



Woodstove Operation & Maintenance Webinar 2

December 7, 2020



Tribal Air Monitoring



Support Center



Webinar Logistics



- Webinar is being recorded – URL for the recording will be in post-webinar email and posted at <https://bit.ly/AIAQTPwebinars>
- Please complete the webinar feedback survey – Link for the feedback survey will be in post-webinar email
- Certificates will be emailed to participants
- Webinar 3 will be held on December 15, 2020

Thank you for joining the webinar!

Thursday, November 12, 2020; 10:00am-11:30am Pacific Time

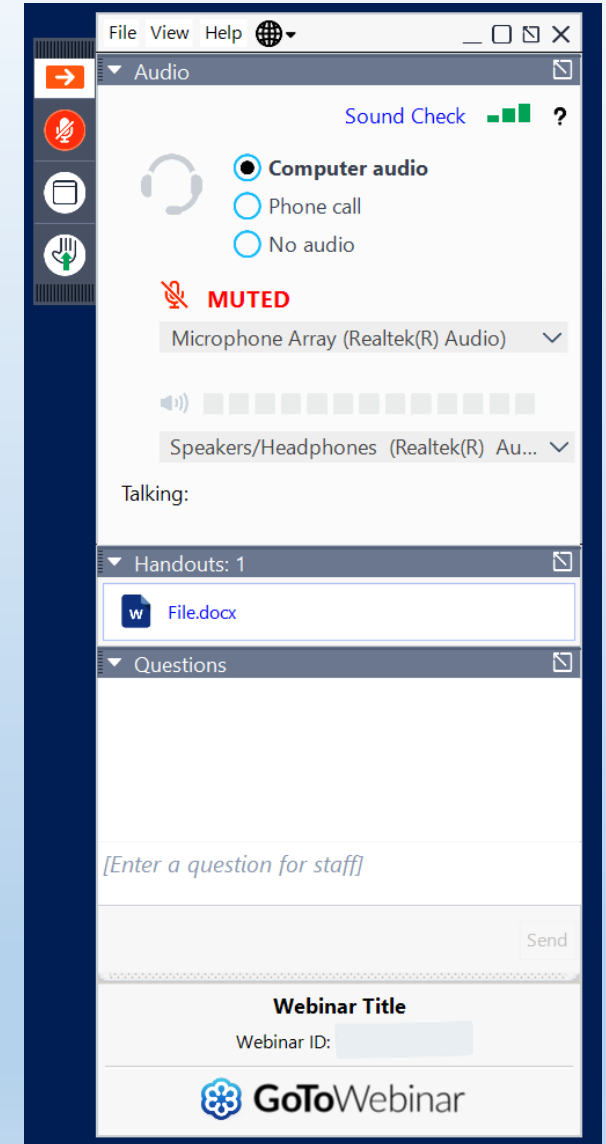
 Submit questions in the "Questions" pane

 Raise your hand if you would like to be unmuted

 Download files from the "Handouts" pane



Presented by the Institute for Tribal Environmental Professionals
American Indian Air Quality Training Program
Questions? Contact Darlene.Santos@nau.edu





Polling Questions

Poll Question 1



- Which of the following best describes your role?
 - Environmental Staff
 - Community or Tribal Leader
 - Federal or State Partner
 - Tribal Housing Staff
 - Other

Poll Question 2



- How many years have you worked in Air Quality or Housing?
 - Less than a year
 - 1-3 years
 - 3-5 years
 - 5-10 years
 - Over 10 years

Poll Question 3



- Have you ever installed a woodstove?
 - Yes
 - No

Poll Question 4



- Did you complete the online HPB Woodstove Installation Basics training course?
 - Yes
 - No
- If not, can access training at link below:
<https://hpbef.mindflash.com/PublicCoursePage.aspx?c=5059774539631>

Presenters

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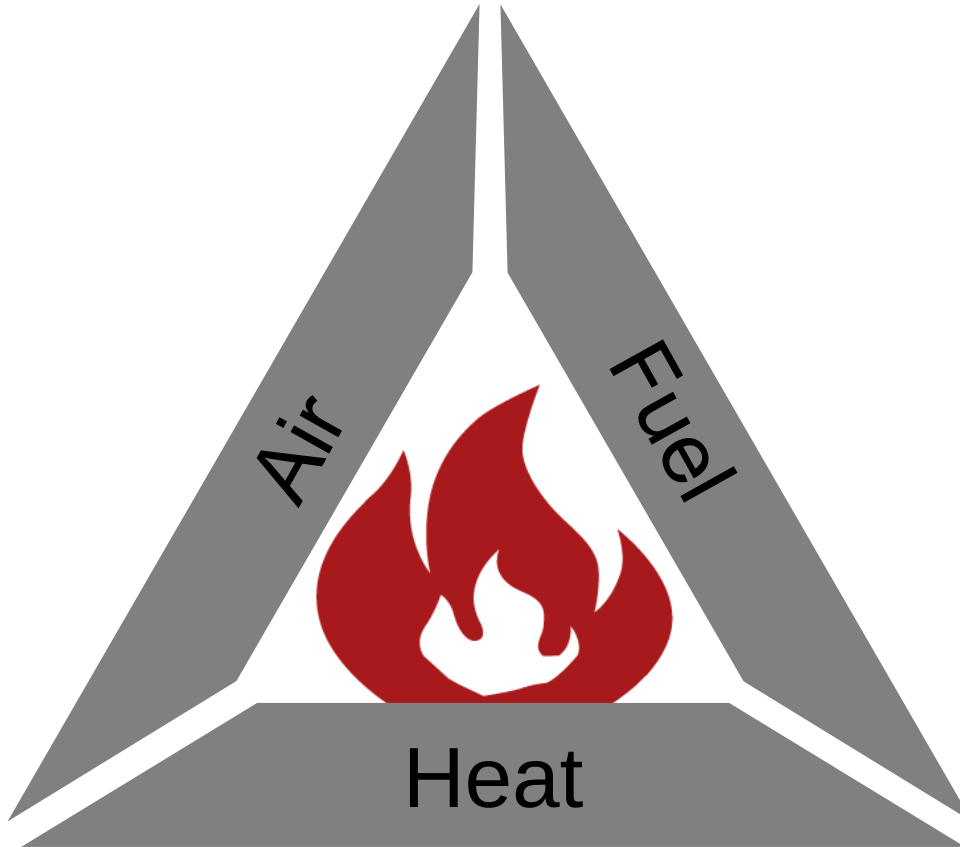
Woodstove Installation Basics

Principles of Combustion



Principles of Combustion

- Air
- Fuel
- Heat

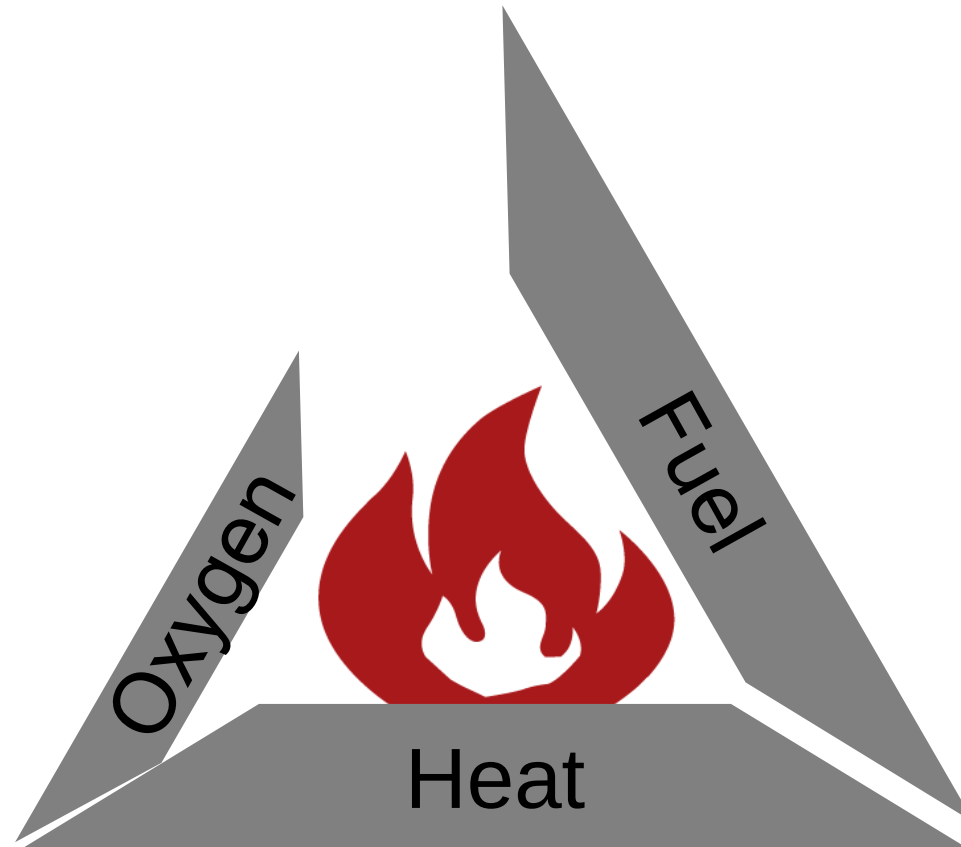


Complete Combustion

- Heat
- Water vapor
- Carbon Dioxide
- Ashes (Solid fuel)

Incomplete Combustion

- Wasted fuel
- Emissions
 - Air quality



Incomplete Combustion

Carbon Monoxide

- Colorless, odorless, tasteless, TOXIC, combustible gas
- Mixes with hemoglobin in bloodstream
 - Deprives muscles and organs of oxygen
- Results of exposure:
 - Headaches, fatigue, nausea, dizziness, convulsions, DEATH
- Effects dependent on:
 - CO concentration
 - Health, age, sex, size of victim

Incomplete Combustion

- Poor Performance
 - Flames may be small and “lazy”
 - Reduced heat output
 - Callbacks and dissatisfied customers

Incomplete Combustion

- Sooting
 - Minor maintenance nuisance
 - Thousands of dollars worth of damage

Efficiency

% of fuels energy converted to heat

- Temperature
 - Ignition temperature must be maintained
- Turbulence
 - Mixing of air and combustible gases
 - Air directed for secondary combustion
- Time
 - Baffles, increase residence time

