Installation, Start-Up and Service Instructions

CONTENTS

SAFETY CONSIDERATIONS

SAFETY NOTE

Air-handling equipment will provide safe and reliable service when operated within design specifications. The equipment should be operated and serviced only by authorized personnel who have a thorough knowledge of system operation, safety devices, and emergency procedures.

Good judgment should be used in applying any manufacturer's instructions to avoid injury to personnel or damage to equipment and property.

⚠WARNING

Disconnect all power to the unit before performing maintenance or service. Unit may automatically start if power is not disconnected. Electrical shock and personal injury could result.

⚠WARNING

If it is necessary to remove and dispose of mercury contactors in electric heat section, follow all local, state, and federal laws regarding disposal of equipment containing hazardous materials.

See Fig. 1 for the Proposition 65 warning label.

WARNING: Cancer - www.P65Warnings.ca.gov

Fig. 1 — Proposition 65 Warning Label

PRE-INSTALLATION

General

The 45J,K,Q constant volume (series) and 45M,N,R variable volume (parallel) fan powered boxes (see Fig. 2 and 3) can be equipped to provide pressure independent, variable volume (VAV). All units can also be equipped with factory-installed analog electronic, pneumatic, or variable air volume (VAV) controls. Units are available with factory-installed electric or hot water heat.

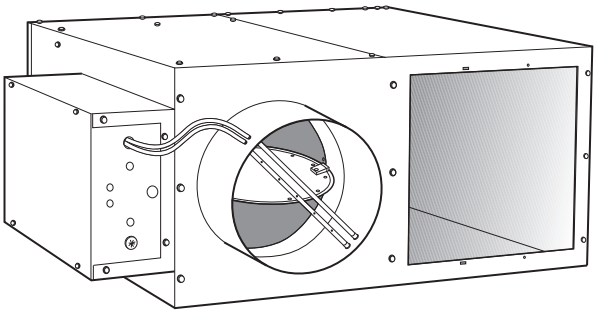


Fig. 2 — Series Flow Unit (45K Shown)

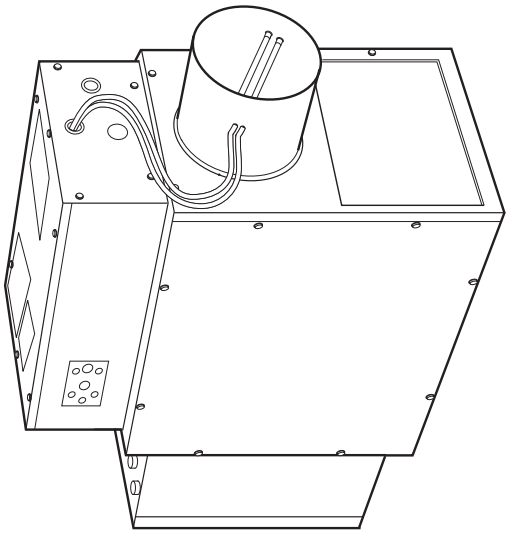


Fig. 3 — Parallel Fan Unit (45J Shown)

The 45J,M units are standard fan powered terminal units. The 45K,N units are quiet fan powered terminal units. The 45Q,R units are low profile fan powered terminal units.

CONTROL OFFERINGS

Each 45J, 45K, 45M, 45N, 45Q, 45R unit is supplied with a flow probe as a standard feature. This probe offers a flow averaging capability and results in flow sensing capacity equal to any competitive unit.

Control options include VAV, VVT, analog electronic, and pressure-independent pneumatic.

Pneumatic controls are available with linear actuators and single-function or multi-function controller. The multi-function controller provides a simple switchover from normally open to normally closed applications.

Electronic control units feature a factory-installed enclosure that provides easy access for field connections.

STORAGE AND HANDLING

Inspect for damage upon receipt. Shipping damage claims should be filed with shipper at time of delivery. Store in a clean, dry, and covered location. Do not stack units. When unpacking units, care should be taken that the inlet collars and externally mounted components do not become damaged. Do not lift units using collars, sensors, or externally mounted components as handles. If a unit is supplied with electric or hot water heat, care should be taken to prevent damage to these devices. Do not lay uncrated units on end or sides. Do not stack uncrated units over 6 ft high. Handle with care. Do not handle control boxes by tubing connections or other external attachments. Tables 1-7 shows component weights.

INITIAL INSPECTION

Once items have been removed from packing, check carefully for damage to duct connections, coils, or controls. File damage claim immediately with transportation agency and notify Carrier.

NOTE: Remove all packaging material and foreign material from unit and ensure the blower wheel moves freely before installation. Units are shipped with cardboard in both sides of the fan inlet that MUST be removed.

Unit Identification

Each unit has 2 main labels attached to the casing. The FAN UNIT label (Fig. 4) lists the model number, supply voltage requirements, motor horsepower and overcurrent protection requirements. The AIRFLOW label (Fig. 5) lists the model number, unit size, factory order number and location. The location "tag" indicates where the unit is intended for installation. There may be other labels attached to the unit, as options or codes may require. Read all labels on a typical unit before attempting installation. Control boxes are assembled as indicated on the identification label.

Contact your local Carrier representative for more information.

Carrier
United Technologies

FAN UNIT

MODEL NO 45N – 5 —12 CODE 10 –579600 – C 014 REV:
MOTOR VOLT 277 PHASE 1 HZ 60
HP 1/2 FLA(EA) 3.110
HEAT VOLT 480 PHASE 3 HZ 60
KW 12.0 AMPS 14.43
TAG: FPB—313
MOTOR(S) ARE THERMALLY PROTECTED
MIN. SUPPLY CIRCUIT AMPS 21.920 REPLACEMENT LINE FUSE
MAX. FUSE OR HACR CIRCUIT BREAKERS 25.000 AMPS 25 AMP 600V
MAX. OUTLET AIR TEMPERATURE 200 F
UNIT DESIGNED TO OPERATE AT NO LESS THAN 0.2 IWG STATIC PRESSURE.
ZERO CLEARANCE FROM UNIT, CONNECTED DUCT AND/OR PLENUM
TO COMBUSTIBLE MATERIAL.

Fig. 4 — Fan Unit Label

Carrier
United Technologies

DUCT HEATER UP AIR FLOW

ORDER: 599049 ITEM: 010 REV: SN: C – 599049 – 10
MODEL: 45J DUCT SIZE: 12 X 10 MIN FPM: 0375
LINE VLT: 480 PH: 03 HZ: 60 KW: 2.50 AMP: 3.00
STEP: 01 CTL VOLT: 24 CTL VA: 50
MIN CIR AMP: 5.60 15 AMP 600V INTERNAL FUSE
MAX. FUSE OR HACR CIRCUIT BREAKERS 15.00 AMP
MIN WIRE SIZE (COPPER CONDUCTORS ONLY): 12AWG
(SUITABLE FOR AT LEAST 75 DEGREES CENT.)
TAG: VAV – 05 – 01

Fig. 5 — Airflow Label

INSTALLATION PRECAUTION

Check that construction debris does not enter unit or ductwork. Do not operate the central-station air-handling fan without final or construction filters in place. Accumulated dust and construction debris distributed through the ductwork can adversely affect unit operation.

SERVICE ACCESS

Provide service clearance for unit access (see Installation section on page 4 for details).

CODES

Install units in compliance with all applicable code requirements.

UNIT SUSPENSION

See Installation section on page 4 for unit suspension details.

Warranty

All Carrier-furnished items carry the standard Carrier warranty.

Table 1 — 45J Unit Weights

45J SIZE	UNIT ONLY (lb)	WITH PNEUMATIC CONTROLS	WITH DDC OR ANALOG CONTROLS	WITH ELECTRIC HEATER	WITH HOT WATER	
					1-Row	2-Row
2	70	+4	+9	+30	+19	+21
3	70	+4	+9	+30	+20	+22
4	85	+4	+9	+32	+22	+25
5	85	+4	+9	+32	+24	+28
6	100	+4	+9	+35	+25	+30
7	175	+4	+9	+40	+35	+43

Table 2 — 45M Unit Weights

SIZE	UNIT ONLY (lb)	WITH PNEUMATIC CONTROLS	WITH DDC OR ANALOG CONTROLS	WITH ELECTRIC HEATER	WITH HOT WATER	
					1-Row	2-Row
2	114	+4	+9	+30	+19	+21
3	114	+4	+9	+30	+20	+22
4	115	+4	+9	+32	+22	+25
5	122	+4	+9	+32	+24	+28
6	123	+4	+9	+35	+25	+30
7	127	+4	+9	+40	+35	+43

Table 3 — 45K Unit Weights

45K SIZE	UNIT ONLY (lb)	WITH PNEUMATIC CONTROLS	WITH DDC OR ANALOG CONTROLS	WITH ELECTRIC HEAT	WITH HOT WATER	
					1-Row	2-Row
2	185	+4	+9	+30	+9	+12
3	200	+4	+9	+30	+9	+12
4	200	+4	+9	+32	+9	+12
5	225	+4	+9	+32	+12	+17
6	250	+4	+9	+35	+12	+17
7	260	+4	+9	+40	+12	+17

Table 4 — 45N Unit Weights

45N SIZE	UNIT ONLY (lb)	WITH PNEUMATIC CONTROLS	WITH DDC OR ANALOG CONTROLS	WITH ELECTRIC HEATER	WITH HOT WATER	
					1-Row	2-Row
2	185	+4	+9	+30	+9	+12
3	200	+4	+9	+30	+9	+12
4	200	+4	+9	+32	+9	+12
5	225	+4	+9	+32	+12	+17
6	250	+4	+9	+35	+12	+17
7	260	+4	+9	+40	+12	+17

Table 5 — 45Q Unit Weights

45Q SIZE	UNIT ONLY (lb)	WITH PNEUMATIC CONTROLS (lb)	WITH DDC OR ANALOG CONTROLS (lb)	WITH ELECTRIC HEAT (lb)	WITH HOT WATER (1 ROW/2 ROW) (lb)
3	75	+4	+9	+30	+10/+12
4	120	+4	+9	+35	+12/+14
5	100	+4	+9	+35	+12/+14

Table 6 — 45Q Dedicated Outdoor-Air System Unit Weights

45Q DOAS BOX SIZE	UNIT WITH COOLING COILS (lb)			WITH DDC OR ANALOG CONTROLS (lb)	WITH ELECTRIC HEAT (lb)	WITH HOT WATER (1 ROW/2 ROW) (lb)
	2-ROW	4-ROW	6-ROW			
3	97	106	120	+9	+30	+10/+12
5	130	145	160	+9	+35	+12/+14

Table 7 — 45R Unit Weights

45R SIZE	UNIT ONLY (lb)	WITH PNEUMATIC CONTROLS (lb)	WITH DDC OR ANALOG CONTROLS (lb)	WITH ELECTRIC HEAT (lb)	WITH HOT WATER (1 ROW/2 ROW) (lb)
2	91	+4	+9	+25	+8/+10
4	106	+4	+9	+25	+8/+10

LEGEND FOR TABLES 1-7

DDC — Direct Digital Controls
DOAS — Dedicated Outdoor-Air System

CONTROL OPTIONS

The units are offered with a wide variety of factory-mounted controls that regulate the volume of air delivery from the unit and respond to cooling and heating load requirements of the conditioned space. All control packages can operate stand-alone and will fulfill the thermal requirements of a given control space. These devices are available in both pneumatic and electronic arrangements. The 3V™ and ComfortID™ control types are communicating controls which can be integrated into a CCN building system. A number of DDC (direct digital control) control packages by others are available for consignment mounting as indicated.

