



**Application Manual
for
Mechanical Venting of Fireplaces, Stoves,
BBQ's and Pizza Ovens**

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INTRODUCTION

The primary aim of this application manual is to provide more detailed guidance on mechanical venting of wood-fired appliances than can be found in the codes or in the appliance manufacturers' instructions. It is intended for the convenience and assistance of contractors, chimney sweeps, building inspectors, architects, engineers, and others concerned with the correct installation and configuration of EXHAUSTO Chimney Fans.

The manual contains extensive information about chimney problems, how they can be solved, how to analyze and calculate fireplace chimney systems. It also contains information about how to adapt chimney fans for different applications.

Finally, for those who have an interest in a theoretical approach, the manual's appendix contains relevant theory regarding fireplace chimney systems.

On the other hand, a chimney fan can be used on any type stack or chimney flue because it does not pressurize anything.

There seems to be no doubt that mechanical venting will be a part of many venting installations in the future. In Europe, mechanical venting is a growth area and we see the same trend here for commercial applications as well as for residential applications.

Definition of Mechanical Venting

While used for decades in Europe, mechanical venting of fireplaces and stoves is relatively new in USA. Building codes, ANSI and NFPA standards hardly mention "mechanical venting". And, when mechanical venting is mentioned it is referred to as "draft inducing", which leads to "draft inducing equipment".

"Draft inducer" has become trade name for a paddle-wheel fan that is inserted into the flue between the appliance outlet and the chimney termination.

There is still a misconception about mechanical venting. Many professionals still don't understand the difference between draft inducers and chimney fans. These are our definitions that should explain the major differences:

Draft Inducer: "A fan or ventilator that is installed between the appliance outlet and the chimney termination. The draft inducer creates a negative pressure on the inlet side and a positive pressure on the outlet side."

Chimney Fan: "A fan or ventilator that is installed at the chimney termination. The chimney fan creates a negative pressure in the entire chimney system".

Obviously, by pressurizing the flue the draft inducer can not be used in any stack or chimney flue that is exposed to living quarters. Using an in-line draft inducer almost always creates problems with warranties provided by stack and chimney manufacturers, and if the chimney system is listed the installation of a draft inducer will definitely void the listing. Further, the draft inducer is neither made nor designed for use in a dirty environment with creosote.

SECTION 1: SMOKE - PROBLEMS & CAUSES

Chimney Performance

The most important part of a woodburning system is the chimney, and to work properly it must safely exhaust the product of combustion and at the same time draw enough oxygen into the appliance to maintain combustion.

Chimneys operate on the simple principle that warm air rises because it has a lower density than cold air. Warmer flue gases in the chimney create a pressure difference called draft and the rising gases create a partial vacuum at the bottom of the chimney and at the appliance.

What's known as "draft problems" are actually chimney performance problems and are seldom caused by inadequate draft. They are more often caused by poor design and operational problems caused by the chimney itself.

There are two major factors to consider when working with chimneys: draft and flue gas volume (or flow). Draft is the force which causes the gases to be exhausted. The flue gas volume is the amount of gases which pass through the system as a result of the draft.

The sizing of a chimney should be based on the flow requirement, as any chimney size has a certain capacity in regards to the appliance it is serving.

Two major factors influence the chimney capacity: draft and flow resistance. Flow resistance is a result of friction, and always exists between the moving gases and the flue through which they flow. Even straight walls represent flow resistance, but of course bends, turns, shape of the flue etc. are more restrictive.

For a system to work properly, the draft **MUST** exceed the flow resistance. Otherwise the flow is reversed in the system.

Chimney Performance Problems

The principles for flow and draft apply to all heating appliances, but there are some differences to be aware of.

Open heaters (open fireplaces, BBQ's) require a large chimney capacity, as they exhaust a relatively large volume of flue gases, because of the speed at which the combustion takes place. As a result, they also draw plenty of room air, which lowers the average flue gas temperature, which lowers the average chimney temperature, which again reduces the draft.

Closed heaters (stoves, fireplace inserts, ovens, etc.) burn more slowly, and thus produce less exhaust. The flow of air for combustion is restricted by the

relatively small inlets, and therefore the draft must be strong.

These are some typical performance problems:

■ The chimney flue is too small.

A chimney may be severely restricted if the inner diameter of the flue is too small. This situation often occurs when a chimney is re-lined, and the flue opening thereby is reduced.

In this situation, the velocity of the flue gases reaches a point where the flow resistance is so substantial that the flow resistance exceeds the draft.

A rule of thumb for maximum velocity is 1,800 FPM in the flue.

It is common belief that the actual area of a chimney flue determines the capacity of the chimney. The shape of the flue is also important when determining the required area.

An 8"x12" flue has an area of 96 sq.in., while an 8" round flue has an area of 50 sq.in., or roughly 50% of the capacity of the 8"x12" flue.

However, the corners in a rectangular duct are counter-productive and add to the resistance.

An alternative to just calculating the area of the flue opening of the rectangular flue is to use the area of the largest round flexible tube that can be inserted. (this is meant as a guideline and has nothing to do with the size liner that can be installed. In technical term this is referred to as the "hydraulic diameter").

Refer to Appendix B, pg. 25: "Conversion of Rectangular Flues".

■ The chimney flue is too large

While increasing flue size increases the capacity of a chimney by reducing the flow resistance, it will decrease draft. Gases move more slowly in a large flue, and will maintain a lower average temperature since they have more time to cool.

Extreme cooling can offset the gain in capacity and could even lead to a net decrease in draft.

This phenomena is typical where a stove or fireplace insert is connected to a chimney that was originally sized and designed for an open fireplace. Closed heaters require smaller flues.

■ The chimney is too short.

There is a better draft in a tall chimney than in a

short chimney. Chimney height and the temperature difference between the average flue gas temperature of the outside air are the major factors influencing the amount of draft.

A rule of thumb for minimum height states that the total system height (from the floor the appliance is mounted on to the top of the chimney) should never be less than 15 feet.

■ **The chimney is too high.**

Increasing the height of a chimney increases the draft. Realistically, draft does not increase in direct proportion to the increased height. At some point, additional height gives the flue gases more time to transfer heat to the flue walls and cool off. This will cause a reduction in the available draft.

If a system meets the recommended minimum chimney height and draft problems are experienced, it may have no or little effect to extend the chimney.

Combined with a flue that is too small, additional chimney height can create extreme problems, that can only be solved mechanically.

■ **The chimney is installed on an outside wall.**

If one or more sides of the chimney is part of an external wall, the chimney is exposed to the outside cold. This chilling effect will reduce the available draft of the chimney, and it can be so bad that the exhaust gas is not able to create any draft at all. This is especially true if the chimney is not insulated.

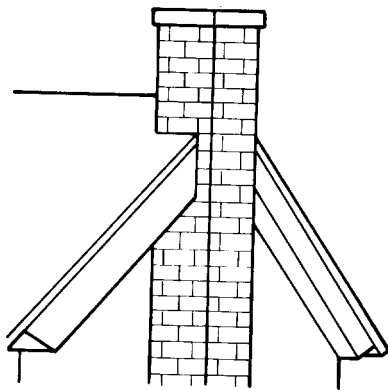


Fig. 1

■ **Stack effects**

During cold weather, a house can create exactly the same "draft" effect as a chimney. The taller the house, the more stack effect.

Two- or three storey houses and buildings can produce quite a substantial "draft" that can overcome the chimney draft and cause reversed flow in the

chimney.

This phenomena can cause what is called the "Cold-Backdraft-at-Standby" Syndrome. The negative pressure created by the stack effect will cause a fireplace or wood stove in a basement to backdraft, so it can be difficult, if not impossible, to start a fire. If the chimney is located on an outside wall and subject to cooling effects, it is most likely not possible to use the fireplaces.

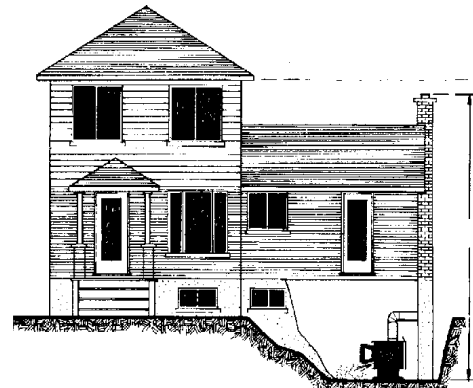


Fig. 2

■ **Downdraft/Backdraft.**

Downdraft is one of the most common problems, and often a periodical problem.

In most cases, the backdraft is caused by tall trees or buildings close to the chimney. This influences wind directions and pressures surrounding the building and can give "back puffs" in the chimney. On some occasions a chimney can have perfect draft for years and then suddenly after f.inst. 10 years, surrounding trees have grown and reached a height that affects the chimney draft.

It could also be the location of the house that causes the problem. A house in a valley or on a hill is more likely to have downdrafting problems. The wind can be very turbulent in these locations and often cause a downward pressure in the chimney.

The height of the chimney can often be blamed for the downdraft. Even if the chimney meets minimum height requirements in regards to height above the roof line, it could still be too short to avoid the effects of the turbulence.

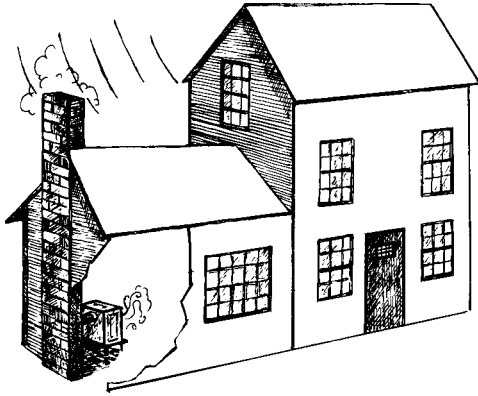


Fig. 3

■ Bad fireplace design

Not only the chimney, but also the fireplace, stove or other appliances may cause smoke to be omitted into the room. Here are some typical problems:

The fireplace opening may be oversized for the chimney. Normally the area of the opening should not exceed 10-12 times the flue area.

The lintel could be too wide. The width should not be greater than 4".

