MODINE

6-575.4
Part 5H73594A (Rev. C)

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INSTALLATION AND SERVICE MANUAL
gas-fired unit heaters
models PV & BV

All models approved for use in California (with IPI) by the CEC, in New York by the MEA Division and in Massachusetts. AGA certified to ANSI Z83 standrads.

Contents

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death, and could cause exposure to substances which have been determined by various state agencies to cause cancer, birth defects or other reproductive harm. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

FOR YOUR SAFETY

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

To prevent premature heat exchanger failure do not locate ANY gas-fired units in areas where chlorinated, halogenated or acid vapors are present in the atmosphere.

FOR YOUR SAFETY

If you smell gas:
1. Open windows.
2. Don't touch electrical switches.
3. Extinguish any open flame.
4. Immediately call your gas supplier.

THIS MANUAL IS THE PROPERTY OF THE OWNER. PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB. UNIT HEATER IS CERTIFIED FOR NON-RESIDENTIAL APPLICATIONS.

Inspection on Arrival

1. Inspect unit upon arrival. In case of damage, report immediately to transportation company and your local Modine sales representative.
2. Check rating plate on unit to verify that power supply meets available electric power at the point of installation.
3. Inspect unit received for conformance with description of product ordered (including specifications where applicable).

SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH.

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage. All units must be wired strictly in accordance with wiring diagram furnished with the unit.
2. Turn off all gas before installing unit heaters.
3. Gas pressure to unit heater controls must never exceed 14" W.C. (1/2 psi).

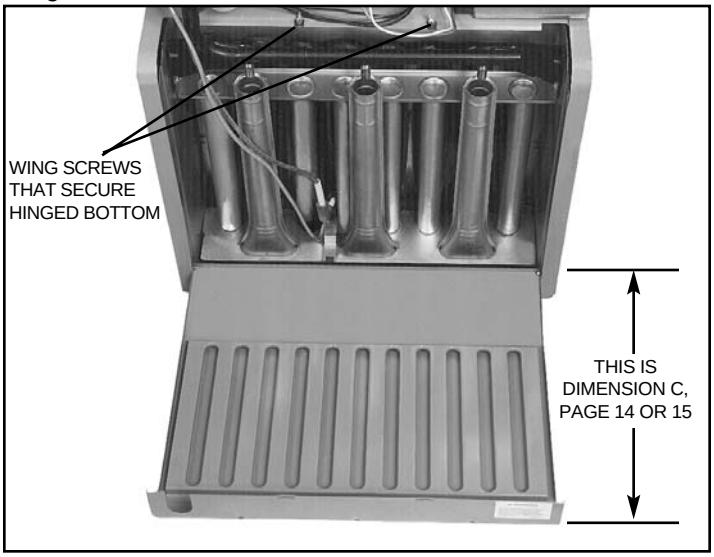
   When leak testing the gas supply piping system, the unit and its combination gas control must be isolated during any pressure testing in excess of 14" W.C. (1/2 psi).

   The unit should be isolated from the gas supply piping system by closing its field installed manual shut-off valve.
4. Check gas inlet pressure at unit upstream from combination gas control. The inlet pressure should be 6-7" W.C. on natural gas or 12-14" W.C. on propane gas. Purging of gas piping should be performed as described in ANSI Z223.1—Latest Edition or in Canada in CAN/CGA-B149 codes.
5. All units must be vented to the outside atmosphere.
6. Do not install in potentially explosive or flammable atmospheres laden with grain dust, sawdust, or similar air-borne materials. In such applications a blower type heater installed in a separate room with ducting, including appropriate back flow prevention dampers, to the dust-laden room is recommended.
7. Installation of units in high humidity or salt water atmospheres will cause accelerated corrosion resulting in a reduction of the normal life of the units.
8. To prevent premature heat exchanger failure do not locate ANY gas-fired unit in areas where chlorinated, halogenated or acid vapors are present in the atmosphere.
9. Avoid installing units in extremely drafty locations. Drafts can cause burner flames to impinge on heat exchangers which shortens life. Maintain separation between units so discharge from one unit will not be directed into the inlet of another.
10. Do not locate units in tightly sealed rooms or small compartments without provision for adequate combustion air and venting. Combustion air must have access to the confined space through a minimum of two permanent openings in the enclosure, at least one near the bottom. They should provide a free area of one square inch per 1000 BTU per hour input rating of the unit with a minimum of 100 square inches for each opening, whichever is greater.
11. Do not install unit outdoors.
12. Do not locate unit closer to combustible materials than the clearances listed. For all PV/BV sizes, minimum clearance to combustibles from the bottom is 12", from the left side 18" and from the right side 6". For PV sizes 30-145 minimum clearance to combustible materials from the top is 1", clearance for sizes 175-350 is 2", and clearance for the 400 is 3".

    For PV sizes 30-100 minimum clearance to combustible materials from the vent connector is 2", clearance for sizes 125-300 is 3", and clearance for sizes 350 & 400 is 6".

    For all BV sizes, from the top and from the vent connector is 6".
13. Allow at least 6" clearance at the sides and 12" clearance at rear (or 6" beyond end of motor at rear of unit, whichever is greater) to provide ample air for combustion and proper operation of fan.
14. The minimum distance from combustible material is based on the combustible material surface not exceeding 160°F. Clearance from the top of the unit may be required to be greater than the minimum specified if heat damage, other than fire, may occur to materials above the unit heater at the temperature described.
15. Do not install units below 7 feet measured from the bottom of the unit to the floor.
16. Modine unit heaters are designed for use in heating applications with ambient temperatures between 32° F and 90° F. If an application exists where ambient temperatures can be expected to fall outside of this range, contact factory for recommendations.
17. Provide clearance for opening hinged bottom for servicing. See Figure 1. Do not set unit on its bottom.
18. To assure that flames do not impinge on heat exchanger surfaces, the unit must be suspended in a vertical and level position. Failure to suspend unit properly may shorten the life of the unit heater.
19. Do not lift unit heater by gas controls, gas manifold, or power exhauster.
20. Be sure no obstructions block air intake and discharge of unit heater.
21. Do not attach duct work, air filters, or polytubes to any propeller (PV) model unit heaters.
22. In aircraft hangars, keep the bottom of the unit at least 10' from the highest surface of the wings or engine enclosure of the highest aircraft housed in the hangar and in accordance with the requirements of the enforcing authority and/or NFPA 409 – Latest Edition.
23. In garages or other sections of aircraft hangars such as offices and shops which communicate with areas used for servicing or storage, keep the bottom of the unit at least 7' above the floor. In public garages, the unit must be installed in accordance with the Standard for Parking Structures NFPA 88A and the Standard for Repair Garages NFPA 88B. In Canada, installation of unit heaters in airplane hangars must be in accordance with the requirements of the enforcing authority, and in public garages in accordance with the current CAN/CGA-B149 codes.
24. Consult piping, electrical, and venting instructions in this manual before final installation.
25. All literature shipped with your unit should be kept for future use for servicing or service diagnosis. Do not discard any literature shipped with your unit.
26. When servicing or repairing this equipment, use only Modine approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the unit for complete unit model number, serial number and company address. Any substitution of parts or controls not approved by Modine will be at owners risk.

Figure 1
Hinged Bottom for Service



INSTALLATION

In the U.S., the installation of these units must comply with the "National Fuel Gas Code," ANSI Z223.1, latest edition (also known as NFPA 54) and other applicable local building codes. In Canada, the installation of these units must comply with local plumbing or waste water codes and other applicable codes and with the current code CAN/CGA-B149.1, "Installation Code for Natural Gas Burning Appliances and Equipment" or CAN/CGA-B149.2, "Installation Code for Propane Burning Appliances and Equipment."

1. All installation and service of these units must be performed by a qualified installation and service agency only as defined in ANSI Z223.1, latest edition or in Canada by a licensed gas fitter.
2. This unit is certified by CSA, with the controls furnished. For replacement parts, please order according to the replacement parts list on serial plate. Always know your model and serial numbers. Modine reserves the right to substitute other authorized controls as replacements.
3. Unit is balanced for correct performance. Do not alter fan or operate motors at reduced speed.
4. Information on controls is supplied separately.
5. Modine unit heaters use the same burner for natural and propane gases.

Locating Unit Heaters

⚠ CAUTION

Units must not be installed in potentially explosive, flammable or corrosive atmospheres.

To prevent premature heat exchanger failure do not locate ANY gas-fired unit in areas where chlorinated, halogenated or acid vapors are present in the atmosphere.

In locating units, consider general space-heating requirements, availability of gas, and proximity to vent locations. Unit heaters should be located so heated air streams wipe exposed walls without blowing directly against them. In multiple unit installations, arrange units so that each supports the air stream from another, setting up circulatory air movement in the area, but maintain separation between units so discharge from one unit will not be directed into the inlet of another. In buildings exposed to prevailing winds, a large portion of the heated air should be directed along the windward wall. Avoid interference of air streams as much as possible.

Mounting height (measured from bottom of unit) at which unit heaters are installed is critical. Maximum mounting heights are listed in performance data tables. Alternate mounting heights for units with deflector hoods or nozzles are also included. The maximum mounting height for any unit is that height above which the unit will not deliver heated air to the floor.The maximum mounting heights must not be exceeded in order to assure maximum comfort.

Modine unit heaters are designed for use in heating applications with ambient temperatures between 32° F and 90° F. If an application exists where ambient temperatures can be expected to fall outside of this range, contact factory for recommendations.

Combustion Air Requirements

Units installed in tightly sealed buildings or confined spaces should be provided with two permanent openings, one near the top of the enclosure and one near the bottom. Each opening should have a free area of not less than one square inch per 1,000 BTU per hour of the total input rating of all units in the enclosure, freely communicating with interior areas having, in turn, adequate infiltration from the outside.

⚠ CAUTION

For all PV/BV sizes, minimum clearance to combustibles from the bottom is 12", from the left side 18" and from the right side 6". For PV sizes 30-145 minimum clearance to combustible materials from the top is 1", clearance for sizes 175-350 is 2", and clearance for the 400 is 3". For PV sizes 30-100 minimum clearance to combustible materials from the vent connector is 2", clearance for sizes 125-300 is 3", and clearance for sizes 350 & 400 is 6". For all BV sizes, from the top and from the vent connector is 6". Allow at least 12 inches at the rear, or 6 inches beyond the end of the motor (whichever is greater), to provide ample air for combustion and for proper operation of fan. Provide clearance for opening of the hinged bottom for servicing – See Figure 1.

Unit Suspension

The most common method of hanging Modine gas unit heaters is to utilize 3/8" threaded rod. On each piece of threaded rod used, screw a nut a distance of about one inch onto the end of the threaded rods that will be screwed into the unit heater. Then put a washer over the end of the threaded rod and screw the threaded rod into the unit heater weld nuts on the top of the heater at least 5 turns, and no more than 10 turns. Tighten the nut you first installed onto the threaded rod to prevent it from turning. Drill holes into a steel channel or angle iron at the same centerline dimensions as the heater that is being installed. The steel channels or angle iron pieces need to span and be fastened to appropriate structural members. Cut the threaded rods to the preferred length, push them through the holes in the steel channel or angle iron and secure with washers and lock nuts or lock washers and nuts. A double nut arrangement can be used here instead of at the unit heater (a double nut can be used both places but is not necessary). The entire means of suspension must of course be adequate to support the weight of the unit (see page 14 and 15 for unit weights).

For proper operation, the unit must be installed in a level horizontal position. Clearances to combustibles as specified above must be strictly maintained. Do not install standard unit heaters above the maximum mounting height shown in Table 7 on page 13, or below seven feet from the bottom of the unit to the floor.

For proper operation, the unit must be installed in a level horizontal position. Clearances to combustibles as specified above must be strictly maintained. Do not install standard unit heaters above the maximum mounting height shown in performance data tables, or below seven feet from the bottom of the unit to the floor.

On all propeller units, except the PV300, PV350 and PV400, two tapped holes (3/8-16) are located in the top of the unit to receive threaded rod.

Units with two point suspension, models PV30 through PV250, incorporate a level hanging feature. Depending on what options and accessories are being used, the heater may not hang level as received from the factory. Do not hang heaters with deflector hoods until referring to the "installation manual for deflector hoods" and making the recommended preliminary adjustments on the heater. These preliminary adjustments need to be made with the heater resting on the floor.

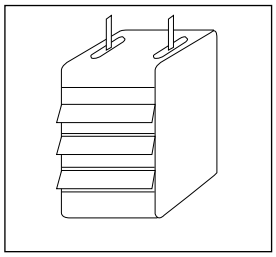
PV30 through PV250 units without deflector hoods that do not hang level after being installed, can be corrected in place. Simply remove both outer side panels (screws to remove are on back flange of side panel) and you will see the (adjustable) mounting brackets (Fig. 2). Loosen the set screws holding the mounting brackets in place and using a rubber mallet or something similar, tap the heater into a position where it does hang level. Re-tighten set screws and replace the outer side panels.

INSTALLATION

The PV300, PV350 and PV400 have four mounting holes. On all blower units, except the BV300, BV350 and BV400, two tapped holes are provided in the top of the unit and two holes in the blower support bracket. The BV300, BV350 and BV400 have four tapped holes in the top of the unit and two in the blower support bracket for mounting. **To assure that flames are directed into the center of heat exchanger tubes, unit must be supported in a vertical position, with suspension hangers "UP." Check with a level. This is important to the operation and life of unit.**

Note: Pipe hanger adapter kits are available as accessories from Modine. The hardware allows for pipe caps to be secured into the top of the unit heater with machine screws (machine screws are 3/8 - 16 x 1.75 UNC-2A THD). The pipe caps can then accommodate 3/4" NPT pipe for mounting.

Figure 2
Adjustable Mounting Brackets



REMOVE SIDE PANELS TO
ADJUST MOUNTING BRACKETS

Venting

⚠ CAUTION

Gas-fired heating equipment must be vented - do not operate unvented. A built-in power exhauster is provided - additional external draft hoods (diverters) or power exhausters are not required or permitted. Installation must conform with local building codes or in the absence of local codes, with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) - Latest Edition. In Canada installation must be in accordance with the National Standard of Canada CAN/CGA-B149.1 for natural gas units, and CAN/CGA-B149.2 for propane units.

NOTE: A **vent** is the vertical passageway used to convey flue gases from the unit or the vent connector to the outside atmosphere. A **vent connector** is the pipe which connects the unit to a vent or chimney.

Venting Instructions

(Including how to rotate the power exhauster)

1. All vertically vented PV/BV models are venting system category I. All horizontally vented PV/BV models are venting system category III.
2. Using Table 1, determine the venting requirements for the category determined above. A category III unit must conform to these venting requirements (detailed in following sections) in addition to those listed below.
3. The power exhauster may be rotated to discharge vertically or horizontally in either direction (except PV/BV 400). Unfasten screws connecting power exhauster to vent collar, rotate to desired location, drill 1/8 inch diameter bite holes and refasten screws. If positioning the power exhauster to discharge vertically, a slight offset and use of a drip leg is recommended, although not required.
4. Models PV30, PV/BV50, 75, 175, 200, 350 and 400 have a vent transition supplied with the unit. See Table 2 for vent transition sizes for these models. Fasten the transition to the power exhauster outlet with at least three corrosion-resistant sheet-metal screws.
5. Select size of vent pipe to fit power exhauster outlet or vent transition, where supplied, at rear of unit (see Table 2 for dimensions). Do not use a vent pipe smaller than the power exhauster outlet or vent transition on the unit. Vent pipe should be galvanized steel or other suitable corrosion-resistant material. Follow the National Fuel Gas Code (in Canada the National Standard of Canada) for minimum thickness of vent material; minimum thickness for vent connectors varies depending on pipe diameter.

Table 2
Vent Pipe Sizes for Units with Transitions

Model	Vent Transition	Vent Pipe Size for Installation
PV30, PV/BV50, 75	4" to 3"	3"
PV/BV 100, 125, 145	none	4"
PV/BV175, 200	6" to 5"	5"
PV/BV 250, 300	none	6"
PV/BV350, 400	6" to 7"	7"

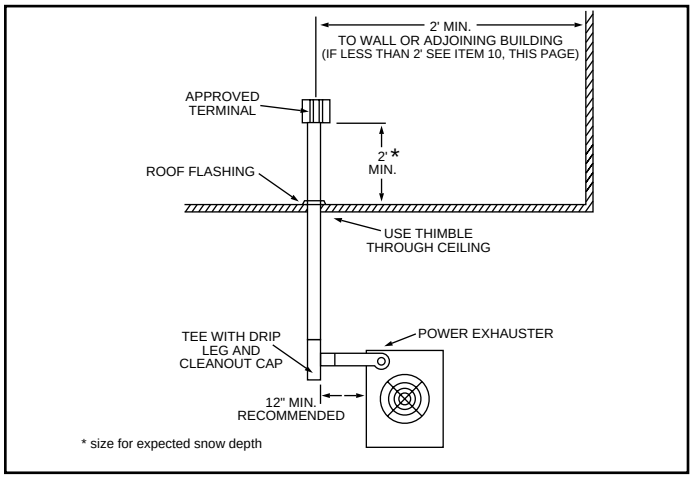
Table 1
ANSI Unit Heater Venting Requirements

Category	Description	Venting Requirements
I	Negative vent pressure Non-condensing	Follow standard venting requirements.
II	Negative vent pressure Condensing	Condensate must be drained.
III	Positive vent pressure Non-condensing	Vent must be gas tight.
IV	Positive vent pressure Condensing	Vent must be liquid and gastight. Condensate must be drained.

6. A minimum of 12 inches straight pipe is recommended from the power exhauster outlet before turns in the vent system. Install with a minimum downward slope from unit of 1/4 inch per foot and suspend securely from overhead structure at points no greater than 3 feet apart. Fasten individual lengths of vent together with at least three corrosion-resistant sheet-metal screws.
7. Avoid venting through unheated space when possible. When single-wall pipe does pass through an unheated space, insulate runs greater than 5 feet to minimize condensation. Inspect for leakage prior to insulating and use insulation that is noncombustible with a rating of not less than 350°F. Install a tee fitting at the low point of the vent system and provide a drip leg with a clean out cap as shown in Figure 3. The drip leg should be cleaned annually.
8. Keep single wall vent pipe at least 6 inches from combustible material. For double wall vent pipe used with Category I units, maintain clearances listed on vent pipe. The minimum distance from combustible material is based on the combustible material surface not exceeding 160°F. Clearance from the vent pipe (or top of the unit) may be required to be greater than the minimum clearance if heat damage other than fire (such as material distortion or discoloration) may occur.
9. Where the vent passes through a combustible floor or roof, a metal thimble 4 inches greater than the vent diameter is necessary. If there is 6 feet or more of vertical vent pipe in the open space between the unit heater and where the vent pipe passes through the floor or roof, the thimble need only be 2 inches greater than the diameter of the vent pipe. If a thimble is be 2 inches greater than the diameter of the vent pipe. If a thimble is not used, all combustible material must be cut away to provide a 6 inch clearance. Any material used to close an opening must be noncombustible.

INSTALLATION

Figure 3
Vertical Venting



10. When vertically venting, the vent must terminate at least 5 feet in vertical height above the unit.
11. Top of vertical stack must extend above any portion of a building within a horizontal distance of 2 feet (see Figure 3).
12. Use an approved vent terminal to reduce downdrafts and moisture in vent.
13. A masonry chimney must not be used as part of the venting system.
14. Use of dampers or other devices in vents is not allowed.

Additional Requirements for Horizontally Vented Category III Units

1. Seal all vent joints with a metallic tape or silastic suitable for temperatures up to 350°F. (3M tapes 425, 433 or 363 are acceptable.) Wrap tape two full turns around the vent pipe.
2. Limit the total equivalent vent pipe length to a minimum of 2 feet and a maximum of 50 feet (except PV/BV145 is 40 feet), making the vent system as straight as possible. (The equivalent length of a 3 inch elbow is 1 foot; a 4 inch elbow, 5 feet; a 5 inch elbow, 6 feet; a 6 inch elbow, 7 feet; and a 7 inch elbow, 11 feet.)
3. Where horizontal vents pass through a combustible wall (up to 8 inches thick), use a thimble with 2" clearances to the vent and insulate between thimble and vent. The vent passage may also be constructed and insulated as shown in Figure 3a. Where horizontal vents pass through a non-combustible wall, no clearances to the wall are required.
4. The vent terminal must be a Gary Steel 1092, Breidert Type L, Tjernlund VH1, or Constant Air-Flo 2433 style terminal.
5. If a Gary Steel 1092 or Breidert Type L vent terminal is used the vent must extend 6 inches beyond the exterior surface of an exterior wall as shown in Figure 3b. Precautions must be taken to prevent degradation of building materials by flue products.
6. If a Tjernlund VH1 vent terminal is used the vent may be flush with the exterior surface of an exterior wall. Precautions must be taken to prevent degradation of building materials by flue products. Where the terminal is not available in the appropriate size for the unit to be installed, use a transition and the next larger size terminal.
7. If a Constant Air-Flo vent terminal is used the vent must extend 12 inches beyond the exterior surface of an exterior wall and be supported as shown in Figure 3c. Precautions must be taken to prevent degradation of building materials by flue products.
8. The vent system shall terminate at least 3 feet above any forced air inlet (except direct vent units) located within 10 feet, and at least 4 feet below, 4 feet horizontally from, or 1 foot above any door, window, or gravity air inlet into any building. The bottom of the vent terminal shall be located above the snow line or at least 1 foot above grade; whichever is greater. When located adjacent to public walkways the vent system shall terminate not less than 7 feet above grade.
9. When condensation may be a problem, the vent system shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief openings, or other equipment.
10. The venting system must be exclusive to a single unit, and no other unit is allowed to be vented into it.

