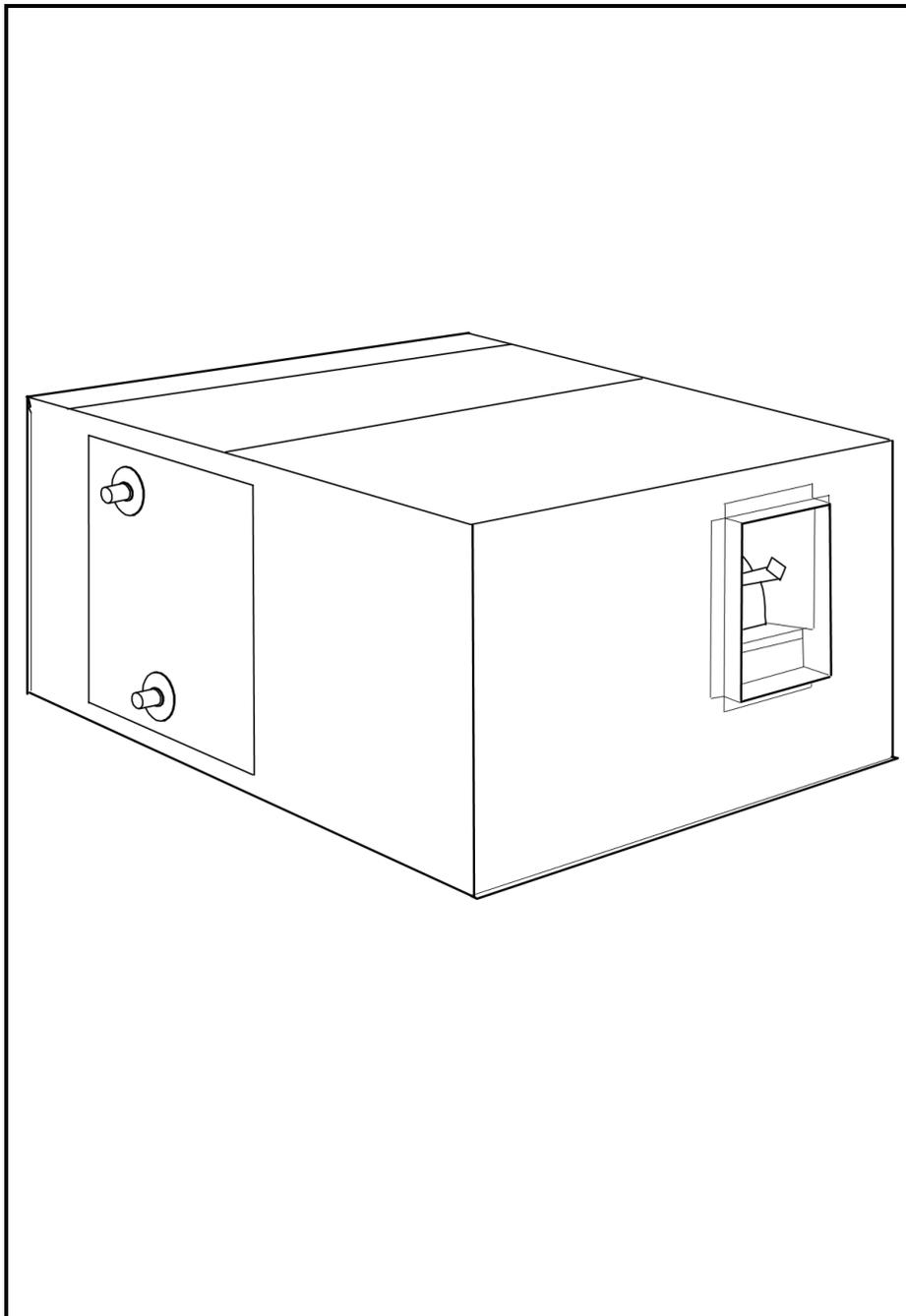




Product Data

39SH,SV,SM,SR00-17 Indoor and Outdoor Air Handlers

Nominal 400 to 8,500 cfm



The 39S series air handlers offer:

- Horizontal and vertical draw-thru arrangements for heating, cooling, ventilation, and VAV (variable air volume) applications
- Small footprint, which assures rigging ease and reduced space requirements

Features/Benefits

Delivering the air handler components for many stringent specification requirements, the 39S series air handlers are compact and fully assembled; they combine versatility with economical, dependable performance.

Dependable performance

Galvanized steel panels ensure structural integrity under all operating conditions. Double-walled hinged access doors on outdoor units also enhance structural stability and provide fast, easy access.

Optional stainless steel drain pan controls condensate.

Internally mounted motors and drives are installed and aligned at the factory. Because they are contained in a cooled, filtered, dehumidified airstream, motor bearings and belts have less wear and require less servicing. Internal mounting also reduces installation time, shipping damage, and vandalism.

Features/Benefits (cont)



Precision-balanced fan wheels limit vibration and eliminate abnormal stress on bearings and other components.

Fan bearings are rated at 200,000 hours average life.

Mixing boxes and filter mixing boxes have parallel blades to provide thorough, efficient air mixing. Dampers are sectioned to prevent excess blade warping and ensure tight closure.

Economy

Factory assembled, prealigned drives and fans eliminate field installation expense, saving money.

Small envelope size is easy to rig and ensures economical use of building space. Quicker, easier installation and set up reduce start-up costs.

High efficiency, precision-balanced fans minimize air turbulence, surging, and unbalanced operation, cutting operating expenses.

Hinged access doors on outdoor, double wall units ease service and promote regular maintenance, saving time and money.

Coil flexibility

The 39S units offer a wide selection of coils for cooling, heating, preheat with cooling, or cooling with reheat

application. Chilled water, DX (direct expansion), and steam coils are available for most product lines in both standard and high capacities while hot water coils are available in 1, 2, 4 and 6 rows for most product lines. The DX coils offer the option of factory-installed TXVs (thermostatic expansion valves) and nozzles and are available for both R-22 and R-410A refrigerants. Single circuit and face splits are also available. Electric heaters are available over a wide kilowatt range in a number of voltages.

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Factory-installed options



ITEM	PRODUCT TYPE			
	SH	SV	SM	SR
MERV 7, 2 in. Pleated Filter	X	X	X	X
Throwaway Filters for Face, Bypass, and Filter Sections	X	—	—	—
Indoor Air Quality (IAQ) Insulation	Std	Std	X	X
Closed Cell Insulation	X	X	X	X
Double Wall Insulation	X	X		X
Motor Start/Stop Station*	X	X	X	—
Plastic Drain Pan†	Std/—	Std/X	—	—
Stainless Steel Drain Pan**	Std/X	Std/X	X	X
Galvanized Steel Drain Pan	—	Std/X	Std	Std

LEGEND

- Std** — Standard Item
X — Optional Item
— — Unavailable Item
Std/— — Standard or Unavailable Item Depending on Unit Size
Std/X — Standard or Optional Item Depending on Unit Size

*Motor start/stop station is not available with electric heat on 39SH units or with 2 speed motors.

†Plastic drain pan is standard on 39SH,SV02-09 units and not available on 39SH00,01,13,17 or 39SV13,17 units.

**Stainless steel drain pan is not available on 39SV02-09 units.

Factory-installed options

Filters — Two-in. throwaway filters are standard on all 39S units. Two-in., MERV 7 pleated filters are also available on all units for increased filtration flexibility.

Insulation — The 39S unit has a minimum $\frac{3}{4}$ in. insulation thickness. Several insulation options are available along with a double-wall finish in order to meet various job-site requirements.

INSULATION OPTIONS

INSULATION TYPE	PRODUCT TYPE			
	SH	SV	SM	SR
Tuf-Skin® II*	—	—	$\frac{3}{4}$ in.	1 in.
Exact-O-Kote® IAQ*	1 in.	1 in.	$\frac{3}{4}$ in.	1 in.
Closed Cell	$\frac{7}{8}$ in.	$\frac{7}{8}$ in.	$\frac{1}{2}$ in.	$\frac{7}{8}$ in.
Double Wall	1 in.	1 in.	—	1 in.

*Registered trademark of Johns Manville, Inc.

NOTE: Dimensions indicate insulation thickness.

Electrical options — Junction boxes are standard on all 39S air handlers. Motor start/stop stations are available on most units for unit fan motor control.

Drain pans — The 39S air handler offers a wide array of drain pan finishes. Plastic and galvanized coatings are offered as low-cost options. Stainless steel is also available, providing an easy-to-clean, corrosion resistant surface.

Application data



Central station air handler

The central station air handler is a heating, ventilating, or air-conditioning unit that is centrally located in, or on, a building or structure and from which air is distributed to desired areas through a system of ducts.

The 39S factory packaged unit

Individual components, such as fans, coils, and filters, are assembled at the factory.

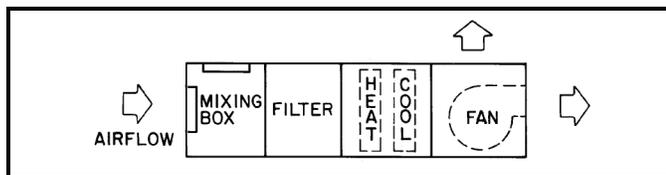
Packaged equipment is less costly than field-fabricated equipment and does not require assembly.

The basic air-handling unit consists of a fan section, coil section, and filter. Other components, such as air-mixing boxes and damper sections, may also be provided.

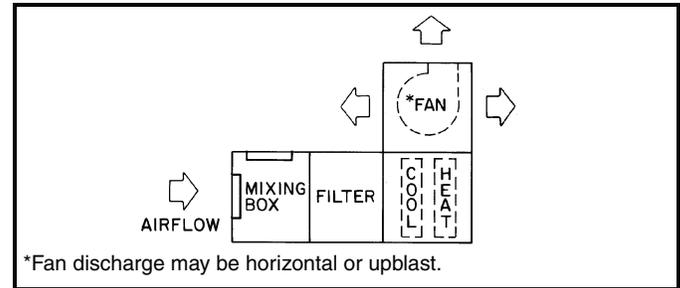
Central station configurations

Draw-thru units

Horizontal



Vertical (indoor unit only)



Fans

The 39S central station air handlers use belt-driven centrifugal fans. A centrifugal fan is one in which the air flows radially through the impeller. Centrifugal fans are classified according to fan wheel and blade construction. The 39S fan has forward-curved blades.

Laws of fan performance

Fan laws are used to predict fan performance under changing operating conditions or by fan size. They are applicable to all types of fans.

The fan laws are stated below. The symbols used in the formulas represent the following variables:

CFM — Volume rate of flow through the fan.

RPM — Rotational speed of the impeller.

P — Pressure developed by the fan.

Hp — Horsepower input to the fan.

D — Fan wheel diameter. The fan size number can be used if it is proportional to the wheel diameter.

W — Air density, varying directly as the barometric pressure and inversely as the absolute temperature.

Application of these laws is limited to cases where fans are geometrically similar.

FAN LAWS

VARIABLE	CONSTANT	LAW	FORMULA
SPEED (RPM)	Air Density Fan Size Distribution System	Airflow varies directly with the Speed.	$\frac{CFM_1}{CFM_2} = \frac{RPM_1}{RPM_2}$
		Pressure varies as the square of the Speed.	$\frac{P_1}{P_2} = \left(\frac{RPM_1}{RPM_2}\right)^2$
		Horsepower varies as the cube of the Speed.	$\frac{HP_1}{HP_2} = \left(\frac{RPM_1}{RPM_2}\right)^3$
FAN SIZE (D)	Air Density Tip Speed	Capacity and Horsepower vary as the square of the Fan Size.	$\frac{CFM_1}{CFM_2} = \frac{HP_1}{HP_2} = \left(\frac{D_1}{D_2}\right)^2$
		Speed varies inversely as the Fan Size.	$\frac{RPM_1}{RPM_2} = \frac{D_2}{D_1}$
		Pressure remains constant.	$P_1 = P_2$
	Air Density Wheel Speed	Capacity varies as the cube of the Size.	$\frac{CFM_1}{CFM_2} = \left(\frac{D_1}{D_2}\right)^3$
		Pressure varies as the square of the Size.	$\frac{P_1}{P_2} = \left(\frac{D_1}{D_2}\right)^2$
		Horsepower varies as the fifth power of the Size.	$\frac{HP_1}{HP_2} = \left(\frac{D_1}{D_2}\right)^5$
AIR DENSITY (W)	Pressure Fan Size Distribution System	Speed, Capacity, and Horsepower vary inversely as the square root of Density.	$\frac{RPM_1}{RPM_2} = \frac{CFM_1}{CFM_2} = \frac{HP_1}{HP_2} = \left(\frac{W_2}{W_1}\right)^{1/2}$
		Pressure and Horsepower vary with Density.	$\frac{P_1}{P_2} = \frac{HP_1}{HP_2} = \frac{W_1}{W_2}$
	Airflow Fan Size Distribution System	Speed remains constant.	$RPM_1 = RPM_2$

Application data (cont)



Fan selection criteria

System requirements — The major factors that influence fan selection are airflow, external static pressure, fan speed, brake horsepower, and sound level. Additional system considerations include the fan control method, overloading, and non-standard air density. Fan selection for air-conditioning service usually involves choosing the smallest fan that provides an acceptable level of performance, efficiency, and quality.

Pressure considerations — The static pressure is the resistance of the combined system apart from the fan. Contributors to static pressure include other components in the air handler, ductwork, and terminals. The static pressure is dependent on the airflow through the system, which is determined by the air conditioning requirements. As shown in the second fan law in the table on the preceding page, the static pressure varies as the square of the airflow (cfm). This ratio between pressure and airflow determines the system curve for any air-handling system.

The static pressure used to select a fan should be the pressure calculated for the system at design airflow. If the static pressure is overestimated, the amount of increase in horsepower and air volume depends upon the steepness of the fan curves in the area of selection.

With forward-curved (FC) fans, if the actual static pressure of the system is less than the design static pressure, the fan has a tendency to deliver more air and draw correspondingly higher bhp (kW of energy). This higher current draw may overload the motor and trip circuit breakers. This is a common occurrence when FC centrifugal fans are operated before all the ductwork has been installed, or during the pull-down load on a VAV (variable air volume) system.

Stability — Fan operation is stable if it remains unchanged after a slight temporary disturbance, or if the fan operation point shifts to another location on the fan curve after a slight permanent disturbance. Fan operation is unstable if it fluctuates repeatedly or erratically. There are 2 main types of unstable fan operation:

System surge is a cycling increase and decrease in system static pressure.

Fan stall is the most common type of instability, and it occurs with any type of centrifugal fan when the fan is starved for air.

Normally, the rotation of the fan wheel forces the air through the blade passageway from the low pressure to the high pressure side of the fan. If the airflow is restricted too much, however, there is not enough air to fill the space between the blades and the air distribution between the blades becomes uneven and erratic. Air can flow backwards through the wheel and the noise level is substantially increased. If the fan runs in this condition for a long time, wheel failure is likely to occur.

For a given speed, the operating point where a fan stalls is a function of the wheel geometry and wheel speed. In general, the stall point is within the range of 15 to 25% of the airflow obtained at free delivery.

Stability and VAV applications — Special considerations must be made for VAV systems. While the initial fan

selection may be acceptable, its operating point could shift to a point of stall at minimum airflow and pressure conditions. The typical minimum airflow is half of the design cooling airflow, which is also often equal to the heating airflow. To determine and plot the minimum airflow versus static pressure, use the following equation. This equation solves for the static pressure at a specific airflow based on a minimum static pressure set point:

$$\left(\left(\frac{\text{CFM}_1}{\text{CFM}_{\text{DESIGN}}} \right)^2 \times (\text{SP}_{\text{DESIGN}} - \text{SP}_{\text{MIN}}) \right) + \text{SP}_{\text{MIN}} = \text{SP}_1$$

$$\left(\left(\frac{7,500}{15,000} \right)^2 \times (4 - 2) \right) + 2 = 2.50 \text{ in. wg}$$

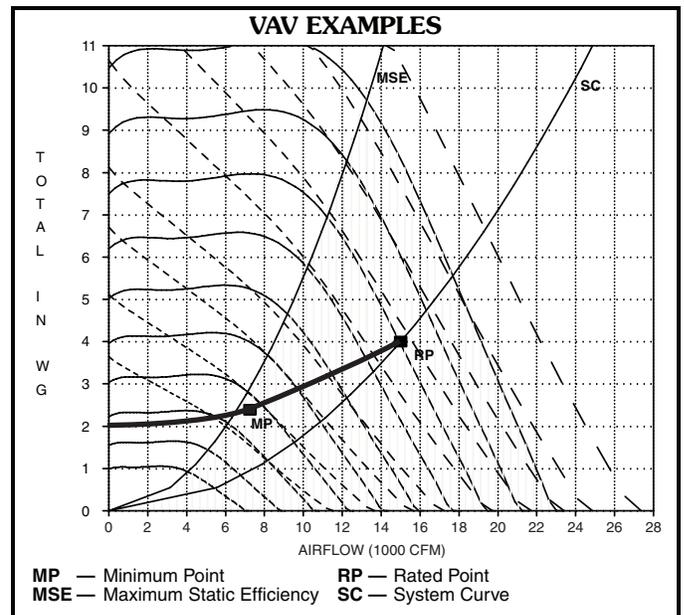
CFM — Airflow in Cubic Feet Per Minute
SP — Static Pressure

The table below illustrates a system with an airfoil fan wheel at a cooling design of 15,000 cfm and a system static pressure of 4 in. wg. The minimum airflow is 7,500 cfm with a minimum system static pressure set point of 2 in. wg. **The minimum static set point is based on zero airflow and does not coincide with the minimum design airflow.**

Example:

% AIRFLOW	CFM	SYSTEM AND FAN STATIC PRESSURE (in. wg)
100	15,000	4.00
90	13,500	3.62
80	12,000	3.28
70	10,500	2.98
60	9,000	2.72
50	7,500	2.50

As shown on the highlighted VAV curve, the minimum airflow and static pressure (MP) are both well within the acceptable operating conditions of the fan.