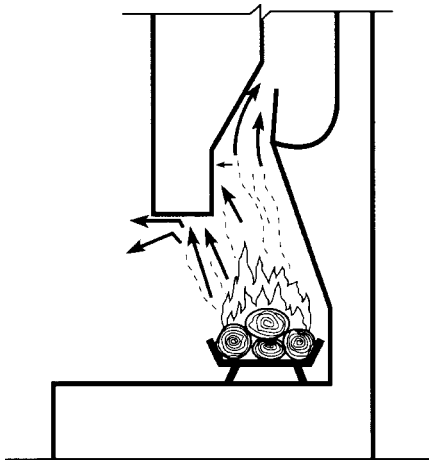


Fig. 4

The smoke chamber could be too short. It should not be less than 18" high. Or it could be asymmetrical with a flue that is not centered.

Excessive projections from the damper, sharp angles in the masonry or anything else working against an aerodynamic smoke chamber or throat design.

Among critical fireplaces are the so called "Walk-In" fireplaces (very big fireplaces), and free-standing fireplaces open on all sides. These fireplaces must capture

the air in the same way as an exhaust hood, which requires a really good draft in order to maintain a high velocity over the fireplace opening.

Finally, there is the see-through fireplace, that is open on two sides. A high percentage of this type of fireplace have draft problems, and problems with turbulence in the firebox. Very often this is caused by a flue that is too small, a bad aerodynamic design of the smoke chamber, the non-existence of same - or, a combination of all.

Most problems are created when a regular one-sided fireplace is converted into a see-through fireplace by knocking the back-wall out and design an opening.

■ Modern insulation of dwelling

When houses are efficiently insulated there is usually not sufficient air for combustion. Very often make-up air vents do not exist resulting in air starvation, and under these conditions there simply is no draft available.

Air starvation can only be overcome by induced draft, but at the same time it should be considered to install make-up air vents. Other appliances using air for the combustion, like fireplaces, furnaces, water heaters etc. can also cause smoking fireplaces.

■ Ventilation

Modern buildings have an increasing number of exhaust fans pulling air out of the building. They can be found in kitchens and bath-rooms, but also central vacuum-cleaners, dryers and more can pull air out.

The buildings will soon be operating in a depressurized mode - the positive pressure is outside and the negative inside the building. The result is that outside air is pulled into the building through openings and cracks, and the chimney is very often the best vent!

The situation is aggravated in restaurant kitchens. Woodfired appliances, like fireplaces, BBQ's and pizza ovens, can be severely affected by kitchen exhaust fans, even when these are well balanced.

SECTION 2: APPLICATIONS FOR THE CHIMNEY FAN

Uses for the chimney fan.

The EXHAUSTO Chimney Fan is designed to cope with the majority of draft problems, whether these are related to the chimney design, the fireplace design, the building design or weather and wind.

The EXHAUSTO chimney Fan can be installed on brick chimneys - lined or un-lined - as well as steel chimneys, whether single, double or triple walls or insulated.

While the chimney fan will make most systems work and solve draft and smoke problems, it must be emphasized that the chimney fan does not correct a problem. For example, it will not "repair" a crack (cracks should always be repaired) in the flue tile, or enlarge an under-sized flue.

What the chimney fan is doing is making impossible situations possible. To use above examples, it will assure air is pulled into the flue instead of flue gases going out through the cracks, and it will enable the use of an undersized flue by creating mechanical draft to overcome the resistance.

Typical Applications.

These are typical applications where chimney fans could be used:

■ Chimney is too low.

The chimney fan will make up for the insufficient draft which is a result of a chimney that is too short.

■ Chimney is too high.

The chimney fan will create the necessary draft caused by insufficient flue gas temperature (less draft) or excessive height (increased resistance).

■ Flue is too small.

The chimney fan will create additional draft to overcome the added restriction caused by a flue that is too small.

■ Flue has been relined.

It is comparable to the situation where the flue is too small.

■ The flue is too large.

The chimney fan will create additional flow in the chimney to make up for the insufficient draft caused by insufficient flue gas temperature.

■ Stack effects.

Due to the existence of mechanical draft, the reverse draft/flow in the chimney is prevented. Even cold starts will now be possible.

■ Downdraft/backdraft situations.

These problems are normally caused by the location of the building and chimney, trees around the building etc. The chimney fan will prevent the problems to occur because the draft it can create, is a lot more powerful than the natural draft. Since the fan is installed on the top of the chimney, the fan also prevents backdraft caused by eddies (turbulence).

■ Depressurization.

In most cases, the chimney fan can easily overcome the negative pressure in a building that causes the fireplace to backdraft. It is important to remember, however, to make sure that a furnace or a water heater installed in the same building, still works properly after the chimney fan is installed. Installation of spill switches on these appliances is highly recommended.

SECTION 3: TECHNICAL DATA & SPECIFICATIONS

Technical Description

The EXHAUSTO chimney fan is a special designed high temperature fan with horizontal discharge. It is ETL-listed (UL Standard 378 for Draft Equipment).

The chimney fan is mounted on the top of the chimney and creates a negative pressure in the entire chimney or stack. This eliminates the risk of chimney spillage with dangerous gases, like carbon monoxide.

Further the fan reduces the creosote build-up dramatically and ensures an optimal combustion in fireplaces, stoves, inserts, boilers, furnaces, water heaters, etc.

The fan is made of cast aluminum and is extremely resistant to corrosion. The chimney fan is equipped with axial vanes made of stainless steel, and can withstand exhaust gases and warm air up to max. 650°F (max. 300°C.). The design of the vanes assures a minimum soot or creosote built-up on the fan base.

The top of the chimney fan is hinged to the base, which eases service and cleaning of the chimney.

The motor is a split-capacitor type constructed by EXHAUSTO to withstand high flue gas temperatures. It has thermal overload protection and is virtually maintenance free with pre-lubricated sealed ball bearing.

The motor is completely enclosed and protected

from rain, water, snow, soot, dust etc. It is balanced to assure a very low noise level and vibration-free use.

The chimney fan as an obstruction.

Installed on the chimney flue termination, the chimney fan could be considered a restriction to the flow.

However, the design of the fan assures a relatively low restriction and lower than most chimney caps!

As a safety-listed product, the chimney fan has been tested to a resistance factor (k-value) of 0.5, which is comparable to a 45° elbow.

Any type of chimney cap is definitely a restriction, but some more than others. Non-listed chimney caps add the most resistance to the chimney flue. As the inlet is generally the same size as the flue, the resistance factor (k-value) could easily exceed that of a 90° elbow.

A UL-listed low resistance chimney cap is usually rated at a resistance factor of 0.5, but they are also aerodynamically designed to safely convey the flue gases.

The EXHAUSTO chimney fan is only a minor resistance to the chimney flue (less than most chimney caps) provided the fan size is selected properly.

However, a fireplace that had smoke problems prior to the installation of an EXHAUSTO chimney fan, will still have smoke problems if the fan is not operating.

Dimensions & Electrical Data

Model	RS 9	RS 12	RS 14	RS 16
Discharge	Horizontal			
Type	Axial Vane			
RPM	1600			
Voltage	1 x 120V			
Amps	0.5	1.2	1.4	3.9
Watts (output)	25	80	100	250
Weight (lbs)	29	37	47	61
A (in)	12	14	16	19
B (in)	10	11	13	16
C (in)	11	14	16	18
D (in)	3	4	4	4
E (in)	8	11	12	14

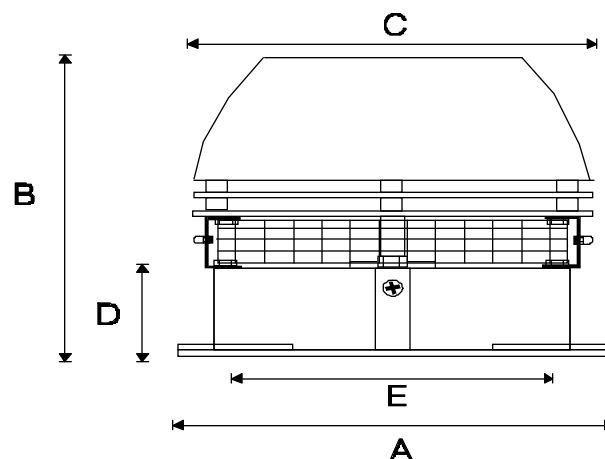


Fig. 5

Capacity Charts

t = 68°F

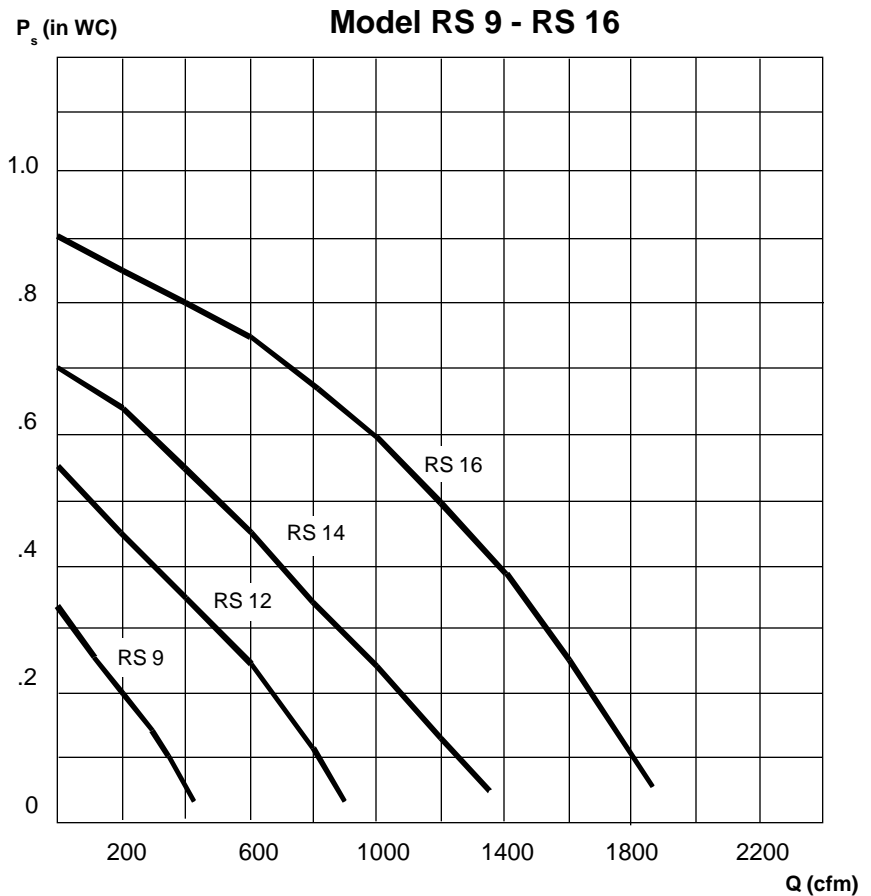
Density = 0.075 lbs/cu.ft.