Control offerings are:

A: Analog Electronic
C: VAV
P: Pneumatic
V: VVT® (45M,N,R units only)
N: None or DDC by others

Each control approach offers a variety of operating functions; a control package number identifies combinations of control functions. Because of the variety of functions available, circuit diagrams, operating sequences, and function descriptions are contained in separate Application Data publications. Refer to the specific control publication for details.

VAV CCN Controls and OPEN VAV Controls

Pressure independent control packages are available with or without heat. These controls provide occupied and unoccupied heating and cooling, demand controlled ventilation (DCV), and zone humidity control. They can be networked together via either BACnet[1] or Carrier Comfort Network (CCN) protocols to provide integrated system operation of all components, including the operation of air source equipment. These controls may be used in a stand-alone terminal, or as part of the Carrier DDC control system. All control arrangements include a standard inlet flow sensor, control enclosure, SCR (silicone control rectifier) fan speed controller, class II 24-volt power transformer, and fan contactor. Several types of room sensors may be ordered, with and without set point adjustment, and with integral CO_2 sensors.

VVT® CCN Controls and OPEN VVT Controls

Pressure dependent control packages are available with or without hot water (on-off control), electric heat (up to 2 stages), or SSR (solid-state relay) electric heat. They are designed to be an integral part of the Carrier Comfort Network (CCN) or Carrier i-Vu® Open Digital Control Systems, for parallel flow units only. All control arrangements include a standard inlet flow sensor, control enclosure, SCR fan speed controller, 24-volt transformer and fan relay.

Analog Electronic Controls

Pressure independent control packages are available with or without hot water or electric heat, automatic or remote night shutdown, and automatic night setback. All control arrangements include a standard inlet flow sensor, control enclosure, SCR fan speed controller, 24-volt transformer, fan relay, and wall thermostat to match the control type.

Pneumatic Controls

Pressure independent control packages are available with or without hot water or electric heat, night shutdown and/or unoccupied heating. All control arrangements include a standard linear inlet flow sensor and SCR fan speed controller.

Single function controller: Provides single function, i.e., DA-NO.

Multi-function controller: Capable of providing DA-NO, DA-NC, RA-NC or RA-NO functions.

Direct Digital Controls (By Others)

Control sequences are available for factory installation of numerous field-supplied controls from various manufacturers. All packages include a standard liner inlet flow sensor, control enclosure, SCR fan speed controller, 24-v transformer, and fan relay.

Contact Carrier for information on mounting field-supplied controls.

No Control Units

Control sequences are also available to provide a control box on units supplied with no factory-installed controls. These arrangements include a standard linear inlet flow sensor, control enclosure, SCR fan speed control, 24-v transformer, and fan relay.

INSTALLATION

Step 1 — Install Fan-Powered Box

SELECT LOCATION

1. Units should be installed so that they do not come in contact with obstacles such as rigid conduit, sprinkler piping, Greenfield flexible metal covering, or rigid pneumatic tubing; such contact can transmit vibration to the building structure, causing objectionable low frequency noise.
2. Units should never be installed tight against concrete slabs or columns, as vibration transmission is amplified in this condition.
3. Fan powered terminals require sufficient clearance for servicing the blower/motor assembly from the bottom of the

1. BACnet is a registered trademark of ASHRAE (American Society of Heating Refrigerating and Air Conditioning Engineers).

unit, low voltage controls from the side and line voltage motor controls or electric heat (if equipped) from the rear (discharge end) of the unit.

Bottom access panel removal requires a minimum of 3-in. minimum clearance, plus substantial horizontal clearance to slide the access panel out of the way for service. Actual horizontal dimensions will vary due to varying access panels for different sized units. See your particular unit's submittal drawings for more detail.

NOTE: Be certain appropriate accommodations for panel removal of most unit casings are large enough to allow adequate internal service room once the panels are removed.

A clearance of 18-in. is recommended for control enclosure access. Unit control enclosure will vary depending on which control package is used. Control enclosure location is specified on unit submittals. Low voltage enclosure covers are removable, not hinged.

A clearance of 36-in. is recommended for line voltage motor controls and electric heat control access. High-voltage motor controls or electric heat control access is supplied with hinged access doors for units with fused disconnect. Specific location is indicated on the unit submittal.

NOTE: These recommendations do not supersede NEC (National Electrical Code) or local codes that may be applicable, which are the responsibility of the installing contractor.

4. Whenever possible, fan-powered boxes should be installed over halls or passageways (rather than over occupied spaces) in order to limit the sound reaching occupants.

POSITION UNIT

1. When moving boxes, use appropriate material handling equipment and avoid contact with shaft extensions, controls, wiring, piping, heaters, and control boxes.
2. Raise unit to position using safe mechanical equipment and support until hanging means are attached and box is level.

INSTALL UNIT

1. Install field-supplied eye bolts, strap hangers or bolt rod supports as desired. Figure 6 illustrates possible unit suspension methods. A typical installation is shown in Fig. 7.
2. Care should be taken to use hanging materials of sufficient stiffness and strength, rigidly attached to the unit. Straps should not be located on coil flanges, electric heat sections, or control boxes. When using trapeze supports, avoid areas where access is required to side mounted controls, or side or bottom access doors. For best installation with trapeze supports, provide elastomeric material between unit and supports.
3. Hangers should be securely attached to bar joist or mounting anchors properly secured to building structure with lugs or poured-in-place hangers. Percussion nails are not considered adequate anchors.

Step 2 — Make Duct Connections

1. Install supply ductwork on each of the unit inlet collars. It is recommended that 3 duct diameters of straight duct are supplied to the inlet of the unit. An elbow put at the inlet of the unit will create turbulence at the inlet making it difficult for the flow sensor to accurately measure the airflow. Check that the pressure pick-up in primary air collar is located properly and that air supply duct connections are airtight. Install supply ductwork on unit inlet collar, following all accepted medium-pressure duct installation procedures. Seal joints against leakage.

NOTE: For maximum efficiency in controlling radiated noise in critical applications, inlet ducts should be fabricated of 24-gage minimum sheet metal in place of flex connections. Flex duct is extremely transparent to radiated sound; consequently high inlet statics (Ps) or sharp bends with excessive pressure drop can cause a radiated noise problem in the space. If flex duct is used, it should be limited to the connection between the distribution duct and the boot diffuser.

2. Install the discharge duct. On units with electric heat, the recommended minimum distance of straight duct before any transitions, elbows or branch connections is 48 inches. It is strongly recommended that lined discharge duct be used downstream of the unit. Insulate duct as required.
3. Fan boxes should not be attached to octopus sections immediately downstream of the unit.
4. Install optional return-air filters before operating the unit.
5. Where construction filters were supplied with the box, leave filters in place until installation is complete and building is cleaned for occupancy.

Step 3 — Connect Power Wiring (See Fig. 8)

1. All power wiring must comply with local codes and with the NEC (National Electrical Code) ANSI/NFPA (American National Standards Institute/National Fire Protection Association) 70-2017. Disconnect switches are optional equipment. Electrical, control and piping diagrams are shown on the exterior labeling or on a diagram inside the control and high-voltage enclosure covers, unless otherwise specified in the order write-up. All units are wired for a single point electrical connection to the fan and electric heater (if equipped). Electric heaters provided by Carrier are balanced by kW per stage. The installing electrician should rotate incoming electric service by phase to help balance overall building load.
2. All field wiring must be provided with a safety disconnect per NEC 424-19, 20, and 21.
3. Disconnect all incoming power before wiring or servicing unit. All disconnect switches on the terminal (if equipped) should be in the OFF position while making power connections.
4. Units with electric heat should use copper wires rated at least 125% of rating plate amperage. Refer to the unit's rating label and minimum supply circuit amps.
5. Observe wiring diagram and instructions attached to the unit. The 480-v, 3-phase units require a Wye power source with a fourth (neutral) wire in addition to the full sized ground wire. All units must be grounded as required by NEC 424-14 and 250.

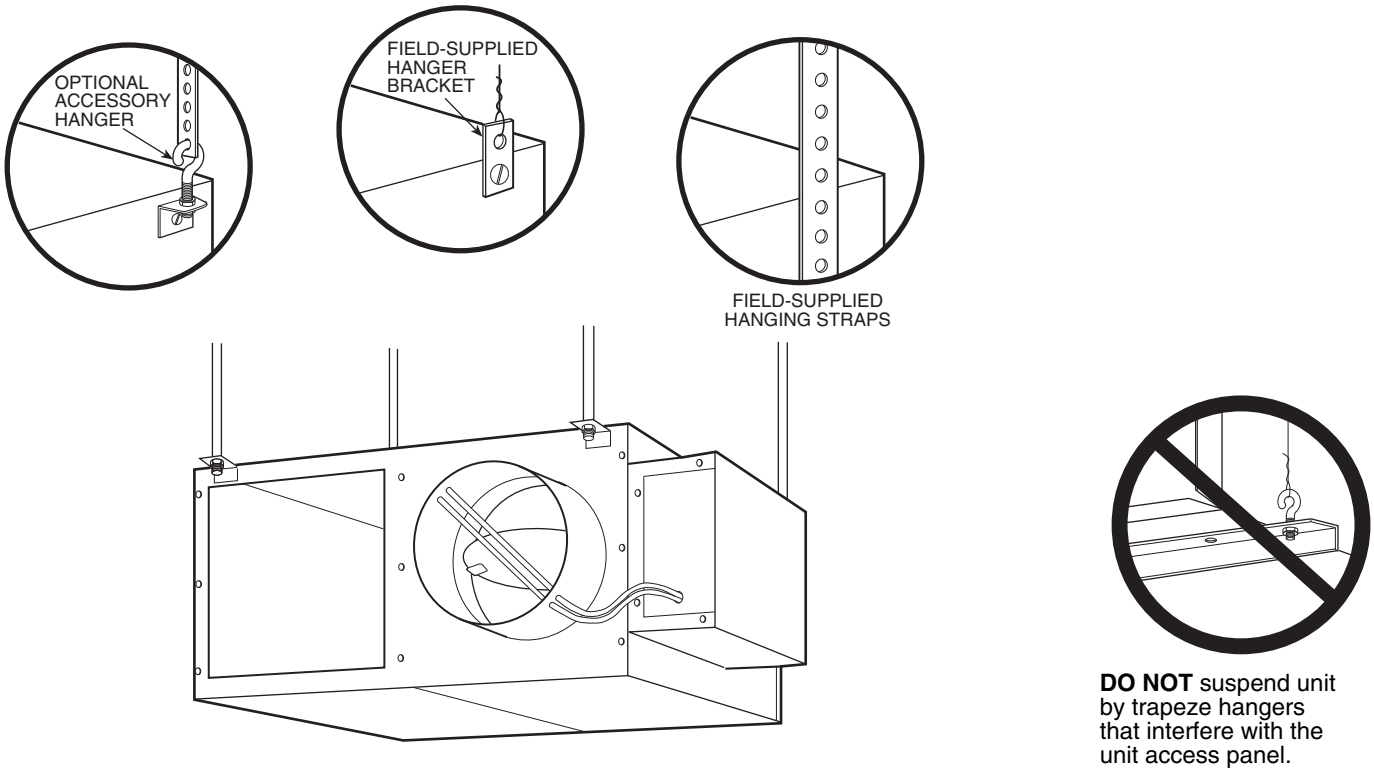


Fig. 6 — Typical Unit Suspension Methods (45K Shown)

