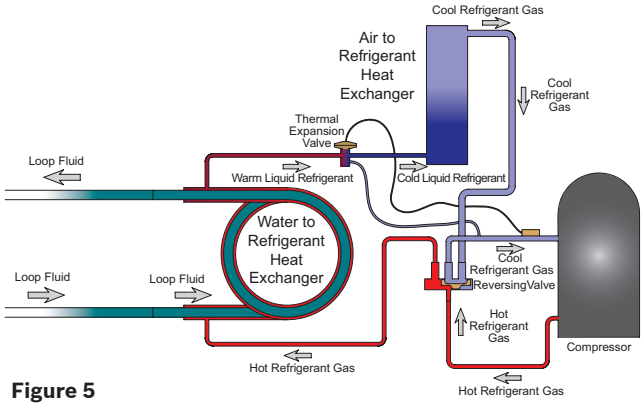


Figure 5

Water-to-Air Heat Pump Cycle — Heating

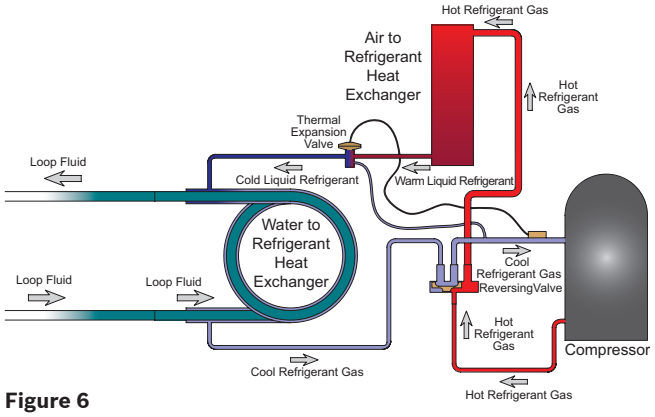


Figure 6

Unit Location

Any mechanical device will, at some point in time require servicing and repair. With this in mind sufficient space must be provided around the unit for service personnel to perform maintenance or repair.

Units are not designed for outdoor installation. Avoid locations where the unit may be exposed to freezing conditions or where the humidity levels could cause condensation on the unit panels for example when exposed to outdoor ambient conditions.

Vertical Unit Installation

The vertical high and low units are normally installed in a mechanical plant room. If installed in a close and confined space, ensure adequate space for return air to the unit is available. In addition, sufficient service space for filter replacement, access to compressor, motors and other components is necessary.

Assure that the floor is structurally strong enough to support the weight of the equipment with minimum deflection. A good, level floor is required to insure proper fit-up and alignment of all bolt together and union coupled modules. Isolation springs should be utilized to minimize sound and vibration transmission.

Avoid direct line of sight to the unit. Install a sound-baffle over any door that has a return air grille.

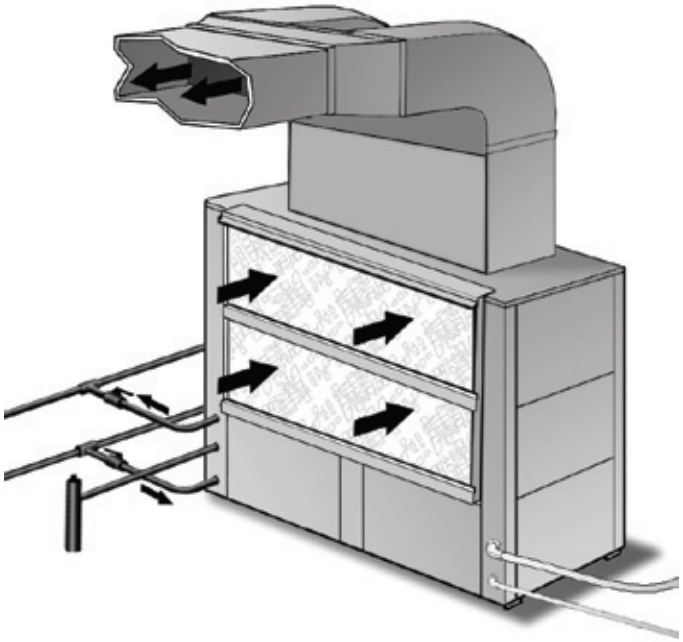


Figure 7: "Low-Boy" (Intention is to show a basic example of ductwork installation, always adhere to local codes and standards)

Typical Unit Installation

Ductwork and Sound Attenuation Considerations

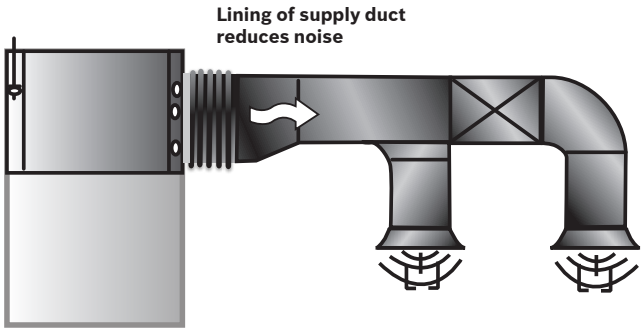


Figure 8: Supply Air Ducting (Intention is to show a basic example of ductwork installation, always adhere to local codes and standards)

Sound is becoming an increasingly important factor in all HVAC installations. The MC Model has been designed to minimize sound, but sound acoustical design plays an important part of the sound level in the space.

Most of the problems associated with HVAC generated sound can be avoided by paying close attention to duct design and equipment placement.

A discharge flange is provided on all vertical high models for fastening of ductwork. We recommend using a flexible collar between the discharge flange and the duct transformation to reduce vibration transmission from the cabinet and to simplify disconnection of the unit from the ceiling ductwork.

Return air to the unit could be either free return or ducted. The filter rack is provided with a flange should a ducted return be used. We recommend using a flexible collar between the return flange and the duct transformation to reduce vibration transmission from the cabinet and to simplify disconnection of the unit from the ductwork.

Sound is transmitted down the ductwork and it is important to avoid direct line of sight between the unit and the space, both on the return or supply side. To accomplish this, design the duct runs with two 90° turns.

As a general recommendation, duct interiors should have an acoustic / thermal lining of least ½" thick over the entire duct run or a minimum of the first 5 feet of the supply trunk.

Line the last five diameters of duct before each outlet with a one-inch thick sound blanket. Line elbows and transition pieces, as well as a short distance upstream and downstream of the fittings.

Elbows, tees and dampers can create turbulence or distortion in the airflow. Using aerodynamic fittings will help in reducing this effect. Place a straight length of duct, 5 to 10 times the duct width, before the next fitting to smooth out airflow.

Diffusers that are located in the bottom of a trunk duct can also produce noise.

Balancing dampers should be located several duct widths upstream from an air outlet.

Ductwork should be mounted and supported using isolation devices that absorb vibration.

Applications such as Hotel, Motel, Dormitory or Nursing Home that use a single duct discharge are susceptible to noise. These applications typically have low static pressures and short duct lengths. In these applications the discharge duct must be fully lined and have a square elbow without turning vanes. A velocity not exceeding 500 to 600 fpm is recommended. Return air for these applications should enter through a sidewall grille and route up the stud space to a ceiling plenum.

Piping

The water loop system is typically designed using a "reverse return" piping system which includes a flow control device so that flow requirements are met for each zone. A high pressure stainless steel flexible hose kit is recommended to connect the unit to the building's hard piping and acts as a sound attenuator for both the unit operating noise and hydraulic pumping noise. One end of the hose has a swivel fitting to facilitate removal of the unit for replacement or service.

Hose kits come in several configurations, but in all cases should include supply and return shutoff ball valves to allow removal of a unit without the need to shut down the entire heat pump system. The hose kit may contain either a manual or automatic flow control that may be preset to ensure correct water flow to the unit.

Other components of the hose kit may be a Y-strainer to prevent dirt from fouling the water coil. A blow down valve is recommended with the Y-strainer.

Many installations today use variable frequency drives on the water loop pump as an energy saving measure. This requires the flow to the unit be shut off when it is not operating. This can be accomplished by including a 2-way solenoid valve in the hose kit, which is field wired to open when the compressor is energized. A factory supplied, internal 2-position solenoid valve is also an option. Pressure / Temperature ports should be included in these fittings to allow the service technician to measure water flow and temperatures when checking unit operation.

Condensate Drain Piping

Condensate piping can be made of steel, copper or PVC pipe. In most cases, PVC pipe eliminates the need to wrap insulation around the pipe to prevent sweating.

A condensate drain connection is installed in the unit. The condensate piping must be trapped at the unit and pitched away from the unit not less than ¼" per foot. A vent is required after the trap so that the condensate will drain away from the unit. The vent can also act as a cleanout if the trap becomes clogged. The condensate drain should not be directly piped to a drain/waste/vent stack. See local codes for the correct application of condensate piping to drains.

Operating Limits

The MC Models are capable of operating over a wide range of conditions. For operation in a geothermal application or any other installation where the loop fluid temperature may drop below the ambient dew point, the extended range option is recommended. This consists of additional insulation on the piping to prevent condensation.

- Maximum and minimum fluid conditions are at unit rated flow rate.
- Maximum and minimum operating limits may not be combined. If one value is at either maximum or minimum, the other two should be at normal operating range.
- Entering fluid temperatures below 45°F in the heating mode require antifreeze.

Equipment Selection

To ensure that you get the optimal performance from your FHP heat pump it is important that they be selected accurately to match your design conditions.

Prior to making equipment selections the zone conditions need to be determined. Bosch Thermotechnology Corp. recommends using a building load program to determine the heating and cooling loads.

The catalog provides a wide range of entering air and water conditions that will meet most applications. The unit performance can be determined by referring to the data tables from page 25 to 29.

Our Bosch Select Tools Selection Software (BST) is designed to provide you with a fast and accurate selection based on your specific conditions. This software is available through the commercial website. You may click on the BST link and request an account.

Unit Operating Limits—MC Model

Operating Limits – Cooling & Heating	Standard Unit	Extended Range Option
Cooling		
Minimum ambient air temperature	50	50
Maximum ambient air temperature	100	100
Minimum evaporator entering air db/wb °F	68/57	68/57
Rated air coil entering air db/wb °F	80/67	80/67
Maximum evaporator entering air db/wb °F	95/85	95/85
Minimum water coil entering fluid temperature °F	50	50
Water loop typical coil entering fluid range temperature °F	70/90	70/90
Maximum water coil entering fluid temperature °F	110	110
Heating		
Minimum ambient air temperature °F	50	40
Maximum ambient air temperature °F	100	85
Minimum evaporator entering air db °F	50	50
Rated air coil entering air °F	68	68
Maximum evaporator entering air db °F	80	80
Normal water coil entering fluid range °F	50-80	25-80
Minimum water coil entering Fluid °F	50	30*

*Antifreeze solution is required at these fluid temperatures.