Additional Venting Requirements for Venting Into a Common Vent (Category I Units Only)

1. Do not vent a Category I unit into a common vent with mechanical draft systems operating under positive pressure (Category III or IV units).
2. The area of the common vent should be equal to or greater than the area of the largest vent plus 50 percent of the area of all additional vents.
3. The individual vents should enter at different levels.

Figure 3a
Vent Construction Through Combustible Walls

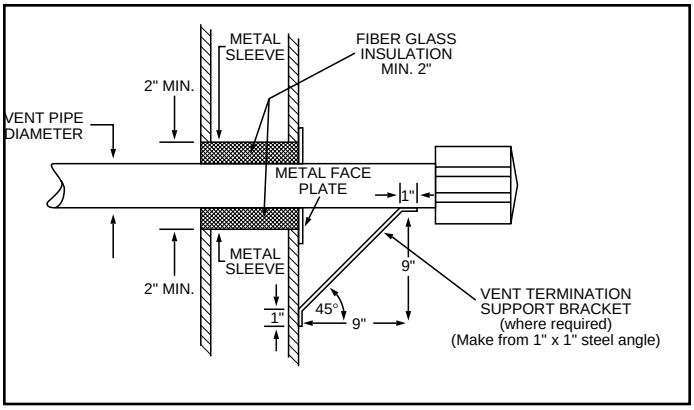
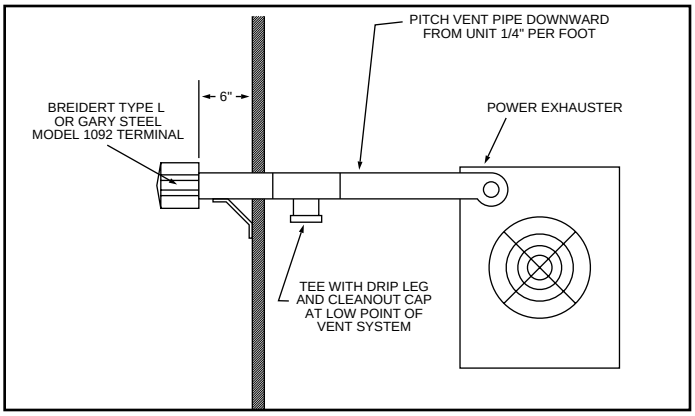


Figure 3b
Horizontal Venting - Breidert or Gary Steel Vent Terminal



INSTALLATION

Additional Venting Requirements for Units Installed in Canada

1. The vent pipe must not pass through an unheated space or interior part of an open chimney unless the vent pipe is insulated.
2. Where the vent pipe may be exposed to extreme cold, or come into contact with snow or ice, the vent construction method shown in Figures 3d & 3e must be used. It is preferred that the double wall vent be one continuous piece but a joint is allowed outside the building.
3. The vent terminal must extend 16 inches beyond the exterior surface of an exterior wall and be supported as shown in figure 3a.
4. The heater system shall be checked at least once a year by a qualified service technician.

Figure 3d
Alternate Canadian Venting
Arrangement for Vertical Venting

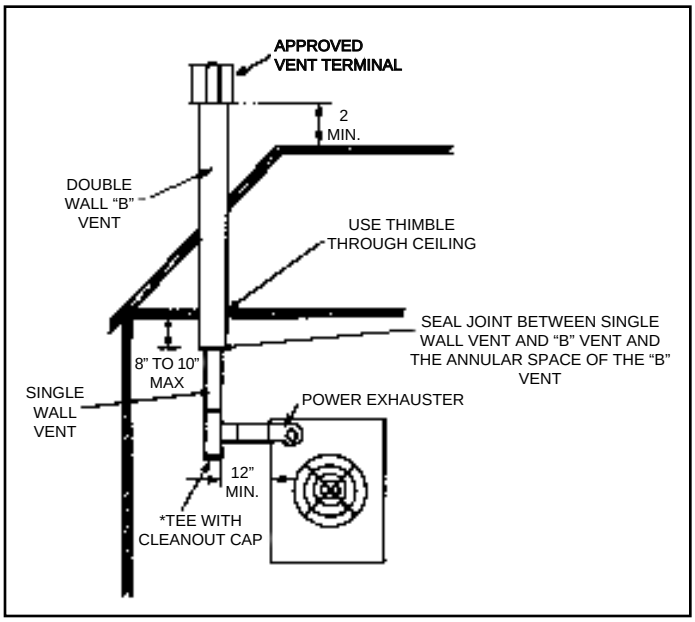
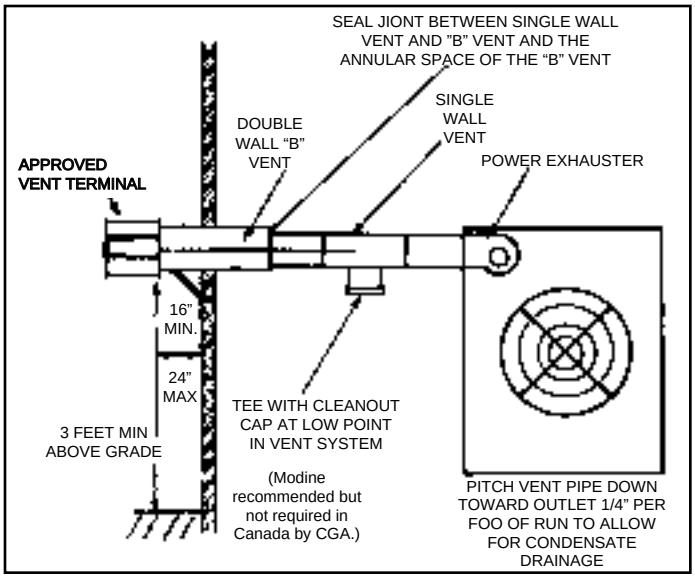


Figure 3e
Alternate Canadian Venting
Arrangement for Horizontal Venting



INSTALLATION

Piping

⚠ CAUTION

Gas pressure to unit heater controls must never exceed 14" W.C. (1/2 psi).

When leak testing the gas supply piping system, the appliance and its combination gas control must be isolated during any pressure testing in excess of 14" W.C. (1/2 psi).

The appliance should be isolated from the gas supply piping system by closing its field installed manual shut-off valve. This manual shut-off valve should be located within 6' of the heater.

1. Installation of piping must be in accordance with local codes, and ANSI Z223.1, "National Fuel Gas Code," or CAN/CGA-B149 in Canada.
2. Piping to units should conform with local and national requirements for type and volume and gas handled, and pressure drop allowed in the line. Refer to Table 5a, to determine the cubic feet per hour (cfh) for the type of gas and size of unit to be installed. Using this cfh value and the length of pipe necessary, determine the pipe diameter from Table 3. Where several units are served by the same main, the total capacity, cfh, and length of main must be considered. Avoid pipe sizes smaller than 1/2". Table 1 allows for the usual number of fittings with a 0.3" W.C. pressure drop. Where the gas supplied has a specific gravity other than 0.60, apply the multiplying factor as given in Table 4.
3. After threading and reaming the ends, inspect piping and remove loose dirt and chips.
4. Support piping so that no strains are imposed on unit or controls.
5. Use two wrenches when connecting piping to unit controls.
6. Provide a drip sediment trap before each unit and in the line where low spots cannot be avoided. (See Figure 4).
7. Take-off to unit should come from top or side of main to avoid trapping condensate.
8. Piping, subject to wide temperature variations, should be insulated.
9. Pitch piping up toward unit at least 1/4" per 15' of horizontal run.
10. Compounds used on threaded joints of gas piping must be resistant to action of liquefied petroleum gases.
11. Purge air before lighting unit by disconnecting pilot tubing at combination gas control. In no case should line be purged into heat exchanger.
12. After installation, check system for gas leaks, using a soap solution.
13. Install a ground joint union and a manual shut off valve immediately upstream of the unit including a 1/8" NPT plugged tapping accessible for test gage connection. (See Figure 4).
14. Allow at least 5 feet of piping between any high pressure regulator and unit control string.
15. When Pressure/Leak testing, pressures above 14" W.C. (1/2 psi), close the field installed shut-off valve, disconnect the appliance and its combination gas control from the gas supply line, and plug the supply line before testing. When testing pressures 14" W.C. (1/2 psi) or below, close the manual shut-off valve on the appliance before testing.

Table 3 – Gas Pipe Capacities

In Cu. Ft. per Hour with Pressure Drop pf 0.3 in. W.C. with Specific Gravity 0.60.

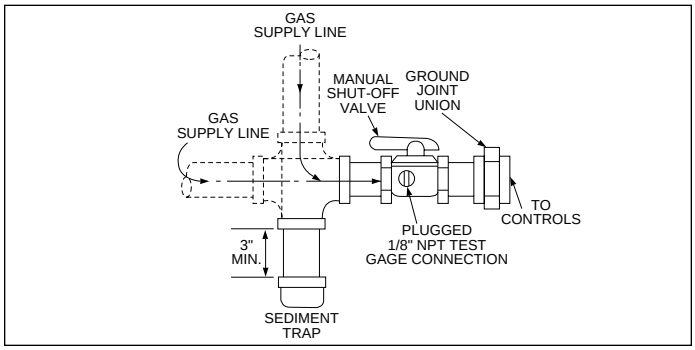
Length of Pipe in Ft.	Diameter of Pipe - Inches									
	1/2	3/4	1	1-1/4	1-1/2	2	3	4	6	8
15	76	218	440	750	1220	2480	6500	13880	38700	79000
30	73	152	285	590	890	1650	4700	9700	27370	55850
45	44	124	260	435	700	1475	3900	7900	23350	45600
60	50	105	190	400	610	1150	3250	6800	19330	39500
75		97	200	345	545	1120	3000	6000	17310	35300
90		88	160	320	490	930	2600	5400	15800	32250
105		80	168	285	450	920	2450	5100	14620	29850
120			158	270	420	860	2300	4800	13680	27920
150			120	242	380	710	2000	4100	12240	25000
180			128	225	350	720	1950	4000	11160	22800
210				205	320	660	1780	3700	10330	21100
240				190	300	620	1680	3490	9600	19740
270				178	285	580	1580	3250	9000	18610
300				170	270	545	1490	3000	8500	17660
450				140	226	450	1230	2500	7000	14420
600				119	192	380	1030	2130	6000	12480

Table 4
Specific Gravity Conversion Factors

Multiplying factors to be used with table 1 when the specific gravity of gas is other than 0.60.

Natural Gas		Propane Gas	
Specific Gravity	Factor	Specific Gravity	Factor
0.55	1.04	1.50	0.633
0.60	1.00	1.53	0.626
0.65	0.962	1.60	0.612

Figure 4
Recommended Piping to Controls



INSTALLATION

Wiring

⚠ CAUTION

Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage. ALL UNITS MUST BE WIRED STRICTLY IN ACCORDANCE WITH WIRING DIAGRAM FURNISHED WITH UNIT.

ANY WIRING DIFFERENT FROM WIRING DIAGRAM MAY BE HAZARDOUS TO PERSONS AND PROPERTY.

Any damage to or failure of Modine units caused by incorrect wiring of the units is not covered by MODINE'S STANDARD WARRANTY (see Back Cover).

All field installed wiring must be done in accordance with the National Electrical Code ANSI/NFPA 70 – Latest Edition or Canadian Electrical Code CSA C22.1 Part 1 or local codes. Unit must be electrically grounded according to these codes. See wiring diagram shipped with unit.

The power to these unit heaters should be protected with a circuit breaker. Units for use with three-phase electric power must be provided with a motor starter having properly sized overload protection.

Location of thermostat should be determined by heating requirements and be mounted on an inside wall about 5' above floor level where it will not be affected by heat from the unit or other sources, or drafts from frequently opened doors. See instructions packed with thermostat.

Installation of Blower Models (BV Units)

⚠ CAUTION

Proper air flow and distribution, across the heat exchanger must be provided to prevent early failure of the blower unit heater.

Attachment of Field Installed Ductwork, Blower (BV) Models Only

⚠ CAUTION

Do not attempt to attach ductwork of any kind to propeller PV models.

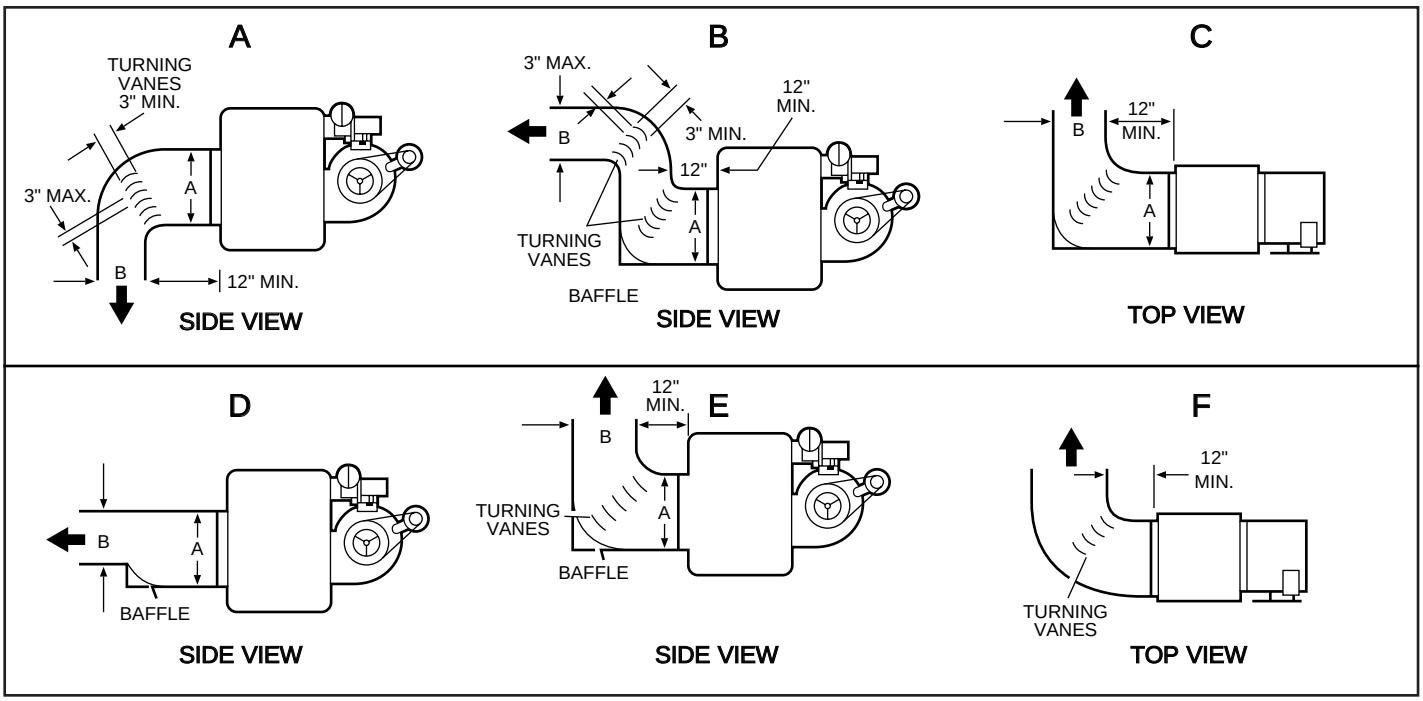
Burned-out heat exchanger as well as shorter equipment life will result from not providing uniform air distribution.
When installing heater always follow good duct design practices for even distribution of the air across the heat exchanger. Recommended layouts are shown below. When installing blower units with ductwork the following must be done.

1. Provide uniform air distribution over the heat exchanger. Use turning vanes where required. See figures below.
2. Provide removable access panels in the ductwork on the downstream side of the unit heater. These openings should be large enough to view smoke or reflect light inside the casing to indicate leaks in the heat exchanger and to check for hot spots on exchanger due to poor air distribution or lack of sufficient air.
3. If ductwork is connected to the rear of the unit use Modine blower enclosure kit or if using field designed enclosure maintain dimensions of blower enclosure as shown on page 15.

⚠ CAUTION

Check for red heat exchanger tubes. If bottom of tubes become red while blower unit is in operation, check for proper air volume and air distribution. Adjust blower speed or correct discharge duct design to correct problem.

Recommended Installations - Dimension "B" Should Never Be Less than 1/2 of "A". Duct must be fitted to discharge of unit only.



INSTALLATION

Installation of Blower Models (BV UNITS)

Determining Blower Speed

The drive assembly and motor on all gas-fired blower unit heaters are factory assembled. The adjustable motor sheave has been pre-set to provide the highest CFM at the lowest static pressure the drive can be used (see pages 16 & 17). The motor sheave should be adjusted as required when the unit is to be operated at other conditions. Adjustment must always be within the range shown in the performance data tables for blower unit heaters, and the temperature rise range shown on the unit's rating plate.

To determine the proper blower speed and motor sheave turns open, the conditions under which the unit is to operate must be known. If the blower unit is to be used without duct work, nozzles or filters, the only criteria for determining the motor sheave turns open and blower speed is the amount of air to be delivered. The performance data tables for blower models are shown on pages 16 and 17. As an example, a model BV350 unit, operating with no external static pressure, that is, no duct work, nozzles, etc., and is to deliver an air volume of 6481 cfm (cfm = cubic feet of air per minute) requires that the unit be supplied with a 5 hp motor, a C116 drive, and the drive pulley must be set at 2.5 turns open to achieve a blower speed of 970 rpm. See "Blower Adjustments" on page 10 for setting of motor sheave turns open.

If a blower unit is to be used with ductwork or nozzles, etc., the total external static pressure under which the unit is to operate, and the required air flow must be known before the unit can be properly adjusted. Any device added externally to the unit, and which the air must pass through, causes a resistance to air flow. This resistance is called pressure loss. The total of the pressure losses must be determined before adjusting the blower speed.

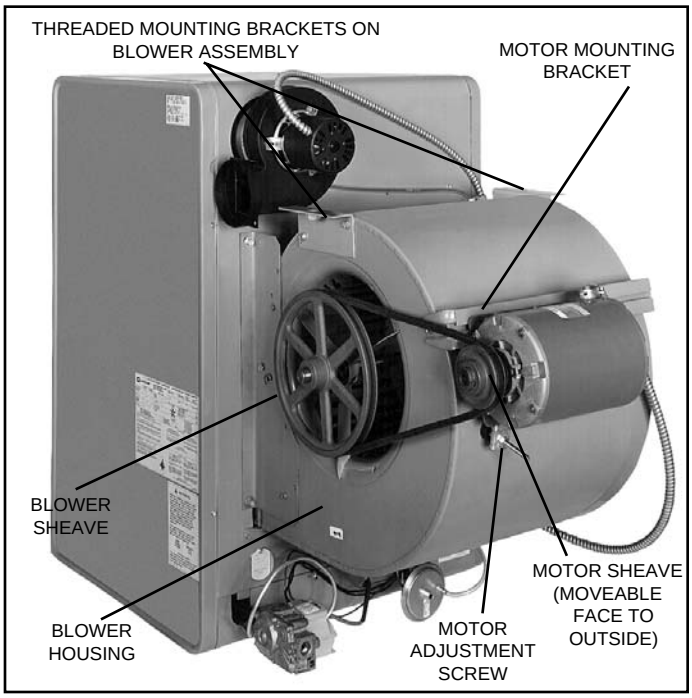
If Modine filters are used, the expected pressure loss through the filters is given in the filter table on page 17. If Modine supplied discharge nozzles are used, the expected pressure drop of the nozzles can be found footnoted at the bottom of page 14. If filters, nozzles or ductwork are to be used with the unit, and they are not supplied by Modine, the design engineer or installing contractor must determine the pressure loss for the externally added devices or ductwork to arrive at the total external static pressure under which the unit is to operate.

Once the total static pressure and the required air flow are known, the operating speed of the blower can be determined and the correct motor sheave adjustments made. As an example, let's say, a model BV350 is to be used with a Modine supplied blower enclosure and Modine supplied filters attached to someone else's ductwork. The unit is to move 6481 cfm or air flow against an external static pressure of 0.2" W.C. Also, you must add 0.2" W.C. for the filter pressure drop for a total of 0.4" W.C. total pressure drop. Entering the performance table on page 16 for a BV350, at 6481 cfm and 0.4" W.C. static pressure, it is seen that the unit will require a 5 hp motor using a C116 drive, and the motor sheave should be set at .5 turns open to achieve a blower speed of 1060 rpm. You can see this example differs from similar conditions in paragraph 2 by the number of turns open and a higher rpm, which is needed to overcome the added external static pressure from the filters.

