MODINE

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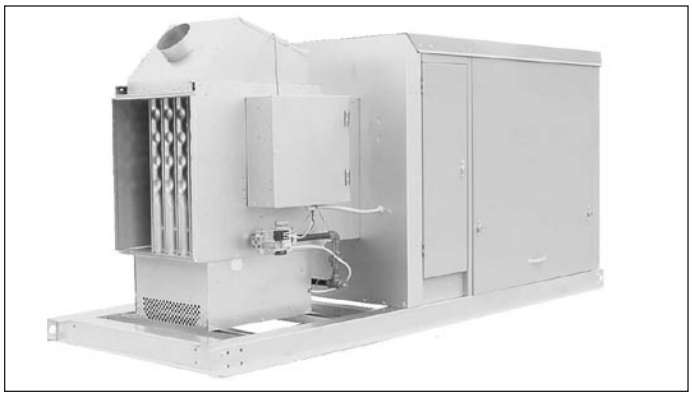
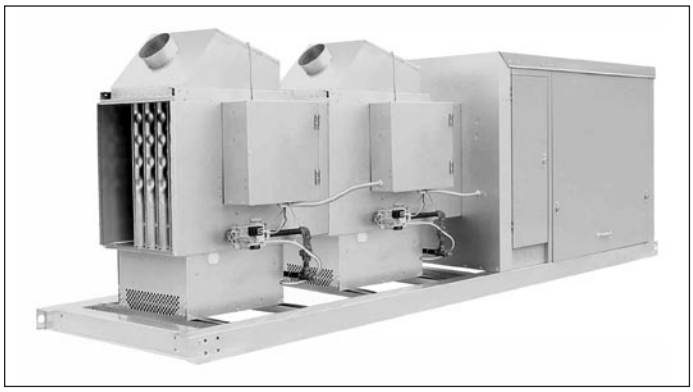
INSTALLATION AND SERVICE MANUAL
gas-fired indoor gravity vented duct furnaces/make-up air units
models DBG/DCG





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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.

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.

Inspection on Arrival

1. Inspect unit upon arrival. In case of damage, report it immediately to transportation company and your local factory 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 upon arrival for conformance with description of product ordered (including specifications where applicable).

⚠ WARNING

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

⚠ 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.

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

SPECIAL PRECAUTIONS / TABLE OF CONTENTS

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. THESE INSTRUCTIONS ARE SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

⚠ DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

⚠ WARNING

1. Gas fired heating equipment must be vented - do not operate unvented.
2. A built-in draft diverter is provided - additional external diverters are not required or permitted.
3. Gas-fired heating equipment which has been improperly vented, or which experiences a blocked vent condition may have flue gases accidentally spilled into the heated space. See page 25 for specific information about the blocked vent safety switch supplied on the unit.
4. All field gas piping must be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
5. Gas pressure to appliance controls must never exceed 14" W.C. (1/2 psi).
6. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
7. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
8. To reduce the opportunity for condensation, the minimum sea level input to the appliance, as indicated on the serial plate, must not be less than 5% below the rated input, or 5% below the minimum rated input of dual rated units.
9. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than the rated voltage.
10. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
11. When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owners risk.

⚠ CAUTION

1. Purging of air from gas supply line should be performed as described in ANSI Z223.1 - latest edition “National Fuel Gas Code”, or in Canada in CAN/CGA-B149 codes.
2. Do not attempt to reuse any mechanical or electronic ignition controllers which has been wet. Replace defective controller.
3. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.

IMPORTANT

1. To prevent premature heat exchanger failure, do not locate ANY gas-fired appliances in areas where corrosive vapors (i.e. chlorinated, halogenated or acid) are present in the atmosphere.
2. To prevent premature heat exchanger failure, the input to the appliance, as indicated on the serial plate, must not exceed the rated input by more than 5%.
3. To prevent premature heat exchanger failure, observe heat exchanger tubes by looking at the heat exchanger through the field installed access openings in connecting ductwork in cooling package units or the unit access doors in blower package units. If the bottom of the tubes become red while blower and duct furnace are in operation, check to be sure the blower has been set to the proper rpm for the application. Refer to page 15 for Blower Adjustments.
4. Start-up and adjustment procedures should be performed by a qualified service agency.
5. To check most of the Possible Remedies in the trouble-shooting guide listed in Table 50.1, refer to the applicable sections of the manual.

Table of Contents

SI (METRIC) CONVERSION FACTORS / UNIT LOCATION

SI (METRIC) CONVERSION FACTORS

Table 3.1

To Convert	Multiply By	To Obtain
"W.C.	0.24	kPa
psig	6.893	kPa
°F	(°F-32) x 0.555	°C
inches	25.4	mm
feet	0.305	meters
CFM	0.028	m^3/min

To Convert	Multiply By	To Obtain
CFH	1.699	m^3/min
Btu/ft^3	0.0374	mJ/m^3
pound	0.453	kg
Btu/hr	0.000293	kW/hr
gallons	3.785	liters
psig	27.7	"W.C.

UNIT LOCATION

⚠ DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

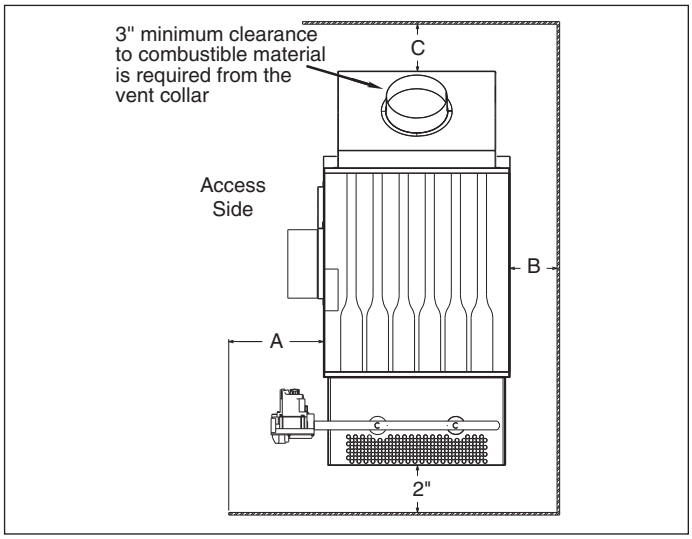
IMPORTANT

To prevent premature heat exchanger failure, do not locate ANY gas-fired appliances in areas where corrosive vapors (i.e. chlorinated, halogenated or acid) are present in the atmosphere.

Location Recommendations

1. When locating the furnace, consider general space and heating requirements, availability of gas and electrical supply, and proximity to vent locations.
2. Unit must be installed on the positive pressure side of the circulating blower.
3. Be sure the structural support at the unit location site is adequate to support the weight of the unit. For proper operation the unit must be installed in a level horizontal position.
4. Do not install units in locations where the flue products can be drawn into the adjacent building openings such as windows, fresh air intakes, etc.
5. Be sure that the minimum clearances to combustible materials and recommended service clearances are maintained. Units are designed for installation on non-combustible surfaces with the minimum clearances shown in Figure 3.1 and Tables 3.2 and 3.3.
6. Units installed downstream of refrigeration systems, or exposed to inlet air temperatures of 40°F or less, may experience condensation, therefore, provisions should be made for disposal of condensate. Means have been provided in the bottom pan of the unit to accommodate a condensate drain line connection flange.
7. When locating units, it is important to consider that the exhaust vent piping must be connected to the outside atmosphere.
8. In garages or other sections of aircraft hangars such as offices and shops that communicate with areas used for servicing or storage, keep the bottom of the unit at least 7' above the floor unless the unit is properly guarded to provide user protection from moving parts. In parking garages, the unit must be installed in accordance with the standard for parking structures ANSI/NFPA 88A, and in repair garages the standard for repair garages NFPA #88B. In Canada, installation of 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.
9. Do not install units in locations where gas ignition system is exposed to water spray, rain, or dripping water.

Figure 3.1 - Combustible Material and Service Clearances



① A 3" minimum clearance to combustible material is required from the vent collar.

Table 3.2 - Combustible Material Clearances

Model Size	Access Side (A)	Non- Access Side (B)	Top (C)
75-175	6"	1"	2"
200-960	6"	2"	2"

Table 3.3 - Recommended Service Clearances

Model Size	Access Side (A)	Non-Access Side (B)	Top (C)
75	18"	6"	10"
100/125	20"	6"	10"
150/175	25"	6"	10"
200/225	27"	6"	10"
250/300	30"	6"	10"
350/400	41"	6"	10"
500/600	30"	6"	10"
700/800	41"	6"	10"
840/960	41"	6"	10"

Combustion Air Requirements

Units installed in tightly sealed buildings or confined spaces must be provided with two permanent openings, one near the top of the confined space 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 off all units in the enclosure, freely communicating with interior areas having, in turn adequate infiltration from the outside.
For further details on supplying combustion air to a confined (tightly sealed) space or unconfined space, see the National Fuel Gas Code ANSI Z223.1 of CAN/CGA B149.1 or .2 Installation Code, latest edition.

Sound and Vibration Levels

All standard blower mechanical equipment generates some sound and vibration that may require attenuation. Libraries, private offices and hospital facilities will require more attenuation, and in such cases, an acoustical consultant may be retained to assist in the application. Locating the equipment away from the critical area is desirable within ducting limitations. Generally, a unit should be located within 15 feet of a primary support beam. Smaller deflections mean lesser vibration and noise transmission.

UNIT LOCATION/UNIT LIFTING/UNIT MOUNTING

UNIT LIFTING

All standard blower system units are shipped fully crated with skid supports below the unit. The unit may be lifted from the bottom by means of a fork lift or other lifting device only if the shipping support skids are left in place. DO NOT attempt to lift the unit from the bottom unless the shipping skid supports are still in place. When lifting units, make sure the load is balanced. All extended cabinet systems are shipped without a crate and cannot be lifted with a fork truck. Use a crane or other overhead lifting device in conjunction with the lifting holes (refer to page 45 for base rail lifting hole locations) for safe unit relocation. If the unit must be lifted from the bottom for final installation of the unit be sure to properly support the unit over its entire length to prevent damage.

UNIT MOUNTING

Be sure the method of unit support (suspension or floor mounting) is adequate to support the weight of the unit (see Weights for base unit and factory installed option weights). For proper operation, the unit must be installed in a level horizontal position. Combustible material and service clearances as specified in Figure 3.1 and Tables 3.2 and 3.3 must be strictly maintained. To assure that flames are directed into the center of the heat exchanger tubes, the unit must be level in a horizontal position. Use a spirit level to ensure that the unit is suspended or floor mounted correctly.

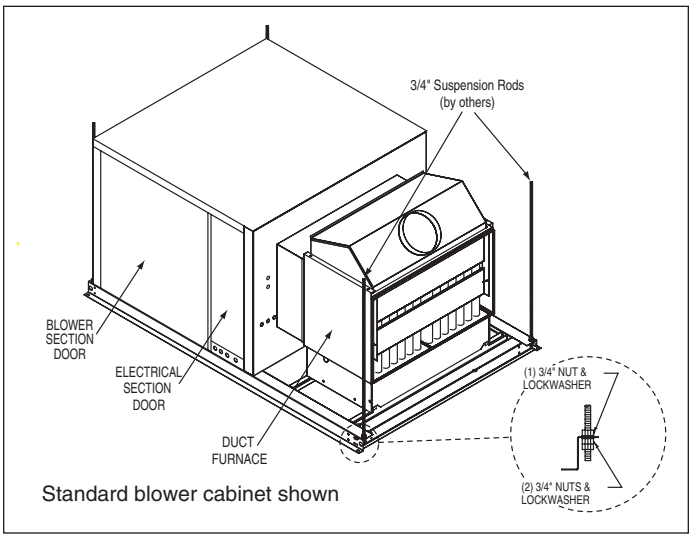
Unit Suspension

3/4" diameter suspension hanging locations are provided in the base rail assembly of the unit. Refer to Figure 45.1 for Suspension Hanging Locations and Figure 4.1 demonstrates how the unit should be suspended and the suspension rods fastened to the unit base rail. If required, vibration isolators may be added.

Floor Mounted Units

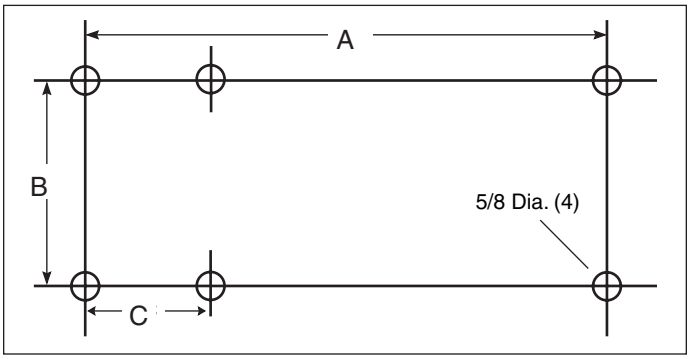
For floor installations, the floor structure must be adequately designed to support the live weight load of the unit and any other required support structure. Additional reinforcement should be provided, if necessary. The floor should include threaded 5/8-inch anchor bolts spaced according to Figure 4.2, for securing the unit in place. Anchor bolts should extend at least 1-1/2" above the surface of the floor to allow clearance for mounting washers, nuts and bolts (mounting washers, nuts, and bolts by others).

Figure 4.1 - Unit Suspension Method



Standard blower cabinet shown

Figure 4.2 - Floor Mounted Units



Model Size	Blower Type (Digit 16)	DBG Units (A)	DCG Units (A)	All Units (B)	DBG Units (C)
75	All	86.27	115.48	33.85	-
100/25	All	86.37	115.48	36.36	-
150/175	All	86.37	115.48	40.61	-
200/225	All	86.37	115.48	42.71	-
250/300	E,F,G, or H	86.37	115.48	45.75	-
250/300	I,J, or K	112.12	151.34	45.75	-
350/400	E,F,G or H	86.37	115.48	57.27	-
350/400	I,J, or K	122.2	151.34	57.27	-
500/600	G or H	119.52	-	45.75	33.5
500/600	I,J, or K	155.38	-	45.75	33.5
700/800	G or H	119.52	-	57.27	33.5
700/800	I,J,K, or L	155.37	-	57.27	33.5
840/960	I,J,K, or L	184.61	-	57.27	62.73

DUCT INSTALLATION

Furnace discharge duct connection

1. The furnace discharge is designed to accept straight ductwork. (See Figure 5.1.) Provide an airtight seal between the ductwork and the furnace. Seams with cracks in the ductwork should be caulked and/or taped and be of permanent type. All duct connections MUST be airtight to prevent air leakage.
2. Provide uniform air distribution over the heat exchanger. Use turning vanes where required to obtain uniform air distribution. (See Figure 5.2).
3. Provide removable access panels on the downstream side of the ductwork. (See Figure 5.1.) This opening 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 heat exchangers due to poor air distribution or lack of sufficient air (CFM).

Figure 5.1 - Furnace Discharge Duct Connection

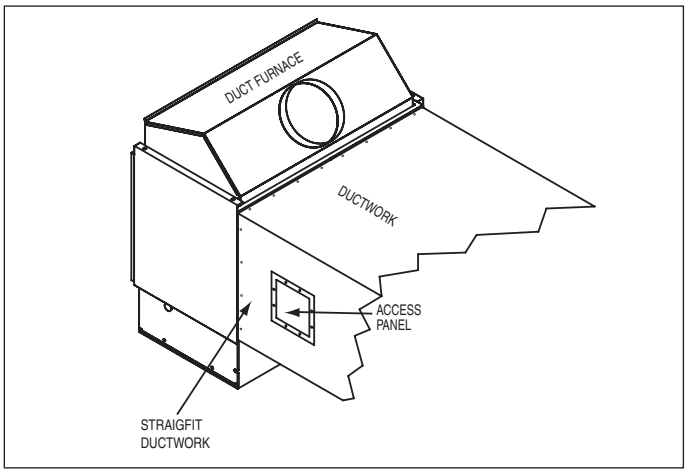
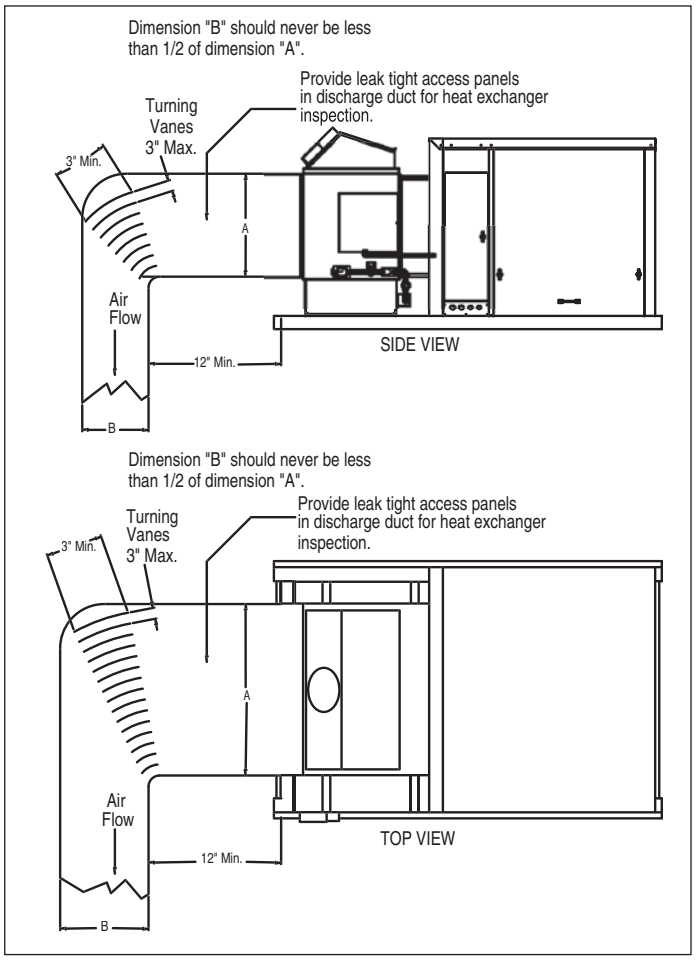


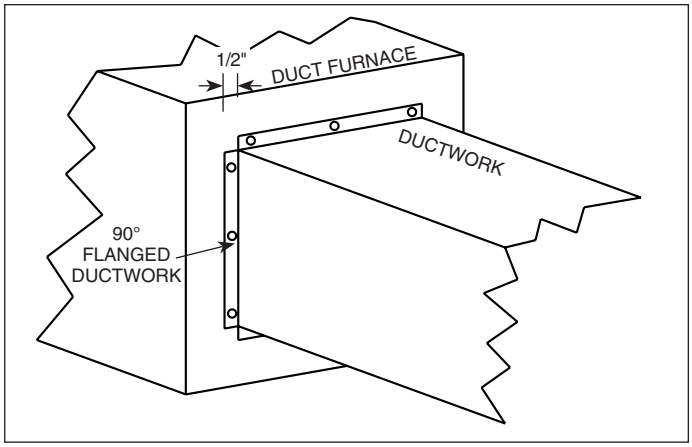
Figure 5.2 - Recommended Field Installed Discharge Duct Configurations for Blower Package Units



Blower section and cooling cabinet discharge duct connections

The blower section back and bottom and cooling cabinet section discharge are designed to accept 90° flanged ductwork. (See Figure 5.3.) Provide an airtight seal between the ductwork and the unit. Seams with cracks in the ductwork should be caulked and/or taped and be of permanent type. All duct connections MUST be airtight to prevent air leakage.

Figure 5.3 - Blower Section and Cooling Cabinet Discharge Duct Connections



INSTALLATION

Venting

⚠ WARNING

1. Gas fired heating equipment must be vented - do not operate unvented.
2. A built-in draft diverter is provided - additional external draft diverters are not required or permitted.
3. Gas-fired heating equipment which has been improperly vented, or which experiences a blocked vent condition may have flue gasses accidentally spilled into the heated space. See page 25 for specific information about the blocked vent safety switch supplied on the unit.
4. Modine Manufacturing Company offers power exhausters as an accessory. Power exhausters not supplied by Modine Manufacturing Company are not permitted.

Table 6.1 - ANSI Venting Requirements

Appliance 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.

General Venting Air Instructions

1. Installation of venting must conform with local building codes, or in the absence of local codes, with 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.
2. All units with single-stage controls are Category I. All units with two-stage or modulating controls are Category II. The installation of a Catagory II unit must conform to the requirements from Table 6.1 in addition to those listed below.
3. From Table 43.1 or 44.1, select the size of vent pipe that fits the flue outlet for the unit. Do not use a vent pipe smaller than the size of the outlet on the appliance. The pipe should be suitable corrosion resistant material. Follow the National Fuel Gas Code for minimum thickness and composition of vent material. The minimum thickness for connectors varies depending on the 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. Vent pipes should be fitted with a tee with a drip leg and a clean out cap to prevent against the possibility of any moisture in the vent pipe from entering the unit. The drip leg should be inspected and cleaned out periodically during the heating season.
6. The National Fuel Gas Code requires at least 6 inches from combustible materials for single wall vent pipe. The minimum distance from combustible materials is based on the combustible material surface not exceeding 160°F. Clearance from the vent pipe (or the top of the unit) may be required to be greater than 6 inches if heat damage other than fire (such as material distortion or discoloration) could result.
7. Avoid venting through unheated space . When venting does pass through an unheated space, insulate runs greater than 5 feet to minimize condensation. Inspect for leakage prior to insulating and use insulation that is noncombustible with a rating of not less than 350°F. Install a tee fitting at the low point of the vent system and provide a drip leg with a clean out cap as shown in Figure 7.1.
8. When the vent passes through an interior wall or floor, 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 appliance and where the vent pipe passes through the wall or floor, 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 6 inches of clearance. Any material used to close the opening must be noncombustible.
9. Do NOT use dampers or other devices in the vent or combustion air pipes.
10. Precautions must be taken to prevent degradation of building materials by flue products.
11. The outlet of the vent should extend as shown in Figure 7.1 and Table 7.1 if the following conditions are met:

    Vent diameter is less than 12 inches, vent is of double wall construction and is a listed product, and the vent does not terminate within 10 feet of a vertical wall or similar obstruction.

    For vents that have a diameter of 12 inches or larger, constructed of single wall, or terminate within 10 feet of a vertical wall or similar obstruction, the vent pipe shall extend at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet (refer to Figure 7.2).
12. 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.
13. 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 Figure 49.1).
14. For instructions on common venting refer to the National Gas Code.
15. The vent must terminate no less than 5 feet above the vent connector.
16. A unit located within an unoccupied attic or concealed space shall not be vented with single wall vent pipe.
17. Single wall vent pipe must not pass through any attic, inside wall, consealed space, or floor.

INSTALLATION

Table 7.1 - Minimum Height from Roof to Lowest Discharge Opening

Rise X (in)	Roof Pitch	Min Height H (ft)*
0-6	Flat to 6/12	1.00
6-7	6/12 to 7/12	1.25
7-8	7/12 to 8/12	1.50
8-9	8/12 to 9/12	2.00
9-10	9/12 to 10/12	2.50
10-11	10/12 to 11/12	3.25
11-12	11/12 to 12/12	4.00
12-14	12/12 to 14/12	5.00
14-16	14/12 to 16/12	6.00
16-18	16/12 to 18/12	7.00
18-20	18/12 to 20/12	7.50
20-21	20/12 to 21/12	8.00

* Size according to expected snow depth.

Figure 7.1 - Gravity Vented Duct Furnace Venting (pitched roof)

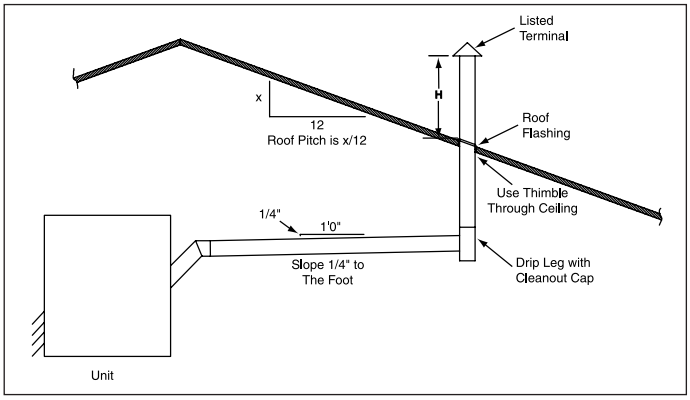
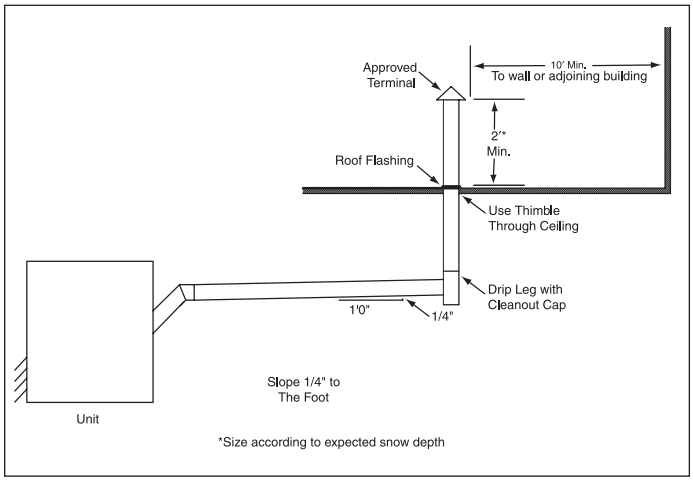


Figure 7.2 - Gravity Vented Duct Furnace Venting (obstructed)



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.

ADDITIONAL VENTING REQUIREMENTS FOR VENTING INTO AN EXISTING MASONRY CHIMNEY OR COMMON VENT (CATEGORY III OR IV 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.

UNIT INSTALLATION

Gas Connections

⚠ WARNING

1. All field gas piping must be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
2. Gas pressure to appliance controls must never exceed 14" W.C. (1/2 psi).
3. To reduce the opportunity for condensation, the minimum sea level input to the appliance, as indicated on the serial plate, must not be less than 5% below the rated input, or 5% below the minimum rated input of dual rated units.

⚠ CAUTION

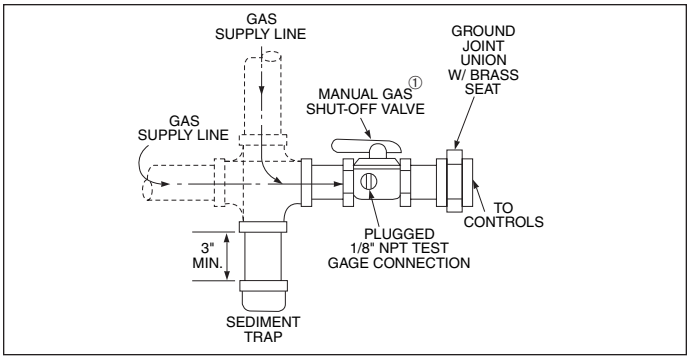
Purging of air from gas supply line should be performed as described in ANSI Z223.1 - latest edition "National Fuel Gas Code", or in Canada in CAN/CGA-B149 codes.

IMPORTANT

To prevent premature heat exchanger failure, the input to the appliance, as indicated on the serial plate, must not exceed the rated input by more than 5%.

1. Installation of piping must conform with local building codes, or in the absence of local codes, with 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.
2. Piping to units should conform with local and national requirements for type and volume of gas handled, and pressure drop allowed in the line. Refer to Table 14.1 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 8.1. 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 8.1 allows for a 0.3" W.C. pressure drop in the supply pressure from the building main to the unit. The inlet pressure to the unit must be 6-7" W.C. for natural gas and 11-14" W.C. for propane gas. When sizing the inlet gas pipe diameter, make sure that the unit supply pressure can be met after the 0.3" W.C. has been subtracted. If the 0.3" W.C. pressure drop is too high, refer to the Gas Engineer's Handbook for other gas pipe capacities.
3. The gas piping to the unit can enter the unit from the side of the unit or from below. Install a ground joint union with brass seat and a manual shut-off valve external of the unit casing, and adjacent to the unit for emergency shut-off and easy servicing of controls, including a 1/8" NPT plugged tapping accessible for test gauge connection (See Figure 8.1). Verify the manual shut-off valve is gas tight on an annual basis.
4. Provide a sediment trap before each unit in the line where low spots cannot be avoided. (See Figure 8.1).
5. 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.

Figure 8.1 - Recommended Sediment Trap/Manual Shut-off Valve Installation - Side or Bottom Gas Connection



① Manual shut-off valve is in the "OFF" position when handle is perpendicular to pipe.

Table 8.1 - Gas Pipe Capacities

Gas Pipe Capacities (Up to 14" W.C. Gas Pressure through Schedule 40 Pipe)
Cubic Feet per Hour with Pressure Drop of 0.3" W.C.
Natural Gas - Specific Gravity - 0.60
Propane Gas - Specific Gravity - 1.50

Length Of Pipe (feet)	Pipe Diameter											
	1/2"		3/4"		1"		1-1/4"		1-1/2"		2"	
	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane	Natural	Propane
10	132	83	278	175	520	328	1050	662	1600	1008	3050	1922
20	92	58	190	120	350	221	730	460	1100	693	2100	1323
30	73	46	152	96	285	180	590	372	890	561	1650	1040
40	63	40	130	82	245	154	500	315	760	479	1450	914
50	56	35	115	72	215	135	440	277	670	422	1270	800
60	50	32	105	66	195	123	400	252	610	384	1150	725
70	46	29	96	60	180	113	370	233	560	353	1050	662
80	43	27	90	57	170	107	350	221	530	334	990	624
90	40	25	84	53	160	101	320	202	490	309	930	586
100	38	24	79	50	150	95	305	192	460	290	870	548
125	34	21	72	45	130	82	275	173	410	258	780	491
150	31	20	64	40	120	76	250	158	380	239	710	447

UNIT INSTALLATION

Electrical Connections

⚠ WARNING

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
4. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than rated voltage.

⚠ CAUTION

Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than rated voltage.

1. Installation of wiring must conform with local building codes, or in the absence of local codes, with the National Electric Code ANSI/NFPA 70 - Latest Edition. Unit must be electrically grounded in conformance to this code. In Canada, wiring must comply with CSA C22.1, Part 1, Electrical Code.
2. Two copies of the job specific wiring diagram are provided with each unit, one located in the duct furnace electrical junction box and one in the electrical section of the unit. Refer to this diagram for all wiring connections.
3. The wire gauge must be sized according to the National Electric Code or CSA code based on the power supply voltage, amp draw, and length of run. Refer to Table 9.1 for maximum wire lengths. Once the wire gauge has been determined, refer to Table 9.2 for the number of wires for which the low voltage terminal blocks in the unit are rated.

Table 9.1 - Low Voltage (24V) Maximum Wire Length (Feet)

NEC-1996, Table 310-17, Copper wire with 90°C insulation, conductors in free space (not in conduit), 86°F ambient. For other wire types, refer to the NEC of CSA code.

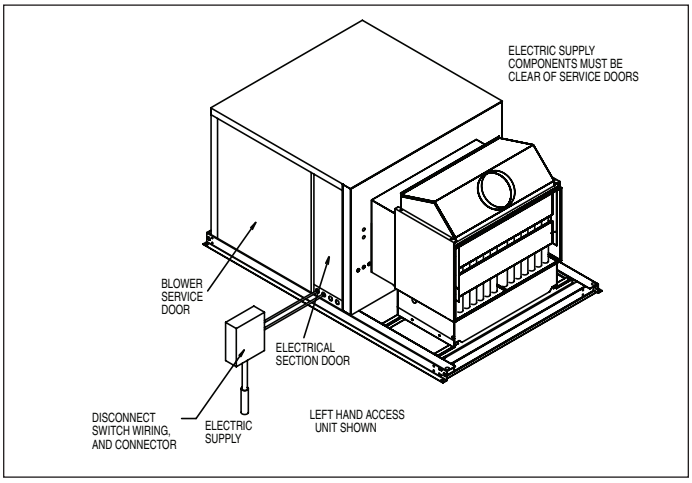
		Wire Gauge				
Model No. Digit 15	Trans. VA	18 GA	16Ga	14 Ga	12 Ga	10 Ga
1	40	162	216	315	360	495
2	75	86	115	168	192	264
3	150	43	58	84	96	132
4	250	26	35	50	58	79

Table 9.2 - Number of Wires Per Terminal

Wire Gauge	Number of Wires per Terminal
#10 AWG	1
#12 AWG	1 to 2
#14 AWG	1 to 3
#16 AWG	1 to 4
#18 AWG	1 to 5
#22 AWG	2 to 5

4. Make sure all multi-voltage components (motors, transformers, etc.) are wired in accordance with the power supply voltage.

Figure 9.1 - Recommended Accessory Field Installed Disconnect Switch Mounting Locations



5. The power supply to the unit must be protected with a fused or circuit breaker disconnect switch. Refer to the Factory Mounted Option Locations (Figure 18.1) for the factory mounted disconnect switch location and then review the unit to determine if a factory installed dead front disconnect switch was provided. Accessory field installed disconnect switches should be mounted where shown in Figure 9.1. For fusible disconnect switches, refer to the Model Identification plate for the fuse size and type.
6. The power supply must be within 5% of the voltage rating and each phase must be balanced within 2 percent of each other. If not, advise the utility company.
7. External electrical service connections that must be installed include:
   a. Supply power connection (120, 208, 240, 480, or 600 volts).
   b. Connection of thermostats, remote monitoring panels, building pressure sensors, CO detectors, time clocks, or any other accessory control devices that may be supplied (24 volts).
8. Refer to the unit dimensional drawings on Figures 43.1 through 44.1 for the electrical knock-out locations.
9. All supply power electrical connections are made in the electrical section of the unit. The low voltage (thermostat and accessory control devices) can be wired to either the electrical section or the duct furnace electrical junction box. Refer to the wiring diagram for the terminal location of all low voltage wiring.

Cooling Coil Units

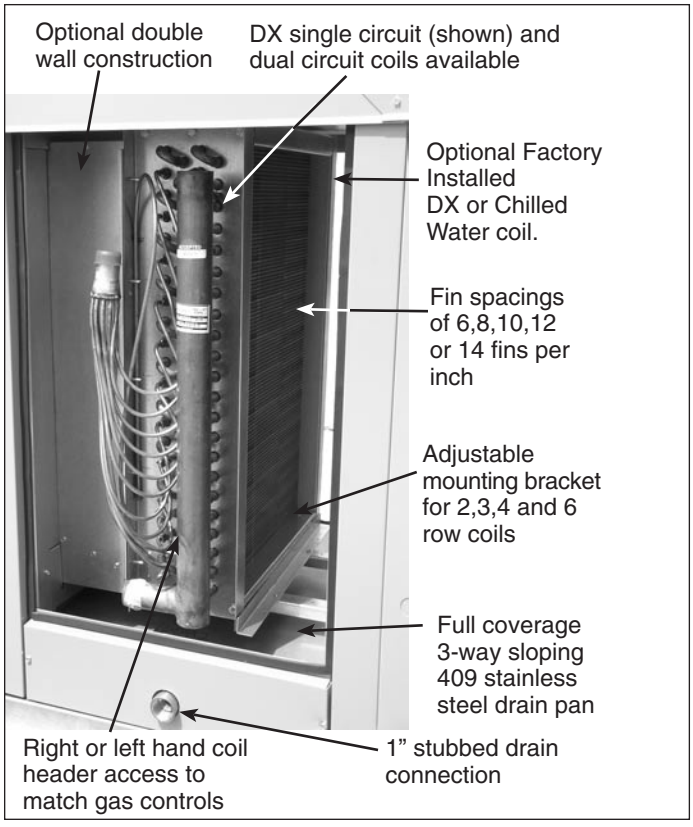
Models with a cooling section can be provided with either a factory installed direct expansion (DX) evaporator, a chilled fluid (for use with water, ethylene glycol, or propylene glycol fluids) coil, or the coil can be field supplied and installed by others. For units equipped with a factory installed cooling coil (Digit 23 = 1), refer to the packing slip to determine the coil type provided. The cooling section is located downstream of the duct furnace heat exchanger in a blow-through configuration, preventing condensation on the heat exchanger in the cooling mode. Thus, a stainless steel heat exchanger is not required when a cooling section is used. (However, a stainless steel heat exchanger is still recommended when the combined entering/return air to the unit is below 40°F.)

UNIT INSTALLATION

The cooling section includes a full coverage, 3-way sloping 409 stainless steel drain pan to remove condensate from coil headers, thermal expansion valves, and refrigerant piping. Insulation is standard on outdoor units and optional on indoor units and double wall construction is optional on all units. The cabinet includes two doors, a removable upper door for service access to the coil once the plumbing has been installed and a lower door which includes a factory supplied 1" stubbed drain connection to the exterior of the cabinet. Field connections for coil inlet and outlet piping can be made through the cabinet corner post or back of the unit. The cooling section duct transition includes 1-1/2" flanges for fastening the sides of the coil. The bottom duct transition is angled to remove any condensation that may be entrained in the supply air stream.

For field supplied coils, do not exceed the maximum coil dimensions listed in Literature 82-135. The dimensions listed are for the maximum coil dimensions. If the coil supplied is smaller than the listed dimensions, field supplied blank off plates are required to prevent air bypass around the coil. The coil is supported by two 14 gauge support rails which contain mounting provisions for fastening 4", 5", 6", 7.5", 8.5", and 10" deep coils. When obtaining the specifications from a coil manufacturer, it is important to obtain the pressure drop through the coil so that the proper motor horsepower can be selected.