Antifreeze Correction Data

Antifreeze Correction							
Antifreeze Type	Antifreeze %	Cooling			Heating		WPD Correction Factor EWT 30 °F
		Avg. Water Temp 90 °F			Avg. Water Temp 30 °F		
		Total Cap.	Sens. Cap	Power	Htg. Cap	Power	
Water	0	1.000	1.000	1.000	1.000	1.000	1.000
Propylene Glycol	5	0.997	0.997	1.004	0.989	0.997	1.060
	10	0.994	0.994	1.006	0.986	0.995	1.125
	15	0.990	0.990	1.009	0.978	0.988	1.190
	25	0.983	0.983	1.016	0.960	0.979	1.300
Methanol	5	0.997	0.997	1.003	0.990	0.997	1.060
	10	0.996	0.996	1.005	0.979	0.993	1.100
	15	0.994	0.994	1.008	0.970	0.990	1.140
Ethanol	5	0.998	0.998	1.002	0.981	0.994	1.160
	10	0.996	0.996	1.004	0.960	0.988	1.230
	15	0.992	0.992	1.006	0.944	0.983	1.280
	25	0.986	0.986	1.009	0.917	0.974	1.400
Ethylene Glycol	5	0.997	0.997	1.003	0.993	0.998	1.060
	10	0.995	0.995	1.004	0.986	0.996	1.120
	15	0.992	0.992	1.005	0.980	0.993	1.190
	25	0.988	0.988	1.009	0.970	0.990	1.330
	30	0.985	0.985	1.012	0.965	0.987	1.400

Waterside Pressure Drop

Model	GPM	Economiser		Hot Water Coil		Hot Water Coil	
		Pressure Drop (PSIG)	Pressure Drop (ft of H2O)	Pressure Drop (PSIG)	Pressure Drop (ft of H2O)	Pressure Drop (PSIG)	Pressure Drop (ft of H2O)
MC360	60	3.9	8.9	5.7	13.1	1.8	4.2
	70	5.1	11.7	7.8	17.9	2.5	5.7
	80	6.5	14.9	10.2	23.5	3.3	7.5
	90	8.0	18.4	12.9	29.8	4.1	9.5
MC480	90	3.7	8.6	3.2	7.3	1.1	2.6
	100	4.5	10.4	3.9	9.1	1.3	2.9
	110	5.3	12.3	4.8	11.0	1.5	3.5
	120	6.2	14.4	5.7	13.1	1.8	4.2
MC600	120	3.8	8.8	5.7	13.1	1.8	4.2
	130	4.4	10.2	6.7	15.4	2.1	4.9
	140	5.1	11.7	7.8	17.9	2.5	5.7
	150	5.7	13.2	8.9	20.6	2.9	6.6
MC720	150	5.7	13.2	8.9	20.6	2.9	6.6
	160	6.4	14.8	10.2	23.5	3.3	7.5
	170	7.2	16.6	11.5	26.5	3.7	8.5
	180	8.0	18.3	12.9	29.8	4.1	9.5

NOTE: Based on 70°F

Capacity Data

MC360 (12000 CFM)

Cooling									Heating						
Entering Fluid Temp (°F)	Water Flow (GPM)	Pressure Drop PSI (FOH)	Entering Air Temp (db/ wb) °F	Total Capacity (MBTUH)	Sensible Capacity (MBTUH)	Heat of Rejection (MBTUH)	Power Input (kW)	EER	Entering Fluid Temp (°F)	Pressure Drop PSI (FOH)	Entering Air Temp (°F)	Total Capacity (MBTUH)	Heat of Absorption (MBTUH)	Power Input (kW)	COP
50	45	2.5 (5.8)	75/63	437.0	327.9	501.7	19.9	21.9	30	2.8 (6.6)	60	280.9	211.6	19.5	4.2
			80/67	463.1	337.4	530.3	20.5	22.6			70	276.5	200.3	21.7	3.7
			85/71	490.3	345.0	560.1	21.0	23.3			80	272.8	187.2	24.1	3.3
	60	4.2 (9.7)	75/63	446.7	332.2	509.2	19.0	23.5		4.8 (11.0)	60	290.8	220.7	19.7	4.3
			80/67	473.9	341.2	538.9	19.5	24.3			70	286.2	207.9	21.9	3.8
			85/71	501.1	350.2	568.3	20.0	25.1			80	281.3	195.2	24.3	3.4
	90	8.7 (20.0)	75/63	456.9	335.8	517.4	18.1	25.2		9.9 (22.9)	60	302.4	231.1	20.0	4.4
			80/67	484.4	346.0	547.0	18.5	26.1			70	297.0	217.7	22.1	3.9
			85/71	514.2	353.7	579.2	19.0	27.0			80	290.8	204.1	24.6	3.5
60	45	2.4 (5.6)	75/63	420.5	320.3	489.4	21.7	19.4	40	2.7 (6.4)	60	314.8	243.3	20.3	4.6
			80/67	445.9	329.8	517.3	22.2	20.1			70	310.3	230.7	22.5	4.0
			85/71	472.0	338.4	546.1	22.8	20.7			80	306.5	219.3	25.0	3.6
	60	4.0 (9.3)	75/63	430.0	324.9	496.5	20.7	20.8		4.6 (10.7)	60	327.5	254.9	20.6	4.7
			80/67	456.5	333.8	525.4	21.2	21.6			70	322.2	241.5	22.8	4.1
			85/71	483.5	342.5	554.9	21.7	22.3			80	318.2	228.0	25.3	3.7
	90	8.4 (19.4)	75/63	439.9	328.5	504.1	19.7	22.3		9.6 (22.1)	60	342.4	268.2	20.9	4.8
			80/67	466.6	338.8	532.9	20.1	23.2			70	336.1	253.7	23.1	4.3
			85/71	494.8	347.9	563.4	20.6	24.1			80	329.5	240.0	25.6	3.8
70	45	2.3 (5.4)	75/63	403.4	312.9	477.3	23.6	17.1	50	2.5 (5.8)	60	362.7	288.0	21.4	5.0
			80/67	427.2	322.7	503.7	24.1	17.7			70	357.3	275.3	23.7	4.4
			85/71	452.0	332.4	531.1	24.7	18.3			80	352.0	260.8	26.2	3.9
	60	3.9 (9.0)	75/63	412.5	316.6	483.7	22.6	18.3		4.2 (9.7)	60	377.5	301.6	21.8	5.1
			80/67	437.2	326.6	510.8	23.0	19.0			70	370.7	288.9	24.0	4.5
			85/71	464.0	335.6	540.2	23.6	19.7			80	364.5	272.5	26.5	4.0
	90	8.1 (18.7)	75/63	422.1	320.7	490.8	21.6	19.6		8.7 (20.0)	60	394.3	316.6	22.2	5.2
			80/67	448.5	330.2	519.4	22.0	20.4			70	387.0	300.9	24.4	4.6
			85/71	475.7	340.0	548.9	22.4	21.3			80	378.3	285.4	26.9	4.1
80	45	2.3 (5.2)	75/63	385.8	304.6	465.7	25.9	14.9	60	2.4 (5.6)	60	405.8	329.9	22.5	5.3
			80/67	409.1	314.5	491.6	26.4	15.5			70	399.8	315.0	24.8	4.7
			85/71	432.0	325.2	517.0	26.9	16.0			80	394.4	299.9	27.4	4.2
	60	3.8 (8.7)	75/63	394.4	308.3	471.4	24.8	15.9		4.0 (9.3)	60	424.7	345.4	23.0	5.4
			80/67	418.7	318.2	498.1	25.2	16.6			70	417.1	329.2	25.3	4.8
			85/71	443.7	328.2	525.5	25.7	17.3			80	410.8	312.9	27.8	4.3
	90	7.8 (18.1)	75/63	402.8	312.7	476.8	23.7	17.0		8.4 (19.4)	60	444.9	363.0	23.5	5.6
			80/67	428.1	323.0	504.3	24.0	17.8			70	435.7	345.4	25.8	5.0
			85/71	455.0	332.5	533.6	24.5	18.6			80	425.9	329.2	28.3	4.4
85	45	2.2 (5.1)	75/63	375.9	301.4	459.1	27.1	13.9	70	2.3 (5.4)	60	452.8	373.5	23.7	5.6
			80/67	399.3	311.0	485.1	27.7	14.4			70	446.7	356.6	26.1	5.0
			85/71	421.9	321.6	510.4	28.2	15.0			80	439.9	341.5	28.7	4.5
	60	3.7 (8.6)	75/63	384.4	305.0	464.6	26.0	14.8		3.9 (9.0)	60	474.8	391.6	24.3	5.7
			80/67	408.2	315.2	490.6	26.4	15.5			70	466.0	373.9	26.6	5.1
			85/71	433.2	324.6	518.3	26.9	16.1			80	457.7	356.1	29.2	4.6
	90	7.7 (17.8)	75/63	393.2	308.7	470.3	24.8	15.8		8.1 (18.7)	60	498.4	412.1	24.9	5.9
			80/67	418.0	319.1	497.3	25.2	16.6			70	487.7	392.5	27.3	5.2
			85/71	443.6	329.4	525.2	25.6	17.3			80	477.5	372.9	29.8	4.7
90	45	2.2 (5.0)	75/63	366.7	297.6	453.5	28.4	12.9	80	2.3 (5.2)	60	502.0	418.9	25.1	5.9
			80/67	388.8	307.8	478.2	28.9	13.4			70	493.6	401.4	27.5	5.3
			85/71	411.5	318.0	503.6	29.5	14.0			80	485.7	383.5	30.1	4.7
	60	3.7 (8.5)	75/63	375.5	300.4	459.2	27.3	13.8		3.8 (8.7)	60	527.1	439.7	25.8	6.0
			80/67	398.8	310.6	484.9	27.7	14.4			70	516.8	420.3	28.2	5.4
			85/71	421.9	321.6	510.3	28.2	15.0			80	507.0	400.6	30.8	4.8
	90	7.6 (17.6)	75/63	384.1	304.0	464.6	26.1	14.7		7.8 (18.1)	60	554.1	462.9	26.5	6.1
			80/67	408.4	314.5	491.1	26.5	15.4			70	541.8	441.2	28.9	5.5
			85/71	433.6	324.5	518.5	26.9	16.1			80	529.8	419.4	31.5	4.9
100	45	2.1 (4.9)	75/63	347.3	289.6	442.2	31.3	11.1							
			80/67	368.6	300.1	466.1	31.8	11.6							
			85/71	390.8	309.5	491.0	32.4	12.1							
	60	3.6 (8.2)	75/63	356.0	292.1	447.5	30.1	11.8							
			80/67	377.5	303.5	471.3	30.5	12.4							
			85/71	399.5	313.7	495.5	31.0	12.9							
	90	7.4 (17.0)	75/63	364.2	295.5	452.4	28.9	12.6							
			80/67	387.4	306.3	477.7	29.3	13.2							
			85/71	411.2	316.9	503.7	29.6	13.9							
110	45	2.1 (4.8)	75/63	327.4	281.5	431.7	34.6	9.5							
			80/67	347.4	292.2	454.3	35.1	9.9							
			85/71	367.9	302.8	477.5	35.6	10.3							
	60	3.5 (8.0)	75/63	334.7	284.5	435.5	33.4	10.0							
			80/67	355.7	295.3	458.8	33.8	10.5							
			85/71	377.0	305.9	482.5	34.2	11.0							
	90	7.2 (16.6)	75/63	342.6	287.7	439.6	32.1	10.7							
			80/67	365.4	297.8	464.7	32.4	11.3							
			85/71	387.9	308.5	489.3	32.8	11.8							

Extended Range - Anti-freeze required

AHRI/ISO13256-1 certified performance is rated at entering air conditions of 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Tabulated unit performance does not include fan or pump power corrections required for AHRI/ISO standard performance ratings.

