

Why Catalytic Combusters?

At Woodstock Soapstone, when asked if we use catalytic combusters in our wood stoves, our answer is an emphatic yes! Since we began using catalytic technology in 1982, we have found it to be the cleanest and most efficient way to burn wood.

Catalytic design was one of several technologies developed as a response to the Environmental Protection Agency's mandate for wood stove manufacturers to produce cleaner burning stoves. Early designs were often difficult or expensive to operate and maintain, and some manufacturers opted for alternatives to the catalytic combustor to achieve the EPA emissions requirements. Here at Woodstock Soapstone, we have developed an easy to use a catalytic system that our customers swear by. To learn more about catalytic technology, please read on.

WHAT IS A CATALYTIC COMBUSTOR?

Catalytic combustors are the wood stove equivalent to the catalytic converters used in cars, busses, forklifts, trains, and generators to remove pollution from the exhaust. In a woodstove, the catalytic combustor not only removes pollution from the exhaust, *it also creates usable heat and a safer chimney.*

The combustor itself is a ceramic honeycomb brick that wood smoke passes through before it leaves the stove. The walls of the honeycomb are coated with "reactants" (primarily platinum, palladium or rhodium). When woodsmoke has reached 500 degrees and comes in contact with a catalyst, it begins to burn. As the particulates in the smoke burn, additional heat is created in your stove. The exhaust that goes up your chimney is cleaner than before.



Catalytic Combuster

Non-catalytic stoves generally use extended flame paths and introduction of secondary air to burn particulates in the smoke stream. Using this method, the chemical compounds in wood will not burn until the smoke reaches almost 1,100 degrees. Such high temperatures can be hard to achieve, particularly during long burn times. Catalytic combustors reduce the ignition point of the chemical compounds in the smoke, allowing them to be turned into heat before they leave the stove. This boosts stove efficiency, reduces pollution, and dramatically improves woodstove safety.

WHY WE PREFER CATALYTIC COMBUSTORS IN OUR STOVES

Catalytic stoves are more efficient than non-catalytic stoves. Catalytic stoves are 14% more efficient than non-catalytic stoves.

Why are catalytic stoves more efficient? (1) They convert more of the exiting gasses to heat, and (2) They work more efficiently at low to medium heat outputs than non-catalytic stoves.

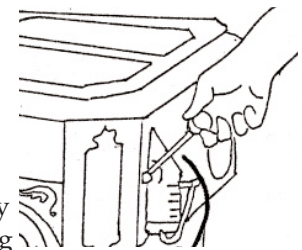
The EPA assigns a 72% efficiency rating to catalytic stoves, and a 63% efficiency rating to non-catalytic stoves. Although this is a difference of 9 percentage points, it is actually an increase in efficiency of 14% for catalytic stoves compared to non-cats. $72\%/63\% = 1.14$, or a 14% difference.

EPA Efficiency Ratings

Catalytic stoves are easier to operate than non-catalytic stoves. A catalytic combustor begins to burn volatile materials in the exhaust stream at 500 degrees. Non-catalytic stoves do not begin to perform efficiently until secondary air is introduced to exhaust temperatures that are over 1000 degrees. This is a crucial difference for two reasons: 1) the hotter you have to get your fire before you can start operating efficiently, the more heat you send up the chimney, and 2) achieving temperatures of 1,000 degrees in the firebox is not an easy task for every homeowner.

Getting secondary light-off (ignition of exhaust gases) in a non-catalytic stove can be difficult for an experienced technician in a test lab using kiln-dried wood and is even more difficult for a homeowner using cordwood of varying moisture content and density. Non-catalytic stoves simply work better in the lab than in the real world. Getting advertised efficiency in a non-cat stove is like buying a car that is supposed to get 30 mpg, and then discovering that you can't drive over 45 miles per hour and have to coast down hills to get the mileage you were expecting.

To achieve the advertised efficiency in a catalytic stove, all you have to do is close the catalytic bypass door when the exhaust stream approaches 500 degrees (typically about 40 minutes after kindling a fire, or 15-20 minutes after reloading.



