MODINE

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April, 2002

INSTALLATION AND SERVICE MANUAL
gas-fired unit heaters
models PD and BD

All models approved for use in California by the CEC (when equipped with IPI), in New York by the MEA division, and in Massachusetts. Unit heater is certified for non-residential applications.

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 throroughly before installing or servicing this equipment.

⚠ CAUTION

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.

IMPORTANT

The use of this manual is specifically intended for a qualified installation and service agency. A qualified installation and service agency must perform all installation and service of these appliances.

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.**

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.

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).

THIS MANUAL IS THE PROPERTY OF THE OWNER.
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

Heater Parts from ACF Greenhouses

INSTALLATION

SPECIAL PRECAUTIONS

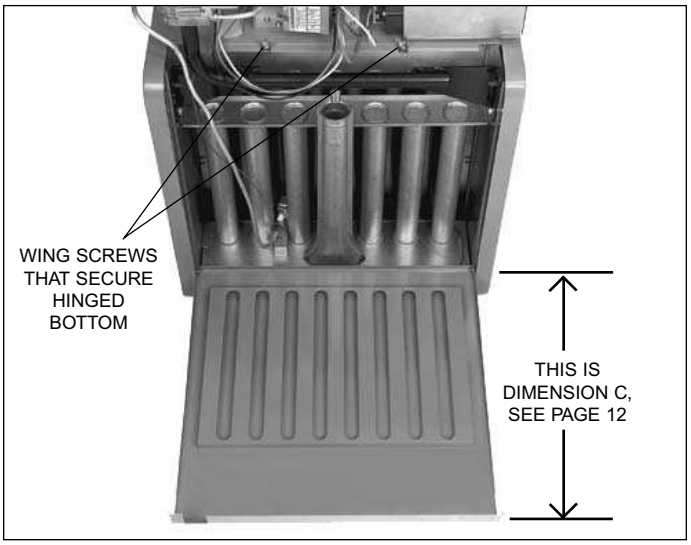
THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY 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 during any pressure testing of the gas supply piping system.
4. Check gas inlet pressure at unit upstream from the 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 span 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. For all sizes, minimum clearance to combustibles from the bottom is 12" and from the sides 18"; for PD sizes 30-50 from the top is 1" and from the flue collar 2"; for PD sizes 75-300 from the top is 2" and from the flue collar is 3"; for PD 350 from the top is 3" and from the flue collar is 4"; for PD 400 from the top is 4" and from the flue collar is 5"; and for all BD sizes from the top and flue collar 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 materials based on the combustible material surface not exceeding 160°F. Clearance from the top of the unit may be required to be greater than 6” 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 (PD) 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 No. 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. Gas-fired heating equipment which has been improperly vented, or which experiences a blocked vent condition may have the flue gases accidentally spilled into the heating space. See page 20 for specific information about the blocked vent safety switch supplied on the unit.
27. 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 Burner Service
*(See Dimension "C", page 12)



Heater Parts from ACF Greenhouses

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 C.S.A., with the controls furnished. For replacement parts, submit the complete model and serial numbers shown on rating plate on the unit. 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 atmosphere.

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 Table 7 on page 18. Alternate mounting heights for units with deflector hoods or nozzles are shown on pages 14,16 and 17. 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.

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.

⚠ CAUTION

For all sizes, minimum clearance to combustibles from the bottom is 12" and from the sides 18"; for PD sizes 30-50 from the top is 1" and from the flue collar 2"; for PD sizes 75-300 from the top is 2" and from the flue collar is 3"; for PD 350 from the top is 3" and from the flue collar is 4"; for PD 400 from the top is 4" and from the flue collar is 5"; and for all BD sizes from the top and flue collar is 6".
Allow at least 12" at the rear or 6" 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 at the hinged bottom for servicing - See Figure 1.

On all propeller units, except the PD 350 and PD 400, two tapped holes (3/8-16) are located in the top of the unit to receive threaded rods.

Units with two point suspension, models PD30 through PD300, 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.

PD30 through PD300 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.

Heater Parts from ACF Greenhouses

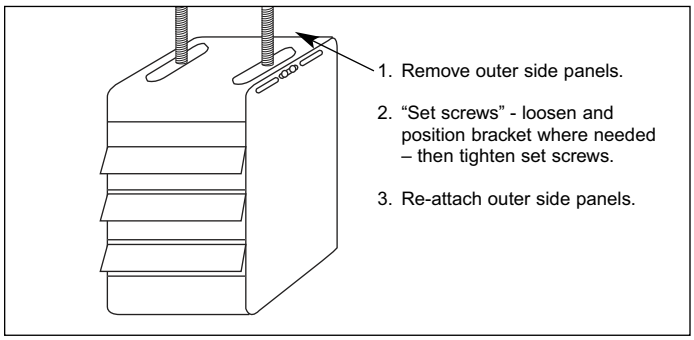
INSTALLATION

The PD 350 and PD 400 have four mounting holes. On all blower units, except the PD 350 and PD 400, two tapped holes are provided in the top of the unit and two holes in the blower support bracket. The PD 350 and PD 400 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.

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

Figure 2
Adjustable Mounting Brackets - To Adjust:



1. Remove outer side panels.
2. "Set screws" - loosen and position bracket where needed – then tighten set screws.
3. Re-attach outer side panels.

⚠ CAUTION

Gas Unit Heaters must be vented – do not operate unvented. A built-in draft hood (diverter) is provided – additional external draft hoods (diverters) are not required or permitted. Gas-fired heating equipment that has been improperly vented or which experiences a blocked vent condition may have flue gases accidentally spilled into the heated space. See page 20 for specific information about the blocked vent safety switch supplied on the unit.

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 CAN/CGA-B149.1 for natural gas units, and CAN/CGA-B149.2 for propane units.

Venting Instructions

1. All units with single-stage controls are Category I.
2. All units with two-stage or modulating controls are Category II. The installation of a Category II unit must conform to the requirements from Table 1 in addition to those listed below.
3. Select size of vent pipe to fit vent pipe connection at rear of appliance (see Page 12 and 13, Dimension J). Do not use a vent pipe smaller than the vent pipe connection on the unit. Vent pipe should be galvanized steel or other suitable corrosion-resistant material. Follow the National Fuel Gas Code for minimum thicknesses of vent material; minimum thicknesses for flue collars vary depending on pipe diameter.
4. Limit length of horizontal runs to 75% of vertical height. Install with a minimum upward slope from unit of 1/4 inch per foot and suspend securely from overhead structure at points no greater than 3 feet apart. For best venting, put as much vertical vent as close to the unit as possible. Fasten individual lengths of vent together with at least three corrosion-resistant sheet-metal screws.
5. Avoid venting through unheated space when possible. When venting does pass through an unheated space, Modine recommends the use of Type B double wall vent. If single wall vent is used, insulate vent runs greater than 5 feet to minimize condensation. 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 to provide a drip leg with a clean out cap as shown in Figure 3. The drip leg should be cleaned annually.
6. Keep single wall vent pipe at least 6 inches from combustible material. For double wall vent pipe, maintain clearances listed on vent pipe (Category I and II units) (see page 2, section 12 for allowable reductions). The minimum distance from combustible material is based on the combustible material surface not exceeding 160°F. Clearance from the vent connector, vent, or top of 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.
7. 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 vent pipe in the open space between the unit 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 not used, all combustible material must be cut away to provide the specified clearance to combustibles. Any material used to close the opening must be noncombustible.

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 gastight.
IV	Positive vent pressure Condensing	Vent must be liquid and gastight. Condensate must be drained.

8. Top of vertical vent should extend at least two feet above the highest point where it passes through a roof and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet (see Figure 3).
9. Use a vent terminal to reduce downdrafts and moisture in vent. A vent terminal that is very open will avoid spillage at unit's diverter relief opening and tripping of the blocked vent safety switch.
10. Check vent system to see that combustion products are being vented properly. Operate unit for several minutes and then pass a lighted match around the edge of the diverter relief opening. If the flame is drawn into the opening, the vent system is drawing properly. If not, make adjustments to provide adequate draft (see page 21).
11. A drip leg with cleanout cap is recomended for all vent systems to reduce the opportunity of damage to unit due to condensation.

ADDITIONAL VENTING REQUIREMENTS FOR CATEGORY II UNITS

Vent system must provide for drainage of condensate. At the low point of the vent system, install a tee fitting with a connector and attach flexible tubing, minimum 3/8 inch I.D., and run to a drain. Tee fitting and associated condensate disposal system must be periodically cleaned.

Heater Parts from ACF Greenhouses

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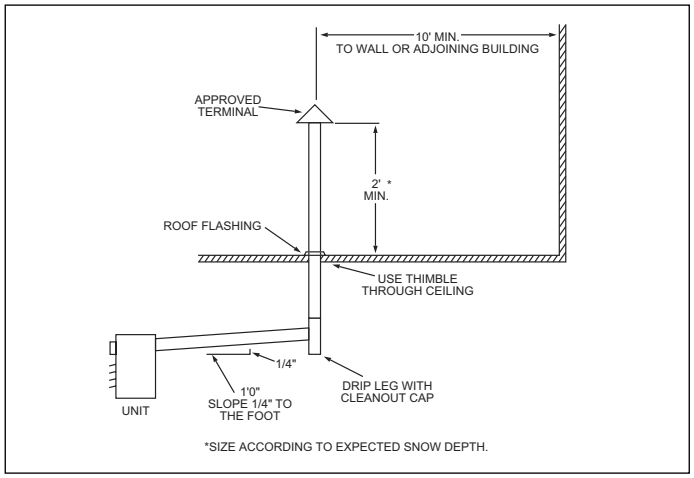
ADDITIONAL VENTING REQUIREMENTS FOR VENTING INTO AN EXISTING MASONRY CHIMNEY OR COMMON VENT (CATEGORY I and II UNITS ONLY)

1. Do not vent a Category I or II unit into a common vent with mechanical draft systems operating under positive pressure (Category III or IV units).
2. When connecting vent to an existing chimney, do not push vent pipe beyond internal surface of chimney.
3. When venting into a common vent, 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.
4. When venting into a common vent, the individual vents should enter at different levels.

Figure 3
Unit Heater Venting



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 during any pressure testing of the gas supply piping system.

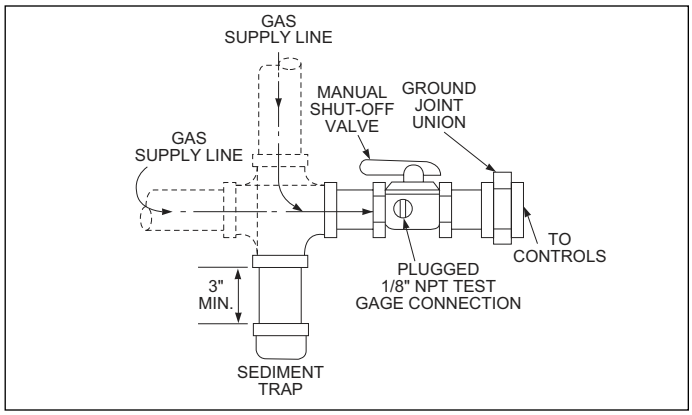
1. Installation of piping must be in accordance with local codes, and ANSI Z223.1, “National Fuel Gas Code,” or CAN/CGA-B149 in Canada. **Do not use flexible connectors**.
2. Piping to units should conform with local and national requirements for type and volume and gas handled, and pressure drop allowed in the line. Refer to Table 4, 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 3 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 2.
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 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 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 2
Specific Gravity Conversion Factors

Multiplying factors to be used with Table 3 cubic ft./hr. values 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



Heater Parts from ACF Greenhouses

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

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 single-phase electric power, should be provided with a manual motor starter, having properly sized overload protection. 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 (BD 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 (BD) Models Only

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

⚠ CAUTION

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

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 13.

⚠ CAUTION

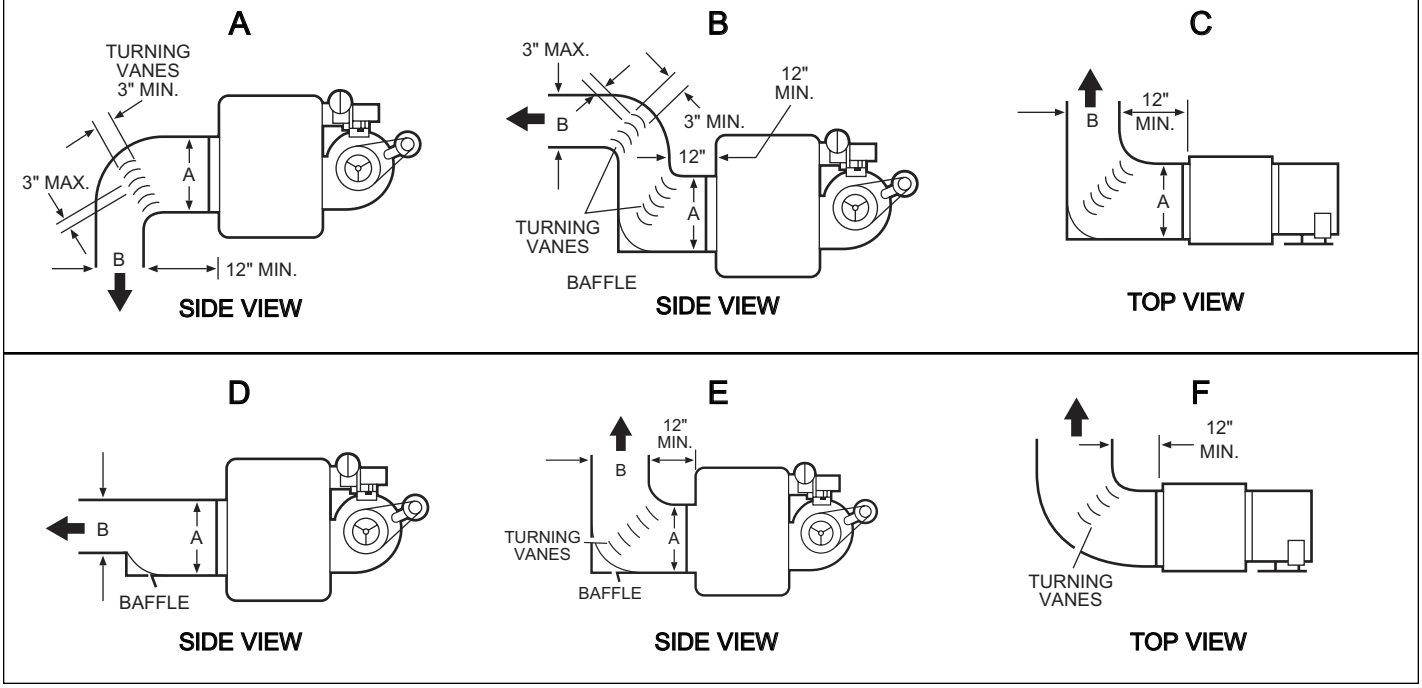
Check for red heat exchanger tubes. If bottom of tubes become red while blower unit is in operation, check for proper air volume and air distribution. Adjust blower speed or correct discharge duct design to correct problem.