Ps = Static Pressure

n = 1600 RPM

The models were tested on the following duct sizes:

RS 9	8"
RS 12	10"
RS 14	12"
RS 16	16"



Sound Diagram

Model	Lw dB							Lp dB(A)
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
RS 9	54	50	47	43	38	31	25	21
RS 12	64	60	55	52	48	42	34	30
RS 14	75	69	65	62	57	51	44	41
RS 16	81	76	72	69	64	58	52	47

Tolerance +/- 3 dB

Lw = Sound Power Level dB

Lp = Sound Pressure Level dB(A) in 10 meter/
30 feet distance from the fan.

Note: A sound power level of 30 dB is comparable to a voice - very soft whisper.
70 dB is comparable to a voice - conversational level.

Lp (5 meter/15 feet) = Lp (10 meter/30 feet) + 6 dB

Lp (20 meter/60 feet) = Lp (10 meter/30 feet) - 6 dB

SECTION 4: HOW TO SELECT CHIMNEY FAN

There are two ways to determine the chimney fan type and size for a specific application.

One alternative is to calculate the flue gas volume and the flow resistance and then select a chimney fan that meets the calculated requirements. This is normally referred to as an "engineered system". For directions on how to do a manual calculation, please refer to Appendix A.

However, most applications are relatively simple and are covered by the selection charts on page 11 and 12.

The selection charts are based on the following assumptions:

Height of chimney: 15-30 ft.

Flue gas temperature (fuel):

Wood: 300°F

Natural Gas: 200°F

Frontal inlet velocity:

Fireplaces (wood) 48 FPM

Fireplaces (gas) 36 FPM

See-through (wood) 72 FPM

See-through (gas) 54 FPM

Free-standing 96 FPM

Stoves 72 FPM

Pizza ovens 84 FPM

Fireplaces

The **first step** is to determine the area of fireplace opening. Follow these directions:

One-sided:

Determine the fireplace opening area by multiplying width "A" and height "B" (all measures in *inches*).

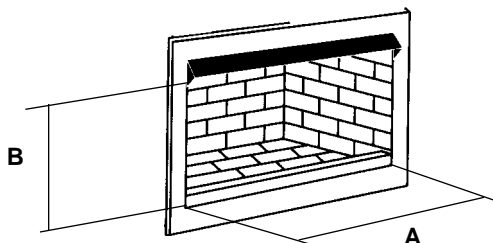


Fig. 6

Two-sided (See-through):

Multiply the height "B" by the width "A" to find the area of the opening on one side. Add 50% (multiply the area by 1.5) and use this adjusted area to find the appropriate column.

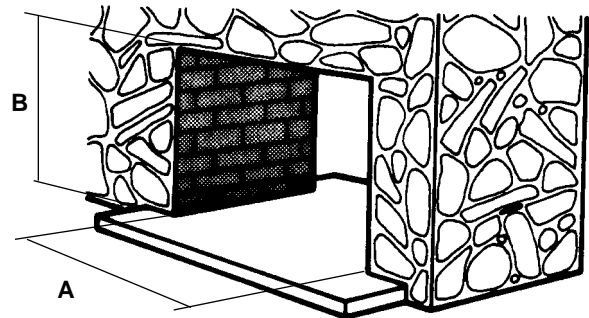


Fig. 7

Three-sided (corner installation):

To determine the area of a three-sided fireplace, find the length of diagonals, "A" and "B". Add "A" and "B" and multiply the sum by "C" (all measures in *inches*).

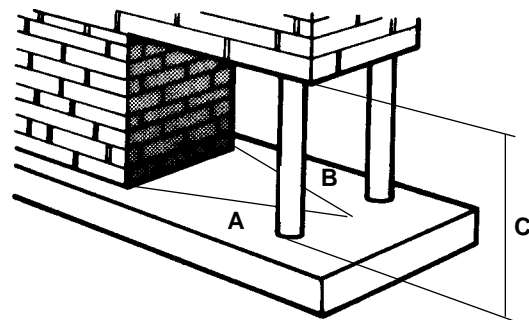


Fig. 8

Free-standing (open all around)

Measure the width "A" and the depth "B" of the hood. Multiply "A" and "B" and add 50% (multiply the area by 1.5).

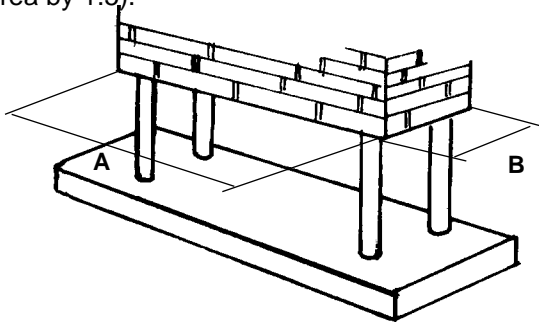


Fig. 9

If the free-standing fireplace is round, measure the diameter, D, and calculate the area by using this formula:

$$\text{Area} = D \times D \times .7854$$

and add 50% (multiply the area by 1.5).

The **second step** is to determine the size of the flue opening. If the flue is rectangular, refer to Appendix C on how to convert a rectangular flue to a round flue.

The **third step** is to make sure there are no more than two 90° bends, and the chimney height is min. 10 feet and does not exceed 30 feet. If you exceed these limits, you may need to use a stronger fan.

The **fourth step** is to cross reference the opening and the flue size in order to determine which size fan to use.

Stoves and fireplace inserts

Determine the area of the door opening by multiplying "A" and "B". The chart on page 12 shows the size

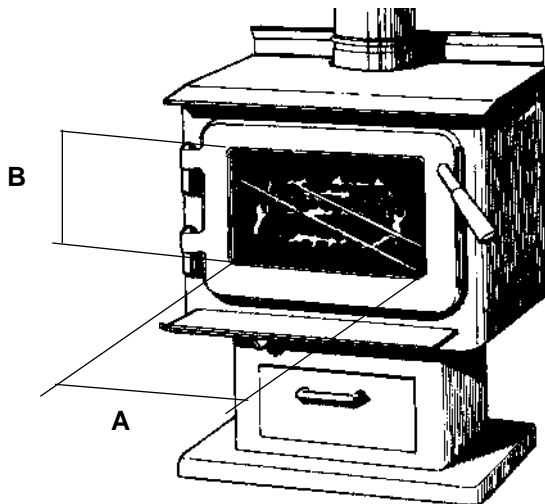


Fig. 10

fan to use.

Wood-fired Pizza Ovens

Determine the area of the door opening by multiplying the measures "A" and "B" and the flue size (all measures in *inches*). Cross reference this information for selection of the appropriate chimney fan. The fan selection is based on max. 1/10"W.C. negative room pressure.

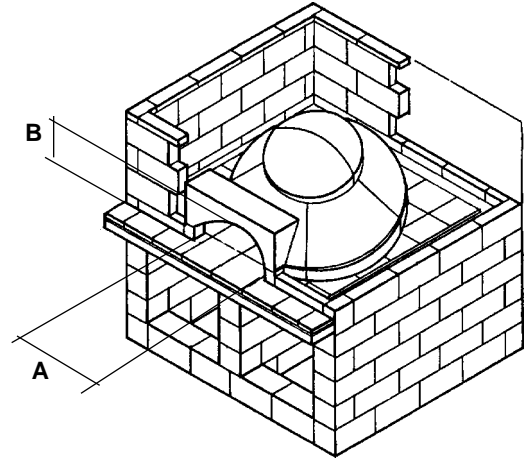


Fig. 11

If the application experiences more than the allowed negative pressure, even if it is only temporary, select one size larger chimney fan.


Other Applications


If you need a chimney fan for an application that is not covered by the charts or if you are not sure about what's needed for your applications, please contact EXHAUSTO at 1-800-255-2923, and we will be happy to assist you dimensioning the chimney fan.

Fan Selection Tables for Fireplaces



NB. If your flue size is not found in the flue size column, always use the closest flue size with the largest fan.

Example. Your opening is 750 sq.in and your flue size is 9". An 8" inch flue requires a model RS12, while a 10" flue requires a model RS 9. For a 9" flue, use a model RS12.

