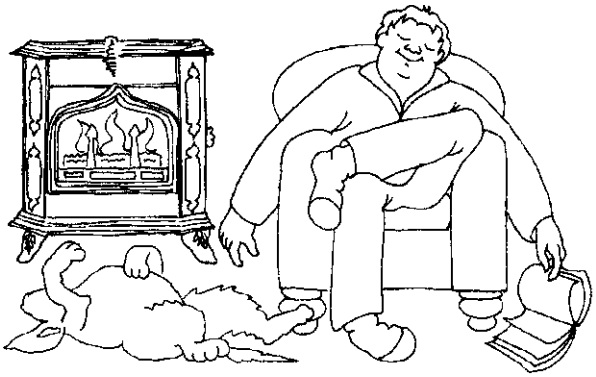
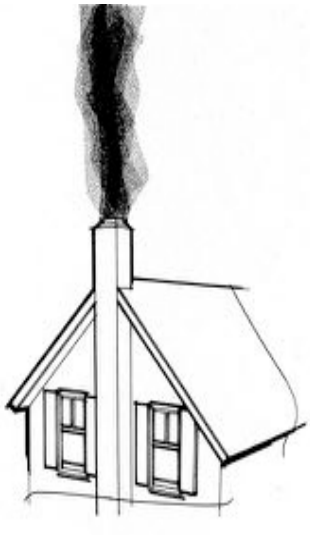
Catalytic Combustor Tips



The catalytic combustor in your stove is designed to clean the smoke that leaves your chimney, reduce creosote, and enable you to get more heat from each piece of wood. Most of the chemical compounds in wood smoke are combustible. High temperatures (in excess of 1000° F) can loosen the bonds of these chemical compounds and "burn" both combustible gasses and particles in wood smoke. However, most stoves cannot consistently produce temperatures in excess of 1000 degrees, particularly during long burning times. A catalytic combustor lowers the temperature at which particles and gasses begin to burn. With a Catalyst, wood smoke begins burning at 500° F instead of 1000°F.

The smoke from a catalytic stove almost looks like steam - clear, white, and clean.



Older, non-catalytic stoves generate smoke that is black or brown, and dirty.

The catalytic combustor is a ceramic honeycomb, filled with long rectangular tubes, or "cells". The inside walls of each cell are rough, with many minute nooks and crannies. This creates the largest possible surface area to interact with the wood smoke as it passes through the honeycomb. Precious metals, such as platinum and palladium, are sprayed on the inside of these cells, and coat all of the surface area in each cell. The catalytic converter in your stove is very similar to the one that is in the exhaust system of your automobile and works to achieve the same results.

The Three T's: Temperature, Turbulence And Time

Your catalytic combustor can get the most heat out of each piece of wood and the cleanest burning if it has three things: temperature, turbulence, and time.

1. Temperature: The catalytic combuster starts burning the gasses and particles in wood smoke when the smoke reaches approximately 500° F. At temperatures lower than 500° there is very little catalytic activity. When you are starting a fire in a cold stove, you will need to get the firebox up to 500° before the combustor will ignite. This takes about 30 minutes, unless the stove has already been burning, in which case the time is much shorter. When you are re-loading the stove, you just need to get the firebox back up to 500° to keep the combustor ignited, and this takes about 10 minutes. The drier your wood, the quicker the catalyst will ignite, whether you are kindling a fire, or just reloading.

Note for Woodstock Soapstone Stove owners:

Each stove comes with a surface thermometer. The tem - perature on top of the stove is roughly half the temperature inside the stove – so when the stove top thermometer read 250° your firebox temperature is 500° and the combustor has ignited.

The thermometer is only a guide. The soapstone takes time to absorb heat and then retains that heat for a while so if anything the firebox will be hot and the catalyst will ignite before the top thermometer reaches 250°!

2. Turbulence: The wood smoke can reacts best with the precious metals inside the honeycomb cells if there is some turbulence in the air-flow. Turbulence enables more of the wood smoke to come into contact with more of the surface area in the honeycomb cells. An expanded metal screen that sits in front of the catalytic combustor in your Woodstock Soapstone Stove to creates this turbulence in the exhaust stream as it enters the catalyst. It also protects the catalytic combustor from direct flame contact.

3. Time: Once temperature and turbulence are achieved, the catalytic combustor just needs to have enough time to burn all the gasses in the wood smoke as they pass through the cells. For this reason, the catalyst works best on a slow to moderate burn, which is also the most efficient rate of burning if you are using your stove as a primary souce of heat.