Unit performance may be interpolated. Extrapolation is not allowed.

For conditions other than rating conditions provided, consult the BST selection software.

Ratings below 40°F are with a methanol solution.

The results reported herein are estimates based on testing by FHP. Variations in the installation and operational environment may alter performance. Bosch disclaims all warranties, express and implied, that the performance will be as reported, including the warranty of merchantability and fitness for purpose. In addition, continuous research and development may result in a change to an appliances design and specifications, which Bosch may change without notice. Before purchase, confirm the design specifications of the appliance.

NOTE: Gross performance figures

Subject to change without prior notice.

Capacity Data

MC480 (16000 CFM)

Cooling									Heating						
Entering Fluid Temp (°F)	Water Flow (GPM)	Pressure Drop PSI (FOH)	Entering Air Temp (db/wb) °F	Total Capacity (MBTUH)	Sensible Capacity (MBTUH)	Heat of Rejection (MBTUH)	Power Input (kW)	EER	Entering Fluid Temp (°F)	Pressure Drop PSI (FOH)	Entering Air Temp (°F)	Total Capacity (MBTUH)	Heat of Absorption (MBTUH)	Power Input (kW)	COP
50	60	1.9 (4.5)	75/63	600.3	434.8	686.8	26.7	22.5	30	2.2 (5.1)	60	366.6	274.9	25.9	4.2
			80/67	636.5	446.7	725.5	27.2	23.4			70	361.3	259.4	28.6	3.7
			85/71	673.4	456.1	764.9	27.6	24.4			80	358.7	243.5	31.9	3.3
	80	3.2 (7.5)	75/63	614.4	441.0	699.4	25.9	23.7		3.7 (8.6)	60	381.7	288.3	26.2	4.3
			80/67	653.0	449.8	740.2	26.2	24.9			70	373.5	271.0	28.9	3.8
			85/71	690.8	462.0	780.1	26.5	26.1			80	370.3	254.8	32.2	3.4
	120	6.7 (15.6)	75/63	630.1	445.0	714.2	25.2	25.0		7.7 (17.8)	60	399.1	303.8	26.6	4.4
			80/67	668.8	457.9	754.7	25.4	26.3			70	388.0	284.4	29.3	3.9
			85/71	709.1	468.2	796.8	25.6	27.7			80	382.7	265.3	32.5	3.5
60	60	1.9 (4.3)	75/63	576.4	424.5	666.9	28.5	20.2	40	2.1 (4.9)	60	417.3	322.0	27.1	4.5
			80/67	612.1	435.1	705.4	29.1	21.1			70	410.3	305.0	29.8	4.0
			85/71	648.2	445.2	744.4	29.6	21.9			80	405.0	286.8	33.1	3.6
	80	3.1 (7.3)	75/63	590.2	430.4	678.2	27.4	21.5		3.6 (8.3)	60	435.9	338.7	27.5	4.6
			80/67	627.4	440.9	718.0	27.9	22.5			70	427.6	320.3	30.2	4.2
			85/71	665.1	451.1	758.1	28.2	23.6			80	419.5	300.6	33.5	3.7
	120	6.5 (15.0)	75/63	605.6	433.9	691.8	26.5	22.9		7.4 (17.2)	60	457.3	357.8	28.0	4.8
			80/67	643.3	447.0	731.6	26.8	24.0			70	447.2	337.6	30.7	4.3
			85/71	682.9	457.3	773.3	27.0	25.3			80	436.1	315.5	34.0	3.8
70	60	1.8 (4.2)	75/63	552.0	414.0	648.1	30.9	17.9	50	1.9 (4.5)	60	484.5	385.8	28.7	5.0
			80/67	586.9	423.6	686.1	31.5	18.7			70	476.1	367.7	31.5	4.4
			85/71	621.9	434.5	724.2	32.1	19.4			80	468.8	346.3	34.8	3.9
	80	3.0 (7.0)	75/63	565.8	417.3	658.9	29.6	19.1		3.2 (7.5)	60	505.9	404.5	29.1	5.1
			80/67	601.6	429.3	697.3	30.0	20.0			70	494.7	383.8	31.9	4.5
			85/71	638.0	440.6	736.4	30.5	20.9			80	486.1	362.3	35.3	4.0
	120	6.3 (14.5)	75/63	579.5	423.2	669.7	28.4	20.4		6.7 (15.6)	60	529.5	425.2	29.7	5.2
			80/67	617.1	435.3	709.6	28.7	21.5			70	513.2	401.5	32.5	4.6
			85/71	655.0	447.0	749.8	29.0	22.6			80	505.2	379.8	35.8	4.1
80	60	1.8 (4.0)	75/63	527.5	399.9	631.3	33.8	15.6	60	1.9 (4.3)	60	545.1	442.6	30.1	5.3
			80/67	560.6	412.3	667.6	34.4	16.3			70	535.3	421.4	33.0	4.8
			85/71	594.5	423.8	704.8	35.1	17.0			80	526.9	399.9	36.5	4.2
	80	2.9 (6.8)	75/63	540.2	405.4	640.0	32.3	16.7		3.1 (7.3)	60	570.4	464.5	30.6	5.5
			80/67	573.8	420.1	676.4	32.8	17.5			70	557.7	442.3	33.6	4.9
			85/71	609.9	429.9	715.5	33.3	18.3			80	545.5	418.4	37.0	4.3
	120	6.1 (14.1)	75/63	553.5	410.9	649.7	30.9	17.9		6.5 (15.0)	60	598.2	488.8	31.3	5.6
			80/67	588.5	425.9	687.1	31.2	18.8			70	584.3	463.5	34.3	5.0
			85/71	625.1	438.5	726.3	31.6	19.8			80	568.2	437.6	37.7	4.4
85	60	1.7 (4.0)	75/63	514.7	393.6	623.0	35.5	14.5	70	1.8 (4.2)	60	608.6	502.0	31.6	5.6
			80/67	546.2	409.0	657.6	36.1	15.1			70	597.7	479.3	34.7	5.1
			85/71	580.4	418.9	695.3	36.8	15.8			80	588.3	456.3	38.2	4.5
	80	2.9 (6.7)	75/63	527.1	399.0	631.1	33.9	15.5		3.0 (7.0)	60	638.0	527.4	32.3	5.8
			80/67	560.1	414.2	666.9	34.4	16.3			70	624.1	503.7	35.4	5.2
			85/71	594.5	427.1	704.3	34.9	17.0			80	612.8	478.8	39.0	4.6
	120	6.0 (13.9)	75/63	539.2	406.3	639.2	32.4	16.7		6.3 (14.5)	60	670.4	555.3	33.1	5.9
			80/67	575.2	417.8	677.8	32.8	17.6			70	655.3	528.0	36.2	5.3
			85/71	611.5	430.2	716.7	33.2	18.4			80	641.5	500.8	39.8	4.7
90	60	1.7 (3.9)	75/63	501.4	388.3	614.5	37.3	13.5	80	1.8 (4.0)	60	673.1	563.8	33.2	5.9
			80/67	533.5	401.2	649.9	37.9	14.1			70	661.7	539.3	36.5	5.3
			85/71	566.3	413.5	686.1	38.6	14.7			80	653.1	516.3	40.2	4.8
	80	2.8 (6.6)	75/63	513.3	393.6	622.0	35.6	14.4		2.9 (6.8)	60	708.5	592.9	34.1	6.1
			80/67	546.7	406.7	658.4	36.2	15.1			70	693.8	567.8	37.4	5.4
			85/71	580.0	421.6	694.5	36.7	15.8			80	681.6	541.5	41.1	4.9
	120	5.9 (13.6)	75/63	525.1	400.8	629.4	34.0	15.4		6.1 (14.1)	60	745.9	624.3	35.1	6.2
			80/67	559.8	414.4	666.7	34.4	16.3			70	730.1	595.2	38.4	5.6
			85/71	595.3	427.6	704.8	34.8	17.1			80	715.4	565.9	42.2	5.0
100	60	1.6 (3.8)	75/63	474.5	376.8	598.9	41.3	11.5							
			80/67	505.4	390.4	633.2	42.0	12.0							
			85/71	537.0	403.2	668.3	42.7	12.6							
	80	2.8 (6.4)	75/63	485.0	383.8	604.3	39.5	12.3							
			80/67	518.1	395.1	640.6	40.1	12.9							
			85/71	550.9	409.1	676.5	40.6	13.6							
	120	5.7 (13.2)	75/63	496.9	388.4	611.4	37.8	13.1							
			80/67	530.2	403.0	647.4	38.2	13.9							
			85/71	564.7	416.4	684.6	38.6	14.6							
110	60	1.6 (3.7)	75/63	445.8	367.6	583.4	45.9	9.7							
			80/67	475.5	382.0	616.6	46.6	10.2							
			85/71	505.3	397.2	649.8	47.3	10.7							
	80	2.7 (6.2)	75/63	457.4	369.5	589.8	44.1	10.4							
			80/67	488.5	383.8	623.9	44.6	10.9							
			85/71	519.8	398.5	658.3	45.2	11.5							
	120	5.6 (12.9)	75/63	467.5	376.5	594.6	42.3	11.1							
			80/67	499.8	391.2	629.5	42.6	11.7							
			85/71	533.0	405.0	665.4	43.1	12.4							

Extended Range - Anti-freeze required

AHRI/ISO13256-1 certified performance is rated at entering air conditions of 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Tabulated unit performance does not include fan or pump power corrections required for AHRI/ISO standard performance ratings.

Unit performance may be interpolated. Extrapolation is not allowed.

For conditions other than rating conditions provided, consult the BST selection software.

Ratings below 40°F are with a methanol solution.

The results reported herein are estimates based on testing by FHP. Variations in the installation and operational environment may alter performance. Bosch disclaims all warranties, express and implied, that the performance will be as reported, including the warranty of merchantability and fitness for purpose. In addition, continuous research and development may result in a change to an appliances design and specifications, which Bosch may change without notice. Before purchase, confirm the design specifications of the appliance.