To Install (Figure 5)

1. Remove and discard the motor tie down strap and the shipping block beneath the belt tension adjusting screw (Not used on all models.)

Figure 5
Main Blower Unit Heater Components



2. Adjust motor adjusting screw for a belt deflection of approximately 3/4" with five pounds of force applied midway between the sheaves (refer to Figure 6a). Since the belt tension will decrease dramatically after an initial run-in period, it is necessary to periodically re-check the tension. Excessive tension will cause bearing wear and noise.
3. The blower bearings are lubricated for life; however, before initial unit operation the blower shaft should be lubricated at the bearings with SAE 20 oil. This will reduce initial friction and start the plastic lubricant flowing.
4. Make electrical connections according to the wiring diagram.
5. Check rotation of the blower. Motor should be in clockwise rotation when facing motor sheave. If rotation is incorrect, correction should be made by interchanging wiring within the motor. See wiring diagram on the motor.
6. The actual current draw of the motor should be determined. Under no condition should the current draw exceed that shown on the motor rating plate.
7. It is the installers responsibility to adjust the motor sheave to provide the specified blower performance as listed on pages 16 & 17 for blower settings different from the factory set performance. The drive number on the unit may be identified by referring to the Power Code number on the serial plate of the unit (see page 27 for model number nomenclature) and matching that number with those shown on page 18. From the listing, the drive number can be determined.
8. Blower sheave and motor sheave should be measured to assure correct drive is on unit. Refer to page 19 for drive sizes.

INSTALLATION

Blower Adjustments

Following electrical connections, check blower rotation to assure blow-through heating. If necessary interchange wiring to reverse blower rotation. Start fan motor and check blower sheave RPM with a hand-held or strobe-type tachometer. RPM should check out with the speeds listed in Performance Data shown on pages 16 and 17. A single-speed motor with an adjustable motor sheave is supplied with these units. If blower fan speed changes are required, adjust motor sheave as follows:

NOTE: Do not fire unit until blower adjustment has been made or unit may cycle on limit (overheat) control.

1. Shut-off power before making blower speed adjustments. Refer to Determining Blower Speed on previous page and to Blower Drive Selection on pages 16 and 17 to determine proper blower RPM.
2. Loosen motor base and take belt off of motor sheave.
3. Loosen set screw on outer side of adjustable motor sheave (see Figure 6).
4. To reduce the speed of the blower, turn outer side of motor sheave counterclockwise.
5. To increase the speed of the blower, turn outer side of motor sheave clockwise.
6. Retighten motor sheave set screw, replace belt and retighten motor base. Adjust motor adjusting screw such that there is 3/4” belt deflection when pressed with 5 pounds of force midway between the blower and motor sheaves (see Figure 6a). Since the belt tension will decrease dramatically after an initial run-in period, it is necessary to periodically re-check the tension to assure continual proper belt adjustment.
7. Check to make certain motor sheave and blower sheave are aligned. Re-align if necessary.
8. Re-check blower RPM after adjustment.
9. Check motor amps. Do not exceed amps shown on motor nameplate. Slow blower if necessary.
10. Check air temperature rise across unit. Check temperature rise against values shown in Performance Tables on pages16 and 17 to assure actual desired air flow is being achieved.
11. If adjustments are required, recheck motor amps after final blower speed adjustment.

Figure 6
Motor Sheave Adjustment

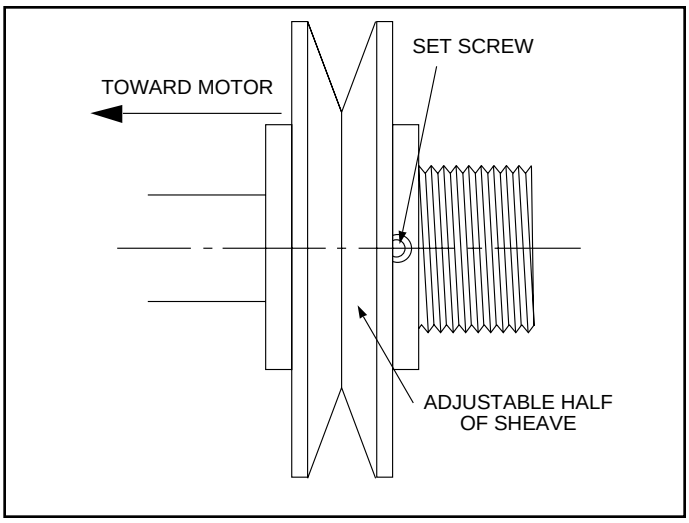
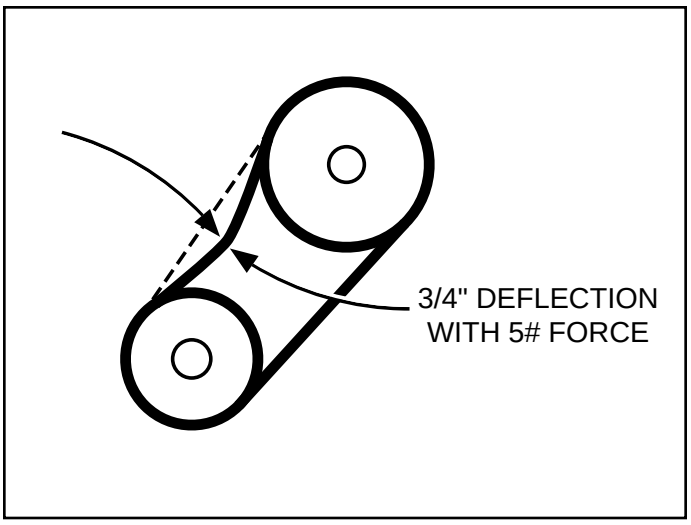


Figure 6a
Belt Tension Adjustment



OPERATION

⚠ CAUTION

Start-up and adjustment procedures should be performed by a qualified service technician.
Check the gas inlet pressure at the unit upstream of the combination gas control. The inlet pressure should be 6-7" W.C. on natural gas or 12-14" W.C. on propane. If inlet pressure is too high, install an additional pressure regulator upstream of the combination gas control.
The pilot flame must be adjusted as described below.
Purging of air from gas lines, piping, and lighting the pilot should be performed as described in ANSI Z223.1-latest edition “National Fuel Gas Code” (CAN/CGA-B149 in Canada).
Be sure no obstructions block air intake and discharge of unit heater.

Prior to Operation

Although this unit has been assembled and fire-tested at the factory, the following pre-operational procedures should be performed to assure proper on-site operation.

1. Turn off power.
2. Check burner to insure proper alignment.
3. Check fan clearance. Fan should not contact casing when spun by hand.
4. Check all electrical connections to be sure they are secure.
5. If you are not familiar with the unit’s controls (i.e. combination gas control), refer to the control manufacturer’s literature supplied with the unit.
6. Check that all horizontal deflector blades are open a minimum of 30° as measured from vertical.

OPERATION

Lighting Instructions (also on unit)

For units with standing pilot

1. Set thermostat to lowest setting. Move gas control knob (or lever) to OFF and wait 5 minutes.
2. Move gas control knob to pilot (or move gas control lever to set) and depress reset button while lighting the pilot and hold for 1 minute after pilot is lit.
3. Move gas control control knob (or lever) to ON.
4. Set thermostat to desired setting.

For units with intermittent pilot

1. Set thermostat to lowest setting. Move gas control knob (or lever) to OFF and wait 5 minutes.
2. Move gas control knob (or lever) to ON.
4. Set thermostat to desired setting. (pilot and main burner will light automatically when thermostat calls for heat).

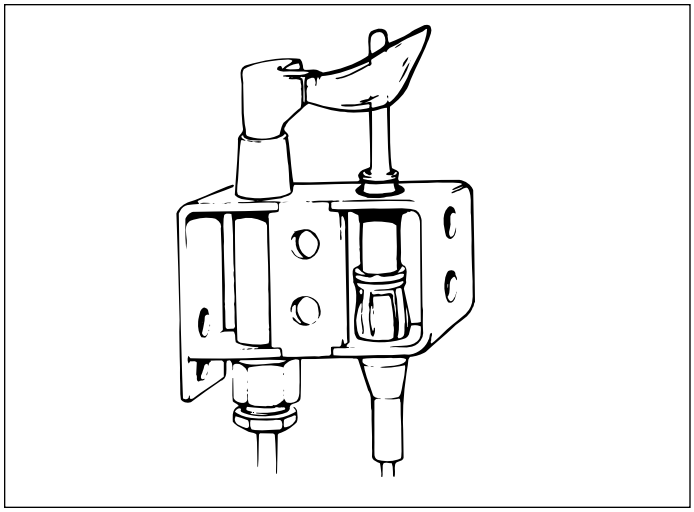
Shut Down Instructions

Turn off power and close all gas valves.

After Initial Start-Up

1. Check pilot flame adjustment as discussed below.
2. Check gas piping for leaks with a soap bubble solution to insure safe operation.
3. Check gas input rate, as described below, to assure proper gas flow and pressure.

Figure 7
Correct Pilot Flame



Pilot Flame Adjustment

The pilot is orificed to burn properly with an inlet pressure of 6-7" W.C. on natural gas and 12-14" W.C. on propane gas, but final adjustment must be made after installation. Adjust to have a soft steady flame 3/4 to 1" long and encompassing 3/8-1/2" of the tip of the thermocouple or flame sensing rod. Normally this flame will produce satisfactory results. To adjust flame use pilot adjustment screw on combination gas control (for location, see the combination gas control literature supplied with unit). If the pilot flame is longer and larger than shown by Figure 7, it is possible that it may cause soot and/or impinge on the heat exchanger causing burnout. If the pilot flame is shorter than shown it may cause poor ignition and result in the controls not opening the combination gas control. A short flame can be caused by a dirty pilot orifice. Pilot flame condition should be observed periodically to assure trouble-free operation.

Natural Gas Flame Control

Control of burner flames on units utilizing natural gas is achieved by moving the gas manifold to either increase or decrease primary combustion air. Prior to flame adjustment, operate unit with bottom pan closed for about five minutes. Operation can be viewed through the viewing port on the rear of the unit (see Figure 10).

Lack of primary air will cause soft yellow-tipped flames. Excess primary air produces short, well-defined flames with a tendency to lift off the burner ports. Proper operation with natural gas provides a soft blue flame with a well-defined inner cone.

To increase primary air, lower the bottom pan (see Figure 1). With the bottom pan lowered, loosen the manifold mounting screws (see Figure 17) and tap the manifold away from the mixer tubes until the yellow flames disappear. To decrease the primary air, move the manifold closer to the mixer tubes until flames no longer lift from burner ports, but being careful not to cause yellow tipping. Retighten manifold mounting screws after adjustment. Once adjustment has been made, close the bottom pan.

Propane Gas Flame Control

Adjustable primary air shutters are attached to the orifices on the gas manifold for units equipped for propane gas operation (see Figure 19). **An optimum flame will show a slight yellow tip.** If flame adjustment is necessary, adjust the primary air shutters. Loosen wing nuts and push shutters forward to reduce primary air until yellow flame tips appear. Then increase primary air until yellow tips diminish to just a slight yellow tip and a clean blue flame with a well-defined inner cone appears.

It may also be necessary to adjust the manifold position in addition to adjusting air shutters to obtain the proper flame. Follow the instructions under “Natural Gas Flame Control” for adjusting the manifold.

⚠ CAUTION

Check the gas inlet pressure at the unit upstream of the combination gas control. The inlet pressure should be 6-7" W.C. on natural gas or 12-14" W.C. on propane. If inlet pressure is too high, install an additional pressure regulator upstream of the combination gas control.

Important – Inlet pressure and manifold pressure must be checked with unit in operation when making final adjustments.

CHECKING INPUT RATE

Input Adjustments

The gas pressure regulator (part of the combination gas control) is adjusted at the factory for average gas conditions. It is important that gas be supplied to the heater in accordance with the input rating stamped on the serial plate. Actual input should be checked and necessary adjustments made after the heater is installed. Over-firing, a result of too high an input, reduces the life of the unit, and increases maintenance. Under no circumstances should the input exceed that shown on the rating plate.

Input can be determined by the meter-timing method provided other gas equipment connected to the meter is off during the test. If this is not possible, use the pressure method.

(A) Meter Timing Method

1. Shut off all other gas-burning equipment, including other pilot lights served by the gas meter.
2. Start the heater and determine the number of seconds it takes to consume 1 cu. ft. of gas. Two basic formulas are useful:

   F1 = 3600 C/T

   F2 = F1/C

   where

   F1 = input to heater, Btuh.

   F2 = input to heater, cu. ft. per hr.

   C = heating value of gas, Btu per cu. ft.

   T = time to consume 1 cu. ft. of gas in sec.

   The heating value of gas may be determined from the local utility or gas dealer.

These are representative values:

GAS	Btu per cu. ft.
Natural	1000-1150
Propane	2500

3. If the seconds for 1 cu. ft. are more (input less) than shown in Table 5 for model being tested, locate the combination gas control and pressure regulator adjustment screw (see Figure 11b). Remove the cap screw from the pressure regulator and take one clockwise turn at a time on the adjustment screw until the correct time is obtained. If the seconds are less (input greater) than indicated in the table, follow the same procedure in a **counter-clockwise** direction.

If the correct number of seconds cannot be obtained check orifice size. Correct orifices can be obtained from Modine Manufacturing Company, Buena Vista, Virginia. When requesting orifices, state type of gas, heating value, and its specific gravity. Also give model number of unit.

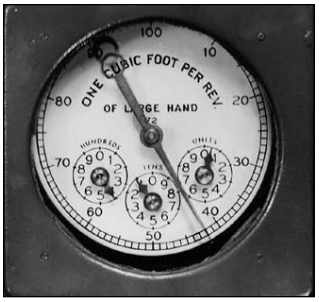
For example, if the input to the heater is 100,000 Btuh and the heating value of the gas is 1000 Btu per cu. ft., then, by the second formula, the input is 100 cu. ft. per hr. Table 5 indicates the time for one revolution of various size meter dials with various input rates. If a 1 cu. ft. meter dial is used, we proceed down the cu. ft. column to 100 cu. ft. per hr. and then horizontally to the left to determine a time of 36 seconds for one revolution of the dial. Similarly, if the 1/2 cu. ft. dial is used, we determine a time of 18 seconds for one revolution at the required input. After proper firing rate has been achieved, replace regulator cap screw.

Table 5
Meter-timing Gas

(Time required for one revolution is charted for various size meter dials and various rates of gas input in cu. ft. per hour. To convert to Btuh, multiply by the heating value of the gas used.)

Time for 1 Revolution, Sec.	Input, Cu. Ft. per Hour, when meter dial size is:			
	1/2 cu. ft.	1 cu. ft.	2 cu. ft.	5 cu. ft.
10	180	360	720	1800
12	150	300	600	1500
14	129	257	514	1286
16	112	225	450	1125
18	100	200	400	1000
20	90	180	360	900
22	82	164	327	818
24	75	150	300	750
26	69	138	277	692
28	64	129	257	643
30	60	120	240	600
35	51	103	206	514
40	45	90	180	450
45	40	80	160	400
50	36	72	144	360
55	33	65	131	327
60	30	60	120	300
70	26	51	103	257
80	22	45	90	225
90	20	40	80	200
100	18	36	72	180
120	15	30	60	150

Figure 9
Dials of Typical Gas Meter



(B) Pressure Method

The pressure method determines input by measuring the pressure of the gas in the manifold in inches of water.

1. Determine correct manifold pressure from Table 5a.
2. Locate combination gas control.
3. Move gas control knob (or lever) to OFF.
4. Remove the 1/8" pipe plug in outlet pressure tap in combination gas control (see Figure 11b) and attach water manometer or “U” tube which is at least 12" high.
5. Follow lighting instructions and turn thermostat up to get unit to fire.
6. If pressure as indicated by “U” tube is less than 1/2" higher or lower than indicated in Table 5a, adjust regulator as described under “Meter-Timing Method,” Step 3.

   If pressure as indicated by “U” tube is more than 1/2" higher or lower than indicated in Table 5a, check inlet pressure at unit. The inlet pressure should be 6-7" W.C. pressure on natural gas and 12-14" W.C. on propane gas.

After adjustment, move gas control knob (or lever) to OFF and replace 1/8" pipe plug. With plug in place follow the lighting instructions to put unit back in service.

CHECKING INPUT RATE

Figure 10
Major Gas and Electric Components

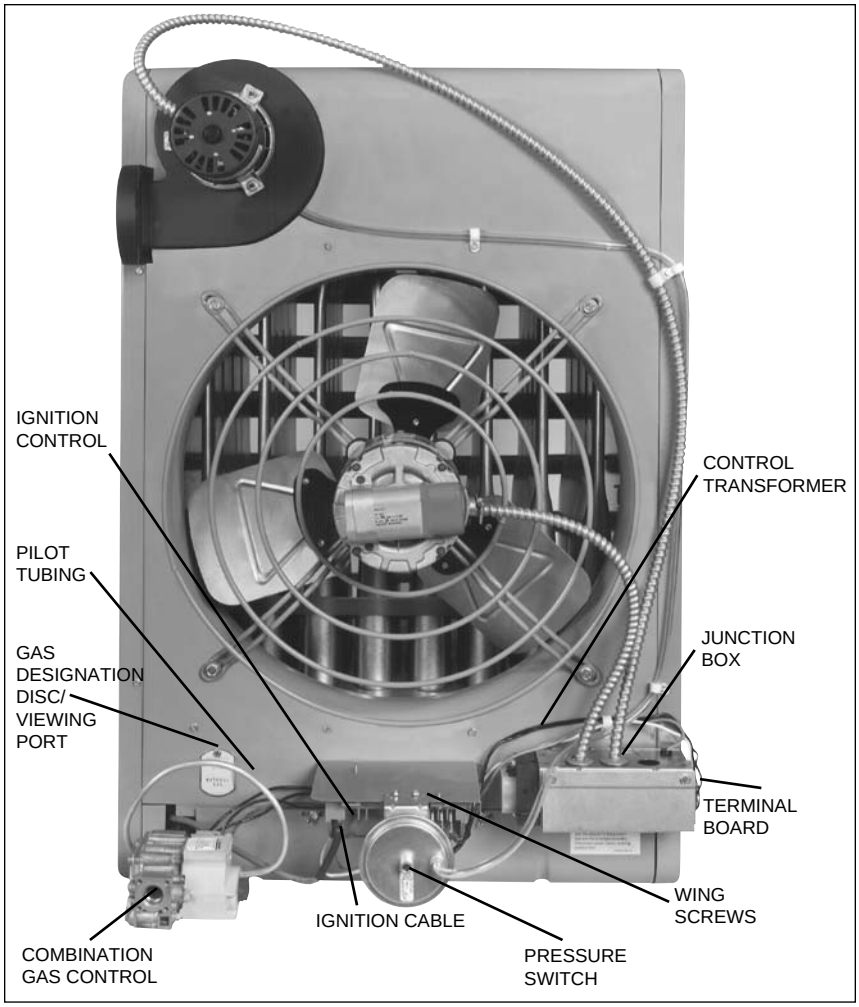
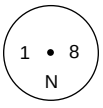
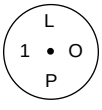


Table 6
Orifice Drill Sizes with Decimal Equivalents

Main Burner Orifices			
Drill Size	Dia. Decimal Equivalent	Drill Size	Dia. Decimal Equivalent
20	.1610	37	.1040
22	.1570	39	.0995
23	.1540	40	.0980
25	.1495	42	.0935
26	.1470	43	.0890
27	.1440	45	.0820
30	.1285	52	.0635

Table 7
Pilot Orifice Identity Numbers

Pilot Burner Manufacturer	Identity No. Natural Gas	Identity No. Propane Gas
Honeywell	HCR - 18	HBR - 12 or BBR - 11
Robertshaw	 ①	 ①
Johnson	7715	4710

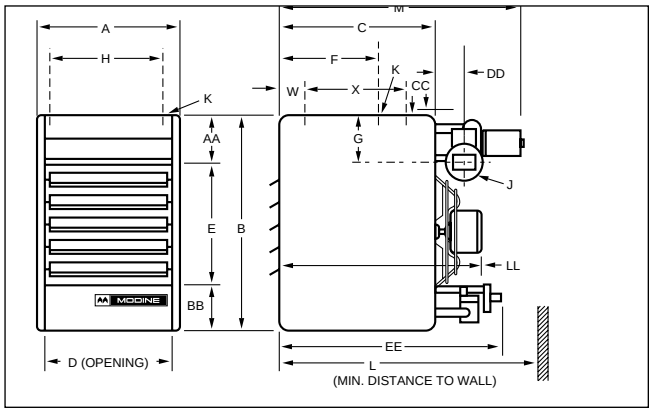
① As number appears on top of pilot orifice.