Sound considerations — The fan is one of the main sound sources in an air-conditioning system. Other sources of sound include the duct system and terminals, because they generate turbulence in the air flowing through them. Simply estimating fan sound does not give an accurate picture of total system sound, but because fan sound is a major component of system sound, fan sound should be minimized.

To minimize its sound generation, a fan must be correctly sized and should be selected to operate at or near peak efficiency. Oversized fans can generate much higher sound power levels than necessary, especially in VAV systems operating at low airflows. Undersized fans can also result in higher sound power levels because of increased fan speeds and the higher tip velocity of the air leaving the fan blades.

For VAV systems, the part load point at which the fan operates most of the time should be used to select a fan for lowest sound output.

Variable frequency drives (VFDs) are used to modulate fan volume. A VFD reduces the sound power level as the fan speed is reduced. At 50% load, the sound level is reduced approximately 15 dB compared to the sound level at 100% load. When using variable frequency drives, it is important to be sure that the static deflection of the vibration isolators is adequate. At very low fan speeds, the fan frequency may approach the natural frequency of the spring isolation. If this happens, the vibration levels can be amplified and resonant vibration conditions can occur.

When sound level is a major consideration, a blow-thru fan should be considered because of the reduced discharge sound level. This sound reduction is due to the sound absorption of the coil section downstream from the fan. Transition fittings and elbows can be reduced in size or eliminated, thereby eliminating a sound source.

To obtain projected sound data for a selected 39S unit, use the electronic catalog **AHUBuilder**[®] program.

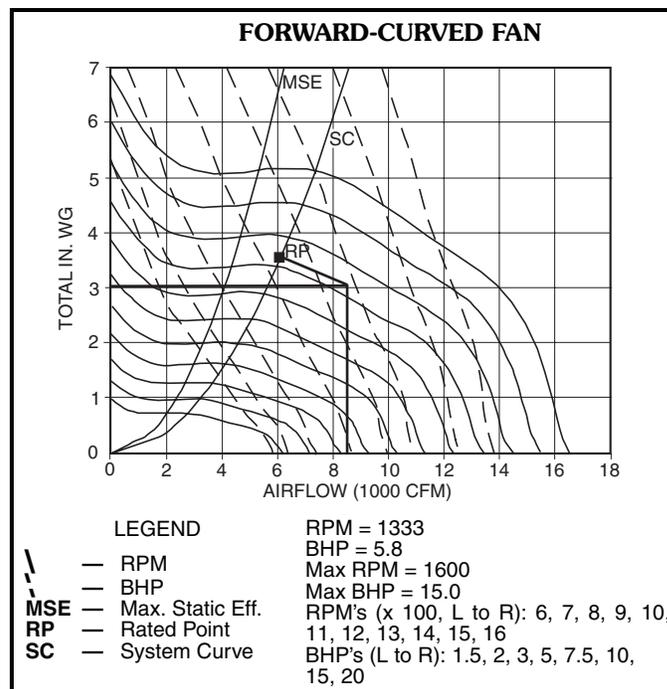
Dirty filtration considerations — Consider selecting an air handler with dirty filters so that, in theory, the unit will have enough horsepower to deliver the same amount of air when the filters are dirty. On a constant volume unit, that would only work if the unit contained an airflow measuring station and could adjust the flow accordingly via a VFD. Otherwise, the point of operation moves along the RPM line as the static pressure in the system changes.

What happens when the fan with sheaves selected for dirty filters is ordered? Three things:

1. The air balancer forces the selection of a smaller sheave because the airflow is too high. When the filters load up, airflow is reduced.
2. If an air balance is not performed, the cooling coil may exhibit moisture carryover due to the considerable increase in airflow.
3. The fan motor trips out on overload with the forward-curved fan because of the increase in bhp.

Example:

Forward-curved fan, 6,100 cfm, 1372 rpm, 5.8 bhp, selected with 100% 2 in. pleated filters. Dirty filters result in a total static pressure (TSP) of 3.56 inches.



Clean filters result in a TSP of 3.06 in.

Follow the 1372 rpm line down to 3.06 in.

Clean filter cfm will be 8,500 cfm. Also note that the horsepower goes from 5.8 bhp to about 9 bhp because the FC fan is an overloading type fan.

So, if dirty filters need to be taken into consideration, do one of the following:

1. Make the final fan selection with the **clean** filter rpm but use the motor horsepower requirement for **dirty** filters.
2. Make the final fan selection with the **dirty** filter rpm and use the motor horsepower requirement for **dirty** filters — **only if** the engineer plans on using a VFD and airflow measurement station or if it is a VAV system.

Fan, motor, and drive heat considerations — The work output of a fan and its motor and drive contribute directly to the airflow and pressure exiting the air handler. Not all of the energy output of the fan generates airflow, however. Fan motors are not 100% efficient, and their efficiency loss translates directly into heat that must be factored in when calculating the temperature rise across a fan section. Fans also add a certain amount of heat to the airstream due to the effects of compression and bearing friction. Finally, belt drives do not transmit all of the energy generated by the motor. Some of the energy is lost in the form of heat due to belt tension and the type and number of belts. Belt drive bhp losses range from 2 to 6 percent; a 3% loss is typical.

Because the 39S Series air handlers all have their fans, motors, and drives located within the airstream, heat losses from these components affect the power requirements, cooling load, and heating load.

Application data (cont)



Power losses in the motor and drive should be allowed for when determining the motor output (bhp), so that the motor can be correctly sized and so that the additional heat output can be subtracted from cooling capacity or added to heating capacity. A typical example follows:

Given Fan Operating Point:

- 13,224 cfm
- 9.6 Fan bhp
- 3.0% estimated drive loss

Calculate the required fan motor output (H_p) due to drive loss:

$$H_p = (\text{Fan bhp}) \times (\text{Drive Loss})$$
$$H_p = 9.6 \times 1.03$$
$$H_p = 9.89 \text{ hp (select 10 Hp motor)}$$

Calculate the total fan motor heat output (Q) according to motor efficiency:

$$Q = (\text{Motor Output}) \div (\text{Motor Efficiency [Typical]})$$
$$Q = 9.89 \div 0.86$$
$$Q = 11.5 \text{ hp}$$

Convert horsepower to Btu per hour.

$$11.5 \text{ hp} \times 2545 = 29,268 \text{ Btuh}$$

Calculate the increase in leaving-air temperature (ΔT) due to fan and motor heat and drive losses:

$$Q = 1.1 \times \text{cfm} \times \Delta T$$
$$29,268 \text{ Btuh} = 1.1 \times 13,224 \times \Delta T$$
$$29,268 \text{ Btuh} = 14,546.4 \times \Delta T$$
$$\Delta T = 2.01 \text{ F (use to estimate coil requirements)}$$

Fan application

Certain fans are more efficient in low-static pressure systems, while others operate best in higher pressure systems. Some fan types are designed to handle very large air volumes while others are more efficient at lower volumes. The low cost 39S unit is designed for use with low-static pressure systems and is only available with forward-curved fans. For higher static applications, specify 39M or 39R units.

Forward-curved (FC) fans are typically used for low to medium pressure applications (0 to 5 in. wg total static pressure [TSP]).

The FC fans are reasonably stable over a wide airflow (cfm) range at constant speed. Because of the relatively flat curve, FC fans tolerate modulation in airflow without large increases in static pressure. Most important, FC fans are lowest in first cost.

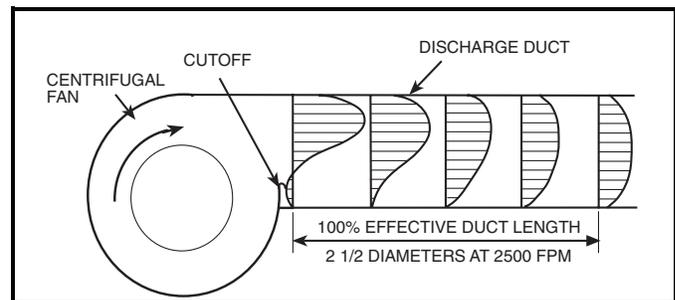
Duct design considerations

The discharge ductwork immediately downstream from the fan is critical for successful applications. Poorly designed ductwork can degrade fan performance and contributes to excessive pressure drop and noise.

The 39S Series forward-curved fans are tested as part of a system with straight discharge ductwork, and the fan ratings are based on this duct design. When designing ductwork in the field, it is important to use a straight discharge duct of the correct dimensions to obtain maximum fan performance. The straight section of ductwork helps the airflow to develop a uniform velocity profile as it exits the fan and allows the velocity pressure to recover into static pressure. See the figure at right.

For 100% recovery of velocity pressure into static pressure, the straight portion of the discharge duct must be at least $2\frac{1}{2}$ times the discharge diameter in length for velocities of 2500 fpm or less. For each additional 1000 fpm, add one duct diameter to the length of the straight portion of the ductwork.

As an example of how to size the straight portion of duct, assume the fan has a 34 x 34 in. discharge outlet (8.03 sq ft). The equivalent diameter is 39 in., so the straight duct length required would be 8 ft long.



Fan control on variable air volume systems

Introduction

With their inherent characteristics of reducing airflow to meet demand, VAV systems can be a source of major energy savings, because fan brake horsepower (bhp) varies with the amount of air delivered.

The degree to which bhp savings are realized, however, is also affected by the type of fan volume control selected and the effectiveness of its application. Effective fan control assures proper duct pressure for the required control stability of the air terminals and provides quiet terminal unit operation when “riding the fan curve.”

Consider the following when selecting a fan volume control method:

1. System parameters
 - a. Airflow (cfm)
 - b. Static pressure
 - c. Percent volume reduction (turndown)
2. Fan type and selection point
 - a. Design point efficiency
 - b. Part load efficiency (especially the point where the fan will be operating most of the time)
 - c. Part load stability
3. Ease of control installation and use
4. Motor selection
 - a. Higher bhp inputs due to efficiency of VAV control method
 - b. Compatibility with VAV control
5. Sound levels
 - a. Fan-generated sound
 - b. Terminal sound
 - c. Control-generated sound
 - d. System sound (ducts, fittings)
6. Initial cost and operating cost
7. Reliability and ease of maintenance

System parameters

Before a fan type or control is selected, the system must be analyzed at both the design point and part load. The fan is likely to be operating at part load a large percentage of the time.

Methods of fan air-volume control

- “Riding the fan curve” with terminal throttling (forward curved fans)
- Variable frequency drives (VFDs)

A short description of these control methods follows. A summary comparison table is provided at the end of the section.

Forward-curved (FC) fans with terminal throttling (riding fan curve) — This is the simplest, most reliable, and most economical first-cost method of air volume control on VAV systems, since no accessories are required. This type of VAV control can be used on forward-curved fans with flat pressure characteristics and in systems where static pressure changes at the terminals are moderate. Air volume reduction is produced solely by throttling of terminal units in response to load reduction. As the units throttle, system resistance changes.

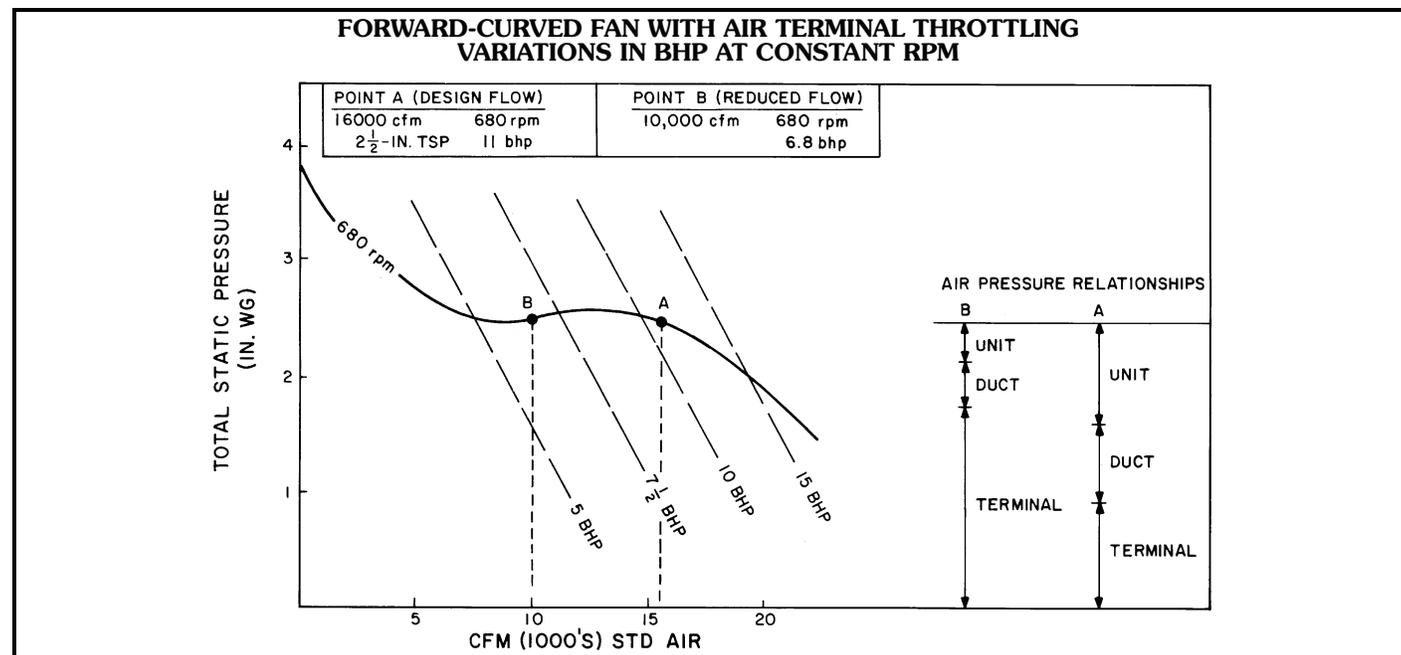
The chart below, Forward-Curved Fan with Air Terminal Throttling, illustrates the reduction in bhp and airflow at constant speed. Point A is the peak airflow operating point. Note the required bhp at this airflow. As airflow is reduced by terminal throttling, move along the fan constant rpm curve to point B. Note the lower cfm and bhp values at B.

At reduced airflow conditions, the total system static pressure may undergo little or no change although air pressure loss through the air-handling unit decreases. This means that duct pressure increases as pressure loss across the terminal unit increases. For low-static and medium-static pressure systems, this increase in duct pressure should not result in noticeable sound level changes. However, at higher design static pressures, sound levels and duct leakage may increase and the control method should be reviewed to determine if it is feasible.

FAN TYPE AND APPLICATION

TYPE	CHARACTERISTICS	APPLICATION
Forward-Curved (FC) Side View 	<ul style="list-style-type: none"> • Double-width, double-inlet (DWDI) construction. • Best at low or medium pressure (approximately 0 to 5 in. wg). • Horsepower increases continuously with increase in air quantity (overloads) as static pressure decreases. • Runs at relatively low speed, typically 400 to 1200 rpm. • Blades curve toward direction of rotation. 	For low to medium pressure air-handling applications.

FORWARD-CURVED FAN WITH AIR TERMINAL THROTTLING VARIATIONS IN BHP AT CONSTANT RPM



Application data (cont)



Variable frequency drives — Variable frequency drives (VFDs) are used to modulate the fan motor speed in response to air volume requirements. To vary the motor speed, a VFD changes the input frequency and line voltage into a wide range of frequency and voltage outputs, while maintaining a constant ratio of frequency to voltage.

Variable frequency drives convert input ac power to dc power and then convert the dc power to a different ac power output using an inverter. The inverter creates the ac output by rapidly switching the polarity of the voltage from positive to negative. Power output from the VFD is not a smooth sine wave, but has many “steps” in the wave form. This type of power output can cause a standard fan motor to exceed its rated temperature range. The stepped power output also results in motor efficiency losses that must be considered when calculating the energy savings offered by the VFD.

Because of the stepped power output generated by VFDs, fan motors rated for inverter duty are recommended. If a standard motor is used with a VFD, the motor should not be operated at the full service factor.

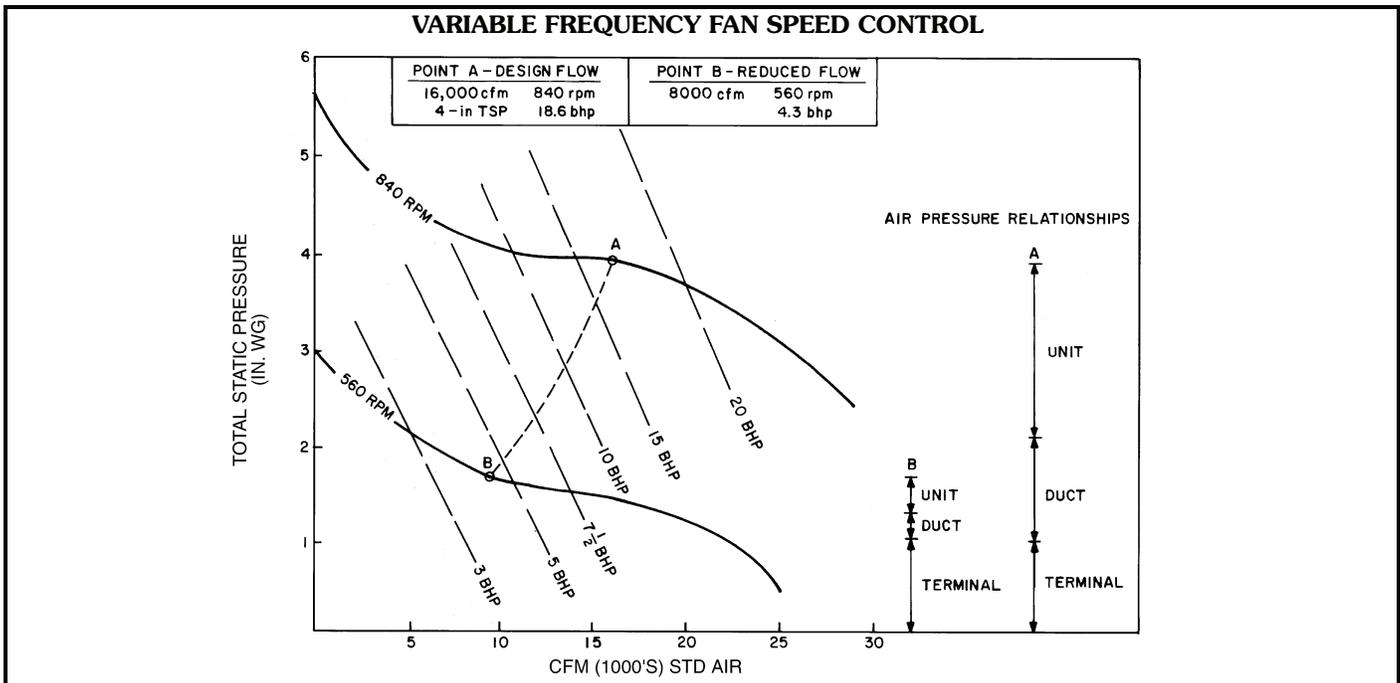
Variable frequency drives can be an effective way to control air volume and save energy. They can provide greater reduction in fan bhp than throttling with either fan discharge dampers or inlet guide vanes. At reduced load requirements, fan speed is reduced proportionately, with resulting lower airflow, lower static pressure, lower bhp requirements, and lower sound levels.