NOTE: Gross performance figures

Capacity Data

MC600 (20000 CFM)

Cooling									Heating						
Entering Fluid Temp (°F)	Water Flow (GPM)	Pressure Drop PSI (FOH)	Entering Air Temp (db/ wb) °F	Total Capacity (MBTUH)	Sensible Capacity (MBTUH)	Heat of Rejection (MBTUH)	Power Input (kW)	EER	Entering Fluid Temp (°F)	Pressure Drop PSI (FOH)	Entering Air Temp (°F)	Total Capacity (MBTUH)	Heat of Absorption (MBTUH)	Power Input (kW)	COP
50	75.2	1.8 (4.1)	75/63	703.7	535.5	798.3	29.1	24.2	30	2.0 (4.7)	60	447.2	344.1	28.5	4.6
			80/67	745.3	550.9	843.7	29.8	25.0			70	439.7	323.9	31.6	4.1
			85/71	788.8	566.8	891.3	30.6	25.8			80	433.9	302.8	35.4	3.6
	100	3.0 (6.8)	75/63	719.0	541.1	811.0	27.8	25.8		3.4 (7.8)	60	463.8	359.3	28.8	4.7
			80/67	762.0	558.3	857.6	28.5	26.8			70	454.4	338.1	32.0	4.2
			85/71	807.5	573.6	907.1	29.2	27.7			80	447.5	316.2	35.6	3.7
	150	6.1 (14.1)	75/63	733.8	549.0	823.2	26.5	27.6		7.0 (16.2)	60	482.6	376.5	29.2	4.9
			80/67	780.5	564.6	873.5	27.2	28.7			70	472.2	354.1	32.3	4.3
			85/71	827.2	580.8	923.8	27.8	29.8			80	463.2	331.5	35.9	3.8
60	75.2	1.7 (3.9)	75/63	675.8	523.1	775.9	31.7	21.4	40	1.9 (4.5)	60	502.4	396.8	29.6	5.0
			80/67	717.4	538.5	821.5	32.4	22.1			70	494.5	376.1	32.8	4.4
			85/71	759.3	554.6	867.5	33.2	22.9			80	487.7	355.1	36.4	3.9
	100	2.9 (6.6)	75/63	690.2	529.3	787.3	30.3	22.8		3.3 (7.5)	60	523.4	416.0	30.0	5.1
			80/67	733.6	544.7	834.5	31.0	23.7			70	513.6	393.8	33.2	4.5
			85/71	777.6	560.8	882.4	31.7	24.6			80	505.0	374.0	36.9	4.0
	150	5.9 (13.7)	75/63	705.1	536.5	799.2	28.9	24.4		6.8 (15.6)	60	547.6	438.0	30.5	5.3
			80/67	750.7	551.2	848.6	29.5	25.4			70	536.1	414.1	33.7	4.7
			85/71	796.5	568.0	898.1	30.1	26.4			80	525.7	390.4	37.3	4.1
70	75.2	1.7 (3.8)	75/63	648.0	510.2	754.9	34.6	18.7	50	1.8 (4.1)	60	580.0	470.2	31.2	5.5
			80/67	686.6	527.8	797.3	35.3	19.5			70	570.2	448.4	34.5	4.8
			85/71	726.8	544.4	841.7	36.1	20.2			80	560.9	424.4	38.1	4.3
	100	2.8 (6.4)	75/63	661.0	516.8	764.3	33.1	20.0		3.0 (6.8)	60	603.1	492.9	31.7	5.6
			80/67	702.2	533.9	809.3	33.8	20.8			70	592.1	470.2	35.0	5.0
			85/71	745.3	549.1	856.5	34.5	21.6			80	581.2	443.6	38.6	4.4
	150	5.7 (13.2)	75/63	675.4	522.9	775.5	31.7	21.3		6.1 (14.1)	60	631.1	517.3	32.3	5.7
			80/67	719.4	538.6	823.2	32.2	22.3			70	617.1	490.9	35.5	5.1
			85/71	763.6	555.6	871.0	32.8	23.3			80	603.8	465.0	39.2	4.5
80	75.2	1.6 (3.7)	75/63	617.8	498.8	732.5	37.9	16.3	60	1.7 (3.9)	60	651.2	537.7	32.7	5.8
			80/67	655.6	515.9	774.4	38.6	17.0			70	639.3	513.2	36.1	5.2
			85/71	694.1	532.8	817.0	39.4	17.6			80	629.3	489.2	39.8	4.6
	100	2.7 (6.2)	75/63	631.1	504.3	742.1	36.4	17.4		2.9 (6.6)	60	679.1	564.7	33.4	6.0
			80/67	671.5	520.3	786.3	37.0	18.2			70	665.7	538.1	36.7	5.3
			85/71	712.1	537.1	830.8	37.7	18.9			80	653.4	513.2	40.4	4.7
	150	5.5 (12.8)	75/63	645.8	508.7	753.3	34.8	18.5		5.9 (13.7)	60	712.2	593.6	34.1	6.1
			80/67	686.9	526.7	797.9	35.4	19.4			70	695.9	564.5	37.4	5.5
			85/71	728.3	545.0	842.8	35.9	20.3			80	677.9	536.9	41.1	4.8
85	75.2	1.6 (3.6)	75/63	603.5	491.6	722.9	39.7	15.2	70	1.7 (3.8)	60	726.6	608.9	34.4	6.2
			80/67	640.6	508.7	764.0	40.5	15.8			70	712.9	582.2	37.9	5.5
			85/71	677.2	526.9	804.6	41.2	16.4			80	700.5	555.1	41.6	4.9
	100	2.6 (6.1)	75/63	615.6	497.9	730.9	38.1	16.1		2.8 (6.4)	60	759.4	640.3	35.2	6.3
			80/67	654.3	515.4	773.4	38.7	16.9			70	743.8	611.2	38.6	5.6
			85/71	693.8	532.7	816.7	39.4	17.6			80	729.0	581.7	42.4	5.0
	150	5.5 (12.6)	75/63	629.1	503.5	740.7	36.6	17.2		5.7 (13.2)	60	797.5	673.9	36.1	6.5
			80/67	670.5	519.7	785.7	37.1	18.1			70	778.9	641.7	39.5	5.8
			85/71	712.1	537.0	830.9	37.7	18.9			80	761.0	609.3	43.3	5.2
90	75.2	1.5 (3.6)	75/63	587.5	486.3	711.7	41.7	14.1	80	1.6 (3.7)	60	805.2	683.2	36.3	6.5
			80/67	623.6	503.7	751.8	42.4	14.7			70	789.6	653.7	39.8	5.8
			85/71	661.4	519.1	794.0	43.1	15.3			80	774.9	624.1	43.7	5.2
	100	2.6 (6.0)	75/63	601.0	490.3	721.2	40.1	15.0		2.7 (6.2)	60	843.3	718.7	37.3	6.6
			80/67	638.8	507.9	762.7	40.7	15.7			70	825.0	686.8	40.8	5.9
			85/71	676.2	526.5	803.9	41.3	16.4			80	807.6	654.5	44.6	5.3
	150	5.4 (12.4)	75/63	613.9	496.0	730.2	38.5	16.0		5.5 (12.8)	60	886.9	757.1	38.4	6.8
			80/67	652.5	514.7	772.1	38.9	16.8			70	865.1	721.4	41.8	6.1
			85/71	693.0	532.5	816.2	39.5	17.6			80	844.1	685.6	45.6	5.4
100	75.2	1.5 (3.5)	75/63	556.2	473.5	691.5	45.9	12.1							
			80/67	591.0	491.4	730.2	46.6	12.7							
			85/71	624.6	508.6	767.9	47.3	13.2							
	100	2.5 (5.8)	75/63	569.1	477.1	700.1	44.3	12.9							
			80/67	604.8	496.2	739.4	44.8	13.5							
			85/71	641.8	512.5	780.4	45.5	14.1							
	150	5.2 (12.0)	75/63	580.3	483.3	706.9	42.6	13.6							
			80/67	619.0	500.5	749.1	43.1	14.4							
			85/71	656.4	519.6	789.9	43.6	15.1							
110	75.2	1.5 (3.4)	75/63	523.7	460.4	672.2	50.8	10.3							
			80/67	555.9	478.3	708.2	51.4	10.8							
			85/71	590.0	496.6	746.5	52.1	11.3							
	100	2.4 (5.6)	75/63	535.2	465.0	678.8	49.0	10.9							
			80/67	569.2	483.3	716.5	49.5	11.5							
			85/71	605.3	499.7	756.5	50.2	12.1							
	150	5.1 (11.7)	75/63	546.5	469.6	685.6	47.3	11.6							
			80/67	582.2	488.1	724.6	47.7	12.2							
			85/71	617.9	506.3	763.5	48.2	12.8							

Extended Range - Anti-freeze required

AHRI/ISO13256-1 certified performance is rated at entering air conditions of 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Tabulated unit performance does not include fan or pump power corrections required for AHRI/ISO standard performance ratings.

Unit performance may be interpolated. Extrapolation is not allowed.

For conditions other than rating conditions provided, consult the BST selection software.

Ratings below 40°F are with a methanol solution.

The results reported herein are estimates based on testing by FHP. Variations in the installation and operational environment may alter performance. Bosch disclaims all warranties, express and implied, that the performance will be as reported, including the warranty of merchantability and fitness for purpose. In addition, continuous research and development may result in a change to an appliances design and specifications, which Bosch may change without notice. Before purchase, confirm the design specifications of the appliance.

NOTE: Gross performance figures

Subject to change without prior notice.

Capacity Data

MC720 (24000 CFM)