Woodstove Installation Basics

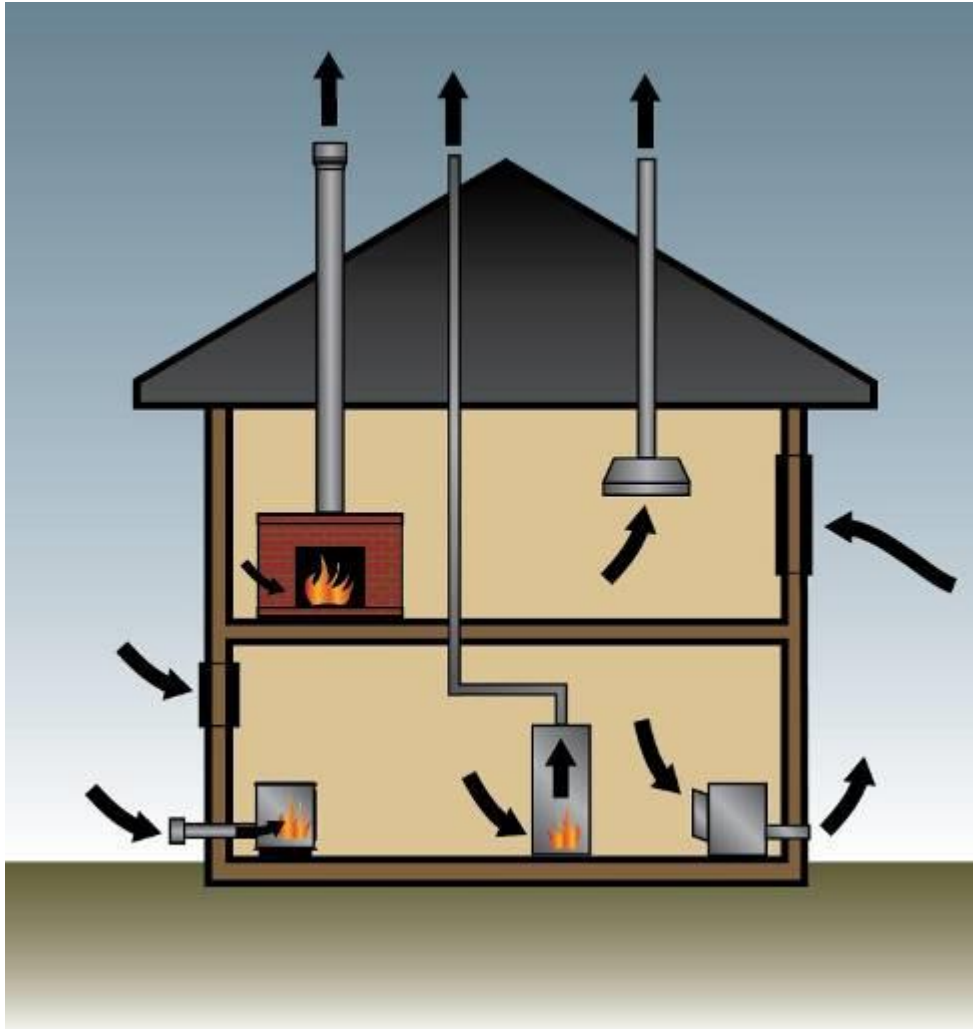
Appliance Types



Hearth Systems



Hearth Systems



Appliance Types

Masonry Fireplace



Appliance Types

Factory Built Fireplace



Appliance Types

Freestanding Stoves



Appliance Types

Fireplace Inserts



Appliance Types

Coal Stoves



Wood Cookstoves



Appliance Types

Masonry



Furnaces

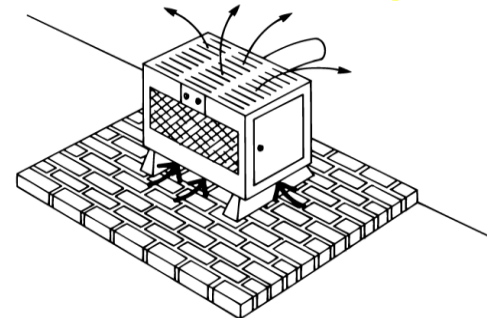
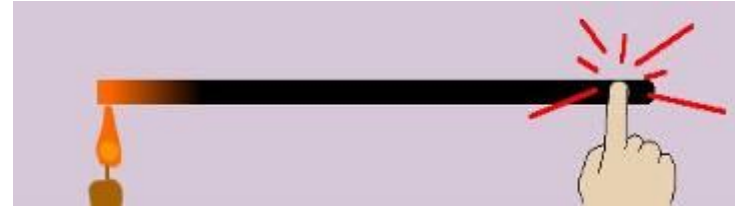


Outdoor



Heat Delivery

- Conduction
 - Direct transmission of heat from one surface to another
- Radiant
 - Waves of energy converted to heat on contact with solid surface
- Convection
 - Transfer of heated air

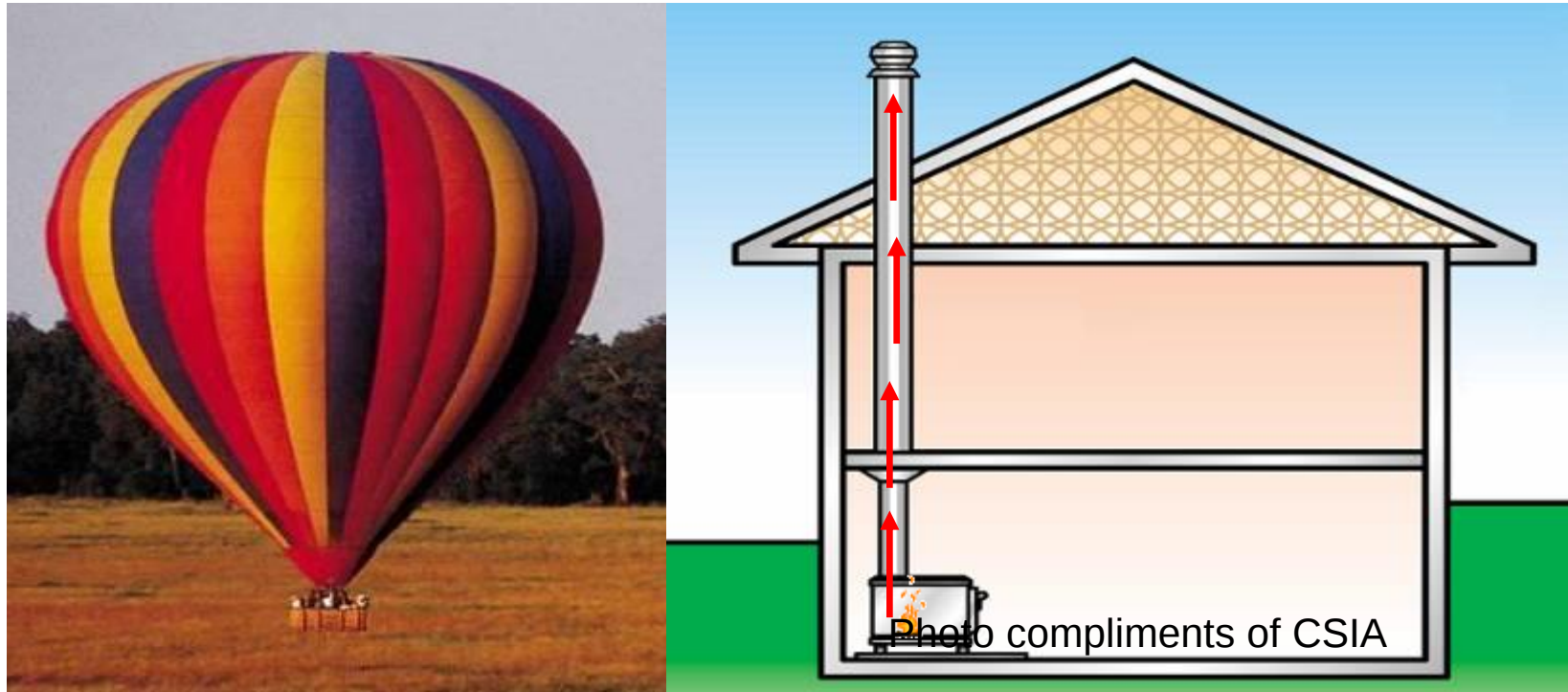


Woodstove Installation Basics

Installation Planning



Principles of Draft and Flow



- Exhausts flue gases to outside
- Protects home from hot gases and sparks.
- Causes combustion air to be drawn in

Natural Draft

- Force that moves air into the appliance and combustion by-products
- Pressure difference
 - Temperature difference between gases in the venting system and that of outdoor air
 - Greater the temperature difference the more draft created
 - Movement from zones of high pressure to zones of low pressure

Flow

- Volume of gases that pass through venting system as a result of draft
- Sufficient flow to remove combustion by-products required
- Resistance to flow has net effect of reduced draft
 - Adverse effect on combustion process
 - Lower flue gas temperatures

House Pressure Conditions

- House Stack Effect
 - Heated portion of house taller than vent termination
 - Leaks (recessed lighting, attic fan), open window in upper portion create greater chimney effect than vent



Combustibles

- Walls with wood framing
- Paper-faced materials
 - Papered sheetrock (dry wall)
 - including fire-rated papered sheetrock
- Plaster on wood lath or studs



Combustibles

- Noncombustible

- Entirely

- metal
 - Brick
 - Tile
 - Concrete
 - Slate
 - Plaster on metal lath



Combustibles

- If you don't know...
.....Assume it is combustible



Combustibles

- Pyrolysis -Ignition temperatures of combustibles lowers with age and heating
- When ignition temperature reached, combustible material ignites, without direct contact with flame

Combustibles

- Scorching and smoldering may not be noticed before a fire starts



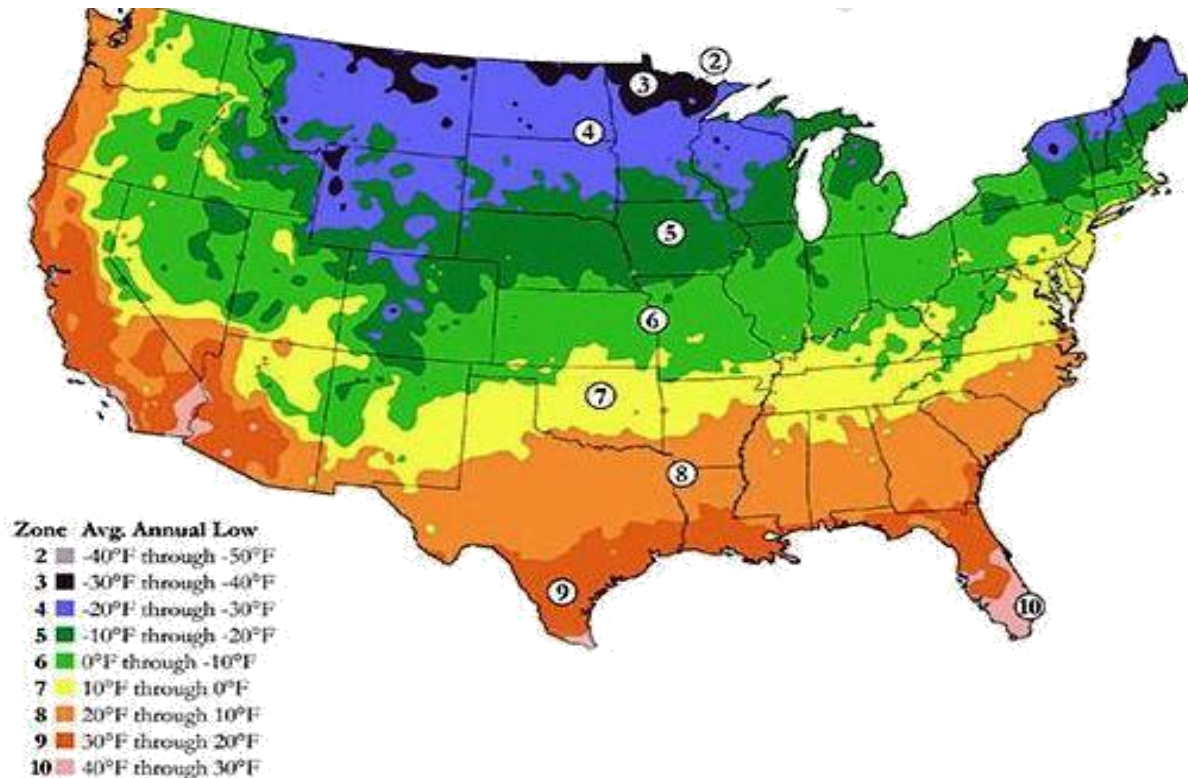
Appliance Installation Planning

- Venting Obstructions
 - Wiring
 - Ductwork
 - Construction features like trusses
- Outside Air
 - Draw from approved, ventilated source
- Electrical Outlet
 - Check grounding and polarity

Appliance Installation Planning

Freestanding Stoves

- Establish Realistic Expectations
 - Climate



Appliance Installation Planning

Freestanding Stoves

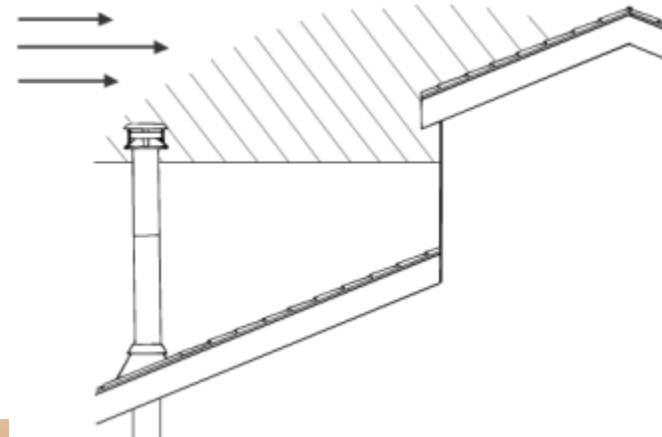
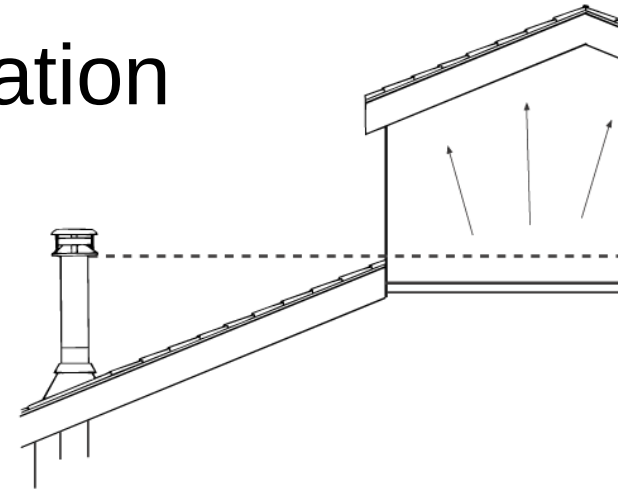
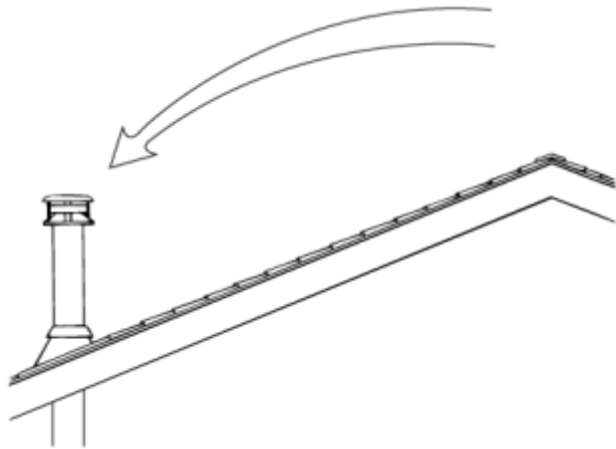
- Establish Realistic Expectations

- Insulation
- Tightness of construction
- Windows
- Type of house
- Traffic patterns



Natural Draft Chimney Location

- Avoid low level roof penetration
 - Prevent house stack effect
 - Avoid wind turbulence



Natural Draft Chimney Location

- Interior location when possible
 - Keep flue gases warm for optimum draft
 - Prevent cold hearth syndrome in standby and startup



Woodstove Installation Basics

Safety Guidelines



Proper Lifting Techniques

- Stand close to object
- Bend knees and keep back straight
- Lift with leg and buttock muscles



can quickly overstress your back.