As the load decreases in a VAV system and the terminal units throttle, duct static pressure increases. A static pressure sensor in the duct system detects the pressure increase and initiates a fan speed change through the VFD. Fan speed is reduced until the duct sensor detects a satisfactory duct pressure.

The Variable Frequency Fan Speed Control chart illustrates the results of fan speed reduction as operation shifts from Point A to Point B. If duct pressure begins to fall due to terminal units opening, the duct sensor signals the VFD to increase fan speed.

This method of air volume control permits fan speed reduction down to as low as 10% of the design speed. With FC fans riding the fan curve at the lower rpm, airflow may be as low as 10% of peak design, **as long as motor rpm is not less than 1/6 of motor synchronous speed.**

The method may be applied to any size VAV system with any type of fan. It is particularly cost effective on systems with high turndown requirements where the full speed reduction capability can be used.



FAN SUMMARY COMPARISON

TYPE OF CONTROL	FIRST-COST RANK	TURNDOWN RANGE (Normal)*	SOUND GENERATION RANK†	ENERGY-SAVINGS RANK	APPLICATION RANGE — NORMAL FOR AIR COND.	COMMENTS
FC Fan Terminal Throttling (Riding Fan Curve)	1 (Lowest Cost)	60-70%	3	3	TSP 0" to 4.5" Cfm 3,000 to 15,000	For moderate turndown systems with a flat fan curve and low to medium static pressure and cfm range.
FC Fan with 2-Speed Motor	3	(Not Applicable)	2	2	TSP 0" to 4.5" Cfm 3,000 to 15,000	For systems with predictable 2-load situations in low to medium static pressure range. Controls are more complicated. Starters are more costly.
FC Fan With Variable Frequency Drive	2	10-15%	1 (Quietest)	1 (Best)	TSP 0" to 4.5" Cfm 3,000 to 15,000	For high turndown, low to medium static pressure systems. Best energy savings. Fast payback. Fan generates least sound.

LEGEND

FC — Forward Curved
TSP — Total Static Pressure

*Percentage of modulation of the design airflow.

†Including part load.

NOTE: Rank is based on a relative scale of 1 to 4. Some methods have comparable rating.

Unit control arrangements with Direct Digital Controls

Supply fan control

Supply fan control is used to match the supply fan delivery to the airflow required by the load in a variable air volume system. This is done by maintaining a constant static pressure in the supply duct at a point approximately $\frac{2}{3}$ of the distance from the supply fan discharge.

The microprocessor uses a control loop to provide the capability. This processor measures the static pressure at the pick-up probe, compares it to the desired set point, and modulates the fan volume control device. See the Supply Fan Control figure. The volume control device can be a factory-installed or field-installed variable frequency drive (VFD).

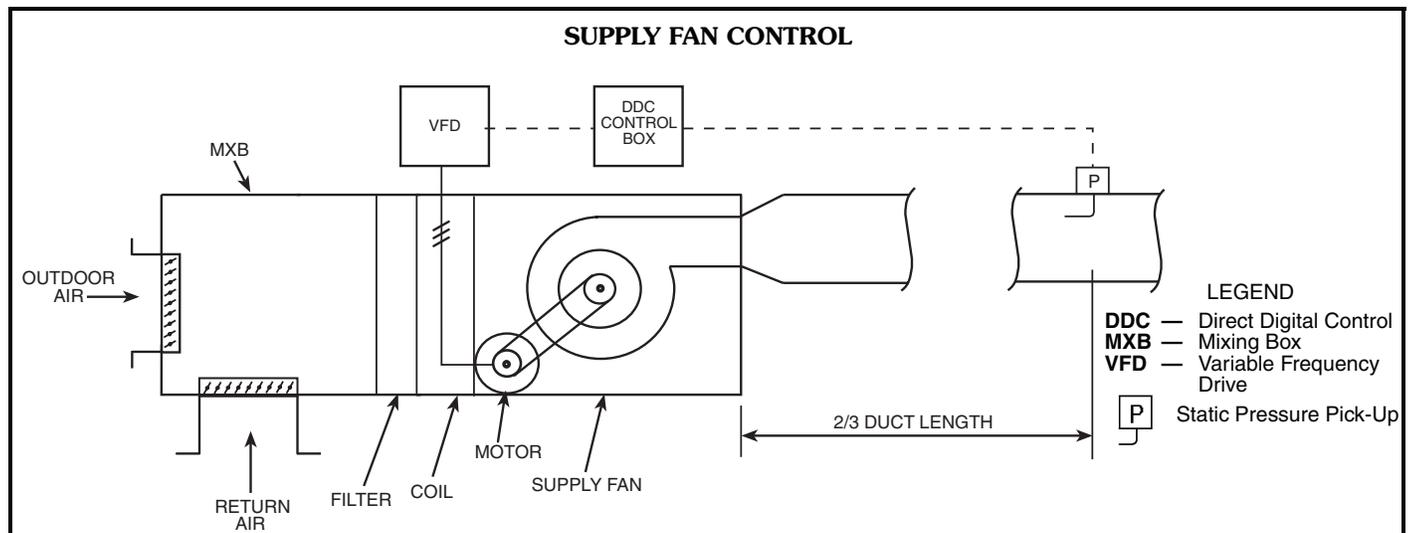
Inlet guide vanes are not offered on 39S units. For supply fan control, it is recommended that a VFD be used. The VFD offers several advantages over inlet guide vanes. First, the VFD operates more efficiently in most applications, thus saving energy. The VFD also provides the ability to maintain control over a much larger airflow range (it has a higher turn-down ratio). The following guideline should be used to ensure proper control:

- Variable frequency drives should not be operated at below 10% of the maximum for which the fan was selected, regardless of the fan type.

For supply fan applications, the microprocessor option maintains the duct static pressure at a desired set point between 0.2 and 4.5 in. wg to within ± 0.1 in. wg throughout the fan control range. In applications where over 100 ft of pneumatic tubing is required, the transducer must be removed from the control box and remotely mounted near the static pressure pickup.

Indoor air quality (IAQ) applications

The CO₂ demand-controlled ventilation override increases the minimum ventilation level in order to maintain the CO₂ level at or below the maximum level per person. Features include the ability to save energy by ventilating only to the actual rate required, rather than the maximum design occupancy rate. When combined with Product Integrated Controls, the feature automatically adapts and changes ventilation quantity without operator set point adjustments. The feature has user-selectable values for minimum mixed-air temperature override, maximum damper ventilation override position, and supply air tempering (when hot water/steam heat is used).



Application data (cont)



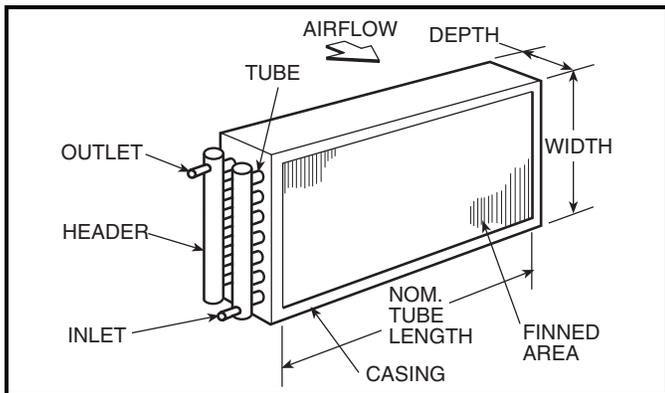
Coils

Coil definitions

A coil, as the term is used with air-handling equipment, is a heat exchange device. A heating or cooling medium passes through the coil, where it either rejects heat to or absorbs heat from the airstream passing over the coil, depending upon the relative temperatures of medium and airstream.

Tube — The tube is a small-diameter pipe through which the heating or cooling medium passes as it rejects or absorbs heat. Coil tubes are generally constructed of copper but may be made of other metals.

Fin — The coil fin is a thin metal plate attached to the tube to improve the heat transfer efficiency from medium to airstream. Typically, it is made of either aluminum or copper.



Header — The header is a pipe of large diameter to which several tubes are connected. It serves as a distributor of the heating or cooling medium to the tubes. Headers are typically of non-ferrous metal or steel.

Casing — The supporting metal structure for tubes and header is called a casing. It is usually made of galvanized steel but can be made of other materials (stainless steel).

Inlet and outlet — These are pipe stubs on the header where the heating or cooling medium enters and leaves the coil.

In water coils, the supply inlet is the pipe stub located on the side where the air leaves the coil. The outlet is the stub on the entering air side of the coil. Such an arrangement is known as counterflow.

In steam coils, the inlet is always the higher stub so that condensate will drain out of the lower stub.

Finned area or face area — The working area of the coil is defined as the width times length of the finned area through which air passes. This finned or face area does not include the extra dimensions for the casing.

Face velocity — This is the air velocity in fpm across the finned or face area of a coil. It is determined by dividing the air volume in cfm by the coil face area in square feet.

$$\text{Face Velocity (fpm)} = \frac{\text{Air Volume (cfm)}}{\text{Coil Face Area (sq ft)}}$$

The first step in selecting an air handler size is to determine the maximum allowable face velocity.

This maximum is determined by the specifier and is based primarily on the following criteria:

1. Avoidance of moisture carryover into the ductwork (applies to cooling coils only).
2. Air pressure drop across the coil.
3. Heat transfer efficiency.

The maximum safe air velocity without moisture carryover into the ductwork depends on the type and spacing of the finned surface, the amount of moisture on the coil, and the geometry between coil and fan inlet or ductwork. Since coil moisture conditions vary, and coil versus duct geometry varies (for example, between draw-thru, blow-thru, vertical, or horizontal units), the specified maximum face velocity should allow for these variations.

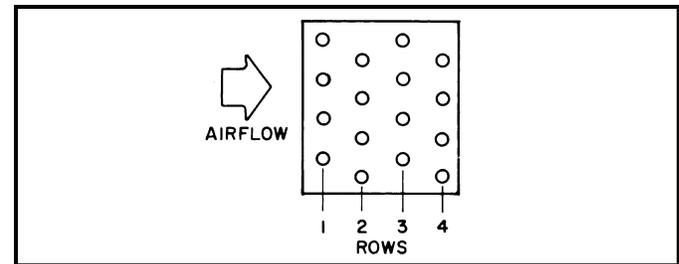
Fan horsepower is also affected by face velocity, since the air resistance across the coil varies roughly as the square of the face velocity.

For the above reasons, the maximum specified face velocity is normally a conservative figure (on the low side). Suggested design face velocities are as follows:

COIL TYPE	FACE VELOCITY RANGE
Cooling	400 to 525 fpm
Heating	400 to 800 fpm

In variable air volume (VAV) applications, the system generally operates below peak air volume for extended periods. In such cases, the design face velocity is commonly selected at the higher end of the suggested range.

Tube face — This is the number of tubes in any one coil row.



Above is a 4-row coil with a 4-tube face. Note that tubes are staggered in adjacent rows.

Cooling coils are typically available in 4 and 6-row configurations. Coils should be sized for the most efficient use of water. Water temperature differences of 12 to 16° F are typical and represent optimum selection points.

Selection procedure (cont)



Electric heat selection procedure

I Determine electric heat requirements based on size of selected unit.

Given:

Air Quantity 3,000 cfm
 Entering-Air Temperature 54 F
 Leaving-Air Temperature 77 F
 Maximum Air Velocity 650 fpm
 Electric Service 460-v, 3-ph, 60-Hz
 Unit Type Horizontal Draw-Thru

II Determine heating load.

$$\begin{aligned} \text{Heating Load} &= 1.1 \times \text{Cfm} \times \text{Air Temp Rise} \\ &= 1.1 \times 3,000 \times 23 \\ &= 75,900 \text{ Btuh (75.9 MBtuh)} \end{aligned}$$

III Verify unit size.

Size of the electric heating coil face area is usually predetermined by the selection of the air-handling unit and the cooling coil. However, the heater size must be checked to assure that the minimum face velocity is provided for the heater.

$$\begin{aligned} \text{Minimum Face Area} &= \frac{3,000}{650 \text{ fpm}} \\ &= 4.6 \text{ sq ft} \end{aligned}$$

$$\begin{aligned} \text{Actual Face Velocity} &= \frac{3,000}{4.9 \text{ sq ft}} \quad (\text{Actual Coil Face Area}) \\ &= 615 \text{ fpm} \end{aligned}$$

IV Determine kilowatt equivalent of heating load.

$$\begin{aligned} \text{kW Heating Load} &= \frac{75.9 \text{ MBtuh}}{3.413 \text{ MBtuh/kW}} \\ &= \frac{75.9}{3.413} \\ &= 22.2 \text{ kW} \end{aligned}$$

V Determine unit electric heater size.

Select the heater which has a kW rating closest to but greater than the required kW and is available at the required voltage.

VI Determine capacity of electric heater.

$$\begin{aligned} \text{Capacity} &= 23 \text{ kW} \times 3.413 \\ &= 78.5 \text{ MBtuh} \end{aligned}$$

VII Calculate air temperature rise.

$$\begin{aligned} \text{Air Temp Rise} &= \frac{78,500 \text{ Btuh}}{1.1 \times 3,000 \text{ Cfm}} \\ &= 23.8 \text{ F} \end{aligned}$$

VIII Calculate the actual leaving-air temperature.

$$\begin{aligned} \text{Leaving Air Temp} &= \text{Ent Air Temp} + \text{Air Temp Rise} \\ &= 54 + 23.8 \\ &= 77.8 \text{ F} \end{aligned}$$

IX Voltage variations.

Variations from the rated voltage of the electric heating coils can significantly affect the coil's rated output. The effects of voltage variation can be determined by the following formula.

$$\text{kW}_a = \text{kW}_r \times \left(\frac{V_a}{V_r} \right)^2$$

kW_a = Actual kW Output From Coil
 kW_r = Rated kW Output From Coil
 V_a = Actual Voltage at Coil
 V_r = Rated Voltage at Coil

Air-handling selection guide

1. Unit size = Coil face area (ft²) = design cfm/max face velocity
 Example: 4,000 cfm/500 fpm = 8 → Size 09
2. Consider your system and choose the appropriate component sections.
3. Determine overall unit dimensions and weight. The height and width for any given unit size is the same for all component sections.
4. Finalize your selections using the latest version of the **AHUBuilder**[®] program. The **AHUBuilder** program is a comprehensive selection tool designed to help customers make the proper air handler choice quickly and efficiently.

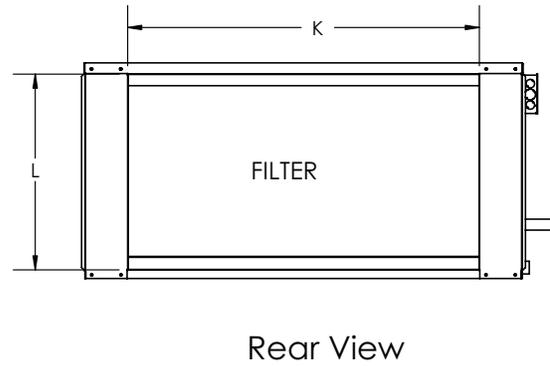
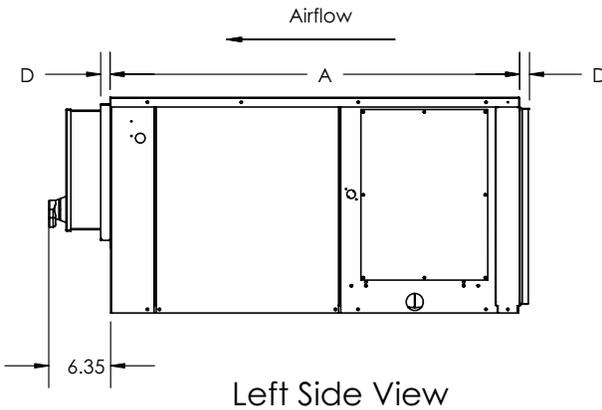
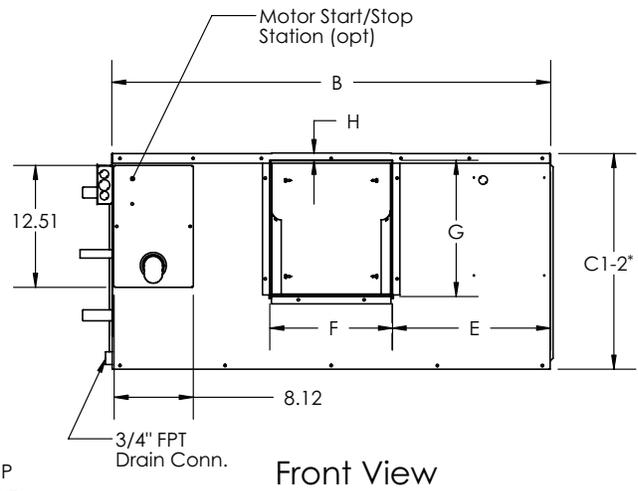
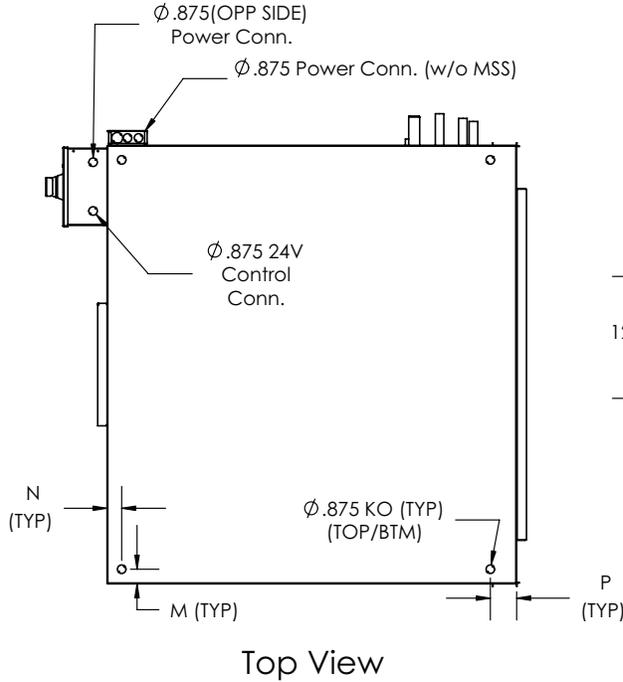
Performance data

Refer to the **AHUBuilder** program for 39S unit performance data.