Cooling									Heating						
Entering Fluid Temp (°F)	Water Flow (GPM)	Pressure Drop PSI (FOH)	Entering Air Temp (db/ wb) °F	Total Capacity (MBTUH)	Sensible Capacity (MBTUH)	Heat of Rejection (MBTUH)	Power Input (kW)	EER	Entering Fluid Temp (°F)	Pressure Drop PSI (FOH)	Entering Air Temp (°F)	Total Capacity (MBTUH)	Heat of Absorption (MBTUH)	Power Input (kW)	COP
50	90	2.5 (5.8)	75/63	874.2	656.0	1003.5	39.9	21.9	30	2.8 (6.6)	60	561.9	423.2	38.9	4.2
			80/67	926.2	674.7	1060.5	40.9	22.6			70	553.0	400.7	43.3	3.7
			85/71	980.5	690.0	1120.3	42.1	23.3			80	545.7	374.3	48.2	3.3
	120	4.2 (9.7)	75/63	893.5	664.3	1018.5	38.0	23.5		4.8 (11.0)	60	581.7	441.5	39.4	4.3
			80/67	947.9	682.4	1077.7	39.0	24.3			70	572.5	415.7	43.8	3.8
			85/71	1002.1	700.5	1136.7	40.0	25.1			80	562.6	390.3	48.6	3.4
	180	8.7 (20.0)	75/63	913.8	671.6	1034.8	36.3	25.2		9.9 (22.9)	60	604.8	462.3	39.9	4.4
			80/67	968.8	692.0	1094.0	37.1	26.1			70	594.0	435.5	44.3	3.9
			85/71	1028.3	707.4	1158.4	38.0	27.0			80	581.7	408.3	49.1	3.5
60	90	2.4 (5.6)	75/63	840.9	640.6	978.7	43.3	19.4	40	2.8 (6.4)	60	629.6	486.5	40.5	4.6
			80/67	891.7	659.6	1034.7	44.4	20.1			70	620.6	461.3	45.0	4.0
			85/71	943.9	676.8	1092.2	45.5	20.7			80	613.0	438.5	49.9	3.6
	120	4.0 (9.3)	75/63	860.0	649.8	993.0	41.4	20.8		4.6 (10.7)	60	655.0	509.9	41.1	4.7
			80/67	912.9	667.6	1050.7	42.3	21.6			70	644.5	482.9	45.6	4.1
			85/71	967.0	685.1	1109.8	43.3	22.3			80	636.5	456.1	50.5	3.7
	180	8.4 (19.4)	75/63	879.8	657.0	1008.2	39.4	22.3		9.6 (22.1)	60	684.9	536.5	41.8	4.8
			80/67	933.1	677.5	1065.8	40.2	23.2			70	672.1	507.5	46.2	4.3
			85/71	989.5	695.8	1126.8	41.1	24.1			80	658.9	480.0	51.2	3.8
70	90	2.3 (5.4)	75/63	806.7	625.7	954.7	47.3	17.1	50	2.5 (5.8)	60	725.5	576.0	42.8	5.0
			80/67	854.4	645.3	1007.4	48.3	17.7			70	714.5	550.6	47.4	4.4
			85/71	904.0	664.7	1062.3	49.4	18.3			80	704.0	521.6	52.4	3.9
	120	3.9 (9.0)	75/63	824.9	633.2	967.5	45.2	18.3		4.2 (9.7)	60	754.9	603.2	43.6	5.1
			80/67	874.4	653.2	1021.6	46.1	19.0			70	741.5	577.8	48.1	4.5
			85/71	928.0	671.1	1080.4	47.1	19.7			80	729.0	545.0	53.1	4.0
	180	8.1 (18.7)	75/63	844.2	641.3	981.5	43.1	19.6		8.7 (20.0)	60	788.6	633.1	44.4	5.2
			80/67	897.0	660.4	1038.7	43.9	20.4			70	774.0	601.8	48.9	4.6
			85/71	951.5	680.0	1097.9	44.8	21.3			80	756.6	570.8	53.9	4.1
80	90	2.3 (5.2)	75/63	771.6	609.2	931.5	51.8	14.9	60	2.4 (5.6)	60	811.6	659.8	45.0	5.3
			80/67	818.1	628.9	983.2	52.8	15.5			70	799.5	630.0	49.6	4.7
			85/71	863.9	650.4	1034.1	53.9	16.0			80	788.7	599.8	54.8	4.2
	120	3.8 (8.7)	75/63	788.8	616.6	942.8	49.6	15.9		4.0 (9.3)	60	849.4	690.7	45.9	5.4
			80/67	837.4	636.5	996.1	50.5	16.6			70	834.2	658.5	50.5	4.8
			85/71	887.3	656.5	1051.0	51.4	17.3			80	821.6	625.7	55.7	4.3
	180	7.8 (18.1)	75/63	805.5	625.4	953.6	47.3	17.0		8.4 (19.4)	60	889.7	726.1	47.0	5.6
			80/67	856.2	646.0	1008.6	48.1	17.8			70	871.4	690.7	51.5	5.0
			85/71	910.1	665.0	1067.2	49.0	18.6			80	851.8	658.5	56.6	4.4
85	90	2.2 (5.1)	75/63	751.9	602.9	918.3	54.2	13.9	70	2.3 (5.4)	60	905.6	747.0	47.5	5.6
			80/67	798.5	622.0	970.3	55.3	14.4			70	893.3	713.1	52.2	5.0
			85/71	843.8	643.2	1020.7	56.4	15.0			80	879.7	682.9	57.4	4.5
	120	3.7 (8.6)	75/63	768.9	610.0	929.1	51.9	14.8		3.9 (9.0)	60	949.6	783.2	48.6	5.7
			80/67	816.3	630.5	981.3	52.8	15.5			70	931.9	747.8	53.3	5.1
			85/71	866.4	649.1	1036.5	53.8	16.1			80	915.3	712.1	58.5	4.6
	180	7.7 (17.8)	75/63	786.4	617.3	940.6	49.7	15.8		8.1 (18.7)	60	996.7	824.1	49.8	5.9
			80/67	836.0	638.1	994.6	50.4	16.6			70	975.4	785.0	54.5	5.2
			85/71	887.3	658.7	1050.3	51.2	17.3			80	955.1	745.7	59.7	4.7
90	90	2.2 (5.0)	75/63	733.4	595.2	907.0	56.9	12.9	80	2.3 (5.2)	60	1004.0	837.9	50.1	5.9
			80/67	777.7	615.7	956.5	57.9	13.4			70	987.2	802.8	55.0	5.3
			85/71	823.0	635.9	1007.1	59.0	14.0			80	971.5	767.1	60.3	4.7
	120	3.7 (8.5)	75/63	751.0	600.8	918.4	54.6	13.8		3.8 (8.7)	60	1054.3	879.3	51.5	6.0
			80/67	797.6	621.3	969.7	55.4	14.4			70	1033.7	840.6	56.3	5.4
			85/71	843.7	643.2	1020.6	56.3	15.0			80	1014.1	801.3	61.6	4.8
	180	7.6 (17.6)	75/63	768.2	608.0	929.3	52.2	14.7		7.8 (18.1)	60	1108.3	925.8	53.1	6.1
			80/67	816.8	629.0	982.2	53.0	15.4			70	1083.5	882.5	57.8	5.5
			85/71	867.1	649.0	1037.0	53.8	16.1			80	1059.7	838.9	63.1	4.9
100	90	2.1 (4.9)	75/63	694.7	579.3	884.5	62.7	11.1							
			80/67	737.2	600.2	932.1	63.7	11.6							
			85/71	781.6	619.1	982.1	64.8	12.1							
	120	3.6 (8.2)	75/63	711.9	584.3	895.0	60.3	11.8							
			80/67	754.9	607.0	942.5	61.1	12.4							
			85/71	799.0	627.5	991.0	61.9	12.9							
	180	7.4 (17.0)	75/63	728.4	590.9	904.7	57.8	12.6							
			80/67	774.8	612.5	955.3	58.5	13.2							
			85/71	822.4	633.7	1007.4	59.3	13.9							
110	90	2.1 (4.8)	75/63	654.8	563.1	863.5	69.2	9.5							
			80/67	694.8	584.3	908.5	70.2	9.9							
			85/71	735.9	605.6	954.9	71.3	10.3							
	120	3.5 (8.0)	75/63	669.4	569.0	870.9	66.8	10.0							
			80/67	711.3	590.5	917.5	67.6	10.5							
			85/71	753.9	611.8	965.0	68.5	11.0							
	180	7.2 (16.6)	75/63	685.2	575.4	879.3	64.2	10.7							
			80/67	730.9	595.6	929.3	64.9	11.3							
			85/71	775.9	617.1	978.7	65.6	11.8							

Extended Range - Anti-freeze required

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NOTE: Gross performance figures

Electrical Data

Belt Drive Motor

Model	Voltage Code	Voltage/ Ph/Hz	Voltage Min/ Max	Compressor				Total Unit w/Belt Drive Motor			
				Quantity	RLA (each)	LRA (each)	Motor HP	Motor Quantity	FLA	Min Circuit Amps	Max Fuse HACR
MC360	3	208-230/3/60	197/253	2	55.8	340	7.5	1	19.4	145.0	200
	3	208-230/3/60	197/253	2	55.8	340	10	1	25.8	151.4	200
	3	208-230/3/60	197/253	2	55.8	340	15	1	38.6	164.2	200
	3	208-230/3/60	197/253	2	55.8	340	20	1	49.6	175.2	225
	4	460/3/60	414/506	2	26.9	173	7.5	1	9.7	70.2	90
	4	460/3/60	414/506	2	26.9	173	10	1	12.9	73.4	100
	4	460/3/60	414/506	2	26.9	173	15	1	19.3	79.8	100
	4	460/3/60	414/506	2	26.9	173	20	1	24.8	85.3	110
	5	575/3/60	518/632	2	23.7	132	7.5	1	7.8	61.1	80
	5	575/3/60	518/632	2	23.7	132	10	1	10.3	63.6	80
	5	575/3/60	518/632	2	23.7	132	15	1	15.4	68.7	90
	5	575/3/60	518/632	2	23.7	132	20	1	19.8	73.1	90
MC480	3	208-230/3/60	197/253	4	33.3	239	7.5	2	19.4	180.3	200
	3	208-230/3/60	197/253	4	33.3	239	10	2	25.8	193.1	225
	3	208-230/3/60	197/253	4	33.3	239	15	2	38.6	218.7	250
	4	460/3/60	414/506	4	17.9	125	7.5	2	9.7	95.5	110
	4	460/3/60	414/506	4	17.9	125	10	2	12.9	101.9	110
	4	460/3/60	414/506	4	17.9	125	15	2	19.3	114.7	125
	5	575/3/60	518/632	4	12.8	80	7.5	2	7.8	70.0	80
	5	575/3/60	518/632	4	12.8	80	10	2	10.3	75.0	80
	5	575/3/60	518/632	4	12.8	80	15	2	15.4	85.2	90
MC600	3	208-230/3/60	197/253	4	48.1	245	7.5	2	19.4	243.2	250
	3	208-230/3/60	197/253	4	48.1	245	10	2	25.8	256.0	300
	3	208-230/3/60	197/253	4	48.1	245	15	2	38.6	281.6	300
	3	208-230/3/60	197/253	4	48.1	245	20	2	49.6	303.6	350
	4	460/3/60	414/506	4	18.6	125	7.5	2	9.7	98.5	110
	4	460/3/60	414/506	4	18.6	125	10	2	12.9	104.9	110
	4	460/3/60	414/506	4	18.6	125	15	2	19.3	117.7	125
	4	460/3/60	414/506	4	18.6	125	20	2	24.8	128.7	150
	5	575/3/60	518/632	4	14.7	100	7.5	2	7.8	78.1	90
	5	575/3/60	518/632	4	14.7	100	10	2	10.3	83.1	90
	5	575/3/60	518/632	4	14.7	100	15	2	15.4	93.3	100
	5	575/3/60	518/632	4	14.7	100	20	2	19.8	102.1	110
MC720	3	208-230/3/60	197/253	4	55.8	340	7.5	2	19.4	276.0	300
	3	208-230/3/60	197/253	4	55.8	340	10	2	25.8	288.8	300
	3	208-230/3/60	197/253	4	55.8	340	15	2	38.6	314.4	350
	3	208-230/3/60	197/253	4	55.8	340	20	2	49.6	336.4	350
	4	460/3/60	414/506	4	26.9	173	7.5	2	9.7	133.7	150
	4	460/3/60	414/506	4	26.9	173	10.0	2	12.9	140.1	150
	4	460/3/60	414/506	4	26.9	173	15.0	2	19.3	152.9	175
	4	460/3/60	414/506	4	26.9	173	20.0	2	24.8	163.9	175
	5	575/3/60	518/632	4	23.7	132	7.5	2	7.8	116.3	125
	5	575/3/60	518/632	4	23.7	132	10.0	2	10.3	121.3	125
	5	575/3/60	518/632	4	23.7	132	15.0	2	15.4	131.5	150
	5	575/3/60	518/632	4	23.7	132	20.0	2	19.8	140.3	150