Flue Size	Fireplaces (wood-fired) 							
	Fireplace Opening (sq.in.)							
	Max. 500	Max. 800	Max. 1,200	Max 1,900	Max. 2,500	Max. 3,500	Max. 5,000	Max. 6,000
6	RS 9	RS 14	*	*	*	*	*	*
7	RS 9	RS 12	RS 16	*	*	*	*	*
8	RS 9	RS 12	RS 14	RS 16	*	*	*	*
10	RS9	RS 9	RS 12	RS 14	RS 16	RS 16	RS 16	*
12	RS 9	RS 9	RS 12	RS 14	RS 16	RS 16	RS 16	*
14	RS 12	RS 12	RS 12	RS 12	RS 16	RS 16	RS 16	*
16	RS 12	RS 12	RS 12	RS 12	RS 16	RS 16	RS 16	*
18	RS 12	RS 12	RS 12	RS 12	RS 16	RS 16	RS 16	*
20	RS 12	RS 12	RS 12	RS 12	RS 16	RS 16	RS 16	*
22	RS 12	RS 12	RS 12	RS 12	RS 16	RS 16	RS 16	*

Flue Size	Fireplaces (gas-fired) 							
	Fireplace Opening (sq.in.)							
	Max. 500	Max. 800	Max. 1,200	Max 1,900	Max. 2,500	Max. 3,500	Max. 5,000	Max. 6,000
6	RS 9	RS 12	RS 14	*	*	*	*	*
7	RS 9	RS 12	RS 14	*	*	*	*	*
8	RS 9	RS 9	RS 12	RS 16	*	*	*	*
10	RS9	RS 9	RS 12	RS 12	RS 14	RS 16	RS 16	*
12	RS 9	RS 9	RS 12	RS 12	RS 14	RS 16	RS 16	*
14	RS 12	RS 12	RS 12	RS 12	RS 14	RS 16	RS 16	*
16	RS 12	RS 12	RS 12	RS 12	RS 14	RS 16	RS 16	*
18	RS 12	RS 12	RS 12	RS 12	RS 14	RS 16	RS 16	*
20	RS 12	RS 12	RS 12	RS 12	RS 14	RS 16	RS 16	*
22	RS 12	RS 12	RS 12	RS 12	RS 14	RS 16	RS 16	*

Fan Selection Tables for Stoves and Fireplace Inserts

Flue Size	Stoves	Fireplace Inserts	Pizza Ovens *)
			
	Door Opening (sq.in.)		
	Max. 300	Max. 300	Max. 300
6	RS 9	RS 9	RS 9
7	RS 9	RS 9	RS 9
8	RS 9	RS 9	RS 12
9	RS 9	RS 9	RS 12
10	RS 9	RS 9	RS 12
12	RS 12	RS 12	RS 14

*) For the sizing in conjunction with a wood-fired pizza oven a negative pressure of 1/10" W.C. has been taken into consideration as most of these ovens are used in kitchens with exhaust fans.

SECTION 5: INSTALLATION INSTRUCTIONS

Installation of the Chimney Fan

The installation of the chimney fan is estimated to take an average of 15 minutes, when installed on a brick chimney or a steel chimney. The installation time does not include: setting up ladder, lifting fan to the top of the chimney, cutting back flue tile etc. Only the installation of fiber mat, mounting brackets, steel chimney adaptor, safety wire, and junction box is included.

Open the carton and remove all packing materials.

The standard chimney fan package includes: chimney fan w. bird screen, 3-4 ft cable in conduit, weatherproof junction box (not shown), fiber mat, safety wire with anchor, Installation brackets (set of 4), motor speed control (not shown), Installation Instructions and a Warranty Registration Card.

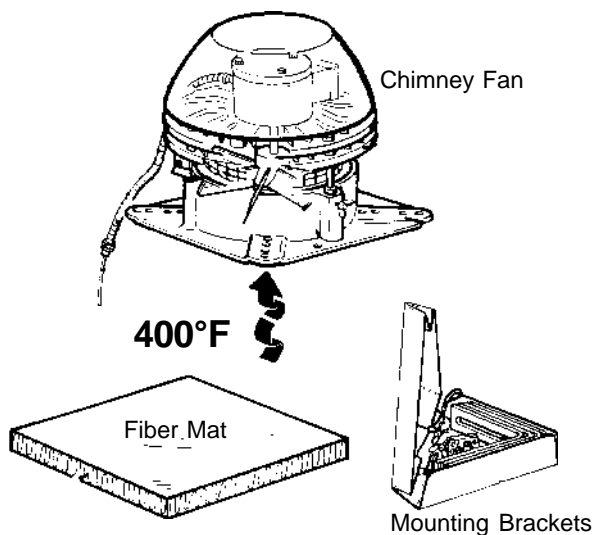


Fig. 12

Make sure the axial vane turns without making noise or offering resistance. Also make sure it is in balance.

Installation on brick chimney.

The installation procedure is the same whether the flue is round or rectangular.

If a clay tile flue liner is installed, it might stick up a few inches. Cut it back so it is flush with the chimney crown.

Step 1:

Measure the inside of the flue and cut a matching hole in the fiber mat. Leave a minimum distance of

3/4" to any side of the fiber mat.

The aluminum foil on the fiber mat must face up against the fan base.

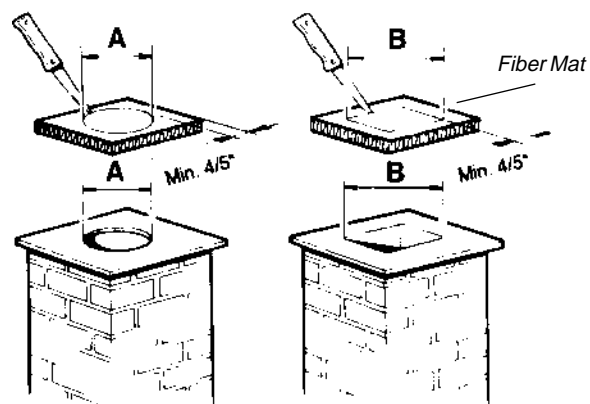


Fig. 13

Step 2:

Locate the installation brackets in the grooves on the underside of the fan base using the bolts and nuts supplied, to secure the brackets. Note that the bolts shall be installed from the bottom side in the two inner holes.

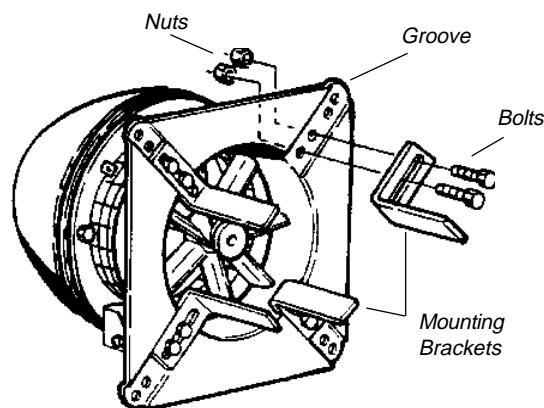


Fig. 14

Adjust the final position of the installation brackets ensuring that there is clearance between the brackets and the flue wall.

If the brackets touch the flue wall, it is likely to create some noise from the vibration.

Step 3:

The chimney fan is now ready for installation on the top of the chimney. Place the fiber mat on the top of the chimney, with the aluminum facing upwards, and place the fan on the top of the mat.

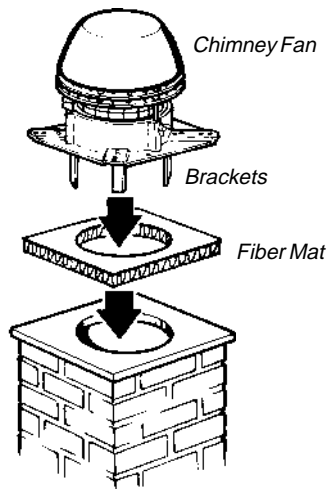


Fig. 15

Step 4:

Decide on the location of the bolt and wall plug (1). Drill a hole in the stack and secure the safety wire by the bolt and the wall plug. Take the safety wire

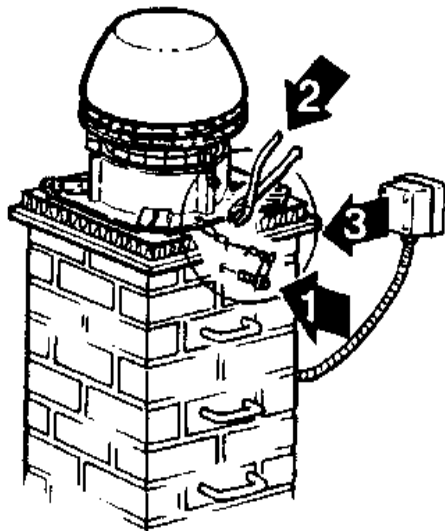


Fig. 16

through the hole in the fan base and return it to the free clamp of the wire.

Tighten the safety wire slightly (2) and crimp the free clamp to provide secure anchoring for subsequent safe cleaning and service.

Fit the liquid tight junction box (3) on the outside wall of the chimney stack, but make sure the conduit is 10-12" away from the fan outlet. Run the installation cable to the fan speed control/switch and the main electric supply. See Section 6: Wiring the chimney fan.

Installation on Steel Chimneys.

Installation on a steel chimney follows the same procedure as for masonry chimneys, except that a steel chimney adaptor FRS is required.

The adaptor (optional) fits standard flue dimensions or as required. The collar slides into the flue

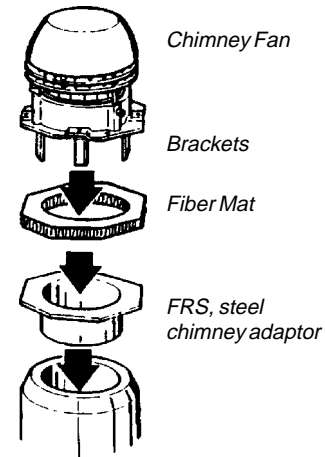


Fig. 17

where the long engagement ensures safe anchoring.

The remaining part of the installation follows step 3 through step 6.

Special Applications.

1. High temperature applications.

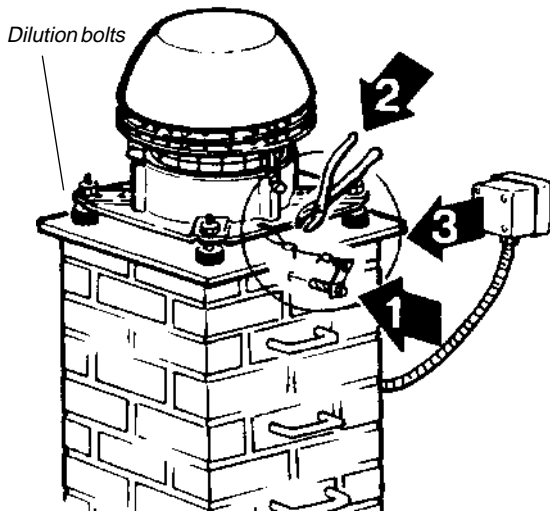
If the fan is used for applications where the flue gas temperature exceeds 400°F at the exit point, but does not exceed 650°F, dilution bolts must be used. Typical situations are chimneys that are only 6-8' high.