To engage to catalytic combustor, simply push up the bypass handle

Catalytic combustors are more economical than non-catalytic stoves. Because they start operating efficiently at lower temperatures, catalytic stoves generally have longer burn cycles, lower stack temperatures and higher heat transfer rates than non-catalytic stoves. This means that the heat generated stays in your home rather than going up your chimney or to the great outdoors. The longer burn times and high efficiency and heat transfer rates of catalytic stoves also mean you burn less wood to heat your home. It's that simple.

Catalytic stoves burn cleaner than non-catalytic stoves. Current EPA regulations restrict only particulate emissions. Catalytic combustors provide dramatic reductions in airborne particulates, *but catalysts are also* highly efficient at burning other compounds in the exhaust stream, such as carbon monoxide, methane, benzene, and volatile organic compounds. This thorough combustion means higher efficiency, lower emissions, and safer performance (less creosote in the chimney because the exhaust is mainly CO₂ and water vapor).

As an added bonus, catalytic stoves are often more durable than non-catalytic stoves. Catalytic stoves burn very cleanly and efficiently at low to medium heat outputs, as noted above. The thermal stress of burning particulates and volatiles is concentrated *in the catalyst*, which is a durable ceramic material built to withstand normal temperatures up to 1,700 degrees. Focusing all of the high temperature activity in the catalytic combustor allows other stove components to stay in comfortable operating temperatures and not get overheated.

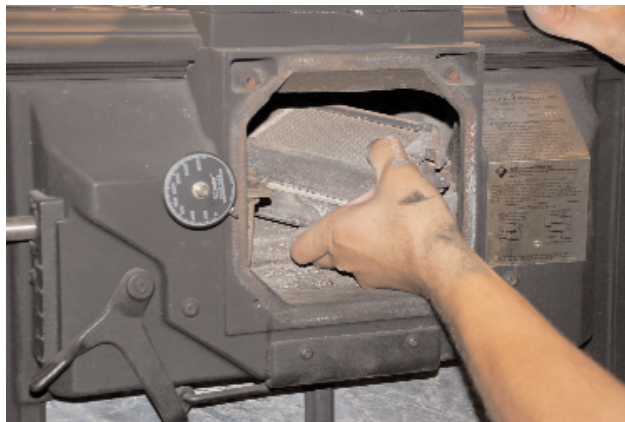
Non-catalytic stoves require insulated fireboxes and much higher temperatures to achieve secondary combustion and begin burning particulates and gasses in the exhaust. The insulation material is usually firebrick or ceramic. The insulation improves EPA emissions but decreases heat transfer efficiency. If a non-catalytic stove is over-fired, the whole firebox may be damaged by thermal stress. This would result in a large repair job with a hefty cost for the replacement parts needed to repair your stove.

OTHER CONSIDERATIONS

Maintenance and replacement is fast and easy. About every six weeks, or every cord of wood, the catalytic combustor needs to be cleaned. This simply means removing it from the stove and cleaning off ash deposits with a soft brush or shop vac. When you're done, just put it back into the stove.



Inexpensive and easy to replace. Replacing a catalytic combustor is a matter of taking the old combustor out of the stove and removing two bolts from its box frame. The old one is discarded – no need to return it to us – and the new one placed into the box frame. Re-bolt the frame and put it back into the stove. You're ready to go.



Replacing the combustor in a Keystone stove

Our catalytic combustors are fully warranted for the first three years you own your stove, and carry a pro rated discount for the fourth, fifth, and sixth year. After the six-year warranty expires, the replacement cost of a catalyst is \$125.

Long life span. Most of our customers replace their combustors at an average of four to six years. We even get orders from customers who have had their combustor as many as eight or nine years. The replacement rate varies depending on how you operate your stove, the type of wood you burn, and how long, or severe, your heating season is.

Applied Ceramics, the manufacturer of our catalytic combustors estimates the combustors to have useful life of 12-14,000 hours, depending on how you use your stove. You can expect about four years from it if you use the stove 24 hours/day from November 15 through April 15 (5 months x 30 days x 24 hours/day x 4 years =14,400 hours). If you plan to use the stove less than 5 months/year, or as intermittent or back-up heat, the replacement cycle would be proportionately longer.

With the simple technology available to reduce pollution in the atmosphere, reduce creosote in your chimney, and provide for a durable and highly efficient woodstove, at Woodstock Soapstone we will continue to provide our customers with stoves that employ catalytic technology.