

Cold air intake for wood stoves

By Dr Tom Chalko, MSc, PhD

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Some people argue that there are no benefits for using outside cool air intake for wood stoves and that the best source of combustion air for wood stove is the room in which people live and try to heat.

If taking combustion air from where people are present was really a good idea, why combustion air for car engines is not drawn from inside car cabins? All modern cars strive to use a “cold air intake” and draw the coldest air possible for engine combustion.

The colder the air – the denser it is and more oxygen per unit volume it contains, so it must be good to assist combustion.

Cold air intake experiment

I have installed an outside cold-air intake in the ash compartment of my Morso 2110 wood stove in a way that I can compare behavior of my stove with different combustion air supply just by opening and closing valves without touching the fuel or altering the fire under various atmospheric and other conditions.

From my experience the cold air intake is astonishingly better than a room air intake. I would say that there is no comparison. I actually see no reason to use an interior air intake for my wood stove and I wonder how did I live without stove cold air intake for so many years...

Advantages of the cold air intake that I observed using my wood stove are:

1. Starting, restarting and maintaining the fire become surprisingly easy with a cold air intake. All functions of the stove operator become easier and less time consuming.
2. Wider range of fire intensity control. Opening a grate that separates firebox from an underneath ash compartment provides very impressive range of fire control with cold air intake. When the grate is open – fire behaves

like someone continuously blows oxygen-rich air from underneath, fast restarting the fire even in quite extreme situations. When the grate is fully closed a slow-burning process occurs. Intermediate grate positions allow control of fire intensity.

3. As a cold air drawn for combustion becomes heated up in the combustion chamber – it expands. Colder air expanding in the combustion chamber assists chimney draft quite noticeably, even in situations that are quite challenging when air is taken from inside the room. The improvement in chimney draft and fire behavior in those “difficult situations” is very noticeable. Starting fire with stove doors fully closed (no smoke indoor) becomes easy.
4. Temperatures in the entire house become more uniform with cold air intake than with room air intake, because cold outside air is not forcibly drawn through distant gaps away from the stove. It is well known that interior heat losses via mass transfer (cold air leaks) are very significant in comparison to losses associated with conduction, convection and radiation of heat. Since we feel more comfortable when interior temperature differences are smaller - we can keep a smaller fire to maintain thermal comfort in the entire interior. Not only we use less time to refuel the stove and service the fire, but we also use noticeably less fuel to stay comfortable.
5. With cold air intake stove glass windows are clean and transparent, enabling me to enjoy a better view of the fire and save time that I otherwise would use to clean the stove glass.
6. No smoke smell indoor, even in difficult situations and during fire starting with imperfect fuel.
7. Noticeably less smoke and smoke smell outdoors
8. Ability to maintain hot fire of difficult to burn or partial fuel loads that is impossible to maintain (extinguishes itself) with room air intake.

9. More complete combustion - less ash and debris, easier stove cleaning

Above advantages are subject to following conditions:

1. Cold air needs to be introduced to the ash compartment underneath the fire. Only some wood stoves actually have such compartments. Trying to introduce cold air pipe directly into hot firebox is likely to cause surprises and challenges.
2. Cold air intake needs to be taken from a location that experiences static atmospheric pressure, free from dynamic pressure variations associated with winds. I located my cold air intake under the floor of my house, a location that is protected from wind.
3. Cold air intake needs to be equipped with a spark arrestor to prevent unexpected accidents
4. Stove chimney system needs to be reasonably designed and constructed

Details of my installation

First I used a long pilot drill to drill a 5mm hole from inside the ash compartment underneath the grate and the fire to make sure that hole in the ash compartment wall was in the right place, away from obstacles (ribs), and was well aligned with the hole in the heat shield installed at the back of the stove.



Fig 1. Cold air intake at the back of the ash compartment underneath the firebox (ash tray removed) after a few months of use. Note a shiny appearance of the duct with no trace of smoke presence. The stove is 10 years old.



Fig 2. Flexible aluminum duct and ball valve at the back of the stove. Aluminum duct is cold to touch when the wood stove is hot.

Using pilot holes as guides I drilled 50mm holes from outside using a bi-metal hole saw bit. Two standard 50mm galvanized plumbing pops wedged into one another provided support for my cold air duct. A short piece of 50mm accordion-style aluminum automotive duct, a 50mm ball valve and a piece of matching pvc pipe going under the floor formed my cold air intake duct.

A fine metal mesh covers the duct intake under the house. This mesh serves as a spark arrestor and protects the duct intake from insects and other animals that may want to enter it.

Conclusions

If you do not use cold air intake for your wood stove – you do not know what you are missing. If you have any doubts about cold air intake benefits – do what I did: install a valve on the cold air intake duct so that you can block the cold air and unblock room air intake valves in your stove that you currently use. This way you can easily compare cold air intake with room air intake to see the difference yourself.