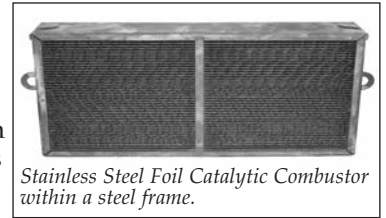


# CATALYTIC COMBUSTORS

Here is how your catalytic combustor works.

The catalytic combustor is a stainless steel foil with hundreds of cells. Precious metals, such as platinum, are sprayed on the inside of these cells to coat the steel foil. This creates the surface area which interacts with the wood smoke. The catalytic combustor in your stove is very similar to the one in the exhaust system of your automobile and works to achieve the same results - high efficiency and clean air!



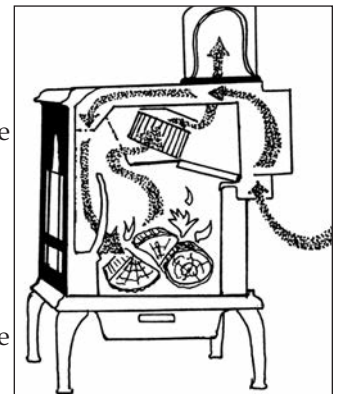
When you first start a fire, you should bypass your catalytic combustor and let the smoke go directly up the chimney. Once wood smoke reaches 500° F internally (about 10-15 minutes after re-establishing a strong fire), it is hot enough to ignite the catalytic combustor. As the wood smoke passes through the cells in the combustor, the smoke reacts with the precious metals which line the inside of the honeycomb and both combustible gases and particles in the smoke ignite and burn. This “catalytic burn” reduces emissions and also increases heat output from the stove.

Without a catalytic combustor, between 5% - 40% of the chemical energy contained in wood simply escapes up the chimney when wood is burned. Energy laden gases are exhausted up the chimney where they pollute the air or may condense on the inside of the chimney flue as creosote. The slower the burn, without a catalytic combustor, the greater the amount of energy that is lost. A long smoldering fire is the least efficient use of energy in wood, yet it produces lots of smoke, which is the fuel supply for the catalytic combustor.

Most of the chemical compounds in wood smoke are combustible. The catalyst produces high temperatures, which loosen the bonds of these chemical compounds and “burns” wood smoke. A stove that “burns” these compounds and uses smoke as additional fuel will burn more efficiently and produce more heat, while reducing creosote and air pollution at the same time. However, most stoves cannot consistently produce temperatures high enough to burn cleanly, particularly during long burning times - hence the need for a catalytic combustor.

Your catalytic combustor can get the most efficiency out of every piece of wood if it has three things: temperature, turbulence, and time.

- 1. Temperature.** The catalytic combustor can only start burning the gases in the wood smoke after the smoke has reached at least 500 degrees F. Before the smoke reaches that temperature, it simply is not hot enough to start the reaction at the combustor. This will result in an inefficient smoldering fire.
- 2. Turbulence.** The wood smoke can interact best with the precious metals inside the foil cells if there is some variation in the air flow. Increased turbulence enables more of the wood smoke to come into contact with more cells. The exhaust path as well as the irregular surface of the combustor cells adds needed turbulence.
- 3. Time.** Once the temperature and turbulence are achieved, the catalytic combustor just needs to have enough time to burn all the gases in the wood smoke. For this reason, it is best to minimize the amount of air you allow into the firebox once the combustor is ignited. Allowing too much air into the firebox speeds up the rate at which the fire burns. The ideal air setting for a long catalytic burn allows enough air to keep the wood burning and producing smoke.



With proper care, a new catalytic combustor will give years of fuel savings and lowered emissions. By following some simple guidelines you can ensure maximum combustor performance and longevity. Your catalytic combustor is designed to last for 12,000 -14,000 hours of use. You can ensure yourself of getting the maximum life from your combustor by following these simple guidelines:

- 1) Burn only natural, well-seasoned wood.
- 2) Wait until the exhaust gases reach about 500 degrees F (internally) before engaging the catalytic combustor (about 10-15 minutes after re-establishing a strong fire).
- 3) Bypass the combustor before reloading and leave the bypass open for a few minutes after reloading to raise the temperature in the stove.
- 4) Don't overfire the stove.
- 5) Clean the combustor regularly. See instructions below.

You can also obtain a lot of useful information by visiting our website, [www.woodstove.com](http://www.woodstove.com). Other very useful web sites on all aspects of wood burning are, [www.hearth.com](http://www.hearth.com), [www.woodheat.org](http://www.woodheat.org) and [www.csia.org](http://www.csia.org). CSIA is the Chimney Safety Institute of America.