Figure 10.1 - Cooling Section

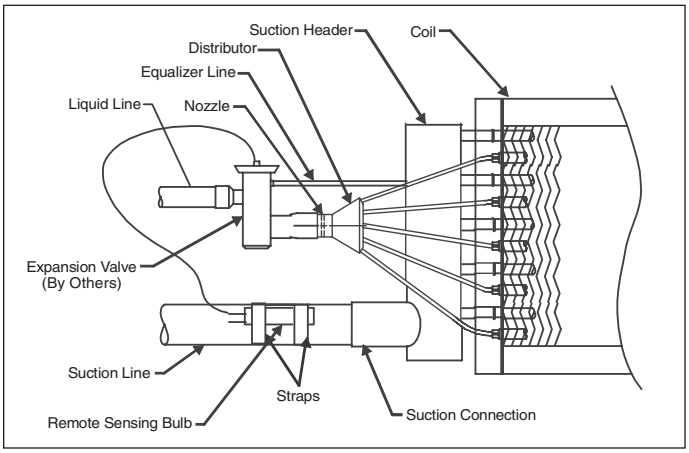


For Both Chilled Water and Direct Expansion Coils: The condensate drain line needs to include a P-trap immediately downstream of the connection to the unit. This trap should extend at least two inches below the connection to prevent air pressure from forcing air into the unit. The trap should be primed with a water/glycol solution to prevent freezing. All points where refrigerant, water or condensate lines enter the structure should be sealed and vibration dampened. Include shut-off valves to isolate the cooling coil from the system in order to remove the coil for service or replacement without draining the entire system. For additional guidelines, refer to the ASHRAE Fundamentals Handbook section of piping recommendations.

Direct Expansion (DX) Piping

The refrigerant lines should be insulated to prevent warming or cooling of the refrigerant. If the suction line is allowed to be cooled, liquid will condense in the line and can severely damage the compressor. If the liquid line is warmed, the refrigerant can "flash" into a gas. This will cause erratic operation of the expansion device and impair the heat transfer ability of the cooling coil. Long runs of piping need to be periodically supported to prevent excess vibration that can damage the piping and joints. It is recommended to provide dampening supports at intervals of length equivalent to 15 tube diameters.

Figure 10.2 - General DX Piping



1. Inspect the refrigerant distributor and verify that the nozzle is in place.
2. All field brazing and welding should be performed using high quality materials and an inert gas purge (such as nitrogen) to reduce oxidation of the internal surface of the coil.
3. Connect the suction line and suction connection.
4. Install the expansion valve (By Others). Follow the expansion valve manufacturer's recommendations for installation to avoid damaging the valve.
5. The expansion valve's remote sensing bulb should be securely strapped to the horizontal run of the suction line at the 3 or 9 o'clock position and insulated.
6. Connect the liquid line to the expansion valve. Pressurize the coil, expansion valve assembly and suction connection to 100 psig with dry nitrogen or other suitable gas. The coil should be left pressurized for a minimum of 10 minutes.
7. If the coil holds pressure, the hook-up can be considered leak free. If the pressure drops by 5 psi or less, repressurize the coil and wait another 10 minutes. If the pressure drops again, there are more than likely one or more small leaks, which should be located and repaired. Pressure losses greater than 5 psi would indicate a larger leak, which should be isolated and repaired. Be sure to check valves and fittings as potential sites for leakage or bleed. If the coil is found to be leaking, contact your local factory representative.

UNIT INSTALLATION

Table 11.1 - Cooling Coil Performance Limits

Model Size	DX - Single Circuit		DX - Dual Circuit		Chilled Water		Min CFM (All Units)	Max. Cooling Tons ② ③	
	Max CFM ①	Coil Area (Sq. Ft.)	Max CFM ①	Coil Area (Sq. Ft)	Max CFM ①	Coil Area (Sq. Ft.)		DX Coils	Chilled Water Coils
75	1891	3.44	1707	3.10	1676	3.05	609 ④	9.38	10.56
100	2206	4.01	2048	3.72	2011	3.66	741 ⑤	11.43	12.62
125	2206	4.01	2048	3.72	2011	3.66	926	11.43	12.62
150	2521	4.58	2416	4.39	2372	4.31	1111	13.42	14.77
175	2521	4.58	2416	4.39	2372	4.31	1296	13.42	14.77
200	3352	6.09	3165	5.76	3214	5.84	1481	18.12	19.28
225	3352	6.09	3165	5.76	3214	5.84	1667	18.12	19.28
250	3724	6.77	3538	6.43	3592	6.53	1852	20.24	21.33
300	3724	6.77	3538	6.43	3592	6.53	2222	20.24	21.33
350	5214	9.48	4996	9.08	5073	9.22	2593	27.26	29.25
400	5214	9.48	4996	9.08	5073	9.22	2963	27.26	29.25

① Based on 550 feet per minute (FPM) coil face velocity.
② 1 Ton = 12,000 Btu/Hr
③ Based on 95°F Entering Dry Bulb, 75°F Entering Wet Bulb.
④ Model Size 75 CFM listed for Chilled Water - DX Single Circuit CFM minimum is 688 and DX Dual Circuit CFM min is 621.
⑤ Model Size 100 CFM listed for Chilled Water - DX Single Circuit CFM minimum is 802 and DX Dual Circuit CFM min is 745.

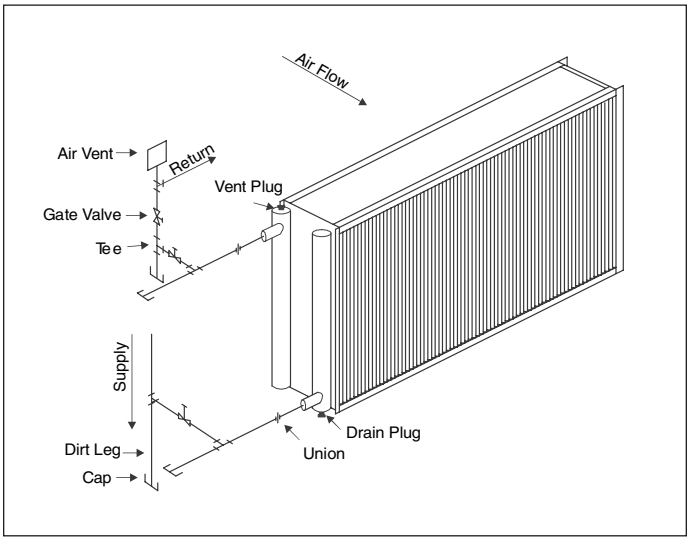
8. Use a vacuum pump to evacuate the coil and any interconnecting piping that has been open to atmosphere. Measure the vacuum in the piping using a micron gauge located as far from the pump as possible (the vacuum at the pump will be greater than the rest of the system). Evacuate the coil to 500 microns or less then close the valve between the pump and the system. If the vacuum holds to 500 microns or less for one minute, the system is ready to be charged or refrigerant pumped down in another portion of the system can be opened to the coil. A steady rise in microns would indicate that moisture is still present and that the coil should be further vacuumed until the moisture has been removed.
9. Failure to obtain a high vacuum is indicative of a great deal of moisture or a small leak. Break the vacuum with a charge of dry nitrogen or other suitable gas and recheck for leaks (soapy water works well). If no leaks are found, continue vacuuming the coil until the desired vacuum is reached.
10. All field piping must be self-supporting.

Chilled Fluid Piping

To prevent noise within a system, an air vent is necessary to bleed off the accumulated air in the system. The vent should be located on the top of the inlet manifold where the air collects. This vent should be opened twice a year. Air in the system will generate noise and may cause water hammer than can damage the joints of the piping and the cooling coil.

The outlet manifold should have a drain installed on the bottom of the manifold to allow for periodic flushing of the system to remove sediments and corrosion products from the cooling coil. This drain should be opened to allow some fluid to drain twice a year. Check coloration and viscosity of the effluent for indications of corrosion in the system. The lines between the unit and the structure should be insulated to prevent freezing of the water.

Figure 11.1 - General Chilled Fluid Piping



1. Once installed, the coil should be pressurized to 100 psig with dry nitrogen or other suitable gas. The coil should be left pressurized for a minimum of 10 minutes. If the coil holds the pressure, the hook-up can be considered leak free. If the pressure drops by 5 psig or less re-pressurize the coil and wait another 10 minutes. If the pressure drops again, there is more than likely one or more small leaks which should be located and repaired. Pressure losses greater than 5 psig would indicate a larger leak that should be isolated and repaired. If the coil itself is found to be leaking, contact your local factory representative.
2. All field brazing and welding should be performed using high quality materials and an inert gas purge (such as nitrogen) to reduce oxidation of the internal surface of the coil.
3. All field piping must be self supporting. System piping should be flexible enough to allow for thermal expansion and contraction of the coil.

UNIT INSTALLATION / START-UP PROCEDURE

Operation

General - All coils

1. Proper air distribution is vital to coil performance. Air flow anywhere on the coil face should not vary by more than 20%.
2. Air velocities should be maintained between 200 and 550 feet per minute.
3. For chilled fluid coils, fluid velocities should be maintained within the recommended values of 1 to 8 fps for Water and 1 to 6 fps for Glycol solutions.

Chilled fluid coils - Initial Start-Up

1. Open all air vents so that air is eliminated from within the coil circuitry and headers. Verify that all vents and drains are not obstructed and do discharge a stream of water.
2. Fill the coil with water then close all vents.
3. Perform an initial hydrostatic leak test of all brazed, threaded or flanged joints, valves and interconnecting piping. Recheck the coil level and correct if necessary. When the setup is found to be leak free, discharge and discard initial water charge. It is important that all grease, oil, flux and sealing compounds present from the installation be removed.

Maintenance

General

1. Filters should be inspected on a regular basis and changed as needed. Maintaining clean filters is a cost-effective way to help maintain maximum coil performance and service life.
2. Periodic inspection of the coil for signs of corrosion and for leaks is recommended. For DX coils, Small leaks can be detected using a Halide torch. Repair and replacement of the coil and the connecting piping, valves, etc., should be performed as needed by a qualified individual(s).
3. Should the coil surface need cleaning, caution should be exercised in selecting the cleaning solution as well as the cleaning equipment. Improper selection can result in damage to the coil and/or health hazards. Clean the coil from the leaving air-side so that foreign material will be washed out of the coil rather than pushed further in. Be sure to carefully read and follow the cleaning fluid manufacturer's recommendations before using any cleaning fluid.
4. For DX coils, the use of filter-dryers in the system piping is recommended along with a sight glass that has a moisture indicator. Replace the filter dryer(s) as needed.
5. For chilled fluid coils,
   A) Maintain the circulated fluid free of sediment, corrosive products and biological contaminants. Periodic testing of the fluid followed by any necessary corrective measures along with maintaining adequate fluid velocities and proper filtering of the fluid will help to satisfy this goal.
   B) Automatic air vents must be utilized to remove accumulated air.
   C) Freeze Protection - During the winter, chilled water coils need to be protected against freezing. The two predominant protective measures are 1) Blowing-out the coils with air or 2) Flushing coils with inhibited glycol. It is recommended to use inhibited glycol designed for HVAC applications for corrosion protection. Select an inhibited glycol solution that will protect the coil from the lowest possible temperatures that can occur at the particular coil's locality.

Start-Up Procedure

IMPORTANT

1. To prevent premature heat exchanger failure, observe heat exchanger tubes by looking at the heat exchanger through the field installed access openings in connecting ductwork in blower package units or the unit access doors in cooling package units. If the bottom of the tubes become red while blower and duct furnace are in operation, check to be sure the blower has been set to the proper rpm for the application. Refer to page 15 for Blower Adjustments.
2. Start-up and adjustment procedures should be performed by a qualified service agency.

1. Turn off power to the unit at the disconnect switch. Check that fuses or circuit breakers are in place and sized correctly. Turn all hand gas valves to the “OFF” position.
2. Remove the blower exterior panels and open the electrical compartment door.
3. Check that the supply voltage matches the unit supply voltage listed on the Model Identification plate. Verify that all wiring is secure and properly protected. Trace circuits to insure that the unit has been wired according to the wiring diagram.
4. Check to insure that the venting system is installed and free from obstructions.
5. Check to see that there are no obstructions to the intake and discharge of the unit.
6. Check the belt tension and sheave alignment. Refer to Blower Adjustments for proper belt tension.
7. Check bearings for proper lubrication. For units provided with pillow block bearings (See Model Nomenclature), refer to Lubrication Recommendations for lubrication requirements.
8. Check to make sure that all filters are in place and that they are installed properly according to direction of air flow.
9. Perform a visual inspection of the unit to make sure no damage has occurred during installation.
10. Turn on power to the unit at the disconnect switch. Check to insure that the voltage between duct furnace electrical box terminals 1 and 2 is 24V.
11. Check the thermostat, ignition control, gas valve, and supply fan blower motor for electrical operation. If these do not function, recheck the wiring diagram. Check to insure that none of the Control Options have tripped.
12. For units with a return air damper, the return air damper linkage needs to be adjusted. Refer to Damper Linkage Adjustment.
13. Check to make sure that the damper opens properly without binding.
14. Check the blower wheel for proper direction of rotation when compared to the air flow direction arrow on the blower housing. Blower wheel rotation, not air movement, must be checked as some air will be delivered through the duct furnace with the blower wheel running backwards.
15. Check the blower speed (rpm). Refer to Blower Adjustments for modification.
16. Check the motor speed (rpm).
17. Check the motor voltage. On three phase systems, check to make sure all legs are in balance.
18. Check the motor amp draw to make sure it does not exceed the motor nameplate rating. On three phase systems, check all legs to insure system is balanced.

19. Recheck the gas supply pressure at the field installed manual shut-off valve. The minumum inlet pressure should be 6" W.C. on natural gas and 11" W.C. on propane gas. The maximum inlet pressure for either gas is 14" W.C. If inlet pressure exceeds 14" W.C., a gas pressure regulator must be added upstream of the combination gas valve.
20. Open the field installed manual gas shut-off valve.
21. Open the manual main gas valve on the combination gas valve. Call for heat with the thermostat and allow the pilot to light for intermitent pilot ignition. If the pilot does not light, purge the pilot line. If air purging is required, disconnect the pilot line at outlet of pilot valve. In no case should line be purged into heat exchanger. Check the pilot flame length (See Pilot Flame Adjustment).
22. Once the pilot has been established, check to make sure that the main gas valve opens. Check the manifold gas pressure (See Main Gas Adjustment) and flame length (See Air Shutter Adjustment) while the supply fan blower is operating.
23. Check to insure that gas controls sequence properly (See Control Operating Sequence). Verify if the unit has any additional control devices and set according to the instructions in the Control Options.
24. Once proper operation of the unit has been verified, remove any jumper wires that were required for testing.
25. Close the electrical compartment door.
26. Replace all exterior panels.

Refer to page 54 for the Start-up Checklist.

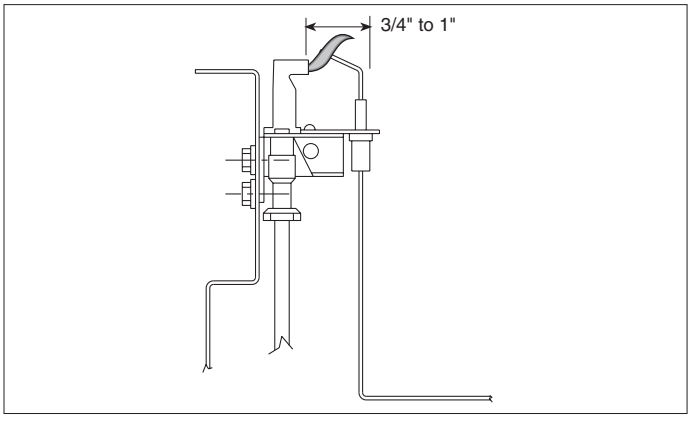
Pilot Burner Adjustment

The pilot burner is orificed to burn properly with an inlet pressure of 6-7" W.C. on natural gas and 11-14" W.C. on propane gas, but final adjustment must be made after installation. If the pilot flame is too long or large, it is possible that it may cause soot and/or impinge on the heat exchanger causing failure. 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.

To Adjust the Pilot Flame

1. Create a call for heat from the thermostat.
2. Remove the cap from the pilot adjustment screw. For location, see the combination gas control literature supplied with unit.
3. Adjust the pilot length by turning the screw in or out to achieve 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 (See Figure 13.1).
4. Replace the cap from the pilot adjustment screw.

Figure 13.1 - Correct Pilot Flame



Main Burner Adjustment

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

Measuring the manifold pressure is done at the tee in the manifold or at the pressure tap of the gas valve for standard gas string. (See Figure 14.1).

To Adjust the Manifold Pressure

1. Move the field installed manual shut-off valve to the “OFF” position.
2. Remove the 1/8" pipe plug in the pipe tee or gas valve and attach a water manometer of “U” tube type which is at least 12" high.
3. Move the field installed manual gas shut-off valve to the “ON” position.
4. Create a high fire call for heat from the thermostat.
5. Determine the correct high fire manifold pressure. For natural gas 3.5” W.C., for propane gas 10” W.C. Adjust the main gas pressure regulator spring to achieve the proper manifold pressure (for location, see the combination gas control literature supplied with unit).
6. If the unit has Electronic Modulation gas controls (determine from the Model Identification Digit 12), the low fire gas pressure needs to be adjusted. Using Figure 14.2 for item number locations, this is accomplished as follows:
   a. Disconnect power.
   b. Remove all wires from Maxitrol Amplifier terminal “3” or duct furnace terminal “43” (if available).
   c. Turn on power at the disconnect switch.
   d. Remove the maximum adjustment screw (4), spring (5), and plunger (8). A small magnet is useful for this purpose. CAUTION - The plunger is a precision part. Handle carefully to avoid marring or picking up grease and dirt. Do not lubricate.
   e. Using minimum adjusting screw (9), adjust low fire manifold pressure to 0.56" W.C. for natural gas and 1.6" W.C. for propane gas.
   f. Replace plunger and spring retainer, spring, and maximum adjusting screw in proper order.
   g. Using maximum adjustment screw (4), adjust high fire manifold pressure to 3.5" W.C. for natural gas and 10" W.C. for propane gas.
   h. Disconnect power.
   i. Replace cover plate (2) and re-install all wires from Maxitrol amplifier terminal “3” or duct furnace terminal “43”.
7. After adjustment, move the field installed manual shut-off valve to the “OFF” position and replace the 1/8" pipe plug.
8. After the plug is in place, move the field installed manual shut-off valve to the “ON” position and recheck pipe plugs for gas leaks with soap solution.

START-UP PROCEDURE

Figure 14.1 - Checking Manifold Pressure with "U" Tube Manometer

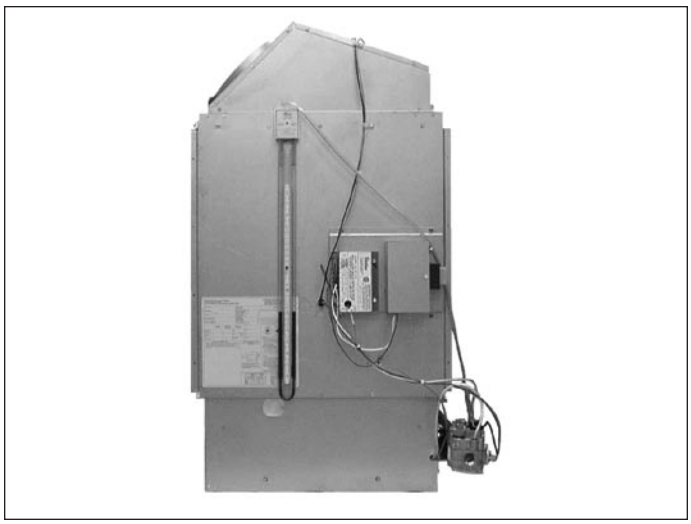
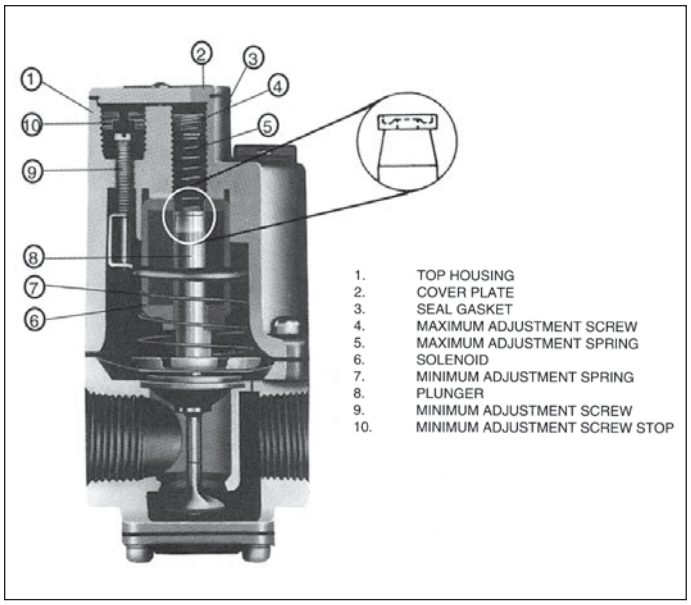


Figure 14.2 - Maxitrol Modulating Valve Adjustments



Air Shutter Adjustment

Proper operation provides a soft blue flame with a well-defined inner core. A lack of primary air will reveal soft yellow-tipped flames. Excess primary air produces short, well-defined flames with a tendency to lift off the burner ports. For both natural and propane gas, the air shutters can be adjusted to control the burner flame height. The air shutters can be accessed by reaching behind the gas valve in Figure 14.1. The larger models may require the removal of the manifold (see Manifold Assembly Removal).

Natural Gas Flame Control

Control of burner flames on duct furnaces utilizing natural gas is achieved by resetting the primary air shutters (See Figure 48.4) to either increase or decrease primary combustion air. Prior to flame adjustment, operate duct furnace for about fifteen minutes. The main burner flame can be viewed after loosening and pushing aside the gas designation disc on the side of the burner box.

To increase primary air, loosen the air shutter set screws and move the air shutters closer to the manifold until the yellow-tipped flames disappear. (See Figure 48.4 for air shutter and heat exchanger support locations.) To decrease primary air, move the air shutters away from the manifolds until flames no longer lift from burner ports, but being careful not to cause yellow tipping. Retighten set screws after adjustment.

Propane Gas Flame Control

An optimum flame will show a slight yellow tip. Prior to flame adjustment, operate furnace for at least fifteen minutes. Loosen air shutter set screws and move the air shutters away from the manifold to reduce the primary air until the yellow flame tips appear. Then increase the primary air until yellow tips diminish and a clean blue flame with a well defined inner cone appears.

Table 14.1 - Manifold Pressure and Gas Consumption

Model Size	Type of Gas	Natural	Propane	
	Btu/Cu. Ft.	1040	2500	
	Specific Gravity	0.60	1.53	
High Fire Manifold Pressure Inches of Water Column		**3.5**	**10**	**No. of Orifices**
75	Cfh Orifice Drill Size	72.1 20	30.0 37	1
100	Cfh Orifice Drill Size	96.1 30	40.0 45	2
125	Cfh Orifice Drill Size	120.2 25	50.0 42	2
150	Cfh Orifice Drill Size	144.2 30	60.0 45	3
175	Cfh Orifice Drill Size	168.3 27	70.0 43	3
200	Cfh Orifice Drill Size	192.3 23	80.0 40	3
225	Cfh Orifice Drill Size	216.3 20	90.0 37	3
250	Cfh Orifice Drill Size	240.4 25	100.0 42	4
300	Cfh Orifice Drill Size	288.7 20	120.0 37	4
350	Cfh Orifice Drill Size	336.5 27	140.0 43	6
400	Cfh Orifice Drill Size	384.6 23	160.0 40	6
500 ①	Cfh Orifice Drill Size	240.4 ① 25	100.0 ① 42	4 ①
600 ①	Cfh Orifice Drill Size	288.7 ① 20	120.0 ① 37	4 ①
700 ①	Cfh Orifice Drill Size	336.5 ① 27	140.0 ① 43	6 ①
800 ①	Cfh Orifice Drill Size	384.6 ① 23	160.0 ① 40	6 ①
840 ②	Cfh Orifice Drill Size	336.5 ② 27	140.0 ② 43	6 ②
960 ②	Cfh Orifice Drill Size	384.6 ② 23	160.0 ② 40	6 ②

① Model contains 2 furnaces. Values shown are per furnace.

② Model contains 3 furnaces. Values shown are per furnace.

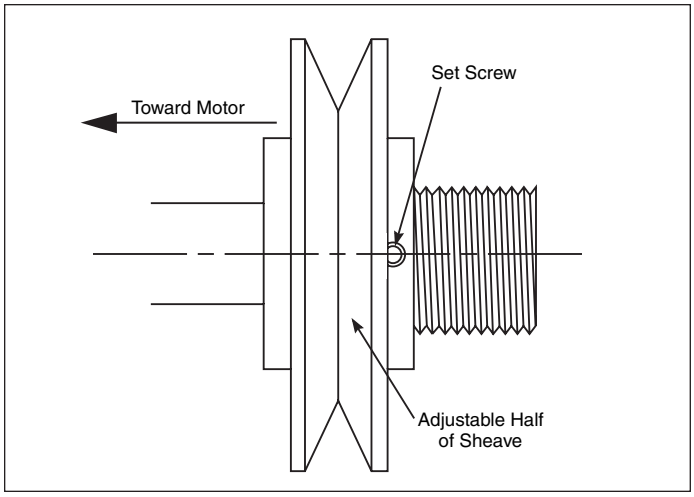
START- UP PROCEDURE

Blower Adjustments

If blower fan speed changes are required, adjust motor sheave as follows:

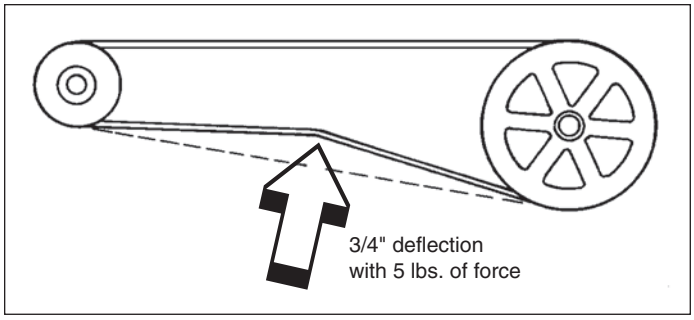
1. Refer to page 34 to determine correct blower speed according to job requirements, then proceed with steps 2 through 8.
2. Loosen motor base and take belt off of motor sheave.
3. Loosen set screw on outer side of adjustable motor sheave.

Figure 15.1 - Motor Sheave Adjustment



4. Turn outer side of motor sheave clockwise until motor sheave is fully closed.
5. From fully closed position, turn outer side of motor sheave counterclockwise until the proper number of turns open are achieved.
6. Retighten motor sheave set screw, replace belt and retighten motor base. Motor base should be shifted for proper belt tension which is 3/4" deflection with about 5 lbs. of force.

Figure 15.2 - Belt Tension Adjustment



7. Recheck blower rpm after adjustment.
   NOTE: Do not fire unit until blower adjustment has been made or unit may cycle on high limit control.
8. Check motor amps. Do not exceed nameplate amps shown on motor nameplate.

Lubrication Recommendations

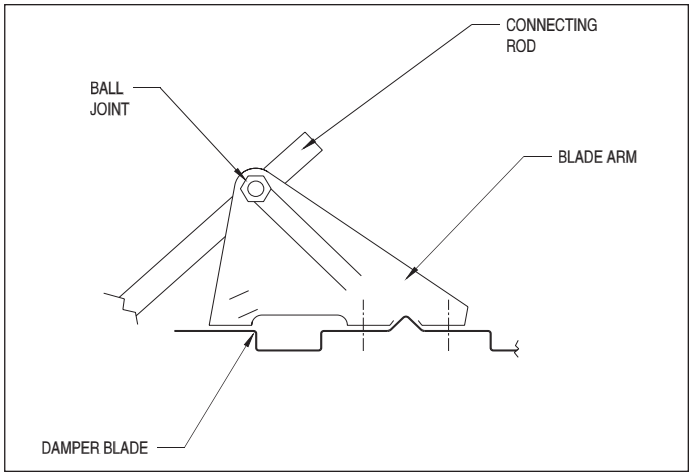
The blower can be provided with either spider or pillow block bearings. Spider bearings are permanently lubricated and do not require lubrication. Pillow block bearings are shipped greased from the factory but will require lubrication. The bearings should be checked and lubricated before each heating season but a more frequent lubrication schedule may be required based on the environment in which the unit is installed, and the frequency of the equipment operation. Shell Alvania #2 lubricant is recommended.

Damper Linkage Adjustment

If the unit is provided with a return air damper, to prevent shipping damage, the return air damper linkage is disconnected and the damper closed. Before operating the unit, the fresh and return air dampers must be connected. This is accomplished by the following:

1. The damper actuator should be de-energized and the fresh air damper in a fully closed position.
2. Open the return air damper in a fully open position.
3. Slide the connecting rod into the ball joint on the blade arm with the return air damper fully open. See Figure 15.3.
4. Tighten the 5/16" hex head screw on the ball joint.

Figure 15.3 - Damper Linkage Adjustment



Control Operating Sequence

IMPORTANT

To prevent premature heat exchanger failure, with all control systems, a blower starting mechanism must be provided so that the blower is running or energized within 45 seconds of the gas control operation.

Indoor gravity vented duct furnaces are supplied with intermittent pilot systems with continuous retry as standard. For intermittent pilot systems, both the main burner and pilot burner are turned off 100% when the thermostat is satisfied. On a call for heat, the system will attempt to light the pilot for 70 seconds. If the pilot is not sensed for any reason, the ignition control will wait for approximately six minutes with the combination gas control closed and no spark. After six minutes, the cycle will begin again. After three cycles, some ignition controllers lockout for approximately one hour before the cycle begins again. This will continue indefinitely until the pilot flame is sensed or power is interrupted to the system.

NOTE: Gas Control Options (see page 16) could change the listed sequence of operation based on their function. The descriptions given are for the basic duct furnace.

START-UP PROCEDURE

Single-Stage Gas Controls

Utilizes a single-stage combination gas control, an ignition control, and a single-stage low voltage thermostat.

1. The thermostat calls for heat.
2. The pilot valve opens and the spark ignitor sparks in an attempt to light the pilot. (If the unit was not provided with a time delay relay, the blower starts at this time.)
3. Once the pilot is lit, the flame sensor proves the pilot and stops the spark ignitor from sparking.
4. The main gas valve is opened and the main burner is lit to 100% full fire.
5. If the unit was provided with a time delay relay, the blower starts after 30 to 45 seconds.
6. The unit continues to operate until the thermostat is satisfied, at which time both the main and pilot valves close 100%. (If the unit was not provided with a time delay relay, the blower stops at this time).
7. If the unit was provided with a time delay relay, the blower stops after 30 to 45 seconds.

Two-Stage Gas Controls

Utilizes a two-stage combination gas control, an ignition control, and a two-stage low voltage thermostat. The unit fires at 50% fire on low stage and 100% fire on high stage.

1. The thermostat calls for low stage heat.
2. The pilot valve opens and the spark ignitor sparks in an attempt to light the pilot. (If the unit was not provided with a time delay relay, the blower starts at this time.)
3. Once the pilot is lit, the flame sensor proves the pilot and stops the spark ignitor from sparking.
4. The main gas valve is opened and the main burner is lit to 50% fire.
5. If the unit was provided with a time delay relay, the blower starts after 30 to 45 seconds.
6. If the temperature at the thermostat continues to fall, the thermostat will call for high stage heat.
7. The main gas valve is opened completely and the main burner is lit to 100% full fire.
8. The unit continues to operate until the high stage of the thermostat is satisfied, at which time the main valve closes to 50% fire.
9. The unit continues to operate until the low stage thermostat is satisfied, at which time both the main and pilot valves close 100%. (If the unit was not provided with a time delay relay, the blower stops at this time.)
10. If the unit was provided with a time delay relay, the blower stops after 30 to 45 seconds.Electronic Modulating Gas Controls

Electronic Modulating Gas Controls
Single Furnace - Model Sizes 75-400

Utilizes an electronic modulating/regulating gas control, combination gas valve, an ignition control, modulating amplifier, and either a modulating room thermostat or modulating duct thermostat with remote temperature set point adjuster. The thermostat controls can modulate the gas flow between 40% through 100% full fire. When the thermostat is satisfied, the amplifier cuts power to the combination gas valve which prevents gas flow to both the main and pilot burners.

When duct sensing is utilized, a room override thermostat can be added. When calling for heat, the room override thermostat provides full fire operation until the space temperature is satisfied. Control is then returned to the duct sensing control. In this situation, either the duct sensor or the room override thermostat can call for heat.

1. The thermostat calls for heat.
2. The pilot valve opens and the spark ignitor sparks in an attempt to light the pilot. (If the unit was not provided with a time delay relay, the blower starts at this time.)
3. Once the pilot is lit, the flame sensor proves the pilot and stops the spark ignitor from sparking.
4. The main gas valve is opened and the main burner is lit to 100% full fire.
5. If the unit was provided with a time delay relay, the blower starts after 30 to 45 seconds.
6. The modulating gas valve can be controlled by either an electronic modulating room or duct thermostat. The thermostat can modulate the firing rate between 40% through 100% full fire. The call for heat is created by a resistance signal (8000 to 12000 ohms) in the thermostat. The amplifier converts this resistance into a DC voltage (0 to 12 volts DC with 0 volts high fire and 12 volts low fire). The output voltage is applied to the modulating gas valve to control the gas flow to the main burner. As the temperature drops, the voltage drops causing the modulating valve to open further. If the discharge air temperature increases, the voltage increases causing the modulating valve to close allowing less gas flow to the main burner. For further information regarding the operation of the electronic modulating system, consult the literature provided with the unit.
7. The unit continues to operate in this manner until the thermostat is satisfied, at which time both the main and pilot valves close 100%. (If the unit was not provided with a time delay relay, the blower stops at this time.)
8. If the unit was provided with a time delay relay, the blower stops after 30 to 45 seconds.

Electronic Modulating Gas Controls
Two & Three Furnaces - Model Sizes 500-960

One Master furnace is provided with up to two Slave furnaces that utilize electronic modulating/regulating gas controls, combination gas valves, ignition controls, one multiple furnace modulating amplifier, and either a modulating room thermostat or modulating duct thermostat with remote temperature adjuster. The thermostat controls can modulate the gas flow of all the furnaces between 40% through 100% full fire. The amplifier sends a signal to all of the gas valves so that they modulate at the same percentage. When the thermostat is satisfied, the amplifier cuts power to the combination gas valves which prevents gas flow to both the main and pilot burners.

When duct sensing is utilized, a room override thermostat can be added. When calling for heat, the room override thermostat provides full fire operation until the space temperature is satisfied. Control is then returned to the duct sensing control. In this situation, either the duct sensor or the room override thermostat can call for heat.

The sequence of operation for Electronic Modulating Gas Controls - Two & Three Furnaces is the same as Electronic Modulating Gas Controls - Single Furnace.

START-UP PROCEDURE

Electronic Modulating Gas Controls - Building Management Control (0-10 Vdc or 4-20 mA Signal)

Utilizes an electronic modulating/regulating gas control, combination gas valve, an ignition control, modulating signal conditioner, and an inverted (0 Vdc or 4 mA being high fire and 10 Vdc or 20 mA being low fire) 0-10 Vdc or 4-20 mA input signal provided by a Building Management System (BMS).

The signal conditioner can modulate the gas flow between 40% through 100% full fire. When the BMS thermostat (field supplied) is satisfied, the BMS heat contact (field supplied) opens to cut power to the combination gas valve which prevents gas flow to both the main and pilot burners.

1. The BMS thermostat (field supplied) calls for heat and closes the BMS heat contact (field supplied).
2. The pilot valve opens and the spark ignitor sparks in an attempt to light the pilot. (If the unit was not provided with a time delay relay, the blower starts at this time.)
3. Once the pilot is lit, the flame sensor proves the pilot and stops the spark ignitor from sparking.
4. The main gas valve is opened and the main burner is lit to 100% full fire.
5. If the unit was provided with a time delay relay, the blower starts after 30 to 45 seconds.
6. The modulating gas valve is controlled by the BMS thermostat. The thermostat can modulate the firing rate between 40% through 100% full fire by modulating the input signal between either 0-10 Vdc or 4-20 mA (The signal conditioner can accept a 0-10 Vdc signal when all the dip switches are in the “OFF” position and 4-20 mA signal when all the dip switches are in the “ON” position). The signal conditioner converts the input signal into a DC voltage (0 to 12 volts DC with 0 volts high fire and 12 volts low fire). The output voltage is applied to the modulating gas valve to control the gas flow to the main burner. As the temperature drops, the voltage drops causing the modulating valve to open further. If the discharge air temperature increases, the voltage increases causing the modulating valve to close allowing less gas flow to the main burner. For further information regarding the operation of the electronic modulating system, consult the literature provided with the unit.
7. The unit continues to operate in this manner until the thermostat is satisfied, at which time the BMS heat contact opens resulting in both the main and pilot valves closing 100%. (If the unit was not provided with a time delay relay, the blower stops at this time.)
8. If the unit was provided with a time delay relay, the blower stops after 30 to 45 seconds.

Variable Air Movement Applications

Units may be supplied with variable frequency drives for applications where variable air volume is required. The minimum air flow may be varied between 30 and 100% of the full speed air flow depending on the controls selection of the unit. Due to the extra restrictions of the controller all selections must be performed with the AccuSpec configuration software. Within AccuSpec, three variable frequency drive speed control changeover options are available:

1. Two speed which may be controlled by a manual high/low switch which may be factory mounted on the control panel or shipped loose for field installation or by exhaust fan interlocks.
2. Floating building pressure sensing which utilizes a photohelic pressure controller to adjust the building pressure by varying the amount of makeup air supplied to the the space.
3. Building management control which allows for an external signal of 0-10VDC of 4-20mA to adjust the unit airflow.