Table 5a
Manifold Pressure & Gas Consumption *

Model	BTU/Cu. Ft. Specific Gravity	Natural 1050 0.60	Propane 2500 1.53	No. of Orifices
Manifold Pressure In. W.C.		3.5	10.0	
PV30	CFH	28.6	12.0	1
	Gal/Hr. Propane	–	.33	
	Sec/cu. ft.	126	300	
	Orifice Drill Size	37	52	
PV50 BV50	CFH	47.6	20.0	1
	Gal/Hr. Propane	–	.55	
	Sec/cu. ft.	76	180	
	Orifice Drill Size	30	45	
PV75 BV75	CFH	71.4	30.0	1
	Gal/Hr. Propane	–	.82	
	Sec/cu. ft.	50	120	
	Orifice Drill Size	20	37	
PV100 BV100	CFH	95.2	40.0	2
	Gal/Hr. Propane	–	1.15	
	Sec/cu. ft.	38	90	
	Orifice Drill Size	30	45	
PV125 BV125	CFH	119.0	50.0	2
	Gal/Hr. Propane	–	1.43	
	Sec/cu. ft.	30	72	
	Orifice Drill Size	25	42	
PV145 BV145	CFH	138.1	58.0	3
	Gal/Hr. Propane	–	1.64	
	Sec/cu. ft.	26	62	
	Orifice Drill Size	30	45	
PV175 BV175	CFH	166.7	70.0	3
	Gal/Hr. Propane	–	1.86	
	Sec/cu. ft.	22	51	
	Orifice Drill Size	27	43	
PV200 BV200	CFH	190.5	80.0	3
	Gal/Hr. Propane	–	2.19	
	Sec/cu. ft.	19	45	
	Orifice Drill Size	23	40	
PV250 BV250	CFH	238.1	100.0	4
	Gal/Hr. Propane	–	2.74	
	Sec/cu. ft.	15	36	
	Orifice Drill Size	25	42	
PV300 BV300	CFH	285.7	120.0	5
	Gal/Hr. Propane	–	3.29	
	Sec/cu. ft.	13	30	
	Orifice Drill Size	26	43	
PV350 BV350	CFH	333.3	140.0	5
	Gal/Hr. Propane	–	3.84	
	Sec/cu. ft.	11	26	
	Orifice Drill Size	22	39	
PV400 BV400	CFH	381.0	160.0	6
	Gal/Hr. Propane	–	4.38	
	Sec/cu. ft.	9	23	
	Orifice Drill Size	23	40	

*Above gases based on average standards. Units can be furnished for gases of different values and specific gravities. (Gal./Hr. based on 60°F. 30" Hg., 91,500 BTU/Gal.) In Canada, refer to rating plate on side of unit for orifices at high altitude.

DIMENSIONS/PERFORMANCE – PV



Dimensions (in inches) – PV

Do not use Propeller units with duct work
For clearance to combustibles, see installation and service manual 6-575

Dimension	PV30	PV50	PV75	PV100	PV125	PV145	PV175	PV200	PV250	PV300	PV350	PV400
A	12-7/8	17-1/4	19-1/4	21	21	23-1/2	25-5/8	25-5/8	28-5/8	33-5/8	33-5/8	40
B	24-1/4	28-3/4	28-3/4	35-1/4	35-1/4	35-1/4	40-1/4	40-1/4	40-1/4	40-1/4	40-1/4	40-1/4
C	14-3/4	20	20	22	22	22	25	25	25	25	25	25
D	10-7/16	14-13/16	16-13/16	18-9/16	18-9/16	21-1/16	23-3/16	23-3/16	26-3/16	31-3/16	31-3/16	37-1/2
E	13	16	16	20	20	20	24	24	24	24	24	24
F	9-1/4	12-1/2	12-1/2	13-1/8	13-1/8	13-1/8	14-3/8	14-3/8	14-5/8	–	–	–
G	5-1/2	5-5/8	5-5/8	6-9/16	6-9/16	6-9/16	7-1/2	7-1/2	7-1/2	7-1/2	7-1/2	⑤
H	9-1/4	13-5/8	15-5/8	17-3/8	17-3/8	19-7/8	22	22	25	30	30	36-3/8
AA	5	6 1/4	6 1/4	8	8	8	9	9	9	9	9	9
BB	6-1/2	6-1/2	6-1/2	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4
CC	3/4	5/8	5/8	–	–	–	–	–	–	–	–	4-1/4 ⑤
DD	2-5/8	2	2	2-11/16	2-11/16	2-11/16	3-5/16	3-5/16	3-5/16	3-5/16	3-5/16	3-5/16
J (Round) ①	3	3	3	4	4	4	5	5	6	6	7	7
K (Mtg Holes) ②	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16
Gas Conn. ③	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	3/4	3/4
W	–	–	–	–	–	–	–	–	–	5	5	5
X	–	–	–	–	–	–	–	–	–	16	16	16
L ④	28-1/4	35	35	37-1/2	37-1/2	38	41	41	43	44-3/8	44-3/8	48-1/2
LL	18-1/2	24	27	31-1/2	31-1/2	32	35	35	37	38-3/8	38-3/8	42-1/2
EE	–	29	29	30-1/2	30-1/2	30-1/2	32-7/8	32-7/8	32-7/8	32-7/8	32-7/8	32-7/8
M	22-7/16	27	27	29-7/8	29-7/8	29-7/8	34-3/4	34-3/4	34-3/4	34-3/4	34-3/4	34-3/4
Fan Diameter	9	12	14	16	16	18	20	20	22	22	22	24
Approx Shipping Wt.	63#	107#	121#	161#	161#	174#	238#	238#	268#	366#	366#	441#

① For some models, this is the dimension of the vent transition outlet supplied with unit.
② PV30 through PV250 - 2 holes (and the level hanging adjustment feature). PV300 through 400 - 4 holes.
③ For natural gas; may vary depending on control availability.
④ Dimension equals overall plus 6".
⑤ The PV400 power exhauster does not rotate a full 180°.

Performance – PV

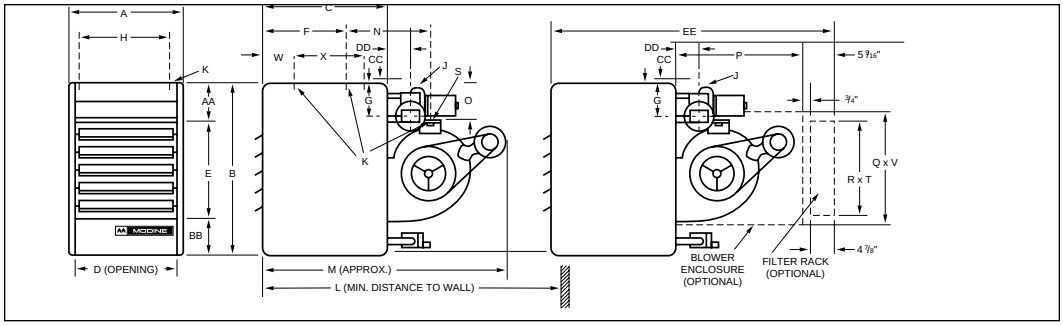
Btu input and output apply to both PV and BV

		PV30	PV50	PV75	PV100	PV125	PV145	PV175	PV200	PV250	PV300	PV350	PV400
Btu/Hr Input		30,000	50,000	75,000	100,000	125,000	145,000	175,000	200,000	250,000	300,000	350,000	400,000
Btu/Hr Output		24,000	40,000	60,000	80,000	100,000	116,000	140,000	160,000	200,000	240,000	280,000	320,000
Entering Airflow CFM		440	740	1130	1440	1850	2400	2500	3000	4100	4400	5000	5900
Outlet Velocity		515	496	665	616	789	893	713	852	1024	960	1094	1094
Air Temp Rise °F		51	50	49	51	50	46	52	49	45	51	52	50
Mounting Height (Max ft) ①		7	8	11	10	13	17	13	16	20	18	20	21
Heat Throw (ft) ①		25	27	39	36	47	59	45	55	72	64	71	74
Standard Motor Data ②	Horse Power	1/40	1/40	1/30	1/30	1/15	1/6	1/6	1/6	1/3	1/3	3/4	3/4
	Unit Amps	2.7	2.7	3.7	3.7	4.1	5.1	5.1	5.1	7.7	7.7	11.1	11.1
	Rpm	1550	1550	1050	1050	1050	1075	1075	1075	1075	1075	1140	1140
	Type	SP	SP	SP	SP	SP	PSC	PSC	PSC	PSC	PSC	PSC	PSC

Ratings shown are for elevations up to 2,000 feet. For elevations above 2,000 feet, ratings should be reduced 4% for each 1000 feet above sea level. (In Canada see rating plate). Ratings reduction requires the use of a high altitude kit.

① At 65°F ambient and unit fired at full rated input. Mounting height is from bottom of unit and without deflector hoods.
② All single phase motors are totally enclosed and include thermal overload protection.

DIMENSIONS/PERFORMANCE – BV



Dimensions (in inches) – BV

For clearance to combustibles, see installation and service manual 6-575

Dimension	BV50	BV75	BV100	BV125	BV145	BV175	BV200	BV250	BV300	BV350	BV400
A	17-1/4	19-1/4	21	21	23-1/2	25-5/8	25-5/8	28-5/8	33-5/8	33-5/8	40
B	28-3/4	28-3/4	35-1/4	35-1/4	35-1/4	40-1/4	40-1/4	40-1/4	40-1/4	40-1/4	40-1/4
C	20	20	22	22	22	25	25	25	25	25	25
D	14-13/16	16-13/16	18-9/16	18-9/16	21-1/16	23-3/16	23-3/16	26-3/16	31-3/16	31-3/16	37-1/2
E	16	16	20	20	20	24	24	24	24	24	24
F	12-1/2	12-1/2	13-1/8	13-1/8	13-1/8	14-3/8	14-3/8	14-5/8	–	–	–
G	5-1/2	5-5/8	6-9/16	6-9/16	6-9/16	7-1/2	7-1/2	7-1/2	7-1/2	7-1/2	⑦
H	13-5/8	15-5/8	17-3/8	17-3/8	19-7/8	22	22	25	30	30	36-3/8
AA	6 1/4	6 1/4	8	8	8	9	9	9	9	9	9
BB	6-1/2	6-1/2	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4	7-1/4
CC	3/4	5/8	5/8	–	–	–	–	–	–	–	4-1/4 ⑦
DD	2	2	2-11/16	2-11/16	2-11/16	3-5/16	3-5/16	3-5/16	3-5/16	3-5/16	3-5/16
J (Round) ①	3	3	4	4	4	5	5	6	6	7	7
K (Mounting Holes) ②	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16
Gas Connections ③	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	3/4	3/4
W	–	–	–	–	–	–	–	–	5	5	5
X	–	–	–	–	–	–	–	–	16	16	16
EE	46-5/8	49-5/8	56-5/8	56-5/8	56-5/8	63-5/8	63-5/8	63-5/8	63-5/8	63-5/8	63-5/8
L w/Blower Enclosure & Filt RK	52-5/8	55-5/8	62-5/8	62-5/8	62-5/8	69-5/8	69-5/8	69-5/8	69-5/8	69-5/8	69-5/8
L w/o Blower Enclosure & Filt RK	43-3/4	46-3/4	52-3/4	52-3/4	53-3/4	58-3/8	58-3/8	58-3/8	58-3/8	58-3/8	64-1/2
M ④	37-3/4	40-3/4	46-3/4	46-3/4	47-3/4	52-3/8	52-3/8	52-3/8	52-3/8	52-3/8	58-1/2
N ⑤	13-1/2	16-1/8	20-3/8	20-3/8	20-3/8	24-1/2	24-1/2	24-1/8	18	18	22
O	5-3/4	5-3/4	7-1/4	7-1/4	7-1/4	8-1/2	8-1/2	8-1/2	8-1/2	8-1/2	8-1/2
P	22	25	30	30	30	34	34	34	36	36	36
Q (Height)	17-1/8	17-1/8	21-3/8	21-3/8	21-3/8	25-1/8	25-1/8	25-1/8	25-1/8	25-1/8	25-1/8
Inlet Duct/R (Height)	15 3/4	15 3/4	20	20	20	23-3/4	23-3/4	23-3/4	23-3/4	23-3/4	23-3/4
Filter Rack Width	16	19-3/4	27-1/2	27-1/2	27-1/2	32-3/4	32-3/4	32-3/4	42-7/8	42-7/8	42-7/8
Width V	17-3/8	21	29	29	29	34	34	34	44-1/4	44-1/4	44-1/4
S (Ctr to Ctr) of Blower Mtg Holes	10-15/16	13-7/16	17-3/8	17-3/8	17-3/8	20-3/8	20-3/8	20-3/8	20-3/8	20-3/8	20-3/8
Motor Pulley Diameter ⑥	3	3	3	3	3	3	3	3	3	4-1/2	4-1/2
Std Blower Pulley Diameter	9	10	15	13	9	13	12	8	8	11	11
Blower Wheel Diameter	8	9	13	13	13	15	15	15	15	15	15
Approx Shipping Weight	151#	163#	220#	220#	236#	314#	314#	338#	427#	427#	497#

① For some models, this is the dimension of the vent transition outlet supplied with unit.
② BV50 through BV250 has 4 mounting holes (2 on unit & 2 on blower assembly) and the BV300 through BV400 has 6 mounting holes, (4 on unit & 2 on blower assembly).
③ For natural gas; may vary depending on control availability.
④ This is an approximate dimension for standard motors, allow 3" for sheave adjustment and optional motors.
⑤ This the distance between the mounting holes in unit and the mounting holes on the blower assembly. On the BV300 through BV400, the dimension is from the rear holes on the unit to the mounting holes on the blower assembly.
⑥ Motor pulley is adjustable.
⑦ The BV400 power exhauster does not rotate a full 180°.

Standard Blower Motor Data – BV

Mounting heights and throws for BV models, without ductwork or nozzles, and at airflows yielding a 55° temp. rise are the same as those listed for equivalent size PV units.

	BV50	BV75	BV100	BV125	BV145	BV175	BV200	BV250	BV300	BV350	BV400
HP	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/2	3/4	1	1-1/2
Amps (@ 115 volt) ①	5.4	5.4	5.4	5.4	5.4	5.4	5.4	11	11	13.4	15.0
RPM	1725	1725	1725	1725	1725	1725	1725	1725	1725	1725	1725
Type	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Perm. Split. Cap.	Cap. Start

① Data listed is for standard 115-volt, 60-hertz, single-phase motors.

Note: Mounting heights and throws for BV models, without ductwork or nozzles, and at a cfm yielding a 55° temperature rise are the same as those listed for

PERFORMANCE DATA – BLOWER UNIT HEATERS

Models With or Without Blower Enclosure ① ② ③ ④ ⑤

For 575V selections, please see chart on page 17.

Model No.	Temp Rise (°F)	Airflow (cfm)	0.0 Static Air Pressure				0.1 Static Pressure				0.2 Static Pressure				0.3 Static Pressure				0.4 Static Pressure			
			RPM	HP	Drive No.	Pulley Turns Open	RPM	HP	Drive No.	Pulley Turns Open	RPM	HP	Drive No.	Pulley Turns Open	RPM	HP	Drive No.	Pulley Turns Open	RPM	HP	Drive No.	Pulley Turns Open
BV50	40	926	625	1/4	-8	3.5	700	1/4	-8	2.5	775	1/4	-8	1	840	1/3	-1	5	910	1/3	-1	4
	45	823	**555**	1/4	-87	0	640			3.5	720			2	795	1/4	-8	0.5	870	1/4	-1	4.5
	50	741	500			1.5	595			4	680			2.5	765			1	845			4.5
	55	673	455			2.5	555	1/4	-87	0	650			3	740			1.5	825	1/4	-8	5
	60	617	420			3.5	525			1	630			3.5	725			2	810			0.5
	65	570	385			4.5	505			1.5	610			4	710			2	805			0.5
	70	529	360			5	485			1.5	595			4	700			2.5	800			0.5
BV75	40	1389	**545**	1/4	-12	0.5	640	1/4	-8	3.5	720	1/3	-8	2	795	1/2	-169	0.5	860	1/2	-3	4.5
	45	1235	485			2	590			4	675	1/4	-8	3	755	1/3	-8	1.5	825	1/2	-169	0
	50	1111	435			3	550	1/4	-12	0	645			3.5	725	1/4	-8	2	800	1/3	-8	0.5
	55	1010	400			4	520			1	620			3.5	700			2.5	775			1
	60	926	365			5	495			1.5	595			4	685			2.5	760	1/4	-8	1.5
	65	855	–	–	–	–	475			2	580			4.5	670			3	750			1.5
	70	794	–	–	–	–	460			2.5	565			4.5	660			3	735			1.5
BV100	40	1852	**310**	1/4	-214	1	395	1/4	-57	3	465	1/4	-57	1	525	1/3	-215	4	575	1/2	-217	3
	45	1646	275			2.5	380			3.5	440			1.5	505	1/4	-215	4.5	560	1/3	-215	3
	50	1481	250			3.5	350			4.5	425			2	490	1/4	-57	0.5	545	1/4	-215	3.5
	55	1347	225			4.5	330			5	410			2.5	475			0.5	535			3.5
	60	1235	210			5	320	1/4	-214	0.5	400			3	470			1	525			4
	65	1140	–	–	–	–	310			1	390			3	460			1	520			4
	70	1058	–	–	–	–	300			1.5	385			3.5	455			1.5	515			4
BV125	40	2315	390	1/3	-36	4.5	460	1/3	-36	2.5	520	1/2	-166	1	570	1/2	-38	4.5	620	3/4	-38	3.5
	45	2058	**345**	1/4	-21	1.5	425	1/4	-36	3.5	485	1/3	-36	2	545	1/2	-166	0.5	595	1/2	-38	4
	50	1852	310			3	395			4	465			2.5	525	1/3	-36	1	575			4.5
	55	1684	285			3.5	375	1/4	-21	0.5	445	1/4	-36	3	505	1/4	-36	1.5	560	1/3	-36	0
	60	1543	260			4.5	355			1	430			3.5	495			1.5	550			0
	65	1425	240	1/4	-214	4	340			1.5	420			3.5	480			2	540	1/4	-36	0.5
	70	1323	220			5	330			2	410			4	475			2	530			0.5
BV145	40	2685	635	3/4	-38	3.5	680	3/4	-38	2.5	725	1	-38	2	765	1	-38	1	805	1	-38	0.5
	45	2387	565	1/2	-166	4.5	615			4	665	3/4	-38	3	710	3/4	-38	2	755			1.5
	50	2148	510	1/2	-98	1	565	1/2	-166	4.5	620	1/2	-166	3.5	670			3	715	3/4	-38	2
	55	1953	465	1/3	-36	2.5	525	1/3	-36	1	580			4.5	635	1/2	-166	3.5	685	1/2	-166	0.5
	60	1790	**425**	1/4	-36	3.5	490			1.5	550	1/3	-36	0	605			4	660			3
	65	1652	390			4.5	465	1/4	-36	2.5	530			0.5	585	1/3	-37	4.5	640			3.5
	70	1534	365			5	440			3	510	1/4	-36	1	570			4.5	625	1/3	-37	3.5
BV175	40	3241	430	1/2	-219	3.5	475	3/4	-219	2	515	3/4	-219	1	550	3/4	-219	0	585	1	-220	4.5
	45	2881	385	1/3	-24	0	430	1/2	-219	3.5	475	1/2	-219	2	515			1	555	3/4	-219	0
	50	2593	**345**	1/4	-24	1.5	400	1/3	-17	4	445			3	490	1/2	-219	1.5	525			1
	55	2357	315			2.5	370	1/4	-24	0.5	420	1/3	-17	3.5	465			2.5	505	1/2	-219	1.5
	60	2160	290			3.5	350			1.5	405			4	450	1/3	-17	3	490			1.5
	65	1994	265			4.5	330			2	385	1/4	-24	0	435			3	480	1/3	-17	2
	70	1852	245			5	320			2.5	375			0.5	425	1/4	-17	3.5	470			2.5
BV200	40	3704	490	3/4	-16	3	530	1	-16	2	565	1	-16	1.5	600	1	-16	0.5	635	1 1/2	-105	3.5
	45	3292	440	1/2	-16	4.5	480	3/4	-16	3.5	520	3/4	-16	2.5	555	3/4	-16	1.5	590	1	-16	1
	50	2963	395	1/2	-224	1	440	1/2	-16	4.5	485			3.5	525			2.5	560	3/4	-16	1.5
	55	2694	360	1/3	-221	2	410	1/2	-224	0.5	455	1/2	-16	4	500	1/2	-16	3	535			2
	60	2469	**330**	1/4	-221	3	385	1/3	-221	1	430			4.5	475			3.5	515	1/2	-16	2.5
	65	2279	305			4	365	1/4	-221	2	415	1/3	-221	0	460			3.5	500			3
	70	2116	280			4.5	345			2.5	400	1/4	-221	0.5	445	1/3	-223	4	490			3
BV250	40	4630	710	2	-180	1.5	745	2	-180	0.5	775	2	-33	4	800	2	-33	3.5	830	3	-111	2.5
	45	4115	630	1 1/2	-105	4	670	1 1/2	-105	2.5	700	1 1/2	-105	1.5	735	1 1/2	-105	0.5	765	2	-33	4
	50	3704	570	1	-16	1.5	610	1	-16	0.5	645			3.5	680			2.5	710	1 1/2	-105	1.5
	55	3367	520	3/4	-16	2.5	560	3/4	-16	1.5	600	1	-16	0.5	635	1	-16	0	670	1	-225	5
	60	3086	**475**	1/2	-16	3.5	520			2.5	560	3/4	-16	1.5	600	3/4	-16	0.5	640			5
	65	2849	440			4.5	490	1/2	-16	3	530			2	575			1	610	3/4	-16	0.5
	70	2646	405			5	460			4	505	1/2	-16	3	550	1/2	-16	1.5	590			1
BV300	40	5556	830	3	-111	3	850	3	-111	2.5	875	3	-111	1.5	900	3	-111	1	–	–	–	–
	45	4938	735	2	-180	0.5	765	2	-180	0	790	2	-33	3.5	815			3	840	3	-111	2.5
	50	4444	665	1 1/2	-112	2.5	690	1 1/2	-112	2	720	1 1/2	-112	1	750	2	-180	0.5	775	2	-33	4
	55	4040	605	1	-16	0.5	635			3.5	665			2.5	695	1 1/2	-112	2	725	1 1/2	-112	1
	60	3704	**555**	3/4	-16	1.5	590	1	-16	1	620	1	-16	0	655			3	685			2
	65	3419	510			2.5	550	3/4	-16	2	585			1	620	1	-16	0	655	1	-225	5
	70	3175	475			3.5	515			2.5	555	3/4	-16	1.5	590	3/4	-16	1	625	1	-16	0
BV350	40	6481	970	5	-116	2.5	995	5	-116	2	1015	5	-116	1.5	1040	5	-116	1	1060	5	-116	0.5
	45	5761	865	3	-116	4.5	890			4	915			3.5	940			3	960			2.5
	50	5185	775	3	-27	2	805	3	-27	1	835	3	-27	0	860	3	-116	4.5	885	3	-116	4
	55	4714	705	2	-158	3.5	740	2	-158	2.5	770	2	-158	2	795	2	-158	1	825	3	-27	0.5
	60	4321	650	1 1/2	-23	1.5	680	1 1/2	-23	0.5	715	1 1/2	-20	3.5	745			2.5	775	2	-158	2
	65	3989	**600**	1	-23	3.5	635			1.5	670	1 1/2	-23	0.5	700	1 1/2	-20	3.5	730	1 1/2	-20	3
	70	3704	555			5	595	1	-23	3	630	1	-23	2	665	1 1/2	-23	1	695	1 1/2	-23	0
BV400	40	7407	945	5	-116	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	45	6584	840	5	-118	0	865	5	-116	4.5	890	5	-116	4	915	5	-116	3.5	940	5	-116	3
	50	5926	755	3	-118	2.5	785	3	-118	1.5	810	3	-118	1	840	5	-118	0	870			4.5
	55	5387	685	2	-58	4	720			3	750			2.5	780	3	-118	1.5	810	3	-118	1
	60	4938	**630**	1 1/2	-23	2	665	2	-58	4.5	695	2	-58	4	730	2	-58	3	765			2
	65	4558	580			3.5	620	1 1/2	-23	2	655	1 1/2	-23	1	690			4	725	2	-58	3
	70	4233	540			5	580			3.5	620			2	655	1 1/2	-23	1	695	1 1/2	-23	0