Dilution bolts will cause cool air to mix with the warm exhaust gas as they will lift the fan from the chimney and leave space so the cool air can get in.

The dilution bolts should be installed in the outer holes in the fan base.

The dilution bolts should be adjusted in height, so the flue gas temperature does not exceed 400°F when discharged through the fan. However, in order to minimize soot deposits make sure the temperatures is above 320°F.

When using dilution bolts the fan's actual capacity decreases and you might need a stronger model. Fiber mat is not required when using dilution bolts.



2. The Flue is Bigger than the Fan Base.

If the flue size exceeds the size of the fan base, it is necessary to alter the top of the chimney by installing a support flange, made out of stainless steel, as shown below.

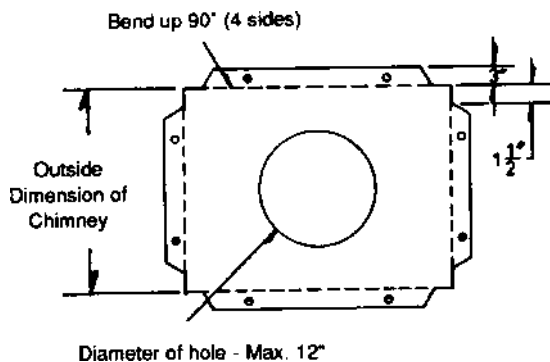


Fig. 19

The support flange must be secured and the hole in the center must be 12" in diameter.

3. The Flue Pipe is Higher than the Chimney.

In many cases, the chimney is designed so the liner or the chimney insert sticks several inches up over the chimney top. If it is a few inches, it's recommended to install the chimney fan on the top, provided the pipe will give enough support for the fan.

If there's insufficient support, the liner or the flue must be cut back, so it is flush with the top of the chimney and the chimney fan can be installed as described in the previous.

4. Two Flues Servicing One Fireplace

This solution is used by many designers when the fireplace opening is large, and the total flue opening must be larger than a standard pipe or liner.

By installing two separate flues the builder has accomplished a total flue opening big enough for the fireplace opening.

When sizing a chimney fan for this kind of application, there are two ways to go about it:

One of the flues must be shut off or disconnected and the chimney fan installed on the open flue, or

A chimney fan should be installed on each flue and operate in tandem.

Note: Using only one flue can cause problems with flow noise due to high velocities. Chimney fans operating in tandem should always be of the same size. Call EXHAUSTO for sizing recommendation.

SECTION 6: WIRING OF THE CHIMNEY FAN

All electrical wiring must be in accordance with requirements of the authority having jurisdiction or, in absence of such requirements, with the National Electrical Code NFPA 70 - latest edition.

Power requirements for the chimney fan depends on the size in use. Electrical requirements are:

RS 9	1 x 120V/60 Cycles/0.4 Amps
RS 12	1 x 120V/60 Cycles/1.2 Amps
RS 14	1 x 120V/60 Cycles/1.4 Amps
RS 16	1 x 120V/60 Cycles/3.9 Amps

We recommend that wiring of the chimney fan is performed by a certified electrician.

Materials needed for solid fuel applications.

The chimney fan is equipped with about 4 feet of high-temperature conduit that terminates in a pre-wired, liquid-tight junction box. Further, a motor speed control is provided for installation in a regular 2x4 wall box.

The junction box should be mounted on the side of the chimney

The wire mostly used to power the fan, is a 2x14 AWG wire with ground. If the chimney is a steel chimney (single, double or triple wall) or a solid brick chimney with a liner, the wire must be run outside the chimney in a liquid-tight conduit (if required by local codes).

If the chimney is just a chase surrounding the actual steel chimney, the wiring can be run inside the chase, but always outside the steel chimney.

Materials needed for non-solid fuel applications.

In addition to the materials needed for solid-fuel applications, non-solid fuel applications (gas) should incorporate a fan proving switch.

Connection diagram.

Due to the heat generated from the flue, the motor run capacitor is located in the junction box. The result is a wiring configuration that may seem a little unusual.

Four wire leads are coming out of the motor and going to the junction box. Two wire leads and a ground lead is assumed going to the junction box from the power supply.

The connections are shown in figure 20:

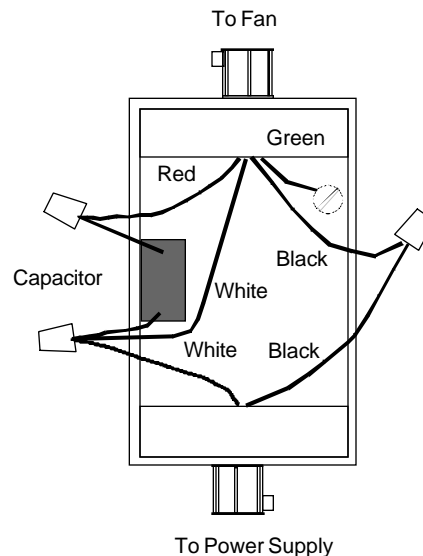


Fig. 20

The diagram below shows the connections for the entire system.

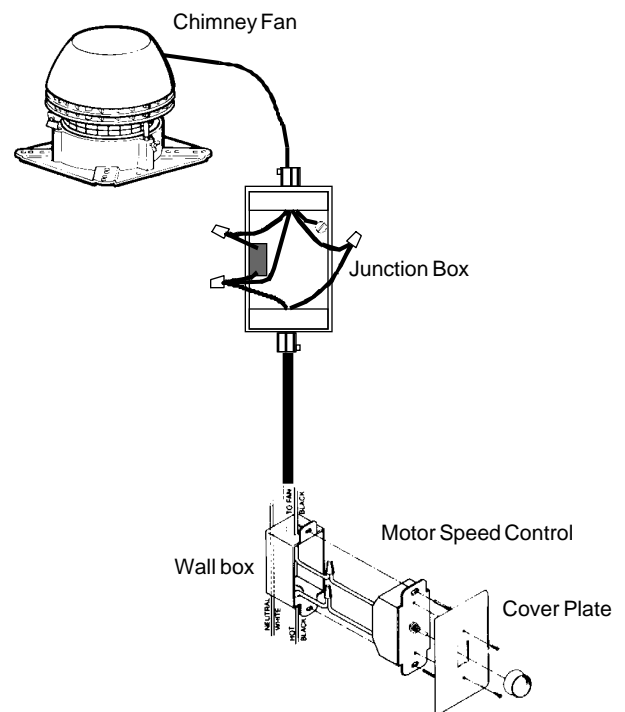
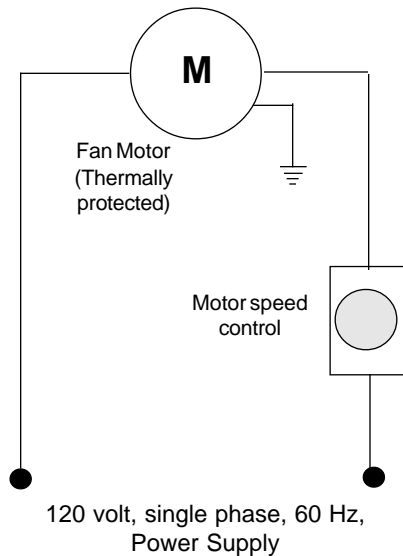


Fig. 21

Wiring Diagram for chimney fan controlled by motor speed control.

This is wiring diagram for the fan.



Sequence of operation:

1. The chimney fan is turned ON prior to starting heating appliance.
2. The fan speed, and thereby the draft, is controlled manually by adjustments made to the motor speed control.
3. When the fire in the heating appliance has died out, the fan can be turned OFF.

Wiring diagram for chimney fan controlled by motor speed control and fan proving switch.

For applications using natural gas or LP gas as fuel, a fan proving switch should be used.

The wiring of the system is shown below, but attention must be paid to the installation and location of the probe connected to the fan proving switch.

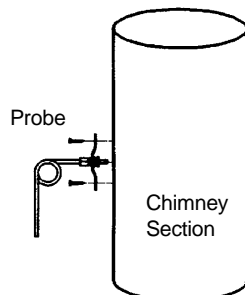


Fig. 23

For the probe (fig. 23), drill a hole in the side of the chimney, attach the mounting plate over it with the

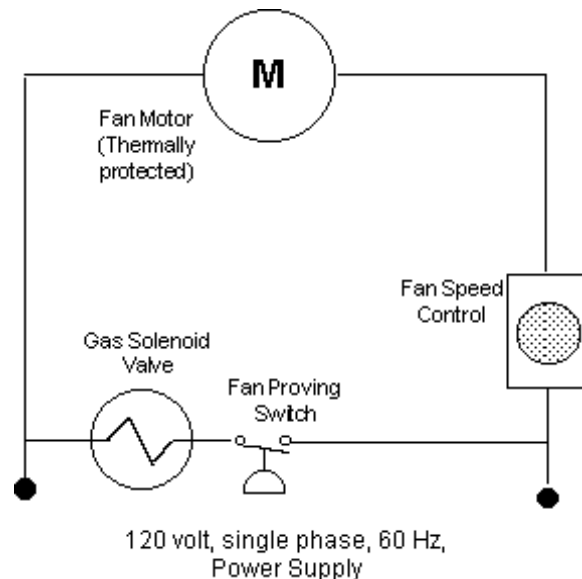
two sheet metal screws. Run a 1/4" tube (copper or aluminum) from the switch and insert the into the side of the chimney through the mounting bracket.

Fan Proving Switch

Low Pressure Port

Fig. 24

For the switch, select a location where the temperature is within the limits of the switch. Mount the switch in a vertical position and follow the adjustment directions later in this Section.



Sequence of operation:

1. The chimney fan is turned ON prior to starting the gas-fired heating appliance.
2. Operation will close the pressure switch and activate (open) the Solenoid Gas Valve located between the gas-tank/main gas supply and the burner.
3. The fan speed, and thereby the draft, is controlled manually by adjustments made to the motor speed control.
4. Any interruption of the draft causing the draft to fall below the pressure switch setting will open the pressure switch and de-activate the Solenoid Gas Valve.