Blower Motor Performance

Belt Drive Motor

Model	Nominal Airflow	Rated Airflow	Total Static Pressure											
			2.00		2.50		3.00		3.50		4.00		4.50	
			RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
MC360	12,000	9,500	813	7.5	871	15	949	10	1034	15	1111	15	1172	15
		10,000	813	7.5	916	10	949	10	1034	15	1111	15	1172	15
		10,500	842	10	916	10	982	15	1034	15	1111	15	1172	15
		11,000	842	10	916	10	982	15	1034	15	1111	15	1172	15
		11,500	871	15	916	15	982	15	1034	15	1111	15	1172	20
		12,000	871	15	949	15	982	15	1072	15	1111	20	1172	20
		12,500	871	15	949	15	1034	15	1072	20	1111	20	1172	20
		13,500	916	15	982	20	1034	20	1072	20	1149	20	-	-
MC480	16,000	13,000	794	7.5	916	7.5	982	7.5	1111	7.5	1200	10	1256	10
		14,000	794	7.5	871	7.5	982	7.5	1072	10	1172	10	1256	10
		15,000	794	7.5	871	7.5	982	7.5	1072	10	1172	10	1256	15
		16,000	794	7.5	871	7.5	982	7.5	1034	10	1149	10	1256	15
		17,000	794	7.5	871	7.5	982	7.5	1034	10	1111	15	1214	15
		18,000	813	7.5	871	7.5	949	10	1034	10	1111	15	1172	15
		19,000	813	7.5	871	15	949	10	1034	15	1111	15	1172	15
MC600	20,000	16,000	794	7.5	871	7.5	982	7.5	1034	10	1149	10	1256	15
		17,000	794	7.5	871	7.5	982	7.5	1034	10	1111	15	1214	15
		18,000	813	7.5	871	8	949	10	1034	10	1111	15	1172	15
		19,000	813	7.5	871	15	949	10	1034	15	1111	15	1172	15
		20,000	813	7.5	916	10	949	10	1034	15	1111	15	1172	15
		21,000	842	10	916	10	982	15	1034	15	1111	15	1172	15
		22,000	842	10	916	10	982	15	1034	15	1111	15	1172	15
		23,000	871	15	916	15	982	15	1034	15	1111	15	1172	20
		24,000	871	15	949	15	982	15	1072	15	1111	20	1172	20
MC720	24,000	19,000	813	7.5	871	15	949	10	1034	15	1111	15	1172	15
		20,000	813	7.5	916	10	949	10	1034	15	1111	15	1172	15
		21,000	842	10	916	10	982	15	1034	15	1111	15	1172	15
		22,000	842	10	916	10	982	15	1034	15	1111	15	1172	15
		23,000	871	15	916	15	982	15	1034	15	1111	15	1172	20
		24,000	871	15	949	15	982	15	1072	15	1111	20	1172	20
		25,000	871	15	949	15	1034	15	1072	20	1111	20	1172	20

Air Side Pressure Drop

Model	Airflow	Air Coils				Filters		
		Cooling	Economiser	Reheat	Hot Water	4" - 30%	4" - 65%	Face Velocity
MC360	8,000	0.35	0.25	0.06	0.12	0.07	0.24	345
	10,000	0.53	0.32	0.07	0.17	0.12	0.3	431
	12,000	0.77	0.47	0.12	0.25	0.19	0.43	517
	13,000	0.9	0.56	0.15	0.29	0.22	0.51	560
MC480	12,000	0.26	0.15	0.02	0.06	0.05	0.1	259
	14,000	0.36	0.2	0.04	0.09	0.06	0.14	302
	16,000	0.47	0.26	0.05	0.11	0.09	0.19	345
	18,000	0.59	0.33	0.06	0.15	0.11	0.24	388
MC600	16,000	0.35	0.25	0.06	0.12	0.07	0.24	345
	18,000	0.43	0.28	0.07	0.16	0.1	0.26	388
	20,000	0.53	0.32	0.07	0.17	0.12	0.3	431
	22,000	0.64	0.4	0.12	0.24	0.15	0.4	474
MC720	20,000	0.53	0.32	0.07	0.17	0.12	0.3	431
	22,000	0.64	0.4	0.12	0.24	0.15	0.4	474
	24,000	0.77	0.47	0.12	0.25	0.19	0.43	517
	25,000	0.84	0.52	0.14	0.26	0.2	0.47	539

NOTE: 1) Cooling and economiser coil shown with wet surface.
2) Reheat coil and hot water coil shown dry.
3) Filters shown clean. 65% filter is avaiable as a field-installed accessory only.

Blower Curve Data

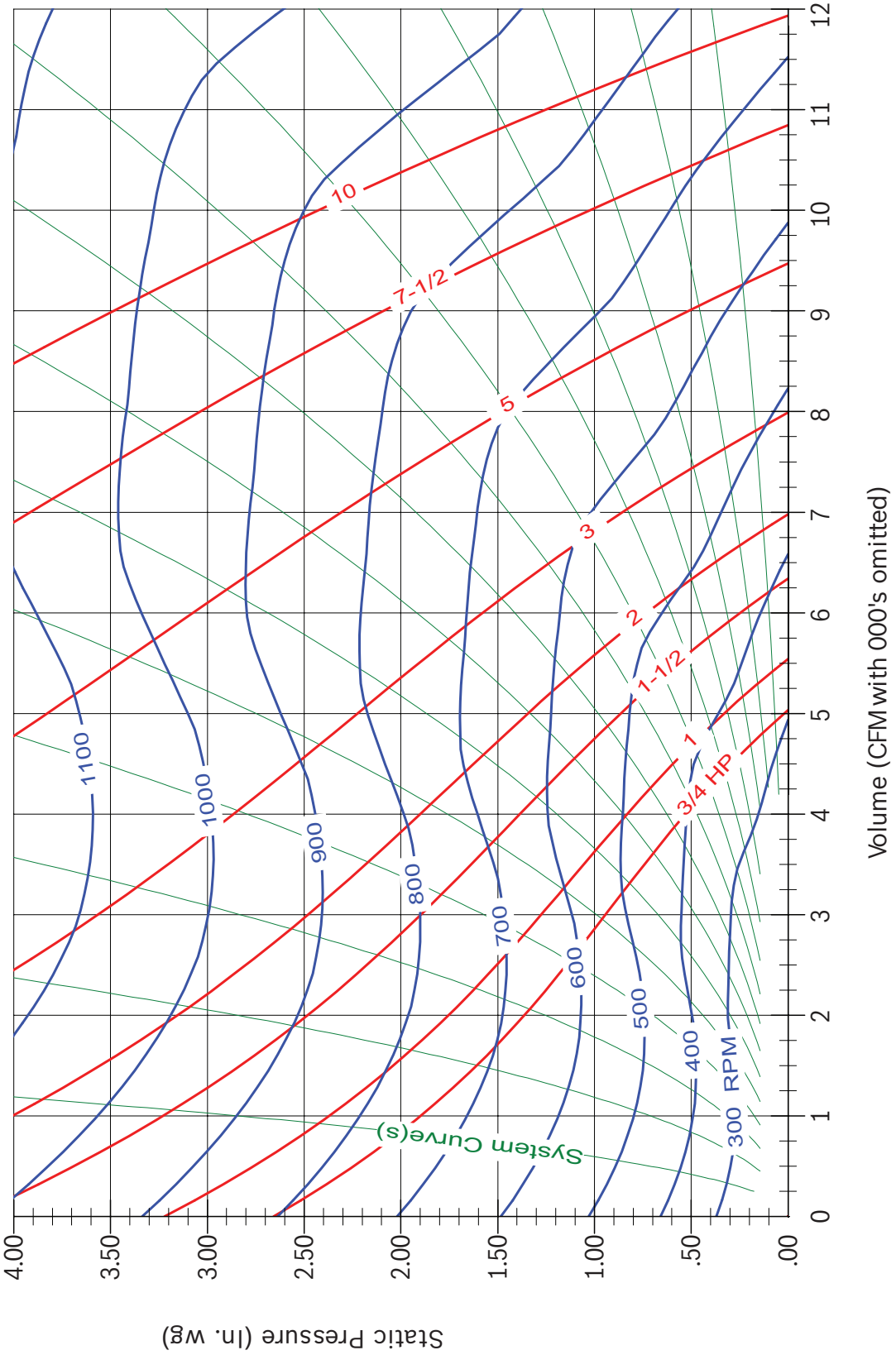

Figure 9

Physical Data

MC Model Water Source Heat Pump

MC Model	MC360	MC480	MC600	MC720
Compressor Type	Scroll	Scroll	Scroll	Scroll
Compressor Qty	2	4	4	4
Compressor Size (HP)	15	10	12.5	15
Refrigeration Charge (oz)	576	640	1152	1152
Max Water Working Pressure (PSIG/kPa)	400/2750	400/2750	400/2750	400/2750
Number of Manifolded Refrigeration Circuits	2	4	4	4
Air Side Coils				
Evaporator Coil Type	Tube-Fin	Tube-Fin	Tube-Fin	Tube-Fin
Evaporator Dimensions (H x L)	26 x 62 (2)	26 x 62 (4)	26 x 62 (4)	26 x 62 (4)
Evaporator Rows	4	3	4	4
Waterside Economiser Coil Dimensions (H x L)	26.2 X 61 (2)	26.2 X 61 (4)	26.2 X 61 (4)	26.2 X 61 (4)
Waterside Economiser Coil Rows	3	3	3	3
Hot Gas Reheat Coil Dimensions (H x L)	26.2 X 62.5 (2)	26.2 X 62.5 (4)	26.2 X 62.5 (4)	26.2 X 62.5 (4)
Hot Gas Reheat Coil Rows	1	1	1	1
Motor & Blower				
Fan Motor Type/Speeds	Belt Drive/1	Belt Drive/1	Belt Drive/1	Belt Drive/1
Standard Fan Motor (HP)	15	10	15	15
Available Fan Motors (HP)	7.5, 10, 15, 20	7.5, 10, 15	7.5, 10, 15, 20	7.5, 10, 15, 20
Blower Wheel Size (Dia. x W x Qty)	18 x 18 x 1	18 x 18 x 2	18 x 18 x 2	18 x 18 x 2
Water Coil				
Connection Type	FPT	FPT	FPT	FPT
Size	2 1/2"	2 1/2"	3"	3"
Water Coil Type (Qty)	Coaxial (2)	Coaxial (4)	Coaxial (4)	Coaxial (4)
Coil Volume (gal)	2.69	1.80	2.69	2.69
Vertical Cabinet				
Nominal size of Standard Filter - 4" (H x L)	17 x 27 (8)	17 x 27 (16)	17 x 27 (16)	17 x 27 (16)
Weight - Operating (lbs)	2,650	4,750	5,500	5,550
Weight - Shipping (lbs)	2,866	4,846	5,700	5,732

Module Operating Weights (lbs)