Additionally, when the air mover supplied by others can provide variable air movement (i.e. 2-speed or variable frequency drive units), the allowable minimum CFM of the duct furnace can be 66% of the minimum listed CFM in Table 26.1 if the unit is applied as follows:

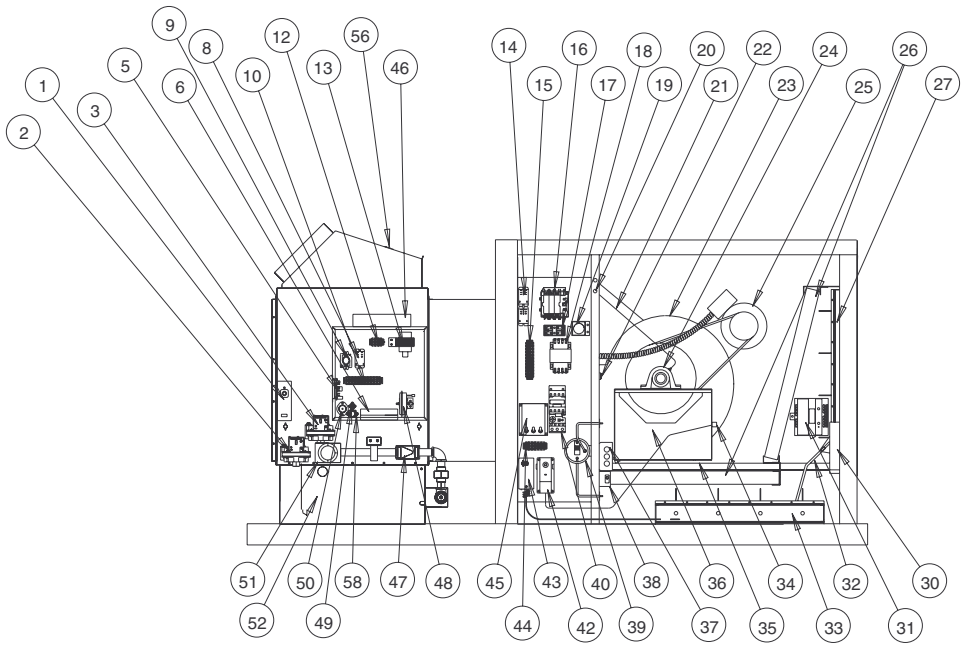
1. The unit is provided with 2-stage, or electronic modulating gas controls. (see Model Identification).
2. The unit is provided with a factory installed discharge air controller.
3. The system does not include a room thermostat.

The factory installed discharge air thermostat will prevent the unit from firing above the allowable 100°F rise when the unit is at or above the minimum CFM by monitoring the discharge air and going to low fire. A room thermostat, because it is located remote from the unit, could cause the unit to over-fire.

OPTIONS

Options - Factory Installed

Figure 18.1 - Factory Mounted Option Locations



1. Discharge Thermostat
2. Low Gas Pressure Switch
3. High Gas Pressure Switch
5. Timed Freeze Protection
6. Ignition Controller
8. Control Relay
9. Time Delay Relay
10. Furnace Low Voltage Terminal Strip
12. Furnace Supply Power Terminal Strip
13. Control Step Down Transformer
14. Control Relay
15. Blower Low Voltage Terminal Strip
16. Dead Front Disconnect Switch
17. Step Down Transformer Fuses
18. Step Down Transformer
19. Factory Installed Minimum Positioner
20. Extended Grease Line Zerk Fittings
21. Extended Grease Lines
22. Return Air Fire Stat
23. Blower Housing
24. Pillow Block Bearings
25. Blower Motor
26. Filters
27. Fresh Air Damper
30. Direct Drive Damper Actuator
31. Enthalpy Controller
32. Damper to Damper Linkage
33. Return Air Damper
34. Proportional Temp Controller Sensor
35. Motor and Blower Vibration Isolation
36. Blower Support
37. Convenience Outlet
38. Blower Door Switch
39. Dirty Filter Switch
40. Motor Starter/VFD Control
42. Proportional Temp Controller
43. Warm-Up Stat
44. Blower Supply Power Terminal Strip
45. Service Switches
46. Electronic Modulating Amplifier
47. Electronic Modulating Gas Valve
48. Air Flow Proving Switch
49. High Limit Switch
50. Supply Air Fire Stat
51. Main Gas Valve
52. Burner Box
56. Blocked Vent Safety Switch
58. Energy Cut off Switch

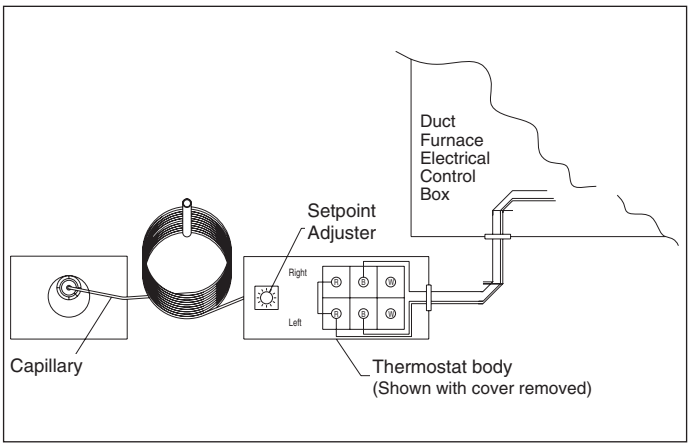
All units include the standard (STD) features. The unit must be reviewed to determine the optional (OPT) features that may have been supplied with the unit.

(1) Discharge Thermostat – (OPT)
The discharge thermostat is factory installed in the discharge air stream of the unit. For additional information, refer to the thermostat vendor literature provided in the literature packet with the unit.

NOTE: Model Sizes 500-960 contain multiple furnaces so multiple thermostats/sensors may be included. The thermostat(s) provided can be one of the following:

a) Two-stage Capillary Type Thermostat – The thermostat includes a thermostat body that is factory installed for cooling package units below the unit junction box. For blower package units the thermostat is factory wired and capillary is to be field installed in duct work. The thermostat body contains the discharge air set point adjuster that must be field set.

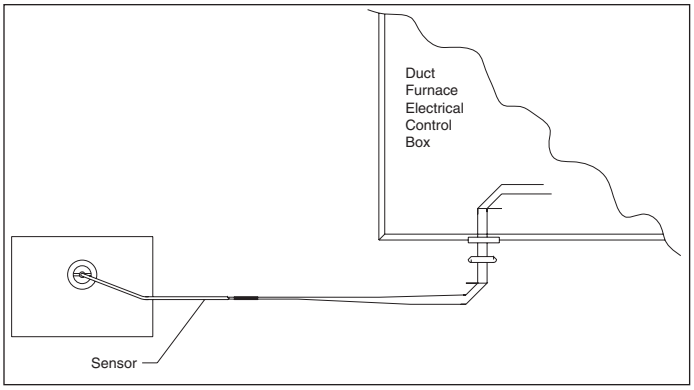
Figure 18.2 - Two-stage Capillary Type Thermostat



OPTIONS

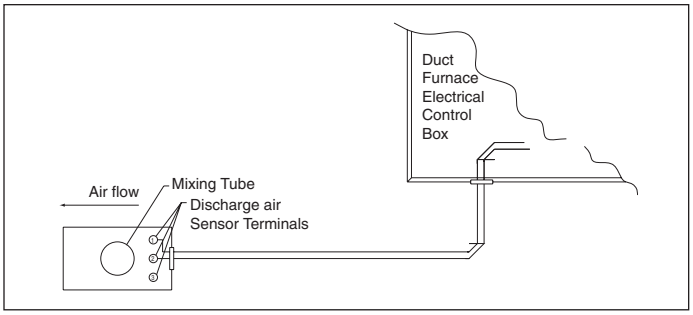
b) Two-stage Electronic Type Thermostat - Includes a factory installed discharge air sensor. The thermostat body is field installed remotely and includes the discharge air set point adjuster that must be field set. Refer to Literature 5-577 latest revision.

Figure 19.1 - Two-stage Electronic Type Thermostat Sensor



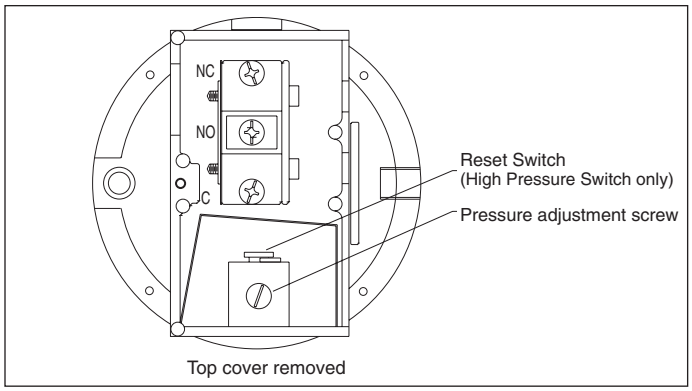
c) Electronic Modulating Discharge Air Thermostat – Includes a factory installed mixing tube and discharge air sensor for cooling package units. For blower package units, the air sensor is factory wired but field installed in duct work. The set point adjuster is field installed remotely and must be field set. Refer to Literature 5-578 latest revision.

Figure 19.3 - Electronic Modulating Discharge Air Thermostat



(2) Low Gas Pressure Switch – (OPT)
The low gas pressure switch is factory installed in the duct furnace above the gas train. The switch monitors the gas pressure upstream of all the gas controls and shuts off the electric supply to the ignition controller and combination gas valve if low gas pressure is experienced. This will shut off all gas flow to the burner. The switch has an automatic reset so that if the gas pressure is interrupted and then is returned, the switch will automatically allow the unit to operate when gas conditions are returned to the allowable range of the pressure switch. The pressure switch range is 2" to 14" W.C. and should be set to insure that the minimum inlet gas pressure is available (6" W.C. for natural gas, 11" W.C. for propane gas).

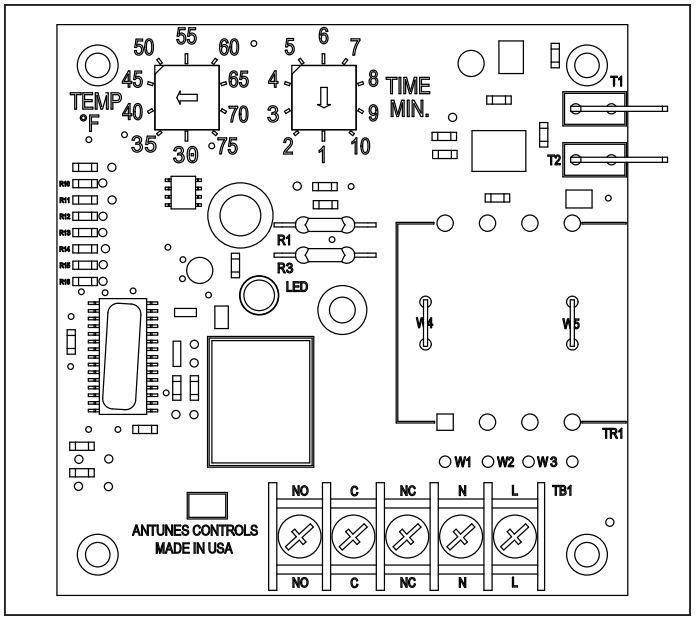
Figure 19.4 - Low or High Gas Pressure Switch



(3) High Gas Pressure Switch – (OPT)
The high gas pressure switch is factory installed in the duct furnace above the gas train. The switch monitors the gas pressure downstream of all the gas controls and shuts off the electric supply to the ignition controller and combination gas valve if high gas pressure is experienced right before the manifold. This will shut off all gas flow to the burner. The switch has a manual reset so that if the gas pressure is too high, a service person must check the unit to make sure that none of the gas controls have been damaged by the high gas pressure and then reset the switch to allow the unit to operate when gas conditions are returned to the allowable range of the pressure switch. The pressure switch range is 2" to 16" W.C. and should be set to insure that the maximum manifold gas pressure is not exceeded (3.5" W.C. for natural gas, 10" W.C. for propane gas).

(5) Timed Freeze Protection – (OPT)
The timed freeze protection system is factory installed in the duct furnace electrical junction box with the sensor (30°-75°F adjustable) factory installed in the discharge air stream. On initial start-up, the timed delay in the system allows the unit to go through the normal ignition sequence. The timed delay is an automatic reset switch and adjustable for 1-10 minutes. In the event that the unit fails to fire after this period, the discharge air sensor will sense the cold air and will shut down the entire unit.

Figure 19.5 - Timed Freeze Protection Module



OPTIONS

(6) Ignition Controller – (OPT)
The ignition controller is factory installed in the duct furnace electrical junction box with the spark ignitor and sensor located on the burner.

For both natural and propane gas units, the ignition controller is 100% shut-off with continuous retry. On a call for heat, the system will attempt to light the pilot for 70 seconds. If the pilot is not sensed for any reason, the ignition control will wait for approximately six minutes with the combination gas control closed and no spark. After six minutes, the cycle will begin again. After three cycles, some ignition controllers lockout for approximately one hour before the cycle begins again. This will continue indefinitely until the pilot flame is sensed or power is interrupted to the system.

(8) Control Relay – (OPT)
The control relay is factory installed in the duct furnace electrical junction box. The relay has a 24V coil with double-pole, double throw (DPDT) contacts. Refer to the unit wiring diagram for the function of the switching operation of the relay. The two normally open and two normally closed contacts are rated for a maximum of 30 amps @ 115V/1Ph.

(9) Time Delay Relay – (STD)
The time delay relay is factory installed in the duct furnace electrical junction box. The time delay relay allows the gas controls to operate for approximately 30 seconds before the blower starts. This allows the heat exchanger a warm up period so that the initial delivered air coming out of the ductwork is not cool. The time delay relay also keeps the motor running for approximately 30 seconds after the call for heat has been satisfied to remove the residual heat from the heat exchanger. For single phase units below 2 Hp, the time delay relay controls the motor directly. For single phase units 2 Hp and greater and all three phase units, the time delay relay controls the motor starter.

(10) Furnace Low Voltage Terminal Strip – (STD)
The furnace low voltage terminal strip is located in the duct furnace electrical junction box. The terminal strip is labeled to match the electrical wiring diagram provided with the unit. Low voltage labeling ranges from terminal numbers 1 to 79. All field wiring connections should be made to the top side of the terminals to prevent miswiring by modifying the factory wiring which is made to the bottom of the terminal strip.

(12) Furnace Supply Power Terminal Strip – (STD)
The furnace supply power terminal strip is located in the duct furnace electrical junction box. The terminal strip is labeled to match the electrical wiring diagram provided with the unit. Supply power labeling ranges from terminal numbers 80 to 99. All field wiring connections should be made to the bottom side of the terminals to prevent miswiring by modifying the factory wiring which is made to the top of the terminal strip.

(13) Control Step Down Transformer – (STD)
The control step down transformer is located in the duct furnace electrical junction box. The transformer is used to step down the supply power (115V, 208V, 230V, 460V, 575V) to 24V. This transformer is used to control the gas controls, damper actuator, motor starter, etc. Refer to the unit model number to determine the volt- amp (VA) capacity of the duct furnace. The 15th digit indicates the VA (See Model Nomenclature).

(14) Control Relay – (OPT)
The control relay is factory installed in the electrical section. See description of Option 8 for additional details.

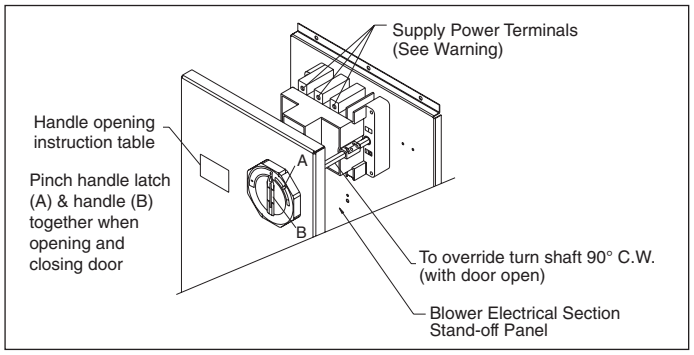
(15) Blower Low Voltage Terminal Strip – (STD)
The blower low voltage terminal strip is located in the electrical section. The terminal strip is labeled to match the electrical wiring diagram provided with the unit. Low voltage labeling ranges from terminal numbers 1 to 79. All field wiring connections should be made to the right side of the terminals to prevent miswiring by modifying the factory wiring which is made to the left side of the terminal strip.

(16) Dead Front Disconnect Switch – (OPT)

⚠ WARNING

When the dead front disconnect switch is in the “OFF” position, supply power remains energized at the blower supply power terminal strip and the top of the dead front disconnect switch. When providing service on or near these terminals, building supply power to the unit should be de-energized.

Figure 20.1 - Dead Front Disconnect Switch Assembly



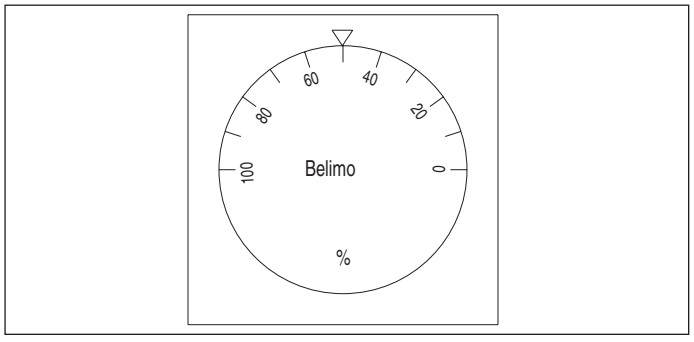
The dead front disconnect switch is factory installed in the electrical section. The disconnect switch is designed so that it must be turned “OFF” before entry to the electrical control cabinet can be obtained (See Figure 20.1). When in the “OFF” position, power is disconnected to all unit wiring electrically following the switch (See Warning). To open, see Figure 20.1. For servicing the unit, the disconnect switch can be manually overridden by using a wrench and turning the disconnect switch shaft 90° clockwise (See Figure 20.1). Fusible and circuit breaker switches available. For fusible switches, Class “J” time delay fuses must be field provided matching the fuse size listed on the Model Identification plate.

(17) Step Down Transformer Fuses – (OPT)
The transformer fuses are factory installed in the electrical section. The fuses are included to protect the transformer. Fuses included.

(18) Step Down Transformer – (OPT)
The step down transformer is factory installed in the eletrical section. The transformer is required for power exhausted units with a supply voltage of 460V/3Ph and 575V/3Ph.

(19) Factory Installed Minimum Positioner – (OPT)
The factory installed minimum positioner is installed in the electrical section and is used with a modulating damper actuator to set the minimum percentage of outside air. The minimum positioner dial is manually set between 0 to 100% resulting in a 2 to 10 VDC signal being sent to the damper actuator. When used in conjunction with the Proportional Temp Controller, the positioner sets the minimum outside air percentage and the Proportional Temp Controller then modulates between the minimum position and 100% outside air.

Figure 20.2 - Minimum Positioner



OPTIONS

(20) Extended Grease Line Zerk Fittings – (OPT)
The extended grease line zerk fittings are factory installed on the exterior corner post between the electrical and blower sections. The zerk fittings allow pillow block bearings to be lubricated with a grease gun. Refer to Lubrication Recommendations for lubricant recommendations.

(21) Extended Grease Lines – (OPT)

The extended grease lines are factory installed in the blower section from the Extended Grease Line Zerk Fittings to the Pillow Block Bearings. The grease lines allow the pillow block bearings to be lubricated without requiring the service personnel to remove both blower doors to access the bearings.

(**22) Return Air Fire Stat – (OPT)**

The return air fire stat is factory installed in the electrical section with the sensor in the return air stream. In case of elevated temperatures in the return air stream, the manual reset switch shuts down the entire unit. If the limit temperature is exceeded, a service person must inspect the unit for the cause of the high discharge temperature, take corrective action, and then reset the switch. For single phase units 1-1/2 HP and less, the fire stat de-energizes a relay that controls blower motor operation. For three phase units and single phase units 2 HP and greater, the fire stat de-energizes the motor starter that controls blower motor operation.

(**23) Blower Housing – (STD**)

The blower housing is factory installed in the blower section. The blower housing contains a double width, double inlet (DWDI) blower wheel so both sides of the blower must be free from obstructions for proper operation. For Right Hand units (Digit 9 = R), during operation the blower wheel should rotate in the clockwise direction when viewed from the service side of the unit. For Left Hand units (Digit 9 = L), during operation the blower wheel should rotate in the counterclockwise direction when viewed from the service side of the unit. If necessary, interchange supply power wiring to reverse blower rotation.

(24) Pillow Block Bearings – (OPT)
The blower bearings are factory installed in the blower section. The blower can be provided with either spider or pillow block bearings. Spider bearings are permanently lubricated and do not require lubrication. Pillow block bearings are shipped non-greased from the factory and require lubrication before start-up. For lubrication recommendations, see Lubrication Recommendations.

(25) Blower Motor – (STD)
The blower motor is factory installed in the blower section. The blower motor can be provided in a variety of supply voltages, frame types, and motor horsepowers. Refer to the model nomenclature to determine the type of motor provided. The blower motor is supplied with an adjustable sheave that can be used to increase/decrease the blower RPM. For instructions on changing the blower RPM, refer to Blower Adjustments.

(26) Filters – (OPT)
When filters are supplied with the unit, a rack and the filters are factory installed in the blower section. The unit can be supplied with 1" or 2" permanent filters, 2" FARR® Aeropleat MERV 7 or 2" FARR® 30/30 MERV 8 filters. For filter replacement, refer to Maintenance.

(27) Fresh Air Damper – (OPT)
When a fresh air damper is supplied with the unit, the damper is factory installed in the blower section. The fresh air damper is used as an outside air shut-off damper, so ultra low leak, Class II leakage resistance (less than 10 CFM/ft^2 at 1" W.C.) dampers with self-compensating stainless steel side seals and santoprene and galvanized steel blade seals are used.

(30) Direct Drive Damper Actuator – (OPT)
The direct drive damper actuator is factory installed in the blower section on the side of the fresh air damper. The actuator controls the position of the fresh air damper. The return air damper, if provided, is controlled by the damper linkage between the two dampers. All damper actuators are low voltage (24V). For Right Hand units (Digit 9 = R), during operation the actuator should rotate in the counterclockwise direction when viewed from the service side of the unit. For Left Hand units (Digit 9 = L), during operation the actuator should rotate in the clockwise direction when viewed from the service side of the unit. Three different types of dampers actuators can be provided: Two-position, Modulating, and Floating.

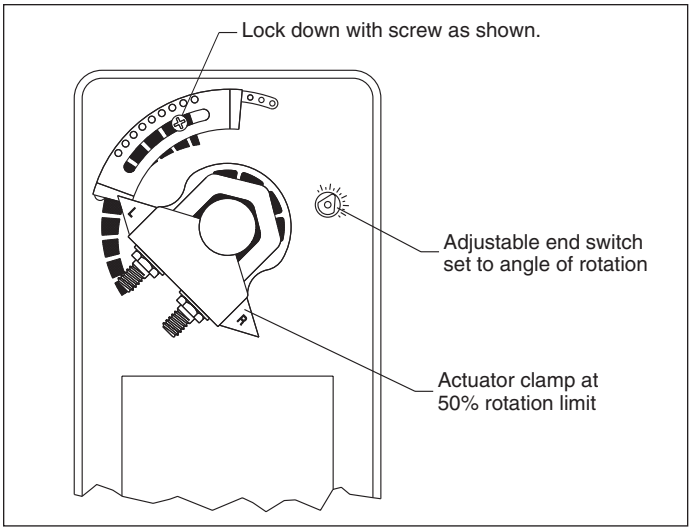
Two-position Damper Actuator: A two-position damper actuator is provided with Air Control options DA, EA, EQ, and FA (Digits 20 & 21). The two-position damper actuator provides open/closed operation of the fresh air damper. When the damper is energized, the fresh air damper is opened to 100% outside air in 75 seconds (For units with a two-position damper limiter, the outside air percentage would be the set by the damper limiter. See Two-Position Damper Limiter below). All two-position damper actuators are spring return, so when the damper is de-energized, the fresh air damper will spring closed. All two-position dampers include auxiliary switches (one normally open and one normally closed) that reverse when the damper actuator is at 85° rotation (adjustable).

Two-Position Damper Limiter: The two-position damper limiter is factory set to prevent the outside air damper from opening 100%. The outside air percentage and the actuator end switch is set based on the unit order.

Field adjustment of the two-position damper limiter is accomplished by the following:

1. Determine the amount of damper rotation required (Percentage of outside air).
2. Locate the angle of rotation limiter on the actuator so that its edge lines up with the degree graduation on the actuator face which corresponds with the required rotation. (See Figure 21.1 which is shown at 50% rotation limit.)
3. Find the appropriate cross-hair location through the slot of the limiter. This is the screw mounting location.
4. Pierce through the label material to allow easy fastening of the retaining screw.
5. Position the limiter back to the desired position, making sure the locating “teeth” on the limiter are engaged into the locating holes on the actuator.
6. Fasten the limiter to the actuator using the self tapping screw provided.
7. Test the damper rotation either manually with the manual crank or apply power and if required, a control signal. Re-adjust if necessary.

Figure 21.1 - Two-position damper actuator and limiter



OPTIONS

Modulating Damper Actuator: A modulating damper actuator is provided with Air Control options GA, GB, GC, GD, GE, GF, GG, GH, GJ, GK, GM, and GN (Digits 20 & 21). The modulating damper actuator provides incremental operation of the fresh air damper (The return air damper is controlled by the fresh air damper position). Full 90° rotation of the modulating actuator requires 150 seconds. All modulating damper actuators operate using a 0-10 Vdc input signal (Air Control GB utilizes a resistor to convert from a 4-20 mA to 0-10 Vdc) from a damper controller. All modulating damper actuators are spring return, so when the damper is de-energized, the fresh air damper will spring closed.

Floating Damper Actuator: A floating damper actuator is provided with Air Control option HP (Digits 20 & 21). The floating damper actuator provides forward and reversing damper operation in response to contact closures from the space pressure controller. When the space pressure is above the desired set point, a high pressure contact on the space pressure controller energizes the damper to drive the fresh air damper closed. When the space pressure is below the desired set point, a low pressure contact on the space pressure controller energizes the damper to drive the fresh air damper open. When the space pressure is between the high and low set points, the damper "floats" at the fresh air percentage that satisfied the space pressure controller. Full 90° rotation of the floating actuator requires 150 seconds. For additional information on the space pressure controller, refer to Literature 5-585.

The damper actuator is designed to "float" and therefore it is not spring return. When the unit is de-energized under normal operation, the fresh air damper is closed by a relay contact closure which electrically drives the damper closed. If the supply power to the unit is interrupted before the damper actuator can drive closed, the fresh air damper will remain open. The damper can be manually closed through the use of the manual override switch on the floating damper actuator.

(31) Enthalpy Controller – (OPT)
An enthalpy controller is provided with Air Control option GJ (Digits 20 & 21) and factory installed in the blower section. The purpose of the enthalpy controller is to use outside air for cooling, whenever possible, to reduce compressor operation of the mechanical cooling system. The economizer functions as a true first stage of cooling and provides maximum fuel economy during the cooling cycle.

An enthalpy sensor is provided with Air Control option GJ and field installed in the inlet air stream. The enthalpy sensor senses and combines the temperature and humidity of the outdoor air to provide the 4-20 mA input signal to the Enthalpy Controller.

HEATING and VENTILATING MODE
When the space thermostat calls for heat or it is in the fan ON position without a call for cooling (ventilation mode), the economizer is automatically locked out. It holds the outdoor air damper at the minimum position setting.

COOLING MODE
When the space thermostat calls for cooling, the system operates as follows:

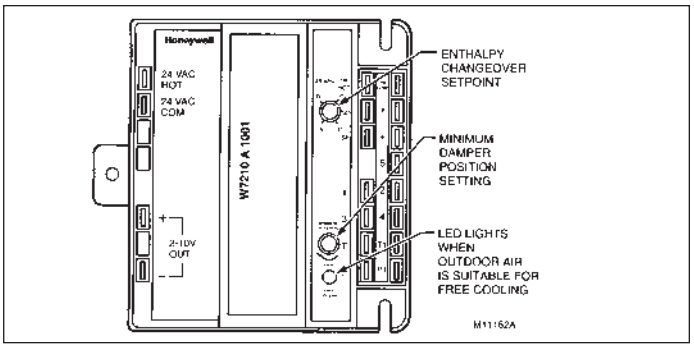
Outdoor Air Enthalpy is Below Changeover Set Point
1. The outdoor air damper is proportioned open (and the return air damper is proportioned closed) to maintain between 50°F and 56°F at the mixed temperature air sensor.
2. During economizer operation, mechanical cooling is operated by the second stage of the cooling on the space thermostat.

Outdoor Air Enthalpy is Above Changeover Set Point
1. The outdoor air damper is closed to its minimum position.
2. A call for cooling from the space thermostat brings on mechanical cooling.

The enthalpy controller is used in conjunction with the Enthalpy Sensor (not shown and field installed) and a mixed air temperature sensor (not shown). The mixed air temperature sensor is factory installed in the blower section to sense the combined temperature of the fresh and return air streams. The sensor is non-adjustable and when in the free cooling mode, modulates the dampers to maintain between 50°F and 56°F at the sensor.

The enthalpy controller contains a minimum position adjustment and an enthalpy changeover set point that must be field set.

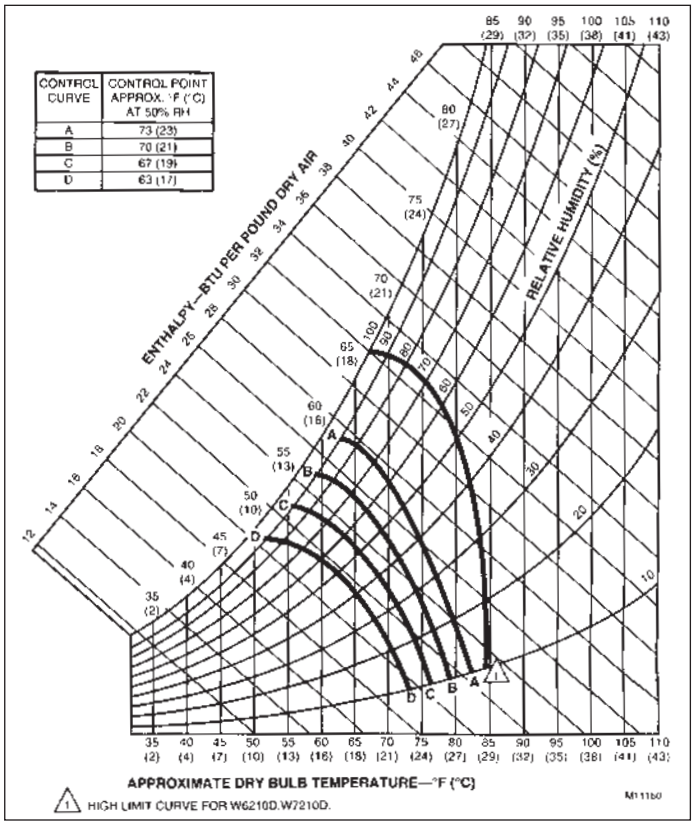
Figure 22.1 - Enthalpy Controller



Minimum Position Adjustment:
The minimum position adjustment keeps the outdoor air damper from closing completely during system operation to provide ventilation in both the heating and cooling modes.

To set the minimum position adjustment:
1. Disconnect mixed air sensor from terminals T and T1 on the enthalpy controller.
2. Make sure the factory installed jumper is in place across terminals P and P1.
3. Connect 24 Vac across terminals TR and TR1.
4. Adjust the minimum position adjustor with a screwdriver for the desired minimum position.

Figure 22.2 - Enthalpy Changeover Set Point Control Points



OPTIONS

Outdoor Enthalpy Changeover Set Point
The outdoor enthalpy changeover set point returns the outdoor air damper to the minimum position when the enthalpy rises above its set point. Enthalpy set point scale markings, located on the enthalpy controller, are A, B, C, and D. See Figure 24.2 for the corresponding control point. The factory installed 620-ohm jumper placed across terminals S_R and + is required for proper operation and should not be removed. Refer to suppliers literature supplied with the unit for additional information.

(32) Damper to Damper Linkage – (OPT)
Units with fresh and return air dampers include a damper actuator that controls the fresh air damper. The return air damper position is controlled by the fresh air damper through the connecting rod. For adjustment, refer to Damper Linkage Adjustment.

(33) Return Air Damper – (OPT)
When a return air damper is supplied with the unit, the damper is factory installed in the blower section. The return air damper is used as an air balancing damper so low leak, Class III leakage resistance (less than 40 CFM/ft^2 at 1" W.C.) dampers with self-compensating stainless steel side seals and santoprene blade seals are used.

(34) Proportional Temperature Controller Sensor – (OPT)
A proportional temperature controller sensor is provided with Air Control options GF, GG, GH, GK, GM, or GN (Digits 20 & 21) and factory installed in the blower section. The sensor provides the mixed air temperature signal to the A350P Proportional Temperature Controller which is mounted in the electrical section.

(35) Motor and Blower Vibration Isolation – (OPT)
The motor vibration isolation is factory installed in the blower section below the blower support bracket. The four (4) 13/32"- neoprene vibration mount grommet provides isolation of the blower housing and motor from the blower support channels. The blower vibration isolation is factory installed in the blower section between blower discharge and the blower duct connection. The blower duct connection is not rigidly mechanically fastened and the 1/4" thick gasketing around the duct transition provides vibration isolation.

(36) Blower Support – (STD)
The blower supports are factory installed in the blower section. The blower supports are used to rigidly support the weight of the blower and motor during operation and shipping.

(37) Convenience Outlet – (OPT)

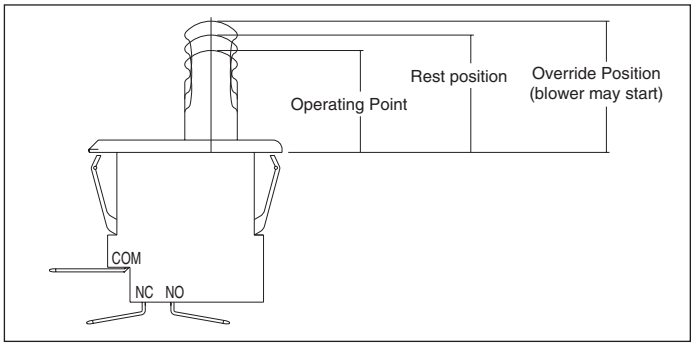
⚠ WARNING

Do not perform service on the convenience outlet without disconnecting its power supply. The convenience outlet power supply is separate from main power supply to the unit. When the main disconnect switch is de-energized, the convenience outlet power supply remains energized.

The convenience outlet is factory installed in the blower section for providing power for 115V service equipment (trouble light, power tools, etc.). The 115V ground fault circuit interrupter (GFCI) is rated for 15 amps and includes test and reset switches. A separate field supplied 115V/1Ph power supply must be routed through the electrical section wall into the back of the convenience outlet junction box.

(38) Blower Door Switch – (OPT)
The blower door switch is factory installed inside the blower section door on the access side of the unit. When the blower section door is removed, the momentary switch is released and interrupts power to the low voltage circuit. For single phase units 1-1/2 Hp and less, the door switch de-energizes a relay that controls blower motor operation. For three phase units and single phase units 2 Hp and greater, the door switch de-energizes the motor starter that controls blower motor operation. For servicing, the switch is equipped with an override position that can be manually pulled out to override the switch. See Figure 23.1

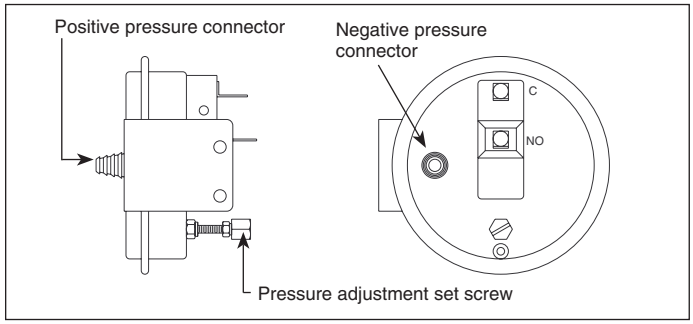
Figure 23.1 - Blower Door Switch with Manual Override



(39) Dirty Filter Switch – (OPT)
The dirty filter pressure switch is factory installed in the electrical section. The dirty filter pressure switch monitors the pressure differential between the two sides of the filters. When the filters become dirty, the differential pressure increases and trips the pressure switch which energizes a light on the remote monitoring panel. The pressure differential switch must be field set because setting the switch requires the blower to be in operation and the ductwork to be installed.

Setting the Dirty Filter Switch
The range of the dirty filter pressure switch is adjustable between 0.17" to 5.0" W.C.
1. Ensure that the unit filters are clean. Clean or replace if necessary.
2. Connect the leads of a continuity tester to the NO and C terminals of the dirty filter pressure switch. See Figure 23.2
3. Set the thermostat so that there is a call for heat. This should fire the burner and the blower should start.
4. Turn the set screw of the pressure switch clockwise until it stops. This will set the pressure at 5.0" W.C. and the continuity tester should be sensing an open circuit.
5. Begin turning the screw counterclockwise until the continuity tester senses a closed circuit. This determines the base pressure of the system.
6. Turn the screw clockwise until the continuity tester senses an open circuit and then one additional full turn (This is approximately 0.25" W.C.) This will allow for the increase in static pressure due to dirty filters.

Figure 23.2 - Dirty Filter Pressure Switch and Air Flow Proving Switch



OPTIONS

(40) Motor Starter – (OPT)
The motor starter is factory installed in the electrical section. A motor starter is required for all three phase motors and single phase motors 2 Hp and greater. The motor starter current set point dial is factory set to the motor full load amp draw listed on the motor nameplate.

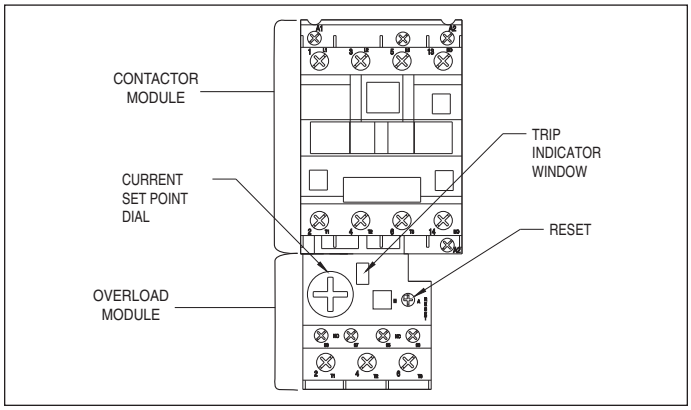
(40) Variable Frequency Drive – (OPT)
The VFD controller adjusts the motor rpm to vary the unit air flow. The minimum air flow may be varied between 30 and 100% of the full speed air flow depending on the controls selection of the unit. The control changeover options are two speed, floating building pressure sensing, and building management control.