Dimensions



39SH UNIT



DIMENSIONS (in.)

39SH UNIT SIZE	UNIT OUTLINE							UNIT MOUNTING			BLOWER OPENING OUTLET		RETURN DUCT CONNECTION	
	A	B	C1*	C2*	D	E	H	M	N	P	F	G	K	L
00,01	38.0	28.0	14.1	15.1	1.0	9.6	1.0	1.6	2.6	3.3	8.6	10.6	22.0	12.3
02,03	37.1	36.6	18.1	19.0	1.0	14.1	1.0	1.5	1.5	2.9	8.4	10.6	27.6	16.4
04	42.0	45.0	22.1	23.0	1.0	17.9	1.0	1.5	1.5	2.7	9.1	13.8	36.0	20.0
05	42.0	45.0	22.1	23.0	1.0	14.3	1.0	1.5	1.5	2.7	12.5	13.8	36.0	20.0
07,09	52.5	57.0	34.8	34.8	1.0	21.8	9.1	2.8	2.8	2.8	16.2	16.2	48.0	32.2
13	57.5	67.2	43.0	43.0	N/A	11.4 [†]	8.0	3.7	3.7	3.7	16.4 [†] (2)	16.4 [†] (2)	57.9	40.5
17	57.5	72.3	48.0	48.0	N/A	14.0 [†]	13.0	3.7	3.7	3.7	16.4 [†] (2)	16.4 [†] (2)	66.0	45.7

LEGEND

- BTM** — Bottom
- KO** — Knockout
- w/o MSS** — Without Motor Start/Stop Station

*"C1" dimension is for standard unit. "C2" dimension is for double-wall units.
[†]Sizes 13 and 17 are twin blowers. Dimension "E" is to closest blower. Dimension "F" and "G" are typical for both fan outlets.

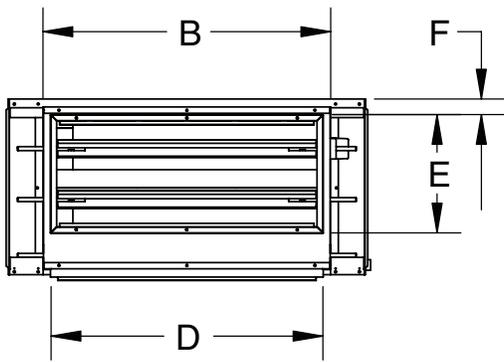
NOTES:

1. Measurements shown in inches.
2. Unit hand is determined by looking into the filters in same direction as airflow. Right hand unit shown for reference.

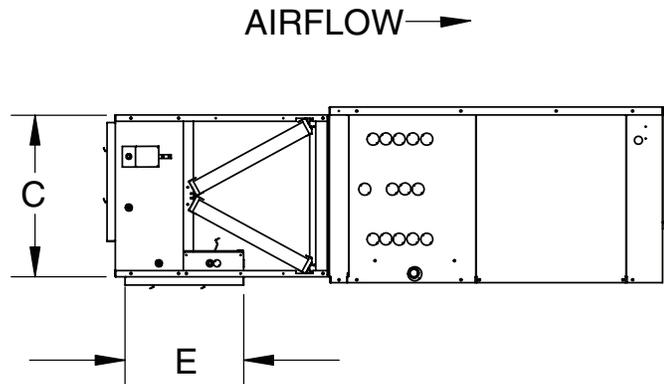
Dimensions (cont)



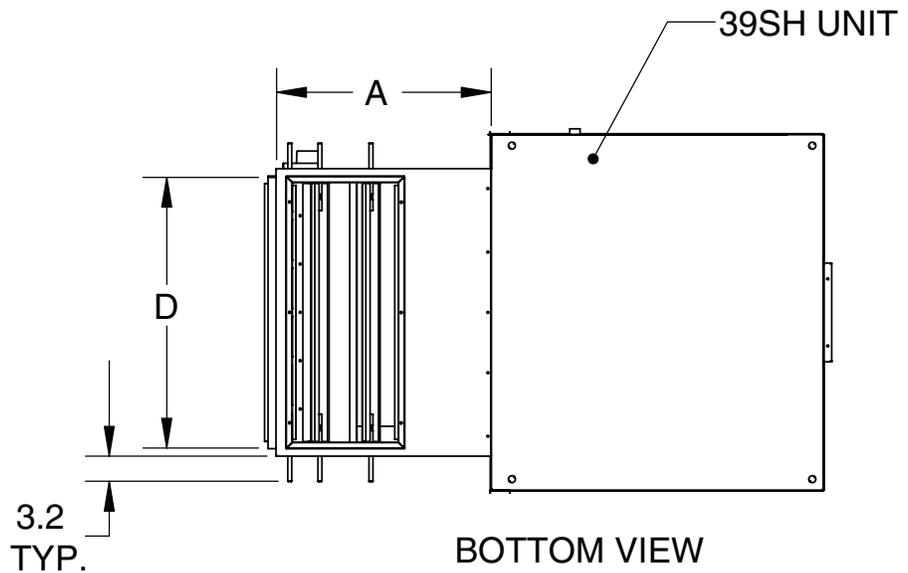
39SH MIXING BOX



REAR VIEW



RIGHT VIEW



BOTTOM VIEW

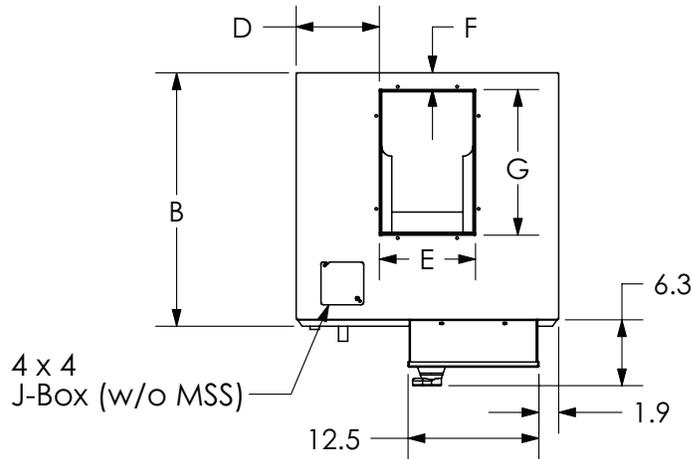
DIMENSIONS (in.)

39SH UNIT SIZE	LENGTH	WIDTH (CENTERED)	HEIGHT (CENTERED)	DUCT WIDTH	DUCT HEIGHT	TOP CLEARANCE	APPROX. SHIPPING WEIGHT lb	FILTERS	
	A	B	C	D	E	F		Size	Qty
00,01	22.1	22.1	12.3	20.4	7.6	2.0	40	14x20x2	2
02,03	27.0	27.7	16.4	25.9	11.6	2.0	90	16x25x2	2
04,05	27.0	36.2	20.4	34.3	15.0	2.0	140	16x32x2	2
07,09	32.0	48.2	32.4	46.3	15.0	9.7	200	20x24x2	4
13	36.0	58.0	40.3	56.0	16.0	13.2	260	20x25x2 16x25x2	4 2
17	40.0	66.2	45.0	64.3	16.0	15.5	320	30x20x2	6

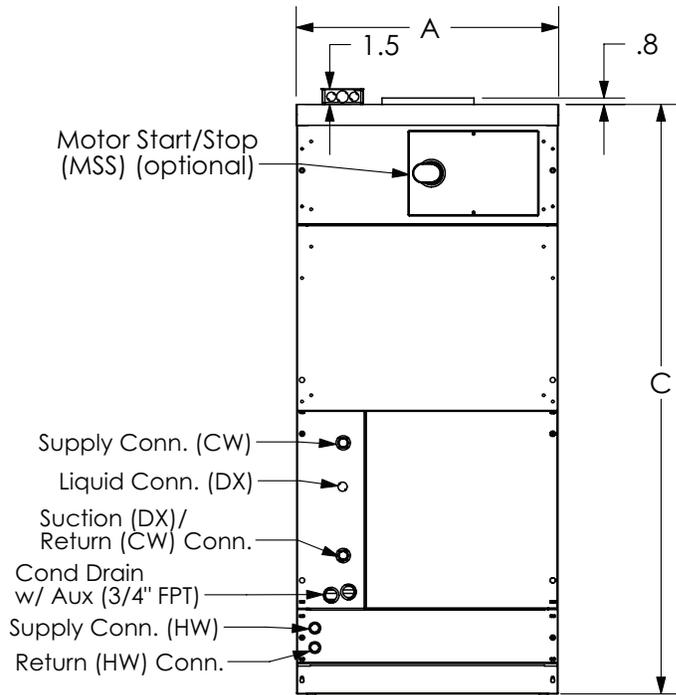
NOTES:

1. 39SH unit shown for reference.
2. Not all components shown for clarity.
3. Optional actuator shown for reference.
4. Dimensions are in inches.

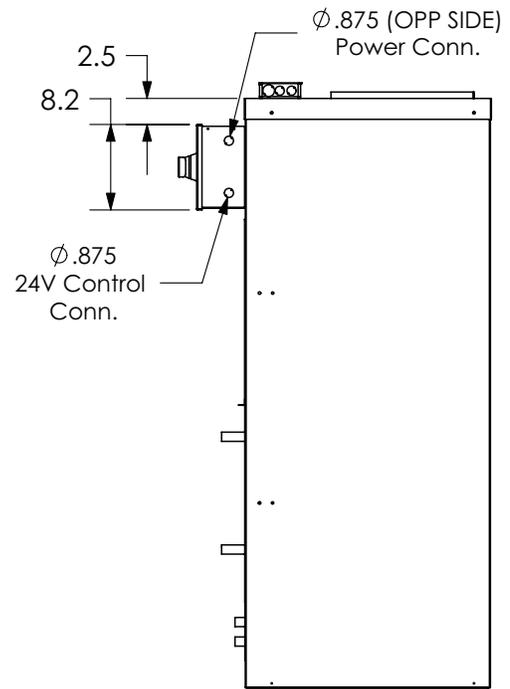
39SV UNIT SIZES 02-05 — PRE-HEAT



Top View



Front View



Right View

DIMENSIONS (in.)

39SV UNIT SIZE	WIDTH			DEPTH				CONNECTION SIZES (OD)		
	A	B	C	D	E	F	G	CW Supply-Return	HW Supply-Return	DX Supply-Return
02	22.3	24.0	50.0	6.9	8.5	3.0	11.8	$3/4 - 3/4$	$7/8 - 7/8$	$3/8 - 3/4$
03	22.3	24.0	50.0	6.9	8.5	3.0	11.8	$3/4 - 3/4$	$7/8 - 7/8$	$3/8 - 3/4$
04	25.1	24.3	56.5	8.0	9.1	1.6	13.9	$7/8 - 7/8$	$7/8 - 7/8$	$1/2 - 7/8$
05	29.5	26.0	59.5	8.4	12.6	1.3	13.9	$1\ 1/8 - 1\ 1/8$	$1\ 1/8 - 1\ 1/8$	$1/2 - 1\ 1/8$

LEGEND

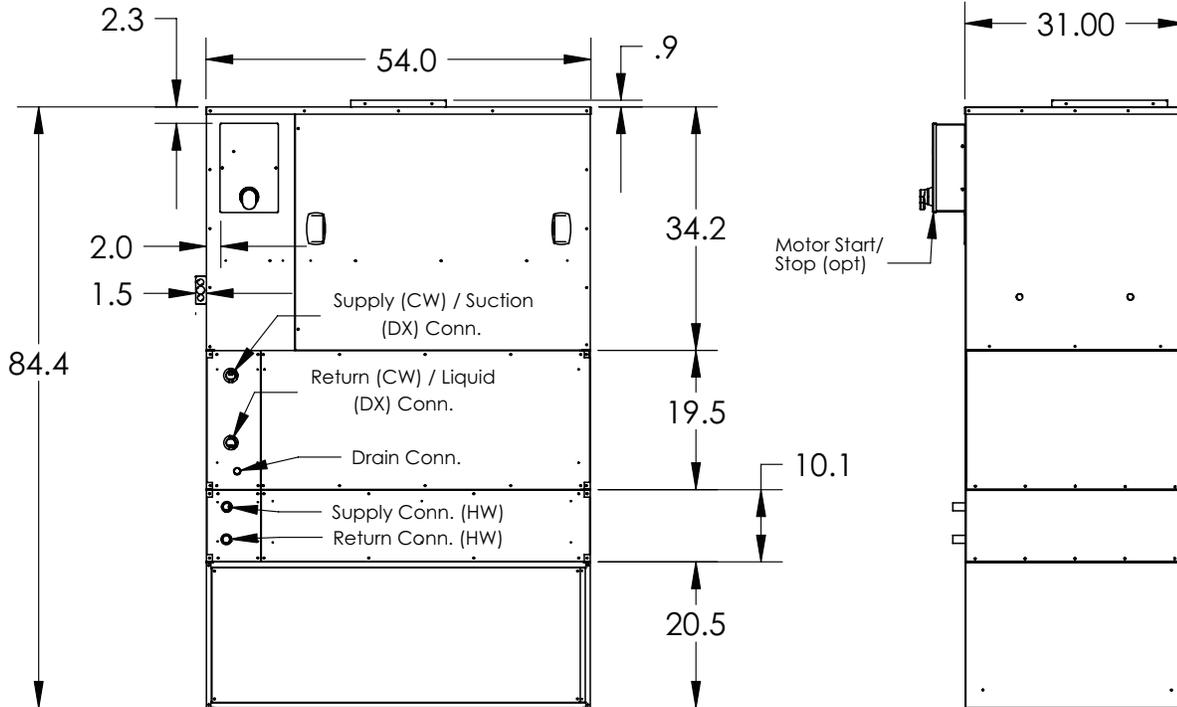
CW — Chilled Water MSS — Motor Start/Stop Station
 DX — Direct Expansion w/o — Without
 HW — Hot Water

NOTE: Measurements shown in inches.

Dimensions (cont)

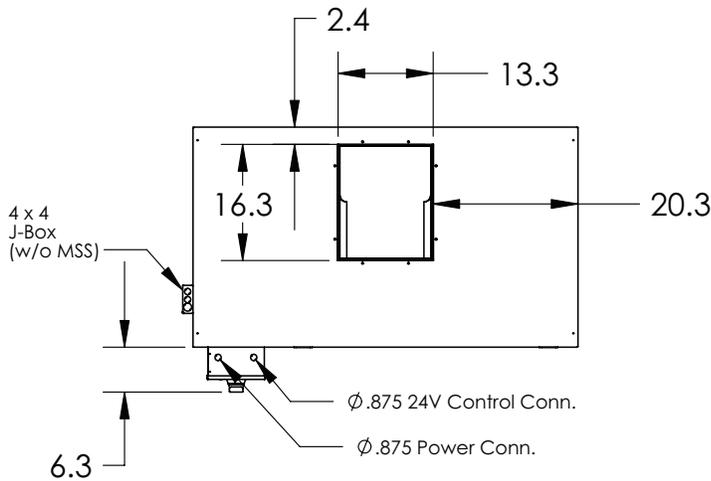


39SV UNIT SIZES 07,09 — PRE-HEAT

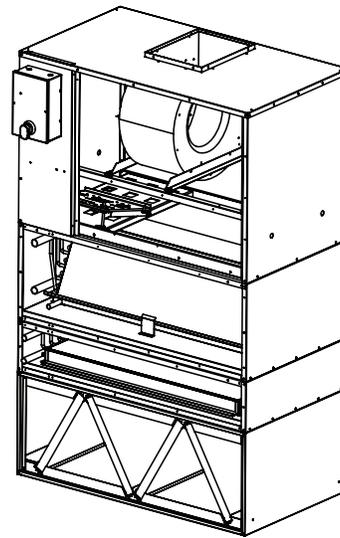


Front View

Right View



Top View



Iso View (w/o panels)

DIMENSIONS (in.)