Model	VH Configuration				VL Configuration			
	MC360	MC480	MC600	MC720	MC360	MC480	MC600	MC720
Main Air Conditioning Section								
Number of Sections	1	2	2	2	1	2	2	2
Main Section (ea)	1450	1175	1550	1575	2100	1825	2200	2225
Reheat Coil Option (ea)	40	40	40	40	40	40	40	40
Filter/Economiser Sections								
Number of Sections	1	2	2	2	1	2	2	2
Filter Section (ea)	310	310	310	310	310	310	310	310
Economiser Option (ea)	200	200	200	200	200	200	200	200
Blower Section								
Number of Sections	1	2	2	2	Included in Main Air Conditioning Section			
Fan Section (w/ Max Motor Size)	650	650	650	650				
Total Unit								
Number of Sections	3	6	6	6	2	4	4	4
Total Unit with Options	2650	4750	5500	5550	2650	4750	5500	5550

Sound Data

Blower Discharge Sound Power Level Based on Selected Airflow Conditions

Model	Selected RPM	Selected Motor HP	Sound Data TSP (in w.c.)	Sound Data CFM	Octave Band Sound Power Levels dB, re 10^{-12} Watts								Overall	A Weighted Overall (dBA)
					Center Frequency - Hz									
					63	125	250	500	1000	2000	4000	8000	50Hz-10kHz	50hz-10kHz
MC360	813	7.5	2.0	9,500	89	88	84	81	78	74	70	67	93	84
	949	10	3.0	10,000	92	94	90	86	84	79	75	72	98	89
	1,111	15	4.0	11,500	94	99	94	90	88	82	79	76	102	93
	1,172	20	4.5	12,500	95	101	96	91	90	84	81	77	104	95
MC480	794	7.5	2.0	13,000	91	90	86	83	80	76	72	70	95	86
	982	10	3.0	15,000	95	97	92	89	86	82	78	75	101	92
	1,111	15	4.0	17,000	97	101	97	93	91	85	82	79	104	96
	1,172	15	4.5	19,000	98	103	99	94	93	87	83	80	106	98
MC600	794	7.5	2.0	16,000	91	90	86	83	80	76	72	70	95	86
	949	10	3.0	19,000	95	97	92	89	86	81	78	75	100	92
	1,111	15	4.0	22,000	97	101	97	93	91	85	82	78	104	96
	1,172	20	4.5	24,000	98	103	99	94	93	87	84	80	106	98
MC720	813	7.5	2.0	19,000	92	91	87	84	81	77	73	70	96	87
	949	10	3.0	20,000	95	97	93	89	87	82	78	75	101	92
	1,111	15	4.0	23,000	97	102	97	93	91	85	82	79	105	96
	1,172	20	4.5	25,000	98	104	99	94	93	87	84	80	107	98

NOTE: Data is based on blower only based on manufacturer's data. AMCA data for installation Type B: Free inlet, Ducted outlet.
Overall information calculated using 63-8000 Hz octave bands.

Unit Dimensions

Vertical High Configuration Water Source Heat Pump

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Width	Depth	Height	Blower Section Access Panel Width	Main Section Height w/o Support Rails	Filter Rack/Duct Flange Height	Blower Section Height	Return Duct Flange Depth	Discharge Duct Flange Depth	Bottom to Discharge Duct Flange	Condensate Drain Height	Water In Height	Water Out Height	Economiser Water In Height	Economiser Drain Height
MC360	69.50	51.63	111.00	65.50	80.00	54.38	31.00	2.88	2.00	81.50	10.95	3.95	15.00	13.00	8.95
MC480	139.00	51.63	111.00	65.50	80.00	54.38	31.00	2.88	2.00	81.50	10.95	3.95	15.00	13.00	8.95
MC600	139.00	51.63	111.00	65.50	80.00	54.38	31.00	2.88	2.00	81.50	10.95	3.95	15.00	13.00	8.95
MC720	139.00	51.63	111.00	65.50	80.00	54.38	31.00	2.88	2.00	81.50	10.95	3.95	15.00	13.00	8.95

Model	P	Q	R	S	T	U	V	W	X	Condenser Water Connections	Condensate Drain Connection	Economiser Drain Connection	Recommended Replacement Nominal Filter Size 4" thick
	Back to Economiser Connections	Economiser Connections to Condenser Connections	Lifting Support Rail Height	Discharge Height	Discharge Width	Discharge Duct Flange Height	Discharge Duct Flange Width	Side to Discharge Duct Flange	Angle Iron Frame Width				
MC360	5.00	23.25	1.50	18.95	21.95	23.95	49.95	9.88	2.0	2 1/2" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (8)
MC480	5.00	23.25	1.50	18.95	21.95	23.95	49.95	9.88	2.0	2 1/2" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (16)
MC600	5.00	23.25	1.50	18.95	21.95	23.95	49.95	9.88	2.0	3" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (16)
MC720	5.00	23.25	1.50	18.95	21.95	23.95	49.95	9.88	2.0	3" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (16)

NOTE: All dimensions in inches unless otherwise noted. All dimensions within +-0.125". Specifications subject to change without notice.

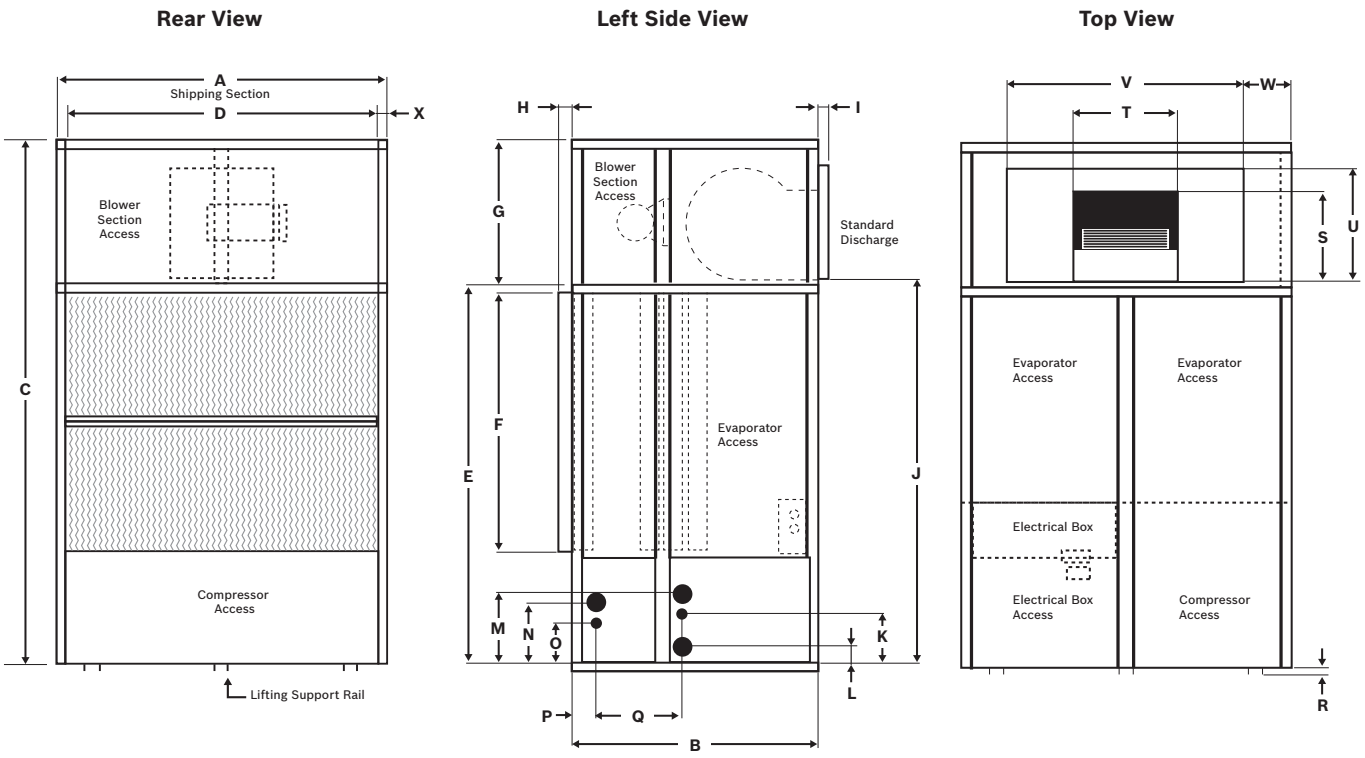

Figure 10

Unit Dimensions

Vertical Low Configuration Water Source Heat Pump

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Width	Depth	Height	Blower Section Access Panel Width	Filter Rack/ Duct Flange Height	Return Duct Flange Depth	Condensate Drain Height	Water In Height	Water Out Height	Economiser Water In Height	Economiser Drain Height	Back to Economiser Connections	Economiser Connections to Condenser Connections	Lifting Support Rail Height
MC360	69.50	64.75	80.00	65.50	54.38	2.88	10.75	3.75	15.00	13.00	8.75	5.00	23.25	1.50
MC480	139.00	64.75	80.00	65.50	54.38	2.88	10.75	3.75	15.00	13.00	8.75	5.00	23.25	1.50
MC600	139.00	64.75	80.00	65.50	54.38	2.88	10.75	3.75	15.00	13.00	8.75	5.00	23.25	1.50
MC720	139.00	64.75	80.00	65.50	54.38	2.88	10.75	3.75	15.00	13.00	8.75	5.00	23.25	1.50

Model	O	P	Q	R	S	T	U	V	W	X	Condenser Water Connections	Condensate Drain Connection	Economiser Drain Connection	Recommended Replacement Nominal Filter Size 4" thick
	Discharge Height	Discharge Depth	Side to Discharge	Front to Discharge	Discharge Duct Flange Depth	Discharge Duct Flange Width	Side to Discharge Duct Flange	Main A/C Section Depth	Filter / Economiser Section Depth	Angle Iron Frame Width				
MC360	18.75	21.75	24.25	9.50	49.75	23.75	22.75	46.00	18.75	2.0	2 1/2" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (8)
MC480	18.75	21.75	24.25	9.50	49.75	23.75	22.75	46.00	18.75	2.0	2 1/2" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (16)
MC600	18.75	21.75	24.25	9.50	49.75	23.75	22.75	46.00	18.75	2.0	3" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (16)
MC720	18.75	21.75	24.25	9.50	49.75	23.75	22.75	46.00	18.75	2.0	3" FPT	3/4" FPT	1 1/4" FPT	17 x 27 (16)

NOTE: All dimensions in inches unless otherwise noted. All dimensions within +-0.125". Specifications subject to change without notice.