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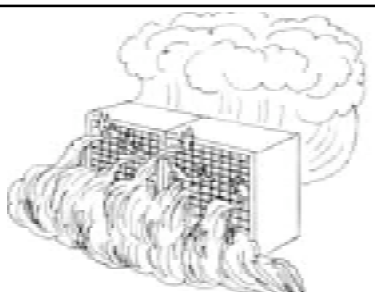
A high damper setting can allow too much air into the firebox, speed up the rate at which the fire burns, and send more wood smoke through the combustor than it can handle at one time. A high damper setting (too much air) also allows unburned wood smoke (and heat) to go up the chimney. The ideal air setting is one that allows enough air to keep the wood burning and producing smoke, but not so much that the smoke is racing through the combustor without being burned.



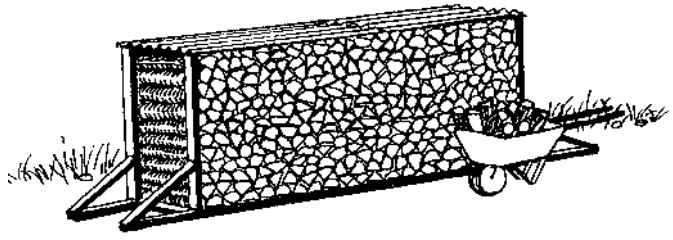
A catalytic combustor is a ceramic honey - comb. As smoke passes through it, both gases and small particles are burned, which increases efficiency and reduces pollution.

If you have excessive draft, you may not be able to completely control the burn rate with the stove damper, and you may need to add a pipe damper. The most common symptom of excessive draft is a fire that does not readily die down when the damper is closed and the air flow is significantly diminished.

How To Get The Best Performance And Longest Life From Your Catalyst

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

1) Burn only natural well-seasoned wood. If wood is not seasoned, the moisture will (1) cool the catalyst, (2) reduce efficiency, and (3) condense in the chimney when it is bitter cold. Burn dry wood and avoid using your stove as an evaporator!



Store your firewood off the ground on 2 x 4's or 2 x 6's. Cover it with plastic, or metal roofing. Leave the sides open for ventilation.

2) Wait until the thermometer on the stove top reaches 250 degrees (500 degrees inside of firebox) to engage the combustor.

3) Bypass the combustor before opening the door and reloading. Leave bypass open for a short time after adding wood to allow moisture in wood to burn off and the exhaust stream to return to 500° inside the stove.

4) Don't overfire the stove. Excessive heat can damage the combustor, and a "raging fire" will also produce an exhaust velocity that reduces the effectiveness of the combustor (see "Time", above).

5) Clean the combustor regularly. We recommend cleaning the combustor with a vacuum cleaner or soft bristled brush every 6 weeks or every cord of wood, whichever comes first.

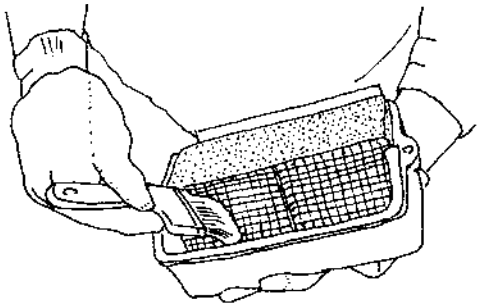
Troubleshooting and FAQ's:

Q. Can I leave the combustor engaged overnight even though by morning the temperature will be below the catalytic range on the thermometer?

A. Yes. Once the wood smoke is up to 500° and the combustor is "ignited" it will continue to burn smoke for as long as there is smoke to be burned. By the time the fire has died down to coals in the morning, there is very little smoke remaining so the combustor is not becoming plugged with lots of too-cool smoke.

Q. How do I clean my catalytic combustor?

A. The best way to clean your catalytic combustor is to simply vacuum off both sides. You can also use a soft bristled brush (like a paint brush). If your combustor seems plugged with ash even after brushing or vacuuming, you can gently clean the cells with a pipe cleaner.



Q. Can I clean my combustor with my air compressor?

A. It is not a good idea to clean your combustor with an air compressor unless you can ensure very low pressure. Using high pressure air to blow the cell free of fly ash build up can also blow off the precious metal coating inside the cells. However, the compressed air that comes in a can (for cleaning camera and computer parts) can be used very effectively.

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Q. I went to clean my catalytic combustor and noticed that the surface is damaged. What happened?