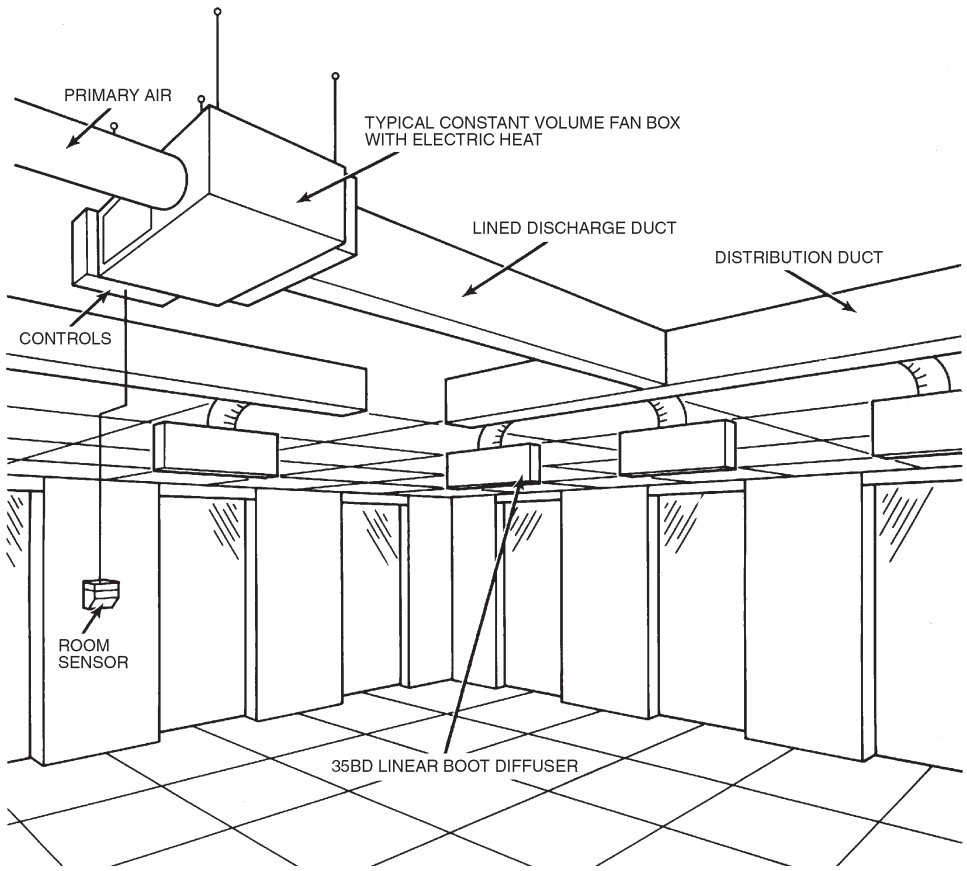
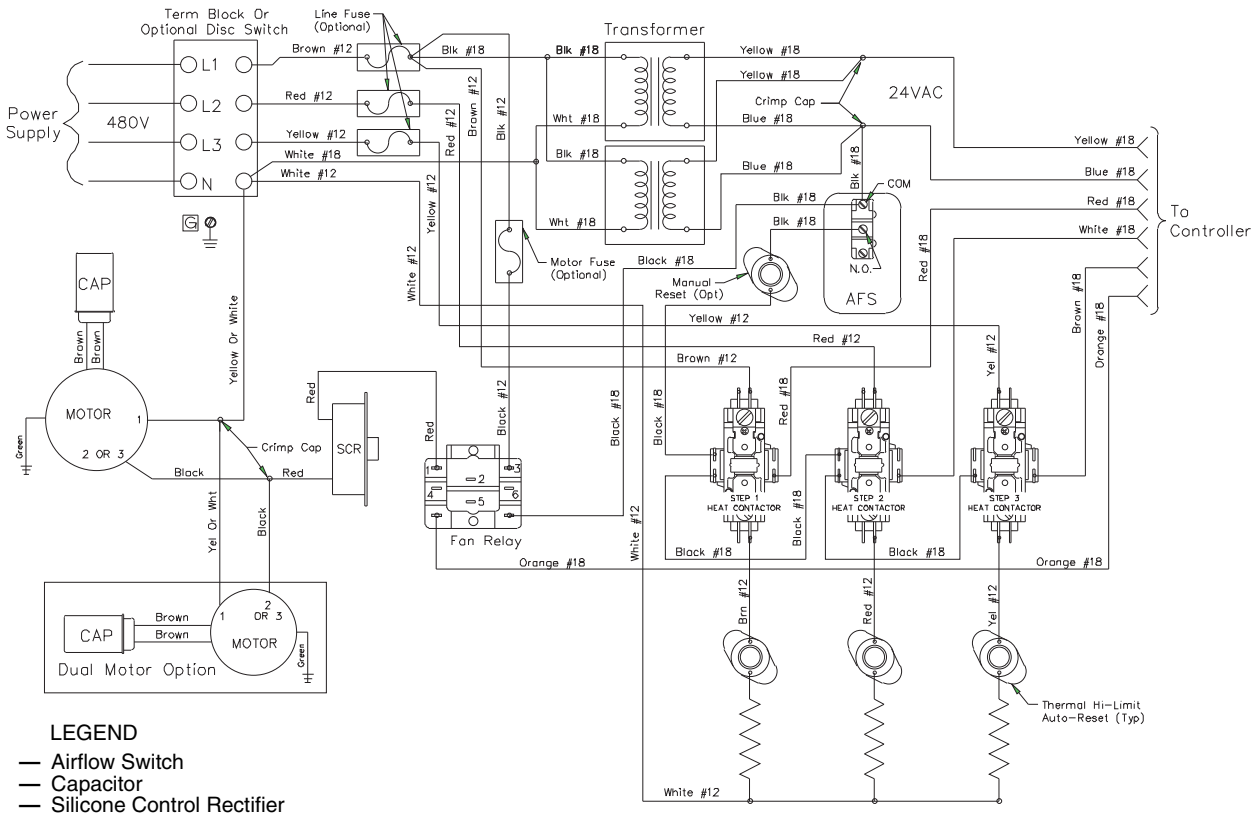


Fig. 7 — Typical Perimeter Installation — Constant Volume Fan-Powered Box



LEGEND

AFS — Airflow Switch
CAP — Capacitor
SCR — Silicone Control Rectifier

Fig. 8 — Typical Power Connections for Fan Powered Units with 3-Stage Electric Heat

Step 4 — Set Up System and Calibrate

GENERAL

The parallel fan powered terminals (45M, 45N, and 45R) are designed to provide varying quantities of cold primary air to a space in response to a thermostat demand for cooling. For a heating demand, the fan will operate to supply ceiling plenum air to the space. For units equipped with a heating coil, the heater will operate as required to meet a heating demand.

The series fan powered terminals (45J, 45K, and 45Q) are designed to provide a constant airflow to the space. The air supplied to the space is a mixture of primary air and ceiling plenum air. The fan speed is adjusted to provide the required airflow to the space. In response to a cooling demand from a thermostat, the damper will increase the amount of cold primary air while reducing the amount of ceiling plenum air to decrease the temperature of the air being delivered to the space.

Most terminal control packages provide pressure compensation to allow pressure independent operation of the primary air damper, regardless of changes to the available static pressure in the supply ductwork. To balance the unit it is necessary to set both the minimum and maximum airflow set points of the controller. The many types of control options available each have specific procedures required for balancing. Refer to the submittal information for these requirements.

SET POINTS

Maximum and minimum airflow set points are normally specified for the job and specific for each unit on the job. Default set point values are provided by the factory and can be reset to the specific requirements in the field. The fan speed must be field adjusted after all discharge ductwork and diffusers have been installed.

Field Adjustment of the Maximum and Minimum Airflow Set Points

Each fan powered terminals unit is equipped with a flow probe installed in the primary air inlet which measures a differential pressure. The relationship between the airflow probe pressure and the corresponding airflow is shown in the Flow Probe Graph. See Fig. 9. This chart is attached to each unit.

SYSTEM CALIBRATION OF THE INLET AIRFLOW SENSOR

To achieve efficient pressure independent operation, the velocity sensor and linear averaging flow probe must be calibrated to the controller. This will ensure that airflow will be accurate for all terminals at system start-up.

System calibration is accomplished by calculating a flow coefficient that adjusts the pressure fpm characteristics. The flow coefficient is determined by dividing the flow for a given unit (design air volume in cfm), at a different velocity pressure of 1.0 in. wg, by the standard pitot tube coefficient of 4005. This ratio is the same for all sizes, if the standard averaging probe is used.

Carrier inlet areas are shown in Table 8. The design air volume is shown. It can be determined from Table 7 that the average design air velocity for units is equal to 0.2660 fpm at 1.0-in. wg.

Determine the design air velocity by dividing the design air volume (the flow at 1.0 in. wg) by the nominal inlet area (sq ft). This factor is the K factor.