Adjusting the Fan Proving Switch setting.

Before any adjustments are made, turn ON the chimney fan and make sure it is operating.

Turn the fan OFF and make sure the pressure switch opens, so the power to the circuit, it controls, is disconnected.

Start the gas-fireplace. Use the motor speed control to set the speed of the chimney fan, so no spillage (back pressure) is experienced. Mark this setting on the motor speed control cover.

Remove the snap cover from the conduit enclosure by loosening its retaining screws. Turn the slotted adjustment screw clockwise to raise the set point and counter clockwise to lower the set point.

Set the adjustment screw to its lowest position. With the gas-fireplace/gas logs operating, reduce the speed of the chimney fan to the point where the fireplace starts to spill gas or flue gas from the top of the opening. Increase the speed gradually to the point where there is no more spillage. Raise the switch's set point so it just opens. Return the fan speed to the original setting marked on the cover.

SECTION 7: CLEANING & MAINTENANCE

How to start a fire.

Fireplaces

Follow instructions on how to build and maintain a good fire.

Prior to starting the fire, set the fan at full speed and light the fire. When the flames from the kindling load just begin to subside, add several small pieces of firewood. When the firewood has caught fire, after 5-15 minutes, the speed should be reduced to a level where a perfect flame/combustion is achieved.

When adding wood to the fire, it may be necessary to increase the speed for a while.

Also, if there are smoke problems they are most likely to incur when the fire is about to die out, so at this point, it may be necessary to increase the speed again.

This procedure will help conserving energy and at the same time assure a maximum heating output from the fireplace.

Stoves.

When starting a fire in a stove, follow the same procedures as for a fireplace, except that the air adjustment device must be completely open during start up.

Cleaning Intervals

There is no simple rule in regards to cleaning a chimney and a chimney fan, except that when the chimney needs cleaning, so does the chimney fan.

It is recommended that the chimney, the flue pipe and the EXHAUSTO chimney fan is checked regularly until a rate of creosote build-up has been determined. Clean when deposits have built up to more than 1/8".

The amount of build-up is directly related to the use of the heating appliance and to the type of fuel being used. In general, gas fired systems do not require cleaning as often as woodfired systems.

Most modern residential systems work so efficiently that cleaning is only required once a year. Commercial systems (fireplaces in restaurants, hotel lobbies, restaurant pizza ovens) require cleaning with shorter intervals.

Cleaning the chimney fan

The EXHAUSTO chimney fan is designed for prolonged use. The fan should be inspected at least once a year when the chimney is inspected. There is no need for lubrication as the fan is maintenance-free.

Soot, tar and other deposits should be removed from the fan blades and the bottom of the motor housing.

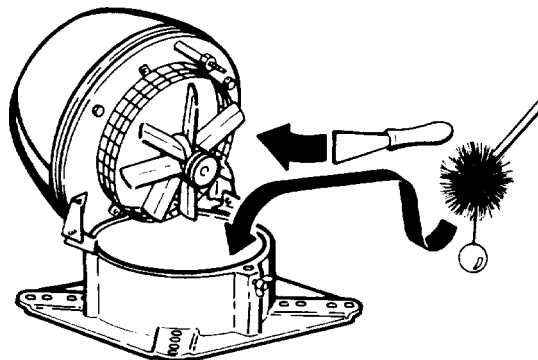


Fig. 20

The top of the fan is hinged and can be opened in order to ease the cleaning.

DO NOT OPEN THE MOTOR HOUSING UNLESS THE POWER HAS BEEN SWITCHED OFF.

Use a simple tool, like a screw driver for removing the deposits. Make sure to fasten the security screw after cleaning.

Appendix

APPENDIX A: DESIGN THEORY

Fireplaces with natural draft chimneys follow the same gravity fluid flow law as gas vents and thermal flow ventilation systems.

To a certain degree, mass flow of hot flue gases through a vertical pipe is a function of the heat release, the chimney area, height, and the flow resistance (system pressure loss coefficient).

Consequently, standard sizing of chimneys must include an estimate of the flue gas volume and the available draft. Available draft is the difference between the natural draft and the system pressure loss. The available draft must be negative for the system to work.

There are limitations to this approach. A lot can be determined and explained via calculations, but some factors must be determined by adding the use of experience and common sense. The location of a building, the existence of cross winds, eddies etc. are examples of such factors. These factors can be expressed as pressure losses, but it is not easy to put a value to them.

The flue gas volume depends on the fuel burned and the amount of air used for the combustion.

The general method to determining the flue gas volume is to base the calculation on the air requirements for the combustion.

The air requirement is found by determining the area of the air inlet and multiplying this with the frontal inlet velocity.

As the air expands when it is warmed up over the fire, the actual flow in the chimney is dependent on the temperature in the chimney.

Normally, a 300°F mean gas temperature rise above ambient (usually 60°F) is used as a guideline, and with this temperature rise, the air will expand with almost 60%.

The following are examples of how the flue gas volume can be determined for different applications.

Estimating Flow

The combustion air requirement can be determined using this formula:

$$Q_t = q \times \frac{A_{inlet} \times V_{inlet}}{144}$$

Q_t = Flow @ t°F (CFM, or cubic feet per minute)

A_{inlet} = Area of opening (square inches)

V_{inlet} = Frontal inlet velocity (FPM, or feet per minute)

q = Expansion factor

Flow in one-sided fireplaces used for solid fuel.

In a one-sided fireplace a frontal inlet velocity of 36-48 FPM (feet per minute) with a mean chimney temperature of min. 300°F should provide a good combustion and a well-working fireplace.

Example: Fireplace height is 24", width is 36" and the frontal inlet velocity is estimated at 48 FPM.

The flow into the firebox is:

$$Q_{60} = \frac{24 \times 36 \times 48 \text{ CFM}}{144} = 288 \text{ CFM}$$

The expansion factor is 1.6 at 300°F, so the flue gas volume in the flue is:

$$Q_{300} = 288 \text{ CFM} \times 1.6 = 460 \text{ CFM}$$

In other words, a wood-fired fireplace with a 2' x 3' opening produces 460 CFM of flue gas (flow) at an average flue gas temperature of 300°F.

Flow in one-sided fireplaces used for gas.

In a one-sided fireplace used for gas firing, a frontal velocity of 18-36 FPM with a mean chimney temperature of min. 200°F should provide a well-working fireplace.

The combustion air requirement can be determined by using the formula for wood-fired fireplaces.

Example: The previous example used for gas, gives this volume into the firebox:

$$Q_{60} = \frac{24 \times 36 \times 36 \text{ CFM}}{144} = 216 \text{ CFM}$$

The expansion factor at 200°F is 1.4, so the flue gas volume in the flue is:

$$Q_{200} = 216 \text{ CFM} \times 1.4 = 302 \text{ CFM}$$

A gas-fired fireplace produces less flue gas volume than a wood-fired.

It is worthwhile noticing that the input of gas logs or gas burner has no major impact on the flue gas volume in an open fireplace.

Flow in open fireplaces without smoke chamber.

If the fireplace does not have a smoke chamber, or if the smoke chamber is very small, it is wise to use a higher frontal inlet velocity - preferably in the range 48-84 FPM.

Freestanding fireplaces

This type of fireplace requires a high frontal inlet velocity in order to capture the products of combustion. For design purposes it is recommended to use a velocity of 84-96 FPM. This is in line with the code requirements for kitchen hoods, where a capacity of 100 CFM per square foot is recommended.

Stoves and fireplace inserts

Stoves are different from open fireplaces due to the fact that they just have a small air inlet for the combustion air. However, the worst case scenario is when the doors are open, so this is the situation the sizing should be based on.

Again the formula:

$$Q_{300} = \frac{A_{inlet} \times V_{inlet} \times 1.6}{144}$$

should be used, and the frontal inlet velocity recommended is 36-48 FPM.

The design method for a fireplace insert is similar to the one used for a stove.

The flow is determined by using the fireplace opening with the doors opened as this represents a worst case scenario.

Wood-fired Pizza Ovens

A new type of bread/pizza oven that is wood fired.

The uniqueness is the design of the oven which is both an oven and a firebox. The door opening serves as an air inlet as well as a the flue outlet.

Even though the temperature inside the oven can reach 500°F, the flue gas temperature is much lower due to the design of the smoke chamber. The smoke chamber is just a small hood that leads into the flue.

For design purposes, it is recommended that a frontal inlet velocity of 84-96 FPM is used.

The formula for calculating the flue gas volume is:

$$Q_{300} = \frac{A \times B \times V_{inlet} \times 1.6}{144}$$

A = Height of door opening

B = Width of door opening

Estimating Flow Resistance

The total flow resistance in a vent system that moves air, is normally referred to as "total static pressure loss". The formula used to determine the static pressure loss in a system is:

$$P_s = .015 \times d_m \times V_{pipe}^2 \times \Sigma k$$

or

$$P_s = .015 \times d_m \times (Q_t / A_{pipe})^2 \times \Sigma k$$

d_m = gas density, lb/ft³

V_{pipe} = system gas velocity (flue gas volume/flue area) at mean condition, Ft/s

A_{pipe} = area of flue, square inches

Σk = Sum of all resistance factors

There are several factors creating resistance in a fireplace/chimney systems:

The flue.

Flue components

The transition from firebox to flue.

In addition there are "external" factors influencing the resistance:

Internal building pressure.

External building pressure.

Wind pattern.

When trying to determining the total resistance in a chimney system, it eases the work to use resistance factors, or k-values. Any part of a chimney system or duct can be assigned a k-value, and the higher the value, the more resistance.

K-values are dimensionless and are used in most other industries dealing with air-flow and vents, like f.inst. the ventilation industry.

There are only a few differences between a ventilation system and a chimney system:

1. A chimney system has natural draft to remove the flue gases, as long as there is a vertical chimney or vent. A ventilation system does not have any natural draft, so mechanical draft fans are always required.
2. A chimney system deals with high temperature air with products of combustion. A ventilation system removes room temperature air with dust particles.
3. Chimney flues are build of stainless steel pipe, sheet metal, steel liner, tile liner, or poured/cast-in-place liners. Most ventilation systems use prefabricated vents of sheet metal or plastic.