Heater Parts from ACF Greenhouses

INSTALLATION

Recommended Installations

Dimension “B” Should Never Be Less than 1/2 of “A”



Installation of Blower Models (BD 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 permit operation of this unit under average conditions of air flow and without any external static pressure. The motor sheave should be adjusted as required when the unit is to be operated at other than average air flows and/or with external static pressures. Adjustment must always be within the performance range shown on pages 18 and 19 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 tables for blower models are shown on pages 18 and 19. As an example, a model BD 350 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 C207 drive, and the drive sheave must be set at 2.5 turns open to achieve a blower speed of 960 rpm (see performance table for units with or without blower enclosure, page 18). See "Blower Adjustments" on page 8 for setting of drive pulley 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 included in the performance data on page 19. 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 BD 350 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, 0.2" W.C. must be added for the filter pressure drop for a total of 0.4" W.C. total pressure drop. Entering the performance table on page 18 for a BD 350, at 6481 cfm and 0.4" W.C. static pressure, it is seen that the unit will require a 5 hp motor using a C207 drive, and the motor sheave should be set at .5 turns open to achieve a blower speed of 1050 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.

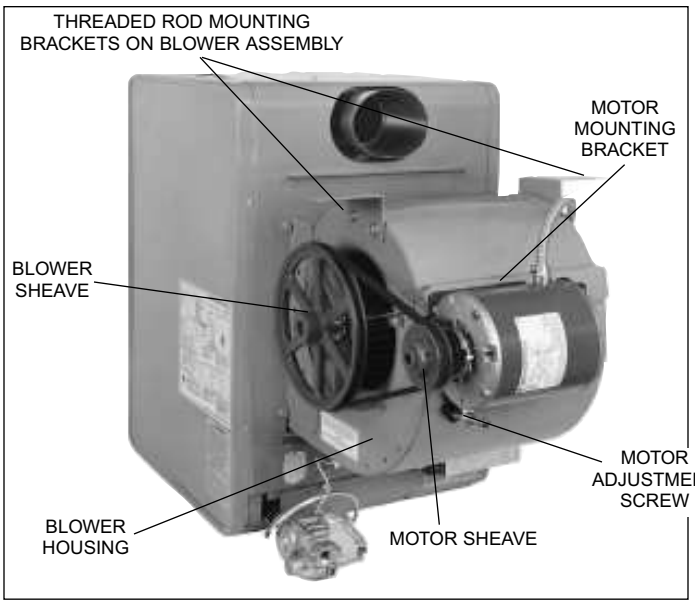
Heater Parts from ACF Greenhouses

INSTALLATION

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
Blower Model



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 pulley. 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 18 & 19 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 26 for model number nomenclature) and matching that number with those shown on page 25. 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 26 for drive sizes.

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 18 and 19. 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 page 7 and to Performance Date on pages 18 and 19 to determine proper blower RPM.
2. Loosen belt 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 speed 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 pages18 and19 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

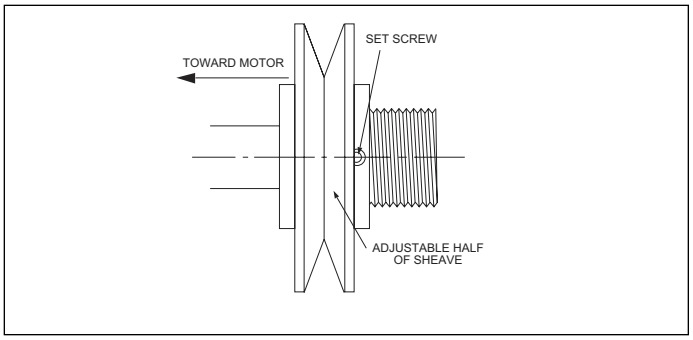
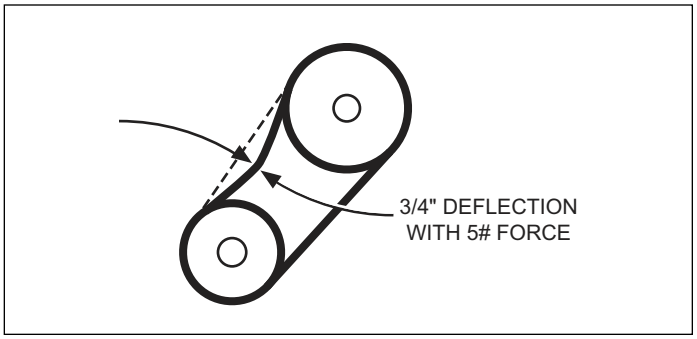


Figure 6a
Belt Tension Adjustment



Heater Parts from ACF Greenhouses

OPERATION

⚠ CAUTION

Start-up and adjustment procedures should be performed by a qualified serviceman.

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 all electric power to the unit.
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.

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 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.
3. Set thermostat to desired setting (pilot and main burner will light automatically when thermostat calls for heat).

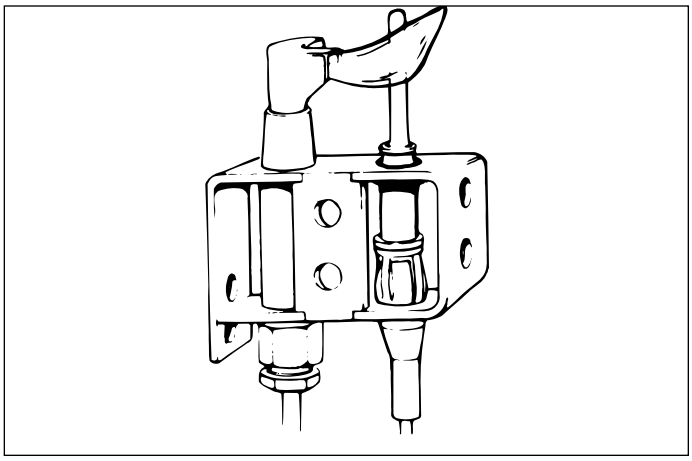
Shut Down Instructions

Turn off power and close manual gas valve.

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 to assure proper gas flow and pressure.

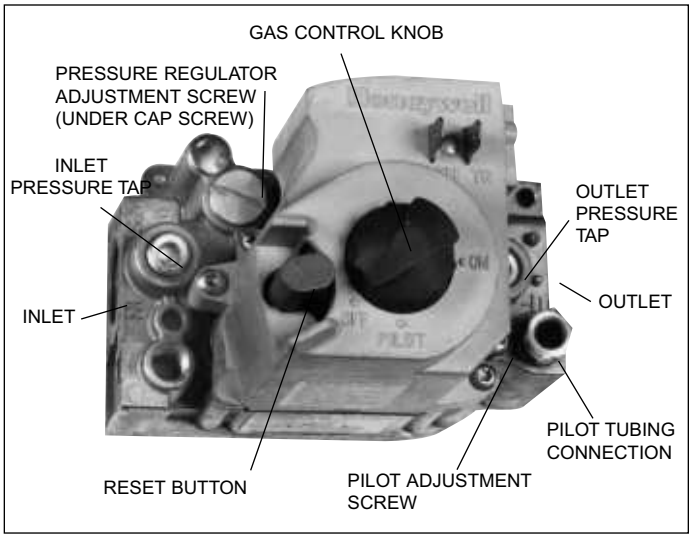
Figure 7
Correct Pilot Flame



Pilot Flame Adjustment

The pilot burner 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.

Figure 8
Typical combination gas control



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 casing closed for about five minutes. Operation can be viewed after loosening and pushing aside the blue gas designation disc on rear of unit.

Heater Parts from ACF Greenhouses

OPERATION

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 core.

To increase primary air, loosen the manifold mounting screws and tap the manifold away from the mixer tubes until yellow-tipped flames disappear. See Figure 14. To decrease 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.

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 15. **An optimum flame will show a slightly yellow tip**. Prior to flame adjustment, operate unit heater with casing closed for at least five minutes. Then lower hinged bottom and adjust primary air shutters. Loosen wing screws and push shutters forward to reduce primary air until yellow flame tips appear. Then increase primary air until yellow tips diminish to just a slightly 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 proper flame. Follow the instructions under "Natural Gas Flame Control" for adjusting the manifold.

Checking Input Rate

⚠ 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.

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 4 for model being tested, locate the combination gas control and pressure regulator adjustment screw (see Figure 8). Remove the cap screw from the pressure regulator and make 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 4 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.

(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 6.
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 9) 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 6, 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 6, 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 the plug in place, follow the lighting instructions to put unit back in service.

Heater Parts from ACF Greenhouses

CHECKING INPUT RATE

Figure 9
Major Gas and Electric Components

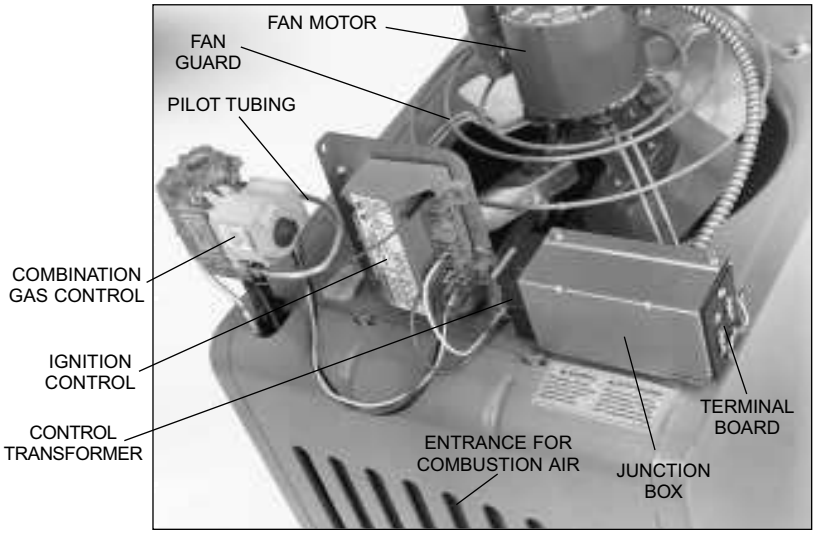


Table 4
Meter-Timing Gas

(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

Table 6
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	
PD 30	CFH	28.6	12.0	
	Gal/Hr. Propane	–	.33	
	Sec/cu. ft.	126	300	1
	Orifice Drill Size	38	52	
PD 50 BD 50	CFH	47.6	20.0	
	Gal/Hr. Propane	–	.55	
	Sec/cu. ft.	76	180	1
	Orifice Drill Size	30	45	
PD 75 BD 75	CFH	71.4	30.0	
	Gal/Hr. Propane	–	.82	
	Sec/cu. ft.	50	120	1
	Orifice Drill Size	21	39	
PD 100 BD 100	CFH	95.2	40.0	
	Gal/Hr. Propane	–	1.15	
	Sec/cu. ft.	38	90	2
	Orifice Drill Size	30	45	
PD 125 BD 125	CFH	119.0	50.0	
	Gal/Hr. Propane	–	1.43	
	Sec/cu. ft.	30	72	2
	Orifice Drill Size	26	43	
PD 150 BD 150	CFH	138.1	58.0	
	Gal/Hr. Propane	–	1.64	
	Sec/cu. ft.	26	62	2
	Orifice Drill Size	21	39	
PD 175 BD 175	CFH	166.7	70.0	
	Gal/Hr. Propane	–	1.86	
	Sec/cu. ft.	22	51	3
	Orifice Drill Size	28	43	
PD 200 BD 200	CFH	190.5	80.0	
	Gal/Hr. Propane	–	2.19	
	Sec/cu. ft.	19	45	3
	Orifice Drill Size	25	42	
PD 250 BD 250	CFH	238.1	100.0	
	Gal/Hr. Propane	–	2.74	
	Sec/cu. ft.	15	36	3
	Orifice Drill Size	18	36	
PD 300 BD 300	CFH	285.7	120.0	
	Gal/Hr. Propane	–	3.29	
	Sec/cu. ft.	13	30	4
	Orifice Drill Size	21	39	
PD 350 BD 350	CFH	333.3	140.0	
	Gal/Hr. Propane	–	3.84	
	Sec/cu. ft.	11	26	5
	Orifice Drill Size	23	41	
PD 400 BD 400	CFH	381.0	160.0	
	Gal/Hr. Propane	–	4.38	
	Sec/cu. ft.	9	23	6
	Orifice Drill Size	25	42	

*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.

Table 5
Orifice Drill Sizes with Decimal Equivalents

Main Burner Orifices

Drill Size	Dia. Decimal Equivalent	Drill Size	Dia. Decimal Equivalent
18	.1695	38	.1015
21	.1590	39	.0995
23	.1540	41	.0960
25	.1495	42	.0935
26	.1470	43	.0890
28	.1405	45	.0820
30	.1285	52	.0635
36	.1065		

Pilot Orifice Identity Numbers

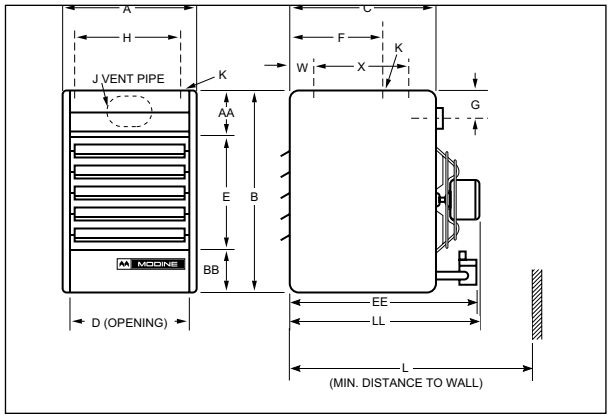
Pilot Burner Manufacturer	Identity No. Natural Gas	Identity No. Propane Gas
Honeywell	BCR-18	BBR-11
Robertshaw	1 • 8 N ①	L 1 • O P ①
Johnson	7715	4710

① As number appears on top of pilot orifice.

Figure 10
Dials of Typical Gas Meter

Heater Parts from ACF Greenhouses

DIMENSIONS/PERFORMANCE – PD



For clearance to combustibles, see page 3.

Dimensions (inches) — PD

Do not use propeller units with duct work.