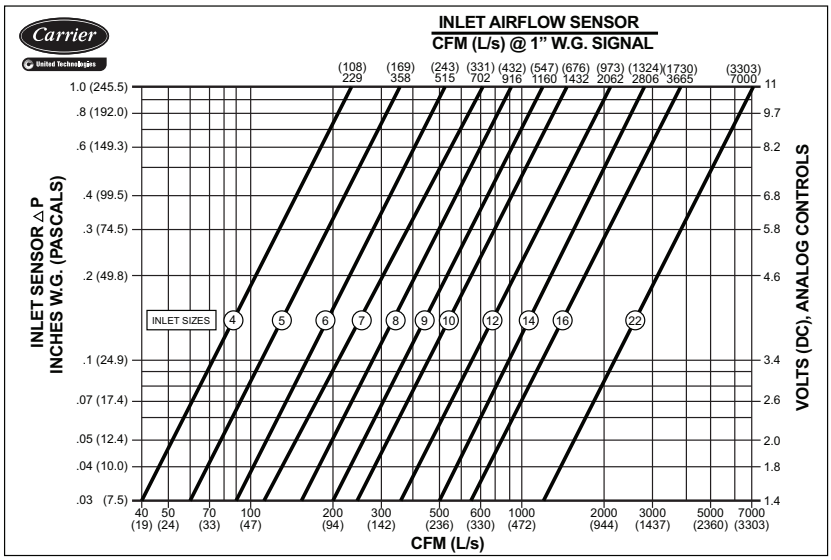


Fig. 9 — Linear Probe CFM vs Signal Chart

Table 8 — Inlet Areas — 45J,K,M,N,Q,R

	INLET DIAMETER (in.)							
	4	5	6	8	10	12	14	16
Inlet Area	0.087 ft²	0.136 ft²	0.196 ft²	0.349 ft²	0.545 ft²	0.785 ft²	1.069 ft²	1.369 ft²
CFM at 1 in. wg	230	360	515	920	1430	2060	2800	3660

NOTE: For ComfortID™ terminals, all flow sizes are normalized using a single probe multiplier (PMF) for all sizes equal to 2.273.

START-UP

General

Before balancing the system, the air handlers must be operating in accordance with the specifications for air capacity, static pressure, and temperature. Record data on a unit performance sheet (Fig. 10). The following items must be checked:

1. All fans must be running at calculated and specified rpm.
2. Permanent or temporary filters must be clean and installed where required.
3. All central station dampers must be adjusted and operating properly.
4. All thermostats must be calibrated and at the desired settings.
5. All ductwork must be tight.
6. All dirt or loose lining must be removed from inside ductwork.
7. Pumps and sprays, when used, must be in operation.
8. Connections to the coil, when used, must be checked.
9. Water control valve, if used, must be checked.

IMPORTANT: Before proceeding with start-up, be certain that voltage, frequency, and phase correspond to unit specifications. Unless noted, all fan motors are 60 Hz, 115, 208/230, or 277 v, single-phase ac.

NOTE: All 45 Series terminal units are shipped with cardboard packaging rings placed in one side of the blower housing internal to the blower/motor. These rings are provided to prevent damage to the motor during shipment. The rings MUST BE REMOVED prior to operation. The packing rings are accessible through the terminal's plenum. Turn the fan wheel by hand to ensure that blower is free spinning. Carrier will not accept responsibility for any additional costs for removal of this packaging material.

Remove the bottom access panel to remove the cardboard packing material.

Initial Start-Up Procedures

NOTE: The following steps MUST be followed in order to properly operate and service this unit.

1. Disconnect all electrical power to the unit. Failure to disconnect the power to the fan box prior to checking and/or servicing the fan box could result in a serious injury.
2. Verify that the fan box is installed level, and that adequate mounting support has been provided.
3. Remove motor access panel from the bottom of the fan box, and also remove the control panel cover.
4. Test the fan motor setscrew. The setscrew should fit tightly, but it may have come loose during shipment or installation.
5. Rotate the blower by hand to ensure proper clearance between the blower and the blower housing.
6. Check the fan box for loose fiberglass insulation, especially on the electric heater elements or the hot water coils (if these accessories are installed).
7. Check the control enclosure and remove any debris.
8. Check the induction inlet filter (if provided) for obstructions, and verify the filter is securely in place.
9. Verify the main power supply to the connection to the fan box for proper voltage. If the fan box is installed with electric heat, the electric heat voltage may exceed the blower motor voltage requirement. Excessive voltage to the fan box may seriously damage it. Verify that the DDC (if equipped) are receiving 24-v ac, –15%, +20%.
10. Identify the control system supplied.
11. Check all control connections (and/or electric) for proper installation.
12. Connect electrical power.

Balancing Carrier Fan Terminals

Carrier fan terminal units contain primary air dampers which, under the control of a volume controller, regulate the amount of cold air distributed to the space.

45J,K,Q SERIES FLOW UNITS

The 45J,K,Q series flow terminals direct all primary air through the unit fan. The terminal is designed to operate with the fan supplying airflow equal to or greater than the airflow supplied by the VAV damper. To balance the unit, therefore, it is necessary to first set the fan flow, and then the VAV damper (primary) flow.

Each control option has specific procedures required for balancing the unit, but some steps are common to all 45J,K,Q units. The fan box adjustments described below must be made in conjunction with the adjustments described in the Speed Controller and Control Adjustments section.

The VAV damper airflow may be set at the factory, but the fan airflow must be set in the field as described in "Setting of VAV (Primary) Airflow."

Setting Fan Airflow

NOTE: If the unit has electric heat or hot water heat, temporarily disable these functions before balancing the fan.

If unit has optional electric heat disconnect downstream of fan motor connections to power, open disconnect.

If unit does not have optional electric heat disconnect, remove one electric heat power line connection. Be sure to insulate loose line from ground wire or other wires.

1. Set the controller to provide heating airflow demand only. Typically, this is accomplished by setting the thermostat to the highest possible temperature setting.

NOTE: A minimum of 0.1 in. wg downstream static pressure is required in the duct to ensure proper heater operation.

2. Determine that the VAV valve is fully closed and that the fan is rotating in the proper direction. (If the VAV damper is open when the fan is started and there is primary air in the system, the fan may start and run backward.)
3. Using a flow hood or duct traverse, determine the delivered fan airflow (cfm).

NOTE: Both flow hood and duct traverse are subject to measurement errors. Be sure that all applicable measurement precautions are taken.

4. Compare the actual cfm in heating mode to the designed airflow. If there is a minimum setting for the VAV damper in heating mode (as recommended by ASHRAE [American Society of Heating, Refrigeration, and Air Conditioning Engineers] Standard 62), this quantity is included in the total measured heating airflow to determine if the desired induction airflow level has been met.
5. Adjust the fan SCR at unit control box to achieve the desired airflow rate. Refer to the performance data tables (Tables 9-11) to ensure airflow through electric heaters meets the requirements before operating the heater.

Setting of VAV (Primary) Airflow

Adjustment of Set Points

Each 45J, 45K, and 45Q supplied with controls is equipped with a pneumatic or electronic volume controller which regulates the quantity of cold primary air entering the terminal and the conditioned space. If required airflow levels are specified with the job order, the minimum and maximum cfm levels will be set at the factory where applicable. If minimum and maximum levels are not specified, a default value of 0 is used for minimum setting at the factory. Other settings of minimum and maximum primary airflow must be set in the field. Airflow (cfm) ranges for the primary air damper are shown in Tables 9-11. The minimum primary airflow (other than zero) is the minimum flow rate controllable by the unit volume controller. The primary air damper can be set at zero for shutoff or at the minimum cfm listed.

Field Adjustment of Minimum and Maximum Airflow Set Points

Each 45J, 45K, and 45Q unit is equipped with a centerpoint averaging flow probe which provides an amplified differential pressure that is proportional to the unit airflow. Output from this probe is used to provide a flow signal to both pneumatic and electronic controls. Unit airflow (cfm) can be read directly from the flow probe on the unit (refer to Fig. 8).

1. With the unit airflow from the fan set, turn on primary (VAV) air supply.
2. To set cfm in the field, connect a gage to the flow probe at the provided 'T' taps, and check the differential pressure. (Alternately, the total flow may be measured, and the previously determined fan induction flow rate may be subtracted from the total flow to determine VAV flow. However, for low primary settings, this may not be as accurate as the flow tap method.)
3. If a minimum VAV flow is required in heating mode, adjust the volume until the differential pressure corresponds to the cfm required.
4. Set the controller to provide maximum cooling demand. This is typically accomplished by first setting the thermostat to the lowest possible temperature setting.
   a. In most series fan boxes, the primary airflow rate is equal to the fan induction flow; in these cases, adjust the volume controller until a balance is achieved between fan induced airflow and primary airflow. When a balance exists, a strip of paper hung at the induction port should hang straight down, and neither be blown in or out of the unit.
   b. If the primary airflow desired is less than the fan induction flow, adjust the volume controller until the differential pressure (measured through the flow probe as described above) corresponds to the cfm required. Verify that induction exists through the inlet ports, using the paper strips as described above. When induction exists, the paper strip should be pulled into the unit.
5. Return all reheat options to normal connections.
6. Cap the 'T' taps.
7. Reset the thermostat to a normal setting.

NOTE: It is normal for the total airflow to the room to increase slightly in full cooling mode.

AIR TERMINAL PERFORMANCE SHEET

JOB NAME _____

JOB LOCATION _____

CUSTOMER _____

ENGINEER _____

BUILDING LOCATION/FLOOR _____

BUS NUMBER _____

CONTROL										SET POINTS				
Tag Number	Zone Address #	Box Size (in./cfm)	Cooling (cfm)		Fan cfm	Heating (cfm)		Heat	kW	Occupied		Unoccupied		Calibration Gain
			Min	Max		Min	Max	Type	Btu	Min	Max	Min	Max	Mult.

Fig. 10 — Air Terminal Performance Sheet

Table 9 — 45J Series Fan Powered Terminal Unit Performance

45J WITH PSC FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW (cfm)		PRIMARY AIRFLOW (cfm)		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
2	6	100	560	52 or 0	515	1/10	1.8	1	0.7
3	6	300	990	52 or 0	515	1/4	3.6	2	1.5
	8			92 or 0	916				
4	8	550	1440	92 or 0	916	1/4	5	2.8	2.1
	10			143 or 0	1432				
	12			206 or 0	1440				
5	10	1100	2140	143 or 0	1432	1/2	8.3	4.6	3.5
	12			206 or 0	2062				
6	12	1200	2530	206 or 0	2062	3/4	9.5	5.8	4.4
	14			281 or 0	2530				
7	16	2100	3900	367 or 0	3665	(2) 3/4	N/A	13.2	9.9

45J WITH ECM FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW (cfm)		PRIMARY AIRFLOW (cfm)		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
3	6	165	1100	52 or 0	515	1/2	7.7	5.0	4.1
	8			92 or 0	916				
6	10	385	2550	143 or 0	1432	1	12.8	10.5	6.9
	12			206 or 0	2062				
	14			281 or 0	2550				
7	16	685	4550	367 or 0	3665	(2) 1	N/A	21.0	13.8

NOTES:
1. 45J maximum primary airflow (cfm) is set by the maximum induced airflow, which may vary as a function of downstream pressure. Maximum airflow shown is based on the maximum induced airflow (fan airflow) or 1.00 in. wg differential pressure signal from inlet airflow sensor, whichever is less.
2. Minimum recommended primary airflow (cfm) is based on 0.03 in. wg differential pressure of the inlet airflow sensor, or 0 airflow. 0.03 in. wg is equal to 15% to 20% of the nominal flow rating of the terminal. Less than 15% to 20% may result in greater than +5% control of box flow.
3. 45J maximum/minimum fan airflow is based on 0.10 in. wg / 0.60 in. wg downstream static pressure, respectively.