The overload module of the motor starter is designed to trip to protect the motor from exceeding the nameplate amps. If the motor exceeds the amp draw on the current set point dial, the trip condition is indicated by a red color in the trip indicator window. The motor starter can be placed in the automatic or manual reset positions. Automatic reset is accomplished by depressing the “RESET” button and turning the button 1/4 turn. When in the automatic reset position, if the overload module trips, the module will reset itself once the overload relay has cooled. In the manual reset position, if the overload module trips, the “RESET” button must be depressed before the blower can operate.

The contractor module includes one (1) normally open auxiliary contact. The contact rating is 10 amps.

If the factory installed motor starter option was not ordered with a unit that has a three phase motor or single phase motor 2 Hp or greater, a motor starter must be field supplied and installed.

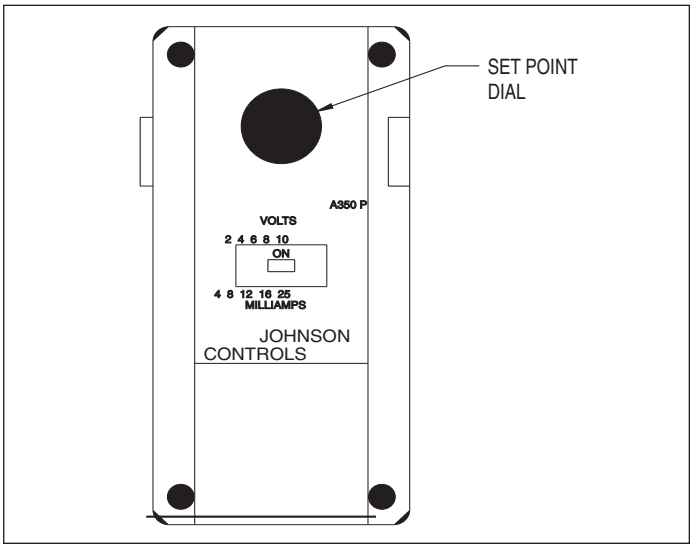
Figure 24.1 - Motor Starter



(42) Proportional Temperature Controller – (OPT)
A proportional temperature controller is provided with Air Control options GF, GG, GH, GK, GM, or GN (Digits 20 & 21) and factory installed in the electrical section. The controller compares the mixed air temperature set point and the mixed air temperature from the Proportional Temperature Controller Sensor. The controller sends a 2-10 Vdc signal to the modulating damper actuator in order to maintain the set point. The controller includes a set point dial that must be field set to the desired mixed air temperature (typically 55°F).

(43) Warm-Up Stat – (OPT)
A warm-up stat is provided with Air Control options GK, GM, or GN (Digits 20 & 21) and factory installed in the electrical section with the sensor in the return air stream. The warm-up thermostat monitors the return air temperature to the unit and prevents the fresh air dampers from opening until the temperature of the return air has reached the desired set point (typically 65°F or 5°F below the room temperature).

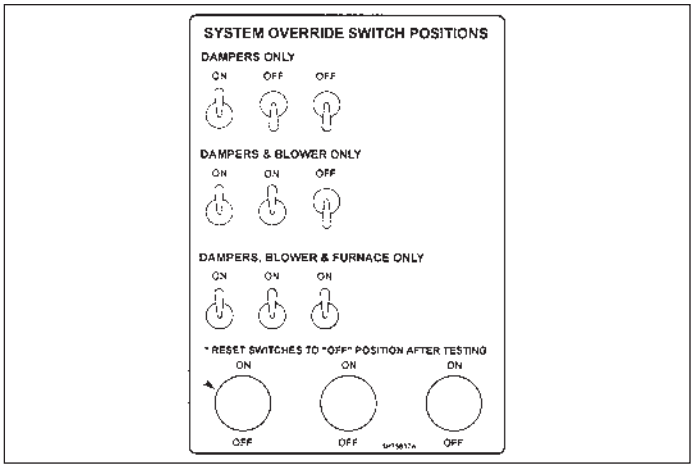
Figure 24.2 - Proportional Temperature Controller



(44) Blower Supply Power Terminal Strip – (STD)
The blower supply power terminal strip is located in the electrical section. The terminal strip is labeled to match the electrical wiring diagram provided with the unit. Supply power labeling ranges from terminal numbers 80 to 99. All field wiring connections should be made to the bottom side of the terminals to prevent miswiring by modifying the factory wiring which is made to the top of the terminal strip.

(45) Service Switches – (OPT)
The service switches are factory installed in the electrical section. The service switches allow for service personnel to independently test operation of the damper, blower, and furnace without using jumper wires. The switches override the remote monitoring panel and/or thermostats to energize each component directly. All switches need to be reset to the “OFF” position after testing otherwise the components will remain energized.

Figure 24.3 - Service Switches



(46) Electronic Modulation Amplifier – (OPT)
An electronic modulation amplifier is provided factory installed in the duct furnace electrical junction box when the unit is equipped with Electronic Modulating Gas Controls (Digit 12 = 4 or 5). The amplifier processes the thermostat temperature and set point signals to modulate the firing rate between 40% to 100% full fire. For additional information, refer to Control Operating Sequence.

OPTIONS

(47) Electronic Modulating Gas Valve – (OPT)
An electronic modulating gas valve is provided factory installed in the duct furnace gas train when the unit is equipped with Electronic Modulating Gas Controls (Digit 12 = 4, 5, 6, 7, or 8). The gas valve modulates the firing rate between 40% to 100% full fire based on the input signal from the Electronic Modulation Amplifier or Signal Conditioner. For additional information, refer to Control Operating Sequence.

(48) Air Flow Proving Switch – (OPT)
The air flow proving switch is factory installed in the duct furnace electrical junction box. The air flow proving switch monitors the pressure differential between the duct furnace and the atmosphere. The purpose of the air flow proving switch is to cut power to the gas controls if a positive pressure is not measured by the switch. This could be caused by a lack of air movement through the heat exchanger.

NOTE: The air flow proving switch will prevent any heat exchanger warm-up because the gas controls can not be energized until air flow is proven.

Setting the Air Flow Proving Switch
The range of the air flow proving switch is adjustable between 0.17" to 5.0" W.C.

1. Set the thermostat so that there is a call for heat. This should start the blower and burner ignition sequence.
2. Turn the set screw of the pressure switch clockwise until it stops. This will set the pressure at 5.0" W.C.
3. Turn the screw counter-clockwise until the gas controls light and then one additional full turn (This is approximately 0.25" W.C.). This will allow for dirty filters or any other slight static pressure increases in the system.

(49) High Limit Switch
Automatic – (STD)
The automatic reset high limit switch is factory installed in the duct furnace electrical junction box. If the limit temperature is exceeded, the gas controls are de-energized until the switch is cooled.

Manual – (OPT)
The manual reset high limit switch is factory installed in place of the standard automatic reset high limit switch located in the duct furnace electrical junction box. In case of a failure of the blower motor, blockage of the inlet air, etc., the manual reset switch prevents the unit from cycling on the high limit. If the limit temperature is exceeded, a service person must inspect the unit for the cause of the high discharge temperature, take corrective action, and then reset the switch.

(50) Supply Air Fire Stat – (OPT)
The supply air fire stat is factory installed in the duct furnace electrical junction box with the sensor in the discharge air stream. In case of elevated temperatures in the supply air stream, the manual reset switch shuts down the entire unit. If the limit temperature is exceeded, a service person must inspect the unit for the cause of the high discharge temperature, take corrective action, and then reset the switch. For single phase units 1-1/2 HP and less, the fire stat de-energizes a relay that controls blower motor operation. For three phase units and single phase units 2 HP and greater, the fire stat de-energizes the motor starter that controls blower motor operation.

(51) Main Gas Valve – (STD)
The main gas valve is factory installed in the duct furnace gas train. The main gas valve provides the pilot, regulator, main gas, and manual shutoff functions. For additional information, see the supplier literature included with the unit.

(52) Burner Box – (STD)
The burner box is located in the duct furnace section and contains the burner and pilot assembly. The burner box includes an access panel for removal of the burner for inspection and servicing.

(56) Blocked Vent Safety Switch
A manual reset BVSS is supplied on all gravity vented duct furnaces and is designed to prevent operation of the main burner in the event there is spillage of flue producs into the space. This spillage may occur due to a restricted vent, inadequate vent draw, uninsulated vent pipe in cold ambient or long vent runs, excessive vent diameter, restricitve vent terminal, negative pressure within space, etc. After the cause of the spillage has been corrected, depressing the button of the BVSS found on top of the unit may reset the BVSS. See trouble shooting section for more information.

(Not Shown) Circuit Analyzer – (OPT)
The circuit analyzer is factory installed on the door of the electrical section. The circuit analyzer is used to quickly assist service personnel in troubleshooting by monitoring the unit firing sequence and vital operating steps. Lights will come on as a point of electrical operation is passed and proven. If any light is not lit, that is the point where failure occurred.

Figure 25.1 - Circuit Analyzer
Circuit analyzer tagging will vary based on the unit ordered. Circuit analyzer shown is for reference only.

GENERAL PERFORMANCE DATA

Table 26.1 - General Performance Data - Models With Blower

Model Size (Digits 4-6)	75		100		125		150		175	
Btu/Hr Input ①	75,000		10,0000		125,000		150,000		175,000	
Btu/Hr Output ①	60,000		80,000		100,000		120,000		140,000	
Blower Style (Digit 16 Letter)	A or B	C or D	C or D	E or F	C or D	E or F	C or D	E or F	C or D	E or F
Max. Temp. Rise (°F)	100	100	100	85	100	100	100	100	100	100
Min. Temp. Rise (°F)	28	20	21	20	27	20	33	20	39	23
Max. CFM	1980	2778	3450	3704	3450	4630	3350	5556	3350	5556
Min. CFM ②	556	556	741	875	926	926	1111	1111	1296	1296

Model Size (Digits 4-6)	200			225			250		
Btu/Hr Input ①	200,000			225,000			250,000		
Btu/Hr Output ①	160,000			180,000			200,000		
Blower Style (Digit 16 Letter)	C or D	E or F	G or H	C or D	E or F	G or H	E or F	G or H	I, J, or K
Max. Temp. Rise (°F)	100	85	85	100	95	95	100	100	96
Min. Temp. Rise (°F)	44	28	23	49	32	26	31	26	20
Max. CFM	3400	5250	6500	3400	5250	6500	6000	7250	9259
Min. CFM ②	1481	1750	1750	1667	1750	1750	1852	1852	1925

Model Size (Digits 4-6)	300			350			400		
Btu/Hr Input ①	300,000			350,000			400,000		
Btu/Hr Output ①	240,000			280,000			320,000		
Blower Style (Digit 16 Letter)	E or F	G or H	I, J, or K	E or F	G or H	I, J, or K	E or F	G or H	I, J, or K
Max. Temp. Rise (°F)	100	100	100	100	100	100	100	100	100
Min. Temp. Rise (°F)	37	31	20	45	37	22	52	42	25
Max. CFM	6000	7250	11111	5700	7000	12000	5700	7000	12000
Min. CFM ②	2222	2222	2222	2593	2593	2593	2963	2963	2963

Model Size (Digits 4-6)	500			600			700		
Btu/Hr Input ①	500,000			600,000			700,000		
Btu/Hr Output ①	400,000			480,000			560,000		
Blower Style (Digit 16 Letter)	G or H	I, J, or K	L	G or H	I, J, or K	L	G or H	I, J, or K	L
Max. Temp. Rise (°F)	120	120	120	120	120	120	120	120	120
Min. Temp. Rise (°F)	53	40	40	63	40	40	76	40	40
Max. CFM	7000	9259	9259	7000	11111	11111	6850	12963	12963
Min. CFM ②	3086	3086	3086	3704	3704	3704	4321	4321	4321

Model Size (Digits 4-6)	800			840		960	
Btu/Hr Input ①	800,000			1,050,000		1,200,000	
Btu/Hr Output ①	640,000			840,000		960,000	
Blower Style (Digit 16 Letter)	G or H	I, J, or K	L	I, J, or K	L	I, J, or K	L
Max. Temp. Rise (°F)	120	120	120	120	120	120	120
Min. Temp. Rise (°F)	87	46	41	60	60	68	63
Max. CFM	6850	13000	14500	13000	13000	13000	14000
Min. CFM ②	4938	4938	4938	6481	6481	7407	7407

① Ratings are shown for elevations up to 2000 ft. For higher elevations the input rating should be reduced at the rate of 4% for each 1000 feet above sea level. For Canada, in elevations between 2000 and 4500 feet, the unit must be derated to 90% of the rating listed above.

② For Variable Air Movement Applications, see page 17.

GENERAL PERFORMANCE DATA

Table 27.1 - Air Temperature Rise

Btu/Hr ①		Air Temperature Rise through Unit (°F)																
Input	Output	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
		Max	CFM															Min②
75,000	60,000	2778	2222	1852	1587	1389	1235	1111	1010	926	855	794	741	694	654	617	585	556
100,000	80,000	3704	2963	2469	2116	1852	1646	1481	1347	1235	1140	1058	988	926	871	823	780	741
125,000	100,000	4630	3704	3086	2646	2315	2058	1852	1684	1543	1425	1323	1235	1157	1089	1029	975	926
150,000	120,000	5556	4444	3704	3175	2778	2469	2222	2020	1852	1709	1587	1481	1389	1307	1235	1170	1111
175,000	140,000	-	5185	4321	3704	3241	2881	2593	2357	2160	1994	1852	1728	1620	1525	1440	1365	1296
200,000	160,000	-	5926	4938	4233	3704	3292	2963	2694	2469	2279	2116	1975	1852	1743	1646	1559	1481
225,000	180,000	-	6667	5556	4762	4167	3704	3333	3030	2778	2564	2381	2222	2083	1961	1852	1754	1667
250,000	200,000	9259	7407	6173	5291	4630	4115	3704	3367	3086	2849	2646	2469	2315	2179	2058	1949	1852
300,000	240,000	11111	8889	7407	6349	5556	4938	4444	4040	3704	3419	3175	2963	2778	2614	2469	2339	2222
350,000	280,000	-	10370	8642	7407	6481	5761	5185	4714	4321	3989	3704	3457	3241	3050	2881	2729	2593
400,000	320,000	-	11852	9877	8466	7407	6584	5926	5387	4938	4558	4233	3951	3704	3486	3292	3119	2963

Btu/Hr ①		Air Temperature Rise through Unit (°F)																
Input	Output	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
		Max	CFM															Min②
500,000	400,000	9259	8230	7407	6734	6173	5698	5291	4938	4630	4357	4115	3899	3704	3527	3367	3221	3086
600,000	480,000	11111	9877	8889	8081	7407	6838	6349	5926	5556	5229	4938	4678	4444	4233	4040	3865	3704
700,000	560,000	12963	11523	10370	9428	8642	7977	7407	6914	6481	6100	5761	5458	5185	4938	4714	4509	4321
800,000	640,000	14500	13000	11852	10774	9877	9117	8466	7901	7407	6972	6584	6238	5926	5644	5387	5153	4938
1,050,000	840,000	-	-	-	-	12963	11966	11111	10370	9722	9150	8642	8187	7778	7407	7071	6763	6481
1,200,000	960,000	-	-	-	-	-	13675	12698	11852	11111	10458	9877	9357	8889	8466	8081	7729	7407

① Ratings are shown for elevations up to 2000 ft. For higher elevations the input rating should be reduced at the rate of 4% for each 1000 feet above sea level. For Canada, in elevations between 2000 and 4500 feet, the unit must be derated to 90% of the rating listed above.

② For Variable Air Movement Applications, see page 17.

Air Temperature Limits

The maximum allowable discharge air temperature is 150°F. The maximum allowable air temperature rise per furnace for Low Air Temperature Rise Units is 60°F. All system units are designed for a maximum allowable total static pressure of 3.0" W.C.

UNIT SELECTION

Selection Procedure

In order to properly select an indirect-fired heating, ventilating, cooling or make-up air unit, it is necessary to have the following basic information.

1. **Required air handling capacity (CFM).**
   The air capacity of the unit is usually determined by the ventilation air requirements, exhaust load of the building, infiltration losses, or the air turns/changes of the space.
2. **Outdoor and indoor design temperature.**
   The outdoor design temperature is determined by using the ASHRAE Guide design temperatures for the city where the equipment is to be installed. For heating and ventilating units, the desired room temperature would be used as the indoor design temperature. In the case of 100% make-up air units, the discharge air temperature should be at least equal to the temperature of the air being exhausted.
3. **Required heating output capacity (Btu/Hr).**
   The heating output capacity of the unit is determined by using the formula:
   BTU/HR = CFM x Temp. Rise (°F) x 1.08
4. **External static pressure to unit.**
   The external static pressure (E.S.P.) is determined using the ASHRAE Guide for duct losses, or may be provided by the design engineer.
5. **Unit configuration with options and accessories (Filters or dampers).**
   The unit configuration is determined by the location where the unit is to be installed. The critical options and accessories are those that add internal static pressure (I.S.P.) to the unit. Once these items are determined, the pressure drop curves would be used to calculate the total pressure drop (T.S.P.)
   Total Static Pressure = Internal + External Static Pressure
6. **Heat exchanger material.**
   The heat exchanger type is determined by the application. The standard heat exchanger material is aluminized steel. A 409 stainless steel heat exchanger and burner is recommended when the unit is installed downstream of a cooling coil or evaporative cooler, and when the combined entering/return air to the unit is below 40°F.
7. **Type of fuel.**
   Either natural or propane gas determined by the design engineer.
8. **Gas control staging method.**
   Either single stage, two stage, mechanical modulation, or electronic modulation determined by the design engineer.
9. **Main power supply voltage to unit.**
10. **Altitude at which unit is to be installed.**

With this information a basic unit can be selected as shown in the following example.

Selection Example Conditions

Select an indirect-fired, 100% make-up air unit to meet the following conditions:

1. CFM at sea level = 5,000 cfm
2. Outdoor design temp. = 10°F
   Indoor design temp. = 70°F
3. Heating output capacity =
   5000 cfm x (70°F -10°F) x 1.08 = 324,000 Btu/Hr
4. External Static Pressure = 0.65
5. The unit with the controls on the Right Hand Side is to be provided with the following:
   2" Permanent Filters, and Fresh Air Damper.
6. Heat exchanger and burner = 409 Stainless Steel.
7. Gas Type = Natural
8. Gas Controls = Electronic Modulating with Duct Sensing.
9. Supply Voltage: 460V/60Hz/3Ph
10. Altitude: 1000 feet

With the information listed above, the basic model, using the Model Nomenclature shown on page 55, can be selected as shown in the following example:

1. **Determine the Model Configuration and Venting:**
   The Model Configuration is determined by the required sections of the unit (Blower only) and the venting style (gravity vented) that are obtained from item #5. Using the Model Nomenclature on page 55, the Model Configuration and Venting = DBG.
2. **Determine the Furnace Input Rating (MBH):**
   Using the Heating output capacity, the Furnace Input Rating is determined from Table 26.1. The closest model to 324,000 Btu/Hr output has an Btu/Hr Input rating of 400,000 Btu/Hr so the Furnace Input Rating = 400.
3. **Determine the Heat Exchanger/Burner/Drip Pan Material:**
   From item #2 in Selection Example Conditions, the Heat Exchanger and Burner required are 409 Stainless Steel. Because the Drip Pan material is not specified, the standard Aluminized Steel drip pan will be used. Thus, the Heat Exchanger/Burner/Drip Pan Material = S.
4. **Determine the Development Sequence:**
   From item #8 in Selection Example Conditions, the modulating gas controls result in the Development Sequence = M.
5. **Determine the Access Side:**
   From item #5 in Selection Example Conditions, the Right Hand Gas controls result in the Access Side = R.
6. **Determine the Air Temperature Rise:**
   From item #2 in Selection Example Conditions, the Air Temperature Rise is 60°F (70°F - 10°F). However, using the output capacity of the DBG400 @ 5000 cfm, the resulting temperature rise is 59.3°F (320,000/(5000 x 1.08)). Since the rise is less than 60°F, the air baffle must remain in place.
7. **Determine the Gas Type:**
   From item #7 in Selection Example Conditions, the Natural Gas results in the Gas Type = N.
8. **Determine the Gas Valve:**
   From item #8 in Selection Example Conditions, the Electronic Modulating with Duct Sensing results in the Gas Valve = 4.
9. **Determine the Additional Safety Switches:**
   Since no additional safety switches were specified, the Additional Safety Switches = 0.

UNIT SELECTION

10. Determine the Supply Voltage:

From item #9 listed above, the 460V/60Hz/3Ph results in the Supply Voltage = F.

11. Determine the Transformer:

For DBG/DCG models, a 75VA Transformer is required. Thus, the Transformer = 2.

12. Determine the Blower Size and Bearing Type:

Using Table 26.1, the Model Size 400 has three available blowers for which the performance tables are shown on pages 30-33. Since all of the blower performance curves can provide the required 5000 cfm, the total static pressure must be determined.

A) The Pressure Drop of an option or accessory is determined by entering the right of the table at the desired cfm and reading up the table until the cfm intersects the desired item. For this example, in table 30.1 the 2" Permanent Filter line is used. At the point of intersection, read across the table to the left and read the pressure drop, in inches of water column for the filters. For this example, the pressure drop is 0.06" W.C. As a result:

For the Model Size 400 with Digit 16 = E,F,G, or H:

2" Permanent Filters:	0.06" W.C.
Internal Static Pressure Drop	0.06" W.C.

The Total Static Pressure for the system is determined by Internal Static + External Static = Total Static Pressure For this example 0.06" + 0.65" = 0.71" W.C. T.S.P.

From page 30,
for the Model Size 400 with Digit 16 = I, J, or K:

2" Permanent Filters:	0.04" W.C.
Internal Static Pressure Drop	0.04" W.C.

The Total Static Pressure for the system is determined by Internal Static + External Static = Total Static Pressure For this example 0.04" + 0.65" = 0.69" W.C. T.S.P.

B) Using the total static pressure (T.S.P.) calculated in step 12a, use blower performance tables for the Model Size 400 (Table 32.1).

Using Table 32.1, enter the table at the required 5000 cfm for E, F blowers, and follow the cfm line up the right until it intersects with the T.S.P. line of 0.75" W.C. which is shown at the top of the table. At the point of intersection of these two columns, read the required horsepower and blower rpm. Repeat this process for 1.00"T.S.P. and literate to determine the BHP and rpm for 0.89" W.C. For this example the horsepower is 5 and the blower rpm is 1280.

Following this procedure for G,H blowers (Using 5000 cfm and 0.89" W.C. T.S.P), the horsepower is 5 hp and 920 rpm. Following this procedure for I,J,H blowers (Using 5000 cfm and 0.87" W.C. T.S.P), the horsepower is 3hp and 700 rpm. Although I,J,H blowers results in a 3 hp motor, this blower requires the use of the extended cabinet length. As a result, for purposes of this selection example G,H will be used.
Since the Bearing Type was not specified, the standard spider bearings will be used. Thus, using Table 32.1 with spider bearings, the Blower Size and Bearing Type = G.

13. Determine the Motor Horsepower:

The motor horsepower determined in step 12 was a 3 Hp. Since the supply voltage is 460V/60Hz/3Ph, a motor starter will need to be provided either with the unit or by others. For purposes of this selection, a motor starter by others will be used so the Motor Horsepower = G.

14. Determine the Motor Type:

The motor type was not specified so for purposes of this selection the standard open drip proof motor will be used so the Motor Type = 1.

15. Determine the Sheave Arrangement:

To establish the Sheave Arrangement, the motor frame size must be determined. The Motor Data tables on pages 38 to 42 contain the motor frame size.

A) Using the Supply Voltage (460V/60Hz/3Ph), enter the correct Motor Data table (Table 41.1). Using Model Nomenclature Digits 17 and 18 (G1) determined in steps 13 and 14, find the motor frame size (182T).

B) Using the Motor Frame Size enter the Sheave Selection table for the selected blower determined by step 13 (Table 35.2). Using the rpm calculated in step 12 (870 rpm), select the sheave range that contains the required rpm. Find the intersection with the Motor Frame Size to determine the Sheave Selection. For this example with a 182T frame with 870 rpm, from Table 35.2, the Sheave Arrangement = I.

16. Determine the Air Control:

The Air Control option is selected based on the required damper configuration. The available damper selections are detailed on page 21. For this selection, a 100% fresh air unit without return air was required so the Air Control = DA.

17. Determine the Evaporative Cooler:

An evaporative cooler is not available, so for purposes of this selection the Evaporative Cooler = 0.

18. Determine the Cooling Coil:

A cooling coil cabinet was not specified so for purposes of this selection the Cooling Coil = 0.

Based on the previous steps, the model number for the base unit is the following:

DBG400SMRLN40F2GG1IDA00

Once the basic model has been determined, the additional options and accessories outlined on page 18 to 25 can be added to the unit.

OPTION & ACCESSORY PRESSURE DROP DATA

Table 30.1 - Option & Accessory Pressure Drop Tables (in "W.C.) ①

			All Units				Weatherproof Unit Only						
Unit Size	Digit 16	CFM	1" Permanent Filters	2" Permanent Filters	2" Farr Aeropleat Filters	2" Farr 30/30 Filters	Evap Cooler 6" Media	Evap Cooler 6" Media w/Prefilter	Evap Cooler 12" Media	Evap Cooler 12" Media w/Prefilter	Downturn Plenum	Rainhood and Birdscreen	Discharge Damper
75	A,B,C,D	556	0.01	0.01	0.02	0.03	0.01	0.05	0.02	0.07	0.00	0.01	0.00
		600	0.01	0.01	0.02	0.03	0.01	0.05	0.02	0.07	0.00	0.01	0.01
		800	0.02	0.01	0.03	0.04	0.02	0.08	0.04	0.12	0.01	0.02	0.01
		1000	0.02	0.02	0.04	0.05	0.03	0.11	0.06	0.17	0.01	0.03	0.01
		1200	0.03	0.02	0.05	0.06	0.04	0.14	0.08	0.22	0.02	0.03	0.01
		1400	0.03	0.03	0.06	0.07	0.06	0.17	0.11	0.29	0.03	0.04	0.02
		1600	0.04	0.04	0.07	0.09	0.08	0.21	0.15	0.36	0.04	0.06	0.02
		1800	0.04	0.04	0.08	0.10	0.10	0.25	0.19	0.44	0.05	0.07	0.03
		2000	0.05	0.05	0.10	0.11	0.12	0.30	0.23	0.53	0.06	0.08	0.03
		2300	0.06	0.07	0.11	0.13	0.16	0.37	0.31	0.68	0.08	0.11	0.04
		2778	0.08	0.09	0.15	0.16	0.23	0.51	0.45	0.96	0.12	0.15	0.06
100/125	C,D,E,F	741	0.01	0.02	0.02	0.02	0.01	0.06	0.02	0.08	0.00	0.03	0.01
		1000	0.02	0.02	0.03	0.04	0.02	0.08	0.04	0.12	0.01	0.05	0.01
		1500	0.03	0.04	0.05	0.07	0.04	0.14	0.08	0.23	0.02	0.07	0.02
		2000	0.05	0.06	0.07	0.10	0.08	0.21	0.15	0.36	0.04	0.10	0.03
		2500	0.07	0.08	0.10	0.14	0.12	0.30	0.23	0.53	0.07	0.13	0.04
		3000	0.09	0.11	0.13	0.19	0.17	0.40	0.34	0.73	0.11	0.16	0.05
		3500	0.11	0.13	0.16	0.24	0.23	0.51	0.46	0.97	0.15	0.19	0.07
		4000	0.14	0.16	0.20	0.30	4000 Max CFM for Evap				0.19	0.22	0.09
		4500	0.17	0.20	0.25	0.37					0.25	0.25	0.11
		4630	0.17	0.21	0.26	0.39					0.26	0.26	0.11
150/175	C,D,E,F	1111	0.01	0.02	0.03	0.04	0.01	0.07	0.03	0.09	0.02	0.02	0.01
		1500	0.02	0.03	0.04	0.05	0.03	0.10	0.05	0.15	0.02	0.03	0.01
		2000	0.03	0.04	0.06	0.08	0.04	0.15	0.09	0.24	0.04	0.05	0.02
		2500	0.05	0.06	0.09	0.11	0.07	0.20	0.14	0.34	0.05	0.08	0.02
		3000	0.06	0.08	0.11	0.15	0.10	0.27	0.20	0.46	0.07	0.10	0.04
		3500	0.08	0.11	0.14	0.18	0.14	0.34	0.27	0.61	0.10	0.14	0.05
		4000	0.11	0.13	0.18	0.23	0.18	0.41	0.35	0.77	0.13	0.18	0.06
		4500	0.13	0.16	0.21	0.27	0.23	0.50	0.45	0.95	0.17	0.22	0.08
		5000	0.16	0.19	0.25	0.32	0.28	0.59	0.55	1.15	0.21	0.27	0.10
		5200	0.17	0.21	0.27	0.34	0.30	0.63	0.60	1.23	0.23	0.29	0.11
		5556	0.19	0.23	0.30	0.38	5200 Max CFM for Evap				0.26	0.33	0.13
200/225	C,D,E,F,G,H	1481	0.01	0.02	0.03	0.03	0.02	0.08	0.04	0.12	0.02	0.03	0.01
		2000	0.01	0.02	0.04	0.04	0.03	0.12	0.07	0.19	0.03	0.05	0.01
		2500	0.02	0.04	0.05	0.06	0.05	0.17	0.10	0.27	0.04	0.08	0.02
		3000	0.03	0.05	0.07	0.08	0.08	0.22	0.15	0.36	0.06	0.10	0.04
		3500	0.03	0.06	0.09	0.10	0.10	0.27	0.20	0.47	0.09	0.14	0.05
		4000	0.05	0.08	0.11	0.12	0.13	0.33	0.27	0.60	0.11	0.18	0.06
		4500	0.06	0.10	0.13	0.15	0.17	0.40	0.34	0.73	0.14	0.22	0.08
		5000	0.07	0.11	0.16	0.18	0.21	0.47	0.42	0.89	0.18	0.27	0.10
		5500	0.09	0.14	0.19	0.21	0.25	0.55	0.50	1.05	0.21	0.32	0.12
		6000	0.11	0.16	0.22	0.25	0.30	0.63	0.60	1.23	0.26	0.38	0.14
		6500	0.13	0.18	0.25	0.28	6000 Max CFM for Evap				0.30	0.45	0.16
250/300 500/600	E,F,G,H	1852	0.03	0.02	0.05	0.05	0.02	0.10	0.05	0.15	0.02	0.07	0.02
		2000	0.03	0.03	0.05	0.06	0.03	0.11	0.06	0.17	0.02	0.08	0.02
		2500	0.04	0.04	0.07	0.09	0.04	0.15	0.09	0.24	0.03	0.09	0.03
		3000	0.05	0.06	0.10	0.11	0.06	0.19	0.13	0.32	0.04	0.12	0.04
		3500	0.07	0.08	0.12	0.15	0.09	0.24	0.17	0.41	0.06	0.14	0.06
		4000	0.08	0.10	0.15	0.18	0.11	0.29	0.23	0.52	0.08	0.16	0.07
		4500	0.10	0.13	0.18	0.22	0.15	0.35	0.29	0.64	0.10	0.19	0.09
		5500	0.14	0.19	0.25	0.31	0.22	0.48	0.43	0.91	0.15	0.25	0.13
		6500	0.19	0.26	0.34	0.42	0.30	0.63	0.60	1.23	0.21	0.31	0.18
		7250	0.23	0.32	0.41	0.51	6500 Max CFM for Evap				0.27	0.37	0.23
	I,J,K,L	1925	0.02	0.01	0.03	0.03	0.01	0.05	0.02	0.08	0.02	0.07	0.02
		3000	0.03	0.03	0.05	0.05	0.03	0.10	0.05	0.15	0.04	0.12	0.04
		4000	0.05	0.05	0.08	0.09	0.04	0.15	0.09	0.23	0.08	0.16	0.07
		5000	0.08	0.08	0.11	0.12	0.07	0.20	0.14	0.34	0.12	0.22	0.11
		6000	0.11	0.11	0.15	0.16	0.10	0.26	0.20	0.46	0.18	0.28	0.16
		7000	0.15	0.15	0.19	0.21	0.14	0.34	0.27	0.61	0.25	0.35	0.21
		8000	0.19	0.20	0.24	0.27	0.18	0.41	0.35	0.77	0.33	0.42	0.28
		9000	0.24	0.25	0.30	0.33	0.23	0.50	0.45	0.95	0.42	0.51	0.35
		10400	0.32	0.33	0.38	0.42	0.30	0.64	0.60	1.23	0.57	0.64	0.47
		11111	0.36	0.38	0.43	0.47	10400 Max CFM for Evap				0.66	0.71	0.53
350/400 700/800 840/960	E,F,G,H	2593	0.02	0.02	0.04	0.04	0.03	0.10	0.05	0.16	0.02	0.03	0.01
		3000	0.02	0.02	0.05	0.05	0.04	0.13	0.07	0.20	0.03	0.04	0.01
		3500	0.03	0.03	0.06	0.06	0.05	0.16	0.10	0.25	0.04	0.05	0.01
		4000	0.03	0.04	0.07	0.08	0.06	0.19	0.13	0.32	0.05	0.07	0.01
		4500	0.04	0.05	0.09	0.10	0.08	0.23	0.16	0.39	0.06	0.09	0.02
		5000	0.05	0.06	0.10	0.12	0.10	0.27	0.20	0.47	0.07	0.11	0.02
		5500	0.06	0.07	0.12	0.14	0.12	0.31	0.24	0.55	0.09	0.14	0.03
		6000	0.06	0.08	0.14	0.17	0.15	0.36	0.29	0.64	0.10	0.17	0.04
		6500	0.07	0.10	0.16	0.19	0.17	0.40	0.34	0.74	0.12	0.20	0.04
		7000	0.08	0.11	0.18	0.22	0.20	0.45	0.39	0.85	0.14	0.23	0.05
	I,J,K,L	2593	0.02	0.01	0.02	0.02	0.02	0.08	0.03	0.11	0.02	0.03	0.01
		3000	0.02	0.02	0.02	0.03	0.02	0.09	0.04	0.14	0.03	0.04	0.01
		4000	0.03	0.03	0.04	0.04	0.04	0.14	0.08	0.22	0.05	0.07	0.01
		5000	0.04	0.04	0.05	0.06	0.06	0.19	0.12	0.31	0.07	0.11	0.02
		6000	0.06	0.05	0.07	0.08	0.09	0.25	0.18	0.42	0.10	0.17	0.04
		7000	0.07	0.07	0.10	0.11	0.12	0.31	0.24	0.55	0.14	0.23	0.05
		8000	0.09	0.09	0.12	0.13	0.16	0.38	0.32	0.70	0.19	0.30	0.08
		9000	0.11	0.12	0.15	0.16	0.20	0.46	0.40	0.86	0.24	0.38	0.10
		10000	0.13	0.14	0.18	0.19	0.25	0.54	0.50	1.04	0.30	0.48	0.14
		11050	0.15	0.17	0.22	0.23	0.31	0.64	0.61	1.24	0.36	0.58	0.17
		12000	0.18	0.20	0.26	0.27	11050 Max CFM for Evap				0.43	0.69	0.21
		13000	0.20	0.24	0.30	0.31					0.51	0.81	0.26

① Accesssory / Option static pressure losses are approximate values only. Please consult the Accuspec selection software for static pressure losses at other than listed CFM.