Dimension Symbol	Model Number											
	PD 30	PD 50	PD 75	PD 100	PD 125	PD 150	PD 175	PD 200	PD 250	PD 300	PD 350	PD 400
A	12-7/8	17-1/4	17-1/4	19-1/4	19-1/4	21	23-1/2	25-5/8	25-5/8	28-5/8	33-5/8	40
B	24-1/4	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
C	14-3/4	14-3/4	20	20	22	22	22	25	25	25	25	25
D	10-7/16	14-13/16	14-13/16	16-13/16	16-13/16	18-9/16	21-1/16	23-3/16	23-3/16	26-3/16	31-3/16	37-1/2
E	13	13	16	16	20	20	20	24	24	24	24	24
F	9-1/4	9-1/4	11	11	12	12	12	13-1/2	13-1/2	14	–	–
G	2	2	2-3/4	2-3/4	3-5/8	3-5/8	3-5/8	4-3/8	4-3/8	4-3/8	4-1/4	4-1/4
H	9-1/4	13-5/8	13-5/8	15-5/8	15-5/8	17-3/8	19-7/8	22	22	25	30	36-3/8
AA	5	5	6-1/4	6-1/4	8	8	8	9	9	9	9	9
BB	6-1/4	6-1/4	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
J ①	3	4	5	6	6	7	7	7	8	9	10	10
K (Mounting Holes) ③	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 Connections ②	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
X	–	–	–	–	–	–	–	–	–	–	16	16
L ④	28-1/4	28-1/4	36	36	36-1/2	37-1/8	37-1/8	40-7/8	41	42-1/4	42-1/4	47-1/4
LL	19-1/2	20-1/8	30	30	30	31-1/8	31-1/8	34-7/8	34-7/8	36-1/4	35-1/2	40-1/2
EE	22-1/4	22-1/4	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
Fan Diameter	9	12	12	14	14	16	18	20	20	22	22	24
Approx. Weight	58#	72#	102#	116#	152#	162#	169#	231#	231#	261#	330#	410#

① Diameter of round vent pipe to fit oval opening.
② For natural gas; may vary depending on control availability.
③ PD 30 through PD 300 — 2 holes (and the level hanging adjustment feature). PD 350 through PD 400 — 4 holes.
④ Dimension equals overall plus 6".

Performance — PD

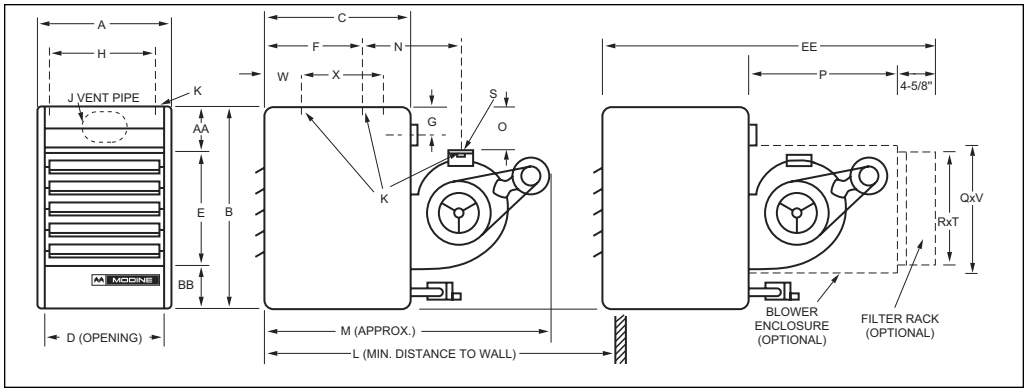
Inputs and outputs are the same for BD as PD

Standard		Model Number											
		PD 30	PD 50	PD 75	PD 100	PD 125	PD 150	PD 175	PD 200	PD 250	PD 300	PD 350	PD 400
Btu/Hr. Input		30,000	50,000	75,000	100,000	125,000	150,000	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	120,000	140,000	160,000	200,000	240,000	280,000	320,000
Entering Airflow CFM		440	740	1100	1460	1850	2180	2550	2870	3700	4460	4870	5440
Outlet Velocity		515	610	736	860	870	931	959	819	1053	1123	1068	1016
Air Temp. Rise °F		51	50	51	51	50	51	51	52	50	50	53	54
Mounting Hgt. (Max. Ft.) ①		7	9	12	14	14	16	17	15	19	21	20	19
Heat Throw Ft. ① (Max. Mtg. Hgt.)		25	33	41	49	51	55	59	51	67	74	70	69
Motor Data ②	Horsepower	1/40	1/40	1/12	1/12	1/8	1/8	1/6	1/6	1/3	1/2	3/4	3/4
	RPM	1550	1550	1550	1550	1625	1625	1075	1075	1075	1075	1125	1125
	Type	Shaded Pole	Shaded Pole	Shaded Pole	Shaded Pole	Perm. Split Cap.	Perm. Split Cap.	Perm. Split Cap.	Perm. Split Cap.	Perm. Split Cap.	Perm. Split Cap.	Perm. Split Cap.	Perm. Split Cap.
Unit total Power (amps)		1.3	1.3	2.5	2.5	2.6	2.6	3.1	3.1	5.7	7.8	8.3	8.3

Ratings shown are for elevations up to 2,000 ft. For elevations above 2,000 feet, ratings should be reduced at the rate of 4% for each 1,000 feet above sea level. (In Canada see rating plate.)
① At 65°F ambient and unit fired at full-rated input. Mounting height as measured from bottom of unit, and without deflector hoods.
② All single phase motors are totally enclosed and thermal overload protected. Data listed is for standard 115-volt, 60 hertz, single-phase motors.

Heater Parts from ACF Greenhouses

DIMENSIONS/PERFORMANCE – BD



For clearance to combustibles, see page 3.

Dimensions (inches) — BD

Dimension Symbol	Model Number										
	BD 50	BD 75	BD 100	BD 125	BD 150	BD 175	BD 200	BD 250	BD 300	BD 350	BD 400
A	17-1/4	17-1/4	19-1/4	19-1/4	21	23-1/2	25-5/8	25-5/8	28-5/8	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
C	14-3/4	20	20	22	22	22	25	25	25	25	25
D	14-13/16	14-13/16	16-13/16	16-13/16	18-9/16	21-1/16	23-3/16	23-3/16	26-3/16	31-3/16	37-1/2
E	13	16	16	20	20	20	24	24	24	24	24
F	9-1/4	11	11	12	12	12	13-1/2	13-1/2	14	–	–
G	2	2-3/4	2-3/4	3-5/8	3-5/8	3-5/8	4-3/8	4-3/8	4-3/8	4-1/4	4-1/4
H	13-5/8	13-5/8	15-5/8	15-5/8	17-3/8	19-7/8	22	22	25	30	36-3/8
AA	5	6-1/4	6-1/4	8	8	8	9	9	9	9	9
BB	6-1/4	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
J ①	4	5	6	6	7	7	7	8	9	10	10
K ④ Mounting Holes	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 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
X	–	–	–	–	–	–	–	–	–	16	16
EE	41-3/8	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
L w/ Blwr Encl & Filt Rk	47-5/8	52-5/8	55-5/8	51-5/8	62-5/8	62-5/8	69-5/8	69-5/8	69-5/8	69-5/8	69-5/8
L w/o Blwr Encl & Filt Rk	38	43-1/8	45-3/4	49-7/8	53-1/8	53-1/8	61	61	61	61	65
M ③	32	37-1/8	39-3/4	43-7/8	47-1/8	47-1/8	55	55	55	55	59
N ⑤	11-3/4	14-7/8	17-5/8	18-5/8	21-1/2	21-1/2	25-7/16	25-7/16	24-15/16	17-15/16	22
O	4-1/2	5-3/4	5-3/4	7-1/2	7-1/4	7-1/4	8-1/2	8-1/2	8-1/2	8-1/2	8-1/2
P	22	22	25	25	30	30	34	34	34	34	34
Q Blower Encl Ht	14-1/8	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
V Blower Encl Width	17-1/2	17-1/2	21-1/4	21-1/4	29	29	34-1/4	34-1/4	34-1/4	44-3/8	44-3/8
R Inlet Duct Height	15-3/4	15-3/4	15-3/4	20	20	20	23-3/4	23-3/4	23-3/4	23-3/4	23-3/4
T Inlet Duct Width	16	16	19-3/4	19-3/4	27-1/2	27-1/2	32-3/4	32-3/4	32-3/4	42-7/8	42-7/8
Center to Center Blower Mtg. Holes S	10-15/16	13-15/16	18-7/16	18-7/16	17-5/16	17-3/8	20-3/8	20-3/8	20-3/8	20-3/8	20-3/8
Std. Mtr. Sheave Dia. ⑥	3	3	3	3	3	3	3	3	3	3	4-1/2
Std. Blower Sheave Dia.	8	10	8	7	11	7	14	10	7	6	10
Blower Wheel Diameter	8	8	9	9	13	13	15	15	15	15	15
Approx. Weight	116#	146#	158#	205#	215#	231#	307#	307#	331#	420#	490#

① Diameter of round vent pipe to fit oval opening.
② For natural gas; may vary depending on control availability.
③ This is an approximate dimension for standard motors, allow 3" for sheave and optional motors.
④ BD 50 thru BD 300 — 4 holes (2 on blower and 2 on unit).
BD350 and BD 400 — 6 holes (2 on blower and 4 on unit).
⑤ Distance between mounting hole in unit casing and mounting hole on blower. On the BD 350 and BD 400, the distance is from rear mounting hole in casing to the mounting hole on blower.
⑥ Motor pulley is adjustable.

Standard Blower Motor Data — BD

Note: Mounting heights and throws for BD models, without ductwork or nozzles, and at a cfm yielding a 55° temperature rise are the same as those listed for equivalent size PD units.

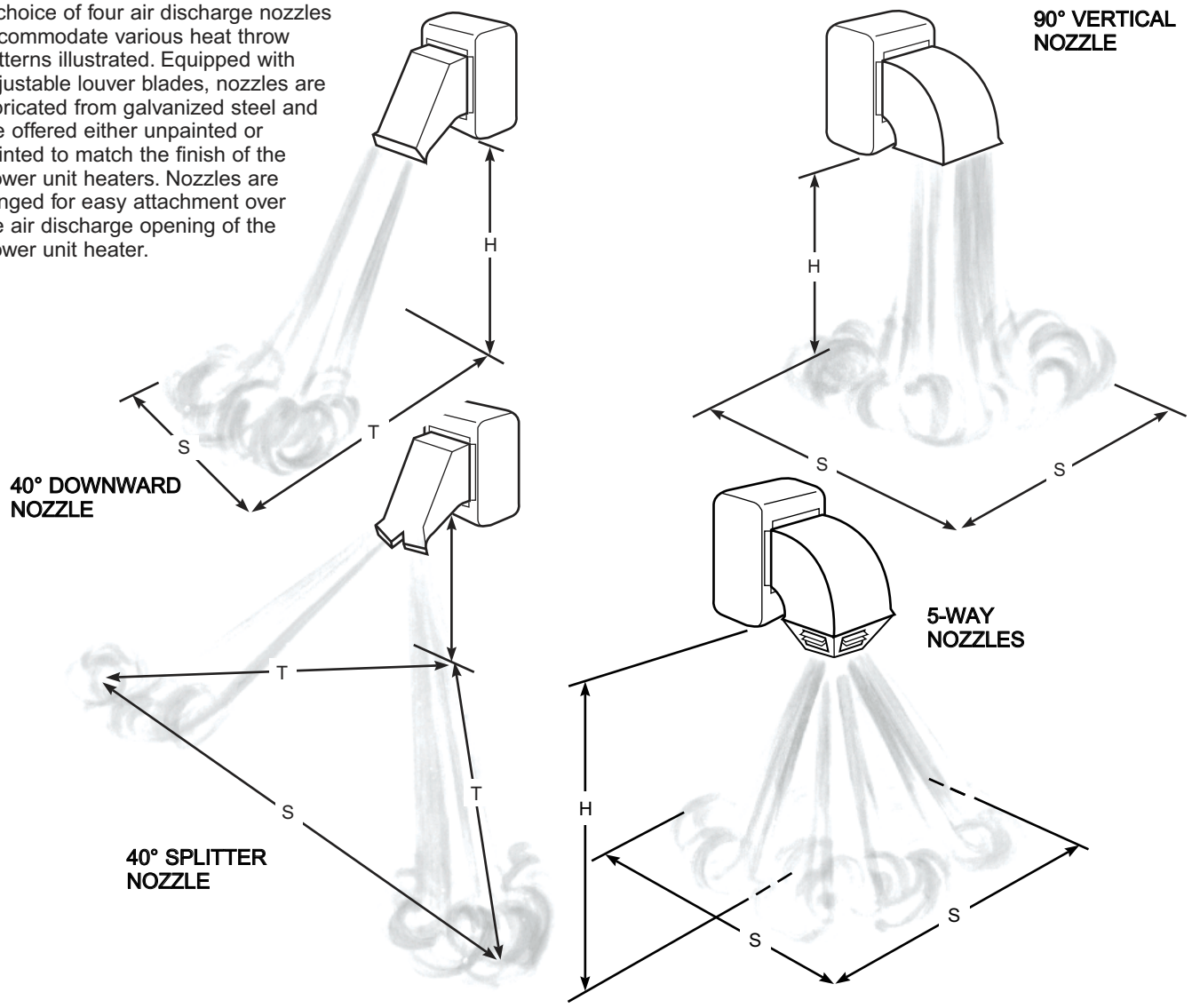
Standard		Model Number										
		BD 50	BD 75	BD 100	BD 125	BD 150	BD 175	BD 200	BD 250	BD 300	BD 350	BD 400
Motor Data	Horsepower	1/4	1/4	1/4	1/4	1/4	1/3	1/4	1/3	3/4	1	1-1/2
	RPM	1725	1725	1725	1725	1725	1725	1725	1725	1725	1725	1725
	Type	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Split Phase	Cap. Start	Cap. Start
Total Unit Power Amps		5.7	5.7	5.7	5.7	5.7	4.9	5.7	4.9	11.3	13.7	15.6

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

Heater Parts from ACF Greenhouses

PERFORMANCE DATA – NOZZLES

A choice of four air discharge nozzles accommodate various heat throw patterns illustrated. 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.