Even leaning forward while sitting at a desk or table
can eventually cause damage and pain.



jen_simons_

-0:57



Ladder Safety

CAUTION

Each year, over 160,000 people are injured as a result of falls from ladders due to **not following safety precautions!**

DANGER

300 Deaths Per Year
Making a mistake while using a single or extension ladder can change or end your life.

Ladder Safety



Ladder Safety

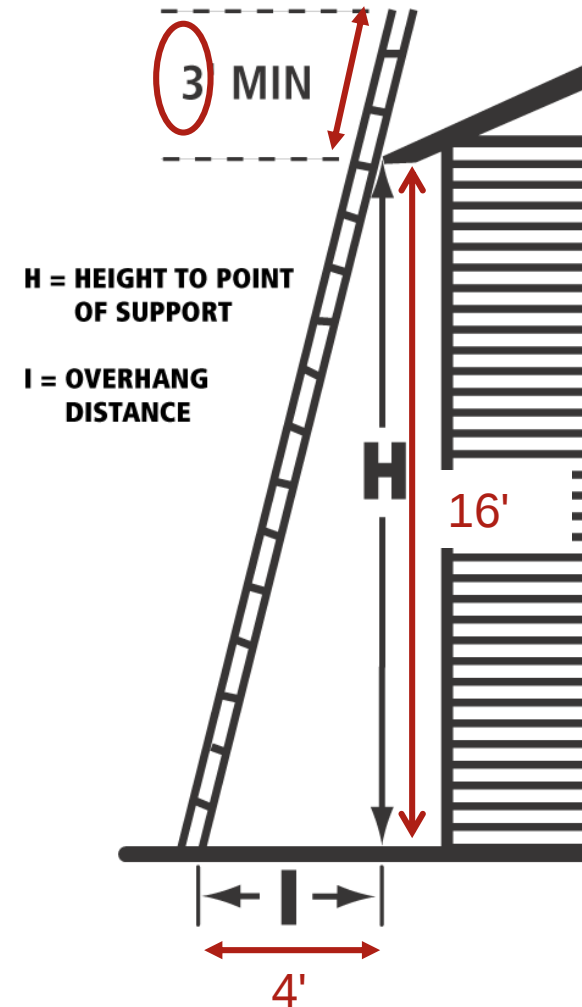


Ladder Safety



Ladder Safety

- Proper Angle Methods
 - 1:4 ratio method:
 - 1 foot horizontal for every 4 feet vertical
 - Example:
 - If $H = 16$,
 - $L = 16/4$ or 4 feet out from point below roof overhang
- Minimum extension above roof contact: 3'



Ladder Safety

- The Ladder Safety App, NIOSH's mobile app is designed to improve extension and step ladder safety

Get the NIOSH Ladder Safety App!



Download for free at [Apple Store](#) and [Google Play](#) available in English and Spanish.

User's Manual is also available:

[iOS](#) ([En español](#))

[Android](#) ([En español](#))

Ladder Safety

- Avoid power lines
 - Particularly with aluminum ladders
 - Direct contact is not necessary
- Similar surfaces for all legs
 - Ladder levelers
- Secure or hold at bottom
- Avoid foot and vehicle traffic



Ladder Safety

- Secure carefully to vehicle
- Check them often



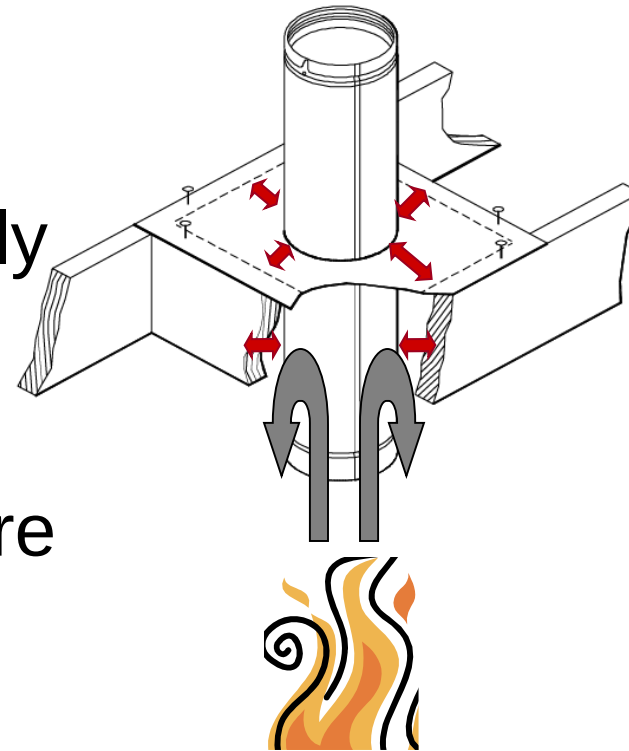
Woodstove Installation Basics

Installation Guidelines



Firestop

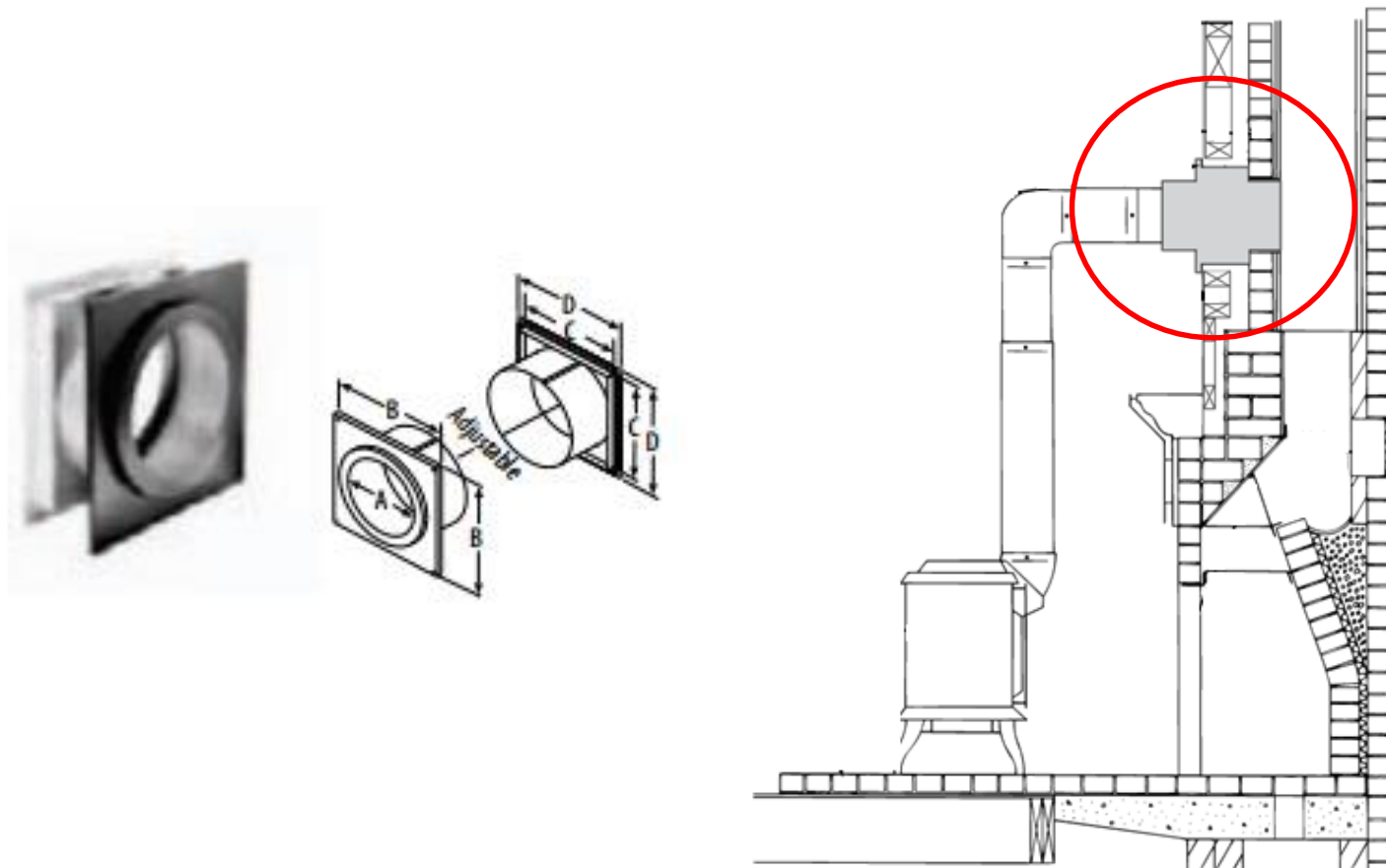
- Pipe installation
 - Ensure pipe clearance to combustible framing
 - Hold pipe in place laterally (from side to side)
- Fire safety
 - Help prevent spread of fire from floor to floor



Chimney Elbows

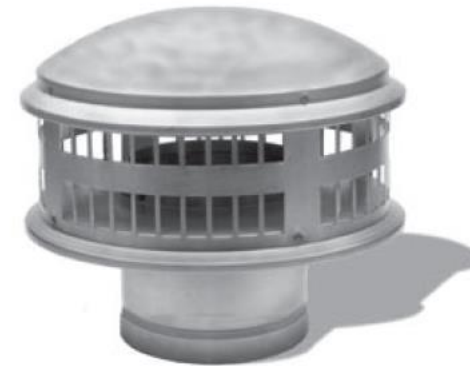
- No more than 30°US (45°Canada)
 - 2012 IRC: maximum 4 elbows, maximum 30° offset
- Use 15° when possible
- Manufacturer may specify
 - Maximum # of elbows
 - Maximum allowable length of inclined portion
- Used in pairs

Wall Thimble

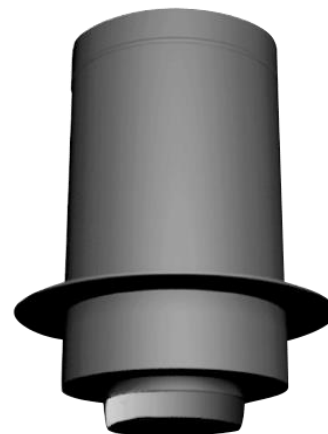


Termination Cap

- Vent cap must be approved for use by vent manufacturer
- Different manufacturers' pipe and termination caps must not be mixed
- Each manufacturer attaches the vent cap a little different
 - Snap lock, twist lock, or spring clip



Support Box



Attic Insulation Shield

- Venting component that prevents insulation from coming in contact with vent pipe above a ceiling penetration.