In other words: A chimney system removes air with a higher temperature and a lower density than a ventilation system. Further the ventilation system is often built in a material with less flow resistance.

Flue Pipe resistance.

As in any pipe material, the roughness of the pipe influences the flow resistance. The rougher the pipe surface, the more resistance. The roughness of a pipe is normally expressed as a Reynolds number, but for all practical purposes these can be converted into k-values that are easier to work with.

Chimney and stack manufacturers as well as ASHRAE have set a range of friction factors (F) to use for the calculation of k-values for different types of chimneys and vents:

<u>Vent Type</u>	<u>Friction Factor, F</u>
Pressure tight stacks	0.22
Gas Vent (B-Vent)	0.25
Single wall steel pipe	0.32
Poured liners	0.34
Clay tile liners	0.38
Corrugated liners	0.50

The k-value of a vent can be determined with this formula:

$$k_L = \frac{F \times L}{d_i}$$

L = Length of entire flue system, feet

d_i = Diameter of flue, inches

Example: A 8" single steel wall flue system of a total length of 25', has a k-value of:

$$k_L = \frac{.32 \times 25}{8} = 1.0$$

Firebox resistance

Some resistance can be found in the transition between the firebox and the flue. The resistance could be compared to a converging tapered entry into the chimney. Allow for a k-value of min. 2, if the inlet is smooth - more if it's rough.

Component resistance.

Chimney and stack manufacturers as well as ASHRAE have set up a range of k-values for different types of components in chimney systems. These can be found in Appendix C.

Other Resistance.

In addition to the resistance from the flow, resistance from negative building pressure, external building pressures etc. must also be taken into consideration. This could actually be measured by using a pressure gauge in the fireplace chimney before starting a fire. It is not unusual to see a negative pressure of 0.1-

0.3"WC for problem fireplaces.

Estimating Natural Draft

The theoretical draft of a gravity chimney or vent is the difference in weight (mass) between a given column of warm flue gas and an equal column of cold ambient air. The theoretical draft can be derived from the following formula:

$$D_t = .2554 \times B \times H \times (1/T_o - 1/T_m)$$

D_t = Theoretical draft, in. WC

B = Local barometric pressure, in Hg

H = Height of the chimney, feet.

T_o = Ambient Temperature + 460, °R

T_m = Mean flue gas temperature + 460, °R

The formula indicates that the draft increases with the height. However, as the mean chimney gas temperature decreases when the height increases, adding height to a chimney is only effective to a certain height.

With a barometric pressure of 29.92 inHg, a 25 feet chimney, 70°F ambient temperature and a mean flue gas temperature of 250°F,

$$\begin{aligned} D_t &= .2554 \times 29.92 \times 25 \times (1/530 - 1/710) \\ &= 191.04 \times (.002 - .0014) = 0.115 \text{ inWC} \end{aligned}$$

The formula also shows that realistically a chimney without draft does not exist.

Estimating available draft.

To find the available draft (D_a) for a chimney system, the static pressure loss is deducted from the theoretical draft:

$$D_a = -D_t + P_s$$

Notice that "draft" is always negative, while static pressure is always positive.

Example:

Theoretical draft, D _t	- .138 inWC
Static pressure loss, P _s	+ .100 inWC
Available draft, D _a	- .038 inWC

Analysing a fireplace venting system.

This is an example on how to analyze and estimate fireplace system:

One-sided fireplace, opening = 24"x36"

Ambient temperature = 60°F

Mean chimney temperature = 300°F

Flue material = Single wall steel pipe

Flue size = 8"

Chimney height from top of firebox = 25'

Off sets = One 30° off-set (= 2 x 30° elbows)

$d_m = 0.075 \text{ lb/ft}^3 @ 60^\circ\text{F}$

$= 0.047 \text{ lb/ft}^3 @ 300^\circ\text{F}$

1. Determine flow:

$$\begin{aligned} Q_t &= q \times A_{\text{inlet}} \times V_{\text{inlet}} / 144 \\ &= 1.6 \times 24 \times 36 \times 48 \text{ CFM} \\ &= \underline{460 \text{ CFM}} \end{aligned}$$

2. Determine k-values:

Pipe:

$$\begin{aligned} k_L &= F \times L / D_i \\ &= .32 \times 25/8 \\ &= 1.0 \end{aligned}$$

Components:

2 x 30° elbows = 2 x .15	.30
Inlet from firebox	2.00
Total k-value	2.30
$\Sigma k = 1.0 + 2.3 = 3.3$	

3. Determine flow resistance:

$$\begin{aligned} P_s &= .015 \times d_m \times (Q_t / A_{\text{pipe}})^2 \times \Sigma k \\ &= .015 \times .047 \times (460/50)^2 \times 3.3 \\ &= .015 \times .047 \times 84.64 \times 3.3 \\ &= \underline{.197"WC} \end{aligned}$$

4. Determine natural draft:

$$\begin{aligned} D_t &= .2554 \times B \times H \times (1/T_o - 1/T_m) \\ &= .2554 \times 29.92 \times (1/530 - 1/710) \\ &= 191.04 \times (.002 - .0014) = \underline{.115"WC} \end{aligned}$$

5. Determine available draft:

$$\begin{aligned} -D_a &= -D_t + P_s \\ &= - .115 + 0.197 \\ &= + .082"WC \end{aligned}$$

The available draft is positive. In other words, the system should be back-drafting. One way of solving this problem could be to increase the flue size from 8" to 10". Going through the same calculations, a 10" flue would give these results:

$$\begin{aligned} Q_t &= 460 \text{ CFM (no change)} \\ k_L &= .8 \\ \Sigma k &= 3.1 \\ P_s &= .015 \times .047 \times (460/78.5)^2 \times 3.1 \\ &= .015 \times .047 \times 34.34 \times 3.1 \\ &= .075"WC \\ D_t &= .115"WC (no change) \\ D_a &= -.115 + .075 \\ &= \underline{-.04"WC} \end{aligned}$$

Now there is draft in the system, so a 10" vent is the appropriate size for venting a 24"x36" fireplace.

Analyzing other factors

If the fireplace and the flue seem to be sized correctly, but there is a smoke problem other information may be needed.

For inst. a depressurized building will negatively affect the draft situation. If the negative pressure is found to be, let's say .1"WC the available draft in above example would be:

$$\begin{aligned} D_a &= -.04"WC + .1"WC \\ &= \underline{+.06"WC} \end{aligned}$$

In other words, the negative building pressure easily overcomes the draft and makes the system back-draft.

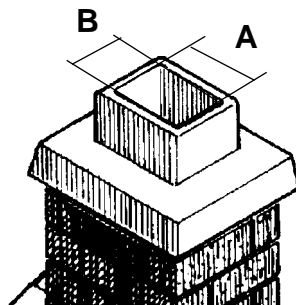
APPENDIX B: CONVERSION OF RECTANGULAR FLUES

Measure the flues inside dimensions and use the chart below to determine the corresponding round

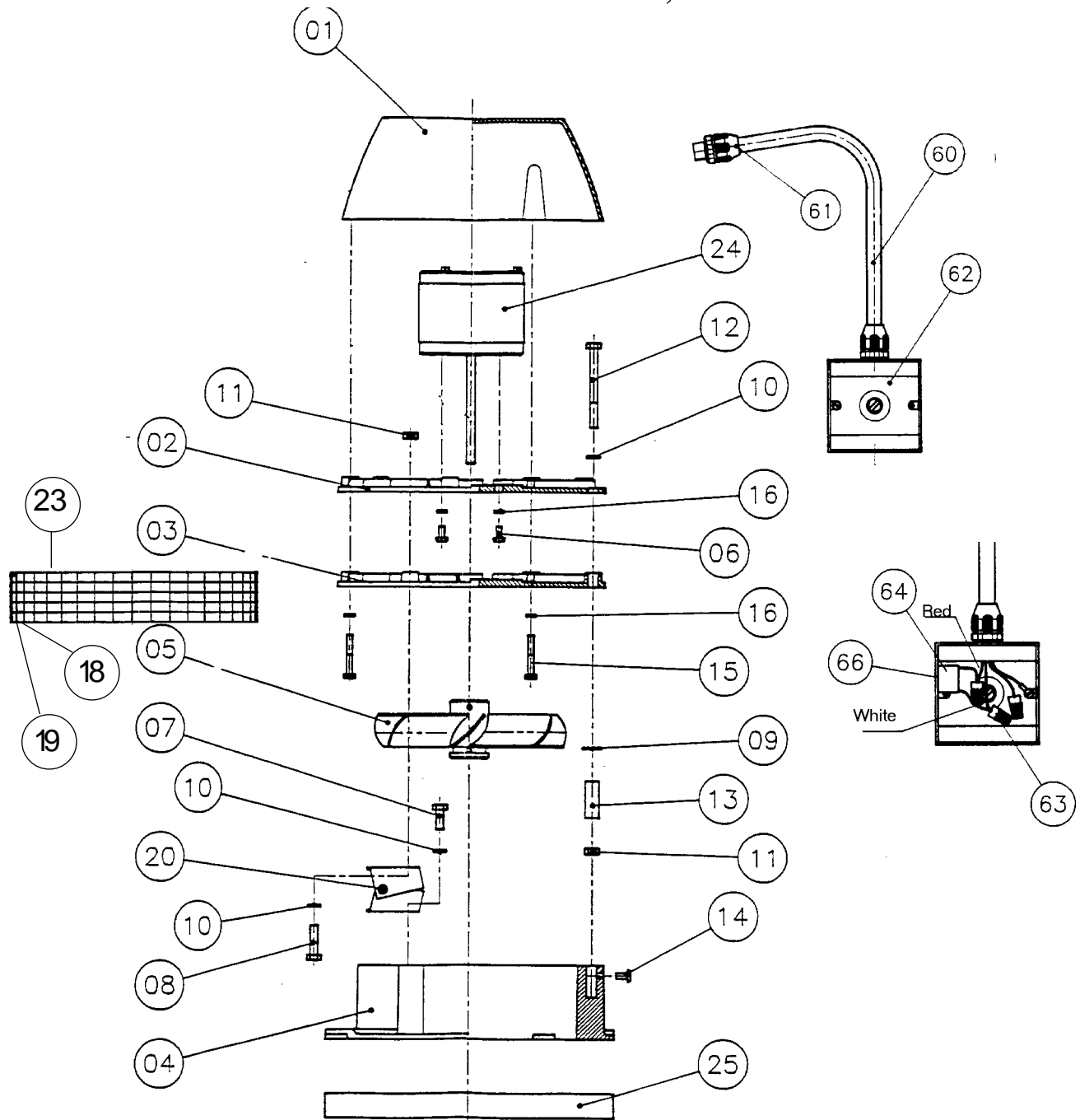
flue diameter. The conversion is the hydraulic diameter.