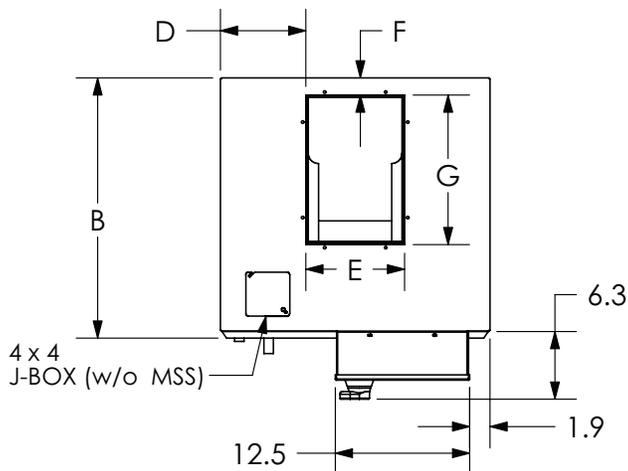
39SV UNIT SIZE	CONNECTION SIZES (OD)			
	CW Supply-Return	HW Supply-Return	DX Liquid-Suction	Drain
07	1 1/8 - 1 1/8	1 1/8 - 1 1/8	5/8 - 1 1/8	0.875
09	1 3/8 - 1 3/8	1 1/8 - 1 1/8	1/2 - 7/8 (2)	0.875

LEGEND

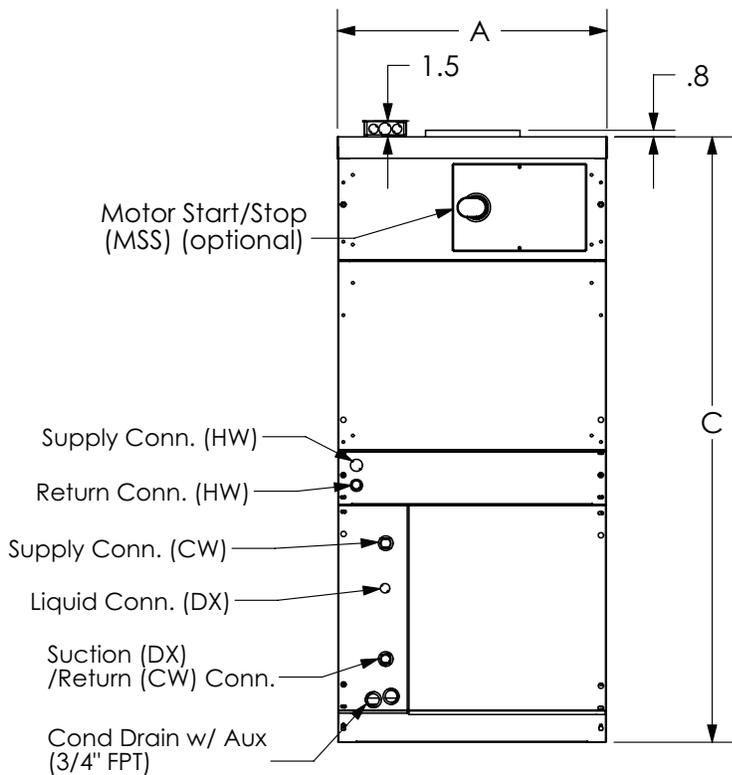
CW — Chilled Water **MSS** — Motor Start/Stop Station
DX — Direct Expansion **w/o** — Without
HW — Hot Water

NOTE: Measurements shown in inches.

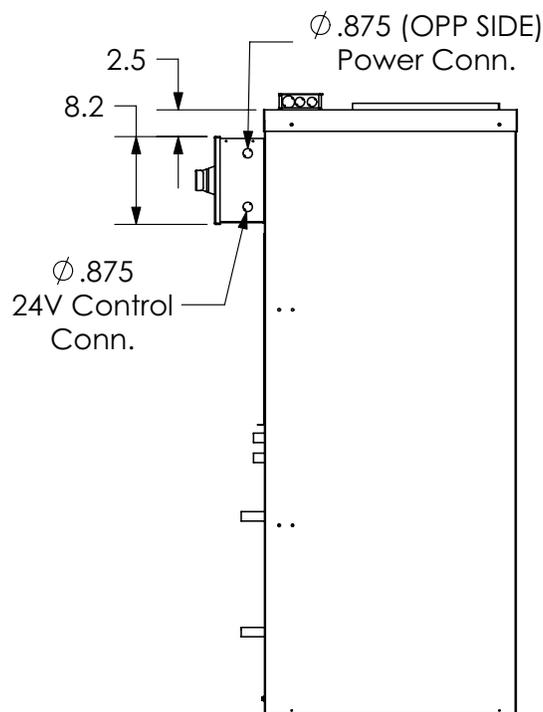
39SV UNIT — RE-HEAT



Top View



Front View



Right View

DIMENSIONS (in.)

39SV UNIT SIZE	WIDTH			DEPTH				HEIGHT		
	A	B	C	D	E	F	G	CW Supply-Return	HW Supply-Return	DX Supply-Return
02	22.3	24.0	50.0	6.9	8.5	3.0	11.8	3/4 - 3/4	7/8 - 7/8	3/8 - 3/4
03	22.3	24.0	50.0	6.9	8.5	3.0	11.8	3/4 - 3/4	7/8 - 7/8	3/8 - 3/4
04	25.1	24.3	56.5	8.0	9.1	1.6	13.9	7/8 - 7/8	7/8 - 7/8	1/2 - 7/8
05	29.5	26.0	59.5	8.4	12.6	1.3	13.9	1 1/8 - 1 1/8	1 1/8 - 1 1/8	1/2 - 1 1/8

LEGEND

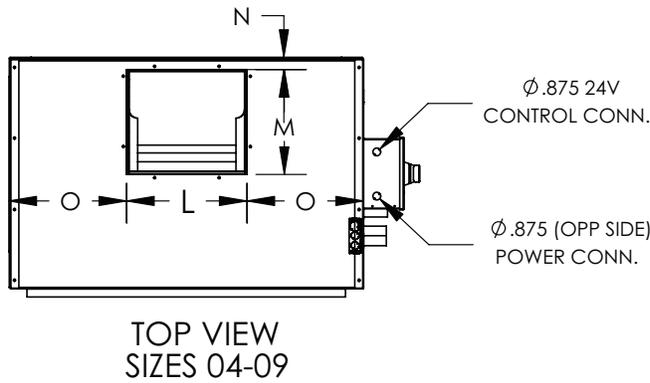
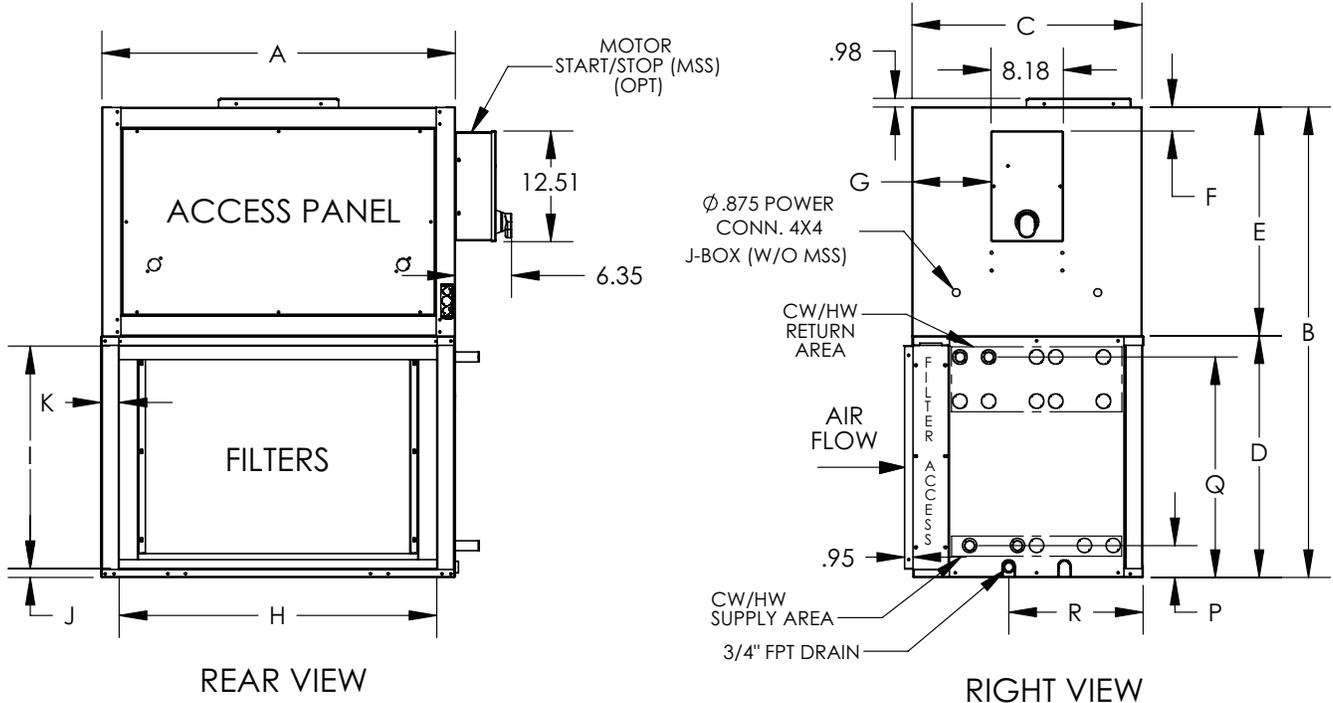
CW — Chilled Water **HW** — Hot Water
DX — Direct Expansion **w/o MSS** — Without Motor Start/Stop Station

NOTE: Measurements shown in inches.

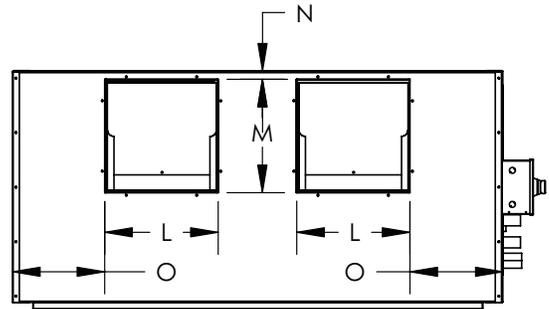
Dimensions (cont)



39SM UNIT — SIZES 04-17 (VERTICAL CONFIGURATION)



TOP VIEW
SIZES 04-09



TOP VIEW
SIZES 13, 17

DIMENSIONS (in.)

39SM UNIT SIZE	WIDTH	HEIGHT	DEPTH	COIL SECTION	BLOWER SECTION	MOTOR START/STOP (OPT.)		RETURN DUCT				SUPPLY DUCT (BLOWER OPENING)				SUPPLY CONN.	RETURN CONN.	DRAIN
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
04	40.0	53.5	26.0	27.5	26.0	2.8	9.0	36.0	25.5	1.0	2.0	13.6	11.9	1.1	13.1	3.6	20.0	15.2
05	40.0	53.5	26.0	27.5	26.0	2.8	9.0	36.0	25.5	1.0	2.0	13.6	11.9	1.1	13.1	3.6	25.0	15.2
07	50.0	68.5	34.0	34.5	34.0	6.8	13.0	48.0	32.0	1.0	1.0	13.4	16.2	1.1	15.4	3.6	25.0	22.5
09	50.0	68.5	34.0	34.5	34.0	6.8	13.0	48.0	32.0	1.0	1.0	13.4	16.2	1.1	15.4	3.6	30.0	22.5
13	72.0	81.5	34.0	47.5	34.0	6.7	13.0	66.0	45.0	2.0	6.0	16.4	16.4	1.1	14.0	3.6	30.0	23.0
17	72.0	81.5	34.0	47.5	34.0	6.7	13.0	66.0	45.0	2.0	6.0	16.4	16.4	1.1	14.0	3.6	42.6	23.0

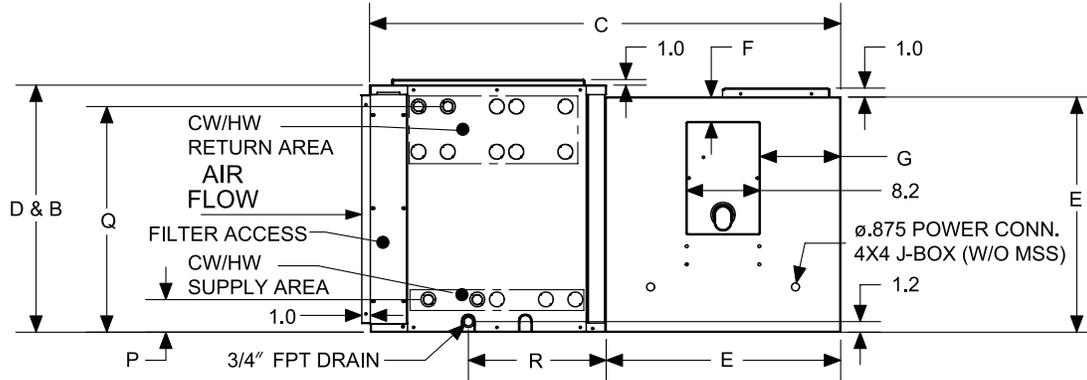
LEGEND

- CW** — Chilled Water
- HW** — Hot Water
- w/o MSS** — Without Motor Start/Stop Station

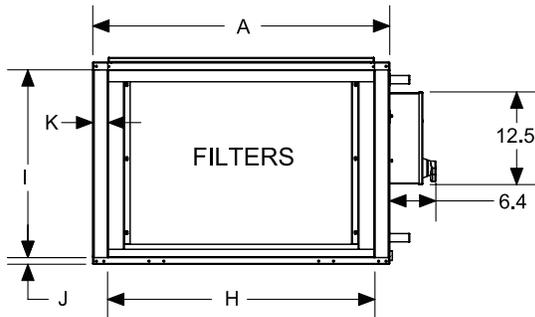
NOTES:

1. Measurements shown in inches.
2. Hand connections are defined by looking at the filters in the direction of airflow.
3. Coil section and blower ship separately and are installed by others.
4. Blower section may be rotated 180 degrees to relocate supply duct.

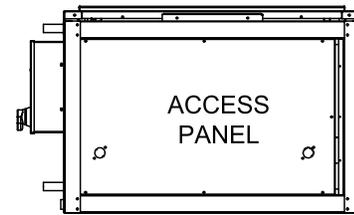
39SM UNIT — SIZES 04-17 (HORIZONTAL CONFIGURATION)



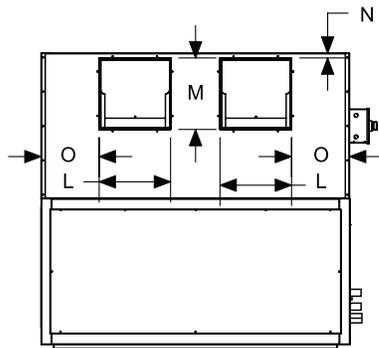
RIGHT VIEW



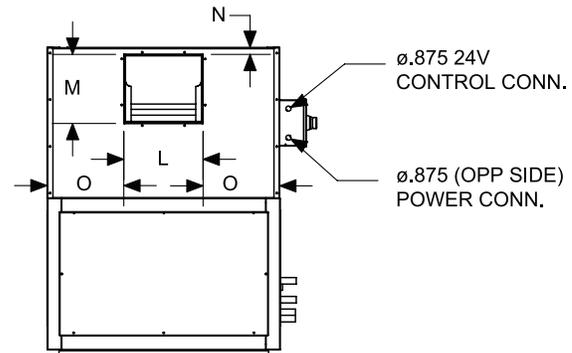
REAR VIEW



FRONT VIEW



TOP VIEW
SIZES 13, 17



TOP VIEW
SIZES 04-09

DIMENSIONS (in.)