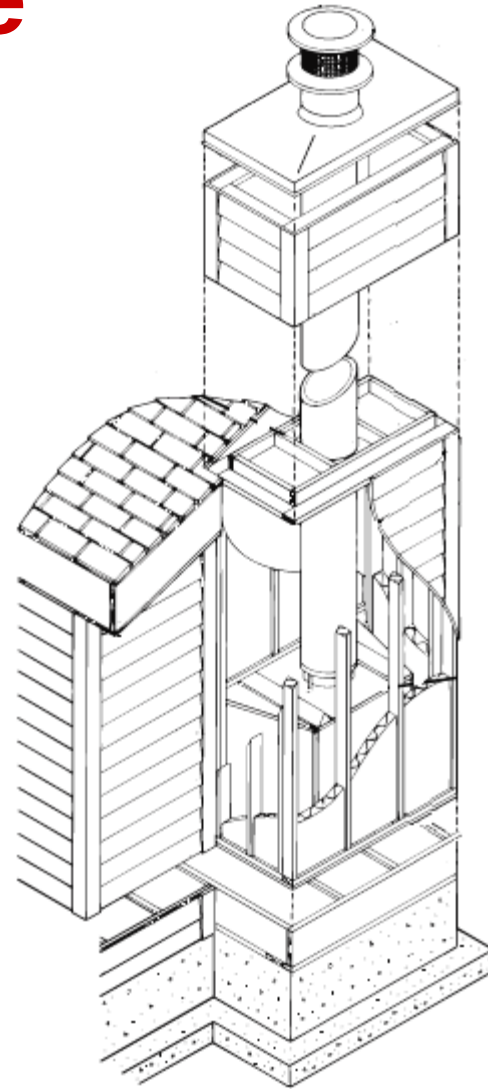


Attic Insulation Shield



Chimney Chase

- Insulate
 - Secure to avoid sagging or contact with chimney
 - No blown insulation unless in covered wall cavity
 - Seal gaps around framing



Chimney Chase

- Cricket
 - If chase more than 30" wide measured perpendicular to roof slope
- Sheet metal or same material as roof



Woodstove Installation Basics

Manufacturer's Instructions



Manufacturer Instructions

- Focus on relevant instructions
 - Multiple models: right #, size, type
 - Multiple requirements: right country (US/Canada)
 - Situation: right home type (very tight, mobile home, etc.); use of room (bed/bath); space (attic/living, ventilated or not)
 - Text/chart: highlighted, warning, note, asterisk
 - Points of measurement: vent centerline/edge; appliance bottom/floor; cap exit/top

Manufacturer Instructions

- No unapproved modifications
- Components from different manufacturers can not be mixed
- Only approved venting, doors, and logs

Manufacturer Instructions

MINIMUM RECOMMENDED FLUE HEIGHTS IN FEET (Measured from the top of the solid fuel appliance)					
Elevation (Ft) Above Sea Level	# OF ELBOWS				
	0	2 x 15°	4 x 15°	2 x 30°	4 x 30°
0 – 1,000	12.00	13.00	14.00	15.00	18.00
1,000 – 2,000	12.48	13.52	14.56	15.60	18.72
2,000 – 3,000	12.96	14.04	15.12	16.20	19.44
3,000 – 4,000	13.44	14.56	15.68	16.80	20.16
4,000 – 5,000	13.92	15.08	16.24	17.40	20.88

- How tall does the flue have to be at 4000' if 4-30° elbows are used?

Manufacturer Instructions

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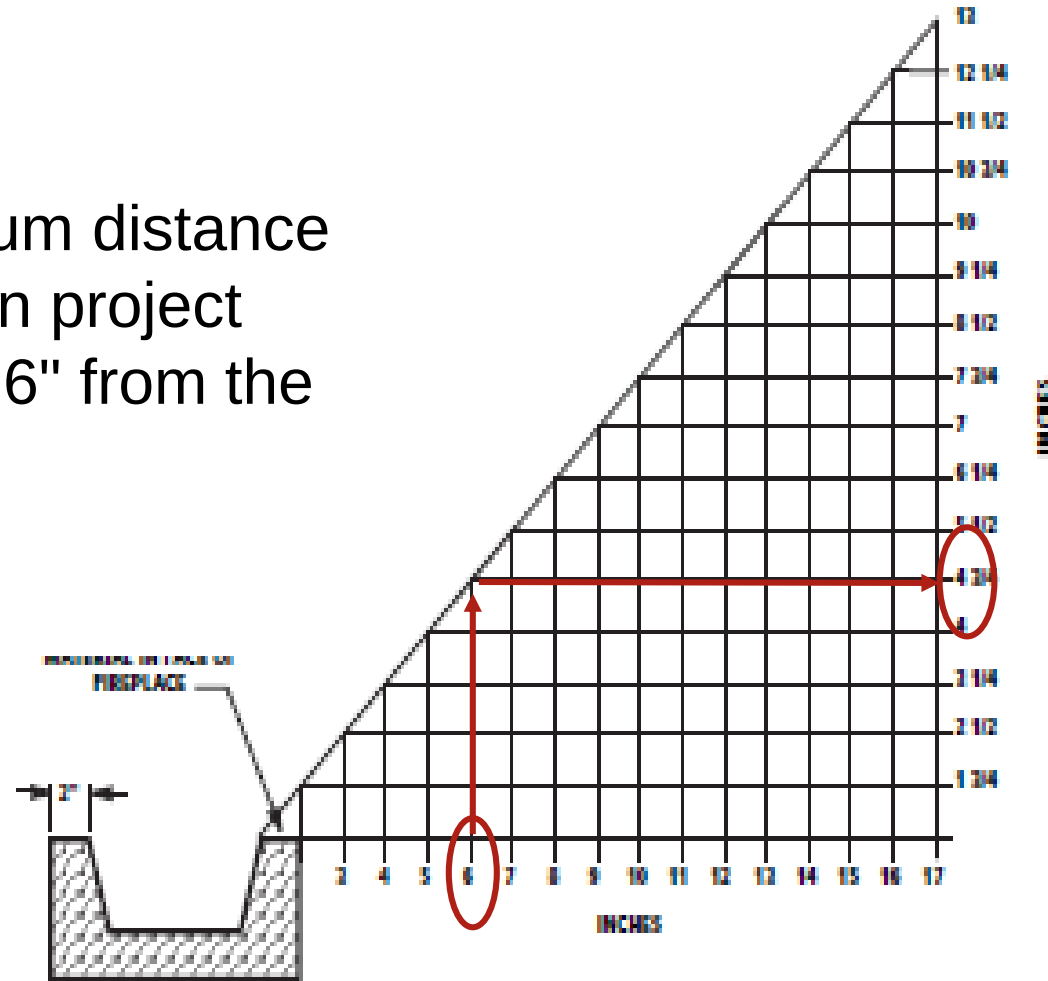
- How tall does the flue have to be at 4000' if 4-30° elbows are used?

20.88'

Manufacturer Instructions

- What is the maximum distance that a bookcase can project from the wall if it is 6" from the fireplace opening?

4 3/4"



Woodstove Installation Basics

Basics of Burning Wood



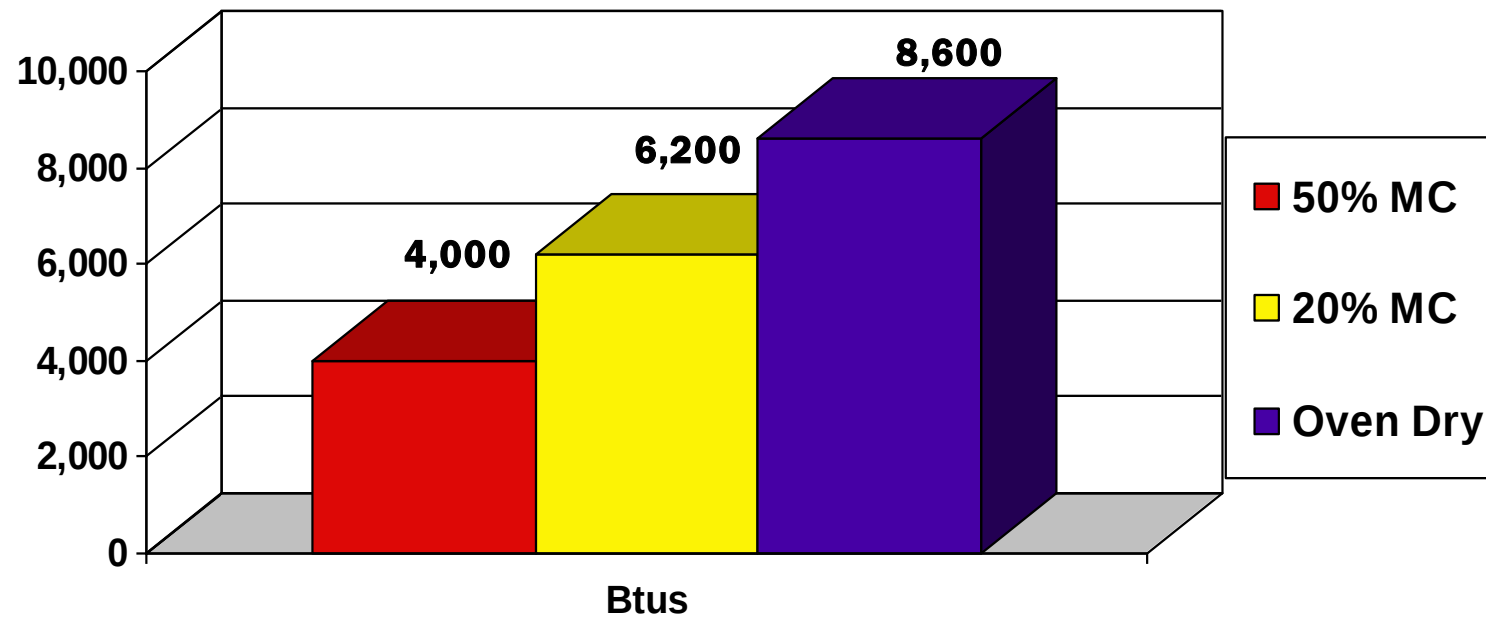
Solid Fuel Systems

Combustion

STAGE	TEMPERATURE	ACTIVITY	RESULTS
I. Moisture Evaporation	Above boiling point of water (>212° F.)	Water contained in wood begins to be driven off	Heat absorbed, not released



Moisture Content



Solid Fuel Systems

Combustion

STAGE	TEMPERATURE	ACTIVITY	RESULTS
I. Moisture Evaporation	Above boiling point of water (>212° F.)	Water contained in wood begins to be driven off	Heat absorbed, not released
II. Release Combustible Gas	Varies: over 500° F.	Chemical compounds formed and released	Not much heat released
III. Ignition Combustion of Vapors and Gases	540° - 1225° F.	With adequate oxygen and heat, gases ignite	Combustion sustaining heat released
IV. Char Burning	Above 900° F.	Remaining wood solids burn with little or no flame	Remaining heat released; ashes produced

Incomplete Combustion

Creosote

- Unburned fuel that condenses in chimney
- Combustible: chimney fire
- Carcinogenic
- Amount depends:
 - Density, temperature, speed of smoke
 - Temperature and roughness of flue surface



Woodstove Installation Basics

Factors Affecting Efficiency



Firewood Condition

- Consequences of using wet wood
 - Operation & maintenance more difficult
 - Wastes fuel
 - Reduces heat output
 - Increases need for maintenance
 - Promotes growth of micro-organisms

Appliance Design

- Catalytic: makes chemical reaction (combustion) occur at lower energy level than usual
 - Lowers normally required 1100°F ignition temperature to 500°F
 - Low temperatures of extended burn sufficient for good combustion

Appliance Design

- Non-catalytic: keeps temperature higher in combustion zones where oxygen present
 - Insulated fireboxes
 - Sometimes smaller fireboxes
 - Gases and oxygen directed to combustion zones
 - Long smoke path keeps gases in residence
 - Baffles
 - Dampers

Appliance Design

- Hybrid: combination of catalytic and non-catalytic design features
 - Catalytic combustor
 - Air for non-catalytic secondary burn
 - EPA lists them, as a catalytic appliance

Woodstove Installation Basics

Woodstove Connectors



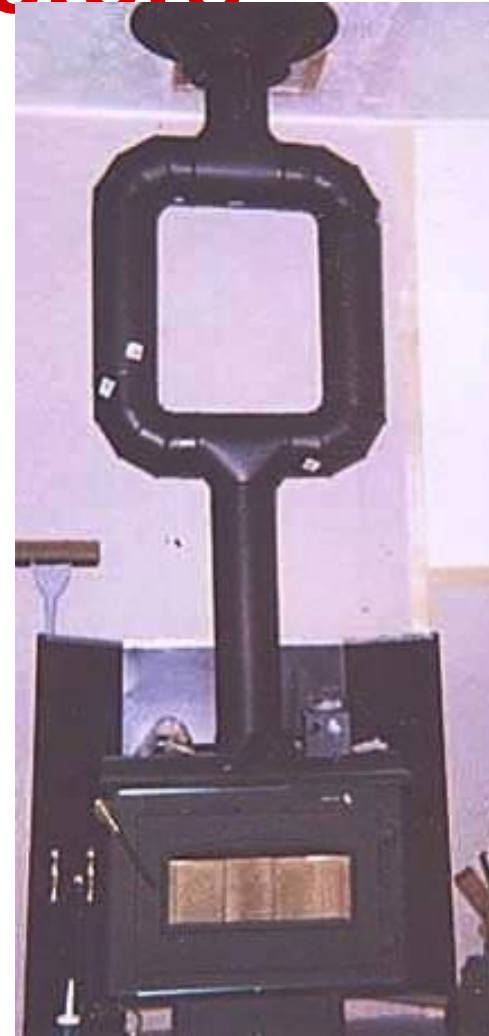
Woodstove Connectors

- Single Wall
- Double Wall



Woodstove Connectors

- Moving combustion products from appliance to chimney
- Never pass through roof, ceiling, crawl space, wall, window, closet, concealed space



