

**INSTALLATION AND
OPERATING INSTRUCTIONS
FOR**

**THE SHAVER
OUTDOOR WOOD and COAL
BURNING FURNACE**

**Manufactured by
Weld Rite Inc.
328 Hwy 62 West
Salem, Arkansas 72576
870-895-3104 or 3111**

<http://www.outdoor-wood-furnaces.com>

**The BEST Outdoor Wood Furnaces
On the Market!**

INTRODUCTION

Thank-You and congratulations on the purchase of your new Shaver Outdoor Wood (or Coal) Burning Furnace! It represents the result of **36 years of Shaver experience** and the input of Shaver customers in the production of a top quality furnace.

With the purchase of this Shaver Furnace, you can now appreciate the high degree of craftsmanship and reliability that are a result of every furnace being carefully hand-built. Your choice shows the recognition you have for high quality products.

You are now a member of the large international family of Shaver customers, who have enjoyed the elegance, efficiency and reliability of our furnaces for many years.

The Shaver Furnace was the first and is the leader in the Outside Wood Burning Furnace field. We sell furnaces as far away as Canada, the UK, Ireland, the Ukraine and Spain!

We deem it important to provide you with this user's and maintenance manual: to allow you to use your equipment under the best possible conditions and in the most optimal manner, and furthermore to increase its operating life. **We strongly advise you to read it twice, carefully and keep it handy.**

Again, **Thank-You** for purchasing the original Shaver Outdoor Wood Burning Furnace

THIS MANUAL INCLUDES IMPORTANT SAFETY INFORMATION.

Your new furnace should have the following:

- (1) Owner's manual complete with Installation and Hook-Up Instructions
- (2) Warranty & Return Warranty Card (pages 6 – 8, 49)
- (3) A large specially designed poker FREE - as a bonus! (Often shipped above the boiler in the back of the furnace.)

Weld Rite Inc.
328 Hwy 62 West
Salem, Arkansas 72576
870-895-3104 or 3111

We are always here to help!

“When in Doubt – Make it Stout”

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GENERAL INFORMATION

Specifications

Type of fuel – Wood and coal only
For outdoor use only
Electrical Rating 115 VAC/ 60 HZ / 1PH
15 AMP Breaker

Clearance to Combustibles

Top, Rear, Sides: 18”
Chimney Connector: 18”
Always use a double or triple-wall pipe when going through any kind of roof with at least 6” to 2 feet of clearance from any combustibles (depending on the type of flu pipe). Check with the manufacturer for their recommendations! We suggest using Metalbestos® stove pipe for the flue, which is insulated to prevent fires (available at ACE Hardware).
Front: 10 feet, with the door facing away from the structure.
Flooring: Non-Combustible

FURNACE DIMENSIONS

Shaver Pro Series 140 - 134,000 BTU and a 125 gallon water tank. 3,000 sq ft.*
45" x 48.5" x 90" tall - 1400 lb shipping weight

Shaver Pro Series 165* - 165,000 BTU and a 170 gallon water tank. 4,000 sq ft.*
45" x 54.5" x 90" tall - 1610 lb shipping weight 1745 with ½" firebox

Shaver Pro Series 250 - 240,000 BTU and a 230 gallon water tank. 5,500 sq ft.*
45" x 70.5" x 90" tall - 2000 lb shipping weight 2200 with ½" firebox

Shaver Pro Series 290 - 280,000 BTU and a 260 gallon water tank. 7000 sq ft.*
45" x 78.5" x 90" tall - 2300 lb shipping weight 2525 with ½" firebox

Shaver Pro Series 340 - 326,000 BTU and a 300 gallon water tank. 8,000 sq ft.*
45" x 88.5" x 90" tall - 2600 lb shipping weight 2875 with ½" firebox

FIREBOX SIZES

Model	Description	Width	Depth	Height (approx)
140	36" cylinder	36"	28"	26" + 10" for Ash Pan*
165	36" cylinder	36"	34"	26" + 10" for Ash Pan
250	36" cylinder	36"	50"	26" + 10" for Ash Pan
290	36" cylinder	36"	58"	26" + 10" for Ash Pan
340	36" cylinder	36"	68"	26" + 10" for Ash Pan

***Non-removable Ash "Pan" or receptacle**

All specifications subject to change at any time.