## Inspection & Cleaning

Your stove comes with a new stainless steel combustor already installed. The stainless combustor is a honeycomb foil block located under the top of your Keystone/Palladian, and is accessed through the top or back cover plate. Typical lifespan for a well maintained catalytic combustor is 4-6 years. There are a few ways to determine if your combustor needs to be cleaned. If you notice the smoke exiting your chimney is thicker and darker in color, the combustor may need cleaning. Additionally, if you notice reduced draft or backpuffing, or performance and heat output has diminished, then the combustor may not be working as efficiently as designed.

The catalytic combustor is protected from ash build up by a high temperature alloy screen. The screen should be cleaned at every combustor cleaning. Plan to clean and inspect your catalytic combustor and screen about every 4-6 weeks. Any fly ash deposits on the screen or combustor will need to be brushed or vacuumed off. An accumulation of fly ash can reduce the draft, causing backpuffing, sluggish burning and inefficient heating performance. You should clean and check your combustor & screen before the heating season begins, as well as on a regular 4-6 week basis.

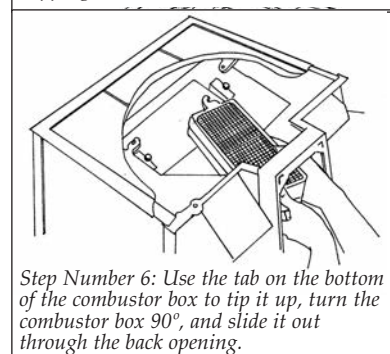
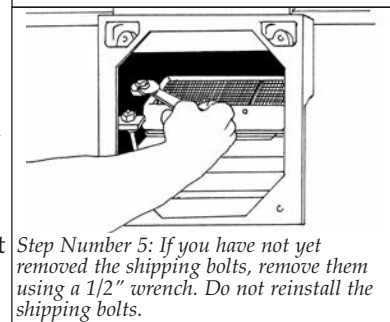
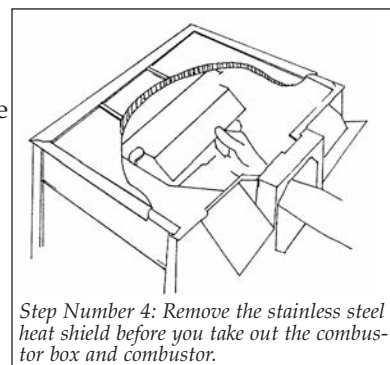
**Tools needed:** (1) work gloves and safety glasses; (2) 7/16" and 1/2" socket or box wrench, or adjustable wrench; (3) soft bristled paint brush or vacuum cleaner (preferably one designed for ash removal).

There are two ways to clean your combustor.

### METHOD I: REMOVE YOUR COMBUSTOR FROM THE STOVE:

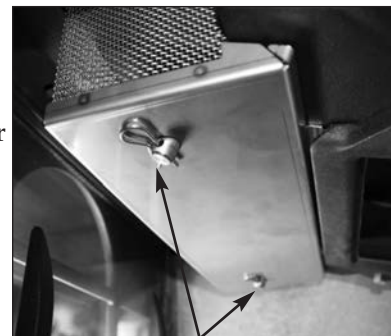
This is the most thorough method of cleaning your combustor.

1. Be sure the fire is out and the stove is cold. Even though the stove may be cold, there may be some lingering embers in the ashes.
2. Your Palladian/Keystone has an interchangeable cover plate and flue collar that enable you to vent the stove from the top or back. Leave the flue collar and pipe in place and remove the cover plate.
3. Using the Allen wrench provided with the stove, remove the four screws.
4. Reach in through the opening, remove the single hex head bolt that holds the stainless steel heat shield in place, using an adjustable wrench or 7/16" open-end wrench, and remove the heat shield (see illustration).
5. If you haven't already done so, remove the two bolts that hold the combustor box in place using the 1/2" open-end wrench. These bolts are located at either side of the combustor box and have flat washers under the bolt heads. These are shipping bolts so the combustor doesn't move while your stove is in transit. You can either discard them now or hold onto them if you ever plan to move your stove again. They do not have to be reinstalled (see illustration at right.)
6. Tip the front of the combustor box up, turn it 90 degrees, and remove it through the rear opening. If you're removing it through the top of the stove, you will have to slide one end of the combustor into the flue opening, and tip it up so that it will come out through the top opening.
7. Once out, you can use a paint brush (or other soft bristled brush) or a vacuum cleaner to remove any fly ash from both sides of the combustor. **Never use anything abrasive** to clean the combustor. A vacuum cleaner may be used, but **never use high pressured (or compressed) air** to blow the cells free of build-up. It could strip the precious metal coating from the inside of the cells. Any cell blockage can be removed with a pipe cleaner or a cotton swab. Vacuum the area where the combustor is installed inside the stove.
8. Once cleaned, put the combustor back into place inside the stove.