Single Wall Connectors

Installation

- Small, crimped end down to contain liquids
- All joints secured with 3 sheet metal screws

Connector Add-Ons

- Heat reclaimer
 - Not needed/effective as with pre-EPA stoves
 - May remove heat needed for draft
- Draft assistance device
 - Short pipe with electric heating element
 - Prime cold flue/prevent flow reversal at tail-out
- Draft control devices for overdraft
 - Stovepipe damper
 - NFPA 211: not restrict more than 80% of connector area
 - Barometric damper

Woodstove Installation Basics

Venting System Requirements

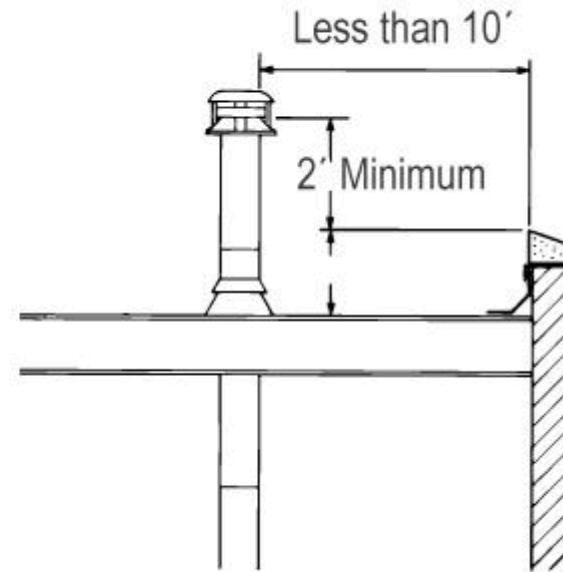
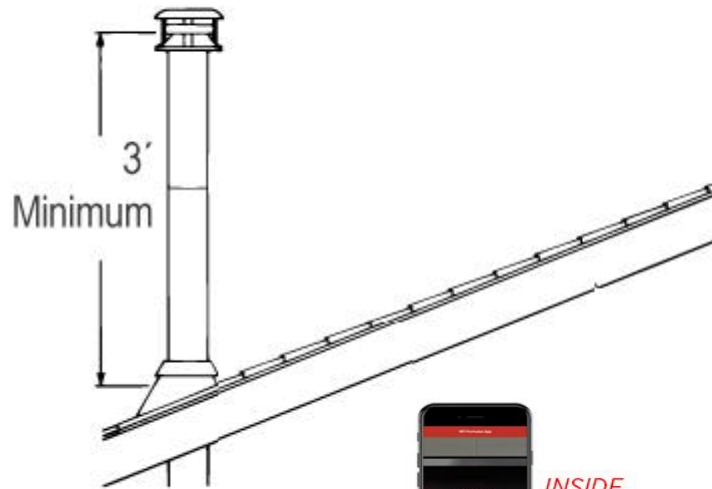


Chimney Size

- Woodstove
 - Same as flue collar area best
 - Smaller than flue collar not allowed
 - Unless allowed by manufacturer
 - Larger than flue collar
 - Reduced velocity/increased residence time
 - Flow resistance from increased surface area
 - Heat loss from increased surface area
 - Increased likelihood of creosote buildup

Chimney Height

- 3 feet above the highest point penetration
- AND at least 2 feet above anything within 10 horizontal feet



This formula is included in the NFI App!

Chimney Height

- Taller than heated portion of house
 - avoid house stack effect
- May recommend heights to be increased
 - 2-3% per 1000 feet of elevation
- EPA woodstoves may need minimum 15' total venting system (connector + chimney)
- Extremely tall chimney can cause overdrafting
 - Damage to combustor and/or internal parts
 - Shorter appliance life

Woodstove Installation Basics

Woodstove Installation
Freestanding Appliances



EDUCATION FOUNDATION

Floor Protection

- Two types of manufactured pads
 - Type 1 Ember Protector
 - For appliances not requiring thermal protection
 - Type 2 Thermal Floor Protector
 - For appliances requiring thermal protection

Protecting Walls

Protection	Wall	Ceiling
a. 3½" masonry wall / NO ventilation	33%	—
b. ½" nc board / 1" batt, NO ventilation	50%	33%
c. Min. 24 gage sheet metal / spaced out 1" for VENTILATION	66%	50%
d. 3½" masonry wall / spaced out 1" for VENTILATION	66%	—
e. ½" noncombustible wall board spaced out 1" for VENTILATION	66%	50%
f. Listed prefabricated systems	Per manufacturer instructions	

Clearance Reduction

- Clearance reduction systems can **NOT** reduce clearance to less than 12"
- Clearances less than 12" can only be listed clearance, NOT reduced clearance

Code Prohibitions

- Garages
- Areas where flammable liquid vapors may be present
- Enclosed spaces less than 512 cubic feet
 - 8'x8'x8'
 - unless listed for alcoves

Woodstove Options & Accessories

- Thermometers
 - Stove Top
 - Probe
 - Catalyst
- Blowers
- Firestarters

Woodstove Installation Basics

Woodstove Installation
Fireplace Inserts & Hearth Stoves

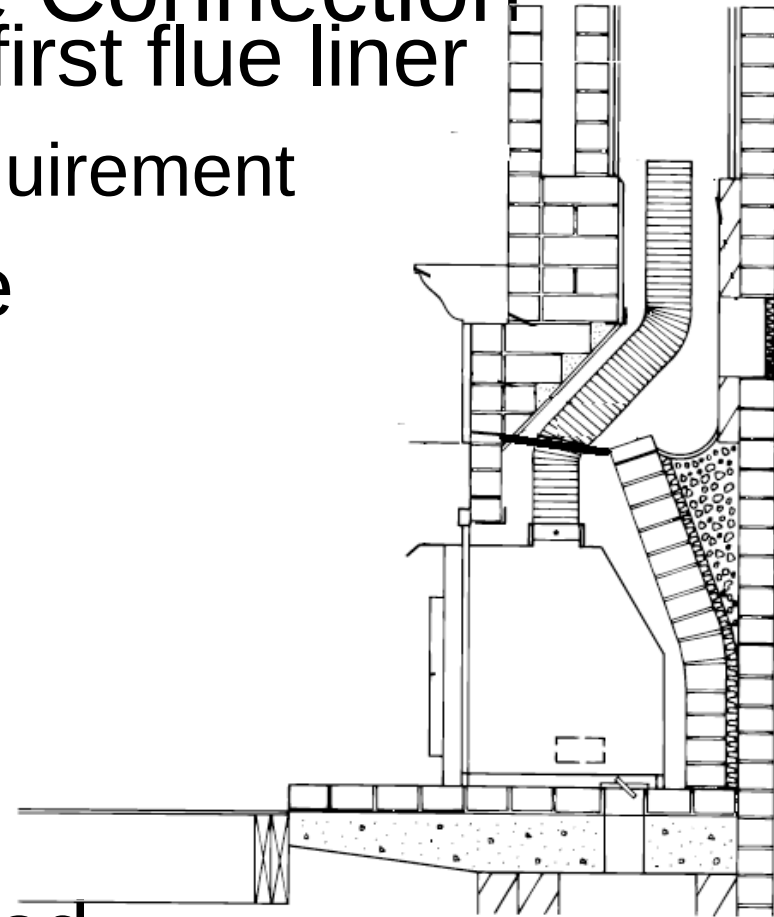


EDUCATION FOUNDATION

Fireplace Insert

Appliance to Flue Connection

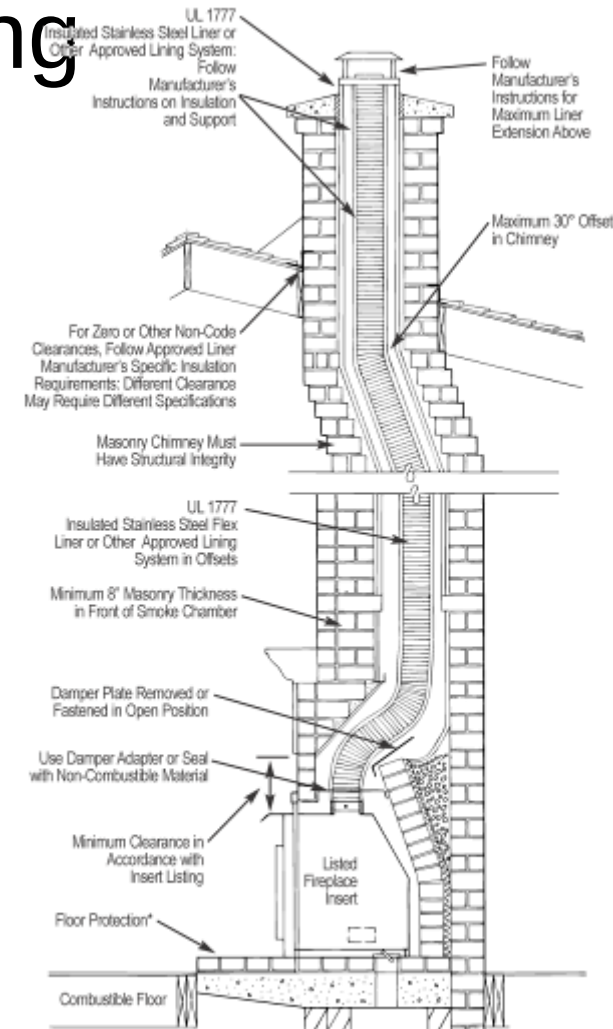
- Stainless connector to first flue liner
 - Minimum NFPA 211 requirement
- Maximum flue liner size
 - IRC:
 - 3 X flue collar area
 - NFPA 211:
 - Interior 3 X; Exterior 2 X
- No dilution air
- Cleanout access required



Fireplace Insert

Full Relining

- Easier startup
- Better performance
- Maintenance
 - Less frequent
 - Less expensive
 - Less difficult



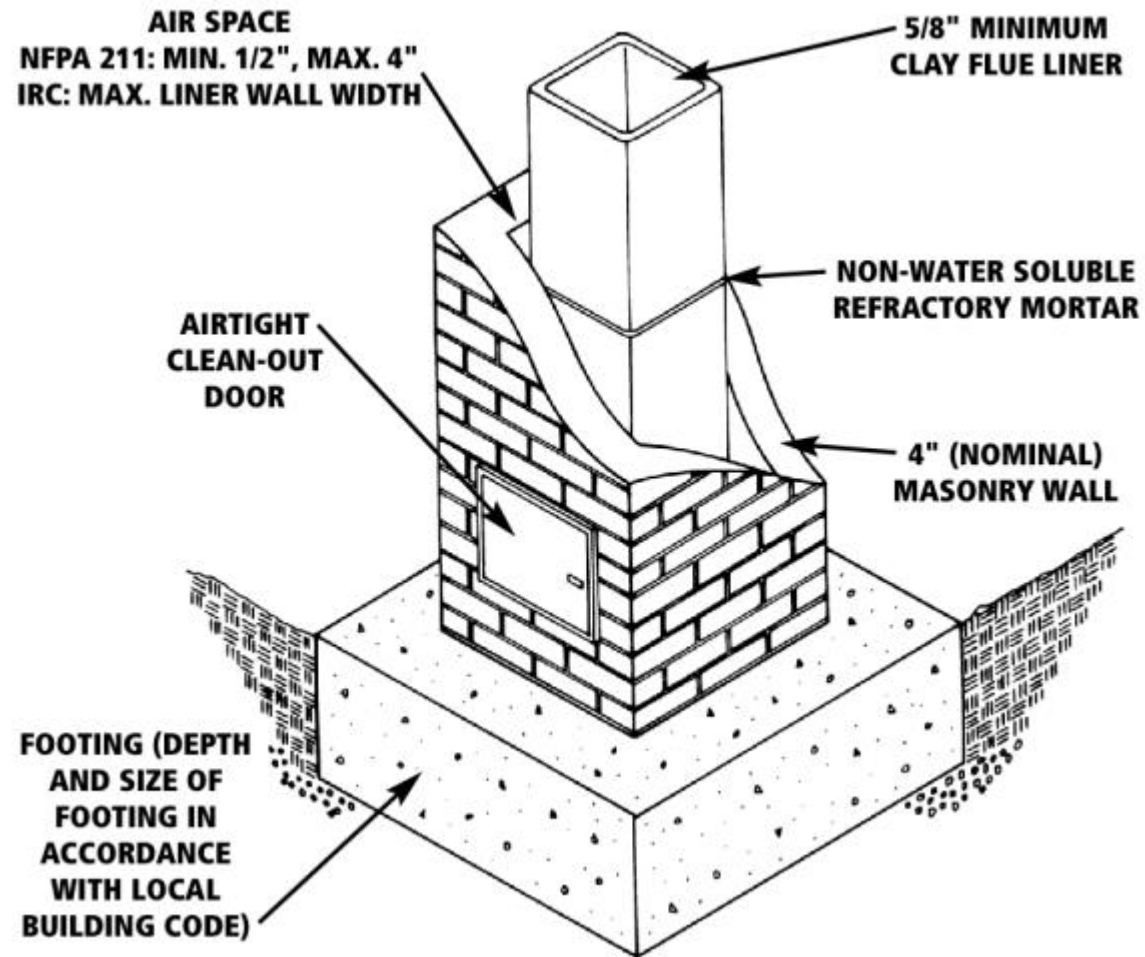
*Floor Protection in Accordance with Solid Fuel Appliance Listing