SAFETY PRECAUTIONS WARNING



Do not operate this equipment for other than its intended purpose nor other than in accordance with the instructions contained in this manual and all other instructions accompanying the furnace.

For furnaces covered by this instruction book, it is important to observe safety precautions to protect yourself from possible injury. Among the many considerations, you are advised to:

- Observe all safety stickers on the furnace.
- **This furnace must be wired by a qualified electrician in accordance with local and/or National Electrical Codes.**
- Never use any type of petroleum product, petroleum based product, charcoal starter, lighter fluid, lantern fuel, kerosene or any other flammable accelerant to start your furnace.
- KEEP ALL SUCH LIQUIDS WELL AWAY FROM FIREPLACE WHEN IT IS IN USE.
- Keep antifreeze, which is flammable, well away from the furnace. Only use non-toxic antifreeze. Test antifreeze and other chemicals annually.
- The use of treated wood (painted, treated, etc.) and any other salvaged material that can emit noxious gases for the environment and is corrosive towards the components of the appliance is NOT ALLOWED and eliminates the rights of guarantee.
- DO NOT BURN GARBAGE, HOUSEHOLD WASTE, STRAW, HAY OR YARD WASTE. In most areas this is illegal. The furnace is designed to burn seasoned cordwood and coal. Burning other materials can reduce the life of the furnace and will void your warranty.
- **Always open the ash door (bottom) before you open the firebox door (top).**
- **Open Loading door – pausing momentarily between the first latch and the safety latch to allow any combustion gases to burn off.**
- DO NOT OPERATE THE FURNACE WITH THE DOOR OR ASH RECEPTACLE DOOR OPEN. Always latch the doors securely. If the ash door is open for any extended period of time, other than for cleaning - it will cause over-firing of the fireplace and boiling.
- Always use proper care when installing, operating and maintaining the furnace.
- **Always wear protective gloves and glasses and be aware that hanging and loose clothing can catch fire!**
- Do not modify the furnace. Do not substitute repairs that can be provided by your dealer, distributor, or Manufacturing Company (Weld Rite, Inc).
- Failure to heed these warning or any additional warnings on the furnace may result in an accident causing personal injury and damage.



CALL BEFORE YOU DIG THAT TRENCH!



Disposal of ashes

OPEN THE ASH DOOR FOR THE DISPOSAL OF ASHES. ASHES SHOULD BE PLACED IN A METAL CONTAINER WITH A TIGHT FITTING LID. THE CLOSED CONTAINER OF ASHES SHOULD BE PLACED ON A NON-COMBUSTIBLE FLOOR OR ON THE GROUND. ALL COMBUSTIBLE MATERIALS SHOULD BE DISPOSED OF BY BURIAL IN SOIL OR OTHERWISE DISPERSED, THEY SHOULD BE RETAINED IN THE CLOSED CONTAINER UNTIL ALL CINDERS HAVE THOROUGHLY COOLED.

All installation and operation must follow Federal, Provincial, State and Local Codes

Lifetime Limited Warranty

5 Year 100% On-Site Warranty!

plus a Lifetime and 30 Year Warranty on roof and siding!

We have a 5-YEAR ON-SITE warranty against leaks on the furnace - NOT prorated.

Plus we have a 20-YEAR ON-SITE warranty against leaks on the furnace - Parts AND Labor.

Electrical components such as the fan, thermostat and pump and the door and grates have a one-year manufacturer's warranty (labor is not covered).

We don't have you ship the furnace back to us, like some other companies demand.

We send a local professional repairman out to your furnace, and it's repaired on the spot, if it ever leaks!