You should now clean the metal screen located inside of the firebox, under the catalytic combustor.

9. Open the side door. The top of the firebox (inside the stove) consists of a flat stainless steel plate (K-805 Scoop Kit) with an attached metal screen. This screen prevents direct flame from hitting the combustor and creates turbulence in the exhaust stream. The scoop plate is held in place with two metal hair pin cotters that feed through stainless steel posts. The scoop plate is also supported in the slot under the bypass damper toward the back of the stove.
10. Remove the two hair pin cotters. This will allow you to remove the scoop plate from the ceiling of the firebox.
11. You can now use a brush, vacuum, or rinse the screen to remove any ash that may have accumulated.
12. To reassemble, put the scoop/screen assembly back in place, taking care that the back edge of the scoop is wedged in the slot under the bypass damper and push the scoop plate up to reveal the holes in the stainless posts. Push the hair pin cotter through the posts so the pins are below the scoop plate/screen assembly. You are finished.



*Pull the two cotter pins on the underside of the scoop plate to remove the screen/plate assembly from the stove for cleaning.*

## **METHOD II: CLEAN YOUR COMBUSTOR FROM INSIDE THE FIREBOX:**

This is a quicker way to give your combustor and screen a quick cleaning when you don't have the time to do the more thorough method described above.

1. Follow the steps above to remove the scoop plate and screen (#9-#10, above).
2. Brush them off with a paint brush or vacuum.
3. While the scoop is removed, reach into the firebox with the brush or vacuum and remove the ash from the "upstream" face of the combustor while it sits in place. Fly ash will accumulate on this side more than the backside. This will keep the cells open for the smoke to flow through.
4. Follow the instructions for re-installing the scoop back into place. (#12, above).

## **REPLACING A CATALYTIC COMBUSTOR**

**You will need the following tools:** (1) 5/32" allen wrench that came with stove, (2) 1/2" open end wrench, (3) 2- 7/16" wrenches, (4) vacuum — preferably one designed for ash removal, (5) work gloves, and (6) safety glasses.

1. Your Palladian/Keystone has an interchangeable cover plate and flue collar which enables you to vent the stove from either the top or back. Leave the flue collar in place and the pipe connected to it. Remove the cover plate, using the enclosed 5/32" allen wrench to loosen the 4 socket set screws in the corners.
2. Reach in through the hexagonal opening, and remove the single hex-head bolt that holds the stainless steel combustor shield in place using an adjustable wrench or 7/16" open-end wrench to loosen the bolt. Remove the stainless steel shield.
3. If you haven't already, remove the two bolts that hold the combustor box in place using the 1/2" open-end wrench. These two bolts are located at either side of the combustor box and have flat washers under the bolt heads. These are shipping bolts so the combustor doesn't move while the stove is being shipped. To make future maintenance easier, do not reinstall them.
4. Tip the front of the combustor box up, turn the box 90 degrees, and remove it through the rear opening. If you are removing the combustor box through the top of the stove, you will have to slide one end of the combustor into the flue collar opening, and tip it up so that it will come out through the top opening.
5. Separate the top and bottom of the combustor box by removing the 2 bolts with two 7/16" wrenches. Remove the old combustor and clean off any old gasket residue. Put the new combustor with its new gasket into the combustor box. It may fit loosely at first but when the stove is fired, the gasket will expand to fill the space. Reassemble the combustor box. Place the box back into the stove so it is seated on the gasket. Bolt the stainless shield back in place.
6. Attach the cover plate again, tightening the 4 socket set screws with the Allen wrench.



# Frequently Asked Questions

## Q. How does the catalytic combustor work?

- A. The catalytic combustor breaks the bonds that hold the chemicals contained in wood smoke together. The result is that these chemicals begin to burn at temperatures of about 500 degrees F (the normal range of exhaust gas temperatures). Without the catalytic combustor, wood smoke would have to be brought up to a temperature of 1000 to 1200 degrees F in order to start to burn. A stove with a catalytic combustor will generate up to 25% more heat from each piece of wood, thus reducing the amount of fuel used during the year.

There are three advantages to burning the smoke created by burning wood. First, the smoke becomes another source of fuel, giving you more heat from the same amount of wood. Second, creosote causing materials will be burned up instead of being deposited in your chimney, reducing the risk of a chimney fire. Third, air pollution will be drastically reduced.