① Shaded area indicates the unit's standard motor & standard drive arrangement. For operation outside the shaded area, specify motor Hp and drive number.
② Outputs shown are for elevations up to 2000'. For elevations over 2000', output needs to be reduced 4% for each 1000' above sea level. (Does not apply in -anada - see rating plate)
③ Sheave turns open are approximate. For proper operation, check blower rpm.
④ Mounting height and throw for BV models (w/o ductwork or nozzles and at airflows yielding a 55° temperature rise), are the same as those listed on page 8 for equivalent PV models.
⑤ Rpm setting shown in **bold** type indicate factory settings and standard drives.

PERFORMANCE DATA – CONTINUED

Models With or Without blower Enclosure ① ② ③ ④

Model No.	Temp Rise (°F)	Airflow (cfm)	0.5 Static Air Pressure RPM	HP	Drive No.	Pulley Turns Open	Data for use with filters only: 0.6 Static Pressure RPM	HP	Drive No.	Pulley Turns Open	0.7 Static Pressure RPM	HP	Drive No.	Pulley Turns Open
BV50	40	926	–	–	–	–	–	–	–	–	–	–	–	–
	45	823	940	1/3	-1	3.5	–	–	–	–	–	–	–	–
	50	741	920			4	990	1/3	-1	3	–	–	–	–
	55	673	905	1/4	-1	4	980			3	–	–	–	–
	60	617	895			4	975			3	–	–	–	–
	65	570	890			4	–	–	–	–	–	–	–	–
	70	529	890			4	–	–	–	–	–	–	–	–
BV75	40	1389	925	1/2	-3	4	985	3/4	-3	3	–	–	–	–
	45	1235	890			4	950	1/2	-3	3.5	–	–	–	–
	50	1111	865			4	930			3.5	–	–	–	–
	55	1010	845	1/3	-114	4.5	910			4	–	–	–	–
	60	926	830			5	895			4	–	–	–	–
	65	855	820	1/3	-8	0	886			4	–	–	–	–
	70	794	810			0.5	875	1/3	-114	4.5	–	–	–	–
BV100	40	1852	625	1/2	-217	2	670	1/2	-217	1	–	–	–	–
	45	1646	610	1/3	-215	2	655			1	–	–	–	–
	50	1481	595			2.5	640	1/3	-215	1.5	–	–	–	–
	55	1347	585			2.5	635			1.5	–	–	–	–
	60	1235	580	1/4	-215	3	630			1.5	–	–	–	–
	65	1140	575			3	620			2	–	–	–	–
	70	1058	570			3	615	1/4	-215	2	–	–	–	–
BV125	40	2315	665	3/4	-38	3	710	3/4	-38	2	–	–	–	–
	45	2058	640	1/2	-38	3.5	685			2.5	–	–	–	–
	50	1852	625			3.5	670	1/2	-38	3	–	–	–	–
	55	1684	610			4	655			3	–	–	–	–
	60	1543	600	1/3	-37	4	645			3.5	–	–	–	–
	65	1425	590			4	640	1/3	-37	3.5	–	–	–	–
	70	1323	585			4.5	630			3.5	–	–	–	–
BV145	40	2685	845	1 1/2	-113	2.5	885	1 1/2	-113	1.5	920	1 1/2	-113	0.5
	45	2387	795	1	-38	0.5	835	1	-38	0	875			1.5
	50	2148	760	3/4	-38	1.5	800	3/4	-38	0.5	845	1	-38	0
	55	1953	730			2	775			1	820	3/4	-38	0
	60	1790	710	1/2	-116	2	755			1.5	800			0.55
	65	1652	690			2.5	740	1/2	-166	1.5	785			1
	70	1534	680			2.5	730			2	775	1/2	-166	1
BV175	40	3241	620	1	-220	3.5	650	1	-220	3	–	–	–	–
	45	2881	590	3/4	-220	4.5	620			3.5	–	–	–	–
	50	2593	565			4.5	600	3/4	-220	4	–	–	–	–
	55	2357	545	3/4	-219	0.5	580			4.5	–	–	–	–
	60	2160	530	1/2	-219	0.5	565			4.5	–	–	–	–
	65	1994	520			1	555	1/2	-219	0	–	–	–	–
	70	1852	510			1	550			0	–	–	–	–
BV200	40	3704	665	1 1/2	-105	3	695	1 1/2	-105	2	–	–	–	–
	45	3292	625	1	-16	0	655			3	–	–	–	–
	50	2693	595			0.5	630	1	-16	0	–	–	–	–
	55	2694	570	3/4	-16	1.5	605	3/4	-16	0.5	–	–	–	–
	60	2469	555			1.5	590			1	–	–	–	–
	65	2279	540	1/2	-16	2	575			1	–	–	–	–
	70	2116	530			2.5	565	1/2	-16	1.5	–	–	–	–
BV250	40	4630	855	3	-111	2	880	3	-111	1.5	910	3	-111	1
	45	4115	790	2	-33	3.5	820	2	-33	3	845	2	-33	2.5
	50	3704	740	1 1/2	-105	0.5	770	1 1/2	-226	4	800	1 1/2	-226	3.5
	55	3367	705			1.5	735	1 1/2	-105	0.5	765	1 1/2	-105	0
	60	3086	670	1	-225	5	705	1	-225	4.5	735			0.5
	65	2849	645	3/4	-225	5	680			4.5	710	1	-109	4
	70	2646	625	3/4	-16	0	660	3/4	-225	5	690			4.5
BV300	40	5556	–	–	–	–	–	–	–	–	–	–	–	–
	45	4938	865	3	-111	2	890	3	-111	1.5	910	3	-111	1
	50	4444	805	2	-33	3.5	830			2.5	855			2
	55	4040	755			4.5	780	2	-33	4	810	2	-33	3
	60	3704	715	1 1/2	-112	1.5	745	1 1/2	-112	0.5	775	1 1/2	-226	4
	65	3419	685			2	715			1.5	745	1 1/2	-112	0.5
	70	3175	660	1	-225	5	690			2	725			1
BV350	40	6481	–	–	–	–	–	–	–	–	–	–	–	–
	45	5761	985	5	-116	2	1005	5	-116	1.5	1030	5	-116	1
	50	5185	910	3	-116	3.5	935			3	955			2.5
	55	4714	850			5	875	3	-116	4	900	3	-116	3.5
	60	4321	800	2	-158	1	830	2	-158	0.5	855			4.5
	65	3989	760			2	790			1.5	815	2	-158	0.5
	70	3704	730	1 1/2	-20	3	755	1 1/2	-20	2.5	785			1.5
BV400	40	7407	–	–	–	–	–	–	–	–	–	–	–	–
	45	6584	965	5	-116	2.5	990	5	-116	3	950	5	-116	2.5
	50	5926	895			4	925			3	950			2.5
	55	5387	840	3	-118	0	870	3	-116	4.5	900			3.5
	60	4938	795			1	825	3	-118	0.5	860	3	-116	4.5
	65	4558	760	2	-58	2	795			1	825	3	-118	0.5
	70	4233	730			3	765	2	-58	2	800	2	-58	1

① Shaded area indicates the unit's standard motor & standard drive arrangement. For operation outside the shaded area, specify motor Hp and drive number.
② Outputs shown are for elevations up to 2000'. For elevations over 2000' output needs to be reduced 4% for each 1000' above sea level. (Does not apply in Canada - see rating plate)
③ Sheave turns open are approximate. For proper operation, check blower rpm.
④ Mounting height and throw for BV models (w/o ductwork or nozzles and at airflows yielding a 55° temperature rise), are the same as those listed on page 8 for comparable PV models.

Filters

For blower units with enclosure and filter, add the following static pressures to the static pressure determined by the system designer for total external static pressure.

BV50	0.1" W.C.
BV75	0.1" W.C.
BV100	0.1" W.C.
BV125	0.1" W.C.
BV145	0.2" W.C.
BV175	0.1" W.C.
BV200	0.1" W.C.
BV250	0.2" W.C.
BV300	0.2" W.C.
BV350	0.2" W.C.
BV400	0.2" W.C.

Important: Note for 575V Only

	HP & Drive from this catalog		HP & Drive to ORDER from price list①
BV50	1/4 - 87	=	1/4 - 168
	1/4 - 8	=	1/4 - 169
	1/4 - 1	=	1/4 - 61
	1/3 - 1	=	1/3 - 61
BV75	1/4 - 12	=	1/4 - 171
	1/4 - 8	=	1/4 - 169
	1/3 - 8	=	1/3 - 169
	1/3 - 114	=	1/3 - 3
BV100	1/4 - 214	=	1/4 - 172
	1/4 - 57	=	1/4 - 167
	1/4 - 215	=	1/4 - 216
	1/3 - 215	=	1/3 - 216
BV125	1/4 - 21	=	1/4 - 165
	1/4 - 214	=	1/4 - 172
	1/4 - 36	=	1/4 - 166
	1/3 - 36	=	1/3 - 166
	1/3 - 37	=	1/3 - 11
BV145	1/4 - 36	=	1/4 - 166
	1/3 - 36	=	1/3 - 166
	1/3 - 37	=	1/3 - 38
	1 1/2 - 218	=	1 1/2 - 179
BV175	1/4 - 24	=	1/4 - 176
	1/4 - 17	=	1/4 - 18
	1/3 - 17	=	1/3 - 18
	1/3 - 24	=	1/3 - 176
BV200	1/4 - 221	=	1/4 - 222
	1/3 - 221	=	1/3 - 222
	1/3 - 223	=	1/3 - 16
	1 1/2 - 105	=	1 1/2 - 180
BV250	1 1/2 - 105	=	1 1/2 - 180
	1 1/2 - 226	=	1 1/2 - 170
BV300	1 1/2 - 105	=	1 1/2 - 180
	1 1/2 - 226	=	1 1/2 - 170
BV350	1 1/2 - 23	=	1 1/2 - 177
	1 1/2 - 20	=	1 1/2 - 158
BV400	1 1/2 - 23	=	1 1/2 - 177

① Performance is the same; motor sheave can just accomodate larger shaft.

MOTOR DATA ① ② ③

Power Code Description – Propeller PV Models

Power Code	Electric Power	PV 30	PV 50	PV 75	PV 100	PV 125	PV 145	PV 175	PV 200	PV 250	PV 300	PV 350	PV 400
		Horsepower											
01	115/60/1	1/40	1/40	1/30	1/30	1/15	1/6	1/6	1/6	1/3	1/3	3/4	3/4
02	230/60/1	1/40	1/40	1/15	1/15	1/15	1/6	1/6	1/6	1/3	1/3	3/4	3/4
04	200/60/3	–	–	–	–	1/3	1/3	1/3	1/3	1/3	1/3	3/4	3/4
05	230/460/60/3	–	–	–	–	1/3	1/3	1/3	1/3	1/3	1/3	3/4	3/4

Motor Data and Total Power Requirement – Propeller PV Models

Voltage	115/60/1				230/60/1				200-208/60/3				230/460/60/3			
HP	Mtr. Amps	Mtr. Rpm	Total Amps	Total Watts	Mtr. Amps	Mtr. Rpm	Total Amps	Total Watts	Mtr. Amps	Mtr. Rpm	Total Amps	Total Watts	Mtr. Amps	Mtr. Rpm	Total Amps	Total Watts
1/40	1.0	1550	2.7	175	0.5	1550	1.3	175	–	–	–	–	–	–	–	–
1/30	2.1	1050	3.7	240	–	–	–	–	–	–	–	–	–	–	–	–
1/15	2.4	1050	4.1	285	1.3	1050	2.2	285	–	–	–	–	–	–	–	–
1/6	2.8	1075	5.1	440	1.6	1075	2.8	360	–	–	–	–	–	–	–	–
1/3	5.4	1075	7.7	665	2.5	1075	3.9	585	1.9	1140	3.3	615	2.1/1.1	1140	3.4/1.7	615
3/4	8.8	1075	11.1	1050	4.4	1075	5.7	1000	3.7	1140	4.9	1020	3.4/1.7	1140	5.0/2.5	1020

① Whenever 200V/1ϕ, 230V/1ϕ, 200V3ϕ, or 230V/3ϕ is used, it is necessary to specify 200V/230V controls. Whenever 460V (or 575V) 3ϕ power is used, it is necessary to choose between 200V/230V or 460V (or 575V) controls. The 200V/230V controls will require the installer to provide a 460V (or 575V) to 230V (or 200V), 75VA step-down transformer [if the power exhauster accessory is used, the step-down transformer needs to be 250VA] with the motor starter coil voltage being 230V (or 200V). The 460V (or 575V) controls require no additional transformer (unless the power exhauster accessory is used, then a 460V (or 575V) to 230V, 250VA step-down transformer is needed) with the motor starter coil voltage 24V.

② PD units with 460V/3ϕ power supply are not listed by C.G.A.

③ All motors used are produced, rated and tested by reputable manufacturers in accordance with NEMA standards and carry the standard warranty of both the motor manufacturer and Modine. All motors are totally enclosed and all single phase motors have built-in thermal overload protection.

Power Code Description – Blower BV Models ② ③ ④ ⑤

Power Code	Electric Power	BV 50		BV 75		BV 100		BV 125		BV 145		BV 175		BV 200		BV 250		BV 300		BV 350		BV 400	
		HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive
01	115/160/1	1/4	87	1/4	12	1/4	214	1/4	21	1/4	36	1/4	24	1/4	221	1/2	16	3/4	16	1	23	1 1/2	23
02	230/60/1	1/4	87	1/4	12	1/4	214	1/4	21	1/4	36	1/4	24	1/4	221	1/2	16	3/4	16	1	23	1 1/2	23
03	200/60/3	1/4	87	1/4	12	1/4	214	1/4	21	1/4	36	1/4	24	1/4	221	1/2	16	3/4	16	1	23	1 1/2	23
04	230/460/60/3	1/4	87	1/4	12	1/4	214	1/4	21	1/4	36	1/4	24	1/4	221	1/2	16	3/4	16	1	23	1 1/2	23
81	575/60/3	1/4	168	1/4	171	1/4	172	1/4	165	1/4	166	1/4	176	1/4	222	1/2	16	3/4	16	1	23	1 1/2	177
05	115/160/1	1/4	8	1/4	8	1/4	57	1/4	214	1/3	36	1/4	17	1/3	221	3/4	16	1	16	1 1/2	23	–	–
06	230/60/1	1/4	8	1/4	8	1/4	57	1/4	214	1/3	36	1/4	17	1/3	221	3/4	16	1	16	1 1/2	23	–	–
07	200/60/3	1/4	8	1/4	8	1/4	57	1/4	214	1/3	36	1/4	17	1/3	221	3/4	16	1	16	1 1/2	23	–	–
08	230/460/60/3	1/4	8	1/4	8	1/4	57	1/4	214	1/3	36	1/4	17	1/3	221	3/4	16	1	16	1 1/2	23	–	–
82	575/60/3	1/4	169	1/4	169	1/4	167	1/4	172	1/3	166	1/4	18	1/3	222	3/4	16	1	16	1 1/2	177	–	–
09	115/160/1	1/4	1	1/3	8	1/4	215	1/4	36	1/3	37	1/3	17	1/3	223	3/4	225	1	225	1 1/2	20	–	–
10	230/60/1	1/4	1	1/3	8	1/4	215	1/4	36	1/3	37	1/3	17	1/3	223	3/4	225	1	225	1 1/2	20	–	–
11	200/60/3	1/4	1	1/3	8	1/4	215	1/4	36	1/3	37	1/3	17	1/3	223	3/4	225	1	225	1 1/2	20	2	158
12	230/460/60/3	1/4	1	1/3	8	1/4	215	1/4	36	1/3	37	1/3	17	1/3	223	3/4	225	1	225	1 1/2	20	2	158
83	575/60/3	1/4	61	1/3	169	1/4	216	1/4	166	1/3	38	1/3	18	1/3	16	3/4	225	1	225	1 1/2	158	2	158
13	115/160/1	1/3	1	1/3	114	1/3	215	1/3	36	1/2	166	1/3	24	1/2	224	1	16	1 1/2	112	–	–	–	–
14	230/60/1	1/3	1	1/3	114	1/3	215	1/3	36	1/2	166	1/3	24	1/2	224	1	16	1 1/2	112	–	–	–	–
15	200/60/3	1/3	1	1/3	114	1/3	215	1/3	36	1/2	166	1/3	24	1/2	224	1	16	1 1/2	112	–	–	3	116
16	230/460/60/3	1/3	1	1/3	114	1/3	215	1/3	36	1/2	166	1/3	24	1/2	224	1	16	1 1/2	112	–	–	3	116
84	575/60/3	1/3	61	1/3	3	1/3	216	1/3	166	1/2	166	1/3	176	1/2	224	1	16	1 1/2	180	–	–	3	116
17	115/160/1	–	–	1/2	3	1/2	217	1/3	37	1/2	38	1/2	219	1/2	16	1	225	1 1/2	226	–	–	–	–
18	230/60/1	–	–	1/2	3	1/2	217	1/3	37	1/2	38	1/2	219	1/2	16	1	225	1 1/2	226	–	–	–	–
19	200/60/3	–	–	1/2	3	1/2	217	1/3	37	1/2	38	1/2	219	1/2	16	1	225	1 1/2	226	2	158	3	118
20	230/460/60/3	–	–	1/2	3	1/2	217	1/3	37	1/2	38	1/2	219	1/2	16	1	225	1 1/2	226	2	158	3	118
85	575/60/3	–	–	1/2	3	1/2	217	1/3	11	1/2	38	1/2	219	1/2	16	1	225	1 1/2	170	2	158	3	118
21	115/160/1	–	–	1/2	169	–	–	1/2	166	3/4	38	3/4	219	3/4	16	1 1/2	112	–	–	–	–	–	–
22	230/60/1	–	–	1/2	169	–	–	1/2	166	3/4	38	3/4	219	3/4	16	1 1/2	112	–	–	–	–	–	–
23	200/60/3	–	–	1/2	169	–	–	1/2	166	3/4	38	3/4	219	3/4	16	1 1/2	112	2	180	3	27	5	118
24	230/460/60/3	–	–	1/2	169	–	–	1/2	166	3/4	38	3/4	219	3/4	16	1 1/2	112	2	180	3	27	5	118
86	575/60/3	–	–	1/2	169	–	–	1/2	166	3/4	38	3/4	219	3/4	16	1 1/2	180	2	180	3	27	5	118
25	115/160/1	–	–	3/4	3	–	–	1/2	38	1	38	3/4	220	1	16	1 1/2	226	–	–	–	–	–	–
26	230/60/1	–	–	3/4	3	–	–	1/2	38	1	38	3/4	220	1	16	1 1/2	226	–	–	–	–	–	–
27	200/60/3	–	–	3/4	3	–	–	1/2	38	1	38	3/4	220	1	16	1 1/2	226	2	33	3	116	5	116
28	230/460/60/3	–	–	3/4	3	–	–	1/2	38	1	38	3/4	220	1	16	1 1/2	226	2	33	3	116	5	116
87	575/60/3	–	–	3/4	3	–	–	1/2	38	1	38	3/4	220	1	16	1 1/2	170	2	33	3	116	5	116
29	115/160/1	–	–	–	–	–	–	3/4	38	1 1/2	218	1	220	1 1/2	112	–	–	–	–	–	–	–	–
30	230/60/1	–	–	–	–	–	–	3/4	38	1 1/2	218	1	220	1 1/2	112	–	–	–	–	–	–	–	–
31	200/60/3	–	–	–	–	–	–	3/4	38	1 1/2	218	1	220	1 1/2	112	2	180	3	111	5	116	–	–
32	230/460/60/3	–	–	–	–	–	–	3/4	38	1 1/2	218	1	220	1 1/2	112	2	180	3	111	5	116	–	–
88	575/60/3	–	–	–	–	–	–	3/4	38	1 1/2	179	1	220	1 1/2	180	2	180	3	111	5	116	–	–
33	115/160/1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
34	230/60/1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
35	200/60/3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	33	–	–	–	–	–	–
36	230/460/60/3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	33	–	–	–	–	–	–
89	575/60/3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	33	–	–	–	–	–	–
37	115/160/1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
38	230/60/1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
39	200/60/3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	111	–	–	–	–	–	–
40	230/460/60/3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	111	–	–	–	–	–	–
90	575/60/3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	111	–	–	–	–	–	–