Years 6-20 are prorated as follows. We pay the following percentage or credit*:

Year 6 - 90%
Year 7 - 80%
Year 8 - 70%
Year 9 - 60%
Year 10 - 50%
Year 11 - 40%
Year 12 - 14 - 30%
Year 15 - 20 - 20%
Year 21 to forever - 10%

* We will give you the percentage discount on the repair or off a replacement boiler. Furnace will be repaired or replaced, whichever is less expensive.

Shipping not included.

No cash or surrender value.

The cost of the service call is not covered after 5 years.

The life of your furnace depends upon proper maintenance. With proper maintenance your furnace can give you 25 - 30 plus years of dependable service. We have many that are 25 years old and they're being built even better now!

You MUST submit a water sample to Wood Boiler Solutions LLC for professional lab analysis. You MUST follow their recommendations for chemicals and brands.

Chemicals are added where the Hot Water coils is. See page 43 for pictures.

Just purchase the "[Water Sample Analysis Kit](http://www.diswebsites.com/woodboilersolutions/store.cfm)" from their store, on page 2 at <http://www.diswebsites.com/woodboilersolutions/store.cfm> or you can call them at 920-382-6498 Monday through Friday, 9am - 4pm CST - and they will send you out the kit.

WARRANTY CONTINUED

When the kit arrives, take a sample according to the easy to follow directions, package it up and mail it back (postage not included). They will mail you back complete results with interpretation and recommendations. (Allow 2 weeks for results)

The following tests are performed and interpreted for you: Nitrite, pH, Total Dissolved Solids, Bio Test, Iron, Glycol Concentration/Level (if applicable) and Total Hardness. They look for minerals that will eat up carbon steel.

This testing procedure will give you complete results and recommendations so you can be assured your system is in top shape for the long haul.

We have Shaver Furnaces in service that are over 30 years old, with wood siding (we used to make them that way) and they're still going strong!

Exclusions

1. Disasters, breakdown or faulty operation linked to:

- Inadequate relation between the nominal power of the equipment and the heat requirements of the premises;
- a faulty installation or faulty connections;
- damage to the thermostat through overheating due to intensive use:
 - the ash box door is left open;
 - When the ventilation convection fan is left off with high fires.
- **Failure to clean out ash!! Moisture combined with ash will eat through a furnace in short order and is NOT covered under warranty**
- an insufficient or excessive draft;
- incorrect use;
- burning non-compatible fuels, destructive and/or damp fuels (treated wood, hay, straw etc...);
burning other than non-treated, non-painted wood or coal; **Damage caused from burning coal is not covered under the warranty – even on the coal series furnace.**
- consumption exceeding the use limits;
- a lack of maintenance; not adding the recommended chemical, water treatment and rust inhibitor.
- any modification, transformation inside the appliance;
- transport and installation.

2. Transport and packaging cost.

3. All costs not previously accepted by Weld Rite, Inc.

4. Costs and deterioration due to the non-use of the equipment.

5. The cost of any incidentals or consequential damage, including the loss of anti-freeze and/or water treatment.

6. Warped Grates or door. Grates and doors always warp over time due to high heat.

7. The guarantee starts on the date of delivery. The invoice showing the delivery date is the only document valid for the guarantee.

All warnings in this manual on Page 5 and elsewhere and all maintenance items on Page 42 constitute part of this warranty.

Please fill in the following information and mail this copy by mail to:

Weld Rite, Inc., 328 Hwy 62 West, Salem, AR 72576

Your name and address:

Phone number(s): _____

Shaver Model:

Date of Purchase:

_____/_____/____

Serial Number: (Only applicable only if financed)

Date of Installation and who installed (Proper self-installation, following the instructions. will not void the warranty):

Dealer Purchased from (if purchased from the factory, put Weld Rite, Inc.):

Dealer Address:

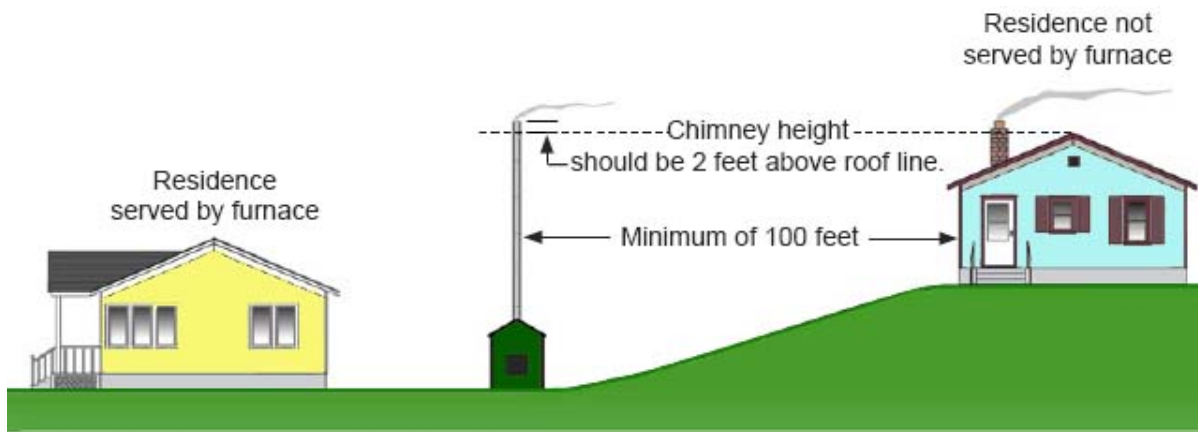
Dealer Phone Number: _____

Please keep this manual with all other important papers. The information in this manual is necessary for the installation, operation and proper use of this furnace. If you should ever have a problem or question please refer to this manual or have it available when you call your Shaver dealer or Weld Rite, Inc. Phone: **870-895-3104 or 3111**

A duplicate for mailing is at the end of this manual. Retain this completed copy for your records.

OUTDOOR FURNACE BEST BURN PRACTICES

1. Read and follow all operating instructions supplied by the manufacturer.
 2. FUEL USED: You may burn any hardwood (or softwood), as well as pallets that have been split up and coal but NEVER burn driftwood, painted, stained or pressure or/and chemically treated wood. Never use the following: trash, plastics, gasoline, rubber, naphtha, household garbage, material treated with petroleum products (particle board, railroad ties and pressure treated wood), leaves, paper products, and cardboard. If you burn softwood, the wood will burn faster and you will have to clean the creosote and chimney more often.
 3. LOADING FUEL: For a more efficient burn, always add wood before the wood has burned out. Most often it can be loaded in the morning and at night. Load coal before wood. See next page.
 4. STARTERS: Do not use lighter fluids, naphtha, gasoline, or chemicals.
 5. LOCATION: It is recommended that the furnace be located with due consideration to the prevailing wind direction. Chimney height can be easily extended with 5.5" Stovepipe. You can get downdrafts if the furnace is too close to a building. See Page 13 for additional information.
- We recommend a distance of at least 100 feet if prevailing winds blow towards any other residence not served by the furnace, it is recommended that the stack be at least 2 feet higher than the eave line of that residence.
 - If located more than 100 feet but no more than 150 feet to any residence, it is recommended that the stack be at least 50% of the eave line of that residence, plus an additional 2 feet.
 - If located more than 150 feet but no more than 200 feet to any residence, it is recommended that the stack be at least 25% of the height of the eave line of that residence, plus an additional 2 feet.



Chimney height relative to nearest downwind neighbor

The chimney can easily be extended with our chimney adaptor (optional) or 5.5" stove pipe, to any height necessary, with zero adverse affect on performance. In fact, it may even draft better. Always use at least a double-wall pipe when going through any kind of roof! The chimney should extend at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet. You can get downdrafts if the furnace is too close to a building.