## Q. How can I tell if the catalytic combustor is working?

- A. *First* - The best way to tell if the catalytic combustor is working is by observing the smoke coming out of your chimney. If there is only a small amount of smoke, and/or it's white in color, the catalytic combustor is working. You will see significantly more smoke when the combustor is being bypassed than when the smoke is being burned by the combustor.

*Second* - One very noticeable effect of a well functioning combustor is the high efficiency of your stove. Catalytic combustors produce lots of heat, which the stove radiates into your home. If you notice that the stove is producing less heat, or that a load of wood doesn't provide as much warmth, under similar circumstances, as it did before, it's time to check the combustor. If and when the catalyst ceases to function properly, the stove will produce noticeably less heat.

*Third* - Regular inspection of the connector pipe and chimney flue should show very little accumulation of soot and creosote. Soot is typically brown and powdery when the combustor is working properly. Heavy buildup of black sticky creosote may indicate the combustor is not functioning or needs cleaning.

## Q. How do I maintain my catalytic combustor?

- A. Combustors should be inspected and cleaned, if necessary, **every 4-6 weeks** during the heating season. When the stove is cool, the combustor can be cleaned by thoroughly vacuuming or brushing both sides.

There is a metal screen in the top of the firebox, just in front of the bypass damper. This screen is made of an alloy called inconel, and can withstand very high temperatures. Since the screen is in a very hot part of the exhaust path, it incinerates most airborne fly ash, and prevents fly ash from reaching the catalytic combustor. If fly ash in its pure mineral form (calcium carbonate or magnesium oxide, for example) is left on the screen, you can remove these mineral deposits by gently tapping on the front of the screen until the deposits become dislodged, brushing the screen with a soft wire brush to dislodge the mineral deposits, or by soaking the screen in a vinegar/water bath for roughly 10 minutes, rinse in fresh water, then reinstall. It is very important to keep the screen clean.

If the stove does not draft well when the catalytic combustor is engaged and the stainless steel screen is clean, then the combustor cells themselves might be partially plugged with fly ash. If this is the case, follow the cleaning procedure described in detail on page 19 of this manual.

## Q. How will I know if the combustor is "worn out"?

- A. There are three symptoms that will indicate that the catalyst in your stove may not be working: First, your stove will generate noticeably less heat than it will when the catalyst is working. Second, you will notice a dramatic increase in the amount of soot and/or creosote in your stovepipe or chimney. Third, the color of the smoke produced by the stove will change. Smoke will appear black or brownish, instead of clear, white smoke (almost steam) from a catalytic stove.

If you suspect that your catalyst is not working, let the stove cool down and clean the combustor and screen and try it again.

## Q. Is it all right to burn my stove hot daily to clean any build up in my chimney system?

- A. It is not necessary to burn your stove hot daily to burn off any creosote build up in the chimney. This function is performed by the catalytic combustor. It is there to reduce the emissions from the stove that contribute to deposits in the connector pipe and chimney flue.

View more frequently asked questions and articles at our web site [www.woodstove.com](http://www.woodstove.com). Other very useful websites on all aspects of wood burning are [www.hearth.com](http://www.hearth.com), [www.woodheat.org](http://www.woodheat.org), and [www.csia.org](http://www.csia.org). CSIA is the Chimney Safety Institute of America.

#### **TWO OTHER IMPORTANT POINTS REGARDING CATALYTIC COMBUSTORS:**

- 1) The combustor uses wood smoke as fuel. Most smoke is created in the early stages of the burn cycle. When a bed of coals is all that remains of your wood, there is little smoke left to fuel the combustor, and it will no longer create substantial amounts of heat. Hence, the temperatures on the surface thermometer tend to fall toward the end of the burn, even though the firebox is full of hot coals. This does not mean that you have to reload the stove or open the bypass. Let the hot coals burn down to ashes.
- 2) Since the combustor blocks the path of exiting smoke, it can reduce the draft in your stove. When draft is reduced by warm or rainy weather, open the bypass damper longer when starting the stove to create more draft.

#### **CATALYTIC COMBUSTOR WARRANTY**

Model #202 Palladian and Model #204 Keystone have a 3-5/8" x 9-1/2" rectangular catalytic combustor, which is made of corrugated stainless steel. These combustors are manufactured by Clariant.

The Keystone & Palladian catalytic combustors in Woodstock Soapstone Stoves have a three year unconditional warranty, with an additional three years of pro-rated warranty. Warranty claims should be addressed to:

Woodstock Soapstone Company, Inc.  
66 Airpark Road  
West Lebanon, NH 03784  
Phone: 1-800-866-4344 • Web: [www.woodstove.com](http://www.woodstove.com)  
Email: [info@woodstove.com](mailto:info@woodstove.com)