BLOWER PERFORMANCE DATA

Table 31.1 - Unit Performance Tables ① ②

Unit Size	Digit 16	Air Temp. Rise	CFM	Total Static Pressure, "W.C.																	
				0.25		0.50		0.75		1.00		1.25		1.50		2.00		2.50		3.00	
				BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM
75	A,B	100°F / -	556	0.09	679	0.15	871	0.22	1031	0.29	1170	0.37	1296	0.45	1411	0.63	1617	0.81	1800	1.01	1968
		79°F / -	700	0.14	747	0.21	924	0.29	1074	0.37	1206	0.46	1327	0.55	1438	0.75	1638	0.95	1818	1.17	1982
		69°F / -	800	0.18	801	0.26	966	0.35	1109	0.44	1237	0.54	1354	0.64	1462	0.84	1658	1.06	1832	1.30	1996
		56°F / -	1000	0.29	917	0.39	1062	0.50	1192	0.60	1310	0.72	1419	0.83	1522	1.07	1709	1.32	1879	-	-
		46°F / -	1200	0.45	1042	0.57	1171	0.69	1289	0.82	1397	0.94	1499	1.08	1595	1.35	1773	-	-	-	-
		40°F / -	1400	0.66	1173	0.80	1288	0.94	1395	1.08	1495	1.23	1589	1.38	1680	-	-	-	-	-	-
		35°F / -	1600	0.93	1308	1.09	1412	1.25	1509	1.42	1601	-	-	-	-	-	-	-	-	-	-
		31°F / -	1800	1.28	1445	1.46	1539	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	C,D	69°F / -	800	-	-	0.15	795	0.21	960	-	-	-	-	-	-	-	-	-	-	-	-
		56°F / -	1000	-	-	0.20	822	0.28	975	0.36	1112	-	-	-	-	-	-	-	-	-	-
		46°F / -	1200	0.19	705	0.27	862	0.35	1003	0.44	1131	0.54	1250	0.65	1361	-	-	-	-	-	-
		40°F / -	1400	0.27	770	36.00	912	0.45	1041	0.55	1161	0.66	1273	0.77	1377	1.00	1572	-	-	-	-
		35°F / -	1600	0.37	839	0.47	968	0.57	1087	0.68	1199	0.80	1304	0.92	1403	1.17	1589	1.44	1760	1.72	1920
		31°F / -	1800	0.49	912	0.60	1030	0.72	1139	0.84	1244	0.96	1343	1.09	1437	1.36	1613	1.65	1777	1.94	1931
		28°F / -	2000	0.65	987	0.77	1095	0.90	1197	1.03	1295	1.16	1388	1.30	1477	1.59	1645	1.89	1802	2.20	1950
		24°F / -	2300	0.94	1104	1.08	1200	1.22	1292	1.37	1380	1.52	1465	1.67	1547	1.98	1703	2.31	1850	2.65	1990
		20°F / -	2778	1.59	1296	1.75	1377	1.92	1456	2.09	1532	2.26	1606	2.44	1679	2.80	1818	-	-	-	-
100/125 Start 125	C,D	100°F / -	741	-	-	0.15	808	0.23	962	0.30	1093	0.38	1212	0.47	1320	0.60	1514	0.86	1686	1.07	1840
	→	80°F/100°F	926	0.13	670	0.21	846	0.29	993	0.38	1121	0.47	1236	0.56	1342	0.77	1532	0.99	1702	1.22	1856
		62°F/77°F	1200	0.22	758	0.31	916	0.41	1052	0.52	1173	0.62	1282	0.74	1384	0.97	1568	1.22	1733	1.48	1884
		53°F/66°F	1400	0.30	828	0.41	975	0.53	1103	0.64	1218	0.76	1323	0.89	1422	1.15	1600	1.42	1762	1.70	1910
		41°F/51°F	1800	0.55	982	0.69	1108	0.83	1220	0.98	1325	1.12	1422	1.27	1513	1.58	1681	1.90	1834	2.23	1976
		34°F/42°F	2200	0.93	1145	1.10	1254	1.27	1354	1.44	1449	1.61	1537	1.79	1621	2.15	1778	2.52	1923	2.90	2057
		28°F/36°F	2600	1.45	1315	1.65	1410	1.85	1500	2.05	1585	2.25	1666	2.46	1744	1.35	1638	-	-	-	-
		25°F/31°F	3000	2.16	1489	2.39	1573	2.61	1654	2.84	1731	-	-	-	-	-	-	-	-	-	-
100/125	E,F	41°F/51°F	1800	0.28	497	0.41	622	0.56	735	0.72	837	-	-	-	-	-	-	-	-	-	-
		34°F/42°F	2200	0.43	553	0.58	662	0.75	762	0.93	855	1.12	942	1.33	1025	-	-	-	-	-	-
		28°F/36°F	2600	0.63	614	0.81	710	1.00	800	1.20	885	1.41	965	1.63	1042	-	-	-	-	-	-
		25°F/31°F	3000	0.91	680	1.11	766	1.32	847	1.54	1731	1.77	997	2.01	1068	2.51	1202	3.04	1328	3.60	1446
		22°F/27°F	3400	1.26	748	1.48	825	1.72	899	1.96	970	2.21	1038	2.47	1104	3.01	1229	3.58	1347	4.17	1459
End 100	→	20°F/25°F	3704	1.58	802	1.83	873	2.08	942	2.34	1008	2.60	1072	2.88	1135	3.45	1254	4.04	1367	4.67	1474
		- / 23°F	4100	2.09	873	2.35	938	2.63	1001	2.91	1062	3.20	1122	3.49	1180	4.10	1291	4.74	1398	-	-
		- / 20°F	4630	2.93	969	3.23	1028	3.53	1085	3.84	1140	4.16	1194	4.48	1247	-	-	-	-	-	-
150/175 Start 175	C,D	100°F/117°F	1111	0.19	727	0.28	884	0.38	1023	0.48	1148	0.59	1262	0.70	1369	0.94	1563	1.21	1738	1.48	1899
	→	86°F/100°F	1296	0.27	793	0.37	937	0.47	1066	0.59	1184	0.71	1293	0.83	1395	1.09	1582	1.37	1752	1.66	1909
		79°F/93°F	1400	0.32	832	0.42	970	0.54	1093	0.66	1208	0.78	1313	0.91	1412	1.18	1596	1.47	1763	1.78	1917
		62°F/72°F	1800	0.59	994	0.72	1109	0.86	1216	1.00	1316	1.15	1410	1.30	1500	1.62	1667	1.95	1823	2.29	1967
		51°F/59°F	2200	1.00	1166	1.16	1264	1.32	1356	1.49	1444	1.66	1529	1.84	1610	2.20	1762	2.57	1906	2.96	2041
		43°F/50°F	2600	1.58	1344	1.76	1429	1.95	1510	2.14	1589	2.34	1664	2.54	1737	2.95	1877	-	-	-	-
		37°F/43°F	3000	2.35	1526	2.57	1600	2.78	1673	3.00	1743	-	-	-	-	-	-	-	-	-	-
150/175	E,F	86°F/100°F	1296	-	-	0.25	609	0.37	734	-	-	-	-	-	-	-	-	-	-	-	-
		79°F/93°F	1400	0.17	474	0.28	615	0.40	737	-	-	-	-	-	-	-	-	-	-	-	-
		62°F/72°F	1800	0.28	526	0.41	650	0.55	760	0.70	859	0.85	952	-	-	-	-	-	-	-	-
		51°F/59°F	2200	0.44	588	0.59	697	0.75	796	0.91	887	1.09	972	1.27	1052	1.67	1201	-	-	-	-
		43°F/50°F	2600	0.67	657	0.83	753	1.01	842	1.19	925	1.39	1004	1.59	1078	2.02	1218	2.47	1348	2.96	1469
		37°F/43°F	3000	0.96	729	1.15	815	1.35	895	1.55	972	1.76	1044	1.98	1114	2.45	1245	2.94	1368	3.45	1483
		33°F/38°F	3400	1.35	804	1.55	881	1.77	955	2.00	1025	2.23	1092	2.47	1157	2.96	1280	3.49	1396	4.03	1505
		29°F/34°F	3800	1.82	880	2.05	951	2.29	1018	2.53	1083	2.79	1146	3.04	1206	3.58	1322	4.14	1431	4.72	1535
		26°F/31°F	4200	2.40	959	2.66	1023	2.92	1085	3.18	1145	3.45	1204	3.73	1260	4.30	1369	4.90	1472	-	-
		24°F/28°F	4700	3.30	1058	3.58	1116	3.87	1172	4.16	1227	4.46	1281	4.76	1333	-	-	-	-	-	-
		21°F/25°F	5200	4.40	1158	4.71	1212	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200/225 Start 225	C,D	100°F/113°F	1481	0.36	871	0.48	1016	0.60	1144	0.73	1259	0.85	1366	0.99	1465	1.26	1646	1.54	1808	1.84	1958
	→	89°F/100°F	1667	0.48	943	0.61	1078	0.75	1198	0.88	1309	1.03	1411	1.17	1507	1.47	1682	1.77	1842	2.09	1988
		85°F/95°F	1750	0.54	975	0.68	1106	0.82	1224	0.96	1332	1.11	1433	1.26	1527	1.57	1700	1.88	1857	2.21	2003
		74°F/83°F	2000	0.76	1077	0.92	1197	1.08	1306	1.24	1407	1.40	1502	1.57	1592	1.91	1758	2.26	1910	2.62	2051
		66°F/74°F	2250	1.04	1181	1.21	1291	1.39	1393	1.57	1488	1.75	1577	1.94	1663	2.31	1822	2.69	1969	-	-
		59°F/67°F	2500	1.38	1288	1.57	1389	1.77	1484	1.97	1573	2.17	1658	2.37	1739	2.78	1892	-	-	-	-
		54°F/61°F	2750	1.79	1396	2.00	1490	2.22	1579	2.44	1663	2.66	1743	2.88	1820	-	-	-	-	-	-
		49°F/56°F	3000	2.28	1506	2.51	1593	2.75	1677	2.98	1756	-	-	-	-	-	-	-	-	-	-
200/225	E,F	85°F/95°F	1750	0.29	594	0.43	723	0.58	838	0.75	944	0.94	1042	1.14	1134	1.58	1303	2.07	1458	2.60	1600
		74°F/83°F	2000	0.40	642	0.54	759	0.71	866	0.88	966	1.08	1058	1.28	1146	1.74	1309	2.23	1458	2.78	1595
		59°F/67°F	2500	0.68	746	0.85	845	1.04	938	1.23	1025	1.45	1108	1.67	1188	2.15	1337	2.67	1475	3.24	1604
		49°F/56°F	3000	1.09	857	1.29	942	1.50	1024	1.72	1101	1.95	1176	2.19	1248	2.71	1384	3.27	1511	3.86	1632
		42°F/48°F	3500	1.66	972	1.88	1047	2.12	1119	2.36	1188	2.61	1255	2.88	1320	3.43	1455	4.03	1563	-	-
		37°F/42°F	4000	2.40	1091	2.65	1157	2.91	1221	3.18	1284	3.46	1345	3.75	1404	4.35	1518	4.98	1628	-	-
		33°F/37°F	4500	3.34	1211	3.62	1270	3.91	1329	4.21	1385	4.51	1441	4.82	1495	-	-	-	-	-	-
		30°F/33°F	5000	4.52	1332	4.82	1387	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200/225	G,H	85°F/95°F	1750	0.20	425	0.33	546	0.48	653	-	-	-	-	-	-	-	-	-	-	-	-
		74°F/83°F	2000	0.26	449	0.40	562	0.56	662	0.74	754	-	-	-	-	-	-	-	-	-	-
		59°F/67°F	2500	0.42	507	0.58	603	0.75	692	0.94	774	1.16	851	1.38	925	-	-	-	-	-	-
		49°F/56°F	3000	0.65	571	0.83	654	1.02	732	1.23	807	1.45	877	1.69	944	2.21	1071	-	-	-	-
		42°F/48°F	3500	0.97	639	1.17	713	1.38	782	1.60	850	1.84	914	2.10	975	2.64	1093	3.23	1202	3.86	1307
		37°F/42°F	4000	1.38	710	1.60	776	1.83	839	2.08	899	2.34	958	2.60	1014	3.18	1123	3.80	1226	4.46	1324
		33°F/37°F	4500	1.90	783	2.14	842	2.40	899	2.66	955	2.94	1008	3.23	1061	3.84	1161	4.48	1258	-	-
		30°F/33°F	5000	2.54	858	2.81	911	3.08	963	3.37	1014	3.67	1064	3.98	1112	4.62	1206	-	-	-	-
		27°F/30°F	5500	3.32	933	3.61	982	3.91	1030	4.22	1077	4.54	1123	4.87	1168	-	-	-	-	-	-
		25°F/28°F	6000	4.25	1009	4.57	1054	4.89	1099	-	-	-	-	-	-	-	-	-	-	-	-

① Total static pressure should include external static pressure and accessory / option static pressure from Table 30.1. Unit internal resistance has been included in the unit performance tables.

② Brake Horsepower and RPM values are approximate values only. Please consult the AccuSpec selection software for values at other than listed CFM / static pressures.

BLOWER PERFORMANCE DATA

Table 32.1 - Unit Performance Tables ① ②

Unit Size	Digit 16	Air Temp. Rise	CFM	Total Static Pressure, "W.C. 0.25 BHP	0.25 RPM	0.50 BHP	0.50 RPM	0.75 BHP	0.75 RPM	1.00 BHP	1.00 RPM	1.25 BHP	1.25 RPM	1.50 BHP	1.50 RPM	2.00 BHP	2.00 RPM	2.50 BHP	2.50 RPM	3.00 BHP	3.00 RPM
250/300	E,F	100°F / 120°F	1852	0.26	532	0.39	665	0.54	782	0.69	887	0.85	985	1.03	1074	1.39	1239	1.79	1387	2.21	1523
Start 300	→	83°F / 100°F	2222	0.39	582	0.54	703	0.70	810	0.87	909	1.05	1000	1.24	1085	1.64	1242	2.06	1385	2.52	1517
		74°F / 89°F	2500	0.51	625	0.68	736	0.85	836	1.04	930	1.23	1016	1.43	1099	1.85	1250	2.30	1389	2.78	1517
		62°F / 74°F	3000	0.80	706	0.99	803	1.19	893	1.40	978	1.62	1058	1.84	1133	2.31	1275	2.81	1406	3.33	1529
		53°F / 63°F	3500	1.19	793	1.41	878	1.64	959	1.87	1036	2.12	1109	2.36	1179	2.88	1312	3.42	1435	3.99	1552
		46°F / 56°F	4000	1.69	882	1.94	958	2.20	1032	2.46	1102	2.73	1170	3.01	1234	3.58	1358	4.17	1474	4.78	1584
		41°F / 49°F	4500	2.34	974	2.62	1043	2.90	1109	3.19	1174	3.49	1236	3.79	1296	4.41	1412	-	-	-	-
		37°F / 44°F	5000	3.14	1067	3.44	1130	3.76	1191	4.08	1250	4.40	1308	4.73	1364	-	-	-	-	-	-
		34°F / 40°F	5500	4.11	1161	4.44	1219	4.78	1275	-	-	-	-	-	-	-	-	-	-	-	-
250/300	G,H	100°F / 120°F	1852	-	-	0.34	519	0.49	623	0.66	713	0.85	795	1.05	870	1.47	1005	1.94	1126	2.44	1237
Start 300	→	83°F / 100°F	2222	0.28	424	0.43	537	0.61	634	0.79	721	0.99	800	1.20	872	1.65	1005	2.14	1123	2.67	1231
		74°F / 89°F	2500	0.35	447	0.52	553	0.71	646	0.90	730	1.11	806	1.33	877	1.81	1006	2.32	1123	2.87	1230
		62°F / 74°F	3000	0.53	492	0.72	588	0.93	674	1.15	752	1.38	824	1.62	892	2.13	1016	2.68	1129	3.27	1232
		53°F / 63°F	3500	0.76	542	0.98	878	1.21	707	1.45	780	1.71	848	1.97	912	2.52	1031	3.11	1140	3.74	1240
		46°F / 56°F	4000	1.07	594	1.31	673	1.57	746	1.83	814	2.11	878	2.39	939	2.99	1052	3.62	1156	4.28	1253
		41°F / 49°F	4500	1.45	649	1.72	721	2.00	789	2.29	852	2.59	912	2.90	969	3.54	1077	4.22	1177	4.92	1270
		37°F / 44°F	5000	1.92	706	2.22	771	2.52	834	2.84	894	3.16	950	3.50	1004	4.18	1107	4.90	1202	-	-
		34°F / 40°F	5500	2.50	767	2.81	824	3.14	882	3.49	938	3.83	991	4.19	1042	4.93	1140	-	-	-	-
		31°F / 37°F	6000	3.16	822	3.52	878	3.87	933	4.24	984	4.61	1035	5.00	1084	-	-	-	-	-	-
		28°F / 34°F	6500	3.96	881	4.34	934	4.72	984	-	-	-	-	-	-	-	-	-	-	-	-
250/300	I, J, K	46°F / 56°F	4000	-	-	0.97	507	1.25	583	1.56	654	1.89	719	2.24	781	-	-	-	-	-	-
		37°F / 44°F	5000	-	-	1.51	560	1.84	626	2.19	688	2.56	748	2.95	804	3.77	908	4.67	1005	-	-
		31°F / 37°F	6000	1.94	559	2.29	620	2.66	679	3.06	734	3.46	787	3.89	838	4.79	935	5.75	1025	6.77	1110
		26°F / 32°F	7000	2.93	632	3.33	686	3.75	738	4.19	788	4.64	836	5.11	882	6.09	971	7.13	1055	8.22	1134
		23°F / 28°F	8000	4.24	707	4.69	755	5.16	802	5.64	847	6.14	891	6.65	933	7.72	1015	8.83	1093	10.00	1167
End 250	→	20°F / 24°F	9259	6.40	804	6.91	846	7.45	887	7.99	927	8.55	966	9.12	1004	10.30	1079	11.52	1150	12.79	1218
		- / 22°F	10000	7.97	862	8.52	901	9.09	939	9.67	977	10.27	1014	10.87	1050	12.12	1120	13.41	1187	14.74	1252
		- / 20°F	11111	10.79	949	11.40	985	12.03	1020	12.66	1054	13.31	1087	13.97	1121	-	-	-	-	-	-
350/400	E,F	100°F / -	2593	0.61	668	0.80	781	1.01	882	1.22	975	1.45	1061	1.69	1142	2.19	1290	2.73	1425	3.30	1550
		96°F / -	2700	0.67	686	0.87	796	1.08	895	1.30	986	1.53	1071	1.78	1151	2.29	1297	2.84	1431	3.42	1555
Start 400	→	87°F / 100°F	2963	0.85	730	1.06	834	1.28	928	1.52	1015	1.76	1097	2.02	1174	2.56	1316	3.13	1446	3.74	1568
		74°F / 85°F	3500	1.30	826	1.54	917	1.80	1002	2.07	1081	2.34	1157	2.62	1228	3.22	1362	3.84	1486	4.50	1602
		65°F / 74°F	4000	1.86	918	2.13	1000	2.42	1078	2.71	1151	3.01	1221	3.32	1288	3.97	1414	4.65	1531	-	-
		58°F / 66°F	4500	2.57	1012	2.87	1087	3.18	1158	3.51	1226	3.84	1291	4.18	1353	4.88	1472	-	-	-	-
		52°F / 59°F	5000	3.44	1109	3.78	1177	4.12	1242	4.47	1305	4.84	1366	-	-	-	-	-	-	-	-
		47°F / 54°F	5500	4.50	1206	4.87	1269	-	-	-	-	-	-	-	-	-	-	-	-	-	-
350/400	G,H	100°F / -	2593	0.43	479	0.62	585	0.84	679	1.09	764	1.35	841	1.64	1142	2.26	1046	2.94	1165	3.68	1275
Start 40	→	87°F / 100°F	2963	0.57	516	0.79	614	1.02	702	1.28	782	1.56	856	1.86	926	2.50	1053	3.20	1170	3.96	1277
		74°F / 85°F	3500	0.85	574	1.09	662	1.35	742	1.63	815	1.93	885	2.25	951	2.93	1072	3.66	1183	4.45	1287
		65°F / 74°F	4000	1.19	631	1.45	710	1.74	784	2.04	853	2.36	918	2.70	980	3.41	1096	4.19	1202	-	-
		58°F / 66°F	4500	1.61	690	1.91	762	2.22	830	2.55	895	2.89	956	3.25	1014	4.00	1124	4.81	1226	-	-
		52°F / 59°F	5000	2.22	767	2.46	817	2.80	880	3.15	940	3.52	998	3.90	1053	4.70	1157	-	-	-	-
		47°F / 54°F	5500	2.77	813	3.12	874	3.49	933	3.87	989	4.25	1042	4.66	1095	-	-	-	-	-	-
		43°F / 49°F	6000	3.53	876	3.91	933	4.30	987	4.70	1040	-	-	-	-	-	-	-	-	-	-
		40°F / 46°F	6500	4.42	939	4.82	992	-	-	-	-	-	-	-	-	-	-	-	-	-	-
350/400	I,J,K	100°F / -	2593	-	-	-	-	0.77	561	1.04	639	1.34	709	1.66	774	2.36	891	3.14	995	4.00	1090
Start 400	→	87°F / 100°F	2963	-	-	-	-	0.89	571	1.18	646	1.49	715	1.81	779	2.54	894	3.34	997	4.20	1091
		65°F / 74°F	4000	-	-	1.07	533	1.37	609	1.69	679	2.03	742	2.40	802	3.18	910	4.04	1009	4.96	1099
		52°F / 59°F	5000	1.37	515	1.69	590	2.04	658	2.41	721	2.79	779	3.19	835	4.05	937	4.98	1030	5.96	1117
		43°F / 49°F	6000	2.20	588	2.58	654	2.97	715	3.39	772	3.82	826	4.26	877	5.20	973	6.21	1061	7.26	1144
		37°F / 42°F	7000	3.34	665	3.77	723	4.22	778	4.68	830	5.16	879	5.65	927	6.68	1016	7.77	1099	8.90	1178
		32°F / 37°F	8000	4.84	744	5.33	796	5.83	845	6.34	893	6.87	938	7.41	982	8.53	1066	9.70	1144	10.92	1219
		29°F / 33°F	9000	6.75	824	7.29	871	7.85	917	8.41	960	8.99	1002	9.58	1043	10.80	1121	12.07	1194	13.37	1265
		26°F / 30°F	10000	9.13	906	9.72	948	10.33	990	10.95	1030	11.58	1069	12.22	1107	13.54	1180	14.90	1249	-	-
		24°F / 27°F	11000	12.01	988	12.66	1027	13.32	1065	14.00	1103	14.68	1139	-	-	-	-	-	-	-	-
		23°F / 26°F	11500	13.66	12.09	14.34	1067	-	-	-	-	-	-	-	-	-	-	-	-	-	-

① Total static pressure should include external static pressure and accessory / option static pressure from Table 30.1. Unit internal resistance has been included in the unit performance tables.

② Brake Horsepower and RPM values are approximate values only. Please consult the AccuSpec selection software for values at other than listed CFM / static pressures.

BLOWER PERFORMANCE DATA

Table 33.1 - Unit Performance Tables ① ②

Unit Size	Digit 16	Air Temp Rise	CFM	Total Static Pressure Inches "W.C."																	
				0.25		0.50		0.75		1.00		1.25		1.50		2.00		2.50		3.00	
				BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM
500/600	G or H	120°F / -	3086	0.62	529	0.82	620	1.03	703	1.26	779	1.50	849	1.75	916	2.28	1038	2.84	1149	3.44	1252
		106°F / -	3500	0.84	575	1.06	658	1.30	736	1.54	807	1.80	874	2.07	937	2.63	1054	3.23	1162	3.86	1262
Start 600	→	100°F / 120°F	3704	0.97	598	1.20	678	1.45	753	1.70	822	1.97	887	2.25	949	2.83	1064	3.44	1170	4.09	1268
		93°F / 111°F	4000	1.18	633	1.43	709	1.69	779	1.96	846	2.24	908	2.53	968	3.14	1080	3.78	1183	4.45	1279
		82°F / 99°F	4500	1.61	693	1.88	762	2.17	827	2.46	889	2.77	948	3.09	1001	3.74	1110	4.43	1208	-	-
		74°F / 89°F	5000	2.13	755	2.43	818	2.75	878	3.07	936	3.40	991	3.74	1044	4.44	1145	-	-	-	-
		67°F / 81°F	5500	2.77	818	3.10	876	3.44	932	3.79	986	4.15	1038	4.51	1088	-	-	-	-	-	-
		62°F / 74°F	6000	3.53	882	3.89	936	4.25	988	4.63	1038	-	-	-	-	-	-	-	-	-	-
		57°F / 68°F	6500	4.41	946	4.80	996	-	-	-	-	-	-	-	-	-	-	-	-	-	-
500/600	I, J, K	120°F / -	3086	0.46	401	0.69	496	0.95	580	1.23	657	-	-	-	-	-	-	-	-	-	-
Start 600	→	100°F / 120°F	3704	0.69	443	0.95	527	1.23	604	1.54	675	-	-	-	-	-	-	-	-	-	-
		93°F / 111°F	4000	0.82	464	1.09	544	1.39	618	1.71	686	2.05	749	2.42	810	-	-	-	-	-	-
		74°F / 89°F	5000	1.43	542	1.75	609	2.09	673	2.46	733	2.84	790	3.24	844	4.09	946	5.01	1041	-	-
		62°F / 74°F	6000	2.31	624	2.68	682	3.07	738	3.48	791	3.91	842	4.35	891	5.29	984	6.28	1072	7.33	1155
		53°F / 63°F	7000	3.51	709	3.94	760	4.38	809	4.84	857	5.31	903	5.80	947	6.82	1032	7.90	1113	9.03	1191
		46°F / 56°F	8000	5.09	797	5.57	842	6.07	886	6.58	928	7.10	970	7.64	1010	8.75	1089	9.92	1163	11.13	1235
End 500	→	41°F / 49°F	9000	7.11	885	7.65	926	8.20	965	8.76	1001	9.33	1042	9.92	1079	11.13	1151	12.38	1220	13.69	1287
		- / 44°F	10000	9.62	975	10.21	1012	10.81	1048	11.43	1083	12.05	1118	12.69	1152	14.00	1218	15.35	1283	-	-
		- / 43°F	10400	10.77	1011	11.38	1046	12.01	1081	12.64	1115	13.29	1149	13.95	1182	15.30	1247	-	-	-	-
		- / 40°F	11000	12.66	1065	13.31	1099	13.97	1132	14.64	1164	15.32	1197	16.01	1228	17.42	1290	-	-	-	-
		- / 40°F	11111	13.04	1075	13.69	1109	14.36	1141	15.03	1174	15.72	1205	16.41	1237	17.83	1298	-	-	-	-
500/600	L	62°F / 74°F	6000	1.69	512	1.97	565	2.26	615	2.57	664	2.89	710	3.23	755	-	-	-	-	-	-
		53°F / 63°F	7000	2.57	580	2.89	626	3.22	671	3.56	714	3.92	756	4.29	797	5.06	874	-	-	-	-
		46°F / 56°F	8000	3.73	650	4.09	691	4.46	731	4.84	770	5.23	808	5.64	845	6.47	916	7.35	984	-	-
Start 500	→	41°F / 49°F	9000	5.21	721	5.60	758	6.01	795	6.43	830	6.86	864	7.30	898	8.21	964	9.16	1027	10.14	1088
		- / 44°F	10000	7.04	793	7.48	827	7.93	860	8.39	892	8.85	924	9.33	955	10.31	1016	11.33	1074	12.38	1131
		- / 43°F	10400	7.88	823	8.34	855	8.80	887	9.28	918	9.76	949	10.25	979	11.26	1038	12.31	1095	13.38	1150
		- / 40°F	11000	9.27	866	9.75	897	10.24	927	10.74	957	11.24	986	11.76	1015	12.81	1071	13.90	1126	-	-
		- / 40°F	11111	9.54	874	10.03	905	10.52	935	11.02	964	11.53	993	12.05	1022	13.12	1078	14.21	1132	-	-
700/800	G or H	120°F / -	4321	1.51	685	1.80	760	2.11	830	2.43	896	2.77	958	3.13	1018	3.88	1131	4.69	1236	-	-
		115°F / -	4500	1.68	708	1.98	780	2.30	847	2.63	912	2.98	973	3.34	1032	4.11	1142	4.94	1245	-	-
Start 800	→	105°F / 120°F	4938	2.15	763	2.48	89	2.82	893	3.17	953	3.54	1011	3.93	1066	4.74	1172	-	-	-	-
		104°F / 119°F	5000	2.23	770	2.55	836	2.90	899	3.26	959	3.63	1016	4.02	1072	4.83	1176	-	-	-	-
		94°F / 108°F	5500	2.89	834	3.25	895	3.62	953	4.00	1009	4.40	1063	4.81	1116	-	-	-	-	-	-
		86°F / 99°F	6000	3.68	900	4.06	956	4.46	1010	4.87	1062	-	-	-	-	-	-	-	-	-	-
		80°F / 91°F	6500	4.61	965	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
700/800	I, J, K	120°F / -	4321	0.87	443	1.14	421	1.42	591	1.72	657	2.04	717	2.37	774	3.08	879	3.84	974	4.65	1063
Start 800	→	104°F / 119°F	5000	1.26	488	1.55	558	1.87	623	2.20	683	2.54	740	2.90	794	3.66	894	4.47	985	5.33	1071
		86°F / 99°F	6000	2.02	558	2.36	619	2.73	677	3.10	731	3.49	782	3.89	832	4.73	924	5.62	1010	6.55	1091
		65°F / 74°F	8000	4.44	707	4.89	755	5.35	801	5.82	845	6.30	888	6.79	930	7.81	1009	8.87	1085	9.96	1156
		58°F / 66°F	9000	6.19	784	6.69	827	7.20	869	7.72	909	8.25	949	8.79	987	9.90	1061	11.04	1131	12.23	1199
		52°F / 59°F	10000	8.36	861	8.91	901	9.47	939	10.04	976	10.62	1012	11.21	1048	12.42	1117	13.66	1183	14.93	1246
		47°F / 54°F	11000	11.00	940	11.60	976	12.22	1011	12.84	1045	13.47	1079	14.11	1112	15.41	1176	16.74	1238	-	-
		43°F / 49°F	12000	14.16	1019	14.81	1052	15.48	1085	16.15	1117	16.83	1148	17.52	1179	18.92	1239	-	-	-	-
		40°F / 46°F	13000	17.88	1098	18.59	1129	19.30	1159	-	-	-	-	-	-	-	-	-	-	-	-
700/800	L	65°F / 74°F	8000	3.26	566	3.60	611	3.95	654	4.31	696	4.67	736	5.05	774	5.84	848	6.66	918	7.51	984
		58°F / 66°F	9000	4.54	626	4.92	667	5.30	706	5.70	744	6.10	780	6.52	816	7.37	885	8.25	950	9.17	1012
		52°F / 59°F	10000	6.13	687	6.54	724	6.97	760	7.40	794	7.85	828	8.30	861	9.22	925	10.17	987	11.15	1046
		47°F / 54°F	11000	8.06	749	8.52	782	8.98	815	9.45	847	9.93	879	10.42	910	11.41	969	12.43	1027	13.48	1083
		47°F / 54°F	11050	8.17	752	8.62	785	9.09	818	9.56	850	10.04	881	10.53	912	11.53	972	12.56	1029	13.61	1084
		43°F / 49°F	12000	10.37	811	10.86	842	11.37	872	11.88	902	12.40	931	12.92	960	13.99	1016	15.08	1070	16.20	1123
End 700	→	40°F / 46°F	13000	13.09	873	13.63	902	14.17	930	14.72	958	15.27	986	15.83	1013	16.98	1065	18.14	1116	19.33	1166
		- / 42°F	14000	16.26	936	16.83	963	17.41	989	18.00	1015	18.59	1041	19.19	1066	-	-	-	-	-	-
		- / 41°F	14500	18.02	968	18.61	994	19.21	1019	19.82	1045	-	-	-	-	-	-	-	-	-	-
840/960	I, J, K	120°F / -	6481	2.72	630	3.09	685	3.48	736	3.88	785	4.30	832	4.72	876	5.60	960	6.52	1038	7.48	1112
		111°F / -	7000	3.36	672	3.76	723	4.17	772	4.60	818	5.04	863	5.49	905	6.42	986	7.38	1061	8.39	1133
End 840	→	105°F / 120°F	7407	3.93	705	4.35	754	4.79	800	5.23	845	5.69	888	6.16	929	7.13	1007	8.13	1081	9.17	1151
		97°F / 111°F	8000	4.87	754	5.33	799	5.90	843	6.27	885	6.76	926	7.26	965	8.28	1040	9.33	1111	10.43	1179
		86°F / 99°F	9000	6.80	837	7.31	878	7.83	918	8.36	956	8.90	994	9.44	1030	10.56	1100	11.71	1166	12.90	1230
		78°F / 89°F	10000	9.20	921	9.76	958	10.33	995	10.91	1030	11.50	1065	12.10	1099	13.32	1164	14.56	1226	-	-
		70°F / 80°F	11050	12.28	1010	12.89	1044	13.52	1078	14.16	1110	14.80	1142	15.45	1173	16.77	1234	-	-	-	-
		65°F / 74°F	12000	15.60	1091	16.27	1123	16.95	1154	17.63	1184	18.32	1214	19.02	1243	-	-	-	-	-	-
		62°F / 71°F	12500	17.58	1134	18.27	1164	18.97	1194	19.69	1224	-	-	-	-	-	-	-	-	-	-
		60°F / 68°F	13000	19.71	1177	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
840/960	L	86°F / 99°F	9000	5.01	675	5.40	715	5.80	753	6.21	789	6.62	825	7.05	859	7.91	925	8.81	988	9.73	1048
		78°F / 89°F	10000	6.78	742	7.21	778	7.64	812	8.09	846	8.54	879	9.00	911	9.95	973	10.91	1032	11.91	1088
		70°F / 80°F	11050	9.04	812	9.51	845	9.99	877	10.48	908	10.97	939	11.47	968	12.50	1026	13.54	1081	14.61	1135
		65°F / 74°F	12000	11.48	876	12.00	907	12.51	937	13.04	966	13.57	994	14.11	1022	15.20	1076	16.32	1129	17.46	1179
End 840	→	60°F / 68°F	13000	14.50	945	15.05	973	15.62	1000	16.18	1028	16.75	1054	17.33	1081	18.50	1132	19.70	1181	-	-
		- / 63°F	14000	18.02	1013	18.61	1039	19.21	1065	19.82	1091	-	-	-	-	-	-	-	-	-	-

① Total static pressure should include external static pressure and accessory / option static pressure from Table 30.1. Unit internal resistance has been included in the unit performance tables.

② Brake Horsepower and RPM values are approximate values only. Please consult the AccuSpec selection software for values at other than listed CFM / static pressures.

BLOWER SHEAVE ASSEMBLY DATA

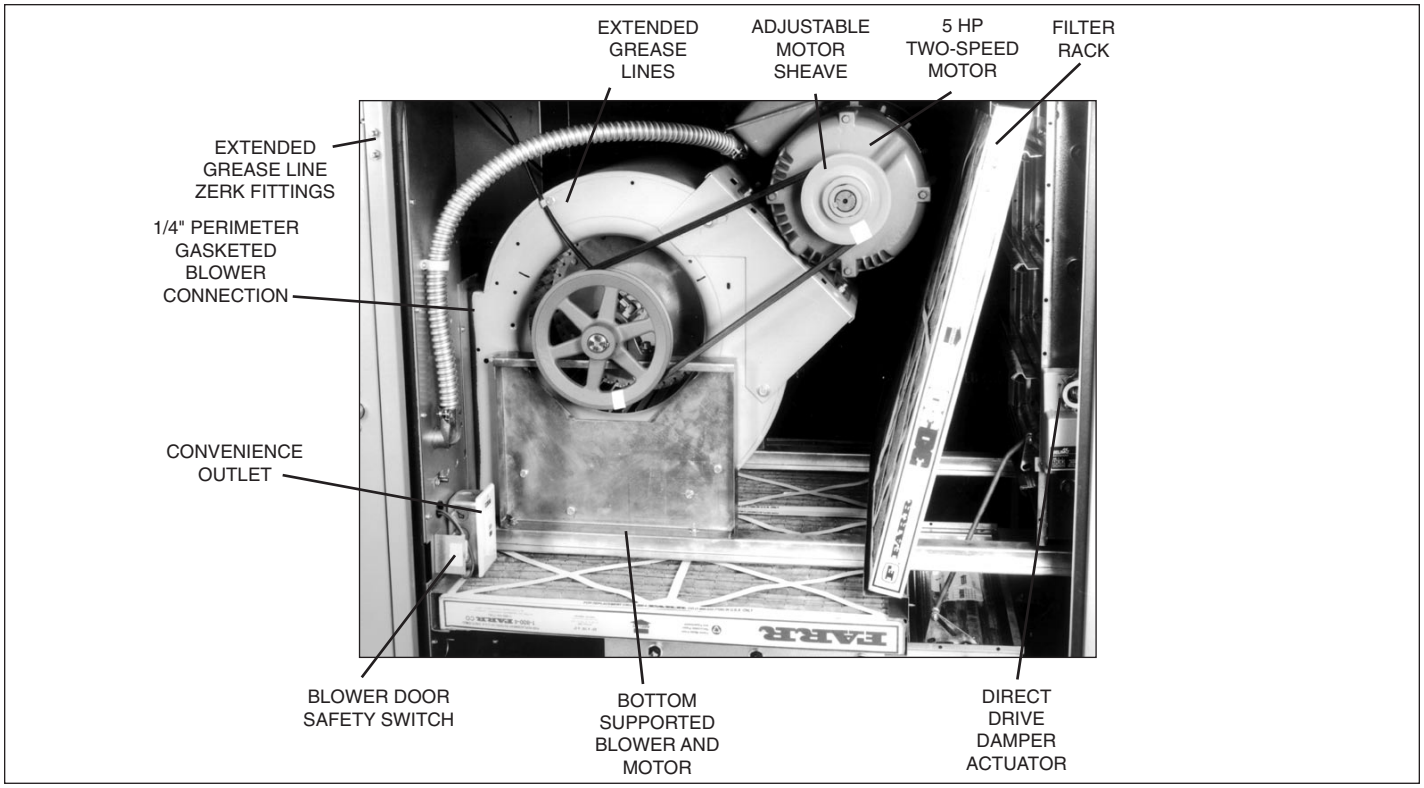
Adjusting the Blower Drive Setting

Based on the Sheave Arrangement, Tables 34.1 through 35.5 give the Sheave Assembly numbers used on units that include a blower. The Sheave Arrangement is Digit 19 and is found on the unit Model Identification Plate. The Sheave Assembly describes the motor and blower sheave size and bore as well as the belt provided.

To determine how many turns open the motor sheave should be set for:

1. Follow the Selection Procedure found on pages 28 and 29 to determine what blower rpm is required to meet the job specifications.
2. Locate the unit Model Identification Plate and note Digit 16 and Digit 19 of the model number. Digit 16 is the Blower Size and Type and Digit 19 is the Sheave Arrangement.
3. Once the Blower Size and Type (Digit 16) is known, enter the proper Sheave Arrangement table.
4. Use the Sheave Arrangement (Digit 19) to determine the Sheave Assembly provided.
5. Use Table 36.1 and the Sheave Assembly number to determine the required turns open to achieve the desired blower rpm.
6. Set the motor sheave as described in Blower Adjustments.