39SM UNIT SIZE	WIDTH	HEIGHT	DEPTH	COIL SECTION	BLOWER SECTION	MOTOR START/STOP (OPT.)		RETURN DUCT				SUPPLY DUCT (BLOWER OPENING)				SUPPLY CONN.	RETURN CONN.	DRAIN
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
04	40.0	27.5	52.0	27.5	26.0	2.7	8.9	36.0	25.5	1.0	2.0	13.6	11.9	1.1	13.1	3.6	20.0	15.2
05	40.0	27.5	52.0	27.5	26.0	2.7	8.9	36.0	25.5	1.0	2.0	13.6	11.9	1.1	13.1	3.6	25.0	15.2
07	50.0	34.5	68.0	34.5	34.0	6.8	12.9	48.0	32.0	1.0	1.0	13.4	16.2	1.1	15.4	3.6	25.0	22.5
09	50.0	34.5	68.0	34.5	34.0	6.8	12.9	48.0	32.0	1.0	1.0	13.4	16.2	1.1	15.4	3.6	30.0	22.5
13	72.0	47.5	68.0	47.5	34.0	6.7	12.9	66.0	45.0	1.0	2.9	16.4	16.4	1.1	14.0	3.6	30.0	23.0
17	72.0	47.5	68.0	47.5	34.0	6.7	12.9	66.0	45.0	1.0	2.9	16.4	16.4	1.1	14.0	3.6	42.6	23.0

LEGEND

- CW — Chilled Water
- HW — Hot Water
- w/o MSS — Without Motor Start/Stop Station

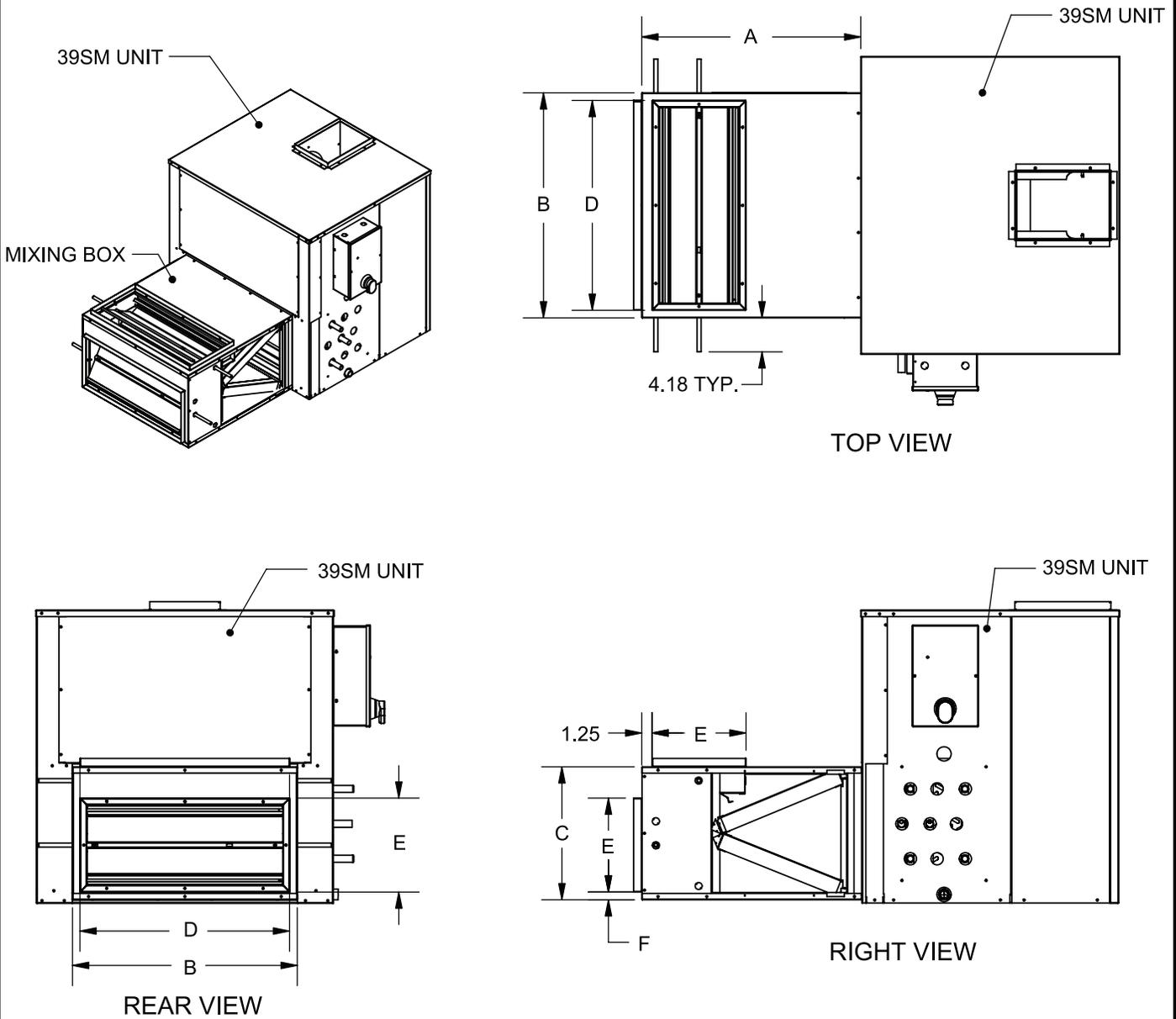
NOTES:

1. Measurements shown in inches.
2. Hand connections are defined by looking at the filters in the direction of airflow.
3. Coil section and blower ship separately and are installed by others.
4. Blower section may be rotated 180 degrees to relocate supply duct.

Dimensions (cont)



39SM UNIT — MIXING BOX



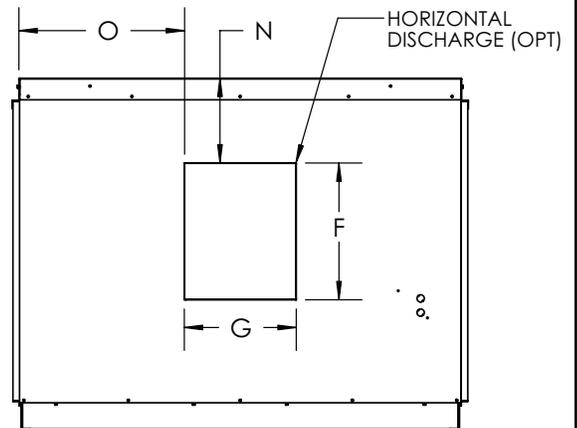
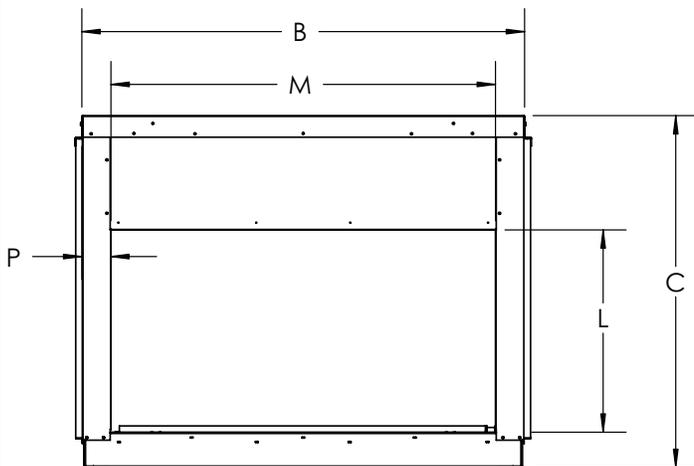
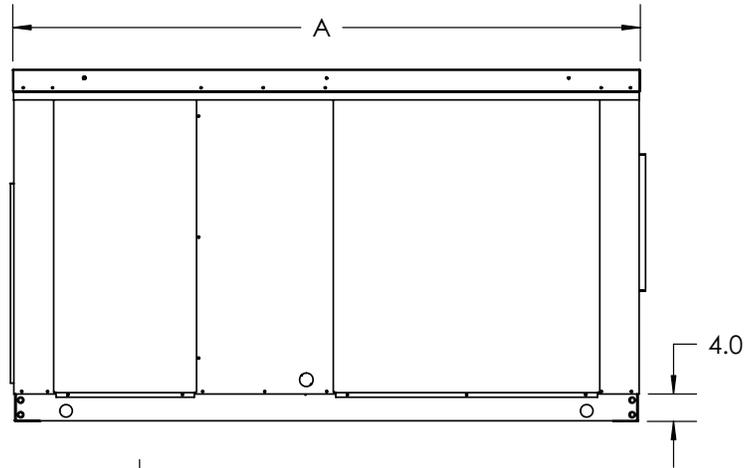
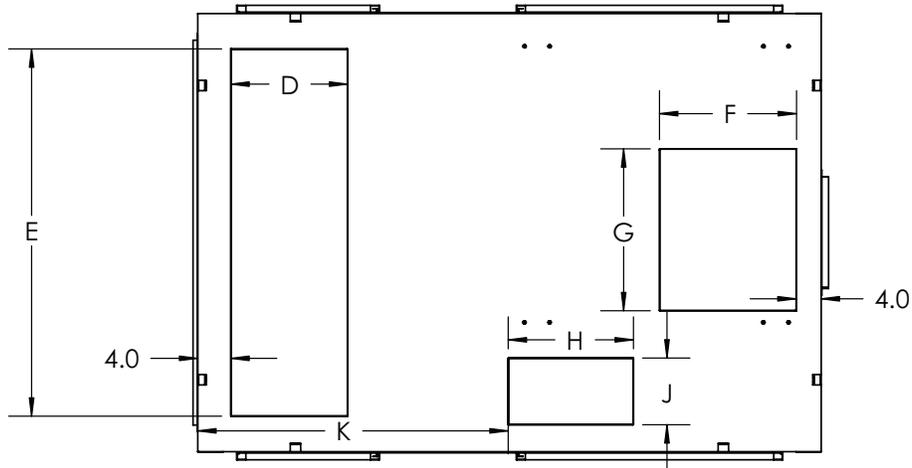
DIMENSIONS (in.)

39SM UNIT SIZE	LENGTH	WIDTH	HEIGHT	DUCT WIDTH	DUCT HEIGHT	TOP CLEARANCE	FILTERS	
	A	B	C	D	E	F	SIZE	QTY
04,05	27.0	36.2	25.5	34.3	15.0	2.0	16 x 32 x 2	2
07,09	32.0	48.2	32.4	46.3	15.0	9.7	20 x 24 x 2	4
13,17	40.0	66.2	45.0	64.3	16.0	15.5	30 x 20 x 2	6

NOTES:

1. Measurements shown in inches.
2. 39SM unit shown for reference only.
3. Not all components shown for clarity.
4. Optional actuator not shown.
5. Top and rear inlets shown. Bottom and rear inlets are also available.

39SR UNIT — SINGLE WALL



DIMENSIONS (in.)

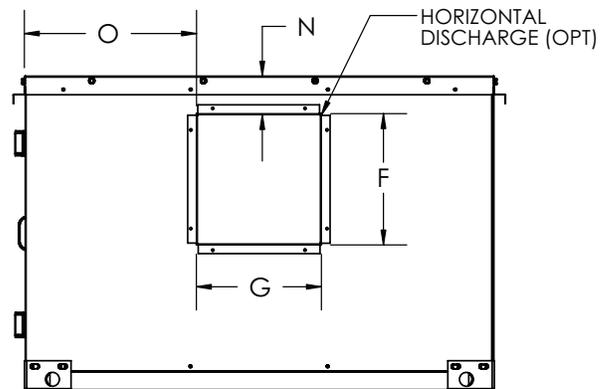
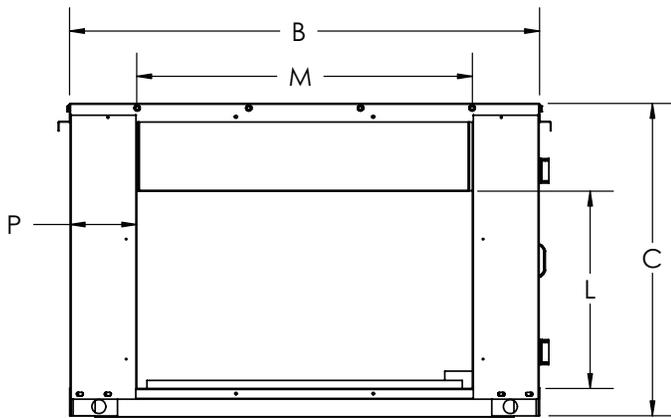
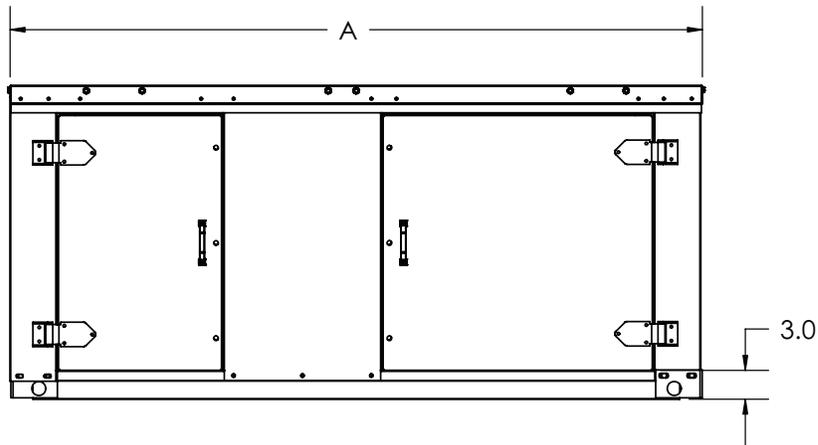
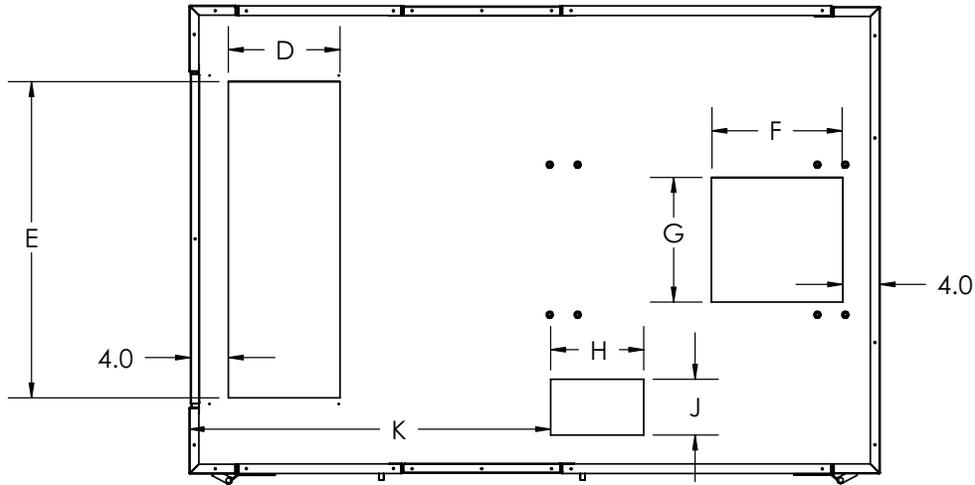
39SR UNIT SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P
02, 03	67.4	39.6	22.5	12.0	25.8	11.9	8.9	11.0	8.0	35.4	14.2	28.4	2.5	15.3	5.6
04, 05	72.1	48.1	28.5	12.0	34.0	14.1	13.1	11.0	8.0	35.6	18.2	35.8	5.1	17.5	6.2
07, 09	75.0	53.0	42.2	14.0	44.0	16.4	13.1	15.0	8.0	37.2	24.3	46.0	10.1	20.0	3.5
13	75.1	53.0	55.7	14.0	44.0	16.4	19.4	15.0	8.0	37.3	32.7	46.0	23.5	16.8	3.5
17	96.0	76.3	53.3	15.0	62.0	19.6	22.0	15.0	8.0	50.3	47.0	68.2	17.4	27.1	4.1

NOTE: Measurements shown in inches.

Dimensions (cont)



39SR UNIT — DOUBLE WALL



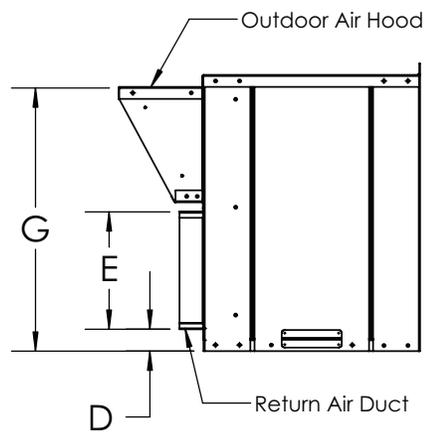
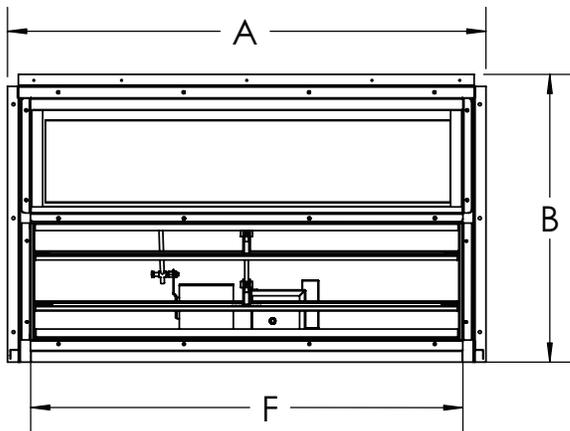
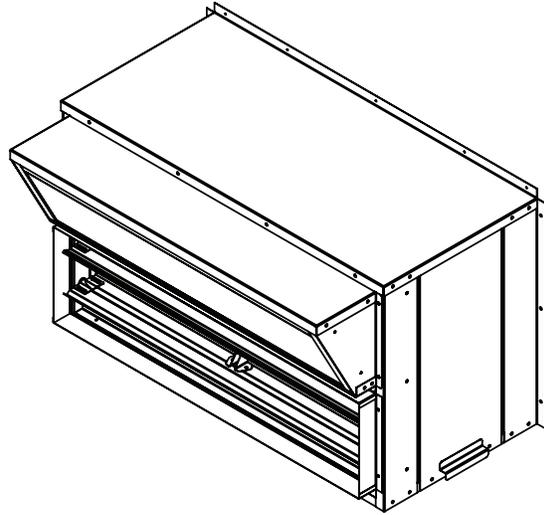
DIMENSIONS (in.)

39SR UNIT SIZE	A	B	C	D	E	F	G	H	J	K	L1	L2	M	N	O	P
02, 03	70.0	42.0	30.5	12.0	26.0	11.9	8.9	10.0	6.0	33.7	17.2	14.2	28.1	8.5	16.6	7.0
04, 05	74.0	50.5	33.6	12.0	34.0	14.1	13.4	10.0	6.0	38.9	21.2	18.2	36.1	4.2	18.6	7.2
07, 09	77.4	55.5	50.9	14.0	44.0	16.4	13.1	15.0	8.0	38.0	35.1	24.3	45.9	19.9	21.2	4.8
13	77.4	55.5	60.6	14.0	44.0	16.4	18.9	15.0	8.0	38.0	48.9	32.8	45.9	29.7	18.3	4.8
17	96.5	76.5	64.1	14.0	62.0	19.0	22.0	15.0	8.0	51.9	48.2	46.9	65.8	24.0	27.3	5.4

NOTES:

1. Measurements shown in inches.
2. L1 dimension is for horizontal or bottom return economizer package option.
3. L2 dimension is for fixed air or manual outside air damper package option.