Table 10 — 45K Series Fan Powered Terminal Unit Performance

45K WITH PSC FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW (cfm)		PRIMARY AIRFLOW (cfm)		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
2	6	50	530	52 or 0	515	1/10	1.4	0.8	0.6
	8			92 or 0	530				
3	6	200	1100	52 or 0	515	1/4	4.3	2.4	1.8
	8			92 or 0	916				
	10			143 or 0	1100				
	12			360 or 0	1100				
4	8	500	1300	92 or 0	916	1/4	4.3	2.4	1.8
	10			143 or 0	1300				
	12			206 or 0	1300				
5	10	800	1900	143 or 0	1432	1/2	8.3	4.4	3.5
	12			206 or 0	1900				
	14			281 or 0	1900				
6	10	1200	2600	143 or 0	1432	3/4	9.5	5.0	4.4
	12			206 or 0	2062				
	14			281 or 0	2600				
	16			367 or 0	2600				
7	10	1250	3000	143 or 0	1432	1	N/A	7.1	5.3
	12			206 or 0	2062				
	14			281 or 0	2806				
	16			367 or 0	3000				

45K WITH ECM FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW (cfm)		PRIMARY AIRFLOW (cfm)		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
3	6	250	1030	52 or 0	515	1/2	7.7	5.0	4.1
	8			92 or 0	916				
	10			143 or 0	1030				
	12			206 or 0	1030				
6	10	500	2600	143 or 0	1432	1	12.8	10.5	6.9
	12			206 or 0	2000				
	14			281 or 0	2000				
	16			367 or 0	2000				
7	10	600	2500	143 or 0	1432	1	12.8	10.5	6.9
	12			206 or 0	2062				
	14			281 or 0	2500				
	16			367 or 0	2500				

NOTES:
1. 45K maximum primary airflow (cfm) is set by the maximum induced airflow, which may vary as a function of downstream pressure. Maximum airflow shown is based on the maximum induced airflow (fan airflow) or 1.00 in. wg differential pressure signal from inlet airflow sensor, whichever is less.
2. Minimum recommended primary airflow (cfm) is based on 0.03 in. wg differential pressure of the inlet airflow sensor, or 0 airflow. 0.03 in. wg is equal to 15% to 20% of the nominal flow rating of the terminal. Less than 15% to 20% may result in greater than +5% control of box flow.
3. 45K maximum/minimum fan airflow is based on 0.10 in. wg / 0.60 in. wg downstream static pressure, respectively.

Table 11 — 45Q Series Fan Powered Terminal

45Q UNITS WITH PSC FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW		PRIMARY AIRFLOW		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
3	8	460	1075	92 or 0	916	1/4	5.8	2.6	2.2
	10			143 or 0	1075				
4	10	805	1650	143 or 0	1432	(2) 1/6	6.9	3.7	2.7
	13.5 X 8			206 or 0	1650				
5	10	840	1970	143 or 0	1432	1/2	8.4	4.2	3.7
	12			206 or 0	1970				
	14			281 or 0	1970				

45Q UNITS WITH ECM FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW		PRIMARY AIRFLOW		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
3	6	170	1100	52 or 0	515	1/3	5.0	3.3	2.6
	8			92 or 0	916				
	10			143 or 0	1100				
4	10	285	1900	143 or 0	1432	(2) 1/3	10.0	6.6	5.2
	13.5 x 8			206 or 0	1900				
5	8	265	1745	92 or 0	916	1/2	7.7	5.0	4.1
	10			143 or 0	1432				
	12			206 or 0	1745				
	14			281 or 0	1745				

45Q UNITS WITH ECM FAN MOTOR AND DOAS BOX									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW		PRIMARY AIRFLOW		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
3	6	150	1000	52 or 0	515	1/3	5.0	3.3	2.6
	8			92 or 0	916				
5	6	250	1625	52 or 0	515	1/2	7.7	5.0	4.1
	8			92 or 0	916				
	10			143 or 0	1432				

NOTES:
1. 45Q maximum primary airflow (CFM) is set by the maximum induced airflow, which may vary as a function of downstream pressure. Maximum airflow shown is based on the maximum induced airflow (fan airflow) or 1.00 in. wg differential pressure signal from inlet airflow sensor, whichever is less.
2. Minimum recommended airflow (CFM) is based on 0.03 in. wg differential pressure of the inlet airflow sensor, or 0 airflow. 0.03 in. wg is equal to 15% to 20% of the nominal flow rating of the terminal. Less than 15% to 20% may result in greater than +5% control of box flow.
3. 45Q maximum/minimum fan airflow is based on 0.10 in. wg / 0.60 in. wg downstream static pressure, respectively.

BALANCING 45M,N,R PARALLEL FLOW UNITS

A parallel fan terminal is designed to operate with the fan supplying air equal to 40 to 60% of the VAV damper maximum setting. Adjustments to the parallel units fan should be made with the primary air closed off. Refer to unit capacity tables to ensure airflow through the electric heater meets the minimum requirements before operating heater.

Each control option has specific procedures required for balancing the unit, but some steps are common to all parallel fan units, as described below.

To balance parallel fan unit:

Setting Fan Airflow

NOTE: If the unit has electric heat or hot water heat, temporarily disable these functions before balancing the fan.

If unit has optional electric heat disconnect downstream of fan motor connections to power, open disconnect.

If unit does not have optional electric heat disconnect, remove one electric heat power line connection. Be sure to insulate loose line from ground wire or other wires.

1. Set the controller to provide heating airflow demand only. Typically, this is accomplished by setting the thermostat to the highest possible temperature setting.

NOTE: A minimum of 0.1 in. wg downstream static pressure is required in the duct to ensure proper heater operation.

2. Determine that the VAV damper is fully closed. This may require a temporary override of the VAV controller. Do not adjust minimum and maximum cfm set points at this time.
3. Using a flow hood or duct traverse, determine the delivered fan airflow (cfm).

   NOTE: Both flow hood and duct traverse are subject to measurement errors. Be sure that all applicable measurement precautions are taken.
4. Compare the required design cfm in heating mode to the actual delivered airflow. If there is a minimum setting for the VAV damper in heating mode (as recommended by ASHRAE [American Society of Heating, Refrigeration, and Air Conditioning Engineers] Standard 62), this quantity is included in the total measured airflow.
5. Adjust the fan SCR at unit control box to achieve the desired airflow rate.

Setting of VAV (Primary) Airflow

Adjustment of Set Points

Each parallel fan unit is equipped with a pneumatic or electronic volume controller which regulates the quantity of cold primary air entering the terminal and the conditioned space. If required airflow levels are specified with the job order, the minimum and maximum cfm levels will be set at the factory. If minimum and maximum levels are not specified, a default value is used. Other settings of minimum and maximum primary airflow must be set in the field. Airflow (cfm) ranges for the primary air damper are shown in Tables 12-14 for 45M,N,R units. The minimum primary airflow (other than zero) is the minimum flow rate controllable by the unit volume controller. The primary air damper can be set at zero for shutoff or at the minimum cfm listed.

Field Adjustment of Minimum and Maximum Airflow Set Points

Each parallel fan unit is equipped with a four quadrant multipoint center averaging flow probe which provides an amplified differential pressure that is proportional to the unit airflow. Output from this probe is used to provide a flow signal to both pneumatic and electronic controls. Unit airflow (cfm) can be read directly from the flow probe on the unit.

1. After the unit airflow from the fan has been set, turn on primary (VAV) air supply and turn off the fan.
2. To set cfm in the field, connect a gage to the flow probe and check the differential pressure.
3. If a minimum VAV flow is required in heating mode, adjust the volume controller until the differential pressure corresponds to the cfm required.
4. Some control sequences allow the fan to start before the VAV damper reaches minimum setting, for an overlapping of fan and VAV flow. For these sequences, after controller min airflow has been adjusted, the total airflow with both fan and primary airflow should be checked. For sequences that call for the fan to start as the first stage of heat, the cooling minimum cfm can be verified at the diffuser.

   Setting the minimum control point will typically require careful adjustment of the thermostat to create a minimum cooling demand signal.

5. a. Set the controller to provide maximum cooling demand. This is typically accomplished by setting the thermostat to the lowest possible temperature setting. For most control sequences, this will cause the fan to shut off.

   b. Adjust the volume controller until the differential pressure (measured through the flow probe as described above) corresponds to the cfm required.
6. Return all reheat options to normal connections.
7. Cap the ends of the inlet flow sensors.
8. Reset the thermostat to a normal setting.

Table 12 — 45M Parallel Fan Powered Terminal Unit Performance

45M WITH PSC FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW (cfm)		PRIMARY AIRFLOW (cfm)		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
2	6	200	400	52 or 0	515	1/10	1.6	0.9	0.7
	8			92 or 0	916	1/10	2		
3	6	300	990	52 or 0	515	1/4	3.6	2	1.5
	8			92 or 0	916				
4	8	550	1440	92 or 0	916	1/4	5	2.8	2.1
	10			143 or 0	1432				
	12			206 or 0	1440				
5	10	1100	2140	143 or 0	1432	1/2	8.3	4.6	3.5
	12			206 or 0	2062				
6	12	1200	2530	206 or 0	2062	3/4	9.5	5.8	4.4
	14			281 or 0	2530				
7	16	2100	3900	367 or 0	3665	(2) 3/4	N/A	13.2	9.9

NOTES:
1. 45M maximum primary airflow (cfm) is based on 1.00 in. wg differential pressure signal from inlet airflow sensor.
2. Minimum recommended primary airflow (cfm) is based on 0.03 in. wg differential pressure of the inlet airflow sensor, or 0 airflow. 0.03 in. wg is equal to 15% to 20% of the nominal flow rating of the terminal. Less than 15% to 20% may result in greater than +5% control of box flow.
3. 45M maximum/minimum fan airflow (cfm) is based on 0.25 in. wg external (downstream) static pressure.