Figure 34.1 - Blower Section



Blower Sheave Assembly Numbers

Table 34.1 - Digit 16 = A or B (9-7 Blower Units)

	RPM Range									
Motor Frame	**656-1001**		**978-1265**		**1150-1561**		**1526-1858**		**1763-2147**	
Size	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly
48	A	**3H35125B1**	C	**3H35125B3**						
56	B	**3H35125B2**	D	**3H35125B4**	F	**3H35125B6**	H	**3H35125B8**	J	**3H35125B10**
143 or 145			E	**3H35125B5**	G	**3H35125B7**	I	**3H35125B9**	K	**3H35125B11**

Table 34.2 - Digit 16 = C or D (9-9 Blower Units)

	RPM Range									
Motor Frame	**656-1001**		**978-1265**		**1150-1561**		**1526-1858**		**1763-2147**	
Size	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly
48	A	**3H35126B1**	C	**3H35126B3**						
56	B	**3H35126B2**	D	**3H35126B4**	F	**3H35126B6**	I	**3H35126B9**	L	**3H35126B12**
143 or 145			E	**3H35126B5**	G	**3H35126B7**	J	**3H35126B10**	M	**3H35126B13**
182 or 184					H	**3H35126B8**	K	**3H35126B11**	N	**3H35126B14**

BLOWER SHEAVE ASSEMBLY DATA

Blower Sheave Assembly Numbers (Con't)

Table 35.1 - Digit 16 = E or F (12-12 Blower Units)

	RPM Range											
Motor Frame	**468-715**		**644-874**		**863-1078**		**1029-1332**		**1150-1438**		**1327-1659**	
Size	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly
48	A	**3H35127B1**										
56	B	**3H35127B2**	C	**3H35127B3**	F	**3H35127B6**	Q	**3H35127B17**				
143 to 145			D	**3H35127B4**	G	**3H35127B7**	I	**3H35127B9**	L	**3H35127B12**		
182 or 184			E	**3H35127B5**	H	**3H35127B8**	J	**3H35127B10**	M	**3H35127B13**	O	**3H35127B15**
213 or 215							K	**3H35127B11**	N	**3H35127B14**	P	**3H35127B16**

Table 35.2 - Digit 16 = G or H (15-15 Blower Units)

	RPM Range									
Motor Frame	**410-625**		**568-771**		**767-958**		**934-1136**		**1136-1380**	
Size	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly
48	A	**3H35128B1**								
56	B	**3H35128B2**	D	**3H35128B4**	G	**3H35128B7**	O	**3H35128B15**		
143 to 145	C	**3H35128B3**	E	**3H35128B5**	H	**3H35128B8**	J	**3H35128B10**		
182 or 184			F	**3H35128B6**	I	**3H35128B9**	K	**3H35128B11**	M	**3H35128B13**
213 or 215							L	**3H35128B12**	N	**3H35128B14**

Table 35.3 - Digit 16 = I or J (18-18 Blower Units under 15 Hp motor)

	RPM Range											
Motor Frame	**491-649**		**586-744**		**682-821**		**821-1009**		**995-1161**		**1101-1285**	
Size	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly
56	A	**3H35129B1**	D	**3H35129B4**								
143 or 145	B	**3H35129B2**	E	**3H35129B5**	H	**3H35129B8**						
182 to 184	C	**3H35129B3**	F	**3H35129B6**	I	**3H35129B9**	K	**3H35129B11**	O	**3H35129B15**		
213 or 215			G	**3H35129B7**	J	**3H35129B10**	L	**3H35129B12**	P	**3H35129B16**	S	**3H35129B19**
254							M	**3H35129B13**	Q	**3H35129B17**	T	**3H35129B20**
256							N	**3H35129B14**	R	**3H35129B18**	U	**3H35129B21**

Table 35.4 - Digit 16 = K (18-18 Blower Units with 15 Hp motor & up)

	RPM Range							
Motor Frame	**826-1009**		**995-1161**		**1101-1285**		**1232-1438**	
Size	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly
254	A	**3H35130B1**	C	**3H35130B3**	E	**3H35130B5**		
256	B	**3H35130B2**	D	**3H35130B4**	F	**3H35130B6**		
284	G	**3H35130B13**	I	**3H35130B15**	K	**3H35130B17**	M	**3H35130B19**
286	H	**3H35130B14**	J	**3H35130B16**	L	**3H35130B18**	N	**3H35130B20**

Table 35.5 - Digit 16 = L (20-18 Blower Units)

	RPM Range											
Motor Frame	**491-649**		**626-765**		**765-901**		**901-1059**		**995-1161**		**1101-1285**	
Size	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly	Digit 19	Sheave Assembly
143 or 145	A	**3H36622B1**	C	**3H36622B3**								
182 to 184	B	**3H36622B2**	D	**3H36622B4**	F	**3H36622B6**	L	**3H36622B12**				
213 or 215			E	**3H36622B5**	G	**3H36622B7**	M	**3H36622B13**	R	**3H36622B18**		
254					H	**3H36622B8**	N	**3H36622B14**	S	**3H36622B19**	W	**3H36622B23**
256					I	**3H36622B9**	O	**3H36622B15**	T	**3H36622B20**	X	**3H36622B24**
284					J	**3H36622B10**	P	**3H36622B16**	U	**3H36622B21**	Y	**3H36622B25**
286					K	**3H36622B11**	Q	**3H36622B17**	V	**3H36622B22**	Z	**3H36622B26**

BLOWER SHEAVE ASSEMBLY DATA

Table 36.1 - Blower Sheave Assembly Settings

Sheave Assembly	Turns Open										
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
	Blower RPM										
3H35125B1-2	1001	966	932	897	863	828	794	759	725	690	656
3H35125B3-5	1265	1236	1208	1179	1150	1121	1093	1064	1035	1006	978
3H35125B6-7	1561	1520	1479	1438	1396	1355	1314	1273	1232	1191	1150
3H35125B8-9	1858	1825	1791	1758	1725	1692	1659	1625	1592	1559	1526
3H35125B10-11	2147	2108	2070	2032	1993	1955	1917	1878	1840	1802	1763
3H35126B1-2	1001	966	932	897	863	828	794	759	725	690	656
3H35126B3-5	1265	1236	1208	1179	1150	1121	1093	1064	1035	1006	978
3H35126B6-8	1561	1520	1479	1438	1396	1355	1314	1273	1232	1191	1150
3H35126B9-11	1858	1825	1791	1758	1725	1692	1659	1625	1592	1559	1526
3H35126B12-14	2147	2108	2070	2032	1993	1955	1917	1878	1840	1802	1763
3H35127B1-2	715	690	665	641	616	591	567	542	518	493	468
3H35127B3-5	874	851	828	805	782	759	736	713	690	667	644
3H35127B6-8	1078	1057	1035	1013	992	970	949	927	906	884	863
3H35127B9-11	1332	1301	1271	1241	1211	1180	1150	1120	1089	1059	1029
3H35127B12-14	1438	1409	1380	1351	1323	1294	1265	1236	1208	1179	1150
3H35127B15-16	1659	1625	1592	1559	1526	1493	1460	1426	1393	1360	1327
3H35127B17	1332	1301	1271	1241	1211	1180	1150	1120	1089	1059	1029
3H35128B1-3	625	604	582	561	539	518	496	474	453	431	410
3H35128B4-6	771	751	731	710	690	670	649	629	609	589	568
3H35128B7-9	958	939	920	901	882	863	843	824	805	786	767
3H35128B10-12	1136	1116	1096	1076	1055	1035	1015	994	974	954	934
3H35128B13-14	1380	1355	1331	1306	1281	1257	1232	1208	1183	1158	1136
3H35128B15	1136	1116	1096	1076	1055	1035	1015	994	974	954	934
3H35129B1-3	649	633	617	601	586	570	554	538	522	506	491
3H35129B4-7	744	728	712	696	681	665	649	633	617	601	586
3H35129B8-10	821	807	793	779	765	751	737	723	709	696	682
3H35129B11-14	1009	991	973	954	936	918	899	881	863	844	821
3H35129B15-18	1161	1144	1128	1111	1095	1078	1062	1045	1028	1012	995
3H35129B19-21	1285	1266	1248	1230	1211	1193	1174	1156	1138	1119	1101
3H35130B1-2	1009	991	973	954	936	918	899	881	863	844	826
3H35130B3-4	1161	1144	1128	1111	1095	1078	1062	1045	1028	1012	995
3H35130B5-6	1285	1266	1248	1230	1211	1193	1174	1156	1138	1119	1101
3H35130B13-14	974	960	946	932	918	904	890	876	863	849	835
3H35130B15-16	1161	1144	1128	1111	1095	1078	1062	1045	1028	1012	995
3H35130B17-18	1285	1266	1248	1230	1211	1193	1174	1156	1138	1119	1101
3H35130B19-20	1438	1417	1396	1376	1355	1335	1314	1294	1273	1253	1232
3H36622B1-2	649	633	617	601	586	570	554	538	522	506	491
3H36622B3-5	765	751	737	723	709	696	682	668	654	640	626
3H36622B6-11	901	888	875	863	850	837	824	811	798	785	765
3H36622B12-17	1059	1044	1029	1014	999	984	968	953	938	923	901
3H36622B18-22	1161	1144	1128	1111	1095	1078	1062	1045	1028	1012	995
3H36622B23-26	1285	1266	1248	1230	1211	1193	1174	1156	1138	1119	1101

BLOWER SHEAVE ASSEMBLY DATA

Table 37.1 - Blower Sheave Assembly Numbers and Size

Sheave Assembly	Motor Sheave		Blower Sheave		Browning Belt No.
	Pitch Diameter	Bore	Pitch Diameter	Bore	
3H35125B1	2.9	0.5	5	0.75	A30
3H35125B2	2.9	0.625	5	0.75	A31
3H35125B3	4.4	0.5	6	0.75	A34
3H35125B4	4.4	0.625	6	0.75	A35
3H35125B5	4.4	0.875	6	0.75	A35
3H35125B6	3.8	0.625	4.2	0.75	A31
3H35125B7	3.8	0.875	4.2	0.75	A31
3H35125B8	5.6	0.625	5.2	0.75	A35
3H35125B9	5.6	0.875	5.2	0.75	A35
3H35125B10	5.6	0.625	4.5	0.75	A34
3H35125B11	5.6	0.875	4.5	0.75	A34
3H35126B1	2.9	0.5	5	0.75	A33
3H35126B2	2.9	0.625	5	0.75	A34
3H35126B3	4.4	0.5	6	0.75	A37
3H35126B4	4.4	0.625	6	0.75	A38
3H35126B5	4.4	0.875	6	0.75	A38
3H35126B6	3.8	0.625	4.2	0.75	A34
3H35126B7	3.8	0.875	4.2	0.75	A34
3H35126B8	3.8	1.125	4.2	0.75	A36
3H35126B9	5.6	0.625	5.2	0.75	A38
3H35126B10	5.6	0.875	5.2	0.75	A38
3H35126B11	5.6	1.125	5.2	0.75	A40
3H35126B12	5.6	0.625	4.5	0.75	A37
3H35126B13	5.6	0.875	4.5	0.75	A37
3H35126B14	5.6	1.125	4.5	0.75	A39
3H35127B1	2.9	0.5	7	1	A42
3H35127B2	2.9	0.625	7	1	A43
3H35127B3	3.8	0.625	7.5	1	A46
3H35127B4	3.8	0.875	7.5	1	A45
3H35127B5	3.8	1.125	7.5	1	A47
3H35127B6	5	0.625	8	1	A48
3H35127B7	5	0.875	8	1	A48
3H35127B8	5	1.125	8	1	A50
3H35127B9	4.4	0.875	5.7	1	A43
3H35127B10	4.4	1.125	5.7	1	A45
3H35127B11	5.2	1.375	6.7	1	A49
3H35127B12	5	0.875	6	1	A45
3H35127B13	5	1.125	6	1	A47
3H35127B14	5.2	1.375	6.2	1	A49
3H35127B15	5	1.125	5.2	1	A45
3H35127B16	5.6	1.375	5.7	1	A48
3H35127B17	4.4	0.625	5.7	1	A43
3H35128B1	2.9	0.5	8	1	A47
3H35128B2	2.9	0.625	8	1	A48
3H35128B3	2.9	0.875	8	1	A48
3H35128B4	3.8	0.625	8.5	1	A50
3H35128B5	3.8	0.875	8.5	1	A50
3H35128B6	3.8	1.125	8.5	1	A52
3H35128B7	5	0.625	9	1	A53
3H35128B8	5	0.875	9	1	A52
3H35128B9	5	1.125	9	1	A54
3H35128B10	5.6	0.875	8.5	1	A53
3H35128B11	5.6	1.125	8.5	1	A54
3H35128B12	5.2	1.375	8	1	A54
3H35128B13	5.6	1.125	7	1	A52
3H35128B14	5.2	1.375	6.5	1	A52
3H35128B15	5.6	0.625	8.5	1	A53

Sheave Assembly	Motor Sheave		Blower Sheave		Browning Belt No.
	Pitch Diameter	Bore	Pitch Diameter	Bore	
3H35129B1	4.1	0.625	10.9	1	B71
3H35129B2	4.1	0.875	10.9	1	B71
3H35129B3	4.1	1.125	10.9	1	B70
3H35129B4	4.7	0.625	10.9	1	BX71
3H35129B5	4.7	0.875	10.9	1	BX71
3H35129B6	4.7	1.125	10.9	1	BX71
3H35129B7	5.5	1.375	12.4	1	BX71
3H35129B8	5.9	0.875	12.4	1	BX77
3H35129B9	5.9	1.125	12.4	1	BX75
3H35129B10	5.9	1.375	12.4	1	BX75
3H35129B11	5.3	1.125	8.9	1	BX68
3H35129B12	5.5	1.375	9.4	1	BX68
3H35129B13	5.5	1.625	9.4	1	BX75
3H35129B14	5.5	1.625	9.4	1	BX75
3H35129B15	7	1.125	10.4	1	B73
3H35129B16	7	1.375	10.4	1	B72
3H35129B17	7	1.625	10.4	1	B78
3H35129B18	7	1.625	10.4	1	B78
3H35129B19	7	1.375	9.4	1	B70
3H35129B20	7	1.625	9.4	1	B77
3H35129B21	7	1.625	9.4	1	B77
3H35130B1	5.5	1.625	9.4	1.44	Qty (2) B74
3H35130B2	5.5	1.625	9.4	1.44	Qty (2) B74
3H35130B3	7	1.625	10.4	1.44	Qty (2) B78
3H35130B4	7	1.625	10.4	1.44	Qty (2) B78
3H35130B5	7	1.625	9.4	1.44	Qty (2) B77
3H35130B6	7	1.625	9.4	1.44	Qty (2) B77
3H35130B13	7	1.875	12.4	1.44	Qty (2) B82
3H35130B14	7	1.875	12.4	1.44	Qty (2) B82
3H35130B15	7	1.875	10.4	1.44	Qty (2) B79
3H35130B16	7	1.875	10.4	1.44	Qty (2) B79
3H35130B17	7	1.875	9.4	1.44	Qty (2) B77
3H35130B18	7	1.875	9.4	1.44	Qty (2) B77
3H35130B19	7	1.875	8.4	1.44	Qty (2) B75
3H35130B20	7	1.875	8.4	1.44	Qty (2) B75
3H36622B1	4.1	0.875	10.9	1.44	B75
3H36622B2	4.1	1.125	10.9	1.44	BX73
3H36622B3	4.1	0.875	8.9	1.44	B72
3H36622B4	4.1	1.125	8.9	1.44	B70
3H36622B5	5.5	1.375	12.4	1.44	BX78
3H36622B6	4.7	1.125	8.9	1.44	B74
3H36622B7	5.5	1.375	10.4	1.44	BX75
3H36622B8	6	1.625	11.4	1.44	Qty (2) BX82
3H36622B9	6	1.625	11.4	1.44	Qty (2) BX82
3H36622B10	7	1.875	13.4	1.44	Qty (2) B86
3H36622B11	7	1.875	13.4	1.44	Qty (2) B86
3H36622B12	5.3	1.125	8.4	1.44	B71
3H36622B13	5.9	1.375	9.4	1.44	BX74
3H36622B14	6	1.625	9.4	1.44	Qty (2) BX79
3H36622B15	6	1.625	9.4	1.44	Qty (2) BX79
3H36622B16	7	1.875	11.4	1.44	Qty (2) B83
3H36622B17	7	1.875	11.4	1.44	Qty (2) B83
3H36622B18	7	1.375	10.4	1.44	B77
3H36622B19	7	1.625	10.4	1.44	Qty (2) B82
3H36622B20	7	1.625	10.4	1.44	Qty (2) B82
3H36622B21	7	1.875	10.4	1.44	Qty (2) B81
3H36622B22	7	1.875	10.4	1.44	Qty (2) B81
3H36622B23	7	1.625	9.4	1.44	Qty (2) B80
3H36622B24	7	1.625	9.4	1.44	Qty (2) B80
3H36622B25	7	1.875	9.4	1.44	Qty (2) B80
3H36622B26	7	1.875	9.4	1.44	Qty (2) B80

ELECTRICAL DATA / MOTOR DATA

Total Unit Amp Draw

The total unit amp draw is a combination of the motor, and the control step down transformer. The control step down transformer includes damper actuators, ignition controllers, gas valves, control relays, amplifiers, and motor starters.

Motor Amp Draw (Tables 38.2 to 42.1) =
Control Step Down Transformer Amp Draw (Table 38.1) =
+
Total Amp Draw =

Table 38.1 - Control Step Down Transformer Amp Draws

Digit 15 (Transformer)	Digit 14 (Supply Voltage)						
	A (115/60/1)	B (208/60/1)	C (230/60/1)	D (208/60/3)	E (230/60/3)	F (460/60/3)	G (575/60/3)
0	0	0	0	0	0	0	0
1	0.35	0.19	0.17	0.19	0.17	0.09	0.07
2	0.65	0.36	0.33	0.36	0.33	0.16	0.13
3	1.30	0.72	0.65	0.72	0.65	0.33	0.26
4	2.17	1.2	1.09	1.20	1.09	0.54	0.43

Table 38.2 - Motor Data for Digit 14 = A - 115V/60Hz/1Ph

Digits 17&18	Motor Size (HP)	Motor Type ①	Frame Size	Amp. Draw	Service Factor	Thermal Overload	Weight (lbs)	Efficiency ② (%)
A1	1/3	ODP	56	6.6	1.35	Yes	25	N/A
A5	1/3	TEFC	48	5.0	1.00	Yes	25	N/A
B1	1/2	ODP	56	9.0	1.20	Yes	23	N/A
B5	1/2	TEFC	56	8.0	1.15	Yes	28	N/A
C1	3/4	ODP	56	11.0	1.25	Yes	25	N/A
C5	3/4	TEFC	56	11.0	1.00	Yes	30	N/A
D1	1	ODP	56	13.4	1.15	Yes	32	N/A
D5	1	TEFC	56	13.4	1.15	Yes	37	N/A
E1	1-1/2	ODP	56	18.0	1.15	Yes	40	N/A
E5	1-1/2	TEFC	56	15.2	1.15	Yes	45	N/A
F1 or R1	2	ODP	145T	21.0	1.15	No	49	N/A
F5 or R5	2	TE	182T	20.0	1.15	No	54	N/A
G1 or S1	3	ODP	184T	34.0	1.15	No	81	N/A
G5 or S5	3	TEFC	184T	32.0	1.00	No	83	N/A

Table 38.3 - Motor Data for Digit 14 = B - 208V/60Hz/1Ph

Digits 17&18	Motor Size (HP)	Motor Type ①	Frame Size	Amp. Draw	Service Factor	Thermal Overload	Weight (lbs)	Efficiency ② (%)
A1	1/3	ODP	56	3.0	1.35	Yes	25	N/A
B1	1/2	ODP	56	4.1	1.20	Yes	23	N/A
B5	1/2	TEFC	56	4.0	1.15	Yes	28	N/A
C1	3/4	ODP	56	5.5	1.25	Yes	25	N/A
C5	3/4	TEFC	56	5.4	1.00	Yes	30	N/A
D1	1	ODP	56	6.8	1.15	Yes	32	N/A
D5	1	TEFC	56	6.8	1.15	Yes	37	N/A
E1	1-1/2	ODP	56	9.3	1.15	Yes	40	N/A
E5	1-1/2	TEFC	56	8.2	1.15	Yes	45	N/A
F1 or R1	2	ODP	145T	11.3	1.15	No	49	N/A
F5 or R5	2	TE	182T	10.8	1.15	No	54	N/A
H1 or T1	5	ODP	184T	23.0	1.15	No	87	N/A
H5 or T5	5	TEFC	184T	22.8	1.00	No	86	N/A

MOTOR DATA

Table 39.1 - Motor Data for Digit 14 = C - 230V/60Hz/1Ph

Digits 17&18	Motor Size (HP)	Motor Type ①	Frame Size	Amp. Draw	Service Factor	Thermal Overload	Weight (lbs)	Efficiency ② (%)
A1	1/3	ODP	56	3.3	1.35	Yes	25	N/A
A5	1/3	TENV	48	2.5	1.00	Yes	25	N/A
B1	1/2	ODP	56	4.5	1.20	Yes	23	N/A
B5	1/2	TEFC	56	4.0	1.15	Yes	28	N/A
C1	3/4	ODP	56	5.5	1.25	Yes	25	N/A
C5	3/4	TEFC	56	5.5	1.00	Yes	30	N/A
D1	1	ODP	56	6.7	1.15	Yes	32	N/A
D5	1	TE	56	6.7	1.15	Yes	37	N/A
E1	1-1/2	ODP	56	9.0	1.15	Yes	40	N/A
E5	1-1/2	TE	56	7.6	1.15	Yes	45	N/A
F1 or R1	2	ODP	145T	10.5	1.15	No	49	N/A
F5 or R5	2	TE	182T	10.0	1.15	No	54	N/A
G1 or S1	3	ODP	184T	17.0	1.15	No	81	N/A
G5 or S5	3	TE	184T	16.0	1.00	No	83	N/A
H1 or T1	5	ODP	184T	22.0	1.15	No	87	N/A
H5 or T5	5	TE	184T	20.2	1.00	No	86	N/A

① Refer to page 42 for Motor Type abbreviations.
② Motors manufacturers do not rate single-phase motors for efficiency.

Table 39.2 - Motor Data for Digit 14 = D - 208V/60Hz/3Ph ①

Digits 17&18	Motor Size (HP)	Motor Type ②	Frame Size	Amp. Draw	Service Factor	Weight (lbs)	Efficiency (%)
A1 or L1	1/3	ODP	56	1.5	1.35	17	N/A
A5 or L5	1/3	TE	48	1.2	1.00	15	N/A
B1 or M1	1/2	ODP	56	2.1	1.25	18	N/A
B5 or M5	1/2	TEFC	56	2.1	1.15	18	N/A
C1 or N1	3/4	ODP	56	2.7	1.25	21	N/A
C5 or N5	3/4	TEFC	56	2.7	1.15	30	N/A
D1 or P1	1	ODP	143T	3.1	1.15	40	82.5%
D2 or P2	1	ODP HE	143T	3.2	1.15	30	84.0%
D3 or P3	1	ODP 18/9	143T	3.5/1.5	1.15	26	76.0 / 59.0%
D4 or P4	1	ODP 18/12	145T	3.4/2.0	1.15	42	74.0 / 60.0%
D5 or P5	1	TEFC	56	3.5	1.15	28	N/A
D6 or P6	1	TE HE	143T	3.5	1.15	68	84.5%
D7 or P7	1	TEFC 18/9	143T	3.5/1.5	1.00	29	76.0 / 58.0%
D8 or P8	1	TEFC 18/12	145T	3.2/1.8	1.00	31	74.0 / 60.0%
E1 or Q1	1 1/2	ODP	145T	5.9	1.15	43	80.0%
E2 or Q2	1 1/2	ODP	145T	4.8	1.00	35	89.5%
E3 or Q3	1 1/2	ODP 18/9	145T	5.0/2.1	1.15	29	80.0 / 65.0%
E4 or Q4	1 1/2	ODP 18/12	145T	5.0/2.9	1.15	49	80.0 / 71.0%
E5 or Q5	1 1/2	TEFC	56	4.8	1.15	33	N/A
E6 or Q6	1 1/2	TE HE	145T	4.9	1.15	62	84.0%
E7 or Q7	1 1/2	TEFC 18/9	145T	4.3/1.9	1.00	38	83.0 / 71.0%
E8 or Q8	1 1/2	TEFC 18/12	145T	5.0/2.9	1.00	38	80.0 / 72.0%
F1 or R1	2	ODP	145T	7.2	1.15	43	82.0%
F2 or R2	2	ODP	145T	5.8	1.00	74	89.5%
F3 or R3	2	ODP 18/9	145T	6.2/2.6	1.15	33	81.0 / 67.0%
F4 or R4	2	ODP 18/12	182T	6.5/3.5	1.15	78	81.0 / NA%
F5 or R5	2	TE	145T	7.0	1.15	52	84.0%
F6 or R6	2	TE HE	145T	6.5	1.15	66	86.5%
F7 or R7	2	TEFC 18/9	145T	6.4/2.5	1.00	41	84.0 / 70.0%
F8 or R8	2	TE 18/12	182T	6.4/3.9	1.15	65	84.0 / 77.0%
G1 or S1	3	ODP	182T	10.0	1.15	78	81.5%
G2 or S2	3	ODP HE	182T	8.9	1.15	83	89.5%
G3 or S3	3	ODP 18/9	182T	10.1/4.1	1.15	66	82.0 / 72.0%
G4 or S4	3	ODP 18/12	184T	9.3/4.9	1.15	79	81.0 / 75.0%
G5 or S5	3	TE	182T	10.0	1.15	83	87.5%
G6 or S6	3	TE HE	182T	9.4-9.1	1.15	92	88.5%
G7 or S7	3	TE 18/9	182T	9.3/3.5	1.00	64	84.0 / 70.0%
G8 or S8	3	TE 18/12	184T	9.2/5.4	1.15	84	84.0 / 82.0%
H1 or T1	5	ODP	184T	16.0	1.15	76	84.0%
H2 or T2	5	ODP HE	182T	15.7	1.15	94	89.5%
H3 or T3	5	ODP 18/9	184T	16.0/6.2	1.15	81	85.0 / 77.0%
H4 or T4	5	ODP 18/12	215T	16.0/9.7	1.15	117	86.0 / 78.0%
H5 or T5	5	TE	184T	14.2	1.15	90	87.5%
H6 or T6	5	TE HE	184T	15.0	1.15	99	88.5%
H7 or T7	5	TE 18/9	184T	15.0/5.3	1.00	85	85.0 / 85.0%
H8 or T8	5	TE 18/12	213T	15.0/8.5	1.15	107	85.0 / 80.0%
I1 or W1	7 1/2	ODP	213T	26.9	1.15	106	81.5%
I2 or W2	7 1/2	ODP HE	213T	22.3	1.15	141	91.7%
I3 or W3	7 1/2	ODP 18/9	213T	23.0/9.3	1.15	108	85.0 / 72.0%
I4 or W4	7 1/2	ODP 18/12	215T	22.0/12.3	1.15	167	89.0 / 85.0%
I5 or W5	7 1/2	TE	213T	24.0	1.15	126	89.5%
I6 or W6	7 1/2	TE HE	213T	22.0	1.15	158	90.2%
I7 or W7	7 1/2	TE 18/9	213T	21.0/8.8	1.15	106	87.0 / 75.0%
I8 or W8	7 1/2	TE 18/12	215T	21.8/12.0	1.15	124	86.0 / 80.0%
J1 or X1	10	ODP	215T	32.6	1.15	120	84.0%
J2 or X2	10	ODP HE	215T	29.0	1.15	126	91.7%
J3 or X3	10	ODP 18/9	215T	27.7/11.2	1.15	118	88.0 / 77.0%
J4 or X4	10	ODP 18/12	256T	27.0/14.5	1.15	196	88.0 / 80.0%
J5 or X5	10	TE	215T	29.0	1.15	130	87.5%
J6 or X6	10	TE HE	215T	27.6	1.15	200	90.2%
J7 or X7	10	TE 18/9	215T	29.0/11.5	1.15	118	87.0 / 77.0%
J8 or X8	10	TE 18/12	254T	30.0/17.0	1.15	212	88.0 / 80.0%
K1 or Y1	15	ODP	254T	45.6	1.15	147	87.5%
K2 or Y2	15	ODP HE	254T	43.4	1.15	220	93.0%
K3 or Y3	15	ODP 18/9	256T	42.5/16.5	1.15	244	90.2 / 84.0%
K5 or Y5	15	TE	254T	42.0	1.15	250	91.0%
K6 or Y6	15	TE HE	254T	40.3	1.15	259	91.7%
K7 or Y7	15	TE 18/9	256T	44.0/16.0	1.15	218	88.0 / 82.0%
K8 or Y8	15	TE 18/12	256T	42.0/23.0	1.15	219	88.0 / 84.0%
V1 or Z1	20	ODP	256T	61.6	1.15	200	87.5%
V2 or Z2	20	ODP HE	256T	57.0	1.15	250	93.6%
V3 or Z3	20	ODP 18/9	284T	56.0/21.0	1.15	221	90.2 / 82.5%
V4 or Z4	20	ODP 18/12	286T	54.0/28.0	1.15	270	89.0 / 86.0%
V6 or Z6	20	TE HE	256T	54.0	1.15	290	91.7%
V7 or Z7	20	TE 18/9	284T	59.0/20.0	1.15	346	89.0 / 88.0%

① Motors have no thermal overload.
② Refer to page 42 for Motor Type abbreviations.

MOTOR DATA

Table 40.1 - Motor Data for Digit 14 = E - 230V/60Hz/3Ph ①

Digits 17&18	Motor Size (HP)	Motor Type ②	Frame Size	Amp. Draw	Service Factor	Weight (lbs)	Efficiency (%)
A1 or L1	1/3	ODP	56	1.6	1.35	17	N/A
A5 or L5	1/3	TE	48	1.2	1.00	15	N/A
B1 or M1	1/2	ODP	56	2.2	1.25	18	N/A
B5 or M5	1/2	TEFC	56	2.2	1.15	18	N/A
C1 or N1	3/4	ODP	56	2.8	1.25	21	N/A
C5 or N5	3/4	TEFC	56	2.8	1.15	30	N/A
D1 or P1	1	ODP	143T	3.1	1.15	36	82.5%
D2 or P2	1	ODP HE	143T	3.2	1.15	30	84.0%
D3 or P3	1	ODP 18/9	143T	3.4/1.6	1.15	26	76.0 / 59.0%
D4 or P4	1	ODP 18/12	145T	3.4/2.2	1.15	42	74.0 / 60.0%
D5 or P5	1	TEFC	56	3.6	1.15	28	N/A
D6 or P6	1	TE HE	143T	3.0	1.15	68	85.5%
D7 or P7	1	TEFC 18/9	143T	3.4/1.6	1.00	29	76.0 / 58.0%
D8 or P8	1	TEFC 18/12	145T	3.4/2.2	1.00	31	74.0 / 60.0%
E1 or Q1	1 1/2	ODP	145T	4.4	1.15	42	84.0%
E2 or Q2	1 1/2	ODP	145T	5.6	1.00	35	89.5%
E3 or Q3	1 1/2	ODP 18/9	145T	4.8/2.7	1.15	29	80.0 / 65.0%
E4 or Q4	1 1/2	ODP 18/12	145T	4.9/2.8	1.15	49	80.0 / 71.0%
E5 or Q5	1 1/2	TEFC	56	4.8	1.15	33	N/A
E6 or Q6	1 1/2	TE HE	145T	5.0	1.15	62	86.5%
E7 or Q7	1 1/2	TEFC 18/9	145T	4.0/1.7	1.00	38	83.0 / 71.0%
E8 or Q8	1 1/2	TEFC 18/12	145T	4.9/2.8	1.00	38	80.0 / 72.0%
F1 or R1	2	ODP	145T	5.8	1.15	43	84.0%
F2 or R2	2	ODP	145T	5.8	1.00	74	89.5%
F3 or R3	2	ODP 18/9	145T	6.4/2.7	1.15	33	81.0 / 67.0%
F4 or R4	2	ODP 18/12	182T	6.3/3.5	1.15	78	81.0 / NA%
F5 or R5	2	TE	145T	5.8	1.15	52	84.0%
F6 or R6	2	TE HE	145T	6.0	1.15	64	85.5%
F7 or R7	2	TEFC 18/9	145T	6.4/2.6	1.00	41	84.0 / 70.0%
F8 or R8	2	TE 18/12	182T	6.4/4.2	1.15	65	84.0 / 77.0%
G1 or S1	3	ODP	182T	9.4	1.15	81	86.5%
G2 or S2	3	ODP HE	182T	8.6	1.15	74	89.5%
G3 or S3	3	ODP 18/9	182T	11.6/4.4	1.15	66	82.0 / 72.0%
G4 or S4	3	ODP 18/12	184T	8.5/4.6	1.15	79	81.0 / 75.0%
G5 or S5	3	TE	182T	8.2	1.15	83	87.5%
G6 or S6	3	TE HE	182T	8.0	1.15	110	89.5%
G7 or S7	3	TE 18/9	182T	10.0/3.6	1.00	64	84.0 / 70.0%
G8 or S8	3	TE 18/12	184T	8.8/5.5	1.15	84	84.0 / 82.0%
H1 or T1	5	ODP	184T	14.0	1.15	87	87.5%
H2 or T2	5	ODP HE	184T	13.6	1.15	94	89.5%
H3 or T3	5	ODP 18/9	184T	17.7/6.2	1.15	81	85.0 / 77.0%
H4 or T4	5	ODP 18/12	215T	15.5/10.2	1.15	117	86.0 / 78.0%
H5 or T5	5	TE	184T	13.0	1.15	90	87.5%
H6 or T6	5	TE HE	184T	13.0	1.15	117	90.2%
H7 or T7	5	TE 18/9	184T	16.0/5.3	1.00	85	85.0 / 85.0%
H8 or T8	5	TE 18/12	213T	14.0/8.8	1.15	107	85.0 / 80.0%
I1 or W1	7 1/2	ODP	213T	19.6	1.15	121	88.5%
I2 or W2	7 1/2	ODP HE	213T	19.4	1.15	160	91.7%
I3 or W3	7 1/2	ODP 18/9	213T	22.5/8.2	1.15	108	85.0 / 72.0%
I4 or W4	7 1/2	ODP 18/12	215T	19.5/12.3	1.15	167	89.0 / 85.0%
I5 or W5	7 1/2	TE	213T	20.0	1.15	126	89.5%
I6 or W6	7 1/2	TE HE	213T	19.2	1.15	194	91.7%
I7 or W7	7 1/2	TE 18/9	213T	21.0/8.8	1.15	106	87.0 / 75.0%
I8 or W8	7 1/2	TE 18/12	215T	20.0/12.4	1.15	124	86.0 / 80.0%
J1 or X1	10	ODP	215T	26.8	1.15	138	89.5%
J2 or X2	10	ODP HE	215T	25.2	1.15	220	91.7%
J3 or X3	10	ODP 18/9	215T	32.4/11.6	1.15	118	88.0 / 77.0%
J4 or X4	10	ODP 18/12	256T	24.0/13.0	1.15	196	88.0 / 80.0%
J5 or X5	10	TE	215T	26.0	1.00	138	89.5%
J6 or X6	10	TE HE	215T	25.0	1.15	213	90.2%
J7 or X7	10	TE 18/9	215T	29.0/11.5	1.15	118	87.0 / 77.0%
J8 or X8	10	TE 18/12	254T	28.0/17.5	1.15	212	88.0 / 80.0%
K1 or Y1	15	ODP	254T	38.6	1.15	215	91.0%
K2 or Y2	15	ODP HE	254T	37.8	1.15	217	93.0%
K3 or Y3	15	ODP 18/9	256T	40.0/17.0	1.15	244	90.2 / 84.0%
K5 or Y5	15	TE	254T	40.0	1.15	250	91.0%
K6 or Y6	15	TE HE	254T	38.0	1.15	322	92.4%
K7 or Y7	15	TE 18/9	256T	39.0/15.0	1.15	218	88.0 / 82.0%
K8 or Y8	15	TE 18/12	256T	38.0/22.0	1.15	219	88.0 / 84.0%
V1 or Z1	20	ODP	256T	50.0	1.15	233	91.0%
V2 or Z2	20	ODP HE	256T	49.0	1.15	250	93.6%
V3 or Z3	20	ODP 18/9	284T	51.0/21.5	1.15	221	90.2 / 82.5%
V4 or Z4	20	ODP 18/12	286T	48.0/26.0	1.15	270	89.0 / 86.0%
V5 or Z5	20	TEFC	256T	51.0	1.15	287	91.0%
V6 or Z6	20	TE HE	256T	48.2	1.15	368	93.0%
V7 or Z7	20	TE 18/9	284T	52.0/18.0	1.15	346	89.0 / 88.0%

① Motors have no thermal overload.

② Refer to page 42 for Motor Type abbreviations.