CONTROL OPERATING SEQUENCE

For Intermittent Pilot

Upon a call for heat from the thermostat, power is supplied to the time delay relay for the power exhauster motor. The power exhauster motor will come on in 1 to 25 seconds and as soon as the pressure switch closes, ignition sparking will start. Sparking will start at the ignitor at the same time the first operator of the combination gas control opens to allow gas to flow to the pilot burner. The pilot flame should light and be sensed (proven) in a few seconds. As soon as the pilot flame is sensed, the sparking will stop and the second operator of the combination gas control will open allowing gas to flow to the main burner. In 10 to 45 seconds from the time the ignition system was energized (1 - 2 minutes

MOTOR DATA ① ③ (see page 18)

Motor Data and Total Unit Power Requirements – Blower BV Models

Voltage	115/60/1				230/60/1				200-208/60/3				230/460/60/3				575/60/3			
HP	Mtr. Amps.	Mtr. Rpm	Total Amps	Total Watts	Mtr. Amps.	Mtr. Rpm	Total Amps	Total Watts	Mtr. Amps.	Mtr. Rpm	Total Amps	Total Watts	Mtr. Amps.	Mtr. Rpm	Total Amps	Total Watts	Mtr. Amps.	Mtr. Rpm	Mtr. Rpm	Total Watts
1/4	5.4	1725	7.7	570	2.7	1725	4.0	520	1.6	1725	2.8	500	1.4/0.7	1725	2.7/1.4	500	0.6	1725	1	500
1/3	5.0	1725	6.9	565	2.5	1725	3.6	515	1.8	1725	3.0	530	1.6/0.8	1725	2.9/1.5	530	0.7	1725	1.2	530
1/2	8.5	1725	10.8	780	3.8	1725	5.1	730	2.5	1725	3.7	730	2.6/1.3	1725	3.9/2.0	730	1	1725	1.4	730
3/4	11.0	1725	13.3	1050	5.5	1725	6.8	1000	3.2	1725	4.4	970	3.0/1.5	1725	4.3/2.2	970	1.2	1725	1.6	970
1	13.4	1725	15.7	1260	6.7	1725	8.0	1210	4.0	1725	5.2	1230	3.8/1.9	1725	5.1/2.6	1230	1.6	1725	2	1230
1-1/2	15.0	1725	17.6	1740	7.5	1725	8.9	1690	5.6	1725	6.8	1630	5.2/2.6	1725	6.5/3.3	1630	2	1725	2.4	1630
2	–	–	–	–	–	–	–	–	6.8	1725	8.1	2080	6.6/3.3	1725	7.9/4.0	2080	2.4	1725	2.8	2080
3	–	–	–	–	–	–	–	–	10.6	1725	11.8	3430	8.8/4.4	1725	10.1/5.1	3430	4.1	1725	4.5	3430
5	–	–	–	–	–	–	–	–	14.3	1725	15.5	4530	13.2/6.6	1725	14.5/7.3	4530	5.3	1725	5.7	4530

Blower Drive Numbers

Sheave	Blower Sheave			Motor	
Drive No.	Belt No. Browning	Pitch Dia.	Bore	Min/Max Pitch Dia.	Bore
1	A29	4	3/4	1.9/2.9	1/2
3	A32	4	3/4	1.9/2.9	5/8
8	A34	6	3/4	1.9/2.9	1/2
11	A40	6	3/4	1.9/2.9	5/8
12	A40	9	3/4	1.9/2.9	1/2
16	A48	8	1	1.9/2.9	5/8
17	A48	9	1	1.9/2.9	1/2
18	A49	9	1	1.9/2.9	5/8
20	A51	9	1	3.4/4.4	5/8
21	A52	13	3/4	1.9/2.9	1/2
23	A56	11	1	3.4/4.4	5/8
24	A56	13	1	1.9/2.9	1/2
27	A54	9	1	3.4/4.4	1 1/8
33	A50	8	1	3.4/4.4	7/8
36	A45	9	3/4	1.9/2.9	1/2
37	A40	6	3/4	1.9/2.9	1/2
38	A41	6	3/4	1.9/2.9	5/8
57	A46	10	3/4	1.9/2.9	1/2
61	A30	4	3/4	1.9/2.9	5/8
87	A38	9	3/4	1.9/2.9	1/2
111	A52	8	1	3.4/4.4	1 1/8
112	A55	10	1	3.4/4.4	1 1/8
114	A32	4	3/4	1.9/2.9	1/2
116	A50	7	1	3.4/4.4	1 1/8

Sheave	Blower Sheave			Motor	
Drive No.	Belt No. Browning	Pitch Dia.	Bore	Min/Max Pitch Dia.	Bore
118	A52	9	1	3.4/4.4	1 1/8
158	A52	9	1	3.4/4.4	7/8
166	A45	9	3/4	1.9/2.9	5/8
168	A39	9	3/4	1.9/2.9	5/8
169	A35	6	3/4	1.9/2.9	5/8
170	A50	8	1	3.4/4.4	7/8
171	A41	9	3/4	1.9/2.9	5/8
176	A57	13	1	1.9/2.9	5/8
177	A56	11	1	3.4/4.4	7/8
179	A42	8	3/4	3.4/4.4	7/8
180	A54	10	1	3.4/4.4	7/8
214	A57	15	3/4	1.9/2.9	1/2
215	A42	7	3/4	1.9/2.9	1/2
217	A43	7	3/4	1.9/2.9	5/8
218	A42	8	3/4	3.4/4.4	5/8
219	A50	9	1	1.9/2.9	5/8
220	A45	6	1	1.9/2.9	5/8
221	A54	12	1	1.9/2.9	1/2
222	A54	12	1	1.9/2.9	5/8
223	A47	8	1	1.9/2.9	1/2
224	A55	12	1	1.9/2.9	5/8
225	A43	5	1	1.9/2.9	5/8
226	A50	8	1	3.4/4.4	5/8

CONTROL OPTIONS

PROPELLER AND BLOWER UNIT HEATERS – PV AND BV MODELS ①

Control System Description	Control Code No.	Service Voltage	Thermostat Voltage	Type of Gas	List Price
Single-Stage, Intermittent Pilot Ignition, 100% Shut-Off with Continuous Retry – Utilizes a single-stage combination gas control and an ignition control (continuous retry). Pilot is automatically lit on call for heat.	30	115V	25V	natural	N/C
	31	200-208/230V	25V	natural	N/C
	32	460V	25V	natural	$ 358
	33	575V	25V	natural	$ 358
	85	115V	25V	propane	N/C
	86	200208/230V	25V	propane	N/C
	93	460V	25V	propane	358
	94	575V	25V	propane	358
Single-Stage, Standing Pilot, 100% Shut-Off – Utilizing a single-stage combination gas control and thermocouple. Pilot needs to be manually lit initially and stays lit.	11	115V	25V	natural	N/C
	12	200-208/230V	25V	natural	N/C
	13	460V	25V	natural	$ 358
	14	575V	25V	natural	$ 358
	81	115V	25V	propane	N/C
	82	200-208/230V	25V	propane	N/C
	91	460V	25V	propane	$ 358
	92	575V	25V	propane	$ 358
Mechanical Modulation with Automatic Pilot Ignition, 100% Shut-Off with Continuous Retry – Utilizes a modulating combination gas control and an ignition control (continuous retry). Pilot is automatically lit whenever there is power to the unit. Modulation range is between 50% and 100% fire; gas control shuts off below 50% fire. **Available on BV models only, 75,000 BTU and higher.**	59	115V	25V	natural	$ 215
	60	200-208/230V	25V	natural	$ 215
	89	115V	25V	propane	$ 215
	90	200-208/230V	25V	propane	$ 215
Two-Stage, Intermittent Pilot Ignition, 100% Shut-Off with Continuous Retry – Utilizes a two-stage combination gas control (which fires at 50% or 100% of full rated input) and an ignition control (continuous retry). Pilot is automatically lit only on a call for heat.	63	115V	25V	natural	$170
	64	200-208/230V	25V	natural	$170
	87	115V	25V	propane	$170
	88	200-208/230V	25V	propane	$170

① Whenever 230V/1ϕ or 230V/3ϕ power is used, it is necessary to specify 230V/25V controls. Whenever 460V/3ϕ power is used, it is necessary to specify 230V/25V controls and in addition, a 460V/230V/250VA step-down transformer (by others) is required. On 230V or 460V/3ϕ systems, the motor starter coil voltage (motor starter by others) must be 230V. For 200V/3ϕ systems, the motor starter coil voltage (motor starter by others) must be 200V.

from the call for heat from the thermostat) the fan motor will start. If the pilot flame is not sensed for any reason, the ignition control will wait for a predetermined time with the combination gas control closed and no spark. After the predetermined time lapses, the cycle will begin again. The time that elapses between cycles is at pre-programmed intervals. This will continue indefinately until the pilot flame is sensed or until power to the system is interrupted.

When the thermostat has been satisfied, power is turned off to the ignition control and the combination gas control, so both the main gas and pilot gas are turned off. The fan will continue to operate for 45 to 75 seconds to allow the heat exchanger to cool down. Finally, the power exhauster motor will turn off 1 - 2 minutes after the thermostat is satisfied. This allows the products of combustion to be cleared from the unit and the vent. This occurs for all control options.

For Standing Pilot

Upon a call for heat from the thermostat, power is supplied to the combination gas control and at the same time power is supplied to the time delay relay. The main burner should light immediately. The fan motor will start in 15 - 45 seconds.

When the thermostat has been satisfied, power is turned off to the combination gas control and the time delay relay. The main burner will go out but the pilot will continue to burn. The fan motor will continue to operate for 45 - 75 seconds to allow the heat exchanger to cool down.

For Two-Stage Control Systems

The thermostat will start the unit with the combination gas control in the first stage (50% of normal input). If the thermostat senses a further drop in temperature the second stage (100% of normal input) of the combination gas control will be energized. When the thermostat senses an increase in temperature the combination gas control will be returned to the first stage operation.

For Mechanical Modulation Systems

When power is turned on the pilot is automatically lit and the power exhauster is energized after a short delay. When the sensing bulb attached to the combination gas control senses a drop in temperature the valve will open at 50% of normal input. If the temperature drops further the valve will open further. As the temperature rises the valve will return to 50% of normal input. If the temperature rises further the valve will close.The power exhauster will run until power is interrupted to the system.

PERFORMANCE DATA – HOODS

Performance Data – 30°, 60° and 90° Downward Deflector Hoods – Propeller Models

Mounting Height to Bottom of Heater	30 ° Downward Deflector Hood	PROPELLER MODELS ① (See Figures A and B)									
Model	PV 50	PV 75	PV 100	PV 125	PV 145	PV 175	PV 200	PV 250	PV 300	PV 350	PV 400
	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z
8'	6 14 19	10 24 32	9 22 31	14 30 41	18 38 52	13 28 39	17 36 49	23 48 65	20 42 57	23 48 65	24 50 68
10'	–	9 21 30	8 19 27	12 29 39	17 37 51	11 26 36	15 35 47	22 47 64	19 41 56	22 47 64	23 49 67
12'	–	6 17 24	5 13 19	11 26 36	16 36 49	10 24 33	14 33 45	21 46 63	18 40 54	21 46 62	22 48 65
14'	–	–	–	9 23 32	14 34 47	7 19 27	13 31 42	20 44 61	16 38 52	20 44 61	21 47 64
16'	–	–	–	–	12 31 43	–	10 27 38	18 42 58	15 36 49	18 42 58	19 45 62
18'	–	–	–	–	–	–	7 20 29	17 40 56	13 33 45	16 40 55	18 43 59
20'	–	–	–	–	–	–	–	15 37 52	10 27 38	15 37 51	16 40 55
22'	–	–	–	–	–	–	–	12 32 45	–	12 32 45	14 36 51
24'	–	–	–	–	–	–	–	–	–	–	9 27 39

Mounting Height to Bottom of Heater	60° Downward Deflector Hood	PROPELLER MODELS ① (See Figures A and B)									
Model	PV 50	PV 75	PV 100	PV 125	PV 145	PV 175	PV 200	PV 250	PV 300	PV 350	PV 400
	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z
8'	0 13 18	0 24 33	0 22 30	0 32 43	0 41 56	0 30 40	0 38 52	0 51 70	0 45 61	0 51 69	0 53 73
10'	–	0 21 29	0 18 25	0 29 40	0 39 54	0 27 37	0 36 49	0 50 68	0 43 59	0 49 68	0 52 71
12'	–	0 15 21	0 9 13	0 26 36	0 37 51	0 23 32	0 34 46	0 48 66	0 41 57	0 48 65	0 50 69
14'	–	–	–	0 21 29	0 34 47	0 16 23	0 30 41	0 46 63	0 39 53	0 46 62	0 48 66
16'	–	–	–	0 15 22	0 30 41	–	0 25 35	0 43 59	0 35 49	0 43 59	0 46 63
18'	–	–	–	–	0 24 33	–	0 14 19	0 40 55	0 31 42	0 40 54	0 43 59
20'	–	–	–	–	–	–	–	0 35 49	0 23 32	0 35 48	0 39 53
22'	–	–	–	–	–	–	–	0 28 39	0 16 23	0 28 39	0 33 46
24'	–	–	–	–	–	–	–	–	–	0 21 30	0 22 31

Mounting Height to Bottom of Heater	90° Downward Deflector Hood	PROPELLER MODELS (See Figures C and D)									
Model	PV 50	PV 75	PV 100	PV 125	PV 145	PV 175	PV 200	PV 250	PV 300	PV 350	PV 400
	S	S	S	S	S	S	S	S	S	S	S
8'	14	23	23	34	46	32	44	65	57	68	74
10'	12	21	20	30	42	29	39	58	51	60	66
12'	11	19	19	27	38	26	36	53	47	55	60
14'	–	17	17	25	35	25	33	50	43	51	56
16'	–	16	16	23	33	23	31	46	41	48	52
18'	–	–	–	22	31	22	29	44	38	45	49
20'	–	–	–	21	29	21	28	41	36	43	47
22'	–	–	–	–	–	–	27	40	35	41	45
24'	–	–	–	–	–	–	25	38	33	39	43
26'	–	–	–	–	–	–	–	36	32	38	41
28'	–	–	–	–	–	–	–	35	31	36	40
30'	–	–	–	–	–	–	–	34	30	35	38
32'	–	–	–	–	–	–	–	–	–	34	37
34'	–	–	–	–	–	–	–	–	–	–	36

① Data Based on units fired at full rated input with an entering air temperature of 60°-80°F. Maximum mounting heights higher versus units without outlet devices.

Figure A

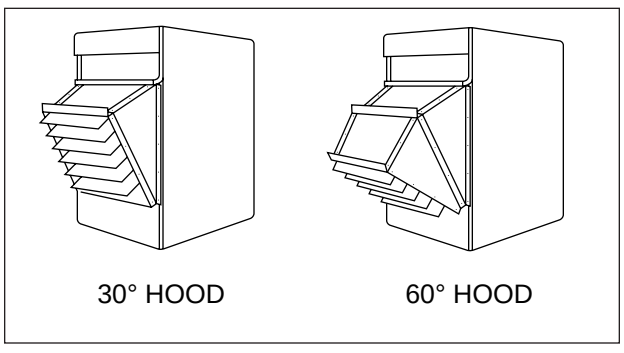
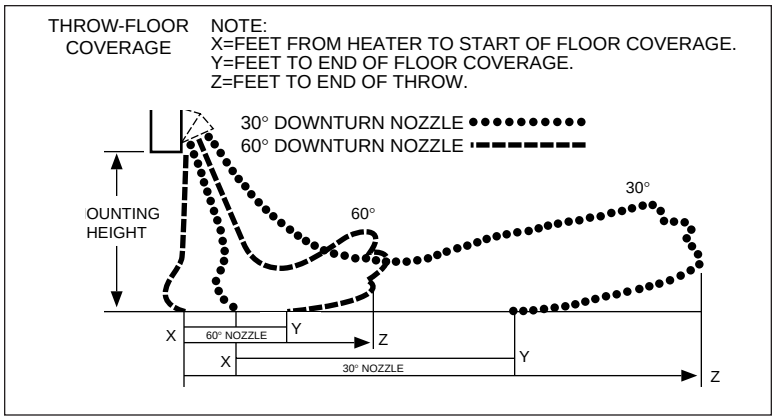


Figure B



PERFORMANCE DATA – HOODS

Performance Data – 30°, 60° and 90° Downward Deflector Hoods – Blower Models

Mounting Height to Bottom of Heater	30 ° Downward Deflector Hood	BLOWER MODELS ② (See Figures A and B)									
Model	BV 50	BV 75	BV 100	BV 125	BV 145	BV 175	BV 200	BV 250	BV 300	BV 350	BV 400
	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z
8'	11 24 33	16 35 48	16 35 48	21 44 60	23 46 63	21 43 59	25 50 69	29 58 79	30 61 83	36 71 97	36 71 97
10'	9 22 30	15 34 46	15 34 46	20 43 59	21 46 62	20 42 58	24 50 68	28 57 78	29 60 82	35 71 96	35 70 96
12'	7 18 25	14 32 44	14 32 44	19 42 57	20 44 60	18 41 56	22 49 66	26 56 77	28 59 81	34 70 95	34 70 95
14'	–	12 29 41	12 29 41	17 40 55	19 43 59	17 39 54	21 47 65	25 55 75	27 58 80	33 69 94	33 69 94
16'	–	10 26 36	10 26 36	16 38 52	17 41 56	16 37 51	20 45 62	24 54 74	26 57 78	32 68 93	31 68 93
18'	–	–	–	14 35 49	16 38 53	14 34 48	18 43 60	23 52 71	24 56 76	30 67 92	30 67 91
20'	–	–	–	12 31 43	14 35 49	11 30 42	16 41 56	21 50 69	23 54 74	29 65 90	29 65 89
22'	–	–	–	–	–	–	14 37 52	18 48 66	21 51 71	28 64 88	27 63 87
24'	–	–	–	–	–	–	10 29 42	17 44 62	20 49 68	26 62 85	26 61 85
26'	–	–	–	–	–	–	–	15 40 56	17 45 63	25 59 82	24 59 82
28'	–	–	–	–	–	–	–	11 32 46	14 39 56	23 57 79	23 56 78
30'	–	–	–	–	–	–	–	–	–	21 53 74	20 52 74
32'	–	–	–	–	–	–	–	–	–	18 48 68	18 47 67