Table 13 — 45N Parallel Fan Powered Terminal Unit

45N WITH PSC FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW (cfm)		PRIMARY AIRFLOW (cfm)		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
2	6	150	530	52 or 0	515	1/10	2.6	1.5	1.1
	8			92 or 0	916				
3	6	160	800	52 or 0	515	1/4	3.1	1.7	1.3
	8			92 or 0	916				
	10			143 or 0	1432				
4	6	190	900	52 or 0	515	1/4	3.4	1.9	1.4
	8			92 or 0	916				
	10			143 or 0	1432				
	12			206 or 0	2062				
5	10	480	1700	143 or 0	1432	1/2	7.3	4.1	3.1
	12			206 or 0	2062				
	14			281 or 0	2806				
6	10	500	1700	143 or 0	1432	1/2	7.3	4.1	3.1
	12			206 or 0	2062				
	14			281 or 0	2806				
	16			367 or 0	3665				
7	10	780	2000	143 or 0	1432	3/4	9.5	5.8	4.4
	12			206 or 0	2062				
	14			281 or 0	2806				
	16			367 or 0	3665				

45N WITH ECM FAN MOTOR									
UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW (cfm)		PRIMARY AIRFLOW (cfm)		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN	MAX		120V	208/240V	277V
4	6	150	1000	52 or 0	515	1/2	7.7	5.0	4.1
	8			92 or 0	916				
	10			143 or 0	1432				
	12			206 or 0	2062				
7	10	240	1600	143 or 0	1432	1	12.8	10.5	6.9
	12			206 or 0	2062				
	14			281 or 0	2806				
	16			367 or 0	3665				

NOTES:
1. 45N maximum primary airflow (cfm) is based on 1.00 in wg differential pressure signal from inlet airflow sensor.
2. Minimum recommended primary airflow (cfm) is based on 0.03 in. wg differential pressure of the inlet airflow sensor, or 0 airflow. 0.03 in. wg is equal to 15% to 20% of the nominal flow rating of the terminal. Less than 15% to 20% may result in greater than +5% control of box flow.

Table 14 — 45R Parallel Fan Powered Terminal Unit With PSC Fan Motor Performance

UNIT SIZE	INLET SIZE (in.)	FAN AIRFLOW		PRIMARY AIRFLOW		MOTOR HP	MOTOR AMPS		
		MIN	MAX	MIN #	MAX		120V	208/240V	277V
2	6	350	665	52 or 0	515	1/6	3.7	1.5	1.4
	8			92 or 0	916				
	10			143 or 0	1432				
4	8	420	855	92 or 0	916	1/4	5.6	2.5	2.0
	10			143 or 0	1432				
	13.5 x 8			206 or 0	2062				

NOTES:
1. 45Q maximum primary airflow (CFM) is based on 1.00 in. wg differential pressure signal from inlet airflow sensor.
2. Minimum recommended airflow (CFM) is based on 0.03 in. wg differential pressure of the inlet airflow sensor, or 0 airflow. 0.03 in. wg is equal to 15% to 20% of the nominal flow rating of the terminal. Less than 15% to 20% may result in greater than +5% control of box flow.
3. 45R maximum/minimum fan airflow is based on 0.25 in. wg external (downstream) static pressure, respectively.

Speed Controller

Each Carrier fan powered air terminal unit is equipped with a fan SCR speed controller, located on the bottom of the control box. The SCR can be adjusted in the field.

NOTE: The 45J size 7 unit and 45Q size 4 unit have two SCR speed controllers, one for each fan. One SCR is located in the standard position at the bottom of the control box; the other is at the top of the control box.

The fan airflow output is dependent on the setting of the controller and the downstream static resistance.

⚠ CAUTION

The minimum stop on the speed controller is factory set at an internal minimum stop to prevent damage to the motor. Do not attempt to override this minimum stop or electrical damage to the fan motor may result.

TO INCREASE THE FAN SPEED (RPM), turn the slotted adjustment on the controller clockwise toward the "HI" marking printed on the controller face plate (see to Fig. 11).

TO DECREASE THE FAN SPEED (RPM), turn the adjustment counterclockwise toward the "LO" marking. (see Fig. 11).

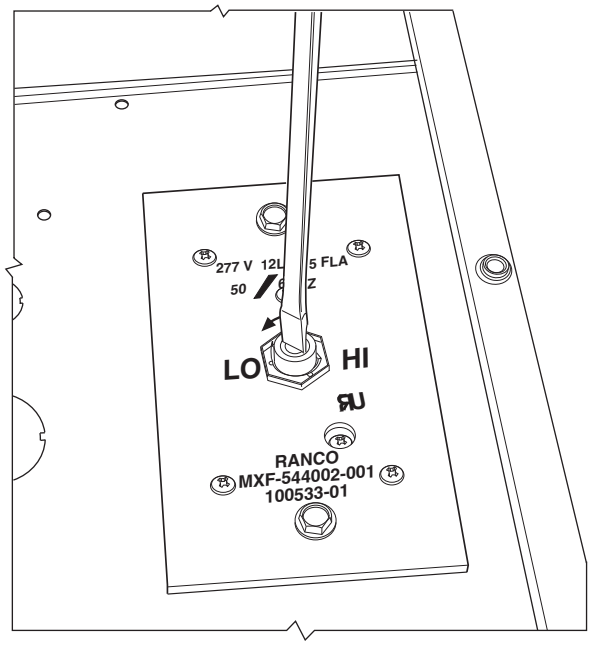


Fig. 11 — Fan Speed Controller

Setting Fan Air Flow with ECM Motors

Several terminal unit models are available with ECM motors for easy balancing. These motors supply a determined amount of air regardless of static pressure from ductwork layout or air distribution. The ECM motors are programmed to provide a maximum CFM depending on model and unit size. The motors are then set to provide the desired CFM as a proportional amount of the maximum. The proportion can be set by several options:

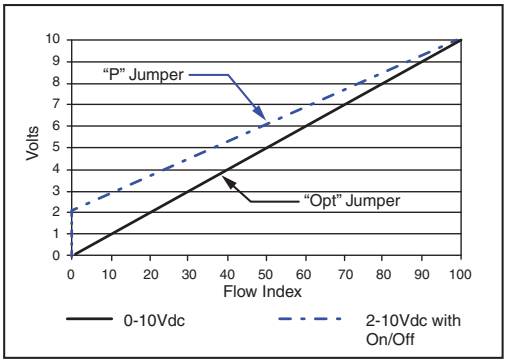
VCU (CONTROL OPTION 6)

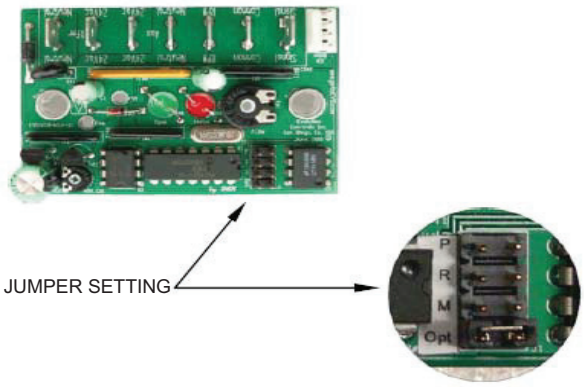
VCU controlled units are manually operated with a digital readout on the ECM controller (see Fig. 12). The digital readout provides a percent of maximum. A fan adjustment knob is rotated until the desired percent is displayed. After 20 seconds from final adjustment, the controller display will alternate between percent and motor RPMs.

Fig. 12 — VCU ECM Controller

ACU-O, 0-10VDC (0-20MA) INPUT (CONTROL OPTION 7)

The board is factory set to accept a 0-10 Vdc signal to control the airflow between 0% and 100% as shown in the chart in Fig. 12. This option does not allow for on/off control. Setting the jumper to the "Opt" position as shown in the "Jumper Setting" in Fig. 13 sets the control signal to 0-10Vdc signal.





NOTE: Both ACU Options provide a manual Override for field setting the ECM motor without being connected to a DDC controller. If a DDC controller is connected, adjusting the manual override with lock out the automation signal for 15 minutes.

Fig. 13 — ACU ECM Controller

ACU-P, 2-10VDC (4-20MA) INPUT (CONTROL OPTION 8)

Another option is to have the board factory set to allow for on/off control by setting the jumper on to the "P" position. This setting uses a 2-10 Vdc control signal range with a voltage signal under 2 Vdc turning the motor off. See Fig. 13 for graph of operating range.

PNEUMATIC CONTROLS

General — Single Function Pneumatic Controller Control Sequences (1300-1305, 1400-1401)

To properly balance the system, all ductwork and outlets must be installed and connected tightly. Reference piping/wiring diagram on unit for specifics for the control sequence selected for the unit.

Units with Single-Function Controllers

1. Determine sequence of operations (reverse-acting, normally closed [RANC], direct-acting, normally open [DANO]). This can be accomplished by reading the diagram affixed to the unit. The standard RANC controller is gray colored; the DANO controller is beige. See Fig. 14-16.
2. Check that main air pressure at the controller. Main air should equal 18 to 25 psi. Main air must be clean and dry.
3. Check for primary airflow in the inlet duct, using a differential pressure sensor tapped into the differential pressure sensor signal line tees.
4. Verify that the installed room thermostat is compatible with the unit control.
5. Close the primary air damper.
   a. RANC — disconnecting the actuator from the controller should allow the damper to close completely.
   b. DANO — connecting to 20 psi air supply directly to the actuator should close the damper completely.
6. Start the blower motor by doing one of the following:

   45J,K,Q Units:

   Both RANC and DANO — Connect electrical power to the blower motor control.

   45M,N,R Units:

   RANC — Connect the main air line to the blower control, bypassing the thermostat input.

   DANO — Disconnect the thermostat line from the blower controls.

   These steps should energize the fan.

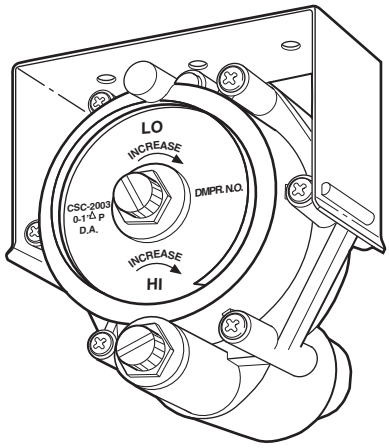


Fig. 14 — Pneumatic Volume Controller (Normally Open) for Pneumatic Control Unit (Beige Color)

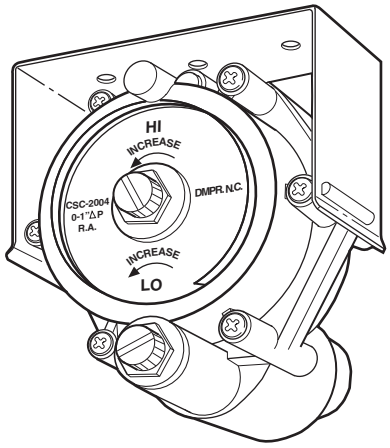


Fig. 15 — Pneumatic Volume Controller (Normally Closed) for Pneumatic Control Unit (Gray Color)

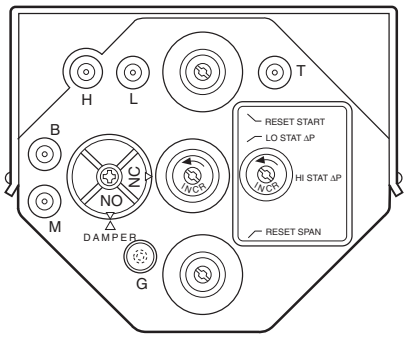


Fig. 16 — CSC 3000 Series Reset Volume Controller

7. Balance the supply outlets using a proportional air volume method.
   a. With the blower discharging full volume (SCR on max setting), measure the total air volume.
   b. Calculate the percentage of the design air volume needed by each outlet.
   c. Multiply the total air volume by the percent-of-design air volume for each diffuser.
   d. Balance each outlet according to the requirements calculated above.
8. Balance the unit fan discharge:
   a. Measure the total flow discharging from the unit.
   b. Adjust the discharge flow from the unit using the unit electronic speed control (SCR).
9. Reconnect the damper actuator and/or the thermostat tubing to the velocity controller with the fan still running. Make sure the piping is as shown on the unit piping/wiring diagram.
10. Balance the primary (cooling) air volume:

    NOTE: To balance the primary air side of the 45M,N,R unit only, the blower motor must be disconnected.
    a. Connect the Magnehelic or inclined manometer (0 to 2.0 in. wg scale, maximum) to the differential pressure sensor tubing.
    b. Measure the volume of air flowing through the inlet using the calibration curve affixed to the unit.