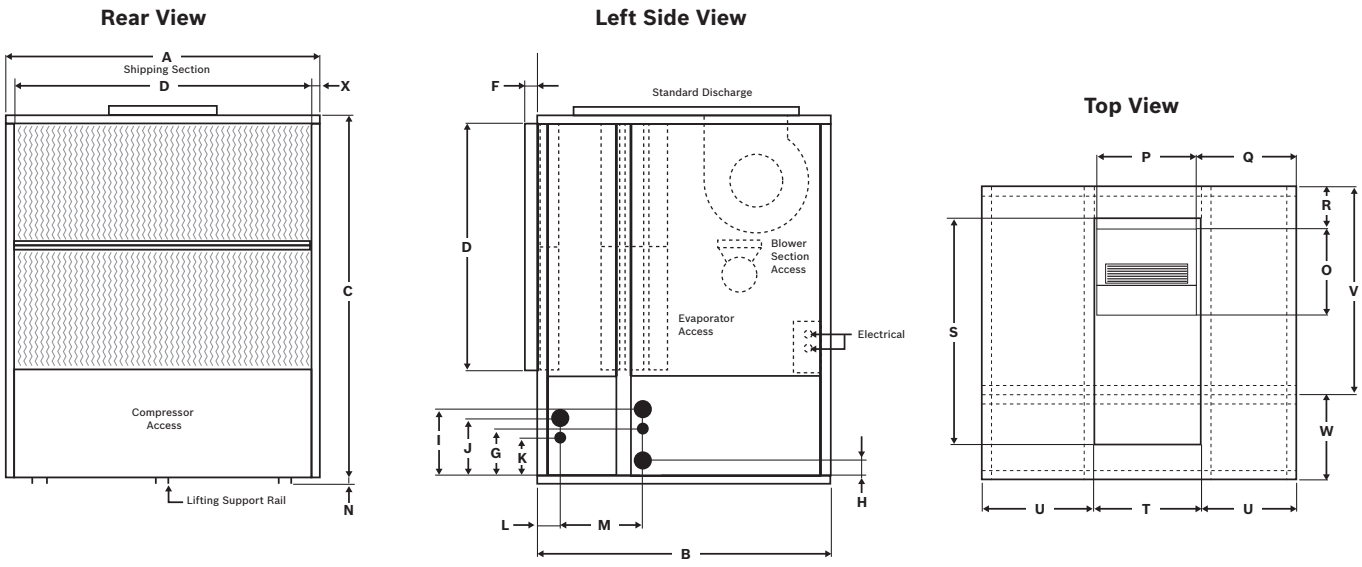

Figure 11

Guide Specifications

General

Furnish and install where shown on plans, MC Model self-contained packaged air conditioning unit. Capacities, models and unit arrangement shall be as shown on the unit schedule and the contract drawings. All units shall conform to UL1995 standard and be certified to CAN/CSA C22.1 No 236 by Intertek-ETL. Unit shall be accepted for use in the City of New York by the Department of Buildings (MEA). Each unit shall be completely factory assembled, piped, wired and tested. Units shall be leak tested and charged with a full operating charge of Refrigerant 410A. Units shall then be disassembled into their individual modules for shipping and assembly on site. Installation and maintenance manuals and wiring diagrams shall be supplied with each unit. Factory test shall include, but not be limited to: complete run check of all electrical components and safeties, including proper control sequencing; pressure test of refrigerant coils and condensers; leak check of completed refrigerant circuits; leak check of completed water circuit; compressor run check.

Cabinet

VH CONFIGURATION: The unit shall be comprised of three distinct modules: 1) Main cooling/heating, 2) Filter/waterside economizer, and 3) Fan section. The unit shall be designed for ease of assembly. The refrigeration circuit shall remain intact during disassembly/assembly. All modules shall be able to pass through a 36" steel framed door. The frame shall be fabricated of an angle iron framework. Unit exterior panels shall be 18 gauge G90 galvanized steel for corrosion protection. Each section shall incorporate removable access panels. The complete cabinet frame and access panels shall be insulated with ½", 1.5lb dual density fiberglass insulation. The main cooling/heating section and the filter/waterside economizer section shall contain a galvanized steel drain pan coated with archem type paint for corrosion resistance.

VL CONFIGURATION: The unit shall be comprised of two distinct modules: 1) Main cooling/heating section with blower(s) and motor(s) 2) Filter/waterside economizer section. The unit shall be designed for ease of assembly. The refrigeration circuit shall remain intact during disassembly/assembly. The frame shall be fabricated of an angle iron framework. Unit exterior panels shall be 18 gauge G90 galvanized steel for corrosion protection. Each section shall incorporate removable access panels. The complete cabinet frame and access panels shall be insulated with ½", 1.5lb dual density fiberglass insulation. The main cooling/heating section and the filter/waterside economizer section shall contain a galvanized steel drain pan coated with archem type paint for corrosion resistance.

Offered as an option, ½" thick, closed cell foam insulation shall promote the indoor air quality (IAQ) of commercial buildings by improving moisture management and sound control.

Evaporator

The direct expansion coil shall be a minimum of 3 rows and fabricated from ⅜" or ½" O.D. seamless copper tubing mechanically bonded to rippled and corrugated aluminum fins. Each individual evaporator coil shall be removable for replacement without disturbing the remaining refrigerant circuits. Each evaporator coil circuit shall be fed by an adjustable thermostatic expansion valve, with external equalizer, sized to provide efficient operation at full and at part load operating points in the cooling and heating modes.

Supply Fan

Supply fans shall be double width, double inlet forward curved type of Class II construction. All fans shall be statically and dynamically balanced. Fan shafts shall be mounted in heavy-duty 150,000 hour greaseable pillow block bearings. The fan motor shall be open drip proof three phase, NEMA T frame E high efficiency EPACT rated, 1800 rpm, with grease lubricated ball bearings. The drive shall include fixed pitch sheaves with multiple V belts sized for 115% of the fan brake horsepower.

Reverse Cycle Operation

Units shall be equipped with reversing valves to allow operation in the reverse cycle heating mode. Electric heaters shall not be allowed as a substitute.

Guide Specifications

Variable Air Volume (Optional)

Airflow modulation can be achieved by the use of a factory or field installed variable frequency drive (VFD). The VFD shall be controlled by a duct static pressure sensor. The pressure set point shall be adjustable and monitored by the unit mounted DDC. All of Bosch's products utilizing a VFD shall also have hot gas bypass to avoid freezing the air coil in reduced air flow situations. The duct static pressure must be installed and wired by the field contractor.

Refrigeration Circuit

Each unit shall contain multiple independent refrigeration circuits. Each circuit shall include a high efficiency heavy-duty scroll compressors. Each circuit shall have high and low pressure cutouts. Each circuit shall be factory sealed and fully charged with Refrigerant 410A. Suction and discharge schrader valves shall be provided for manifold gauge connections to facilitate servicing. Optional hot gas bypass shall be provided to allow unit operation under extended operating conditions avoiding coil freeze up. NOTE: HGBP is required with VAV operation.

Compressors

Each unit shall have multiple high efficiency scroll compressors with internal or external motor protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Each compressor shall be on an independent refrigerant circuit. The compressors shall be mounted on rubber isolators.

Condensers

All condensers shall be coaxial tube-in-tube for maximum heat transfer efficiency and performance. Inner water tubes shall be either copper or optional cupro-nickel with large internal diameters for reduced waterside pressure drops. Outer tubes shall be steel, painted for corrosion protection. All condensers shall be rated at 600 PSIG operating refrigerant pressures and 400 PSIG waterside pressures. Units shall be rated down to 50°F without the use of water regulating valves.

Waterside Economizer (Optional)

A complete waterside economizer package shall be provided, including coil, control valves and factory piping. The complete economizer package shall be rated for 400 PSIG waterside working pressure Economizer operation shall be controlled to maximize free cooling operation. Economizer shall be enabled by the field adjustable aquastat whenever the entering water temperature is less than set point. Water flow shall pass through the economizer coil and condenser in series while in the economizer operating mode and shall bypass the economizer coil while not calling for economizer operation. Mechanical cooling or heating shall be enabled during economizer operation.

Hot Water Preheat (Optional)

Hot water coils shall be 1 or 2 rows, fabricated from ½" O.D. seamless copper tubing mechanically bonded to rippled and corrugated aluminum fins. Coil shall be field mounted.

Hot Gas Reheat (Optional)

Provide a one row hot gas reheat coil to allow the unit to operate in the dehumidification mode without overheating the space. Control of the hot gas reheat shall be conducted by the unit mounted DDC or a unit controller with a humidity sensor that has a digital output to activate the reheat valve.

Filter Section

The unit shall be supplied with 4" deep pleated, 30% high efficiency filters. The filters shall have side access capability through an access panel.

Electrical

Each unit shall be wired and tested at the factory prior to shipment. Wiring shall comply with NEC requirements and shall conform with all applicable ETL standards. The units shall have a single point power connection. The control power shall be supplied through a factory installed, low voltage control circuit transformer with an integral resettable circuit breaker. The fan motor starter shall have at magnetic three line, ambient compensated overload protector with a manual reset. A terminal block shall be provided for the main power connection.

Guide Specifications

Each unit shall be provided with a Unit Protection Module (UPM) that controls compressor operation and monitors the safety controls that protect the unit.

Safety controls include the following:

High pressure switches located in the refrigerant discharge lines. One per refrigeration unit.

Low pressure switches for loss of charge protection located in the unit refrigerant suction lines. One per refrigeration unit.

A factory installed freeze sensor: If the temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition.

Condensate overflow protection sensor located in the drain pan(s) of the unit and wired to the UPM board.

The UPM includes the following features:

Anti-Short Cycle Timer: 5 minute delay on break timer to prevent compressor short cycling.

Random Start: Each controller has a unique random start delay ranging from 270 to 300 seconds.

Low Pressure Bypass Timer: The low pressure switch will be bypassed for 120 seconds after compressor start-up to prevent nuisance low pressure lockouts during cold start-up in the heating mode.

Brownout/Surge/Power Interruption Protection: A 20 millisecond window is to be monitored for the above condition. Should any of these conditions be detected, the 5-minute delay on break timer and the random start timer delay are initiated.

Malfunction Output: The controller shall have a set of wet contacts for remote fault indication.

LED Fault Indication: Two LED indicators are provided as follows:

- Green: Power LED indicates 18 – 30 VAC present at the board.
- Red: Fault indicator with blink codes as follows:
- One Blink: 1st Stage high pressure lockout
- Two Blinks: 1st Stage low pressure lockout
- Three Blinks: 2nd Stage high pressure lockout
- Four Blinks: 2nd Stage low pressure lockout
- Five Blinks: Freeze protection lockout
- Six Blinks: Condensate overflow lockout
- Seven Blinks: Brown Out

Intelligent Reset: If a fault condition is initiated, the 5 minute delay on break time period is initiated and the unit will restart after this delay expires. The UPM is configurable for either 2 or 4 fault occurrences before going into a hard lockout. The selection is made through a dip switch setting on the board. If the fault condition still exists or reoccurs twice or four times within one hour, the unit will go into a hard lockout and requires a manual lockout reset. A condensate overflow fault will, however, put the unit into a hard lockout immediately.

Lockout Reset: A hard lockout can be reset by turning the unit thermostat off and then back on or by shutting off unit power at the circuit breaker.

NOTE: The blower motor will remain active during a lockout condition.

Auxiliary Control Options (Optional)

A pressure differential type water flow switch shall be provided, factory installed, to verify water flow status at the unit. Compressor operation shall be disabled and an alarm signal provided if condenser water flow is lost. Unit operation will be restored when water flow has been reestablished.

DDC Controls: Unit shall be equipped with a factory installed DDC control capable of interfacing with BACnet™, Modbus, N2 or Lon works® (with optional card).

The controller shall be preprogrammed to control the unit and monitor the safety controls.

The unit shall be able to operate as a standalone or be integrated into the building management system.

A leaving water and leaving air sensor shall be installed in the unit.

Wall sensors shall be available for controlling zone temperature.

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