39SR UNIT — HORIZONTAL RETURN ECONOMIZER PACKAGE



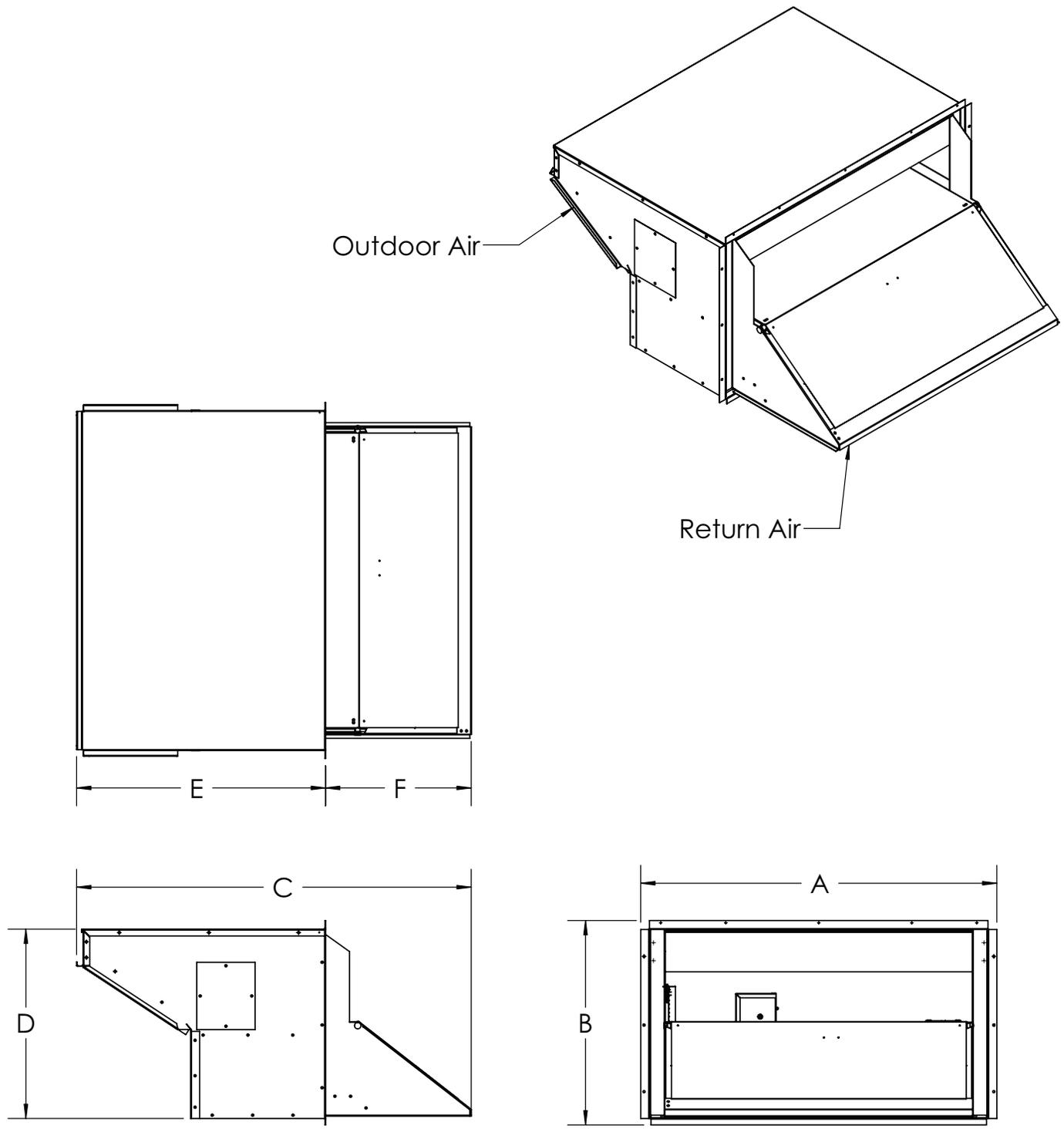
DIMENSIONS (in.)

39SR UNIT SIZE	A	B	C	D	E	F	G
02, 03	30.6	19.9	26.1	2.0	7.7	26.2	17.9
04, 05	39.9	24.0	25.0	1.8	9.9	35.9	22.1

Dimensions (cont)



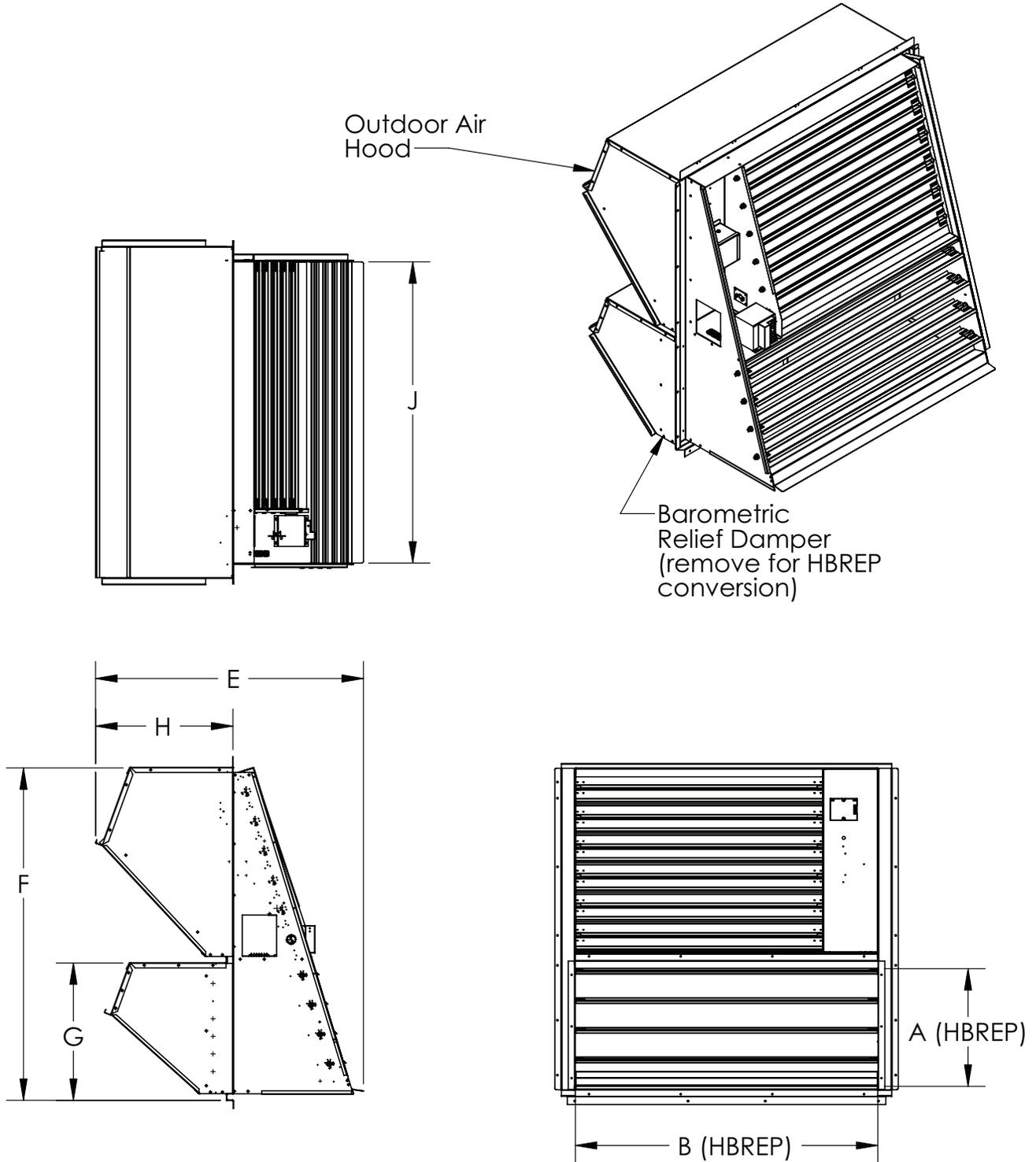
39SR UNIT — BOTTOM RETURN ECONOMIZER PACKAGE



DIMENSIONS (in.)

39SR UNIT SIZE	A	B	C	D	E	F
02, 03	32.100	18.940	42.075	17.260	25.950	16.150
04, 05	39.725	22.825	44.025	21.125	27.750	16.250

39SR UNIT — BOTTOM AND HORIZONTAL RETURN ECONOMIZER PACKAGE



DIMENSIONS (in.)

39SR UNIT SIZE	A	B	E	F	G	H	J
07, 09	13.8	44.1	35.2	34.9	15.4	16.5	48.3
13	18.8	44.1	39.0	48.6	20.1	20.0	48.3
17	19.0	62.9	43.4	45.1	20.1	20.0	66.1

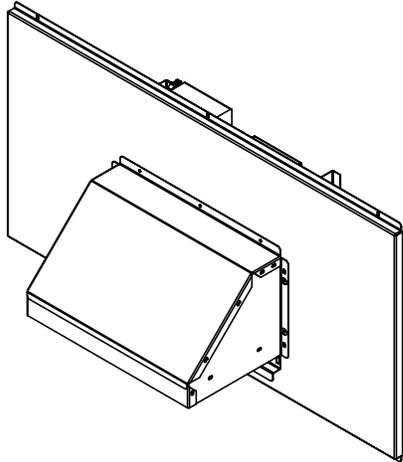
LEGEND

HBREP—Horizontal Return Economizer Package

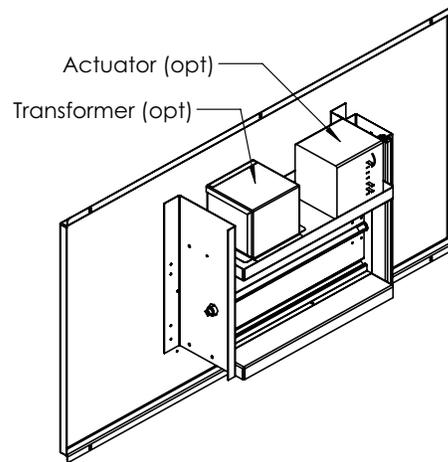
Dimensions (cont)



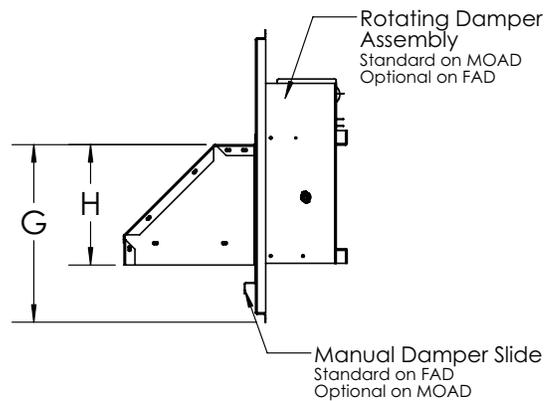
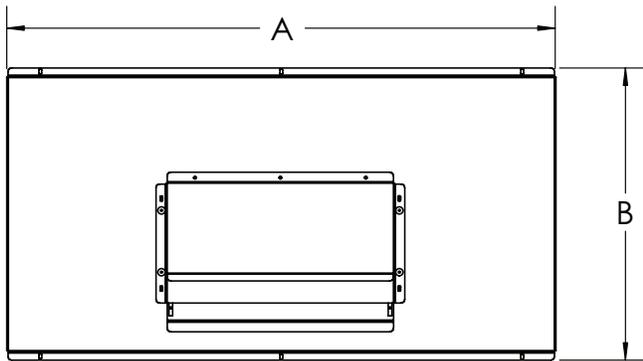
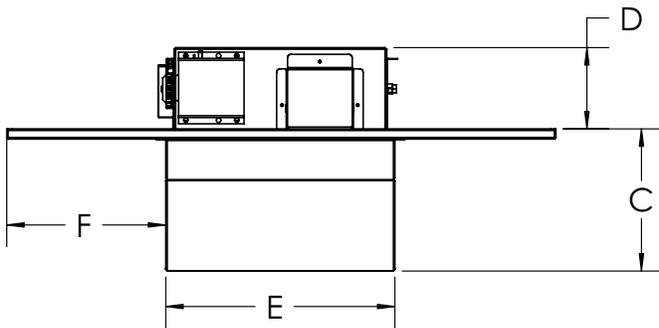
39SR UNIT — FIXED AIR DAMPER/MANUAL OUTSIDE AIR DAMPER



REAR ISOMETRIC VIEW



FRONT ISOMETRIC VIEW



FIXED AIR DAMPER DIMENSIONS (in.)

39SR UNIT SIZE	A	B	C	D	E	F	G	H
02, 03	28.8	16.1	10.7	5.6	10.3	9.3	12.9	10.1
04, 05	37.8	20.1	9.8	5.6	15.8	11.0	12.2	8.3
07, 09	48.8	26.9	14.5	5.6	25.3	11.8	17.6	14.1
13	48.8	34.9	19.4	5.6	21.8	13.5	23.2	19.8
17	30.3	46.8	18.8	5.6	25.3	2.5	32.9	19.8

MANUAL OUTSIDE AIR DAMPER DIMENSIONS (in.)

39SR UNIT SIZE	A	B	C	D	E	F	G	H
02, 03	29.9	19.1	8.7	5.6	24.1	2.9	13.4	10.4
04, 05	37.8	23.5	14.6	5.6	25.3	6.3	17.3	13.8
07, 09	48.8	28.4	17.4	5.6	44.4	2.2	21.8	19.6
13	48.8	34.9	22.3	5.6	40.5	4.1	28.3	25.8
17	30.3	46.8	25.0	5.6	25.2	2.5	38.9	31.8

LEGEND

FAD — Fixed Air Damper
MOAD — Manual Outside Air Damper

Physical data



39SH COIL AND FILTER DATA

39SH UNIT SIZE	00	01	02	03	04	05	07	09	13	17
CHILLED WATER										
Nominal Capacity at 400 fpm (cfm)	632	716	800	1224	1612	2000	2916	3832	5500	7084
Face Area (sq ft)	1.58	1.79	2	3.06	4.03	5	7.29	9.58	13.75	17.71
Coil Connection Size (in. OD sweat)										
4 Row (Qty)	3/4	3/4	3/4	3/4	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8 (2)
6 Row (Qty)	3/4	3/4	3/4	7/8	1 1/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8 (2)
HOT WATER										
Nominal Capacity at 400 fpm (cfm)	632	716	624	956	1612	2000	2688	3544	5348	6640
Face Area (sq ft)	1.58	1.79	1.56	2.39	4.03	5	6.72	8.86	13.37	16.6
Coil Connection Size (in. OD sweat)										
1 Row	5/8	5/8	5/8	5/8	7/8	7/8	N/A	N/A	N/A	N/A
2 Row (Qty)	7/8	7/8	7/8	7/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8 (2)
4 Row* (Qty)	3/4	3/4	3/4	3/4	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8 (2)
6 Row* (Qty)	3/4	3/4	3/4	7/8	1 1/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8 (2)
DIRECT EXPANSION										
Nominal Capacity at 400 fpm (cfm)	452	476	820	1220	1612	2000	2864	4088	5500	6640
Face Area (sq ft)	1.13	1.19	2.05	3.05	4.03	5	7.16	10.22	13.75	16.6
Connection Size (in. OD sweat) (Qty)										
Liquid Line	1/4	1/4	3/8	3/8	1/2	1/2	5/8†, 1/2** (2)	5/8†, 1/2** (2)	1/2** (2)	5/8** (2)
Suction Line	3/4	3/4	3/4	3/4	7/8	1 1/8	1 1/8†, 7/8** (2)	1 3/8†, 7/8** (2)	1 1/8** (2)	1 3/8** (2)
STEAM										
Nominal Capacity at 400 fpm (cfm)	632	716	752	1144	1452	1800	2688	3640	5512	7000
Face Area (sq ft)	1.58	1.79	1.88	2.86	3.63	4.5	6.72	9.1	13.78	17.5
FILTER DATA										
Size (in.) (Qty)	12x25	12x25	16x32	16x32	20x20 (2)	20x20 (2)	16x32 (2) 20x32 (1)	16x32 (2) 20x32 (1)	20x25 (2) 20x20 (4)	16x20 (2) 16x25 (2) 20x20 (2) 20x25 (2) 22.5
Nominal Face Area (sq ft)	2.08	2.08	3.56	3.56	5.56	5.56	11.56	11.56	18.06	

*4 and 6 row hot water coils have the same face area as 4 and 6 row chilled water coils.

†Single circuited coil.