Mounting Height to Bottom of Heater	60° Downward Deflector Hood	BLOWER MODELS ② (See Figures A and B)									
Model	BV 50	BV 75	BV 100	BV 125	BV 145	BV 175	BV 200	BV 250	BV 300	BV 350	BV 400
	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z	X Y Z
8'	0 25 34	0 37 50	0 37 50	0 47 64	0 49 67	0 46 63	0 54 73	0 62 85	0 65 89	0 77 105	0 76 104
10'	0 22 30	0 35 48	0 35 48	0 45 62	0 48 66	0 45 61	0 53 72	0 61 83	0 64 88	0 76 103	0 75 103
12'	0 16 22	0 32 44	0 32 44	0 43 59	0 46 63	0 43 59	0 51 70	0 59 81	0 63 86	0 75 102	0 74 101
14'	–	0 29 40	0 29 40	0 41 56	0 44 60	0 40 55	0 49 67	0 58 79	0 61 84	0 73 100	0 73 100
16'	–	0 23 32	0 23 32	0 38 52	0 41 57	0 37 51	0 47 64	0 56 76	0 60 81	0 72 98	0 71 98
18'	–	–	–	0 34 47	0 38 52	0 33 45	0 43 60	0 53 73	0 57 78	0 70 96	0 70 95
20'	–	–	–	0 28 38	0 33 45	0 26 37	0 40 54	0 50 69	0 55 75	0 68 93	0 67 92
22'	–	–	–	–	0 24 34	–	0 34 47	0 47 64	0 51 71	0 65 90	0 65 89
24'	–	–	–	–	–	–	0 25 35	0 42 58	0 47 65	0 63 86	0 62 85
26'	–	–	–	–	–	–	–	0 36 50	0 42 58	0 59 81	0 59 81
28'	–	–	–	–	–	–	–	0 23 33	0 34 58	0 55 76	0 55 75
30'	–	–	–	–	–	–	–	–	–	0 50 69	0 49 68
32'	–	–	–	–	–	–	–	–	–	0 43 60	0 42 59
34'	–	–	–	–	–	–	–	–	–	0 30 43	0 26 38

Mounting Height to Bottom of Heater	90° Downward Deflector Hood	BLOWER MODELS ② (See Figures C and D)									
Model	BV 50	BV 75	BV 100	BV 125	BV 145	BV 175	BV 200	BV 250	BV 300	BV 350	BV 400
	S	S	S	S	S	S	S	S	S	S	S
8'	24	38	41	55	60	58	71	86	96	121	124
10'	22	34	36	50	54	52	64	77	86	109	111
12'	20	31	33	45	49	47	58	71	79	99	101
14'	18	29	31	42	45	44	54	65	73	92	94
16'	17	27	29	39	42	41	50	61	68	86	88
18'	–	25	27	37	40	39	47	58	64	81	83
20'	–	24	26	35	38	37	45	55	61	77	78
22'	–	23	25	34	36	35	43	52	58	73	75
24'	–	–	–	32	35	33	41	50	56	70	72
26'	–	–	–	31	33	32	40	48	54	68	69
28'	–	–	–	30	32	31	38	46	52	65	66
30'	–	–	–	–	31	30	37	45	50	63	64
32'	–	–	–	–	–	–	36	43	48	61	62
34'	–	–	–	–	–	–	35	42	47	59	60

② Data Based on unit fired at full rated input, 60°-80°F entering air temperature, and a 40°F temperature rise through unit. Maximum mounting heights higher versus units without outlet devises.

Figure C

90° HOOD

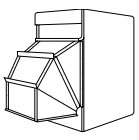
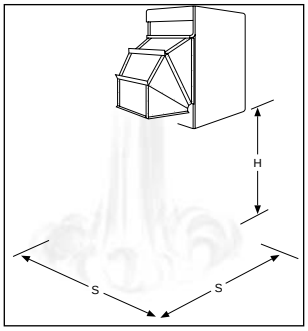


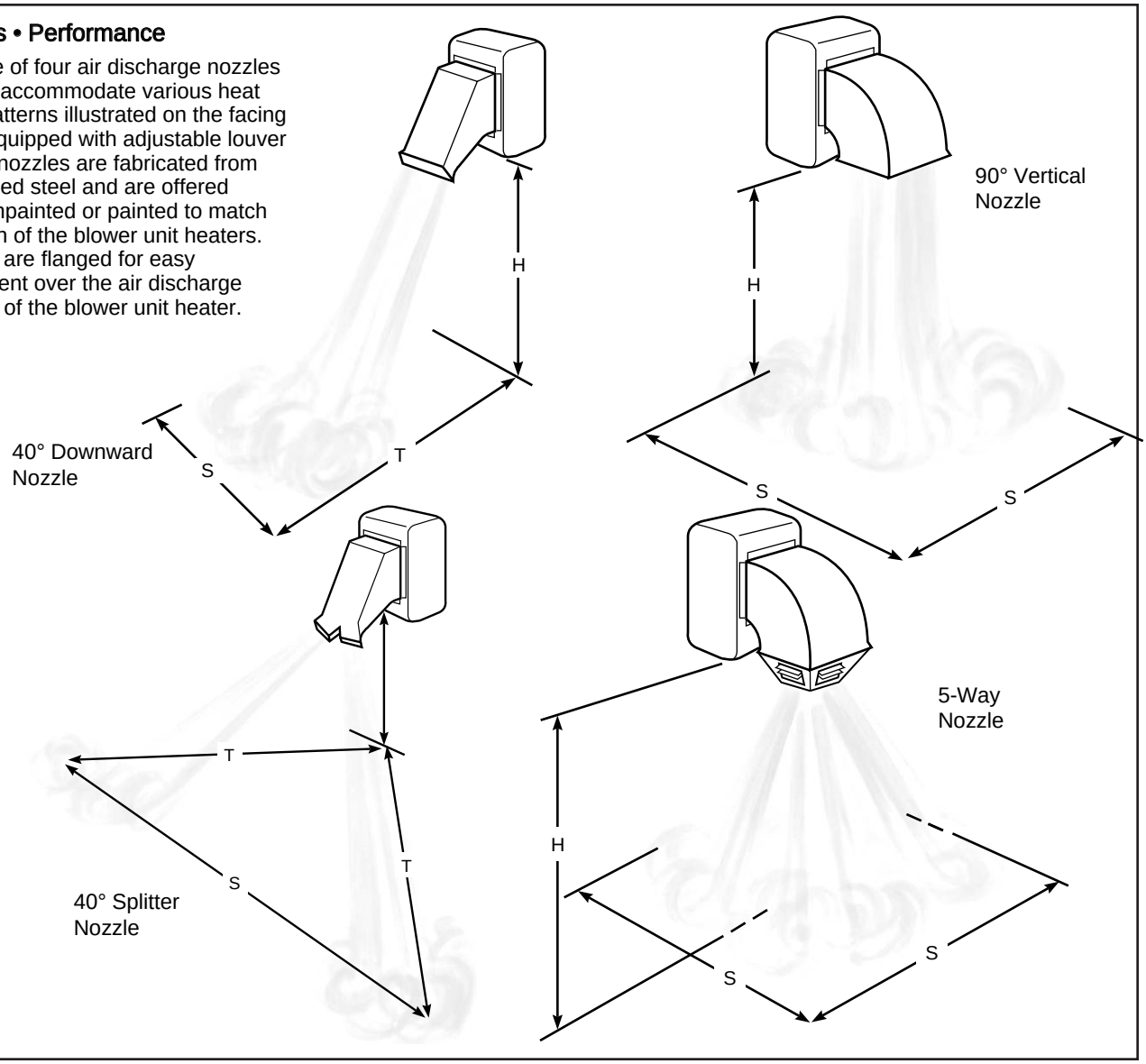
Figure D



PERFORMANCE DATA – NOZZLES

Nozzles • Performance

A choice of four air discharge nozzles (above) accommodate various heat throw patterns illustrated on the facing page. Equipped with adjustable louver blades, nozzles are fabricated from galvanized steel and are offered either unpainted or painted to match the finish of the blower unit heaters. Nozzles are flanged for easy attachment over the air discharge opening of the blower unit heater.

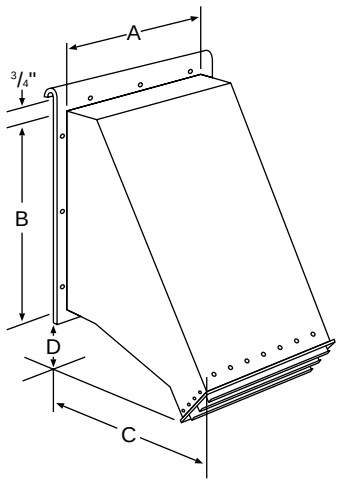


Nozzle Performance Mounting Height, Heat Throw, Heat Spread (in feet)

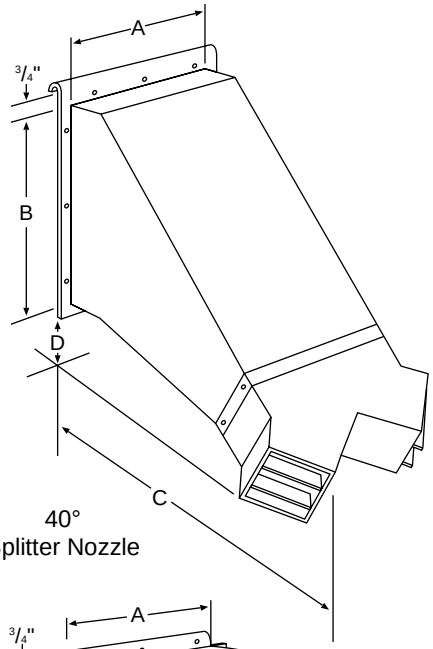
Nozzle Type		Model Number										
		BV 50	BV 75	BV 100	BV 125	BV 145	BV 175	BV 200	BV 250	BV 300	BV 350	BV 400
40° Downward Nozzle	Max. Mounting Ht. (ft.) H	14	16	18	22	21	24	27	26	28	32	32
	Heat Throw (ft.) T	41	49	54	66	63	72	81	78	83	96	96
	Heat Spread (ft.) S	14	16	18	22	21	24	27	26	28	32	32
90° Vertical Nozzle	Max. Mounting Ht. (ft.) H	15	17	18	22	22	21	24	26	28	32	32
	Heat Spread (ft.) S	15	17	18	22	22	21	24	26	28	32	32
40° Splitter Nozzle	Max. Mounting Ht. (ft.) H	–	–	16	20	20	21	24	23	26	30	32
	Heat Throw (ft.) T	–	–	41	50	49	52	59	58	65	75	80
	Heat Spread (ft.) S	–	–	81	100	97	104	117	116	129	151	160
5-Way Nozzle	Max. Mounting Ht. (ft.) H	12	14	15	18	17	18	20	21	20	23	26
	Heat Spread (ft.) S	17	20	21	26	24	25	28	30	27	32	37

The above table is based on an inlet air temperature of 70°F and an air temperature rise of 55°F. Air deflectors on, 40° and 90° discharge nozzles set perpendicular to the face of the air discharge opening. On 5-way nozzles all air deflectors set perpendicular to floor. Static pressure measured at 0.1" W.C. for 90° nozzle, 0.2" W.C. for 40° downward and 5-way nozzle, and 0.3" W.C. for 40° splitter nozzle. Outlet velocities are approximately 1750 FPM for the 40° nozzles, 1000 FPM for the 90° nozzle and 1300 FPM for 5-way. For motor size, drive and blower rpm refer to pages 18 and 19. Mounting height measured from bottom of unit.

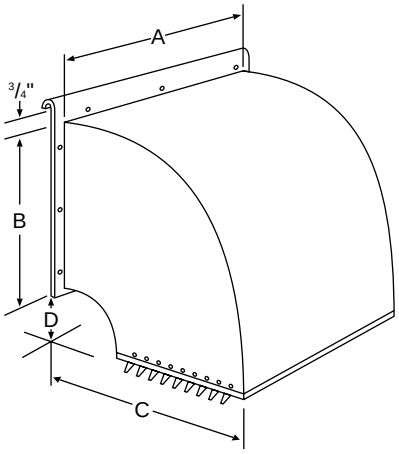
DIMENSIONAL DATA – NOZZLES



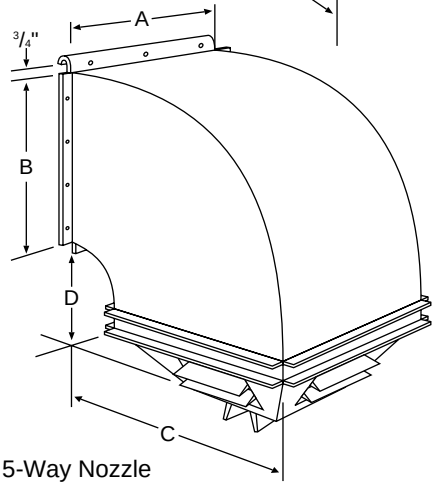
40°
Downward Nozzle



40°
Splitter Nozzle



90°
Vertical Nozzle

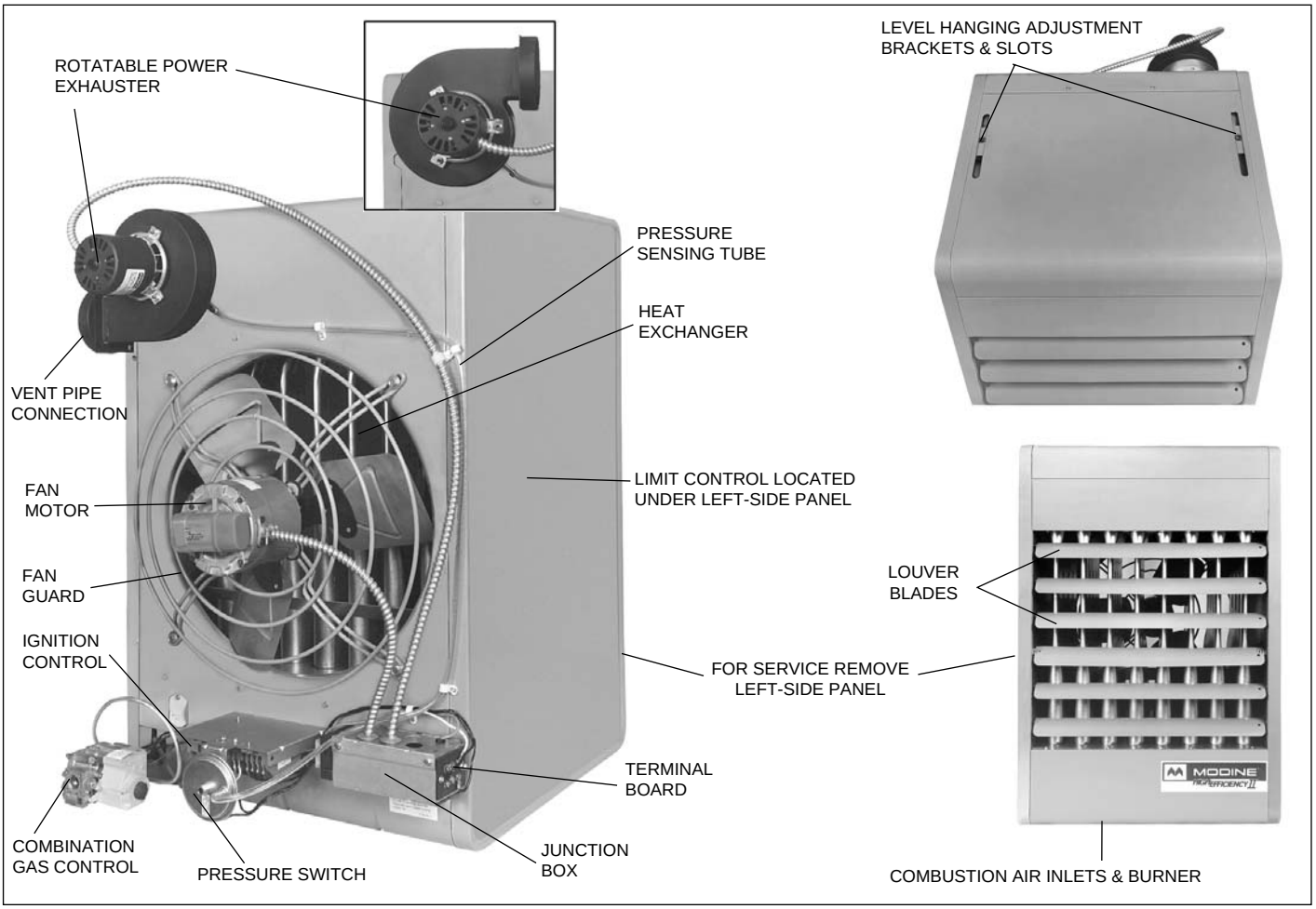


5-Way Nozzle

Dimensions (in inches)

Nozzle Type	Dimension Symbol	Model Number										
		BV 50	BV 75	BV 100	BV 125	BV 145	BV 175	BV 200	BV 250	BV 300	BV 350	BV 400
40° Downward Nozzle	A	14 13/16	16 13/16	18 9/16	18 9/16	21 1/16	23 3/16	23 3/16	26 3/16	31 1/8	31 1/8	37 1/2
	B	16	16	20	20	20	24	24	24	24	24	24
	C	24	22	26	26	25	30	30	30	36	36	36
	D	4	3	4	4	4	4	4	6	11	11	11
90° Vertical Nozzle	A	14 13/16	16 13/16	18 9/16	18 9/16	21 1/16	23 3/16	23 3/16	26 3/16	31 1/8	31 1/8	37 1/2
	B	16	16	20	20	20	24	24	24	24	24	24
	C	15	17	22	22	23	29	29	30	34	34	34
	D	6	6	8	8	8	10	10	10	14	14	14
40° Splitter Nozzle	A	–	–	18 9/16	18 9/16	21 1/16	23 3/16	23 3/16	26 3/16	31 1/8	31 1/8	37 1/2
	B	–	–	20	20	20	24	24	24	24	24	24
	C	–	–	34	34	33	39	39	40	46	46	47
	D	–	–	10	10	11	12	12	14	19	19	20
5-Way Nozzle	A	14 13/16	16 13/16	18 9/16	18 9/16	21	23 3/16	23 3/16	26 3/16	31 1/8	31 1/8	37 1/2
	B	16	16	20	20	20	24	24	24	24	24	24
	C	20 3/4	22 3/4	24 1/2	24 1/2	27	29	29	32	37	37	43 1/2
	D	11	12	13	13	14	15	15	16	18	18	18

Figure 13
Service, Safety and Other Major Unit Heater Components



Limit Control (Overheat Switch)

The limit control, mounted on the left inner side panel (when facing front of unit), will shut off the gas supply to the main burner in the event of overheating. It is a single pole, single throw switch. The contacts open to shut the electric gas valve off in the event the unit should overheat. This limit control should operate only when something is seriously wrong with the unit. Anytime this control operates, correct the difficulty immediately or serious damage may result. If the limit control cuts off the gas supply during normal operation:

1. Make certain the deflector blades are open and that there are not any obstructions in the air inlet or discharge outlet.
2. Check actual input to unit against rated input.
3. Check to be sure motor is operating.
4. On propeller units, check that fan is not loose on motor shaft. On blower units, check belt and sheave for tightness or damage.
5. On propeller units, check fan speed against speed on motor nameplate. On blower units, check blower speed against Performance Data on pages 16 or 17, check for restriction in ducts and for dirty filters.
6. Check to make sure the venting system is not damaged or blocked. Also check to be sure unit is venting normally and that there is not negative pressure in the building adversely affecting draft.
7. Clean heat exchanger tubes inside and out if necessary.
8. If items 1-7 do not solve the problem, check limit control and replace if necessary. The control is accessible by removing the left outer side panel, held in place by screws at the rear of the unit.

IMPORTANT NOTE:

The limit control (overheat switch) on this unit heater will shut off the gas should excessive discharge temperatures occur. Do not attempt to control the fan with the limit control. Any change in wiring to attempt to control the fan with the limit control will result in hazardous conditions and void the warranty.

SERVICE INSTRUCTIONS – GENERAL

General Maintenance

The unit and venting system must be checked once a year by a qualified service technician.

Only people trained and familiar with the operation of unit heaters and their controls should service this equipment.