Woodstove Installation Basics

Woodstove Installation:
Masonry Chimneys



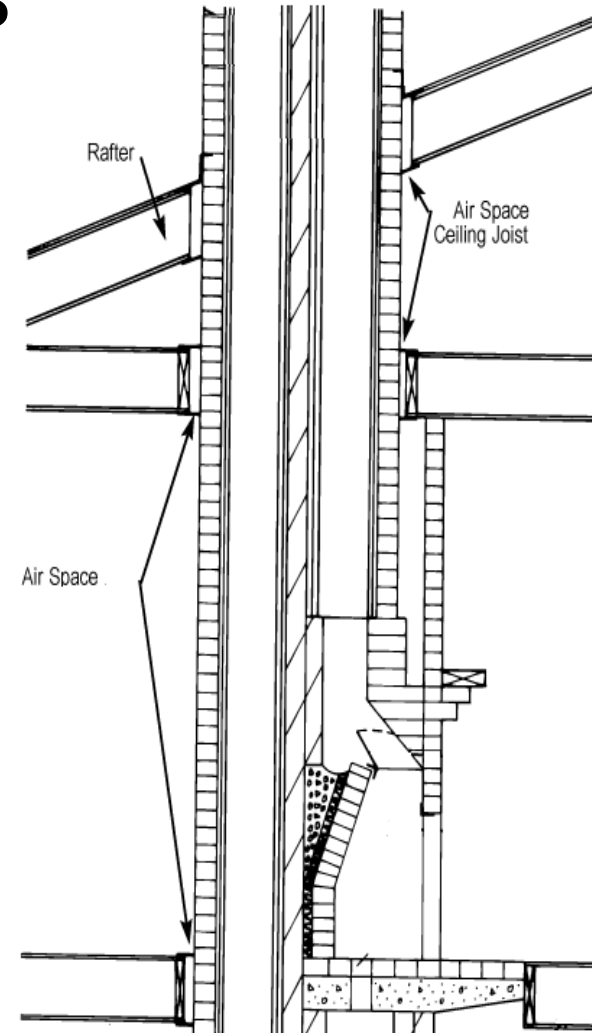
Masonry Chimney



Masonry Chimney

Clearances

- Interior Chimney
 - Minimum 2" clearance
 - Firestop every floor and ceiling
- Exterior Chimney
 - Minimum 1" clearance



Masonry Chimney

Unused Openings

- Seal with full thickness of masonry
- Remove “pie-plate” coverings and replace with masonry

Masonry Chimney

Relining

- Metallic and poured or cast in place
- Field-installation into new or existing masonry chimneys, with or without existing fireclay liners
- For use with woodburning appliances
 - They are tested to 2100°F
- Not for use without a chimney surrounding

Woodstove Installation Basics

System Operation



Owner Communication

Startup

- Read and follow instructions
- Operating procedures
- Appliance response to poor start up

Owner Communication

Safety

- Hot surfaces
- No use of flammable liquids
- Care opening door
- Avoid over firing
- No alterations
 - do not bypass safety switches
- Chimney fire recognition and procedures
- Routine and professional maintenance

Owner Communication

Normal Operation

- Adjust controls according to instructions
- Understand convection blower operation
- Understand thermostat operation

Owner Communication

Wood Stoves

- Startup Procedures
 - Damper and air controls completely open
 - Door closed or slightly open while attended
 - Crumpled paper and dry kindling to warm flue and establish draft
 - Blower operation only with established draft
 - Close bypass damper, reset air controls
 - Temperature gauges recommended

Owner Communication

Wood Stoves

- Non-catalytic EPA stoves
 - Normal burn: air controls mid- to fully open
 - Adjust heat also with amount of wood
 - Extended burn
 - Load full, make sure fully ignited
 - Operate damper (if applicable) as instructed
 - Cut air control back to level in instructions
 - Clean burn produces very little or no smoke except at start-up and reloading

Owner Communication

Wood Stoves

- Catalytic EPA stoves
 - 350-550° Use by-pass close damper
 - 650-1200° : Combustor fully active
 - Air controls to moderate setting
 - 1000-1600° : Normal to 1400°
 - Combustor may glow at 1000° , but not always
 - Over 1800° : dangerously overheating
 - Large loads: burn at low to moderate settings
 - Avoid flame impingement on combustor

Owner Communication

Break-In Procedures

- Verify the installation
 - Clearances
 - Venting requirements
- Moisture
- Paint

Owner Communication

- Ashes
 - Metal container with tight-fitting lid
 - Set on noncombustible floor or ground
 - Never placed in plastic or paper
 - Residential vacuums should not be used for ashes
 - Embers can stay hot for days
 - House fire and deaths have been associated with this condition

Fuel Selection

- Hardwoods & softwoods same BTU/pound
- Hardwoods
 - Generally denser
 - Weigh more than softwood
 - More Btu per cord
- Softwoods
 - Good fire-starting
 - Great for mild weather use
 - Typically dry faster than hardwoods

Fuel Selection

- Living trees cut during the growing season can have moisture content over 150%
- When tree is cut, water trapped in the inner structure begins to work its way slowly to the lower humidity outside the tree
- Trees dead for years can have moisture content of 50% or more

Fuel Selection

- Scrap lumber
- No treated lumber, trash, garbage
- Manufactured logs
 - Approved in some factory-built fireplaces
 - One log at a time
 - No breaking or crumbling
 - Densified logs w/out wax in some woodstoves

Firewood Management

- Cut to short useable
- Split to increase surface area
- Stack in sunny area
 - Each 20°F increase in temperature doubles drying rate
- Stack wood loosely, perpendicular to prevailing wind
- Cover top of stack only to keep rain off

Fuel Management: Drying Time

- Wide variations due to climate, wood preparation and storage, species
- Minimum time recommended 6 months
 - Sometimes with caveat that it be cut, split, stacked in April for October use
- Recommended range from 1-2 years

System Operation

Firewood Assessment

- Bark loose or falling off
- Checking and splitting in the end grain
- Ringing sound rather than dull thump when struck
- Relative lighter weight
- Easier to split
- Little or no sizzle in a fire

Fuel Assessment

Moisture Meters

- Measures electrical resistance
- Reasonably priced meters provide adequate (not precise) readings
 - Moisture contents above 30-40% not precise
 - Importance is that wood is too wet
- Take reading parallel to grain



Chimney Fires

- Clouds of black smoke
- Loud roaring noise
- Flames above chimney
- Metal expansion sounds
- Crackling of creosote
- Long period of heat buildup if not detected

Chimney Fires



Venting System

- Chimney sweeping
 - Proper tools
 - Chimney connectors must also be serviced
 - Professional service for safety and knowledgeable service



Inspecting for Creosote

- NFPA 211 requires once a year
 - Maybe more depending on usage
 - Inspect new installations more often until burning habits and creosote build-up rates are established

Glass Doors

- Only when cool for glass and metal finish
- Non-abrasive cleaners
- Lubricate slide mechanism according to instructions



Owner Communication

Maintenance

- Gaskets

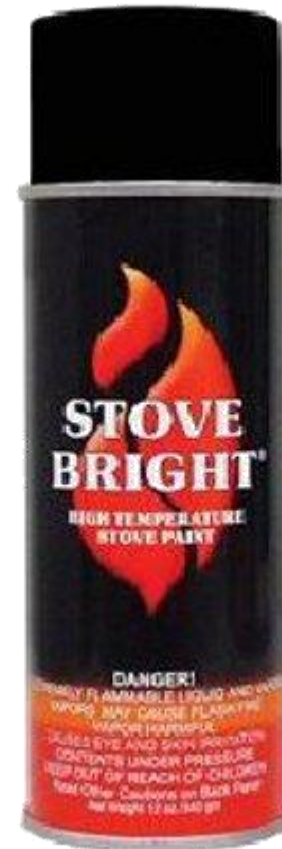


Internal Components

- Seams
- Baffles, dampers, air tubes.
- Animals



Paint



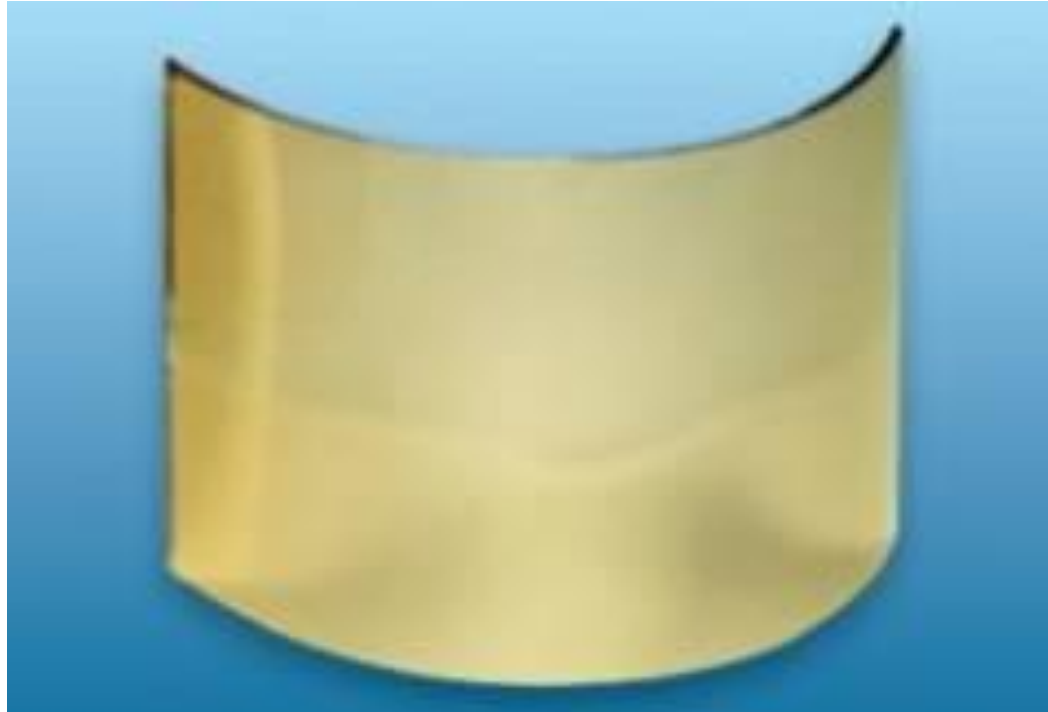
Catalytic Combustor



©Applied Ceramics Used with Permission

Glass/Ceramic

- Coated glass
- Only use manufacturer recommended parts



Firebrick

- Use proper type
- Only use manufacturer recommended parts



Blower Condition



Woodstove Installation Basics

Basic Troubleshooting



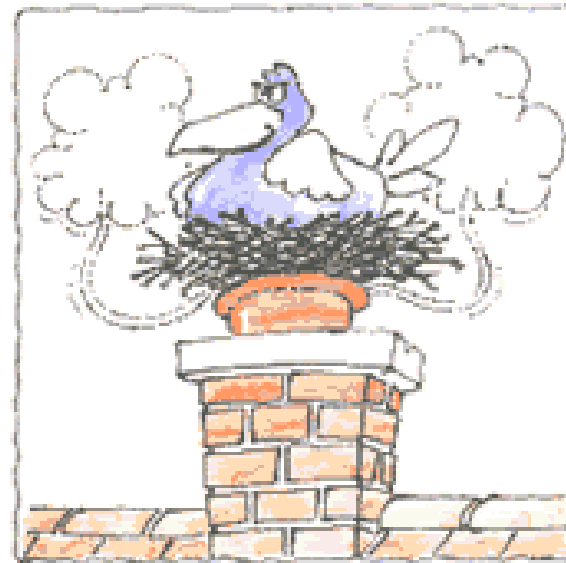
Flue Leakage

- Improperly connected joints
- Multiple openings
 - Reduce draft
 - air drawn in through leak rather than through appliance