**Dual circuited coil.

39SV COIL AND FILTER DATA

39SV UNIT SIZE	02	03	04	05	07	09
CHILLED WATER						
Nominal Capacity at 400 fpm (cfm)	1200	1200	1600	2000	2932	3668
Face Area (sq ft)	3	3	4	5	7.33	9.17
Coil Connection Size (in. OD sweat)	3/4	3/4	7/8	1 1/8	1 1/8	1 3/8
HOT WATER						
Nominal Capacity at 400 fpm (cfm)	804	804	964	1276	2292	3124
Face Area (sq ft)	2.01	2.01	2.41	3.19	5.73	7.81
Coil Connection Size (in. OD sweat)	7/8	7/8	7/8	1 1/8	1 1/8	1 1/8
DIRECT EXPANSION						
Nominal Capacity at 400 fpm (cfm)	1200	1200	1600	2000	2932	3668
Face Area (sq ft)	3	3	4	5	7.33	9.17
Connection Size (in. OD sweat) (Qty)						
Liquid Line	3/8	3/8	1/2	1/2	5/8	1/2 (2)
Suction Line	3/4	3/4	7/8	1 1/8	1 1/8	7/8 (2)
STEAM						
Nominal Capacity at 400 fpm (cfm)	624	624	688	1268	1750	2452
Face Area (sq ft)	1.56	1.56	1.72	3.17	4.375	6.13
FILTER DATA						
Size (in.) (Qty)	20x20	20x20	22.5x22.5	16x25 (2)	20x25 (4)	20x25 (4)
Nominal Face Area (sq ft)	2.78	2.78	3.52	5.56	13.89	13.89

Physical data (cont)



39SM COIL AND FILTER DATA

39SM UNIT SIZE	04	05	07	09	13	17
CHILLED WATER						
Nominal Capacity at 400 fpm (cfm)	1668	2084	2776	3332	5000	7084
Face Area (sq ft)	4.17	5.21	6.94	8.33	12.5	17.71
Coil Connection Size (in. OD sweat)						
4 Row (Qty)	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8 (2)
6 Row (Qty)	1 1/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8 (2)
HOT WATER						
Nominal Capacity at 400 fpm (cfm)	1668	2084	2776	3332	5000	7084
Face Area (sq ft)	4.17	5.21	6.94	8.33	12.5	17.71
Coil Connection Size (in. OD sweat)						
2 Row (Qty)	7/8	1 1/8	1 1/8	1 1/8	1 1/8	1 1/8 (2)
4 Row* (Qty)	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8 (2)
6 Row* (Qty)	1 1/8	1 1/8	1 3/8	1 5/8	1 5/8	1 5/8 (2)
DIRECT EXPANSION						
Nominal Capacity at 400 fpm (cfm)	1668	2000	2668	3332	5000	7000
Face Area (sq ft)	4.17	5	6.67	8.33	12.5	17.5
Connection Size (in. OD sweat)						
Liquid Line	1/2	1/2	5/8	5/8	5/8	5/8 (2)
Suction Line	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8 (2)
STEAM						
Nominal Capacity at 400 fpm (cfm)	1492	1960	2472	3028	4752	6700
Face Area (sq ft)	3.73	4.9	6.18	7.57	11.88	16.75
FILTER DATA						
Size (in.) (Qty)	20x25 (2)	20x25 (2)	16x25 (4)	16x25 (4)	16x20 (2) 20x20 (2) 16x25 (2) 20x25 (2)	16x20 (2) 20x20 (2) 16x25 (2) 20x25 (2)
Nominal Face Area (sq ft)	6.94	6.94	11.11	11.11	22.5	22.5

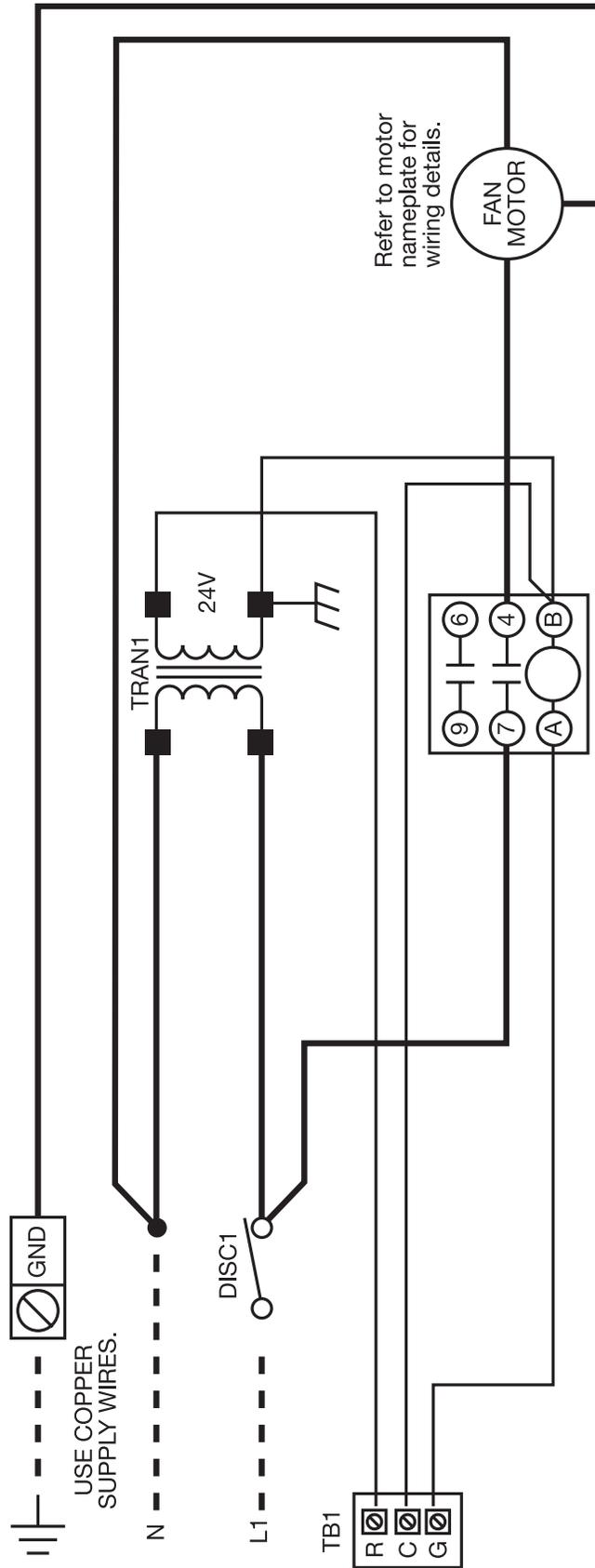
*4 and 6 row hot water coils have the same face area as 4 and 6 row chilled water coils.

39SR COIL AND FILTER DATA

39SR UNIT SIZE	02	03	04	05	07	09	13	17
CHILLED WATER								
Nominal Capacity at 400 fpm (cfm)	800	1224	1612	2000	3252	3792	5124	7000
Face Area (sq ft)	2	3.06	4.03	5	8.13	9.48	12.81	17.5
Coil Connection Size (in. OD sweat)								
4 Row	3/4	3/4	7/8	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8
6 Row	3/4	7/8	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8	1 5/8
HOT WATER								
Nominal Capacity at 400 fpm (cfm)	624	956	1612	2000	3252	3792	5124	7000
Face Area (sq ft)	1.56	2.39	4.03	5	8.13	9.48	12.81	17.5
Coil Connection Size (in. OD sweat)								
2 Row	5/8	7/8	7/8	1 1/8	1 1/8	1 1/8	1 3/8	1 1/8
4 Row*	3/4	3/4	7/8	1 1/8	1 3/8	1 3/8	1 3/8	1 3/8
6 Row*	3/4	7/8	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8	1 5/8
DIRECT EXPANSION								
Nominal Capacity at 400 fpm (cfm)	800	1224	1612	2000	3252	3792	5124	7000
Face Area (sq ft)	2	3.06	4.03	5	8.13	9.48	12.81	17.5
Connection Size (in. OD sweat) (Qty)								
Liquid Line	3/8	3/8	1/2	1/2	5/8	5/8	7/8 (2)	7/8 (2)
Suction Line	3/4	3/4	7/8	1 1/8	1 1/8	1 3/8	1 3/8 (2)	1 5/8 (2)
STEAM								
Nominal Capacity at 400 fpm (cfm)	752	1144	1452	1800	3088	3576	4956	6768
Face Area (sq ft)	1.88	2.86	3.63	4.5	7.72	8.94	12.39	16.92
FILTER DATA								
Single Wall Unit, Throwaway Filter Size (in.) (Qty)	16x32	16x32	20x20 (2)	20x20 (2)	16x25 (4)	16x25 (4)	16x20 (3) 16x25 (3)	16x20 (4) 16x25 (4)
Nominal Face Area (sq ft)	3.56	3.56	5.56	5.56	11.11	11.11	15	20
Single Wall Unit, Pleated Filter Size (in.) (Qty)	16x32	16x32	20x24 (1) 16x20 (1)	20x24 (1) 16x20 (1)	16x25 (4)	16x25 (4)	16x20 (3) 16x25 (3)	16x20 (4) 16x25 (4)
Nominal Face Area (sq ft)	3.56	3.56	5.56	5.56	11.11	11.11	15	20
Double Wall Unit, Pleated and Throwaway Filters Size (in.) (Qty)	16x32 (1) 10x10 (3)	16x32 (1) 10x10 (3)	12x25 (1) 12x20 (1) 16x20 (1) 16x25 (1)	12x25 (1) 12x20 (1) 16x20 (1) 16x25 (1)	25x25 (2) 20x25 (2)	25x25 (2) 20x25 (2)	16x24 (3) 29x48 (1)	16x20 (4) 16x32 (4)
Nominal Face Area (sq ft)	5.64	5.64	8.75	8.75	15.63	15.63	17.67	23.11

*4 and 6 row hot water coils have the same face area as 4 and 6 row chilled water coils.

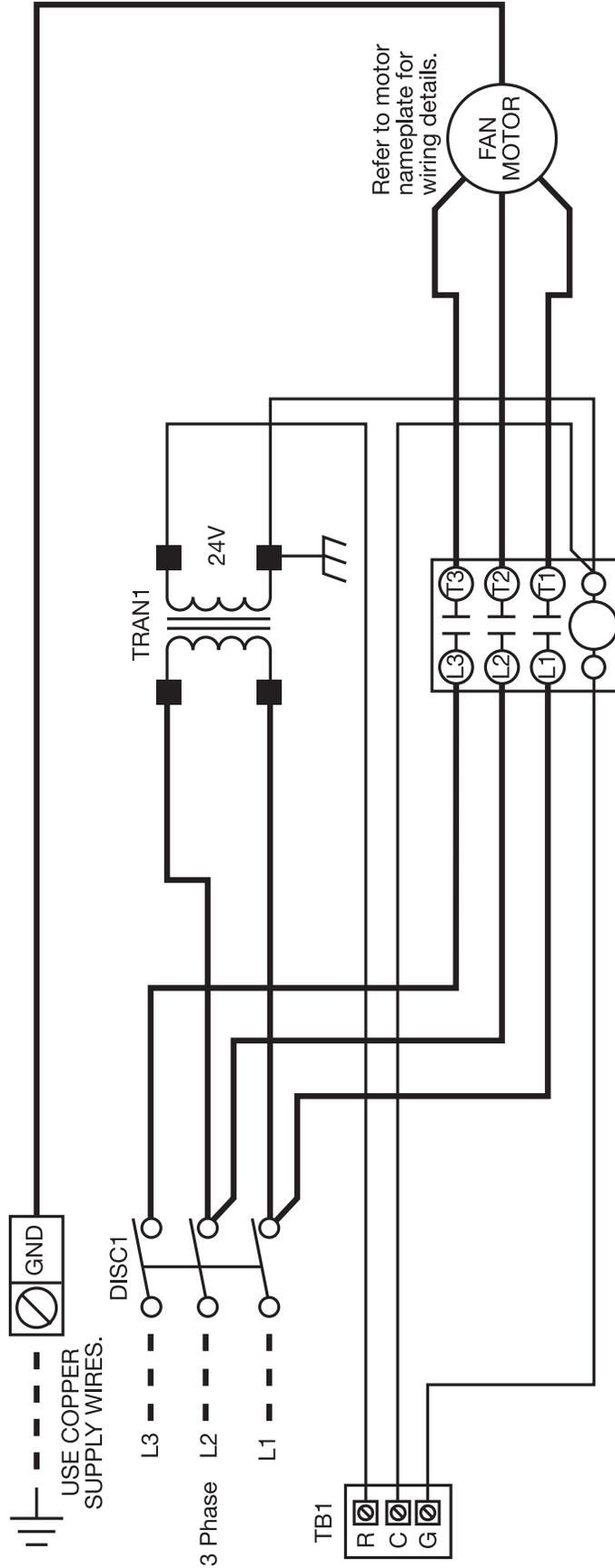
SINGLE-PHASE MOTOR START/STOP STATION WIRING DIAGRAM



Typical control wiring schematics (cont)



THREE-PHASE MOTOR START/STOP STATION WIRING DIAGRAM



Guide specifications



Indoor and Outdoor Air Handlers

HVAC Guide Specifications

Size Range: **400 to 8,500 Nominal Cfm**

Carrier Model Numbers: **39SH,SV,SM,SR**

Part 1 — General

1.01 SYSTEM DESCRIPTION

- A. Central station air handler designed to provide air to a conditioned space as required to meet specified performance requirements for ventilation, heating, cooling, filtration and distribution. Unit shall be assembled for draw-thru application and shall be arranged to discharge conditioned air horizontally or vertically as shown on the contract drawings.
- B. Unit with a direct-expansion cooling coil shall have the capability to be used in a refrigerant circuit in conjunction with air-cooled condensing units.

1.02 QUALITY ASSURANCE

- A. Unit performance shall be designed to comply with ARI Standard 430 for Central Station Air-Handling Units.
- B. Coils shall be designed to comply with ARI Standard 410.
- C. Direct expansion coils shall be designed and tested in accordance with ANSI/ASHRAE 15 Safety Code for Mechanical Refrigeration, latest edition.
- D. Unit shall be constructed in accordance with ETL and ETL, Canada, standards and shall carry the ETL and ETL, Canada, labels.

1.03 DELIVERY, STORAGE AND HANDLING

Unit shall be stored and handled in accordance with the unit manufacturer's instructions.

Part 2 — Products

2.01 EQUIPMENT

A. General:

Unit shall be a factory-assembled central station air handler. Unit may consist of a fan and coil section with factory-installed chilled water or direct expansion coil, preheat or reheat coil, heating coil section, filter section, mixing box as indicated on the equipment schedules.

B. Unit Cabinet:

1. External panels shall have a minimum thickness of 20 gage galvanized steel and are to be covered with a polyurethane based powder coat. Internal parts are to be built from heavy gage galvanized steel.
2. Units shall pass 500-hour salt spray test as described in ASTM B-117.
3. Large access panels shall be provided to permit full access to internal components. The structural integrity of the cabinets shall remain unaffected by the removal of any or all access panels. Double-walled hinged access doors shall be available on double-walled outdoor units.

4. Condensate drain pans shall be constructed of either plastic, galvanized steel or stainless steel.

C. Insulation:

Insulation shall have a minimum thickness of $\frac{3}{4}$ inches.

1. 39SH and 39SV units with double-wall finish shall have Exact-o-kote® IAQ insulation between the inner and outer panels while double-wall 39SR panels shall contain Tuf-Skin® insulation. Double-wall finish shall not be available on 39SM units.
2. Closed cell foam insulation shall be a flexible, polymer based, low density, closed cell, chemically inert foam sheet insulation. Density of closed cell foam insulation shall be 1.5 lb per cubic foot.
3. Indoor air quality (IAQ) insulation shall be fiber-glass insulation with an acrylic coating. Coating is formulated with an immobilized EPA registered, anti-microbial agent to protect against microbial growth.
4. Tuf-Skin II insulation shall be dual density fiber-glass insulation that has a high density skin and a low density core.

D. Fan Section:

1. Fan housing shall be constructed of heavy gage steel with die-formed inlet cones.
2. Fans shall be double width, double inlet type, with forward-curved blades, centrifugal type.
3. Fans shall be statically and dynamically balanced.
4. The fan shaft shall be solid cold rolled steel designed such that its operating speed is below its first critical speed.
5. Fan bearings shall be rubber mounted, self aligning, sealed cartridge, permanently lubricated ball bearings and shall provide dependable fan operation for an average life of 200,000 hours.
6. Fans on SH, SV, and SR units shall be internally isolated with rubber grommets.
7. Fan motor shall be standard duty, 1725 rpm, open drip-proof construction. Fan motors are to be bolted to an adjustable platform to facilitate belt tension and alignment. Motors shall be NEMA B, T-frame design.
8. Drive shall be of the V-belt type. Variable pitch motor sheaves are to be furnished for ease and accuracy in balancing the system and adjusting the required air volume. The blower sheave shall be cast iron single groove with split tapered bushing that is keyed to the blower shaft.

E. Coils:

1. Coils shall be of the staggered tube type constructed with seamless copper tubes and headers, and deep corrugated aluminum fins with

Guide specifications (cont)



straight edges. Manufacturer shall supply full depth collars, drawn in the fin stock to provide accurate control of fin spacing and completely cover the copper tubes to lengthen coil life. The tubes are to be mechanically expanded into the fins for a permanent primary to secondary surface bond, assuring maximum heat transfer efficiency. Coils shall be factory leak tested at 500 psig air pressure.

2. Steam coils shall be inner distributing tube (IDT) construction.

F. Electric Heaters:

1. Electric heaters shall have automatic resets for primary protection and manual resets for secondary protection.
2. There shall be circuit fusing on heaters over 48 amps per UL and NEC.
3. Electric heater plenum section shall be made of minimum 20 gage steel.
4. Heater shall have a standard 24-vac NEMA 1 control panel with hinges and automatic latch-on cover.
5. Heater shall have a standard 24-vac control circuit and class 2 transformer.
6. Air pressure switch frames shall be made of sturdy galvanized steel with rugged steatite insulators and double threaded stainless steel stud bolts.
7. Heating elements shall be openwound nickel/chrome alloy.
8. Heater internal wiring shall be made of stranded copper wire with insulation rated for 105 C.
9. 240-v heaters shall be derated 75% for use in 208-v applications.
10. 39SH electric heaters shall be tied into the unit's main power connection so as to create a single point power connection for the unit and the heater. Single point power is not available on 39SV and 39SM units with electric heat. Electric heat is not available on 39SR units.

G. Filter Sections:

Disposable filters shall be included with the unit as standard. Optional MERV 7 filters shall be available. Filters shall be included in the units as an integral part of the cabinet with easy access provided by the manufacturer.

H. Damper Sections:

1. Mixing boxes shall include low leak damper assemblies constructed of welded steel channel frames with 18 gage galvanized steel blades, die formed stiffeners and full blade stop. Stainless steel side seals and vinyl blade seals to reduce leakage shall be standard. All hardware shall be zinc plated with brass pivot points and bronze oilite bearings. Shafts shall be corrosion resistant steel. Mixing box shall be fully insulated with manufacturer's standard insulation.
2. Face and bypass sections shall have opposed-acting damper blades in the face damper and opposed bypass damper. All damper blades shall be galvanized steel, housed in a galvanized steel frame rotating in bronze oilite bearings. Dampers shall be sectionalized to limit blade length so as to minimize blade warpage.

I. Economizer Packages:

1. Economizers shall include weather hood and low-leak damper assemblies constructed of steel channel frames with 18 gage galvanized steel blades, die formed stiffeners and full blade stop. Stainless steel side seals and vinyl blade seals to reduce leakage shall be standard. All hardware shall be zinc plated with brass pivot points and bronze oilite bearings. Shafts shall be corrosion resistant steel. Includes motor, enthalpy control, mixed air sensor and transformer relay for 208/230/1 volt units. Economizers ship separate for field assembly to unit.
2. Manual fixed outdoor-air dampers for 0 to 35% or 0 to 100% outdoor air.
3. Motorized fixed outdoor-air damper for 0 to 100% outdoor air.

J. Controls:

Motor start/stop station shall include a terminal strip, 24-v Class 2 transformer (75-va), motor relay, contactor, or starter and interlocking disconnect.