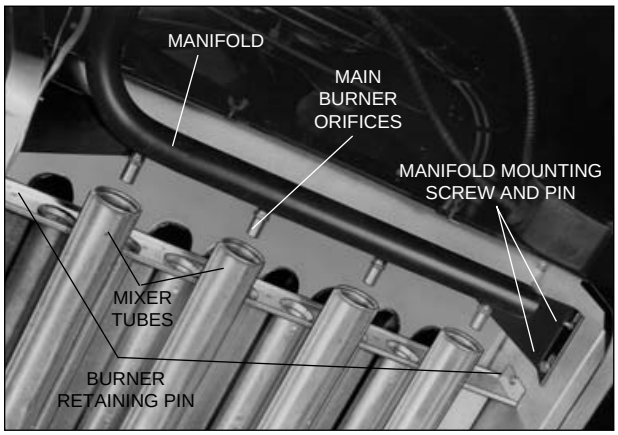
1. Service air moving components annually.
   a. On propeller units this includes checking motors for lubrication if motors are not the permanently lubricated type and check fan for fit on motor shaft and for damage to blades.
   b. On blower units this should include:
      (1) Checking motor and blower bearings for lubrication.
      (2) Checking belt and sheave for proper alignment and adjustment.
      (3) Checking cleanliness of blower wheel and filters.
2. Keep unit free from dust, dirt, grease, and foreign matter, paying particular attention to:
   a. Combustion air inlets.
   b. Burner ports, pilot burner, and main burner orifices (avoid use of hard, sharp instruments capable of damaging surfaces, for cleaning these ports.) If air pressure is available, use air hose to blow out dirt and other foreign matter from within the burner. Also main burner orifices should be checked for blockage due to spider webs, etc.
   c. Primary air shutters (when used).
   d. Clean heat exchanger tubes from bottom with stiff brush after removing burner (Do not use wire brush).
   e. Bottom pan.
   f. Fan blade.
3. Check wiring for possible loose connections.
4. Where gas contains considerable impurities, occasional cleaning of automatic gas valves is required.
5. Controls – See control instruction sheets furnished separately with the unit heater.
6. Power exhauster assembly – The power exhauster motor bearings have been lubricated for long life and do not require additional lubrication. In dirty atmosphere, it may be desirable to clean the motor and blower housing and blow out the cooling air passages of the motor with compressed air.

To Remove Burner

1. Turn off all electricity and gas to unit.
2. Lower bottom pan to expose burner and manifold. See Figure 2, Page 2.
3. Disconnect pilot supply line and pilot ignition leads to the controls.
4. Remove the two burner retaining pins holding the burner in place. The burner can then be easily lowered from the unit. In replacing the burner, be certain that the slots at the front of the burner are located properly on their shoulder rivets and that the burner retaining pins are put back into their proper locations.

TROUBLESHOOTING GUIDE

Figure 17
Manifold Adjustment, Natural Gas



Combustion Symptoms and Diagnosis

To realize full gas heating value requires periodic inspections with proper combustion control corrections as outlined and illustrated here.

1. Lifting Flames

Lifting flames rise unevenly above the burner port and may occur on few or all the ports. Sometimes the flames drop and lift intermittently. Lifting can be eliminated by reducing primary air. If flame cannot be adjusted properly, check input rate to heater and manifold gas pressure; reduce if necessary. Check the orifice size with those listed in Table 5a to be sure the unit is not operating over rated input.

Figure 19
Air Shutter Adjustment, Propane Gas

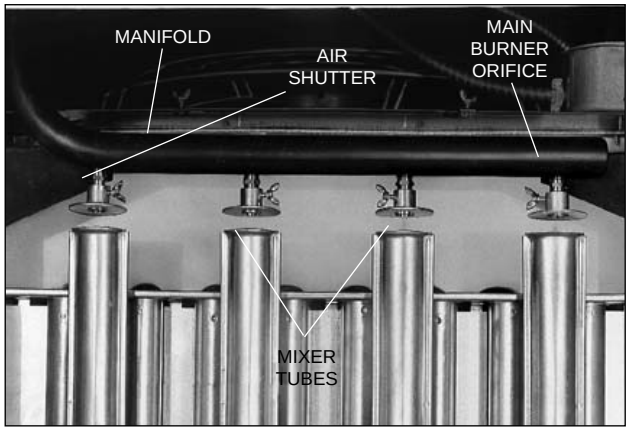
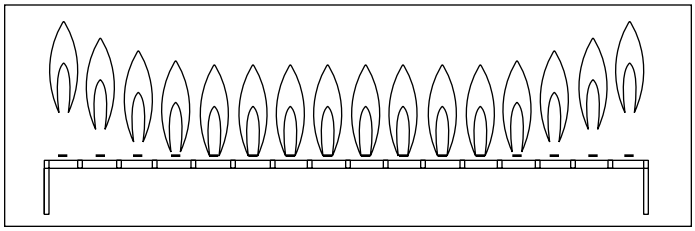


Figure 18
Lifting Flame Condition



2. Yellow Tipping

Yellow tipping of a normally blue flame is caused by insufficient primary air, and indicates incomplete combustion producing carbon monoxide, aldehydes, and free carbon (soot). A dirty orifice or one that is out of line, can also reduce primary air and cause yellow tipping. Check orifice, clean, realign, or replace if necessary. With propane gas, some yellow tipping is always present, but is not objectionable.

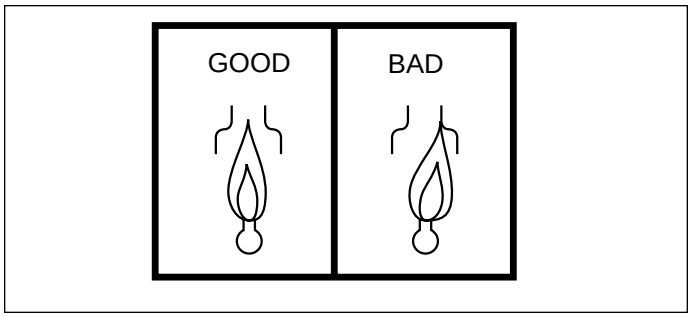
3. Flashback

Flashback occurs when air-gas mixture ignites inside the burner to burn near the orifice. Flashback on ignition or during burner operation usually can be eliminated by reducing primary air. The burner may also be operating below its rated capacity. Check input rate and adjust to correct value by increasing orifice size or manifold gas pressure.

4. Wavering Flames

Drafts across burners may cause flames to waver or appear unstable. Wavering flames can lead to incomplete combustion if flames impinge on cool surfaces. Wavering can be caused by air drafts into the burner compartment or by misalignment of the burner. Draft-blown flames may indicate a cracked heat exchanger.

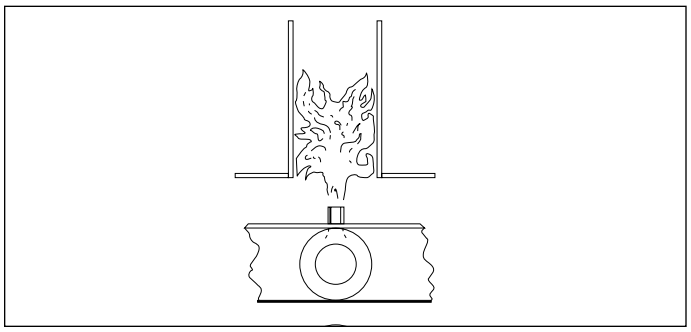
Figure 20
Wavering Flame or Misalignment



5. Floating Flames

Floating flames are long – do not have well-defined cones, roll around in the combustion chamber, sometimes completely off the ports. Usually an aldehyde odor is present to indicate incomplete combustion. If combustion air supply is reduced too far, burner flames will float. Often the pilot flame near the port smothers and goes out. Lack of combustion air causes burner flames to float. The unit may be overfired so its flue outlet area may be too small for the increased firing rate. Check input rate and reduce if necessary. Soot or dust may be blocking the flue. Check flue and clear any blockage. Adjust primary air to get rid of yellow tipping that may produce soot to block flueways. Make sure combustion air inlets are not blocked.

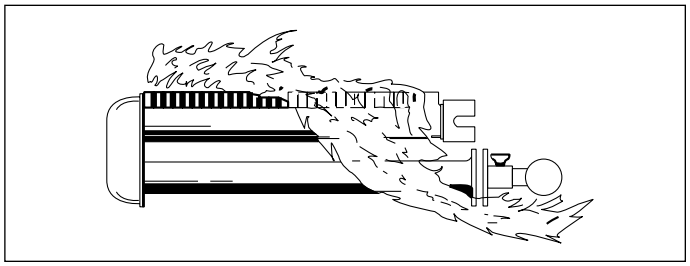
Figure 21
Floating Flame condition



6. Flame Rollout

Flames rolling out of the combustion air inlets when the burner is turned on can create a fire hazard, scorch unit finish, burn wires, or damage controls. Gas in the burner mixer may be ignited, producing flashback. Flame rollout is a variation of floating flames, with flames reaching for air outside the combustion chamber. Basic cause is lack of combustion air that may be due to overfiring, poor venting, or flue blockage.

Figure 22
Flame Rollout Appearance



INTERMITTENT PILOT SYMPTOMS AND DIAGNOSIS

1. Pilot will not light or stay lit:

POSSIBLE CAUSE	POSSIBLE REMEDY
1a No spark at ignitor.	1a. Check connections. Check for proper spark gap, cracked or broken electrode ceramic, blown controller fuse or brittle, cracked or loose high tension cable. Check power exhauster pressure switch. Replace if defective.
1b. Dirty or defective flame sensor or loose connections to flame sensor.	1b. Check milli-ampls of sensor. Clean sensor with steel wool. Tighten loose connections. Replace flame sensor if necessary.
1c. Pilot valve electrical connections loose.	1c. Tighten connections.
1d. Defective pilot valve.	1d. Replace.
1e. Poor ground connections.	1e. Check grounding means.
1f. No power from control transformer.	1f. Check transformer voltage on secondary side for 25v.
1g. Spark not located in pilot gas stream.	1g. Correct or replace pilot.
1h. Dirty or plugged pilot orifice.	1h. Clean or replace.
1i. Pilot line kinked or obstructed.	1i. Correct or replace pilot line.
1j. Pilot flame too low.	1j. Check pilot flame and adjust per valve manu-facturer's recommendations.
1k. Flame sensor out of position.	1k. Reposition.
1l. Defective ignition controller.	1l. Replace.

⚠ CAUTION

Do not attempt to reuse ignition controllers which have been wet. Replace defective controller.

TROUBLESHOOTING GUIDE

2. Pilot lights, main burner will not light:

POSSIBLE CAUSE	POSSIBLE REMEDY
2a. Gas valve in off position.	2a. Turn to on position.
2b. System in lock-out mode.	2b. Reset system.
2c. Cracked or broken sensor ceramic.	2c. Replace sensor.
2d. Defective or loose connections to flame sensor or flame sensor lead.	2d. Correct or replace.
2e. Incorrect gas pressure.	2e. Check and adjust if necessary to manufacturer's recommendations.
2f. Insufficient current signal from flame sensor.	2f. Check current according to manufacturer's recommendations and replace if necessary.
2g. Incorrect or loose wiring.	2g. Check wiring.
2h. Poor ground to ignition controller.	2h. Check grounding means.
2i. No power to ignition controller or gas valve	2i. Check voltage to controller and gas valve.
2j. Loose limit control connections or defective limit.	2j. Check connections. Replace limit control if necessary.
2k. Defective or plugged gas valve regulator.	2k. Inspect gas valve regulator. Replace if necessary.
2l. Defective thermostat or thermostat out of calibration.	2l. Calibrate thermostat or replace if necessary.
2m. Thermostat heat anticipator incorrectly set.	2m. Check anticipator setting and correct if necessary.
2n. Defective ignition controller.	2n. Replace.

3. Burner shuts down before thermostat is satisfied:

POSSIBLE CAUSE	POSSIBLE REMEDY
3a. Flame sensing circuit failure.	3a. Check flame sensing rod, ceramic sensor, sensor lead and connections for damage or loss of continuity; Replace defective elements.
3b. Soot on sensing rod.	3b. Clean off soot with steel wool and adjust pilot to smaller size.
3c. Blockage in heat exchanger.	3c. Clean heat exchanger. Determine cause and correct.
3d. Blockage in main burner orifice.	3d. Clean or replace orifice.

4. Burner fails to shut off after thermostat is satisfied:

POSSIBLE CAUSE	POSSIBLE REMEDY
4a. Faulty thermostat or improper heat anticipator setting.	4a. Check thermostat and anticipator setting. Replace if defective.
4b. Defective ignition controller.	4b. Replace
4c. Defective gas control.	4c. Replace.

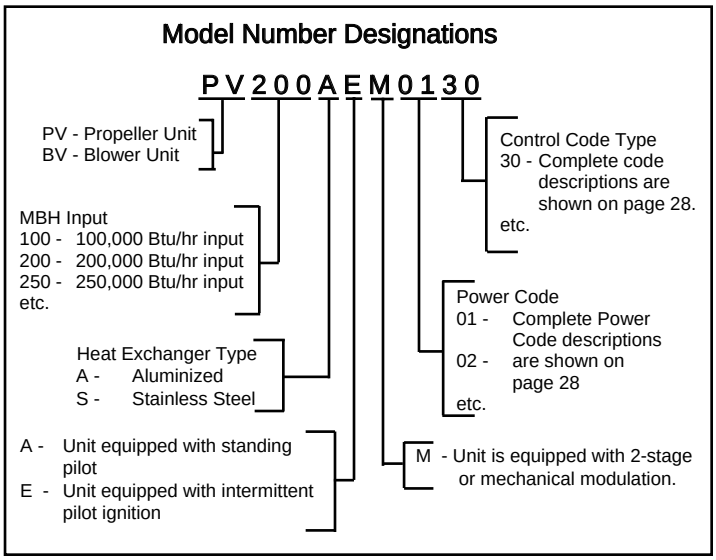
FOR SERVICE

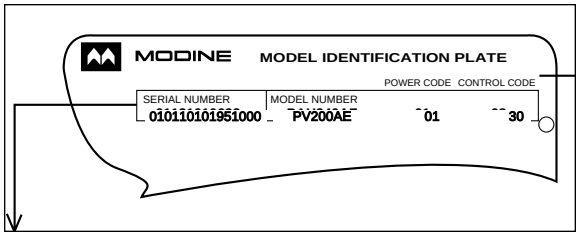
If a qualified service person cannot solve the problem, consult your local gas company or local Modine representative.

When servicing, repairing or replacing parts on these units always give the complete Model Number (which includes power code/control code) and Serial Number from the unit rating plate.

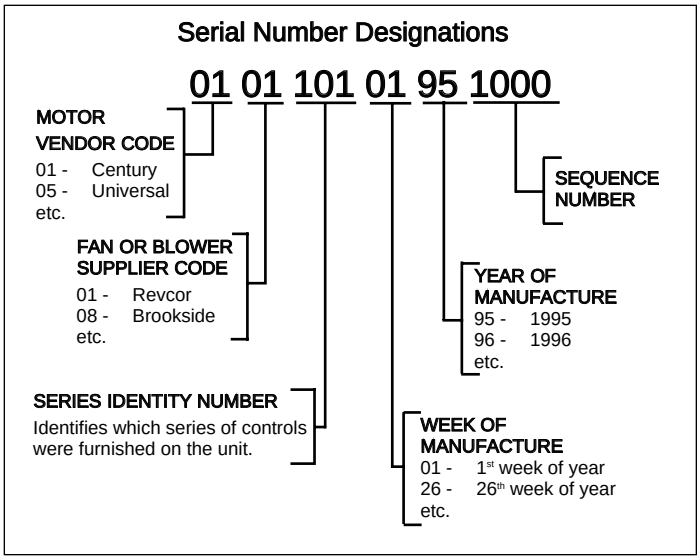
The samples below show where these numbers can be found.

Model Number Designations





Serial Number Designations



Warranty

Seller warrants its products to be free from defects in material and workmanship, EXCLUSIVE, HOWEVER, of failures attributable to the use of materials substituted under emergency conditions for materials normally employed. This warranty covers replacement of any parts furnished from the factory of Seller, but does not cover labor of any kind and materials not furnished by Seller, or any charges for any such labor or materials, whether such labor, materials or charges thereon are due to replacement of parts, adjustments, repairs, or any other work done. This warranty does not apply to any equipment which shall have been repaired or altered outside the factory of Seller in any way so as, in the judgment of Seller, to affect its stability, nor which has been subjected to misuse, negligence, or operating conditions in excess of those for which such equipment was designed. This warranty does not cover the effects of physical or chemical properties of water or steam or other liquids or gases used in the equipment.

BUYER AGREES THAT SELLER'S WARRANTY OF ITS PRODUCTS TO BE FREE FROM DEFECT IN MATERIAL AND WORKMANSHIP, AS LIMITED HEREIN, SHALL BE IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, WHETHER ARISING FROM LAW, COURSE OF DEALING, USAGE OF TRADE, OR OTHERWISE, **THERE ARE NO OTHER WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, WHICH EXTEND BEYOND THE PRODUCT DESCRIPTION CONFIRMED BY BUYER AND SELLER AS OF THE DATE OF FINAL AGREEMENT.**

This warranty is void if the input to the product exceeds the rated input as indicated on the product serial plate by more than 5% on gas-fired and oil-fired units, or if the product in the judgment of SELLER has been installed in a corrosive atmosphere, or subjected to corrosive fluids or gases, been subjected to misuse, negligence, accident, excessive thermal shock, excessive humidity, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to SELLER'S printed instructions, or if the serial number has been altered, defaced or removed.

Heat Exchangers

For Seller's non-separated combustion gas-fired unit heaters and packaged rooftop units

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN ONE HUNDRED TWENTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. FOR GAS-FIRED PRODUCTS INSTALLED IN HIGH HUMIDITY APPLICATIONS AND UTILIZING STAINLESS STEEL HEAT EXCHANGERS, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO TEN YEARS FROM DATE OF SHIPMENT FROM SELLER.

For Seller's Low Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER WHICH SHALL, WITHIN FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 66 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

Heat Exchanger (Condensers) for all Seller's products except non-separated combustion gas-fired unit heaters and infrared heaters, and Burners and Sheet Metal for all products.

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY HEAT EXCHANGER (CONDENSER) OR BURNER WHICH SHALL, WITHIN ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN EIGHTEEN MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

All Other Components Excluding Heat Exchanger (Condenser), Burner, and Sheet Metal

All Seller Heating Products except St. Paul Produced products, Packaged Rooftop Units, and High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY PART OR PARTS WHICH SHALL, WITHIN TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER.

St. Paul Produced Products, Packaged Rooftop Units, and High Intensity Gas-Fired Infrared Heaters

BUYER'S REMEDY FOR BREACH OF WARRANTY EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW IS LIMITED TO REPAIR OR REPLACEMENT AT THE SELLER'S OPTION ANY PART OR PARTS WHICH SHALL WITHIN A PERIOD OF ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN 18 MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF THE SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE.

BUYER AGREES THAT IN NO EVENT WILL SELLER BE LIABLE FOR COSTS OF PROCESSING, LOST PROFITS, INJURY TO GOODWILL, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND RESULTING FROM THE ORDER OR USE OF ITS PRODUCT, WHETHER ARISING FROM BREACH OF WARRANTY, NONCONFORMITY TO ORDERED SPECIFICATIONS, DELAY IN DELIVERY, OR ANY LOSS SUSTAINED BY THE BUYER.

Cancellation – Inspection – Rejection

Orders for material or equipment are not cancelable, either in whole or part, nor is material returnable for credit.

Seller will replace any material or equipment not conforming to the product description as agreed upon by Buyer and Seller as of the data of shipment only if the Buyer notifies Seller, at the address on the Seller's INVOICE, of the particular details of non-conformance or defect of such material of equipment, by written or electronic notice, either before or immediately upon delivery, and only if such non-conforming material or equipment is returned, sold, or otherwise disposed of in accordance with instructions of Seller. Buyer agrees to inspect all of the ordered material or equipment either before or upon delivery and waives all his rights to reject or refuse to accept any non-conforming material or equipment unless notice is given to Seller in the aforesaid time and manner. Buyer may inspect the ordered material at Seller's plant in an area designated by Seller. Buyer agrees that the right of rejection of non-conforming material or equipment, as limited herein, and the right to replacement by Seller with material or equipment, as limited herein, and the right to replacement be Seller with material or equipment conforming to the ordered specifications, are exclusive of all other remedies provided by law. Written authorization must be issued by Seller before any material is returned to its plant.

Governing Law

It is agreed that the parties hereto intend that all questions as to validity, interpretation, and required performance arising out of this contract are to be governed by the laws of the State of Wisconsin (Uniform Commercial Code).

As Modine Manufacturing Company has a continous product improvement program, it reserves the right to change design and specifications without notice. These appliances are certified for non-residential applications.

MODINE

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