MOTOR DATA

Table 41.1 - Motor Data for Digit 14 = F - 460V/60Hz/3Ph ①

Digits 17&18	Motor Size (HP)	Motor Type ②	Frame Size	Amp. Draw	Service Factor	Weight (lbs)	Efficiency (%)
A1 or L1	1/3	ODP	56	0.8	1.35	17	N/A
A3 or L3	1/3	TE	48	0.6	1.00	15	N/A
B1 or M1	1/2	ODP	56	1.1	1.25	18	N/A
B5 or M5	1/2	TEFC	56	1.1	1.15	18	N/A
C1 or N1	3/4	ODP	56	1.4	1.25	21	N/A
C5 or N5	3/4	TEFC	56	1.4	1.15	30	N/A
D1 or P1	1	ODP	143T	1.6	1.15	36	82.5%
D2 or P2	1	ODP HE	143T	1.5	1.15	30	84.0%
D3 or P3	1	ODP 18/9	143T	1.8/0.8	1.15	26	76.0 / 59.0%
D4 or P4	1	ODP 18/12	145T	1.7/1.1	1.15	39	74.0 / 60.0%
D5 or P5	1	TEFC	56	1.8	1.15	28	N/A
D6 or P6	1	TE HE	143T	1.5	1.15	68	85.5%
D7 or P7	1	TEFC 18/9	143T	1.8/0.8	1.00	28	73.0 / 58.0%
D8 or P8	1	TEFC 18/12	145T	1.7/1.1	1.00	31	74.0 / 60.0%
E1 or Q1	1 1/2	ODP	145T	2.2	1.15	42	84.0%
E2 or Q2	1 1/2	ODP	145T	2.4	1.00	35	89.5%
E3 or Q3	1 1/2	ODP 18/9	145T	2.3/1.0	1.15	29	80.0 / 65.0%
E4 or Q4	1 1/2	ODP 18/12	145T	2.4/1.4	1.15	32	75.0 / 71.0%
E5 or Q5	1 1/2	TEFC	56	2.4	1.15	33	N/A
E6 or Q6	1 1/2	TE HE	145T	2.5	1.15	62	86.5%
E7 or Q7	1 1/2	TEFC 18/9	145T	2.0/0.9	1.00	39	83.0 / 71.0%
E8 or Q8	1 1/2	TEFC 18/12	145T	2.5/1.4	1.00	37	80.0 / 72.0%
F1 or R1	2	ODP	145T	2.9	1.15	43	84.0%
F2 or R2	2	ODP	145T	2.9	1.00	74	89.5%
F3 or R3	2	ODP 18/9	145T	3.0/1.3	1.15	33	79.0 / 62.0%
F4 or R4	2	ODP 18/12	182T	3.0/2.0	1.15	61	80.0 / 70.0%
F5 or R5	2	TE	145T	2.9	1.15	52	84.0%
F6 or R6	2	TE HE	145T	3.0	1.15	64	85.5%
F7 or R7	2	TEFC 18/9	145T	3.2/1.3	1.00	42	84.0 / 70.0%
F8 or R8	2	TE 18/12	182T	3.1/1.9	1.15	68	81.0 / 77.0%
G1 or S1	3	ODP	182T	4.5	1.15	81	86.5%
G2 or S2	3	ODP HE	182T	4.3	1.15	74	89.5%
G3 or S3	3	ODP 18/9	182T	4.5/1.8	1.15	60	80.0 / 66.0%
G4 or S4	3	ODP 18/12	184T	4.6/2.7	1.15	71	82.5 / NA%
G5 or S5	3	TE	182T	4.1	1.15	83	87.5%
G6 or S6	3	TE HE	182T	4.0	1.15	110	89.5%
G7 or S7	3	TE 18/9	182T	4.6/1.7	1.15	65	84.0 / 70.0%
G8 or S8	3	TE 18/12	184T	4.3/2.6	1.15	73	82.5 / 75.5%
H1 or T1	5	ODP	184T	7.0	1.15	87	87.5%
H2 or T2	5	ODP HE	184T	6.8	1.15	94	89.5%
H3 or T3	5	ODP 18/9	184T	9.1/3.2	1.15	94	84.0 / 73.0%
H4 or T4	5	ODP 18/12	215T	7.1/4.8	1.15	117	78.0 / 71.0%
H5 or T5	5	TE	184T	6.5	1.15	90	87.5%
H6 or T6	5	TE HE	184T	6.5	1.15	117	90.2%
H7 or T7	5	TE 18/9	184T	7.0/2.5	1.15	83	86.0 / 83.0%
H8 or T8	5	TE 18/12	213T	6.9/4.1	1.15	107	85.0 / 75.5%
I1 or W1	7 1/2	ODP	213T	9.8	1.15	121	88.5%
I2 or W2	7 1/2	ODP HE	213T	9.7	1.15	160	91.7%
I3 or W3	7 1/2	ODP 18/9	213T	11.8/4.2	1.15	125	85.0 / 72.0%
I4 or W4	7 1/2	ODP 18/12	215T	10.0/6.0	1.15	131	87.0 / 80.0%
I5 or W5	7 1/2	TE	213T	10.0	1.15	126	89.5%
I6 or W6	7 1/2	TE HE	213T	9.6	1.15	194	91.7%
I7 or W7	7 1/2	TE 18/9	213T	10.0/4.1	1.15	83	84.0 / 74.0%
I8 or W8	7 1/2	TE 18/12	215T	10.3/5.6	1.15	128	85.0 / 80.0%
J1 or X1	10	ODP	215T	13.4	1.15	138	89.5%
J2 or X2	10	ODP HE	215T	12.6	1.15	220	91.7%
J3 or X3	10	ODP 18/9	215T	15.0/5.3	1.15	116	83.0 / 71.0%
J4 or X4	10	ODP 18/12	256T	12.0/6.3	1.15	192	87.0 / 82.0%
J5 or X5	10	TE	215T	13.0	1.00	138	89.5%
J6 or X6	10	TE HE	215T	12.5	1.15	213	90.2%
J7 or X7	10	TE 18/9	215T	13.0/5.4	1.15	107	86.5 / 77.0%
J8 or X8	10	TE 18/12	254T	13.5/7.5	1.15	222	87.0 / 82.0%
K1 or Y1	15	ODP	254T	19.3	1.15	215	91.0%
K2 or Y2	15	ODP HE	254T	18.9	1.15	217	93.0%
K3 or Y3	15	ODP 18/9	256T	19.3/7.8	1.15	203	88.5 / 81.5%
K4 or Y4	15	ODP 18/12	256T	18.0/9.5	1.15	298	86.0 / 81.0%
K5 or Y5	15	TE	254T	20.0	1.15	250	91.0%
K6 or Y6	15	TE HE	254T	19.0	1.15	322	92.4%
K7 or Y7	15	TE 18/9	256T	19.5/7.5	1.15	218	88.0 / 82.0%
K8 or Y8	15	TE 18/12	256T	19.5/11.0	1.15	223	88.0 / 84.0%
V1 or Z1	20	ODP	256T	25.0	1.15	233	91.0%
V2 or Z2	20	ODP HE	256T	24.5	1.15	250	93.6%
V3 or Z3	20	ODP 18/9	256T	25.2/10.0	1.15	208	89.5 / 82.5%
V4 or Z4	20	ODP 18/12	286T	24.0/13.0	1.15	270	90.0 / 84.0%
V5 or Z5	20	TEFC	256T	25.5	1.15	287	91.0%
V6 or Z6	20	TE HE	256T	24.1	1.15	368	93.0%
V7 or Z7	20	TE 18/9	284T	26.0/8.7	1.15	331	89.0 / 88.0%
V8 or Z8	20	TE 18/12	284T	24.7/14.0	1.15	361	90.0 / 86.0%

① Motors have no thermal overload.

② Refer to page 42 for Motor Type abbreviations.

MOTOR DATA

Table 42.1 - Motor Data for Digit 14 = G - 575V/60Hz/3Ph ①

Digits 17&18	Motor Size (HP)	Motor Type ②	Frame Size	Amp. Draw	Service Factor	Weight (lbs)	Efficiency (%)
A5 or L5	1/3	TEFC	56	0.6	1.15	16	N/A
B1 or M1	1/2	ODP	56	0.9	1.25	25	N/A
B5 or M5	1/2	TEFC	56	0.9	1.15	24	N/A
C1 or N1	3/4	ODP	56	0.9	1.25	28	N/A
C5 or N5	3/4	TEFC	56	1.1	1.15	33	N/A
D1 or P1	1	ODP	143T	1.1	1.15	41	82.5%
D5 or P5	1	TEFC	56	1.5	1.15	28	77.0%
D6 or P6	1	TE HE	143T	1.2	1.15	68	85.5%
E1 or Q1	1 1/2	ODP	145T	1.8	1.15	48	84.0%
E5 or Q5	1 1/2	TEFC	145T	2.0	1.15	72	84.0%
E6 or Q6	1/12	TE HE	145T	1.7	1.15	66	85.5%
F1 or R1	2	ODP	145T	2.3	1.15	50	84.0%
F5 or R5	2	TEFC	145T	2.3	1.15	65	84.0%
F6 or R6	2	TE HE	145T	2.4	1.15	66	86.5%
G1 or S1	3	ODP	182T	3.4	1.15	72	86.5%
G5 or S5	3	TEFC	182T	3.4	1.15	98	87.5%
G6 or S6	3	TE HE	182T	3.2	1.15	100	89.5%
H1 or T1	5	ODP	184T	5.2	1.15	91	87.5%
H5 or T5	5	TEFC	184T	5.2	1.15	89	87.5%
H6 or T6	5	TE HE	184T	5.2	1.15	117	89.5%
I1 or W1	7 1/2	ODP	213T	7.8	1.15	113	88.5%
I5 or W5	7 1/2	TEFC	213T	8.0	1.15	142	89.0%
I6 or W6	7 1/2	TE HE	213T	7.6	1.15	192	90.2%
J1 or X1	10	ODP	215T	10.3	1.15	123	89.5%
J5 or X5	10	TE	215T	10.4	1.15	154	89.5%
J6 or X6	10	TE HE	215T	9.6	1.15	200	90.2%
K1 or Y1	15	ODP	254T	15.4	1.15	184	91.0%
K5 or Y5	15	TE	254T	16.0	1.15	250	91.0%
K6 or Y6	15	TE HE	254T	15.2	1.15	326	92.4%
V1 or Z1	20	ODP	256T	20.8	1.15	255	91.0%
V5 or Z5	20	TEFC	256T	20.4	1.15	287	91.0%
V6 or Z6	20	TE HE	256T	19.5	1.15	368	93.0%

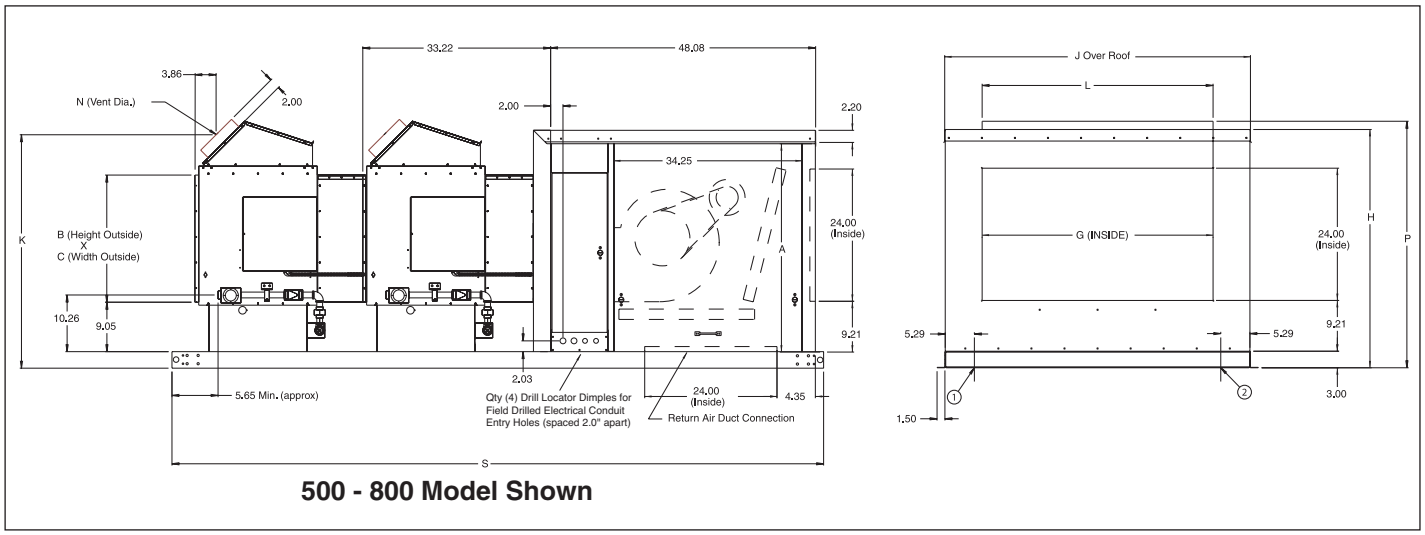
① Motors have no thermal overload

② Motor Type Abbreviations

ODP	Open Drip Proof
ODP HE	Open Drip Proof, High Efficiency
ODP 18/9	Open Drip Proof, 2-speed 1800/900 RPM
ODP 18/12	Open Drip Proof, 2-speed 1800/1200 RPM
TE	Totally Enclosed
TEFC	Totally Enclosed, Fan Cooled
TE HE	Totally Enclosed, High Efficiency
TE 18/9	Totally Enclosed, 2-speed 1800/900 RPM
TE 18/12	Totally Enclosed, 2-speed 1800/1200 RPM
TENV	Totally Enclosed, Non-Ventilating

DIMENSIONS - UNIT

Figure 43.1 - DBG Indoor Gravity Vented Blower Package Unit Dimensions



500 - 800 Model Shown

Figure 43.2 - DCG Indoor Gravity Vented Cooling Package Unit Dimensions

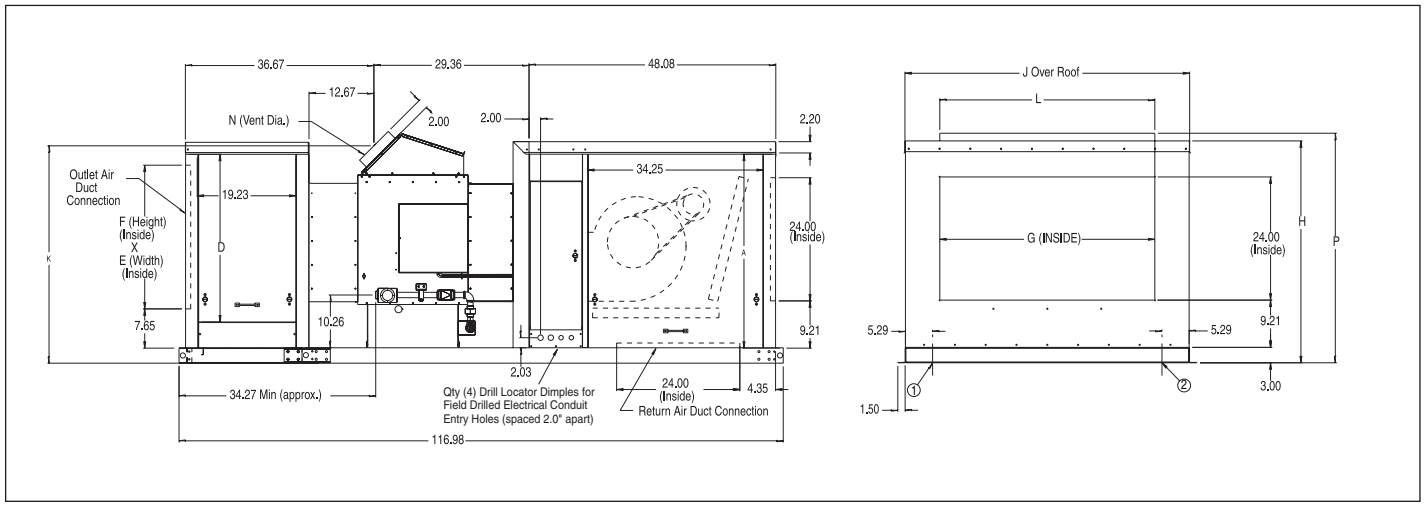


Table 43.1 - DBG/DCG Indoor Gravity Vented Unit Dimensions (All dimensions in inches)

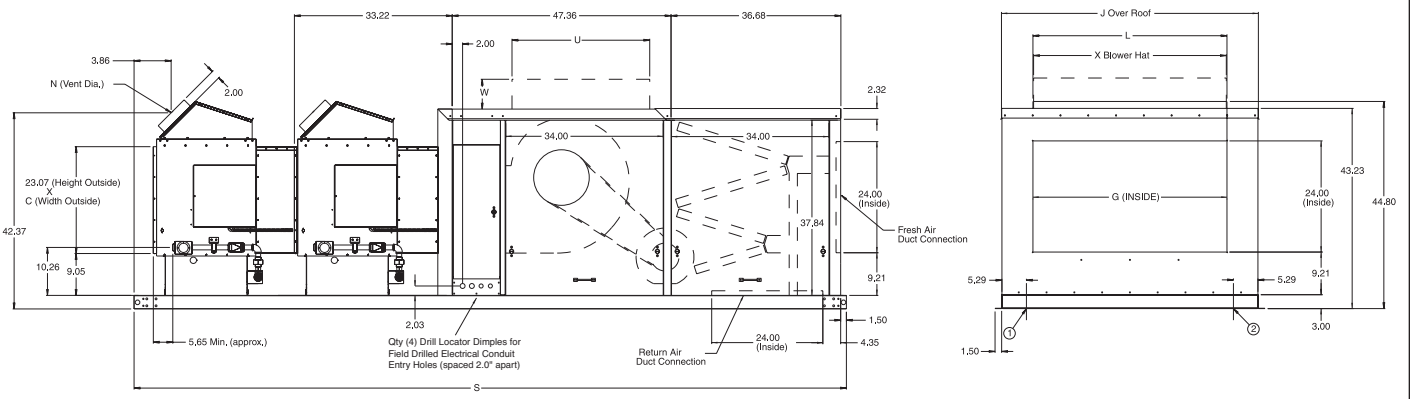
Model Size	Blower Type (Digit 16)	Qty. of Furnaces	Dimensions														Gas Conn.
			A	B	C	D	E	F	G	H	J	K	L	N	P	S	
75	All	1	37.75	19.07	15.21	28.75	18.00	25.00	20.02	39.23	32.06	38.37	12.65	5	40.80	87.77	1/2
100/125	All	1	37.75	19.07	17.70	28.75	21.00	25.00	20.02	39.23	34.56	38.37	15.14	6	40.80	87.77	1/2
150/175	All	1	37.75	19.07	21.96	28.75	24.00	25.00	23.99	39.23	38.82	38.37	19.41	7	40.80	87.77	1/2
200/225	All	1	37.75	23.07	24.09	32.75	27.00	28.00	23.99	43.23	40.94	42.37	21.60	7	44.80	87.77	1/2 / 3/4
250/300	E, F, G, or H	1	3775	23.07	27.13	32.75	30.00	28.00	29.96	43.23	44.05	42.37	24.60	8/10	44.80	87.77	3/4
350/400	E, F, G, or H	1	37.75	23.07	38.63	32.75	42.00	28.00	41.90	43.23	55.57	42.37	36.14	10	44.80	87.77	3/4
500/600	G or H	2	37.75	23.07	27.13	32.75	n/a	n/a	29.96	43.23	44.05	42.37	24.60	8/10	44.80	120.90	3/4
700/800	G or H	2	37.75	23.07	38.63	32.75	n/a	n/a	41.90	43.23	55.57	42.37	36.14	10	44.80	120.90	3/4

① For Right Hand Access Units - Drill Locator Dimples for Field Drilled Electrical Conduit Entry Holes (spaced 2.0" apart)

② For Left Hand Access Units - Drill Locator Dimples for Field Drilled Electrical Conduit Entry Holes (spaced 2.0" apart)

DIMENSIONS - UNIT

Figure 44.1 - DBG Indoor Gravity Vented Blower Package Unit Dimensions with Blower Type I, J, K, or L



500 - 800 Model Shown

Figure 44.2 - DCG Indoor Gravity Vented Cooling Package Unit Dimensions with Blower Type I, J, K, or L

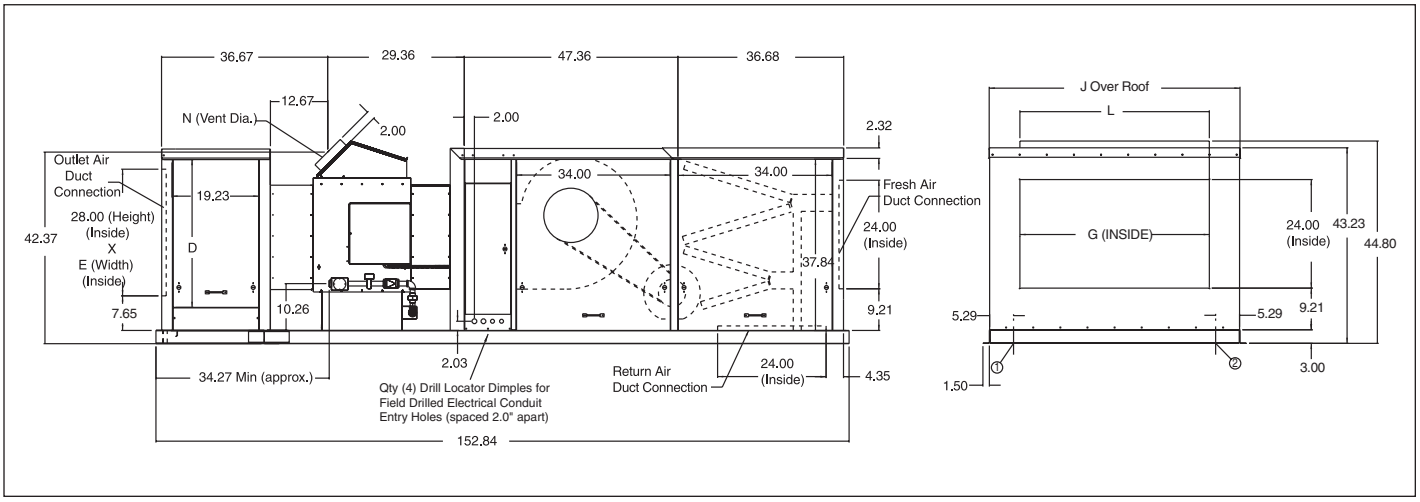


Table 44.1 - DBG/DCG Indoor Gravity Vented Unit Dimensions with Blower Type I, J, K, or L (All dimensions in inches)

Model Size	Blower Type (Digit 16)	Qty. of Furnaces	Dimensions										Gas Conn.
			C	E	G	J	L	N	S	U ③	W ③	X ③	
250/300	I, J, or K	1	27.13	30.00	29.96	44.05	24.60	8/10	123.35	n/a	n/a	n/a	3/4
350/400	I, J, or K	1	38.63	42.00	41.90	55.07	36.14	10	123.35	n/a	n/a	n/a	3/4
500/600	I, J, K, or L	2	27.13	n/a	29.96	44.05	24.60	8/10	156.76	29.74	6.5	41.62	3/4
700/800	I, J, K, or L	2	38.63	n/a	41.90	55.57	36.14	10	156.76	29.74	6.5	41.62	3/4
840/960	I, J, K, or L	3	38.63	n/a	41.90	55.57	36.14	10	185.99	29.74	6.5	41.62	3/4

① For Right Hand Access Units - Drill Locator Dimples for Field Drilled Electrical Conduit Entry Holes (spaced 2.0" apart)
② For Left Hand Access Units - Drill Locator Dimples for Field Drilled Electrical Conduit Entry Holes (spaced 2.0" apart)
③ Applies to units with Digit 16 = L only.

DIMENSIONS - BASE

Figure 45.1 - Unit Base Dimensions

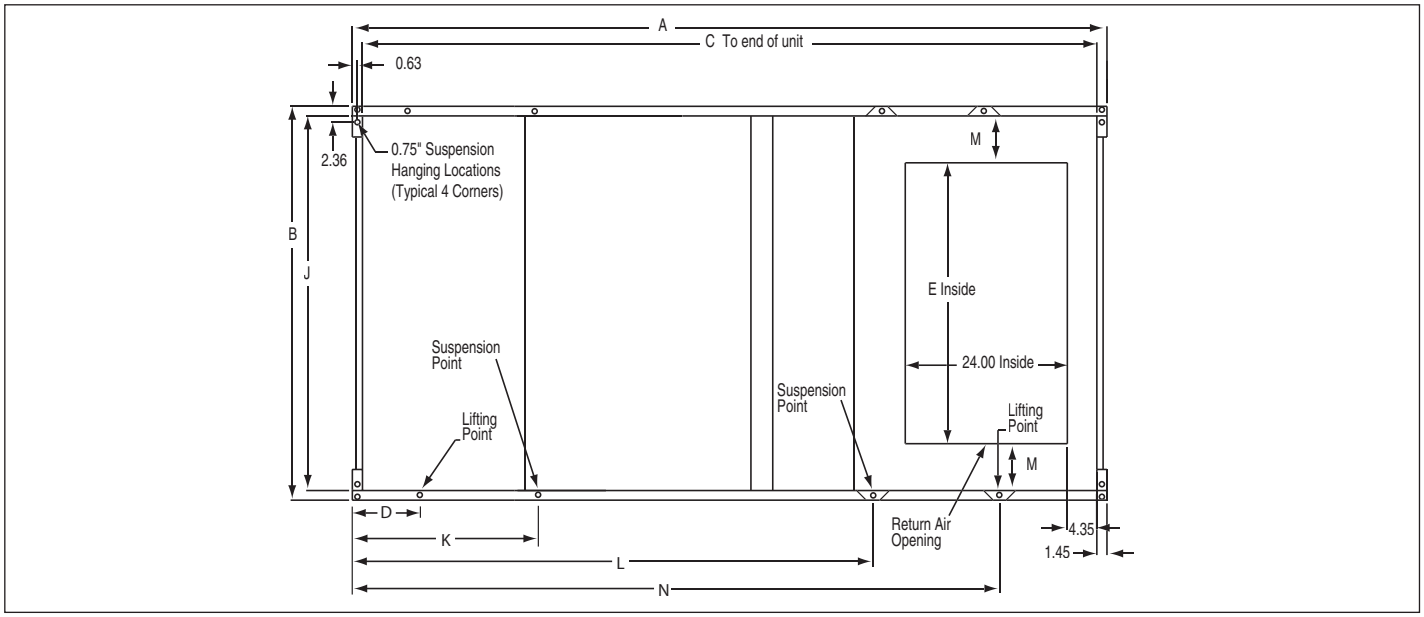


Table 45.1 - Indoor Gravity Vented Blower Package Units (All dimensions in inches)

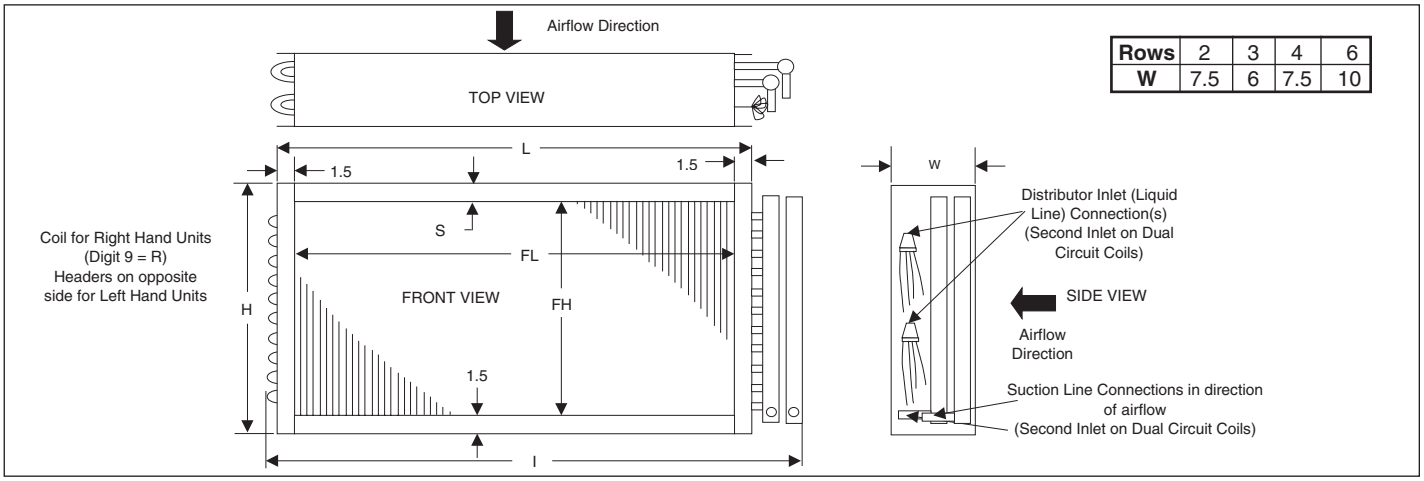
Model Size	Blower Type (Digit 16)	Dimensions									
		A	B	C	D	E	N	K	L	J	M
75	All	87.77	34.85	81.30	n/a	19.52	n/a	n/a	n/a	32.00	6.23
100/125	All	87.77	37.36	81.30	n/a	19.52	n/a	n/a	n/a	34.50	7.49
150/175	All	87.77	41.61	81.30	n/a	23.49	n/a	n/a	n/a	38.75	7.63
200/225	All	87.77	43.71	81.30	n/a	23.49	n/a	n/a	n/a	40.85	8.69
250/300	E,F,G, or H	87.77	46.75	81.30	n/a	29.46	n/a	n/a	n/a	43.89	7.21
250/300	I, J, or K	123.35	46.75	117.26	n/a	29.46	n/a	n/a	n/a	43.89	7.21
350/400	E,F,G, or H	87.77	58.27	81.30	n/a	41.40	n/a	n/a	n/a	55.41	7.00
350/400	I, J, or K	123.35	58.27	117.26	n/a	41.40	n/a	n/a	n/a	55.41	7.00
500/600	G, or H	120.90	46.75	111.68	34.12	29.46	89.14	34.12	n/a	43.89	7.21
500/600	I, J, K, or L	156.76	46.75	147.53	34.12	29.46	117.82	82.27	n/a	43.89	7.21
700/800	G, or H	120.90	58.27	111.68	34.12	41.40	89.14	34.12	n/a	55.41	7.00
700/800	I, J, K, or L	156.76	58.27	147.53	34.12	41.40	117.82	82.27	n/a	55.41	7.00
840/960	I, J, K, or L	185.99	58.27	176.75	30.31	41.40	147.06	63.36	147.06	55.41	7.00

Table 45.2 - Indoor Gravity Vented Cooling Package Units (All dimensions in inches)

Model Size	Blower Type (Digit 16)	Dimensions							
		A	B	C	E	F	G	J	M
75	All	116.98	34.85	114.07	19.52	81.88	56.96	32.00	6.23
100/125	All	116.98	37.36	114.07	19.52	81.88	56.96	34.50	7.49
150/175	All	116.98	41.61	114.07	23.49	81.88	56.96	38.75	7.63
200/225	All	116.98	43.71	114.07	23.49	81.88	56.96	40.85	8.69
250/300	E, F, G, or H	116.98	46.75	114.07	29.46	81.88	56.96	43.89	7.21
250/300	I, J, or K	152.84	46.75	149.93	29.46	117.73	92.81	43.89	7.21
350/400	E, F, G, or H	116.98	58.27	114.07	41.40	81.88	56.96	55.41	7.00
350/400	I, J, or K	152.84	58.27	149.93	41.40	117.73	92.81	55.41	7.00

DIMENSIONS - COOLING COILS

Figure 46.1 - DX Coil Drawing (All dimensions in inches)



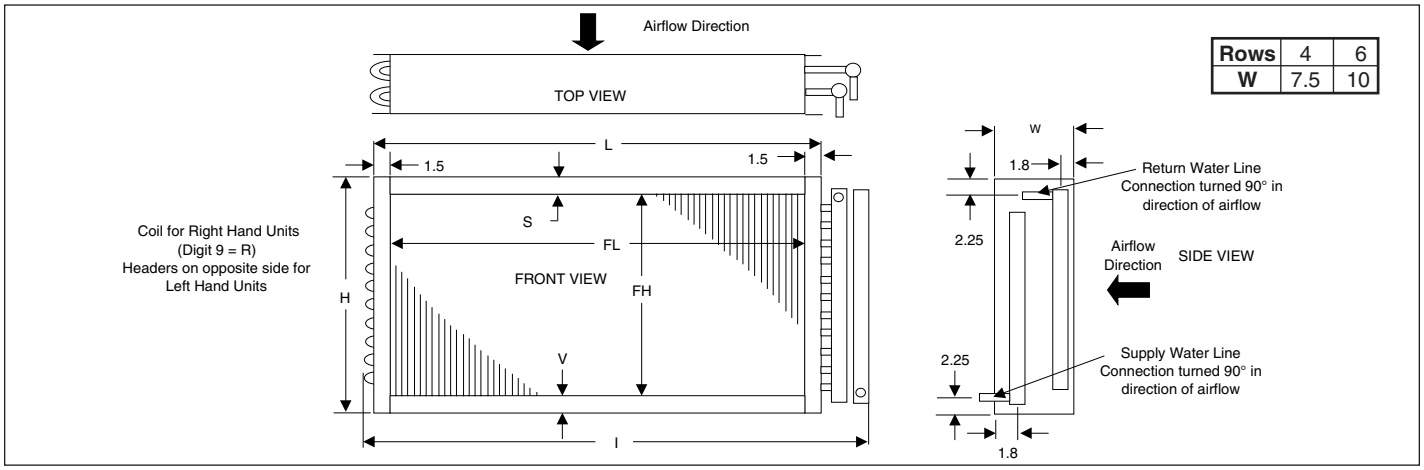
Rows	2	3	4	6
W	7.5	6	7.5	10

Table 46.1 - DX Coil Dimensions

					DX - Single Circuit					DX - Dual Circuit				
Model Size	Cooling MBH	FH	H	S	FL	I	L	Suction Line (Qty)	Liquid Line (Qty)	FL	I	L	Suction Line (Qty)	Liquid Line (Qty)
75	All	27.5	30.5	1.5	18	25	21	(1) 1.625	(1) ①	16.25	26.5	19.25	(2) 1.625	(2) ①
100/125	All	27.5	30.5	1.5	21	28	24	(1) 1.625	(1) ①	19.5	29.75	22.5	(2) 1.625	(2) ①
150/175	All	27.5	30.5	1.5	24	31	27	(1) 1.625	(1) ①	23	33.25	26.0	(2) 1.625	(2) ①
200/225	Below 185 MBH	32.5	34.5	0.5	27	34	30	(1) 1.625	(1) ①	25.5	35.75	28.5	(2) 1.625	(2) ①
	185 MBH & Up	32.5	34.5	0.5	27	34.5	30	(1) 2.125	(1) ①					
250/300	Below 185 MBH	32.5	34.5	0.5	30	37	33	(1) 1.625	(1) ①	28.5	38.75	31.5	(2) 1.625	(2) ①
	185 MBH & Up	32.5	34.5	0.5	30	37.5	33	(1) 2.125	(1) ①					
350/400	Below 185 MBH	32.5	34.5	0.5	42	49	45	(1) 1.625	(1) ①	40.25	50.5	43.25	(2) 1.625	(2) ①
	185 MBH & Up	32.5	34.5	0.5	42	49.5	45	(1) 2.125	(1) ①					

① Liquid line dimensions vary by configuration. Refer to the original order for configured dimensions.

Figure 46.2 - Chilled Water Coil Drawing (All dimensions in inches)



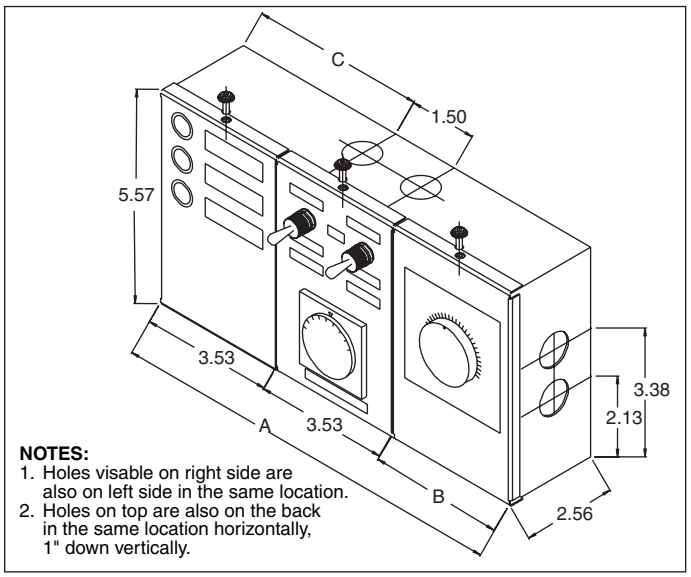
Rows	4	6
W	7.5	10

Table 46.2 - Chilled Water Coil Dimensions

Model Size	FH	H	S	V	FL	I	L	Supply Line	Return Line
75	27	30	1.5	1.5	16.25	25.50	19.25	1.50 MPT	1.50 MPT
100/125	27	30	1.5	1.5	19.50	28.75	22.50	1.50 MPT	1.50 MPT
150/175	27	30	1.5	1.5	23.00	32.25	26.00	1.50 MPT	1.50 MPT
200/225	33	34.5	0.5	1	25.50	34.75	28.50	1.50 MPT	1.50 MPT
250/300	33	34.5	0.5	1	28.50	37.75	31.50	1.50 MPT	1.50 MPT
350/400	33	34.5	0.5	1	40.25	49.50	43.25	1.50 MPT	1.50 MPT

DIMENSIONS/WEIGHTS

Figure 47.1 - Remote Panel Dimensions



NOTES:
1. Holes visable on right side are also on left side in the same location.
2. Holes on top are also on the back in the same location horizontally, 1" down vertically.

Table 47.3 - Remote Panel Dimensions (All dimensions in inches)

Remote Panel Type	A	B	C
Light and Switch Panels Only	7.06	-	2.81
Light and Switch Panels with Single Stage Thermostat or Electronic Set Point Adjustor	10.60	3.53	4.58
Light and Switch Panels with Two Stage Thermostat	13.09	6.03	5.82

Table 47.1 - Blower Package Unit Operating Weights (All weights in pounds)

Model Size	Blower Type (Digit 16)	Unit	Motor	Filters	Dampers Fresh Air	Dampers F & RA	Insulation	Double Wall (All Sections)
75	All	236	See Motor Data	6	26	46	5	38
100/125	All	272		6	26	46	5	38
150/175	All	308		6	29	52	5	43
200/225	All	365		6	29	52	7	46
250/300	E,F,G, or H	396		8	33	60	7	46
250/300	I, J, or K	645		15	33	60	14	93
350/400	E,F,G, or H	482		12	38	70	7	53
350/400	I, J, or K	763		17	38	70	14	96
500/600	G or H	577		8	33	60	7	46
500/600	I, J, K, or L	826		15	33	60	14	93
700/800	G or H	733		12	38	70	7	53
700/800	I, J, K, or L	1014		17	38	70	14	96
840/960	I, J, K, or L	1265		17	38	70	14	96

Table 47.2 - Cooling Package Unit Operating Weights (All weights in pounds)

Model Size	Blower Type (Digit 16)	Unit	Motor	Filters	Dampers Fresh Air	Dampers Fresh & Return Air	Insulation	Double Wall (All Sections)
75	All	343	See Motor Data	6	26	46	10	72
100/125	All	382		6	26	46	10	72
150/175	All	423		6	29	52	10	77
200/225	All	491		6	29	52	12	85
250/300	E,F,G, or H	526		8	33	60	12	87
250/300	I, J, or K	775		15	33	60	19	134
350/400	E,F,G, or H	631		12	38	70	12	101
350/400	I, J, or K	912		17	38	70	19	144

MAINTENANCE

All heating equipment should be serviced before each heating season to assure proper operations. The following items may be required to have more frequent service schedule based on the environment in which the unit is installed, and the frequency of the equipment operation.

Blower Assembly

The blower assembly includes the bearings, drive sheaves and belts.

Blower bearings should be checked and lubricated based on the blower manufacturer's recommendations. Bearings should also be checked for any unusual wear and replaced if needed.