A. The 2 most common reasons for the ceramic substrate to crack, crumble, or break apart are thermal shock or flame impingement.

Thermal Shock happens when the catalytic combustor goes from hot to cold very quickly. The most common cause of thermal shock is engaging the combustor too soon after adding new wood to an already hot fire. If you use wet wood, or wood with snow and ice attached to it, you can be inviting this problem to occur.

When you add wood to the firebox you drastically change the temperature inside the firebox. The first stage in the wood burning process is the release of moisture as steam. If your combustor was working at 800° (400° on top of the stove) and you engage the combustor too early, you send 212° steam through the 800° catalytic combustor. It is the same effect as taking a glass pie plate out of a hot oven and into the freezer. The symptoms start with hairline cracks on the cell walls and progress to entire chunks of combustor substrate crumbling away.

The single biggest thing you can do to prevent thermal shock is to use dry wood.

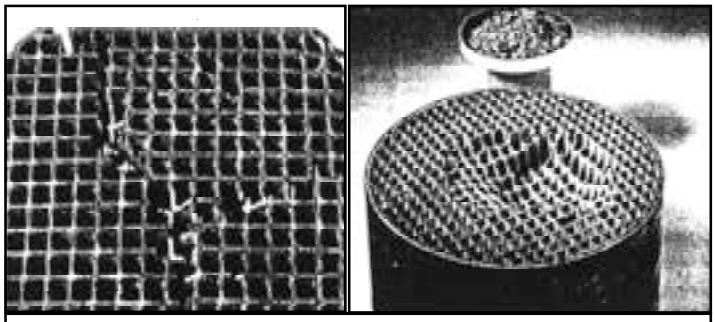
Flame Impingement happens when flames directly enter the combustor for long periods of time. The most common reason for flame impingement is overfiring the stove; burning the stove for long periods with a wide open damper setting and allowing too much air into the firebox, and too hot a fire after the combustor has been engaged.

The other way to overfire the stove is to burn large quantities of very small pieces of wood - dowels, for example. When you fill the firebox with many small pieces of very dry wood, the amount of exposed surface area is very large and all the wood tends to ignite at once, creating an extremely hot fire even if the damper isn't all the way open. It's OK to burn a steady diet of small pieces of wood, lumberyard scraps and the like, as long as you don't fill the firebox full of them!

Direct flame contact will eat away at the ceramic substrate of the catalyst, often looking like someone scooped out sections of the combustor with a spoon (see photo, upper right).

Q. What about non-catalytic stoves? How do they compare with catalytic stoves?

A. There are a number of good non-catalytic stoves on the market, and some of them achieve clean burning that is almost as good as the clean burn that you'll get with a catalyst. Our only reservation about these stoves is the way they are built.



The photo above left shows a combustor with a cracked surface, which is usually the result of thermal shock. Thermal shock is can be caused by burning wood that is wet, or wood that is covered by snow and ice.

The photo at the right shows a combustor that has suffered from flame impingement, which is usually caused by overfiring the stove.

To meet the EPA standards and achieve truly clean burning, the non-catalytic stoves have to burn regularly at temperatures of about 1,000 degrees - i.e. the temperature that gasses and particles in the smoke will burn without a catalyst. In other words, non-catalytic stoves have to operate with very hot firebox temperatures to meet the EPA standards - much hotter than catalytic stoves.

Rather than recommend specific models of non-catalytic stoves made by competitors, we offer this advice: If you are considering a purchase of one of these stoves, look carefully at the firebox and the way the inside of the stove is constructed, keeping in mind that all materials and any moving parts are subject to very high heat. If any of the materials seem to be lightweight or insubstantial, steer clear and keep looking. You will want to invest in a stove that is durable, and able to withstand high heat and heat cycling.

The catalytic combustor in your stove will have to be replaced every 4-5 years. Its replacement cost (about $100) is a small price to pay for the increased efficiency, clean-burning, and peace-of-mind it offers. And, it's much easier to replace a catalyst than a warped firebox.

Q. How do I know when my catalytic combustor needs to be replaced?

A. It's pretty straightforward. You will notice two things: (1) your stove will produce less heat, and (2) the smoke coming out the chimney will be noticeably darker, and will have some "woodsmoke odor".

When your catalyst is working properly, it produces lots of heat. As it wears out the decline in heat output will be noticeable. And when the catalyst is working properly, the "smoke" is almost all carbon dioxide and water vapor, so it appears to be white, or light grey. As the combustor's performance declines over time, the smoke will appear noticeably darker.