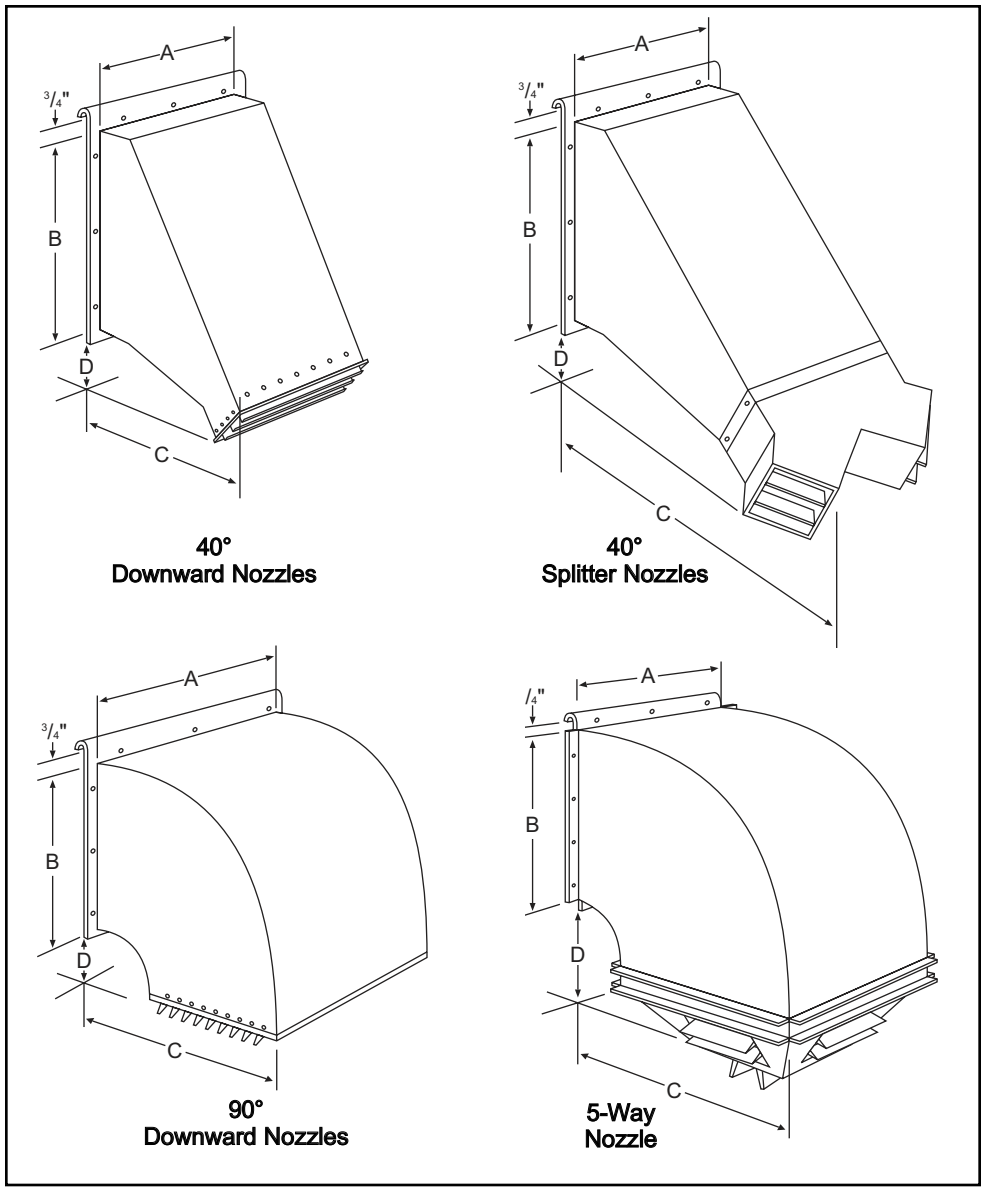
Mounting Height, Heat Throw, Heat Spread (in feet)

Nozzle Type		Model Number										
		BD 50	BD 75	BD 100	BD 125	BD 150	BD 175	BD 200	BD 250	BD 300	BD 350	BD 400
40° Downward Nozzle	Max. Mounting Ht. (ft.) H	16	20	21	24	26	25	27	29	31	32	32
	Heat Throw (ft.) T	48	61	64	71	79	76	81	86	94	96	96
	Heat Spread (ft.) S	16	20	21	24	26	25	27	29	31	32	32
90° Vertical Nozzle	Max. Mounting Ht. (ft.) H	14	22	23	24	26	26	24	29	31	32	32
	Heat Spread (ft.) S	14	22	23	24	26	26	24	29	31	32	32
40° Splitter Nozzle	Max. Mounting Ht. (ft.) H	–	–	–	23	24	24	23	25	28	30	32
	Heat Throw (ft.) T	–	–	–	56	60	59	59	62	70	75	80
	Heat Spread (ft.) S	–	–	–	113	120	118	117	124	140	151	160
5-Way Nozzle	Max. Mounting Ht. (ft.) H	–	18	18	23	22	21	20	25	26	23	26
	Heat Spread (ft.) S	–	25	26	32	31	29	28	35	36	32	36

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.

Heater Parts from ACF Greenhouses

DIMENSIONAL DATA



Dimensions (in inches)

Nozzle Type	Dimension Symbol	Model Number										
		BD 50	BD 75	BD 100	BD 125	BD 150	BD 175	BD 200	BD 250	BD 300	BD 350	BD400
40° Downward Nozzle	A	14-13/16	14-13/16	16-13/16	16-13/16	18-9/16	21-1/16	23-3/16	23-3/16	26-3/16	31-1/8	37-1/2
	B	13	16	16	20	20	20	24	24	24	24	24
	C	20	24	22	26	26	25	30	30	30	36	36
	D	3-1/2	4	3	4	4	4	4	4	6	11	11
90° Vertical Nozzle	A	14-13/16	14-13/16	16-13/16	16-13/16	18-9/16	21-1/16	23-3/16	23-3/16	26-3/16	31-1/8	37-1/2
	B	13	16	16	20	20	20	24	24	24	24	24
	C	15	15	17	22	22	23	29	29	30	34	34
	D	6	6	6	8	8	8	10	10	10	14	14
40° Splitter Nozzle	A	–	–	–	–	18-9/16	21-1/16	23-3/16	23-3/16	26-3/16	31-1/8	37-1/2
	B	–	–	–	–	20	20	24	24	24	24	24
	C	–	–	–	–	34	33	39	39	40	46	47
	D	–	–	–	–	10	11	12	12	14	19	20
5-Way Nozzle	A	14-13/16	14-13/16	16-13/16	16-13/16	18-9/16	21	23-3/16	23-3/16	26-3/16	31-1/8	37-1/2
	B	13	16	16	20	20	20	24	24	24	24	24
	C	20-3/4	20-3/4	22-3/4	22-3/4	24-1/2	27	29	29	32	37	43-1/2
	D	11	11	12	12	13	14	15	15	16	18	18

Heater Parts from ACF Greenhouses

PERFORMANCE DATA – HOODS FOR PROPELLER MODELS

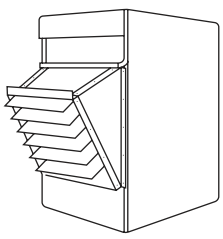
Performance Data — 30°, 60° and 90° Downward Deflector Hoods

Mounting Height to Bottom of Heater	30° Downward Hood For Propeller Units ①																							
Models	PD 50			PD 75			PD 100			PD 125			PD 150			PD 175			PD 200			PD 250			PD 300			PD 350			PD 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'	8	19	26	11	25	34	14	31	43	15	32	44	16	36	49	18	38	52	15	33	45	21	44	60	24	49	67	22	46	63	22	45	62
10'	6	15	22	9	23	22	13	30	41	14	31	43	15	34	47	17	37	51	14	31	43	20	43	59	23	48	66	21	45	62	21	44	61
12'	4	12	17	7	20	28	11	28	39	12	29	40	14	33	45	15	35	49	12	30	41	19	42	58	21	47	65	20	44	61	19	43	59
14'				5	14	21	10	25	35	10	26	37	12	30	42	14	33	46	11	27	37	17	40	56	20	46	63	19	43	59	18	42	57
16'							5	17	25	7	21	30	10	27	38	12	31	43	8	22	31	16	38	53	19	44	61	17	41	56	16	40	55
18'										6	18	26	6	20	29	9	26	37	6	18	26	14	36	50	17	42	58	15	38	53	15	37	52
20'																						12	32	45	15	39	54	13	35	49	13	33	47
22'																						8	24	35	13	35	49	10	29	42	8	25	37
24'																									8	26	38	8	24	36	8	24	35

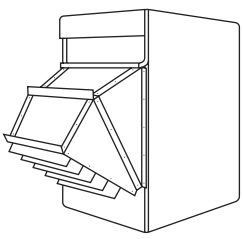
Mounting Height to Bottom of Heater	60° Downward Hood For Propeller Units ①																							
Models	PD 50			PD 75			PD 100			PD 125			PD 150			PD 175			PD 200			PD 250			PD 300			PD 350			PD 400		
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
8'	0	19	26	0	26	36	0	33	45	0	34	47	0	38	52	0	40	55	0	35	47	0	47	65	0	52	72	0	49	68	0	48	66
10'	0	14	19	0	23	32	0	31	42	0	32	44	0	36	49	0	39	53	0	33	45	0	46	63	0	51	70	0	48	66	0	47	64
12'				0	18	25	0	28	38	0	29	40	0	33	46	0	36	50	0	30	41	0	44	60	0	50	68	0	46	64	0	45	62
14'				0	10	14	0	23	33	0	25	35	0	30	41	0	33	46	0	26	36	0	41	57	0	48	65	0	44	61	0	43	59
16'							0	13	19	0	18	25	0	25	35	0	29	41	0	19	27	0	38	53	0	45	62	0	41	57	0	40	55
18'										0	12	17	0	13	19	0	23	32	0	12	17	0	35	48	0	42	58	0	38	52	0	36	50
20'																						0	29	40	0	38	52	0	33	46	0	31	43
22'																						0	16	23	0	32	45	0	25	35	0	21	30
24'																									0	19	28	0	16	24	0	16	23

Mounting Height to Bottom of Heater	90° Downward Hood For Propeller Units ①										
Models	PD 50	PD 75	PD 100	PD 125	PD 150	PD 175	PD 200	PD 250	PD 300	PD 350	PD 400
	S	S	S	S	S	S	S	S	S	S	S
8'	10	23	30	34	38	42	36	54	62	58	56
10'	11	20	27	30	34	37	32	48	56	52	50
12'	12	19	24	27	31	34	29	44	51	47	46
14'		17	23	25	29	32	27	41	47	44	42
16'		16	21	24	27	29	25	38	44	41	39
18'			20	22	25	28	24	36	42	38	37
20'			19	21	24	26	23	34	40	36	35
22'					23	25	22	33	38	35	34
24'								31	36	33	32
26'								30	35	32	31
28'								29	33	31	30
30'									32	30	29

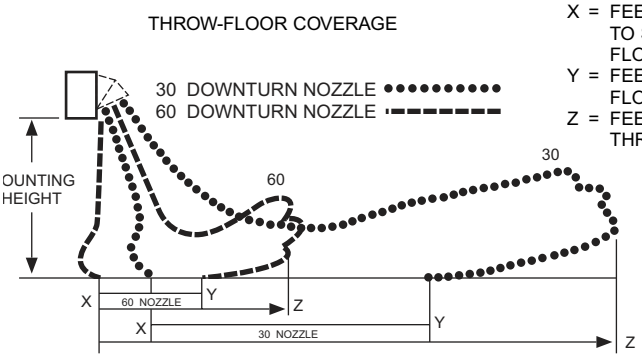
① Data Based on units fired at full rated input with an entering air temperature of 60°-80°F. Maximum mounting heights higher versus units without outlet devices.



30° HOOD



60° HOOD



NOTE:
X = FEED FROM HEATER TO START OF FLOOR COVERAGE.
Y = FEET TO END OF FLOOR COVERAGE.
Z = FEET TO END OF THROW.

Heater Parts from ACF Greenhouses

PERFORMANCE DATA – HOODS FOR BLOWER MODELS

Performance Data — 30°, 60° and 90° Downward Deflector Hoods

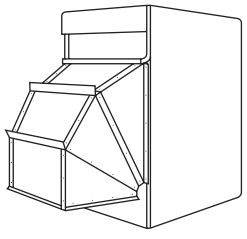
Mounting Height to Bottom of Heater	30° Downward Hood For Blower Units ②																							
Models	BD 50			BD 75			BD 100			BD 125			BD 150			BD 175			BD 200			BD 250			BD 300			BD 350			BD 400		
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
8'	13	29	40	18	38	52	22	47	64	23	47	64	26	53	72	28	56	76	24	50	68	31	63	86	35	69	94	37	73	99	30	61	84
10'	12	28	38	16	37	50	21	46	63	21	46	63	25	52	71	26	55	75	23	49	67	30	62	85	34	69	94	36	72	98	29	61	83
12'	10	25	35	15	35	48	20	45	61	20	45	62	23	51	70	25	54	74	22	48	66	29	62	84	33	68	93	34	71	97	28	60	82
14'	8	21	30	14	33	46	19	43	59	19	43	60	22	50	68	24	53	73	21	47	64	28	61	83	31	67	92	33	71	96	27	59	80
16'				12	30	42	17	41	57	17	42	57	21	48	66	23	52	71	19	45	62	27	59	81	30	66	90	32	69	95	26	57	79
18'				9	25	36	16	39	54	16	39	54	19	46	64	21	50	69	18	43	59	25	58	80	29	65	89	31	68	93	24	56	77
20'							14	35	50	14	36	50	18	44	61	20	48	66	16	40	56	24	56	77	28	63	87	30	67	92	23	54	75
22'							11	30	43	11	31	44	16	41	57	18	45	63	14	36	51	22	54	75	26	62	85	28	65	90	21	52	72
24'													13	36	51	16	42	59	10	29	42	21	52	72	25	59	82	27	63	87	20	49	69
26'																						19	48	68	23	57	79	25	61	85	18	46	64
28'																						16	44	62	21	54	75	23	58	81	15	41	58
30'																						12	36	52	19	50	70	21	55	77	10	32	47