Drive sheaves should be checked at the same time the bearings are inspected. Check to make sure the sheaves are in alignment and are securely fastened to the blower and motor shafts.Belt tension should be rechecked shortly after the unit has been installed to check for belt stretching. After the initial start-up, monthly checks are recommended.

Filters

If the unit is supplied with a dirty filter switch and light, clean or replace the filters any time the dirty filter light comes on.

Units which do not have a dirty filter warning light should have the filters checked monthly. Clean or replace if necessary. In dirty atmospheres, filter maintenance may be required more often.

Figure 48.1 - Filter Replacement Arrangement for Blower Size (Digit 16) A, B, C, D, E, F, G and H

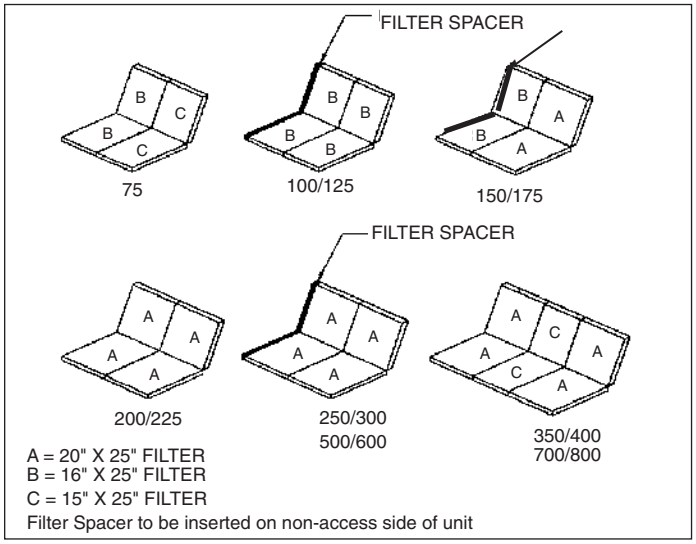
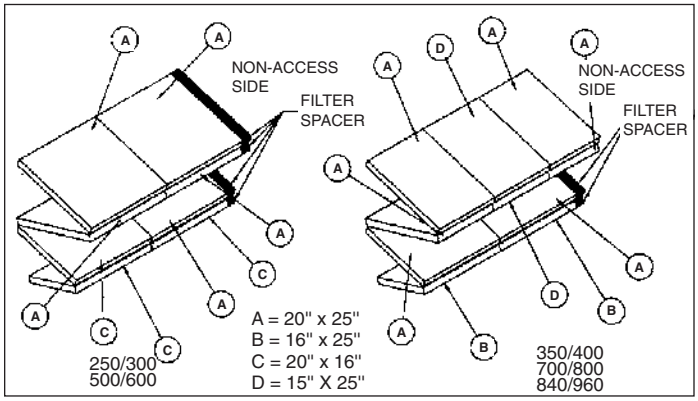


Figure 48.2 - Filter Replacement Arrangement for Blower Size (Digit 16) I, J, K, and L

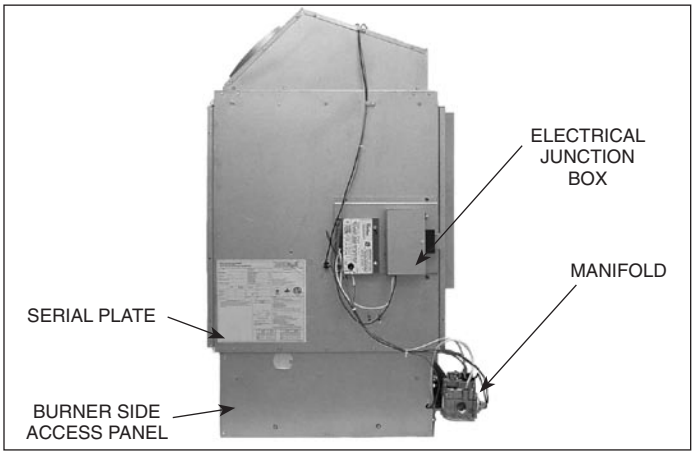


Manifold Assembly Removal

To remove the manifold

1. Shut off gas and electric supply.
2. Disconnect gas manifold at ground union joint.
3. Remove the two screws holding the manifold to the heat exchanger support.
4. Slide the manifold through the manifold bracket.
5. Clean the orifices and adjust the air shutters as necessary.
6. Follow steps 3-6 in reverse order to install the manifold assembly.
7. Turn on the electric and gas supply.
8. Check the ground union joint for leaks with a soap solution. Tighten if necessary.

Figure 48.3 - Manifold Assembly Removal

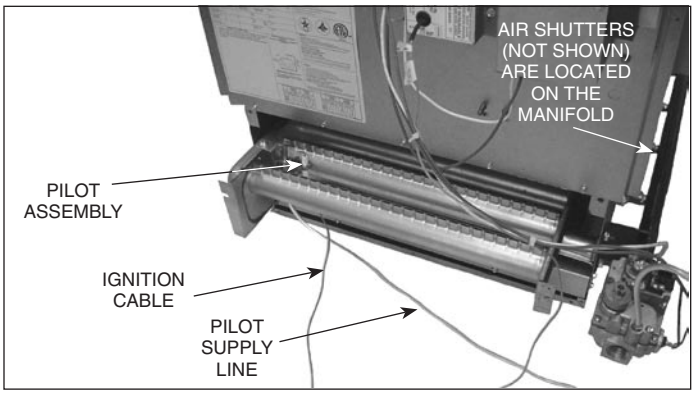


Burner and Pilot Assembly Removal

To remove the burner

1. Shut off gas and electric supply.
2. Disconnect the pilot supply line from the gas valve.
3. Disconnect the ignition cable from the ignition controller (located in the electrical junction box). Feed the cable through the bushing in the bottom of the electrical junction box.
4. Remove the screws holding the burner side access panel. Attached to the panel are the burner retaining pins that align the burner.
5. Slide the burner assembly out. The pilot is attached to the burner assembly.
6. Examine the burner and pilot assembly for cleanliness and/or obstructions as necessary (see Duct Furnace for cleaning instructions).
7. Replace the burner assembly in reverse order. In replacing the burner, be certain that the rear burner slots are located properly on the burner retaining pins. Do not force the burner side access panel, it will not fit if the burner is not properly aligned.
8. Reconnect the ignition cable and pilot gas supply line.
9. Turn on the electric and gas supply.

Figure 48.4 - Burner and Pilot Assembly Removal



SERVICE & TROUBLESHOOTING

⚠ WARNING

When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting Modine Manufacturing Company. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

⚠ CAUTION

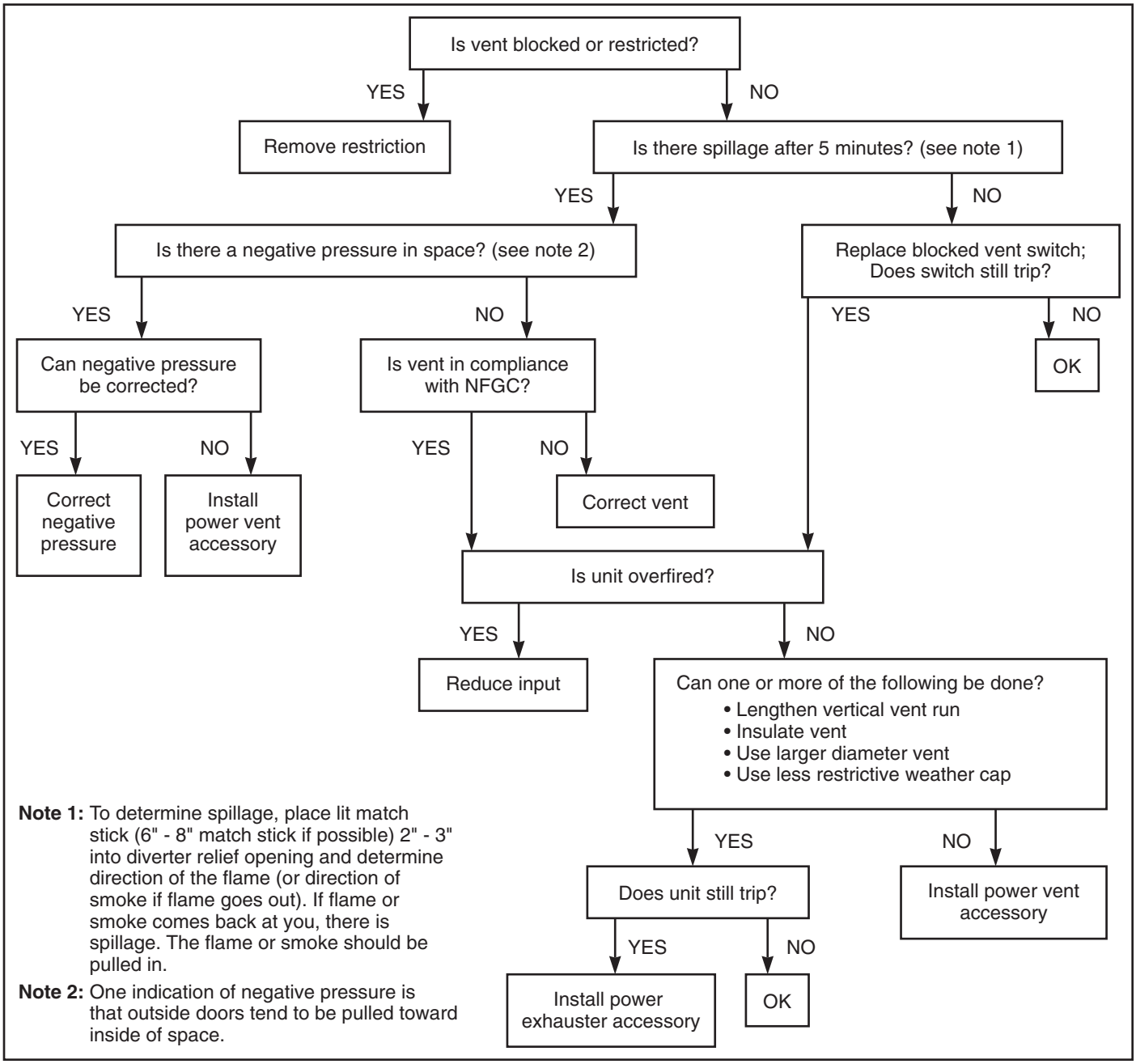
Do not attempt to reuse any mechanical or electrical controllers which have been wet. Replace defective controller.

IMPORTANT

To check most of the Possible Remedies in the troubleshooting guide listed in Table 50.1, refer to the applicable sections of the manual.

Troubleshooting

Figure 49.1 - Blocked Vent Safety Switch (BVSS) Troubleshooting Flow Chart



Note 1: To determine spillage, place lit match stick (6" - 8" match stick if possible) 2" - 3" into diverter relief opening and determine direction of the flame (or direction of smoke if flame goes out). If flame or smoke comes back at you, there is spillage. The flame or smoke should be pulled in.

Note 2: One indication of negative pressure is that outside doors tend to be pulled toward inside of space.

SERVICE & TROUBLESHOOTING

Table 50.1 - Troubleshooting

Trouble	Possible Cause	Possible Remedy
Pilot does not light	**1.** Main gas is off. **2.** Power supply is off. **3.** Air in gas line. **4.** Dirt in pilot orifice. **5.** Gas pressure out of proper range. **6.** Pilot valve does not open. a. Defective ignition controller. b. Defective gas valve. **7.** No Spark at ignitor. a. Loose wire connections. b. Pilot sensor is grounded. c. Defective ignition controller. **8.** Safety device has cut power. **9.** Pilot valve is off. **10.** Dirty thermocouple contact. **11.** Excessive drafts. **12.** Pilot orifice Fitting leak.	**1.** Open manual gas valve. **2.** Turn on main power. **3.** Purge gas line. **4.** Check for plugged pilot orifice and clean with compressed air if necessary. **5.** Adjust to a maximum of 14" W.C. Minimum for Natural Gas - 6" W.C. Minimum for Propane Gas - 11" W.C. **6.** Check wiring for 24 volts to valve. a. Replace ignition controller. b. Replace gas valve. **7.** a. Check all ignition controller wiring. b. Replace sensor if cracked or worn c. Replace ignition controller. **8.** Check all safety devices (High limit, air flow proving switch, differential pressure switch, gas pressure switches, etc.) Determine and correct problem. Reset if necessary. **9.** Turn gas control knob or lever on combination gas control to pilot position. **10.** Be sure thermocouple contact is clean. If problem persists replace thermocouple. **11.** Find source and re-direct airflow away from unit. **12.** Tighten pilot orifice. Flame impingment on thermocouple may cause thermocouple to become inoperative.
Main burners do not light (Pilot is lit)	**1.** Defective valve. **2.** Loose wiring. **3.** Defective pilot sensor **4.** Defective ignition controller. **5.** Improper thermostat wiring. **6.** Blocked vent safety switch trippped.	**1.** Replace valve. **2.** Check wiring to gas valve. **3.** Replace pilot sensor. **4.** Replace ignition controller. **5.** Verify wiring compared to wiring diagram. **6.** Refer to Figure 49.1
Lifting Flames (See Figure 51.1)	**1.** Too much primary air. **2.** Main pressure set too high. **3.** Orifice too large.	**1.** Reduce primary air. **2.** Adjust to a maximum of 14" W.C. **3.** Check orifice size with those listed on the serial plate.
Yellow Tipping (With propane gas, some yellow tipping is always present.)	**1.** Insufficient primary air. **2.** Dirty orifice. **3.** Misaligned orifice.	**1.** Increase primary air. **2.** Check orifices and clean with compressed air if necessary. **3.** Check manifold, replace if necessary.

SERVICE & TROUBLESHOOTING

Trouble	Possible Cause	Possible Remedy
Flashback	**1.** Too much primary air **2.** Main pressure set too high. **3.** Orifice too large.	**1.** Reduce primary air. **2.** Adjust to maximum of 14” W.C. **3.** Check orifice size with those listed on the serial plate.
Floating Flames (See Figure 51.2)	**1.** Insufficient primary air. **2.** Main pressure set too high. **3.** Orifice too large. **4.** Blocked vent.	**1.** Increase primary air. **2.** Adjust to a maximum of 14" W.C. **3.** Check orifice size with those listed on the serial plate. **4.** Clean/correct venting system.
Flame Rollout (See Figure 51.3)	**1.** Main pressure set too high. **2.** Orifice too large. **3.** Blocked vent.	**1.** Adjust to a maximum of 14" W.C. **2.** Check orifice size with those listed on the serial plate. **3.** Clean/correct venting system.
Not Enough Heat	**1.** Unit cycling on high limit. ① a. Obstructions/leaks in duct system. b. Main pressure set too high. c. Blower motor not energized. d. Loose belt e. Blower speed too low. f. Blocked/damaged venting system. g. Air distribution baffle removed (high temperature rise units only). h. Defective high limit switch. **2.** Main pressure set too low. **3.** Too much outside air. **4.** Thermostat malfunction. **5.** Gas controls wired incorrectly. **6.** Unit undersized.	**1.** a. Clean/correct duct system. b. Adjust to a maximum of 14" W.C. c. Check/correct to insure blower motor operates within 45 seconds of when gas controls are energized. d. Adjust belt tension. e. Check/correct blower drive settings for proper rpm. f. Check/correct venting system. g. Replace air distribution baffle. h. Replace high limit switch. **2.** Adjust main gas pressure. Minimum for Natural Gas — 6" W.C. Minimum for Propane Gas — 11" W.C. **3.** Adjust outside air damper to decrease outside air percentage (if possible). **4.** Check/replace thermostat. **5.** Check unit wiring against the wiring diagram. **6.** Check design conditions. If unit is undersized, an additional unit(s) or other heat source must be added.
Too Much Heat	**1.** Thermostat malfunction. **2.** Gas controls do not shut-off. a. Gas controls wired incorrectly. b. Short circuit. **3.** Main gas pressure set too high. **4.** Defective gas valve.	**1.** Check/replace thermostat. **2.** a. Check unit wiring against the wiring diagram. b. Check for loose or worn wires. **3.** Adjust to a maximum of 14" W.C. **4.** Replace gas valve.

① Automatic Reset High Limit

The duct furnace comes standard with an automatic reset high limit switch that will shut-off the gas should the discharge air temperature become excessive. See Figure 18.1, indicator (49) for the location of either the standard automatic or optional manual reset high limit switch. The switch should operate only when something is seriously wrong with the unit operation. Anytime the switch operates, correct the difficulty immediately or serious damage may result. If the switch cuts off the gas supply during normal operation, refer to the “Not Enough Heat” section of Service & Troubleshooting.

Figure 51.1 - Lifting Flame Condition

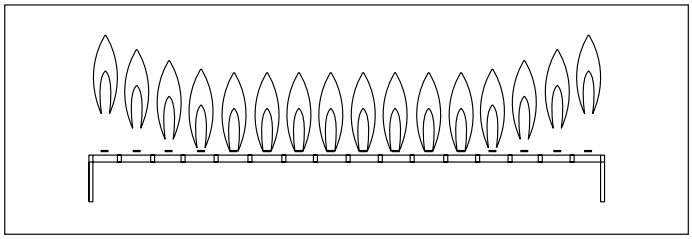


Figure 51.2 - Floating Flame Condition

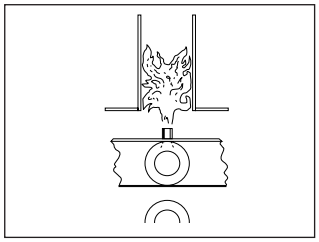
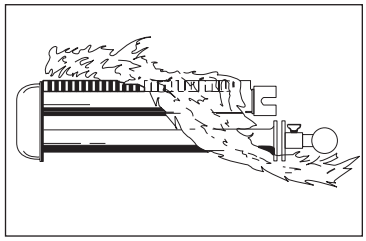


Figure 51.3 - Flame Rollout Appearance



MODEL DESIGNATIONS

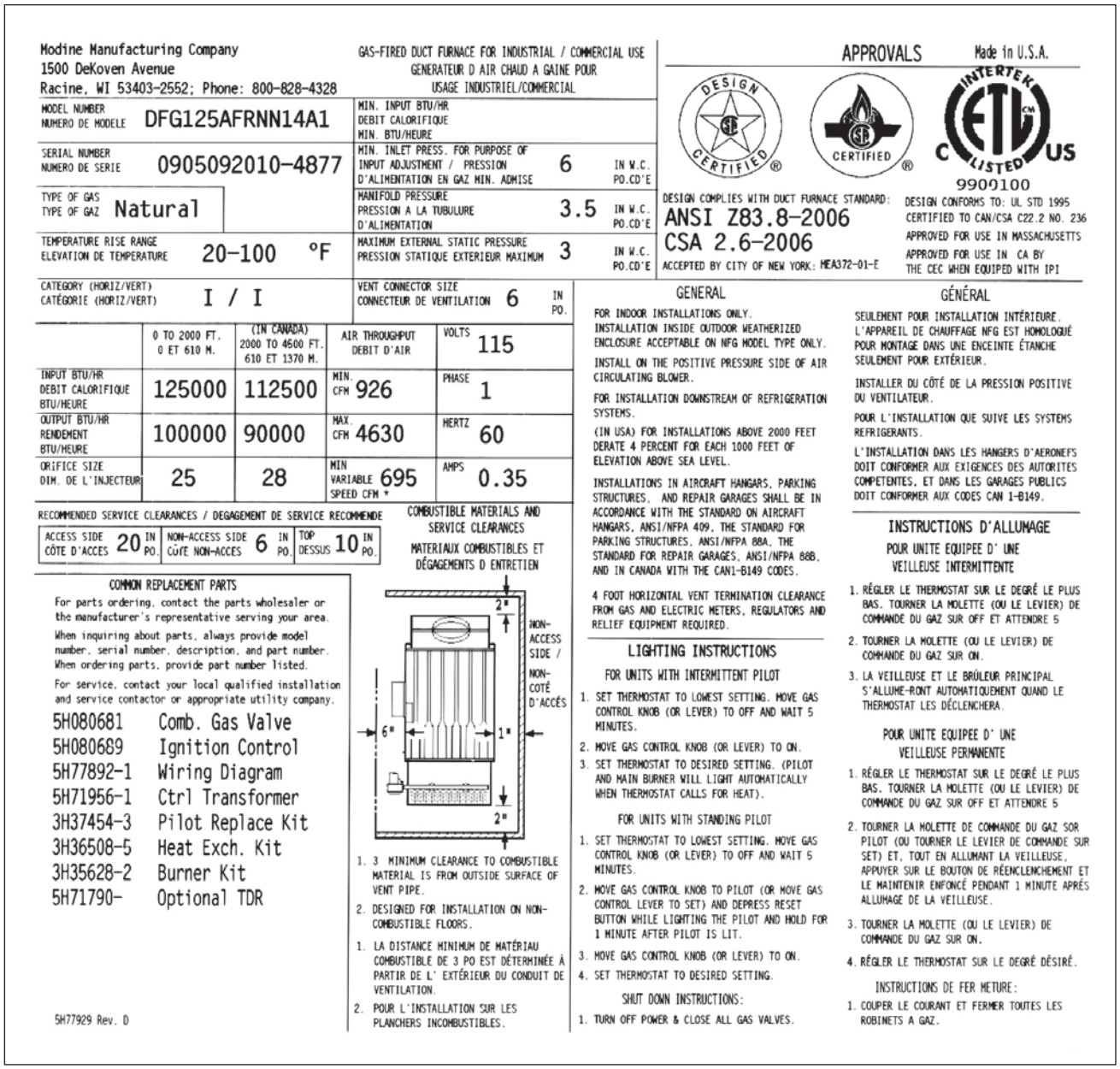
Model Identification

Duct furnace/make-up air units contain an CSA and ETL/ETL Canada certified indoor duct furnace. This duct furnace is combined with either a blower section or a blower and cooling section to make a complete make-up air or heating/ventilating/ cooling unit that is ETL/ETL Canada certified. For this reason, two identification plates are used on these models. The **Serial Plate** is used to identify the duct furnace and its components. The **Model Identification Plate** is used to identify the complete model, including blower and cooling sections.

Ordering

When servicing, repairing or replacing parts on these units, locate the model identification plate of the unit and always give the complete Model Number and Serial Number from the model identification plate. The model identification plate is located on the door of the electrical control box or on the side of unit. The part number for some common replacement parts are listed on the serial plate (See Figure 52.1) and the model identification plate (See Figure 53.1). For a complete description of the model number, see Model Identification.

Figure 52.1 - Serial Plate



MODEL DESIGNATIONS

Figure 53.1 - Model Identification Plate

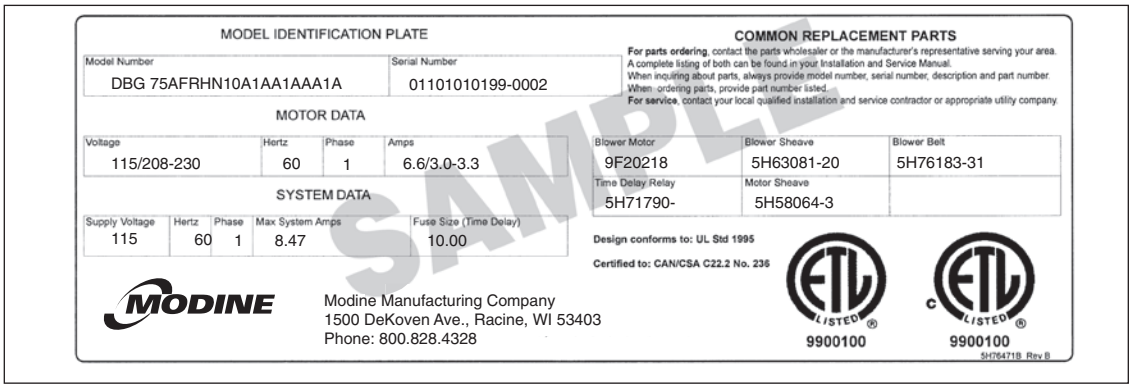


Figure 53.2 - Model DFG Serial Number Designations

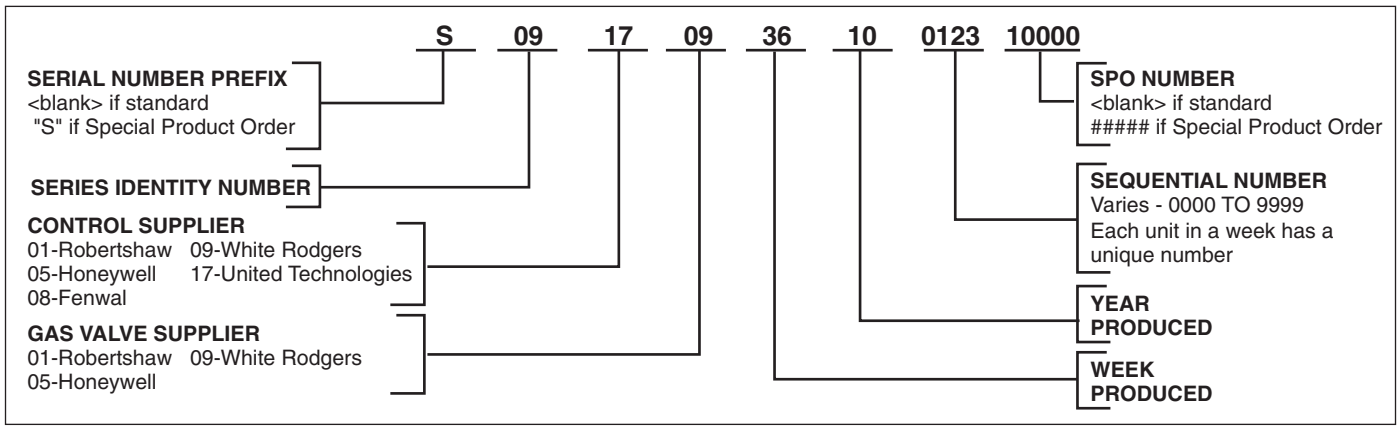
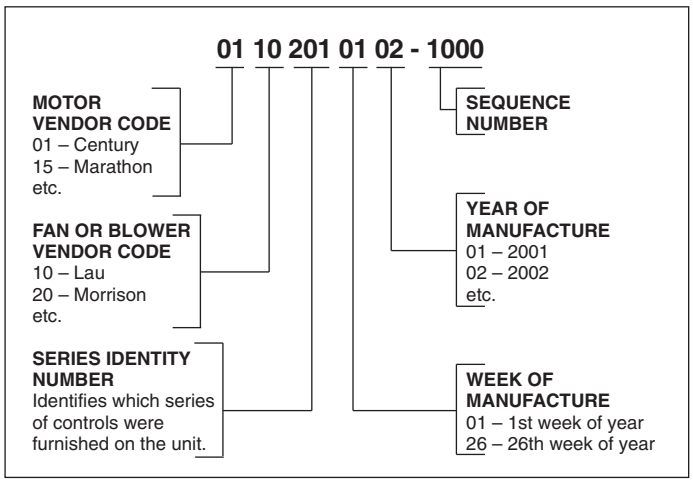


Figure 53.3 - Model DBG/DCG Serial Number Designations



START-UP CHECKLIST

INDIRECT GAS-FIRED HEATING EQUIPMENT

Job Name:	Date:
Address:	Model No.:
City & State:	Order No.:
Start-Up Check List "ALL ITEMS MUST BE CHECKED"	Serial No.:

1. All shipping straps, braces, tie downs removed?	____ Yes	___ No
2. Unit installed level and secure?	____ Yes	___ No
3. Gas burner properly located and aligned?	____ Yes	___ No
4. Blower and motor alignment okay?	____ Yes	___ No
5. Bearings aligned and tight on shaft/bearing supports?	____ Yes	___ No
6. Electrical connections checked and secure?	____ Yes	___ No
7. Gas piping checked and tightened if necessary?	____ Yes	___ No
8. Any visible damage to unit?	____ Yes	___ No
Describe: _____		
If damaged, was the damage repaired?	____ Yes	___ No
9. Air inlet and discharge checked for obstructions?	____ Yes	___ No
10. Bearings checked for proper lubrication?	____ Yes	___ No
11. Filters in place and correct to direction of air flow?	____ Yes	___ No
12. Belt tension checked?	____ Yes	___ No
13. Electric supply to unit: _____ Volts, _____ Hz, _____ Phase		
14. Gas supply to unit: _____ Natural, _____ Propane		
15. Gas supply pressure to unit: _____ " W.C., _____ PSIG		
16. Inlet and/or discharge dampers operating correctly?	____ Yes	___ No
17. Blower rotation correct?	____ Yes	___ No
18. Blower speed: Hi Speed _____ RPM, Lo Speed _____ RPM		
19. Motor speed: Hi Speed _____ RPM, Lo Speed _____ RPM		
20. Is unit noisy? Excessive vibration?	____ Yes	___ No
21. Motor voltage: L1 _____ V, L2 _____ V, L3 _____ V		
22. Motor amps: L1 _____ Amp, L2 _____ Amp, L3 _____ Amp		
23. High temperature limit control continuity checked?	____ Yes	___ No
24. Burner light off		
Low Fire: Does entire burner light off?	____ Yes	___ No
Hi Fire: Burner pressure reading? _____ " W.C.		
Is flame clean and stable?	____ Yes	___ No
Does flame modulate in response to temperature control(s)?	____ Yes	___ No
25. Gas input checked?	____ Yes	___ No
Input at maximum firing rate: _____ Btu/Hr		
Input at minimum firing rate: -_____ Btu/Hr		
26. Gas piping checked for and free of leaks?	____ Yes	___ No
27. Has wiring been verified to match the unit wiring diagram?	____ Yes	___ No
28. Have all the modes of the sequence of operation been verified and tested?	____ Yes	___ No
29. What optional and/or accessory control devices have been set?		
Device: _____ Setting: _____ (°F/psi/Inches W.C./etc.)	____ Yes	___ No
Device: _____ Setting: _____ (°F/psi/Inches W.C./etc.)	____ Yes	___ No
Device: _____ Setting: _____ (°F/psi/Inches W.C./etc.)	____ Yes	___ No

Customer/Owner instructed in operation and maintenance of unit? ____ Yes ___ No

Name of Person(s) Instructed: _____

Comments: _____

_____

Start-Up Company Name: _____ Phone: _____

Signature: _____ Date: _____

MODEL NOMENCLATURE FOR SYSTEM UNITS

Indoor Duct Furnace Model Nomenclature

1	2	3	4 5 6	7	8	9	10	11	12	13	14	15	16	17	18	19	20 21	22	23
PT	UC	V	MBH	HE	DS	AS	ATR	GT	GV	SS	SV	TR	BB	HP	MT	SA	AC	EC	CC

1 - Product Type (PT)
D - Indoor HVAC Unit

2 - Unit Configuration (UC)
B - Blower Package - Furnace & Blower
C - Cooling Package - Furnace, Blower, & Cooling Coil Cabinet

3 - Venting (V)
G - Gravity

4,5,6 - Furnace Input Rating (MBH) (Output on 840 & 960)
100 - 100,000 Btu/Hr Input
175 - 175,000 Btu/Hr Input
250 - 250,000 Btu/Hr Input
400 - 400,000 Btu/Hr Input
500 - 500,000 Btu/Hr Input
600 - 600,000 Btu/Hr Input
840 - 1,050,000 Btu/Hr Input
960 - 1,200,000 Btu/Hr Input

7 - Heat Exchanger/Burner/Drip Pan Material (HE)
A - Aluminized Steel
S - 409 Stainless Steel Heat Exchanger/Burner
T - 409 Stainless Steel Heat Exchanger/Burner/Drip Pan

8 - Development Sequence Designation (DS)
F - Single Stage
M - 2-stage or Modulating

9 - Access Side (AS)
R - Right Hand
L - Left hand

10 - Air Temperature Rise (ATR)
H - High 60°-100°F

11 - Gas Type (GT)
N - Natural with ignition controller
P - Propane with ignition controller

12 - Gas Valve (GV)
1 - Single Stage
2 - Two Stage
4 - Electronic Modulation
5 - Electronic Modulation Master
6 - Electronic Modulation Slave
7 - Electronic Modulation 0-10 Vdc External Input
8 - Electronic Modulation 4-20 mA External Input

13 - Additional Safety Switches (SS)
4 - No Switches (Standard)
0 - No Switches (Premium)
1 - Low Gas Pressure Switch (Premium)
2 - High Gas Pressure Switch (Premium)
3 - High and Low Gas Pressure Switch (Premium)

14 - Supply Voltage (SV)
A - 115/60/1
B - 208/60/1
C - 230/60/1
D - 208/60/3
E - 230/60/3
F - 460/60/3
G - 575/60/3

15 - Transformer (TR)
1 - 40 VA
2 - 75 VA
3 - 150 VA
4 - 250 VA
0 - None

16- Blower Size & Bearing Type (BB)
A - 9-7 Spider Bearings
B - 9-7 Pillow Block Bearings
C - 9-9 Spider Bearings
D - 9-9 Pillow Block Bearings
E - 12-12 Spider Bearings
F - 12-12 Pillow Block Bearings
G - 15-15 Spider Bearings
H - 15-15 Pillow Block Bearings
I - 18-18 Spider Bearings under 15 Hp
J - 18-18 Pillow Block Bearings under 15 Hp
K - 18-18 Pillow Block Bearings for 15 Hp & up
L - 20-18 Pillow Block Bearings

17- Motor Horsepower (HP)
A - 1/3 Hp
B - 1/2 Hp
C - 3/4 Hp
D - 1 Hp
E - 1-1/2 Hp
F - 2 Hp
G - 3 Hp
H - 5 Hp
I - 7-1/2 Hp
J - 10 Hp
K - 15 Hp
V - 20 Hp
L - 1/3 Hp with Motor Starter
M - 1/2 Hp with Motor Starter
N - 3/4 Hp with Motor Starter
P - 1 Hp with Motor Starter
Q - 1-1/2 Hp with Motor Starter
R - 2 Hp Hp with Motor Starter
S - 3 Hp with Motor Starter
T - 5 Hp with Motor Starter
W - 7-1/2 Hp with Motor Starter
X - 10 Hp with Motor Starter
Y - 15 Hp with Motor Starter
Z - 20 Hp with Motor Starter

18- Motor Type (MT)
1 - ODP
2 - ODP - High Eff.
3 - ODP, 1800/900 RPM
4 - ODP, 1800/1200 RPM
5 - TE
6 - TE - High Eff.
7 - TE, 1800/900 RPM
8 - TE, 1800/1200 RPM

19- Sheave Arrangement (SA)
A - (See Sheave Tables 34.1 to 35.5)

20,21 - Air Control (AC)
AA - RA Opening
BA - FA Opening
CA - FA & RA Openings
DA - FA Dampers w/ 2 pos motor (No RA)
EA - FA & RA Dampers w/ 2 pos motor
EQ - ASHRAE Cycle I - ("EA" with Warm-up Stat)
FA - FA Damper & RA Opening w/ 2 pos motor
GA - FA & RA Mod motor w/ 0-10 Vdc External Input
GB - FA & RA Mod motor w/ 4-20 mA External Input
GC - FA & RA Mod motor w/ Minimum Position
GD - FA & RA Mod motor w/ Remote Position (On Remote Panel)
GE - FA & RA Mod motor w/ 3 pos. damper (100% RA, Variable, 100% OA)
GF - FA & RA Mod motor w/ A350P Proportional Temp Controller
GG - FA & RA Mod motor w/ Minimum Position & Prop. Temp Controller
GH - FA & RA Mod motor w/ Remote Position & Prop. Temp Controller
GJ - FA & RA Mod motor w/ FA Enthalpy Controller
GK - ASHRAE Cycle II - ("GG" with Warm-up Stat)
GM - ASHRAE Cycle II - ("GH" with Warm-up Stat)
GN - ASHRAE Cycle III - ("GF" with Warm-up Stat)
HP - FA & RA Floating motor w/ Space Pressure Controller
JA- Manual FA & RA Dampers
KA - Manual FA Damper with Return Air Opening

22 - Evaporative Cooling (EC)
0 - None

23 - Cooling Coil (CC)
0 - None
1 - Factory Installed Coil

COMMERCIAL 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.

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 COMPONENT WHICH SHALL, WITHIN THE APPLICABLE WARRANTY PERIOD DEFINED HEREIN AND UPON PRIOR WRITTEN APPROVAL, 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.

These warranties are issued only to the original owner-user and cannot be transferred or assigned. No provision is made in these warranties for any labor allowance or field labor participation. Seller will not honor any expenses incurred in its behalf with regard to repairs to any of Seller's products. No credit shall be issued for any defective part returned without proper written authorization (including, but not limited to, model number, serial number, date of failure, etc.) and freight prepaid.

OPTIONAL SUPPLEMENTAL WARRANTY

Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years on certain compressors. Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years or nine (9) years on certain heat exchangers.

EXCLUSION OF CONSUMABLES & CONDITIONS BEYOND SELLER'S CONTROL

The above referenced warranty shall not be applicable to any of the following items: refrigerant gas, belts, filters, fuses and other items consumed or worn out by normal wear and tear or conditions beyond Seller's control, including (without limitation as to generality) polluted or contaminated or foreign matter contained in the air or water utilized for heat exchanger (condenser) cooling or if the failure of the part is caused by improper air or water supply, or improper or incorrect sizing of power supply.

Component Applicable Models	**"APPLICABLE WARRANTY PERIOD"**
Heat Exchangers Gas-Fired Units except PSH/BSH	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
Heat Exchangers Low Intensity Infrared Units **Compressors** Condensing Units for Cassettes	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 SIXTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
Burners Low Intensity Infrared Units **Other** Components excluding Heat Exchangers, Coils, Condensers, Burners, Sheet Metal	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
Heat Exchangers/Coils Indoor and Outdoor Duct Furnaces and System Units, PSH/BSH, Steam/Hot Water Units, Oil-Fired Units, Electric Units, Cassettes, Vertical Unit Ventilators **Compressors** Vertical Unit Ventilators **Burners** High Intensity Infrared Units **Sheet Metal Parts** All Products	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

As Modine Manufacturing Company has a continuous product improvement program, it reserves the right to change design and specifications without notice.

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