       RANC
       1) With a 0 psi thermostat signal, measure the unit maximum airflow.
       2) Rotate to the "HI" adjustment knob on the velocity controller, adjust the airflow to the desired maximum setting.
       3) With the 15 psig (or greater) thermostat signal, measure the unit minimum airflow.

       DANO
       1) At a 0 psi stat signal, measure the unit minimum airflow.
       2) Rotate the "LO" adjustment knob of the velocity controller, adjust the minimum flow to the desired setting, as read from the differential pressure sensor.
       3) With a 15 psig (or greater) thermostat signal, measure the unit maximum airflow.
       4) Rotate the "HI" adjustment know on the velocity controller, adjust the airflow to the desired maximum setting.
11. Reconnect the power to the blower motor on the 45M,N,R unit.

NOTES:
1. The single function control system uses a KMC CSC 2000 series velocity controller with a rated air consumption of 0.0083 SCFM at 20 psi main air pressure.
2. The maximum and minimum limits are both changed when adjusting the CENTER knob. For this reason, the center knob should always be set first.
3. Refer to the Table 15 if any of the above steps do not result in satisfactory performance.

Table 15 — Troubleshooting Pneumatic Controls

PROBLEM	LIKELY CAUSE
Controller does not reset to maximum minimum set point during balancing procedure	Thermostat signal is being used for control signal. An artificial signal must be used.
Controller does not reset to maximum or point during operation	Thermostat is not demanding minimum set maximum or minimum air volume. Main air pressure at the controller is less than 15 psi.
Pneumatic actuator does not stroke fully	Leak in pneumatic tubing between the controller and the actuator. Main air pressure at the controller is less that 15 psi. Leak in the actuator diaphragm.
Air valve stays in wide open position	Differential pressure sensor is blocked or obstructed. Insufficient supply air pressure in the unit inlet.

Units with Multi-Function Controllers (Sequences 1306-1317 and 1402-1405)

1. Determine sequence of operation (direct-acting, normally closed [DANC], reverse-acting, normally closed [RANC], direct-acting, normally open, or reverse-acting, normally open). This can be accomplished by reading the diagram affixed to the unit. All sequences above utilize a four-function controller, allowing for changeover from a given sequence to another.
2. Check the main air pressure at the controller. Main air should equal 18 to 25 psi. Main air must be clean and dry.
3. Check for primary airflow in the inlet duct, using a differential pressure sensor tapped into the differential pressure sensor signal line tees.
4. Verify that the installed room thermostat is compatible with the unit control.
5. Close the primary air damper.
   a. DANC, RANC — Disconnecting the actuator from the controller should allow the damper to close completely.
   b. DANO, RANO — Connecting a 20 psi air supply directly to the actuator should close the damper completely.
6. Start the blower motor by doing one of the following:

   45J,K,Q Units:
   DANC, RANC, DANO, RANO — Connect electrical power to the blower motor controls.

   45M,N,R Units:
   DANC, DANO — Disconnect the thermostat line from the blower control.

   RANC, RANO — Connect the main air line to the blower control, bypassing the thermostat input.

   These steps should energize the fan.
7. Balance the supply outlets using a proportional air volume method:
   a. With the blower discharging full volume (SCR on max setting), measure the total air volume.
   b. Calculate the percentage of the design air volume needed by each outlet.
   c. Multiply the total air volume by the percent-of-design air volume for each diffuser.

d. Balance each outlet according to the requirements calculated in previous steps.

8. Balance the unit fan discharge:
   a. Measure the total flow discharging from the unit.
   b. Adjust the discharge flow from the unit using the unit electronic speed control (SCR).
9. Reconnect the damper actuator to the velocity controller with the fan still running. Make sure the piping is as shown on the unit piping/wiring diagram.
10. Balance the primary (cooling) air volumes:

    NOTE: To balance the primary air side of the 45M,N,R units only, the blower motor must be disconnected.

    a. Connect a Magnehelic or inclined manometer (0 to 2.0 in. wg scale, maximum) to the differential pressure sensor tubing.
    b. Measure the volume of air flowing through the inlet using the calibration curve affixed to the unit.
    c. Adjust the "LO STAT" knob, with a 0 psi thermostat signal, to obtain the desired airflow setting. Depending on the control sequence desired, the "LO STAT" knob will vary either the minimum setting or the maximum setting as follows:

       DANC — "LO STAT" knob adjusts the minimum setting.

       RANC — "LO STAT" knob adjusts the maximum setting.

       DANO — "LO STAT" knob adjusts the minimum setting.

       RANO — "LO STAT" knob adjusts the maximum setting.

Operation Sequences

1. During maximum thermostat cooling demand, the primary air damper will open in the maximum airflow setting providing cold primary air at the preset maximum volume. Accessory coils, if supplied, are off, and the unit should discharge primary air only.
2. When the thermostat modulates between maximum cooling and satisfied set point, the primary air damper responds by proportional settings. Accessory coils, if supplied, are off. The 45J,K,Q units only will be inducing plenum air and mixing it with the cold primary air. The 45M,N,R fan will not induce any plenum air at this point.
3. When the thermostat is modulating between maximum heating demand and satisfied setpoint, the primary air damper will be at the minimum air volume setting. A maximum amount of plenum air is induced at this point. In sequence, the first and second stages of electric reheat will energize, if supplied. If hot water heating coils are supplied, they will either open fully or modulate open.
4. During thermostat demand for maximum heating, primary air will flow through the unit at the preset minimum setting, maximum amount of plenum air will be induced, and heating coils, if supplied, are full on. See Table 15 for pneumatic control troubleshooting.
5. Adjust the "HI STAT" knob, with a 15 psi thermostat signal, to obtain the desired airflow setting. Depending on the control sequence desired, the "HI STAT" knob will vary either the minimum setting or the maximum setting as follows:

   DANC — "HI STAT" knob adjusts the maximum setting
   RANC — "HI STAT" knob adjusts the minimum setting
   DANO — "HI STAT" knob adjusts the maximum setting
   RANO — "HI STAT" knob adjusts the minimum setting
6. To adjust the thermostat reset start point, remove gage port ("G") cap and attach a 0 to 30 psi pressure gage and note the pressure reading. Adjust the thermostat pressure to the controller, "T" port to the desired start point. Adjust the "RESET START" knob until the gage pressure begins to change slightly. Remove pressure gage and replace cap.
7. To adjust the thermostat reset span from standard 5 psi, remove gage port ("G") cap and attach a 0 to 30 psi pressure gage and note the pressure reading. Adjust the thermostat pressure to the controller "T" port to the desired start point. Adjust the "RESET SPAN" knob until the gage pressure equals the desired reset span. Remove gage and replace cap.
8. To change logic from a given sequence to another, follow the steps below:
   a. To change from N.O. to N.C. or from N.C. to N.O., loosen the "damper" dial screw and rotate the dial until the desired damper position indicator is aligned with the arrow. The VAV damper must be physically changed to desired position.
   b. To change from DA to RA or from RA to DA, no configuration changes are required — use the appropriate calibration procedures from above.
9. Reconnect the power to the blower motor on the 45M,N units.

NOTES:

1. The multi-function control system uses a KMC CSC 3000 series velocity controller with a rated air consumption of 1.00 SCFH at 20 psi main air pressure.
2. The maximum and minimum limits are both changed when adjusting the center knob. The center knob should always be set first.

Analog Controls Installation and Balancing Procedures

The Analog Electronic Control System is a pressure independent volume reset control that uses a KMC CSP-4702 controller-actuator (see Fig. 17).

Adjustments for the minimum and maximum airflow settings are made at the thermostat. The thermostat (CTE-5202) operates on a 16 VDC power supply from the CSP 4702 controller and outputs a 0 to 10 VDC signal on the AO1 and AO2 terminals. AO1 is used as the cooling output and AO2 is used as the heating output.

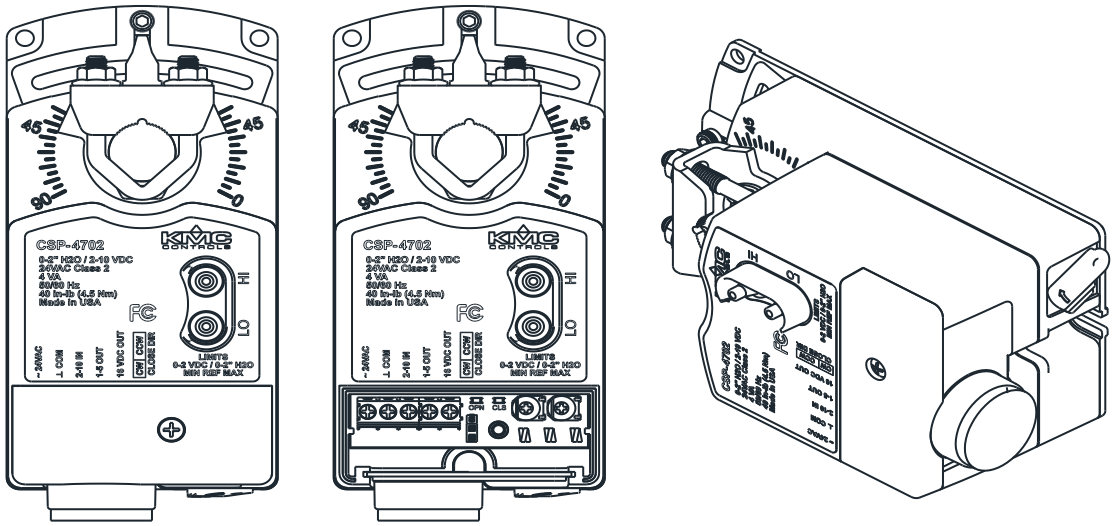


Fig. 17 — CSP-4702 Controller/Actuator

Thermostat Installation

For proper operation, mount the thermostat on an interior wall. Do not mount the thermostat in a location that will cause it to be affected by direct sunlight or other heat or cold sources. The thermostat should be clear of all obstructions so it can properly sense the room temperature. Complete rough-in wiring at each location prior to thermostat installation. Cable insulation must meet local building codes.