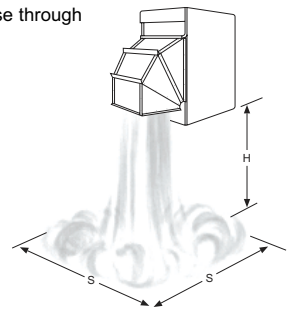
Mounting Height to Bottom of Heater	60° Downward Hood For Blower Units ②																							
Models	BD 50			BD 75			BD 100			BD 125			BD 150			BD 175			BD 200			BD 250			BD 300			BD 350			BD 400		
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
8'	0	31	42	0	40	55	0	50	68	0	50	69	0	56	77	0	60	82	0	53	73	0	68	93	0	74	102	0	78	107	0	66	90
10'	0	28	39	0	38	52	0	48	66	0	49	67	0	55	76	0	59	81	0	52	71	0	67	91	0	74	101	0	77	106	0	65	88
12'	0	25	34	0	36	49	0	47	64	0	47	65	0	54	74	0	57	79	0	50	69	0	65	90	0	72	99	0	76	104	0	63	87
14'	0	19	27	0	33	45	0	44	61	0	45	62	0	52	71	0	56	76	0	48	67	0	64	88	0	71	97	0	75	102	0	62	85
16'	0	11	16	0	29	40	0	42	57	0	42	58	0	50	68	0	54	74	0	46	63	0	62	85	0	69	95	0	73	100	0	60	82
18'				0	22	31	0	38	53	0	39	53	0	47	64	0	51	70	0	43	59	0	60	82	0	68	93	0	72	98	0	58	79
20'							0	33	46	0	34	47	0	43	60	0	48	66	0	39	54	0	58	79	0	65	90	0	70	95	0	55	76
22'							0	26	36	0	27	38	0	39	54	0	44	61	0	34	47	0	55	75	0	63	86	0	67	92	0	52	72
24'										0	16	24	0	33	45	0	39	54	0	24	34	0	51	70	0	60	82	0	64	89	0	48	66
26'																						0	46	64	0	56	78	0	61	84	0	43	60
28'																						0	40	56	0	52	72	0	57	79	0	36	50
30'																						0	30	43	0	46	65	0	53	73	0	22	31

Mounting Height to Bottom of Heater	90° Downward Hood For Blower Units ②										
Models	BD 50	BD 75	BD 100	BD 125	BD 150	BD 175	BD 200	BD 250	BD 300	BD 350	BD 400
	S	S	S	S	S	S	S	S	S	S	S
8'	29	42	56	61	72	79	70	98	113	121	94
10'	26	38	50	55	65	70	63	88	101	108	84
12'	24	35	46	50	59	64	58	80	92	99	77
14'	22	32	43	46	55	60	53	74	85	91	71
16'	21	30	40	43	51	56	50	70	80	85	67
18'	19	28	38	41	48	53	47	66	75	81	63
20'		27	36	39	46	50	45	62	71	76	60
22'		26	34	37	44	48	42	59	68	73	57
24'		24	33	35	42	45	41	57	65	70	55
26'			31	34	40	44	39	55	63	67	52
28'			30	33	39	42	38	53	60	65	50
30'			29	32	37	41	36	51	58	62	49
32'				31	36	39	35	49	56	60	47
34'					35	38	34	48	55	59	46
36'								46	53	57	45
38'								45	52	55	43
40'								44	50	54	42
42'								43	49	53	41

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.

90° HOOD





Heater Parts from ACF Greenhouses

PERFORMANCE DATA - BLOWER UNIT HEATERS

Models With or Without Blower Enclosure ① ② ③ ④ ⑤

For 575V selections, please see chart on page 19.

Model No.	Temp Rise (°F)	Airflow (cfm)	0.0 Static Air Pressure				0.1 Static Air Pressure				0.2 Static Air Pressure				0.3 Static Air Pressure				0.4 Static Pressure			
			RPM	HP	Drive No.	Sheave Turns Open	RPM	HP	Drive No.	Sheave Turns Open	RPM	HP	Drive No.	Sheave Turns Open	RPM	HP	Drive No.	Sheave Turns Open	RPM	HP	Drive No.	Sheave Turns Open
BD 50	40	926	720	1/4	C183	2	800	1/3	C1	5	875	1/2	C61	4.5	945	1/2	C61	3.5	1010	1/2	C61	3
	45	823	640	1/4	C183	3.5	730	1/4	C183	2	810	1/3	C1	5	885	1/3	C1	4	955			3.5
	50	741	575			1	675			3	760	1/4	C183	1.5	845			4.5	915	1/3	C1	4
	55	673	525			2.5	630			0	725			2	810			0.5	885			4.5
	60	617	480	1/4	C182	3.5	595	1/4	C182	0.5	695	1/4	C183	2.5	785	1/4	C183	1	860			4.5
	65	570	445			4.5	565			1.5	670			3	760			1.5	840	1/4	C183	0
	70	529	410			5	545			2	650			3	745			1.5	825			0
BD 75	40	1389	585	1/2	C186	2.5	670	1/2	C186	1.0	745	3/4	C187	3.5	820	3/4		2.5	890	3/4		1.5
	45	1235	520	1/3	C185	4	615			2.0	700	1/2	C186	0.5	775		C187	3.5	850			2.0
	50	1111	470			1	575	1/3		3.0	665	1/3		1.0	745	1/2		3.5	825			2.5
	55	1010	425			2	540	1/4	C185	3.5	635			1.5	725		C186	0.0	805		C187	3.0
	60	926	390	1/4	C184	3	510			4.0	615		C185	2.0	705	1/3		0.0	790	1/2		3.0
	65	855	360			4	490	1/4	C184	0.5	595	1/4		2.5	695		C185	0.5	775			3.5
	70	794	335			5	470			1.0	585			2.5	680	1/4		0.5	770			3.5
BD 100	40	1852	795	1/2	C92	0.5	860	3/4	C91	4.5	925	3/4	C91	4.0	985	3/4	C91	3.0	1040	1	C91	2.5
	45	1646	710	1/3	C90	2.0	780	1/2	C92	1.0	850	1/2		4.5	915			4.0	975	3/4		3.0
	50	1481	640	1/4		3.5	720	1/3	C90	2.0	790		C92	0.5	860	1/2		4.5	925			4.0
	55	1347	580			1.0	670	1/4		3.0	750	1/3		1.5	820		C92	0.5	890	1/2		4.0
	60	1235	530	1/4	C200	2.0	625			0.0	710			2.0	790	1/3		1.0	860			4.5
	65	1140	490			3.0	595	1/4	C200	1.0	680	1/4	C90	2.5	765		C90	1.5	835	1/3	C90	0.0
	70	1058	455			4.0	565			1.5	660			3.0	740	1/4		1.5	820			0.5
BD 125	40	2315	840	3/4	C199	5.0	890	1	C190	4.0	940	1	C190	3.5	990	1	C190	3.0	1035	1-1/2	C201	4.0
	45	2058	745	1/2	C211	3.5	805	3/4	C199	5.0	860	3/4	C199	4.5	915	3/4	C199	4.0	965	1	C190	3.5
	50	1852	670			5.0	735	1/2	C211	4.0	795	1/2	C211	3.0	855			4.5	910	3/4	C199	4.0
	55	1684	610	1/3	C188	2.0	680	1/3	C188	0.5	745			3.5	810	1/2	C211	3.0	865			2.0
	60	1543	560			3.0	635			1.5	705	1/3	C188	0.0	770			3.5	830	1/2	C211	2.5
	65	1425	520	1/4	C188	4.0	600	1/4	C188	2.5	675			1.0	740	1/3	C202	4.0	805			3.0
	70	1323	480			5.0	570			3.0	645	1/4	C188	1.5	715		C188	0.0	785	1/3	C202	3.0
BD 150	40	2778	515	1/2	C96	4.0	565	3/4	C38	4.5	615	3/4	C38	4.0	665	3/4	C38	3.0	705	1	C38	2.0
	45	2469	455	1/3	C191	0.0	515	1/2	C96	4.0	570	1/2	C96	3.0	620			3.5	670	3/4	C38	3.0
	50	2222	410			1.5	475	1/3	C95	5.0	535			3.5	590			2.5	640	3/4	C38	3.5
	55	2020	375			2.5	445			0.5	505			4.0	565	1/2	C96	3.0	615			2.0
	60	1852	345	1/4	C191	3.5	420	1/4	C191	1.0	485	1/3	C95	4.5	545			3.5	600	1/2	C96	2.5
	65	1709	315			4.5	400			2.0	470			5.0	530	1/3	C95	4.0	585			2.5
	70	1587	295			5.0	380			2.5	455	1/4	C191	0.0	520			4.0	575	1/3	C95	3.0
BD 175	40	3241	805	1-1/2	C193	3.5	840	1-1/2	C193	2.5	875	1-1/2	C193	2.0	910	1-1/2	C193	1.0	940	1-1/2	C193	0.0
	45	2881	715	1	C192	4.0	755	1	C192	3.5	795	1	C192	3.0	830			3.0	865			2.0
	50	2593	645	3/4		5.0	690	3/4		4.5	730	3/4		4.0	770	1		3.5	810	1		3.0
	55	2357	585	1/2	C96	2.5	635	1/2	C96	1.5	680			4.5	720	3/4	C192	4.0	765	3/4	C192	3.5
	60	2160	540			3.5	590			2.5	640	1/2	C96	1.5	685			4.5	730	3/4		4.0
	65	1994	495	1/3	C95	4.5	550	1/3	C95	3.5	605			2.5	655	1/2	C96	1.5	700	1/2	C96	0.5
	70	1852	460			5.0	520			4.0	575	1/3	C95	3.0	630			2.0	680			1.0
BD 200	40	3704	420	3/4	C16	5.0	465	3/4	C16	4.0	505	1	C16	3.0	540	1	C16	2.0	3580	1	C16	1.0
	45	3292	375	1/2	C101	5.0	420	1/2	C101	3.5	465	3/4	C16	3.5	510	3/4	C16	2.5	550	1		2.0
	50	2963	335	1/3	C212	1.0	390			4.5	440	1/2	C101	3.0	485		C16	3.5	525	3/4		2.5
	55	2694	305			2.0	365	1/3	C102	5.0	415			3.5	465			2.5	510			2.5
	60	2469	280	1/4	C212	3.0	345			0.5	400			4.0	450	1/2	C101	3.0	500			1.5
	65	2279	260			4.0	325	1/4	C212	1.5	385	1/3	C102	4.5	440			3.0	490	1/2	C101	2.0
	70	2116	240			5.0	310			2.0	375			5.0	430	1/3	C102	3.5	485			2.0
BD 250	40	4630	605	1-1/2	C105	4.5	635	1-1/2	C105	3.5	665	1-1/2	C105	3.0	690	2	C108	4.0	720	2	C108	3.0
	45	4115	535	1	C205	3.5	570	1		3.0	605			4.5	635	1-1/2	C105	3.5	665	1-1/2	C105	2.5
	50	3704	485	3/4		4.5	520	3/4	C205	4.0	555	1		3.0	590	1		2.5	625			4.0
	55	3367	440	1/2	C204	2.0	480			5.0	520	3/4	C205	4.0	555	3/4	C205	3.0	595	1		2.5
	60	3086	405			3.0	450	1/2	C204	1.5	490			4.5	530			4.0	570		C205	3.0
	65	2849	370	1/3	C203	4.0	420			2.5	465	1/2	C204	1.0	510			4.0	550	3/4		3.5
	70	2646	345			4.5	395	1/3	C203	3.0	445			1.5	490	1/2	C204	0.5	535			3.5
BD 300	40	5556	825	3	C111	3.0	850	3	C111	2.5	875	3	C111	2.0	900	3	C111	1.0	-	-	-	-
	45	4938	735	2	C108	3.0	760	2	C108	2.0	790	2	C108	1.5	815	3		3.0	840	3	C111	2.5
	50	4444	660	1-1/2	C106	5.0	690	1-1/2	C106	4.0	720	1-1/2	C106	3.0	750	2	C108	2.5	780	2	C108	1.5
	55	4040	600	1	C205	2.5	635	1-1/2	C106	5.0	665	1-1/2	C106	4.5	700	1-1/2	C106	4.0	730	1-1/2	C106	3.0
	60	3704	550			3.5	590	1	C205	2.5	625	1	C205	2.0	655			5.0	690			4.0
	65	3419	510	3/4	C205	4.0	550	3/4	C205	3.5	585	3/4	C205	2.5	620	1	C205	2.0	655	1	C205	1.0
	70	3175	470			5.0	515			4.0	555			3.5	595	3/4	C205	2.5	630			2.0
BD 350	40	6481	960	5	C207	2.5	980	5	C207	2.0	1005	5	C207	1.5	1030	5	C207	1.0	1050	5	C207	0.5
	45	5761	850	3	C111	2.5	880	3	C111	1.5	905	3	C111	1.0	930			3.0	955			2.5
	50	5185	765	2	C210	4.5	795			3.5	825			3.0	850	3	C111	2.5	880	3	C111	1.5
	55	4714	695	1-1/2	C105	2.0	730	2	C210	5.0	760	2	C210	4.5	790	2	C210	3.5	820	2	C210	3.0
	60	4321	640			3.5	675	1-1/2	C105	2.5	710			1.5	740			0.5	770			4.0
	65	3989	590	1	C107	4.5	630	1	C107	3.5	665	1-1/2	C105	3.0	695	1-1/2	C105	2.0	730	1-1/2	C105	1.0
	70	3704	550			5.0	590			4.5	625	1	C107	3.5	660	1	C107	3.0	695			2.0
BD 400	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	6584	885	5	C207	4.0	915	5	C207	3.5	940	5	2C07	3.0	965	5	C207	2.5	985	5	C207	2.0
	50	5926	800	3	C111	3.5	825	3	C111	3.0	855	3	C111	2.0	880	5		4.0	910			3.5
	55	5387	725	2	C210	5.0	760			4.5	790			4.0	815	3	C111	3.0	845	3	C111	2.5
	60	4938	665			2.5	700	2	C210	6.0	735	2	C210	5.0	765	2	C210	4.5	795			3.5
	65	4558	615	1-1/2	C105	4.0	650	1-1/2	C105	3.0	685	1-1/2	C105	2.0	720			5.0	750	2	C210	4.5
	70	4233	570			4.5	610			4.5	650			3.5	680	1-1/2	C105	2.5	715	1-1/2	C105	1.5