Flue Blockage

- Closed damper
- Blockage by nest or debris
- Creosote build-up in cap or flue



Venting Problems

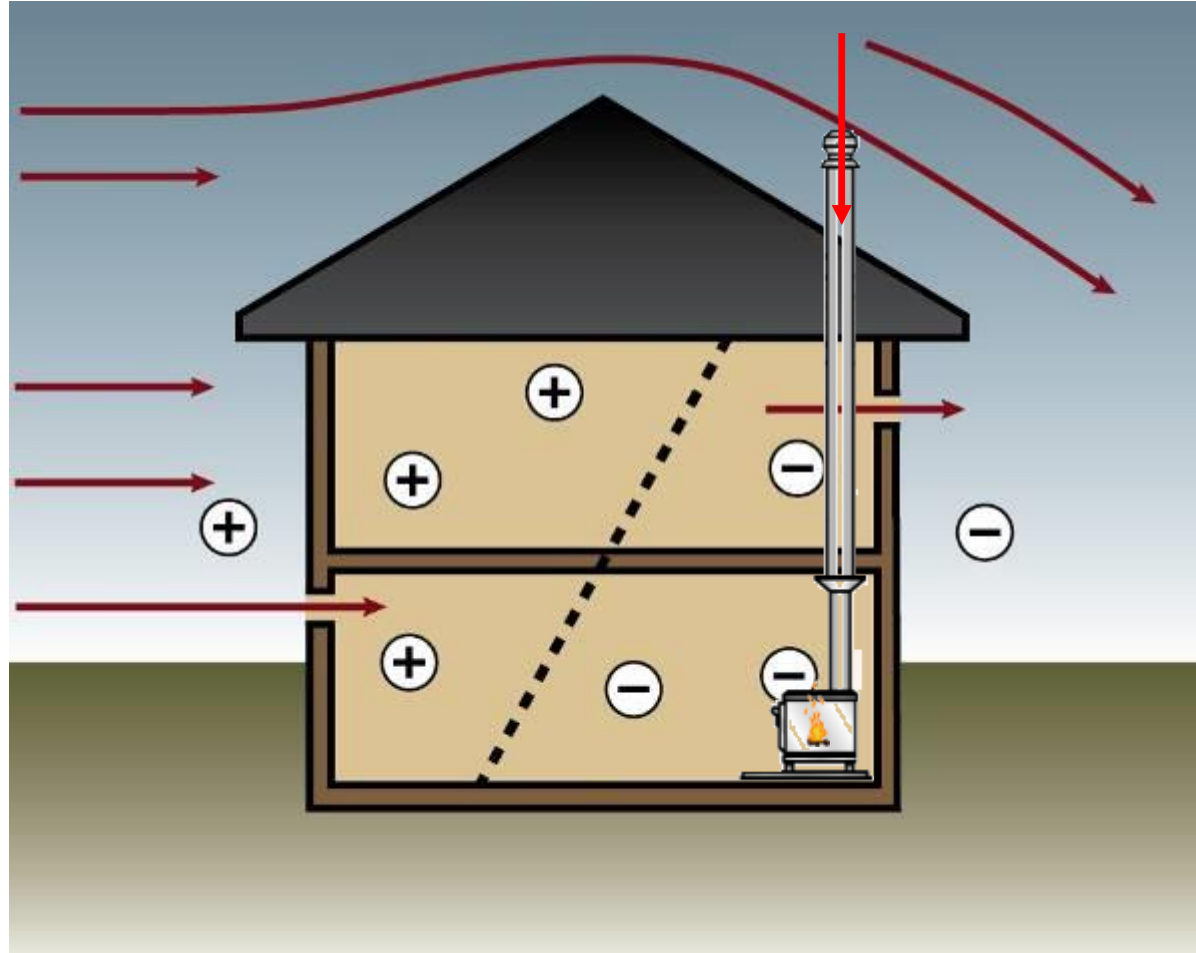
- Unusually strong wind
- Temperature extremes
- Low atmospheric pressure

Venting Problems

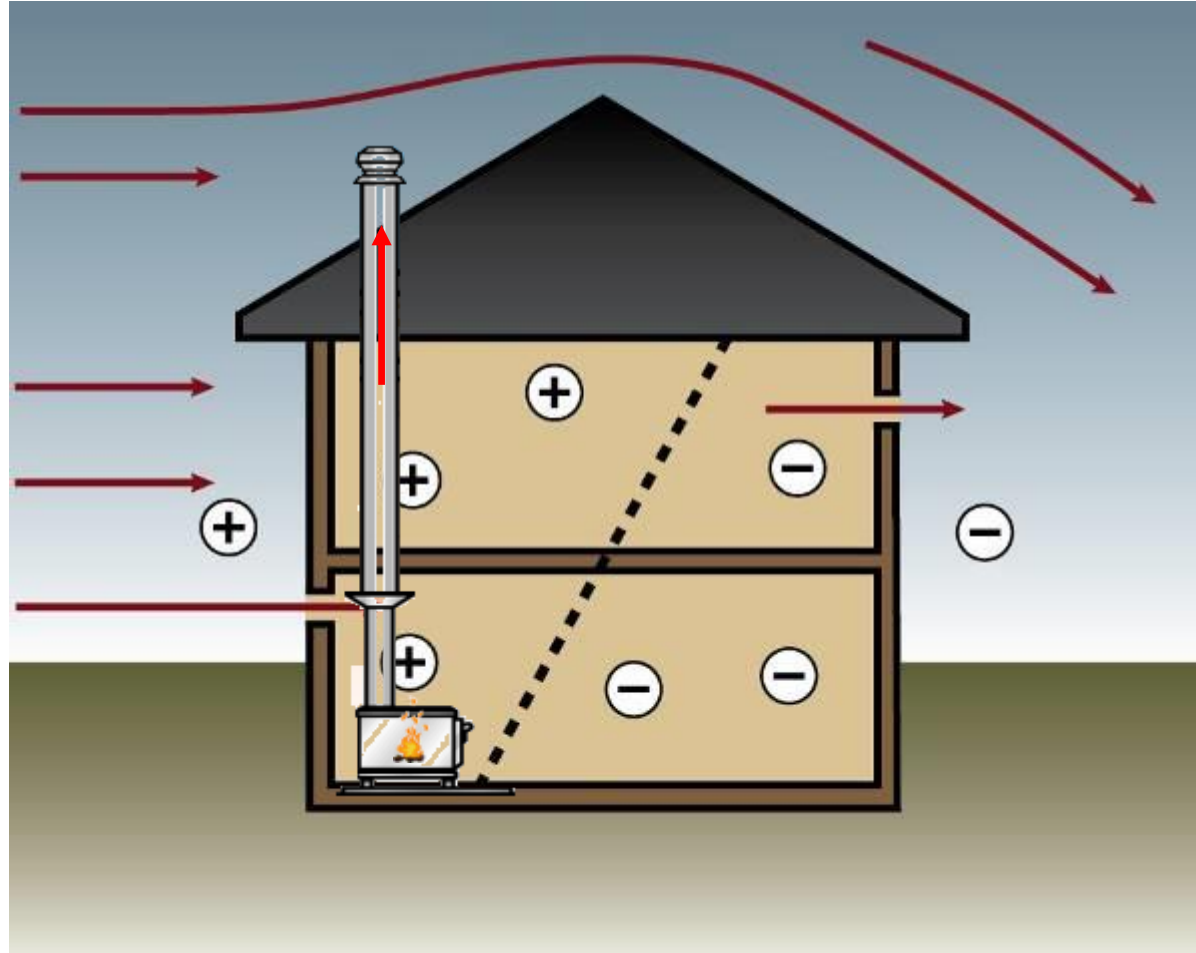
- Turbulence from overhanging tree or nearby structure that causes resistance to flow



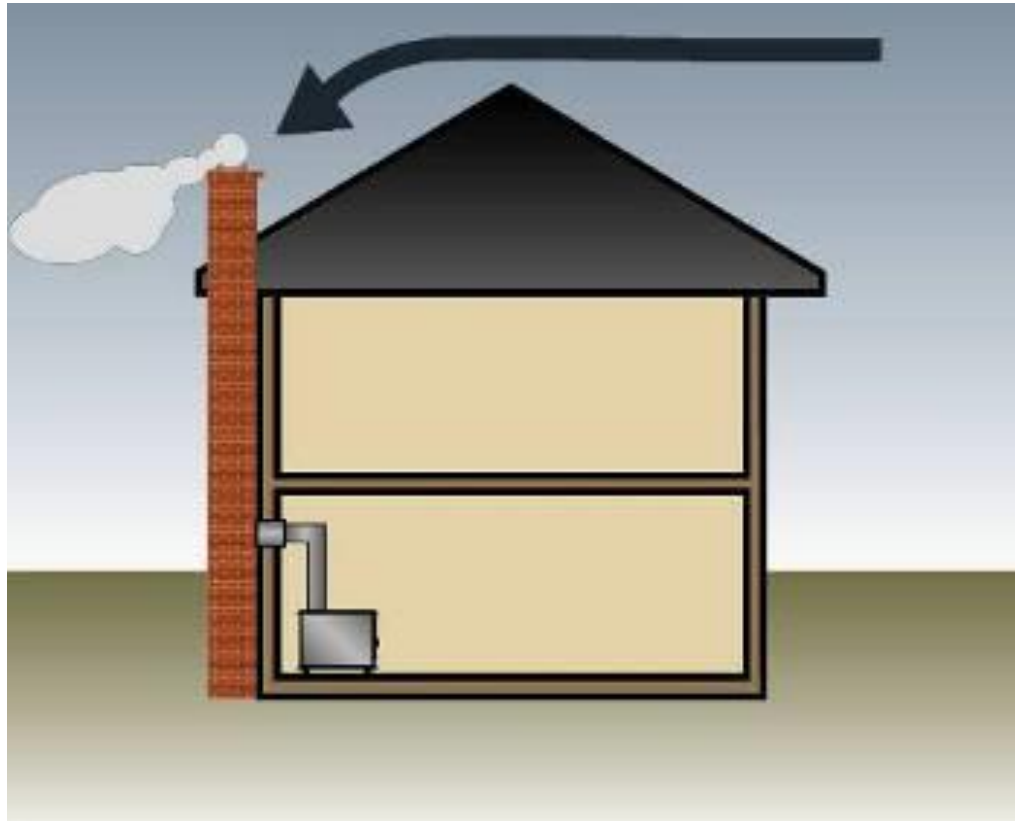
Venting Problems



Venting Problems



Venting Problems



Venting Problems

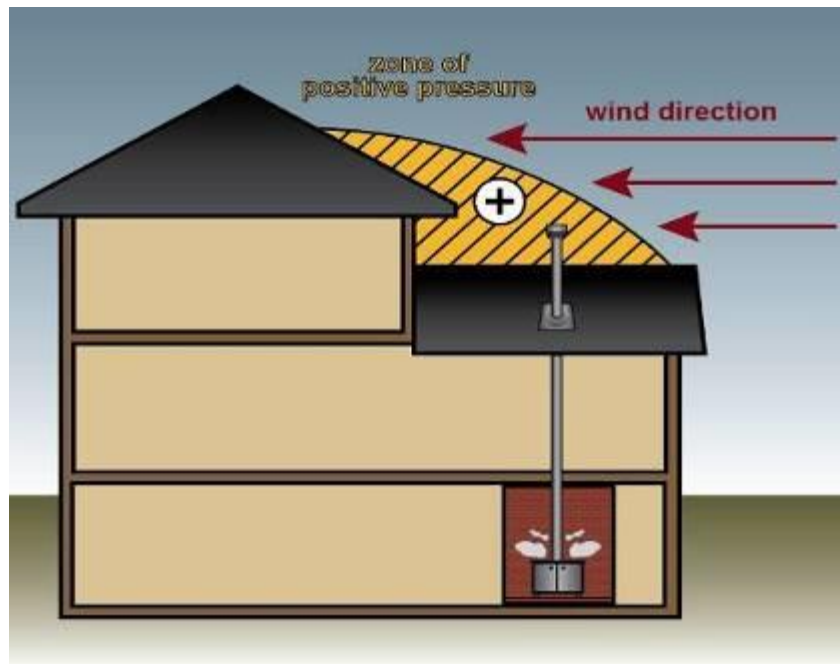


Photo compliments of CSIA

Paint Curing

- Common occurrence for new stoves
 - Also if repainted
- Inform customers ahead of time
- Usually take 3-4 hours

Backpuffing

- Extremely dry wood produces buildup of volatile gases
- Inadequate draft in catalytic stove causes buildup of gases approaching combustor
- Ignition causes more smoke than venting system can handle, so puffs into house

Backpuffing

- Give it more primary air!
- Open the door slowly
- Blocked passageway





Wood Stoves Operation and Maintenance

Roy L Hosteen, 4-Corners Program Coordinator
Stove Exchange and Home Weatherization Program

Wood Stoves Type

Soapstone – Navajo Hybrid
Wood and Coal Stove



US Stove Company
Wood Stove



Type of home the stove is going to be install:

- Structure home
- Mobile Home

Wood Stoves Type

Soapstone – Navajo Hybrid
Wood and Coal Stove



US Stove Company
Wood Stove



For a brand-new wood/coal stove, it needs to be seasoned. On the initial first fire there will be a smell due to the burning in the paint that is coated on the stove. Smoke detector alarm will come on.