Dimension A

		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Dimension B	4	4	4	5	5	5	6	6	6	6	6	6	6	6	6	7	7	7
	5	4	5	5	6	6	6	7	7	7	7	7	8	8	8	8	8	8
	6	5	5	6	6	7	7	8	8	8	8	8	9	9	9	9	9	9
	7	5	6	6	7	7	8	8	9	9	9	9	10	10	10	10	10	10
	8	5	6	7	7	8	8	9	9	10	10	10	10	11	11	11	11	11
	9	6	6	7	8	8	9	9	10	10	11	11	11	12	12	12	12	12
	10	6	7	8	8	9	9	10	10	11	11	12	12	12	13	13	13	13
	11	6	7	8	9	9	10	10	11	11	12	12	13	13	13	14	14	14
	12	6	7	8	9	10	10	11	11	12	12	13	13	14	14	14	15	15
	13	6	7	8	9	10	11	11	12	12	13	13	14	14	15	15	15	16
	14	6	7	8	9	10	11	12	12	13	13	14	14	15	15	16	16	16
	15	6	8	8	9	10	11	12	13	13	14	14	15	15	16	16	17	17
	16	6	8	9	10	11	12	12	13	14	14	15	15	16	16	17	17	18
	17	6	8	9	10	11	12	13	13	14	15	15	16	16	17	17	18	18
	18	7	8	9	10	11	12	13	14	14	15	16	16	17	17	18	18	19
	19	7	8	9	10	11	12	13	14	15	15	16	17	17	18	18	19	19
	20	7	8	9	10	11	12	13	14	15	16	16	17	18	18	19	19	20



APPENDIX D: PARTS LIST



<u>Position</u>	<u>Description</u>	<u>Number needed</u>
01	Motor Cover	1
02	Motor mounting plate	1
03	Motor cooling plate	1
04	Fan base	1
05	Axial vane (stainless)	1
06	Screw - M6 x 16 (stainless)	4
07	Bolt - M8 x 20	2
08	Bolt - M8 x 30	2
09	Washer - 8 mm	1
10	Washer - 8 mm	5
11	Nut - M8	3
12	Bolt - M8 x 80 (stainless)	1
13	Distance tube	1
14	Bolt - M6 x 12 (stainless)	1
15	Bolt - M6 x 45 (stainless)	3
16	Washer - 6 mm	7
18	Clip for spark arrester	3
19	Rivet	3
20	Hinges - set (left/right)	1
21	Mounting brackets (set)	1
23	Spark arrester	1
24	Motor	1
25	Fiber mat	1
60	3/8" hi-temp conduit	1
61	1/2" connector	2
62	2x4" junction box (liquid)	1
63	Wire nuts	4
64	Motor run capacitor	1

APPENDIX E: TROUBLE SHOOTING

Problem	Probable Cause	What to do
There is no power going to the fan.	The circuit breaker may be OFF.	Check the circuit breaker.
	Fan speed control is turned OFF.	Turn fan speed control ON.
	Disconnect switch (if installed) is turned OFF.	Turn disconnect switch ON.
There is power to the fan, but it is not operating.	Bad electrical connections.	Check and correct problems with connections.
	The fan speed controls low voltage setting is set too low.	Increase the setting with the plastic screw on the front plate.
	The fan speed control may be bad.	Check the voltage before the fan speed control and after. If there is power before, but not after the fan speed control, the fan speed control is bad and must be replaced.
There is power to the fan, but it just hums and does not turn.	The motor run capacitor may be bad.	Check the capacitor and replace if necessary.
	If the fan has not been used for a long period of time, creosote may have made the shaft stick.	Clean the fan, especially around the shaft.
	If sub-zero conditions are present, the grease in the bearings may have thickened.	This rarely happens, but if it happens, it is usually to the model RS9, which have less power than the bigger models. Leave the fan ON, even though it is only turning very slowly. After 5-10 minutes it will pick up full speed. You can leave the fan on and run it at a low speed, if you don't want to experience the situation again during extremely cold weather.
The fan is turning and seems to work fine, but there is not enough draft.	The fan may be under-sized.	Replace with a larger fan.
The fan vibrates.	The motor shaft may be bent.	Replace motor.
	The hinges may be bent.	Straighten out/realign the hinges.

Problem	Probable Cause	What to do
Airflow noise can be heard.	The flue is undersized, e.g. the flue area is less than 10% of the fireplace opening.	There is not a lot to do. The chimney could be insulated or the fan speed reduced. This is a problem that is normally only found in short and small steel chimneys.
	The fan is oversized and running too fast.	Reduce the fan speed.
Mechanical noise from the fan.	The hinges could be bent causing the vanes to hit the wall on the fan inlet.	Straighten and realign the hinges.
	Foreign matter could be stuck in the bird screen/spark arrester.	Remove the foreign matter.
	A squeaking noise could indicate that the motor bearings are bad.	Turn the vane. If it doesn't turn without even the slightest resistance, the bearings are worn out and should be replaced.
	The axial vane could be out of balance causing the fan to wobble.	Replace the vane.
	The bolts holding the motor may be loose.	Fasten the motor.

APPENDIX F: WARRANTIES

Warranties

The EXHAUSTO chimney fans have a 2 year Factory Warranty, a 10 year Corrosion Perforation Warranty and a 6 month Satisfaction Guarantee.

IN ORDER TO BE ELIGIBLE FOR WARRANTY AND GUARANTEE COVERAGE IT IS A PROVISION THAT A WARRANTY REGISTRATION FORM HAS BEEN SUBMITTED TO EXHAUSTO WITHIN 30 DAYS FROM THE DATE OF INSTALLATION.

EXHAUSTO RESERVE THE RIGHT TO REFUSE ANY WARRANTY CLAIM IF THE WARRANTY REGISTRATION FORM HAS NOT BEEN MAILED IN.

2-Year Factory Warranty.

We promise the original user that we will replace or repair as we may elect, any part of parts of the new EXHAUSTO chimney fan which are defective in material or workmanship without charge for parts or labor (not including labor for dismantling and installation, freight etc.) during the first 2 years following the date of installation.

10-Year Corrosion Perforation Warranty.

We promise the original user that we will replace or repair as we may elect, any part or parts of the EXHAUSTO chimney fan which are perforated due to corrosion without charge for parts or labor (not including dismantling and installation, freight etc.) during the first 10 years following the date of installation.

General Warranty Provisions.

What the user must do: We recommend that you contact the dealer where you purchased the chimney fan, however, you may also contact EXHAUSTO directly.

What is not covered: Any non-EXHAUSTO product which may be installed in or upon or related to the product is excluded.

Limitations on our responsibility: Please carefully note that this is a two-way agreement. We promise to make free replacements as stated, but you agree that, except for our obligation to make good on this promise, we shall not be responsible for any expenses or inconvenience which you might incur or experience with respect to our product, nor shall we be liable for defects, damage or failures, caused by unauthorized alterations, unreasonable use, accident or abuse, including failure to provide reasonable and necessary maintenance, after our product has been delivered to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

THESE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES ARE EXCLUDED, AS ARE ALL OTHER REPRESENTATIONS TO THE ORIGINAL PURCHASER, AND ALL OTHER OBLIGATIONS OR LIABILITIES, INCLUDING LIABILITY FOR INCIDENTAL AND CONSEQUENTIAL DAMAGES, ON THE PART OF EXHAUSTO OR THE SELLER.

6 Months Performance Guarantee.

This guarantee allows a customer to return an EXHAUSTO chimney fan for a full refund (not to include freight, installation or dismantling charges), if the customer should decide that, within six (6) months from the date of installation, the fan does not give full satisfaction.

Warranty Claim Procedures.

When the dealer files for warranty coverage on behalf of your customer you must follow these warranty claim procedures:

a. If filing a warranty claim under the Two (2) Year Factory Warranty or under the Ten (10) Year Corrosion Perforation Warranty, follow this procedure:

1. Call EXHAUSTO at 1-800-255-2923 and explain what your warranty problem is. Be sure to have model type, place and date of purchase available. If this information is not available, EXHAUSTO might not be able to accept your warranty claim.

2. If the problem can not be solved over the phone, you will be given an authorization to ship the chimney fan back to EXHAUSTO, freight prepaid.

3. If the chimney fan is returned for repair, the chimney fan will be returned to the customer as soon as the warranty claim has been satisfied.

If the repair of the chimney fan involved repair of other parts than the warranty claim called for, EXHAUSTO reserves the right to charge the customer for such repair.

B. If filing a claim under Six (6) Months Performance Guarantee, follow this procedure:

1. Call EXHAUSTO at 1-800-255-2923 and explain what the problem is.

2A. If the problem is, that the application calls for a bigger chimney fan than originally specified and cus-

tomers wants a fan with a higher capacity, EXHAUSTO will replace the first chimney fan with the bigger fan for the difference in price.

2B. If the customer wants to return the chimney fan and receive a refund, the customer must furnish proof of payment including. place and date of purchase.

EXHAUSTO will inspect the returned unit upon receipt and the dealer will receive the refund within 30 days from receipt of the chimney fan. If any damages are detected on the chimney fan, EXHAUSTO reserves the right to charge for the repair and deduct that in the refund.

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