Heater Parts from ACF Greenhouses

PERFORMANCE DATA - CONTINUED

Models With or Without Blower Enclosure ① ② ③ ④ ⑤

Data for use with filters only

Model No.	Temp Rise (°F)	Airflow (cfm)	0.5 Static Air Pressure				0.6 Static Air Pressure				0.7 Static Air Pressure			
			RPM	HP	Drive No.	Sheave Turns Open	RPM	HP	Drive No.	Sheave Turns Open	RPM	HP	Drive No.	Sheave Turns Open
BD 50	40	926	1070	3/4	C61	2.0	1130	3/4	C61	1.5	–	–	–	–
	45	823	1020	1/2		2.5	1085			2.0	–	–	–	–
	50	741	985			3.0	1050	1/2		2.5	–	–	–	–
	55	673	955			3.5	1025			2.5	–	–	–	–
	60	617	935	1/3	C1	3.5	1000	1/3	C1	3.0	–	–	–	–
	65	570	915			4.0	985			3.0	–	–	–	–
	70	529	905			4.0	975			3.0	–	–	–	–
BD 75	40	1389	955	1	C91	3.5	1010	1	C91	3.0	–	–	–	–
	45	1235	920	3/4	C187	1.0	985			3.0	1045	1	C91	2.5
	50	1111	895			1.5	960	3/4	C187	0.5	1025			2.5
	55	1010	880			2.0	945			1.0	1010	3/4	C187	0.0
	60	926	865	1/2		2.0	940			1.0	1005			0.0
	65	855	855			2.0	930			1.0	1000			0.0
	70	794	850			2.0	925			1.0	995			0.0
BD 100	40	1852	1095	1C	C91	2.0	1145	1	C91	1.0	–	–	–	–
	45	1646	1035	3/4		2.5	1090			2.0	1140	1	C91	1.5
	50	1481	985			3.0	1045	3/4		2.5	1100	3/4		2.0
	55	1347	955	1/2		3.5	1015			3.0	1070			2.0
	60	1235	925			4.0	990			3.0	1050			2.5
	65	1140	905			4.0	970	1/2		3.5	1030			2.5
	70	1058	890			4.0	955			3.5	1020	1/2		2.5
BD 125	40	2315	1080	1 1/2	C201	3.0	1125	1 1/2	C201	2.5	1165	1-1/2	C201	1.5
	45	2058	1010	1	C190	3.0	1060	1	C190	2.0	1105	1	C190	1.5
	50	1852	960	3/4	C199	3.5	1010	3/4	C199	3.0	1055			2.5
	55	1684	920			4.0	970			3.0	1020			2.5
	60	1543	890	1/2	C211	1.5	940			3.5	995	3/4	C199	3.0
	65	1425	865			2.0	920	1/2	C211	1.0	970			3.0
	70	1323	845			2.5	900			1.5	955	1/2	C211	0.5
BD 150	40	2778	750	1	C38	1.5	–	–	–	–	–	–	–	–
	45	2469	715			2.0	755	1	C38	1.5	–	–	–	–
	50	2222	685	3/4		2.5	730	3/4		2.0	–	–	–	–
	55	2020	665			3.0	715			2.0	–	–	–	–
	60	1852	650	1/2	C96	1.5	700			2.5	–	–	–	–
	65	1709	640			1.5	690			2.5	–	–	–	–
	70	1587	630			2.0	680	1/2	C96	1.0	–	–	–	–
BD 175	40	3241	970	2	C80	2.5	1005	2	C80	1.5	1035	2	C80	1.0
	45	2881	900	1 1/2	C193	1.0	935	1-1/2	C193	0.5	970			2.5
	50	2593	845	1	C192	2.5	885			1.5	920	1-1/2	C193	0.5
	55	2357	805			3.0	845	1	C192	2.5	880	1	C192	1.5
	60	2160	770	3/4		3.5	815	3/4		2.5	855			2.0
	65	1994	745			3.5	790			3.0	830	3/4		2.5
	70	1852	725	1/2	C96	0.0	770			3.5	815			2.5
BD 200	40	3704	615	1-1/2	C105	4.0	650	1-1/2	C105	3	685	–	–	–
	45	3292	590	1	C16	1.0	625			4	660	–	–	–
	50	2963	570	3/4		1.5	610	1	C16	0.5	645	–	–	–
	55	2694	555			1.5	595			0.5	635	–	–	–
	60	2469	545			2.0	590	3/4		1	630	–	–	–
	65	2279	540			2.0	585			1	625	–	–	–
	70	2116	535	1/2	C101	0.5	580			1	625	–	–	–
BD 250	40	4630	750	2	C108	2.5	775	2	C108	2	–	–	–	–
	45	4115	695	1-1/2	C105	2.0	725			3	755	2	C108	2.5
	50	3704	660			3.0	690	1-1/2	C105	2	720	1-1/2	C105	1.0
	55	3367	630	1	C205	2.0	665			3	695			2.0
	60	3086	605			2.0	645	1	C205	0.5	680	1	C205	1.0
	65	2849	590	3/4		2.5	630			2	665			1.0
	70	2646	575			3.0	615	3/4		2.0	655			1.0
BD 300	40	–	–	–	–	–	–	–	–	–	–	–	–	–
	45	4938	865	3	C111	2.0	890	3	C111	1.5	915	3	C111	1.0
	50	4444	805	2	C108	1.0	830	2	C108	0.5	860			2.0
	55	4040	760	1-1/2	C106	2.5	785			1.5	815	2	C108	1.0
	60	3704	720			3.5	750	1-1/2	C106	2.5	780	1-1/2	C106	1.5
	65	3419	690			4.0	720			3.5	750			2.5
	70	3175	660	1	C205	1.0	695	1	C205	0.5	725			3.0
BD 350	40	6481	1070	5	C207	0.5	1095	5	C207	0.0	–	–	–	–
	45	5761	975			2.0	1000			1.5	1025	5	C207	1.5
	50	5185	905	3	C111	1.0	930	3	C111	0.5	955	3	C111	0.0
	55	4714	845			2.5	870			2.0	900			1.0
	60	4321	800	2	C210	3.5	825	2	C210	3.0	855	2	C210	2.5
	65	3989	760	1-1/2	C105	0.0	790	1-1/2	C100	4.0	815			3.0
	70	3704	725			1.0	755		C105	0.0	785	1-1/2	C100	4.0
BD 400	40	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	6584	1010	5	C207	1.5	1035	5	C207	1.0	1055	5	C207	0.5
	50	5926	935			3.0	955			2.5	980			2.0
	55	5387	870	3	C111	2.0	895	3	C111	1.0	920	3	C111	0.5
	60	4938	820			3.0	850			2.5	875			2.0
	65	4558	780	2	C210	4.0	805	2	C210	3.5	835	2	C210	2.5
	70	4233	745	1 1/2	C105	0.5	775			4.0	800			3.5

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.

BD 50	0.1" W.C.
BD 75	0.2" W.C.
BD 100	0.2" W.C.
BD 125	0.3" W.C.
BD 150	0.1" W.C.
BD 175	0.2" W.C.
BD 200	0.1" W.C.
BD 250	0.2" W.C.
BD 300	0.2" W.C.
BD 350	0.2" W.C.
BD 400	0.2" W.C.

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 BD models (w/o duct-work or nozzles and at an airflow yielding a 55° temperature rise), are the same as those listed on page 12 for equivalent PD models.

⑤ Rpm setting shown in **bold** type indicate factory settings and standard drives.

Important: Note for 575V Only

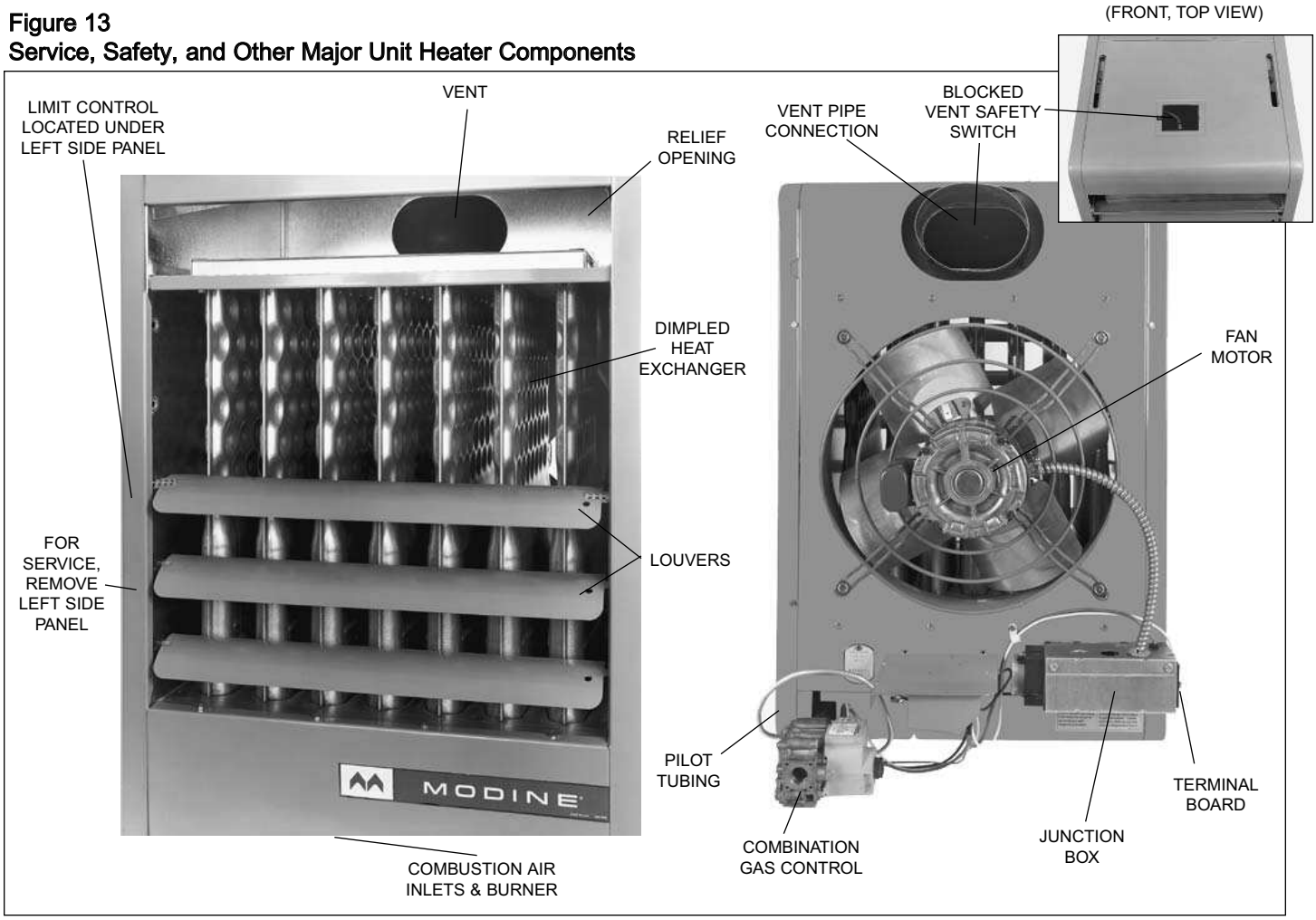
HP & Drive from this Catalog			HP & Drive to ORDER from Price List ①
BD 50	1/4 - C182	=	1/4 - C194
	1/4 - C183	=	1/4 - C195
	1/3 - C1	=	1/3 - C61
BD75	1/4 - C184	=	1/4 - C196
	1/4 - C185	=	1/4 - C186
	1/3 - C185	=	1/3 - C186
BD100	1/4 - C200	=	1/4 - C208
	1/4 - C90	=	1/4 - C92
	1/3 - C90	=	1/3 - C92
BD125	1/4 - C188	=	1/4 - C189
	1/3 - C188	=	1/3 - C189
	1/3 - C202	=	1/3 - C211
	1 1/2 - C201	=	1 1/2 - C209
BD150	1/4 - C191	=	1/4 - C197
	1/3 - C197	=	1/3 - C197
	1/3 - C95	=	1/3 - C96
BD175	1/3 - C95	=	1/3 - C96
	1 1/2 - C193	=	1 1/2 - C198
BD200	1/4 - C212	=	1/4 - C213
	1/3 - C212	=	1/3 - C213
	1/3 - C102	=	1/3 - C101
	1 1/2 - C105	=	1 1/2 - C180
BD250	1/3 - C203	=	1/3 - C204
	1 1/2 - C105	=	1 1/2 - C180
BD300	1 1/2 - C106	=	1 1/2 - C108
BD350	1 1/2 - C105	=	1 1/2 - C180
	1 1/2 - C100	=	1 1/2 - C210
BD400	1 1/2 - C105	=	1 1/2 - C180

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

Heater Parts from ACF Greenhouses

SERVICE INSTRUCTIONS – SAFETY DEVICES

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 sure 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 18 or 19, 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.

Blocked Vent Safety Switch (BVSS)

A BVSS is supplied on all gravity-vented unit heaters and is designed to prevent operation of the main burner if the venting system is blocked.

If the BVSS has tripped, turn off the gas and electric supply to the unit heater. Check the entire vent system connected to the unit heater for blockage or damage.

In the case of a restricted vent, there may not be enough dilution air to carry away the heat radiating off the heat exchanger top (and surrounding area), the BVSS may exceed the temperature setting and trip.

Spillage will also cause the BVSS to trip. If spillage exceeds five minutes, even though the vent is in compliance with the NFGC, some type of change must be made in the vent system to stop the spillage. These changes (improvements) could be lengthening the vertical vent run, reducing the horizontal vent run, insulating the vent pipe, using a larger diameter vent pipe, or using a less restrictive vent terminal.

Heater Parts from ACF Greenhouses

If these changes do not stop the spillage or the installer chooses not to make changes, a power exhauster is really the only recommended fix (see bulletin 6-530).