Get the Model Name, Model Number, Serial Number and date of installation for warranty services if the need arises.

Firewood type

What is commonly used around the Navajo Nation is Cedar, Pinion, Pine, Oak, Aspen, Cottonwood, Chinese elm, Russian Olive and fruit tree.

- Use the moisture meter when purchasing firewood
- Season the firewood for a year by stacking them to dry-out, it best to size, split and stack them.
- Store the season firewood in the woodshed so they remain dry for the most efficient heat output
- Use kindling firewood and then size up the firewood in the fire box to start the fire. Keep watch on the temperature gauge
- What not to put in the stove; Lighter fluid, trash, treated wood, particle board, kerosene, plastic and glossy paper.



Stove Operation

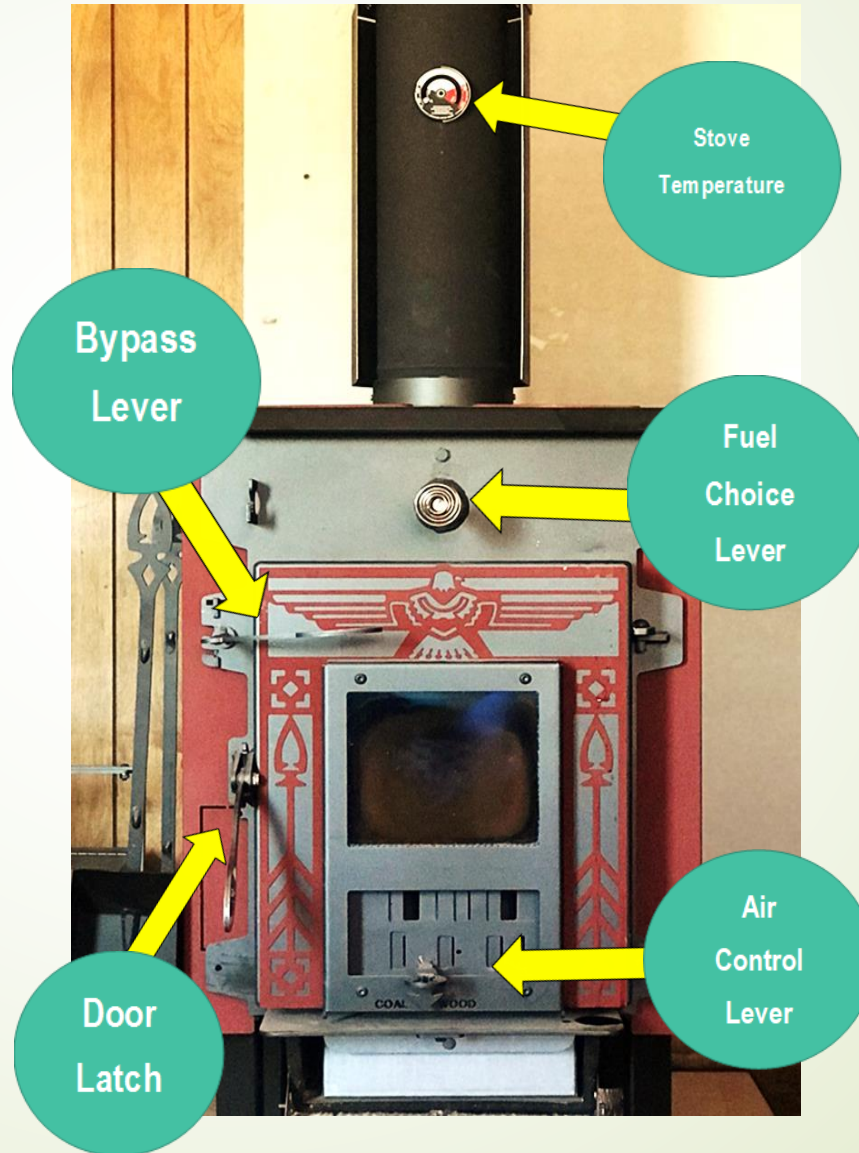
Navajo Hybrid
Wood and coal stove



Stove Operation

Navajo Hybrid Wood and coal stove

Multiple levers on the Navajo Hybrid Stove.



Stove Operation

Navajo Hybrid Wood and coal stove

Air flow on within the stove

- 1) When start a fire
- 2) When temperature gauge reads 300 degrees and the catalyst is engaged. The air control lever needs to be on "WOOD". The catalyst reburns the smoke thus adding to the heat of the stove
- 3) When burning coal, the catalyst needs to be disengaged. The BTU is too high for the catalyst and will burn it through. The air control lever needs to be on "COAL". The air flow is now coming in from the bottom.

Airflow, Model 212

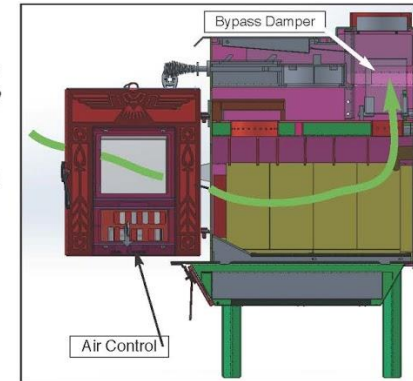
Model 212N, Navajo Stove; Model 212S, Survival Stove

Air Flow Patterns 1) Bypass Open, 2) Wood and 3) Coal

1

Bypass Open

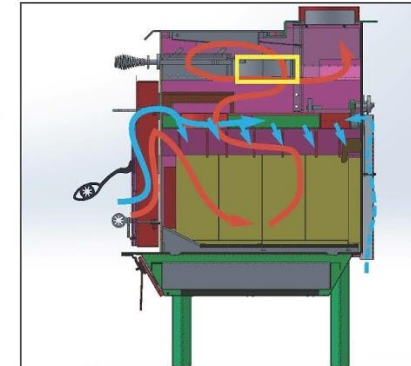
When the Bypass Damper is open, all exiting exhaust goes directly up the chimney, whether the door is open and the stove is being loaded, or the door is closed and a fire is being kindled.



2

Air Flow Pattern For Wood

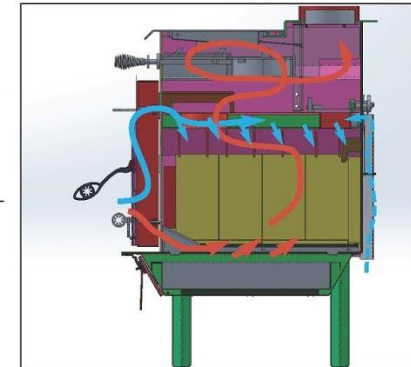
When the bypass is closed and wood is being burned, the red line indicates the path of primary combustion air. Primary combustion air enters the firebox above the viewing window in the loading door. The blue line indicates secondary air. The dotted blue line at the rear of the stove indicates tertiary air. The yellow box indicates the catalyst position.



3

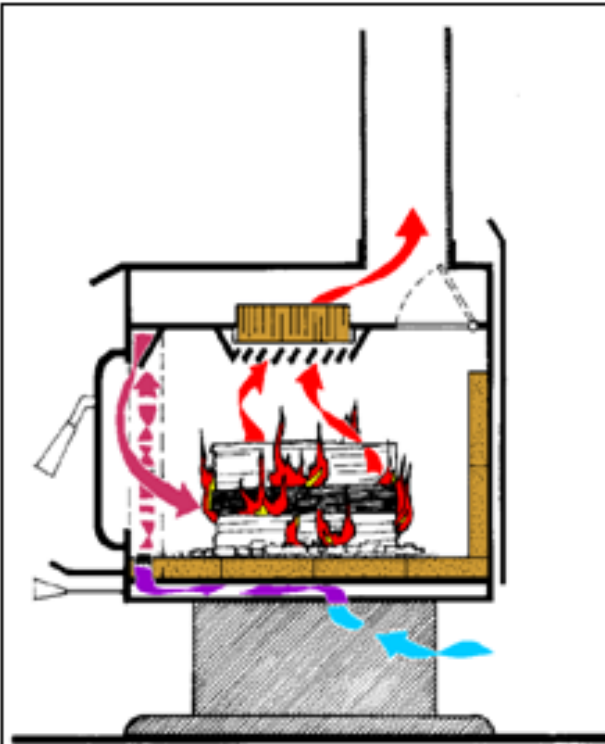
Air Flow Pattern For Coal

When coal is being burned, primary combustion air (red line) enters the firebox through the bottom grate. The blue line indicates secondary air. The dotted blue line at the rear of the stove indicates tertiary air. When coal is being burned, the catalyst is withdrawn into a catalyst garage.

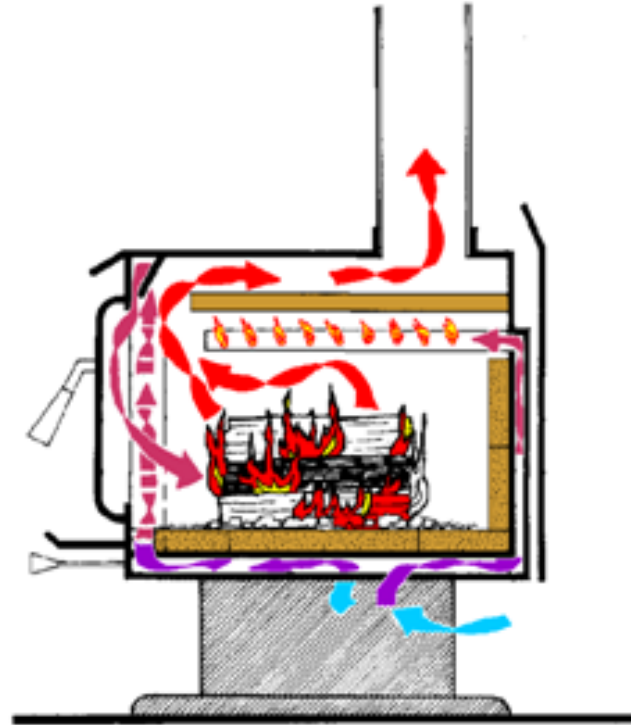


Wood Stoves Type

US Stove Company
Wood Stove



Cross section of a catalytic stove, showing combustion air/exhaust flow patterns, the catalytic element and the bypass damper.



Cross section of a non-catalytic stove, showing combustion air/exhaust flow patterns, large baffle and high level combustion air supply.



Stoves Maintenance

Ash

- Taking ash out of stove and placing it in the ash bucket. The ash bucket needs to be placed in an area where the bottom of the ash bucket does not heat and scorch the floor.
- Ash will remain hot and if it is placed outside on a breezy day, a spark might come out and catch fire elsewhere.
- Clean the catalyst unit in the stove by brushing it with the paint brush provided
- Vacuum-clean the soot on the inter
- Check the fire brick, ensure they are seated correctly

Chimney

- Annual chimney cleaning and inspection
- Use plastic chimney cleaning brush because the metal brush will scratch up the inside of the stove pipes. This will cause easier creosote buildup on the scratches.



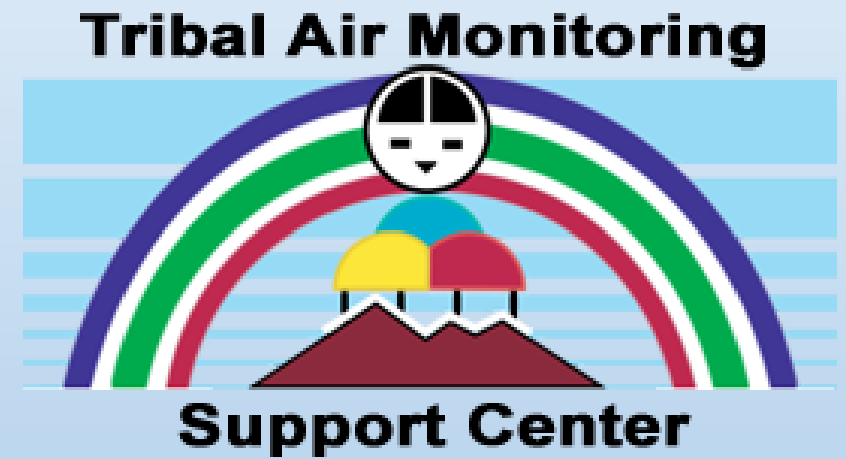
Resources

- U.S. EPA Burn Wise
 - <https://www.epa.gov/burnwise>
- National Fireplace Institute
 - <https://www.nficertified.org/>
- Red Feather Organization
 - <https://www.redfeather.org/>

Courses:

- HPB Education Foundation: Woodstove Installation Basics Training
 - <https://hpbef.mindflash.com/PublicCoursePage.aspx?c=5059774539631>
- NAU ITEP Webinar Trainings
 - https://www7.nau.edu/itep/main/training/training_air





Thank you for joining today's webinar!