1. Remove thermostat cover. If the thermostat is locked on the back plate, turn the two hex screws in on the bottom of the cover (in the two outermost holes) in the back plate CLOCKWISE until they clear the cover. Do not remove these screws completely. Swing the thermostat up and away from the back plate to remove it.
2. Route the wires through the opening in the back plate.
3. Install the back plate directly to the junction box using the screws supplied with the thermostat. Verify the hex screws used for securing the cover are located at the bottom before installing.
4. Connect the wires to the terminal block. Refer to the wiring diagram located on the inside cover of the control enclosure of each unit showing the wiring terminations.
5. Replace the thermostat cover. Turn the two hex screws COUNTER CLOCKWISE until they are flush with the bottom cover and secure it to the back plate.

Programming Thermostat

1. The thermostat has three sequences that are selectable from the display screen. To access the configuration menu on the thermostat, press and hold the Up and Down arrows for 10 seconds until the display starts flashing “LIMITS”. Use the Up and Down arrows to scroll between the different menu options or set a specific value. Use the Setpoint button to select a menu or set a value.
2. To set the minimum and maximum airflow limits, Use AO1 Min and AO1 Max or AO2 Min and AO2 Max. Use the Table 16 to determine thermostat setting for the CFM per inlet size.
3. For details on how to program the thermostat for each control sequence see the specific control sequence submittal.

Table 16 — CFM Chart for Setting Minimum and Maximum Values on Thermostat

AO1 AND AO2	SENSOR SIGNAL	CFMs PER INLET SIZE											
		4	5	6	7	8	9	10	12	14	16	20	22
0-2	0.00	0	0	0	0	0	0	0	0	0	0	0	0
2.1	0.03	36	57	81	111	145	183	226	326	444	580	315	1107
2.2	0.05	51	80	115	157	205	259	320	461	627	820	445	1565
2.3	0.08	63	98	141	192	251	318	392	565	768	1004	545	1917
2.4	0.10	72	113	163	222	290	367	453	652	887	1159	630	2214
2.5	0.13	81	127	182	248	324	410	506	729	992	1296	704	2475
2.6	0.15	89	139	200	272	355	449	555	798	1087	1420	771	2711
2.7	0.18	96	150	216	293	383	485	599	862	1174	1533	833	2928
2.8	0.20	102	160	231	314	410	519	640	922	1255	1639	891	3130
2.9	0.23	109	170	244	333	435	550	679	978	1331	1739	945	3320
3.0	0.25	115	179	258	351	458	580	716	1031	1403	1833	996	3500
3.1	0.28	120	188	270	368	481	608	751	1081	1472	1922	1045	3671
3.2	0.30	125	196	282	384	502	635	784	1129	1537	2008	1091	3834
3.3	0.33	131	204	294	400	522	661	816	1175	1600	2089	1136	3991
3.4	0.35	136	212	305	415	542	686	847	1220	1660	2168	1178	4141
3.5	0.38	140	219	316	430	561	710	877	1263	1718	2244	1220	4287
3.6	0.40	145	226	326	444	580	733	905	1304	1775	2318	1260	4427
3.7	0.43	149	233	336	457	597	756	933	1344	1829	2389	1299	4563
3.8	0.45	154	240	346	471	615	778	960	1383	1882	2459	1336	4696
3.9	0.48	158	247	355	484	632	799	987	1421	1934	2526	1373	4824
4.0	0.50	162	253	364	496	648	820	1012	1458	1984	2592	1408	4950
4.1	0.53	166	259	373	508	664	840	1037	1494	2033	2656	1443	5072
4.2	0.55	170	265	382	520	680	860	1062	1529	2081	2718	1477	5191
4.3	0.58	174	271	391	532	695	879	1086	1563	2128	2779	1510	5308
4.4	0.60	177	277	399	543	710	898	1109	1597	2174	2839	1543	5422
4.5	0.63	181	283	407	555	724	917	1132	1630	2218	2898	1575	5534
4.6	0.65	185	289	416	566	739	935	1154	1662	2262	2955	1606	5644
4.7	0.68	188	294	423	576	753	953	1176	1694	2305	3011	1636	5751
4.8	0.70	192	299	431	587	767	970	1198	1725	2348	3067	1666	5857
4.9	0.73	195	305	439	597	780	987	1219	1755	2389	3121	1696	5960
5.0	0.75	198	310	446	608	794	1004	1240	1785	2430	3174	1725	6062
5.1	0.78	202	315	454	618	807	1021	1260	1815	2470	3227	1753	6162
5.2	0.80	205	320	461	627	820	1037	1281	1844	2510	3278	1782	6261
5.3	0.83	208	325	468	637	832	1053	1300	1873	2549	3329	1809	6358
5.4	0.85	211	330	475	647	845	1069	1320	1901	2587	3379	1836	6454
5.5	0.88	214	335	482	656	857	1085	1339	1929	2625	3428	1863	6548
5.6	0.90	217	340	489	666	869	1100	1358	1956	2662	3477	1890	6641
5.7	0.93	220	344	496	675	881	1115	1377	1983	2699	3525	1916	6732
5.8	0.95	223	349	502	684	893	1130	1395	2009	2735	3572	1941	6823
5.9	0.98	226	353	509	693	905	1145	1414	2036	2771	3619	1967	6912
6.0	1.00	229	358	515	702	916	1160	1432	2062	2806	3665	1992	7000

SERVICE

⚠ WARNING

LOCK OPEN AND TAG heater electrical disconnect before working on this equipment. Otherwise, one leg of the 3-leg heater remains energized.

Controls

No periodic preventive maintenance is necessary.

Fan Motor and Wheel

The fan motor and wheel are accessible from the bottom of the unit. Remove the bottom panel to check the wiring or remove the fan wheel or motor.

The PSC motors are equipped with long life sleeve bearings with non-detergent SAE 20 oil biannually.

NOTE: The ECM motor has permanently lubricated ball bearings that require NO maintenance.

⚠ WARNING

Disconnect power to unit before touching fan motor wiring, or electrical shock or personal injury could result.

TO CHECK WIRING (REFER TO FIG. 18-20)

The PSC motor is connected by quick-connect terminals to the capacitor (brown wire), the housing wire (green ground wire), and the control box (black wire and white wire). Verify that the fan motor wiring is correct as shown in these figures.

TROUBLESHOOTING

To remove the fan motor and wheel:

1. Disconnect motor wiring.
2. The fan motor and wheel assembly is attached to the discharge panel with 4 hex nuts.
3. Remove the motor by removing the 3 screws that attach the torsion flex mounts to the inlet ring.
4. Remove wheel by unscrewing the hub set screws that are accessed through the open end of the wheel.

Fan Motor Wiring

Refer to the fan motor wiring details shown on the wiring diagram attached to the unit. Failure to reconnect the fan properly can cause damage to the motor and/or serious personal injury.

Fan Motor Maintenance

Unit motors are equipped with permanently lubricated bearings. Inspect fan and motor assembly for accumulation of dust and dirt as required by operating environment. Clean as necessary. See Fig. 18-20 for motor wiring.

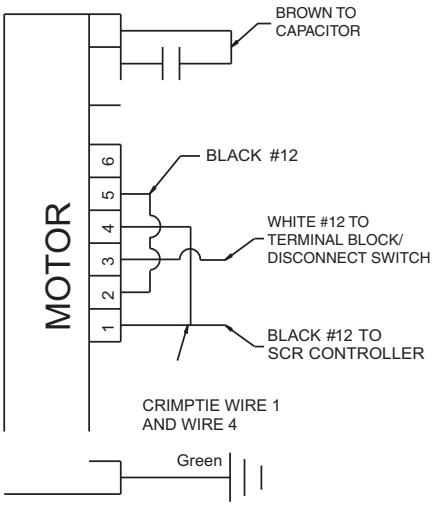


Fig. 18 — PSC Motor Wiring Terminal Block — 115 V, Single Phase

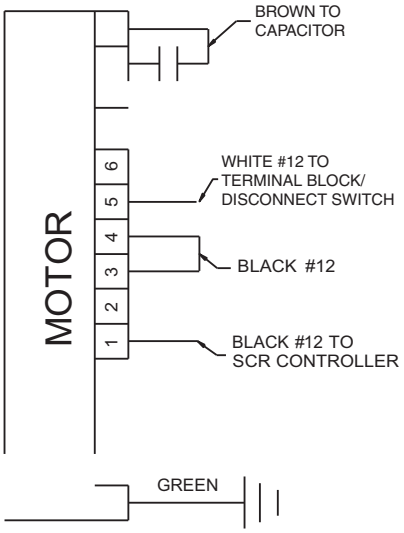


Fig. 19 — PSC Motor Wiring Terminal Block — 208/240 V, Single Phase

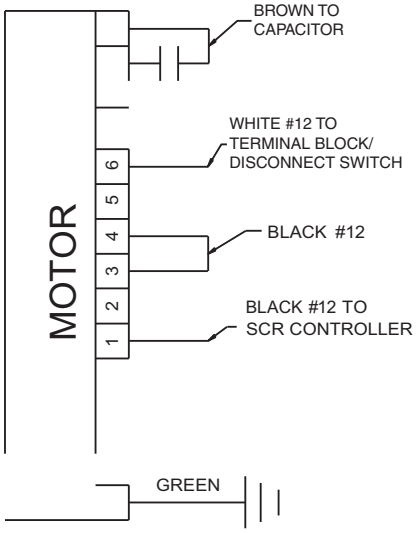


Fig. 20 — PSC Motor Wiring Terminal Block — 277 V, Single Phase

If fan motor does not run:

1. Make sure that there is free rotation of blower wheel.
2. Remove fan packing.
3. Verify that there is no freight or installation damage.
4. Check for proper unit power.
5. Disconnects should be on, and check optional fusing.
6. Check for proper control signal, pie switch setting, proper air control 24 vac at fan contactor, and that the coil is energized.

If fan motor runs, excessive noise:

1. Make sure the blower, and all components have no clearance problems and are securely attached.
2. Verify the integrity of ductwork, make sure there are no leaks or loose connections rattling diffusers or balancing dampers.
3. Confirm that the maximum CFM not too high, or discharge static pressure is too low.

If fan motor runs, insufficient airflow:

1. Check for ductwork restrictions, dirty air filters, and clogged water coils.
2. Re-adjust fan speed control.
3. Discharge static pressure too high.

If repair or replacement is required:

1. Motor and fan should be removed as an assembly. Disconnect all power before servicing.
2. Remove the four hex nuts from the mounting lugs holding the fan assembly to the discharge panel, and lower the assembly.

   NOTE: Do not allow assembly to hang from wiring.
3. Loosen the setscrew if removing motor from blower.
4. Hold the blower wheel to the motor shaft. Remove the three screws holding motor to the fan housing, and slide motor and fan housing apart. Reverse the procedure for assembly.

NOTE: Overtightening motor mounting screws may crush isolation bushings, and cause excessive fan noise and wear.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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