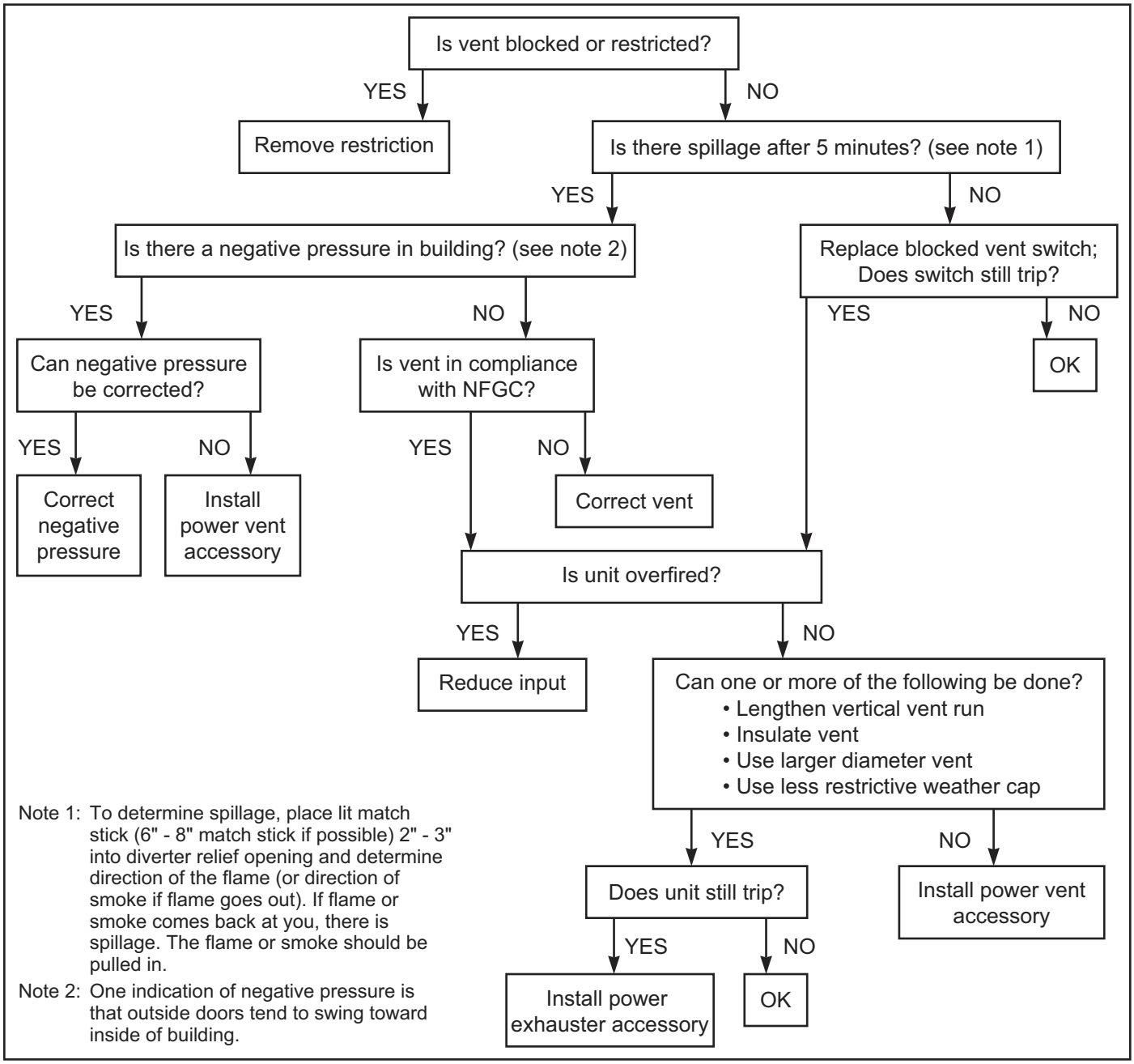
Low ambient installations can also be a cause for extended spillage. Be aware that in these installations for freeze protection and/or condensate protection, there is a good chance that a power exhauster will be necessary.

In instances where the blocked vent safety switch trips repeatedly, refer to Figure 14.

After the vent system has been changed, or if no blockage or damage is found in the vent system, the blocked vent switch may be reset. **To reset the blocked vent switch, depress the reset button located on the switch in the top of the unit.**

With the switch reset, turn on the electric and gas supply to the unit heater and restart the unit. Carefully observe the operation of the unit to assure that it is operating correctly. If the block vent switch does not allow the unit to function, or trips after the unit has operated for a period of time, call a qualified service agency to service the equipment. **Do not attempt to bypass the blocked vent safety switch with a switch. Do not attempt to replace a defective blocked vent safety switch with a switch other than that supplied by the unit heater manufacturer.**

Figure 14
BVSS - Troubleshooting Flow Chart



Heater Parts from ACF Greenhouses

SERVICE INSTRUCTIONS – GENERAL

ONLY PEOPLE TRAINED AND FAMILIAR WITH THE OPERATION OF UNIT HEATERS AND THEIR CONTROLS SHOULD SERVICE THIS UNIT.

General Maintenance

1. Service air moving components annually.
   a. On propeller units this includes checking motor for lubrication if motor is 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 sheaves 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 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. Controls – See control instruction sheets furnished separately with the unit heater.

To Remove Main Burner

1. Turn off all electricity and gas to unit.
2. Lower bottom pan to expose burner and manifold. See Figure 1, Page 2.
3. Disconnect pilot tubing and thermocouple lead (or ignition cable) at the combination gas control (and ignition control.)
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 15
Manifold Adjustment, Natural Gas

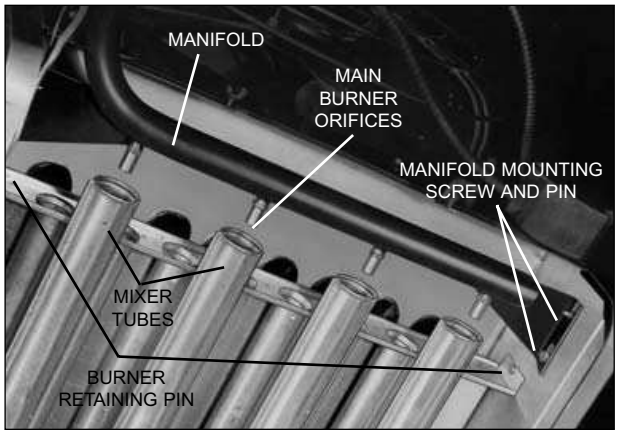
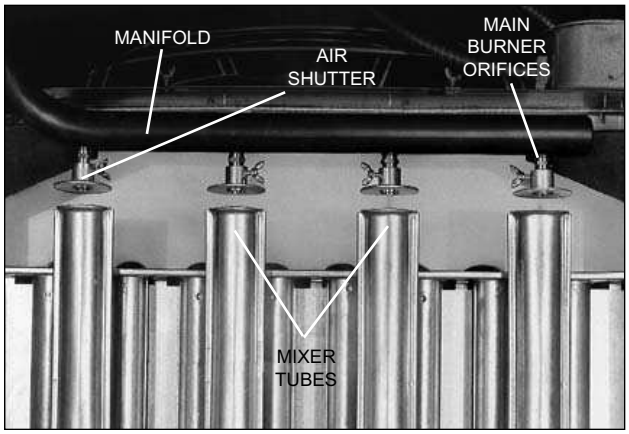


Figure 16
Air Shutter Adjustment, Propane Gas



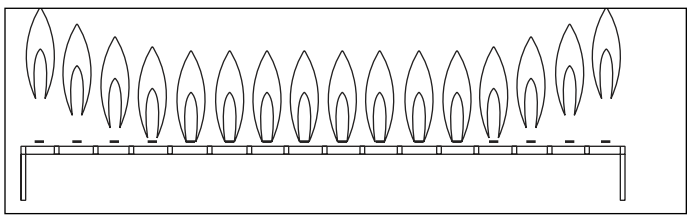
Combustion Problem Symptoms and Diagnosis

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 5 to be sure the unit is not operating over rated input.

Figure 17
Lifting Flame Condition



Heater Parts from ACF Greenhouses

TROUBLESHOOTING GUIDE

2. Yellow Tipping

Yellow tipping of a normally blue flame is caused by insufficient primary air, and indicated 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.

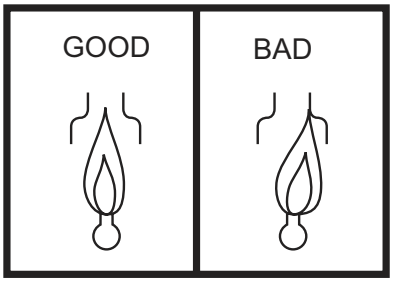
3. Flashback

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.

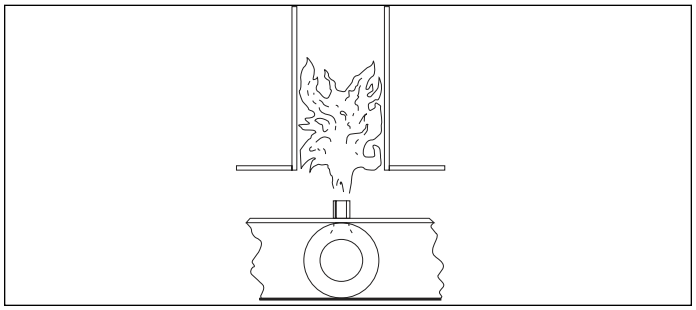
Figure 18
Wavering Flame or Misalignment



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.

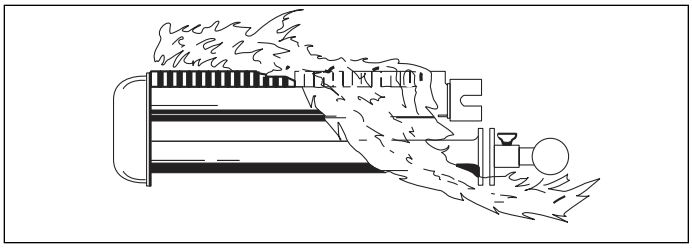
Figure 19
Floating Flame Condition



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 20
Flame Rollout Appearance



Standing Pilot Problem Symptoms and Diagnosis

1. If pilot does not light:

POSSIBLE CAUSES AND REMEDIES
1a. Check that manual gas control (knob or lever) on combination gas control is in the pilot position.
1b. Bleed air from pilot line. (Use special care in bleeding propane units.)
1c. If pilot sputters, check pilot line for condensate or other obstruction.
1d. If pilot flame is feeble or short, check pilot orifice for cleanliness. Replace if necessary. See page 9 for pilot flame adjustment.
1e. Be sure thermocouple contact point is clean. If problem persists, replace thermocouple.
1f. If the above steps do not correct the condition, consult your local qualified installation and service contractor or appropriate utility company.

2. If standing pilot does not stay lit:

POSSIBLE CAUSES AND REMEDIES
2a. Check inlet pressure with all units operating, making certain that there is proper pressure.
2b. Check pipe or tubing size to unit. See Table 2.
2c. Be sure all pilot connections are tight.
2d. Check for excessive drafts.
2e. Check for clogged pilot orifice or pilot line.
2f. Check for leaks around pilot fittings. If leaks cause flame impingement on thermocouple lead, thermocouple may become inoperative.

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3. Effect of pilot operation on safety controls:

POSSIBLE CAUSES AND REMEDIES
3a. A short pilot flame may cause poor ignition and result in the controls not opening the combination gas control or reduce heat on thermocouple to the point where the automatic controls become inoperative, thereby shutting off gas supply to main burners. This may result from a plugged orifice.
3b. Check electrical connection from the thermocouple element to the safety valve to assure good electrical contact. Also check location of pilot flame in relation to thermocouple element.

4. If main burners do not light:

POSSIBLE CAUSES AND REMEDIES
4a. Check that manual valve on combination gas control is in ON position.
4b. Be sure pilot is lit, correctly positioned and strong enough to ignite burner ports.
4c. Check wiring (electrical power supply) to combination gas control.
4d. If unit is equipped with an ECO (energy cut-off device located on rear panel of unit) check fuse in ECO and make sure it has not blown and is operating correctly. Caution: The ECO fuse should blow only if excessive unit temperatures are experienced. If fuse is blown make sure the cause of the unit overheating is found and corrected before replacing the fuse and placing the unit back into operation.
4e. If the above does not correct the condition, consult your local gas company or local Modine representative.

Intermittent Pilot Problem 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-amps of sensor. Tighten loose connections. Clean sensor with steel wool. 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 manufacturer's recommendations.
1k. Flame sensor out of position.	1k. Reposition.
1l. Defective ignition controller.	1l. Replace.

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 adjsut 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.
2p. Blocked vent safety switch tripped.	2p. Refer to page 20 for instructions

3. Burner shuts down before thermostat is satisfied:

POSSIBLE CAUSE	POSSIBLE REMEDY
3a. Flame sensing circuit failure.	3a. Check flame sensing rod, sensor ceramic, sensor lead and connections for damage or loss of continuity; Replace defective elements.
3b. Soot on sensing rod.	3b. Clean off soot 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.

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

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

See page 26 for Model Number and Serial Number Designations.

⚠ CAUTION

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

Heater Parts from ACF Greenhouses

MOTOR DATA ① ② ③

Power Code Description — Propeller PD Models

Pwr. Code	Electric Power	PD 30	PD 50	PD 75	PD 100	PD 125	PD 150	PD 175	PD 200	PD 250	PD 300	PD 350	PD 400
		Horsepower											
01	115/60/1	1/40	1/40	1/12	1/12	1/8	1/8	1/6	1/6	1/3	1/2	3/4	3/4
02	230/60/1	1/40	1/40	1/8	1/8	1/8	1/8	1/6	1/6	1/3	1/2	3/4	3/4
04	200/60/3	–	–	1/4	1/4	1/4	1/4	1/3	1/3	1/3	1/2	3/4	3/4
05	230/460/60/3	–	–	1/4	1/4	1/4	1/4	1/3	1/3	1/3	1/2	3/4	3/4

Motor Data and Total Unit Power Requirements — Propeller PD Models

Voltage	115/60/1				230/60/1				200/60/3				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	1.3	110	0.4	1550	0.6	110	–	–	–	–	–	–	–	–
1/12	1.6	1625	1.9	200	–	–	–	–	–	–	–	–	–	–	–	–
1/8	2.3	1625	2.6	300	1.0	1725	1.2	300	–	–	–	–	–	–	–	–
1/6	2.8	1075	3.1	310	1.5	1075	1.7	310	–	–	–	–	–	–	–	–
1/4	–	–	–	–	–	–	–	–	1.3	1725	1.7	380	1.3/.7	1725	1.6/0.8	380
1/3	5.4	1075	5.7	490	2.2	1075	2.8	490	1.9	1140	2.1	490	2.1/1.1	1140	2.4/1.2	490
1/2	7.5	1075	7.8	690	3.5	1075	3.7	690	2.4	1140	2.8	740	2.6/1.3	1140	3.2/1.6	740
3/4	8.0	1125	8.3	840	4.0	1125	4.2	840	3.6	1140	3.8	1040	3.4/1.7	1140	3.6/1.8	1040

Power Code Description — Blower BD Models

Power Code	Electric Power	BD50		BD75		BD100		BD125		BD150		BD175		BD200		BD250		BD300		BD350		BD400	
		HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive	HP	Drive
01	115/60/1	1/4	182	1/4	184	1/4	200	1/4	188	1/4	191	–	–	1/4	212	–	–	–	–	–	–	–	–
02	230/60/1	1/4	182	1/4	184	1/4	200	1/4	188	1/4	191	–	–	1/4	212	–	–	–	–	–	–	–	–
04	200/60/3	1/4	182	1/4	184	1/4	200	1/4	188	1/4	191	–	–	1/4	212	–	–	–	–	–	–	–	–
05	230/460/60/3	1/4	182	1/4	184	1/4	200	1/4	188	1/4	191	–	–	1/4	212	–	–	–	–	–	–	–	–
07	575/60/3	1/4	194	1/4	196	1/4	208	1/4	189	1/4	197	–	–	1/4	213	–	–	–	–	–	–	–	–
09	115/60/1	1/4	183	1/4	185	1/4	90	1/3	188	1/3	191	1/3	95	1/3	212	1/3	203	3/4	205	1	107	1-1/2	105
10	230/60/1	1/4	183	1/4	185	1/4	90	1/3	188	1/3	191	1/3	95	1/3	212	1/3	203	3/4	205	1	107	1-1/2	105
12	200/60/3	1/4	183	1/4	185	1/4	90	1/3	188	1/3	191	1/3	95	1/3	212	1/3	203	3/4	205	1	107	1-1/2	105
13	230/460/60/3	1/4	183	1/4	185	1/4	90	1/3	188	1/3	191	1/3	95	1/3	212	1/3	203	3/4	205	1	107	1-1/2	105
15	575/60/3	1/4	195	1/4	186	1/4	92	1/3	189	1/3	197	1/3	96	1/3	213	1/3	204	3/4	205	1	107	1-1/2	180
17	115/60/1	1/3	1	1/3	185	1/3	90	1/3	202	1/3	95	1/2	96	1/3	102	1/2	204	1	205	1-1/2	105	–	–
18	230/60/1	1/3	1	1/3	185	1/3	90	1/3	202	1/3	95	1/2	96	1/3	102	1/2	204	1	205	1-1/2	105	–	–
20	200/60/3	1/3	1	1/3	185	1/3	90	1/3	202	1/3	95	1/2	96	1/3	102	1/2	204	1	205	1-1/2	105	2	210
21	230/460/60/3	1/3	1	1/3	185	1/3	90	1/3	202	1/3	95	1/2	96	1/3	102	1/2	204	1	205	1-1/2	105	2	210
23	575/60/3	1/3	61	1/3	186	1/3	92	1/3	211	1/3	96	1/2	96	1/3	101	1/2	204	1	205	1-1/2	180	2	210
25	115/60/1	1/2	61	1/2	186	1/2	92	1/2	211	1/2	96	3/4	192	1/2	101	3/4	205	1-1/2	106	1-1/2	100	–	–
26	230/60/1	1/2	61	1/2	186	1/2	92	1/2	211	1/2	96	3/4	192	1/2	101	3/4	205	1-1/2	106	1-1/2	100	–	–
28	200/60/3	1/2	61	1/2	186	1/2	92	1/2	211	1/2	96	3/4	192	1/2	101	3/4	205	1-1/2	106	1-1/2	100	3	111
29	230/460/60/3	1/2	61	1/2	186	1/2	92	1/2	211	1/2	96	3/4	192	1/2	101	3/4	205	1-1/2	106	1-1/2	100	3	111
31	575/60/3	1/2	61	1/2	186	1/2	92	1/2	211	1/2	96	3/4	192	1/2	101	3/4	205	1-1/2	108	1-1/2	210	3	111
33	115/60/1	3/4	61	1/2	187	1/2	91	3/4	199	3/4	38	1	192	3/4	16	1	205	–	–	–	–	–	–
34	230/60/1	3/4	61	1/2	187	1/2	91	3/4	199	3/4	38	1	192	3/4	16	1	205	–	–	–	–	–	–
36	200/60/3	3/4	61	1/2	187	1/2	91	3/4	199	3/4	38	1	192	3/4	16	1	205	2	108	2	210	5	207
37	230/460/60/3	3/4	61	1/2	187	1/2	91	3/4	199	3/4	38	1	192	3/4	16	1	205	2	108	2	210	5	207
39	575/60/3	3/4	61	1/2	187	1/2	91	3/4	199	3/4	38	1	192	3/4	16	1	205	2	108	2	210	5	207
41	115/60/1	–	–	3/4	187	3/4	91	1	190	1	38	1-1/2	193	1	16	1-1/2	105	–	–	–	–	–	–
42	230/60/1	–	–	3/4	187	3/4	91	1	190	1	38	1-1/2	193	1	16	1-1/2	105	–	–	–	–	–	–
44	200/60/3	–	–	3/4	187	3/4	91	1	190	1	38	1-1/2	193	1	16	1-1/2	105	3	111	3	111	–	–
45	230/460/60/3	–	–	3/4	187	3/4	91	1	190	1	38	1-1/2	193	1	16	1-1/2	105	3	111	3	111	–	–
47	575/60/3	–	–	3/4	187	3/4	91	1	190	1	38	1-1/2	198	1	16	1-1/2	180	3	111	3	111	–	–
49	115/60/1	–	–	1	91	1	91	1-1/2	201	–	–	–	–	1-1/2	105	–	–	–	–	–	–	–	–
50	230/60/1	–	–	1	91	1	91	1-1/2	201	–	–	–	–	1-1/2	105	–	–	–	–	–	–	–	–
52	200/60/3	–	–	1	91	1	91	1-1/2	201	–	–	2	80	1-1/2	105	2	108	–	–	5	207	–	–
53	230/460/60/3	–	–	1	91	1	91	1- 1/2	201	–	–	2	80	1-1/2	105	2	108	–	–	5	207	–	–
55	575/60/3	–	–	1	91	1	91	1-1/2	209	–	–	2	80	1-1/2	180	2	108	–	–	5	207	–	–

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.

Heater Parts from ACF Greenhouses

MOTOR DATA ① ③ (see page 25)

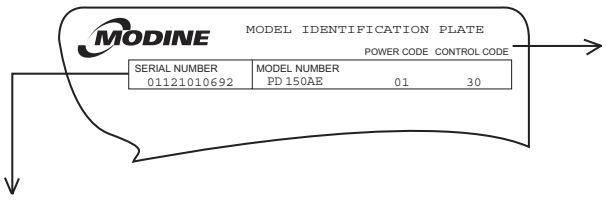
Motor Data and Total Unit Power Requirements – Blower BD Models

Voltage	115/60/1				230/60/1				200/60/3				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	Total Amps	Total Watts
1/4	5.4	1725	5.7	390	2.7	1725	2.9	390	1.2	1725	1.4	370	1.3/0.7	1725	1.6/0.8	370	0.6	1725	0.7	370
1/3	5.0	1725	5.3	410	2.5	1725	2.7	410	1.9	1725	2.1	400	1.6/0.8	1725	1.8/0.9	400	0.6	1725	0.7	400
1/2	8.5	1725	8.8	600	3.8	1725	4.0	600	2.3	1725	2.5	600	2.6/1.3	1725	2.8/1.4	600	0.9	1725	1.0	600
3/4	11.0	1725	11.3	870	5.5	1725	5.7	870	2.9	1725	3.1	840	3.0/1.5	1725	3.2/1.6	840	1.1	1725	1.2	840
1	13.4	1725	13.7	1080	6.7	1725	6.9	1080	4.0	1725	4.2	1100	3.8/1.9	1725	4.0/2.0	1100	1.5	1725	1.6	1100
1-1/2	15.4	1725	15.7	1490	7.7	1725	7.9	1490	5.2	1725	5.4	1500	5.2/2.6	1725	5.4/2.7	1500	1.9	1725	2.0	1500
2	-	-	-	-	-	-	-	-	6.8	1725	7.1	1950	6.6/3.3	1725	6.8/3.4	1950	2.3	1725	2.4	1950
3	-	-	-	-	-	-	-	-	10.6	1725	10.8	3300	8.8/4.4	1725	9.0/4.5	3300	4.0	1725	4.1	3300
5	-	-	-	-	-	-	-	-	14.3	1725	14.5	4400	13.2/6.6	1725	13.4/6.7	4400	5.2	1725	5.3	4400

Blower Drive Numbers

Drive No.	Blower Sheave Belt No. Browning	Blower Sheave Pitch Dia.	Blower Sheave Bore	Motor Sheave Max. Pitch Dia.	Motor Sheave Bore	Drive No.	Blower Sheave Belt No. Browning	Blower Sheave Pitch Dia.	Blower Sheave Bore	Motor Sheave Max. Pitch Dia.	Motor Sheave Bore
C1	A29	4	3/4	2.9	1/2	C188	A38	7	3/4	2.9	1/2
C16	A48	8	1	2.9	5/8	C189	A39	7	3/4	2.9	5/8
C38	A41	6	3/4	2.9	5/8	C190	A35	4	3/4	2.9	5/8
C61	A30	4	3/4	2.9	5/8	C191	A49	11	3/4	2.9	1/2
C80	A45	7	3/4	4.4	7/8	C192	A40	5	3/4	2.9	5/8
C90	A35	6	3/4	2.9	1/2	C193	A47	8	3/4	4.4	5/8
C91	A33	4	3/4	2.9	5/8	C194	A37	8	3/4	2.9	5/8
C92	A36	6	3/4	2.9	5/8	C195	A33	6	3/4	2.9	5/8
C95	A42	7	3/4	2.9	1/2	C196	A44	10	3/4	2.9	5/8
C96	A43	7	3/4	2.9	5/8	C197	A50	11	3/4	2.9	5/8
C100	A50	8	1	4.4	5/8	C198	A47	8	3/4	4.4	7/8
C101	A50	9	1	2.9	5/8	C199	A34	4	3/4	2.9	5/8
C102	A49	9	1	2.9	1/2	C200	A39	8	3/4	2.9	1/2
C105	A54	10	1	4.4	5/8	C201	A40	6	3/4	4.4	5/8
C106	A52	9	1	4.4	5/8	C202	A35	5	3/4	2.9	1/2
C107	A45	6	1	2.9	5/8	C203	A51	10	1	2.9	1/2
C108	A52	9	1	4.4	7/8	C204	A52	10	1	2.9	5/8
C111	A52	8	1	4.4	1-1/8	C205	A46	7	1	2.9	5/8
C180	A54	10	1	4.4	7/8	C207	A51	7	1	4.4	1-1/8
C182	A36	8	3/4	2.9	1/2	C208	A40	8	3/4	2.9	5/8
C183	A33	6	3/4	2.9	1/2	C209	A40	6	3/4	4.4	7/8
C184	A43	10	3/4	2.9	1/2	C210	A51	8	1	4.4	7/8
C185	A37	7	3/4	2.9	1/2	C211	A36	5	3/4	2.9	5/8
C186	A38	7	3/4	2.9	5/8	C212	A58	14	1	2.9	1/2
C187	A35	5	3/4	2.9	5/8	C213	A59	14	1	2.9	5/8

Rating Plate Identification



Serial Number Designations

01 12 101 10 97

MOTOR SUPPLIER CODE
01 - Century
05 - Universal
etc.

FAN OR BLOWER SUPPLIER CODE
01 - Revcor
08 - Brookside
etc.

SERIES IDENTITY NUMBER
Identifies which series of controls were furnished on the unit.

WEEK OF MANUFACTURE
10 - 10th week of 1997
25 - 25th week of 1997
etc.

YEAR OF MANUFACTURE
97 - 1997
98 - 1998
etc.

Model Number Designations

PD 150 A E M 01 30

PD - Propeller Unit
BD - Blower Unit

Input
150 - 150,000 Btu/hr input
175 - 175,000 Btu/hr input
250 - 250,000 Btu/hr input
etc.

Heat Exchanger
A - Aluminized
S - Stainless Steel

Ignition Type
A – Standing Pilot
E – Intermittent Pilot

M - Unit is equipped with 2-stage or mechanical modulation

Power Code
01 - Complete Power Code descriptions
02 - are shown on page 25
etc.

Control Code
30 - Complete Control Code descriptions are shown on page 27

Heater Parts from ACF Greenhouses

CONTROL OPTIONS

Propeller and Blower Unit Heaters – PD and BD Models ①②③④

Control System Description	Control Code No.	Service Voltage	Thermostat Voltage	Type of Gas
Single-Stage, Standing Pilot, 100% Shut-Off – Utilizes a single-stage combination gas control and thermocouple. Pilot needs to be manually lit initially and stays lit.	11 12 13 14 81 82 91 92	115V 200/230V 460V 575V 115V 200/230V 460V 575V	25V 25V 25V 25V 25V 25V 25V 25V	natural natural natural natural propane propane propane propane
Two-Stage, Standing Pilot, 100% Shut-Off – Utilizes a two-stage gas control (which fires at 50% or 100% of full rated input) and thermocouple. Pilot needs to be manually lit initially and stays lit.	25 26 83 84	115V 200/230V 115V 200/230V	25V 25V 25V 25V	natural natural propane propane
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 31 32 33 85 86 93 94	115V 200/230V 460V 575V 115V 200/230V 460V 575V	25V 25V 25V 25V 25V 25V 25V 25V	natural natural natural natural propane propane propane propane
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 BD models only.	59 60 89 90	115V 200/230V 115V 200/230V	25V 25V 25V 25V	natural natural propane propane
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 call for heat.	63 64 87 88	115V 200/230V 115V 200/230V	25V 25V 25V 25V	natural natural propane propane

① CGA approved 460V and 575V available on blower units only.

② All PD and BD models with two-stage or modulating gas controls require a Category II vent system.

③ For units with control systems having fan timer, fan starts 30 seconds (max.) after ignition and shuts down approximately 60 seconds after main burner shuts down. Available on units with up to 1 hp motors or 14 amps @ 115V A.C. Contact factory for applications with units having motors with horsepower ratings above 1 hp or 14 amps @ 115V A.C.

④ 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.

Electrical Details

Supply Voltage	Transformer by Modine	Transformer by Others	Control Voltage	Optional Controls required by others		
				Transformer		Motor Starter Coil Voltage
				Gravity Vented	Power Exhausted	
115V	X		115V	–	–	–
200V	X		200/230V	–	–	200V
230V	X		200/230V	–	–	230V
460V	X		460V	–	460V/230V,250VA	24V
		X	200/230V	460V/230V,75VA ①	460V/230V,250VA	230V ①
575V	X		575V	–	575V/230V,250VA	24V
		X	200/230V	575V/230V,75VA ①	575V/230V,250VA	230V ①

① 460V(575V)/200V transformer as an alternative is okay. Motor starter coil then needs to be 200V also.

Control Operating Sequence

For Standing Pilot (with Pilot Lit)

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

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

For Intermittent Pilot

Upon a call for heat from the thermostat, power is supplied to the ignition control and at the same time power is supplied to the fan timer. Sparking will start at the pilot immediately and 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 15 to 45 seconds from the time the thermostat called for heat the fan motor will start.

On systems utilizing control codes 30-33, 85, 86, 93 or 94, the system will attempt to light the pilot for 70 seconds once there is a demand for heat. If the pilot 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 lapses between cycles is at pre-programmed intervals (approximately 6 minutes). This will continue indefinitely until the pilot flame is sensed or until power is interrupted to the system.

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.

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.

Mechanical Modulation Systems

When power is turned on the pilot is automatically lit. 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.

Heater Parts from ACF Greenhouses

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 continuous product improvement program, it reserves the right to change design and specifications without notice.

MODINE

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Commercial HVAC&R Division
Modine Manufacturing Company
1221 Magnolia Avenue
Buena Vista, Virginia 24416
Phone: 1.800.828.4328 (HEAT)
Fax: 540.261.1903 (Service & Parts)
www.modine.com

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Heater Parts from ACF Greenhouses