6. **Always remember to comply with all applicable federal, state and local codes and laws.**

Wood Recommendations

Burn only cordwood that has been seasoned for 12-18 months. Burning unseasoned wood is wasteful and inefficient, using much of the combustion energy to boil off the excess moisture. It also puts a lot of moisture into the ash “pan” which makes it corrosive. The wood *can* be split to aid in seasoning if it’s real wet and should be approx. 25% moisture content by weight. **However, whole rounds burn longer and are cheaper but will have to be dried longer.**

The following are general guidelines for wood selection:

- Hardwoods burn better than softwoods (mix them if you need to burn softwood).
- Larger pieces (whole rounds) are best and burn better and longer than small pieces.
- 25% moisture content is optimum. Drier is ALWAYS better!

Higher moisture content wastes energy boiling off water. Wood with a lot of moisture can cause more smoke than the chimney can dispose of. It also puts a lot of moisture into the ash “pan”, which makes an extremely corrosive mixture. **Ash corrosion is NOT covered by the warranty.**

Lower moisture content (very dry, old wood) burns rapidly and inefficiently.

Burning Coal

We recommend that you burn a coal and wood mixture. A nice bed of coal (about 8-10 shovels) up to the bottom edge of the door, heaping it in the middle with wood on top, burns best according to our customers.

Keep the ash receptacle and firebox clean, as **coal is very corrosive. Damage from burning coal is not covered under the warranty. You may want to add firebrick, placing it on the floor of the furnace or/and elsewhere.**

This furnace is now available now with an optional adjustable shaker grate, for burning coal – a FIRST in the industry!!



THE SHAVER OUTDOOR WOODBURNING FURNACE

How does an outdoor furnace heat my home?

The Shaver outdoor wood furnace is designed to save the most energy and provide the most comfortable heating available. It heats your home by heating a firebox surrounded by a steel tank filled with water. The furnace is basically a safe non-pressurized boiler with an atmospheric vent. This hot water is then circulated through underground hot water pipes (Pex Pipe) to a water coil (heat exchanger) installed inside your existing central duct system.

If you have a boiler, a water-to-water heat exchanger is used. The Shaver furnace can be connected to virtually any existing pressurized or non-pressurized boiler, Hydronic or radiant heating system that operates at 180 degrees or less. It will not work with steam systems.

A typical water-to-air heat exchanger - much like a small radiator or heater core in a car, is installed in your ductwork. When air blows through it, heat is extracted and hot air blows out of your vents. You can also use hydronic or radiant heat utilizing Pex Pipe under the floors or in a concrete floors or by using radiators or baseboard hydronic heaters.



How does the SHAVER furnace heat water for household use?

Water is circulated directly between your hot water heater and the outdoor furnace, through the built in heat exchanger in our furnace. The water going back to your hot water heater is preheated by a coil in the outdoor furnace. The only energy required is maintaining the hot water temperature in the outdoor furnace. An extra circulating pump is needed. Page 35

A stainless steel shell and tube heat exchanger should be used for heating pools and spas. The chlorine will tear up a brazed plate heat exchanger. See page 37

How do the Thermostat Controls work?

The only visible addition to the heating system inside your home is a 2nd thermostat, which is located near the existing thermostat, if possible. The thermostat is installed (see page 32) so that it turns the blower on inside your existing furnace to force air across the hot water coil (heat exchanger). This forces hot air into your central duct system. The original wall thermostat turns on your original furnace, if the outside wood furnace is not in operation. Your existing furnace will automatically take over to maintain your household temperature.

When the indoor furnace fan powers up, it sends power to the circulating pump, in the outdoor furnace, to circulate the hot water through the heat exchanger.

If you have an existing boiler, the pumps are controlled by the thermostat. When the pump comes on (assuming one main pump), power is sent to the outdoor furnace's pump so that both pumps run simultaneously.

Simply wire the outdoor furnace's circulating pump to the power wire of the indoor pump (if using a single pump). If you are using a controller for multiple pumps and zones but don't have one main pump, you will need to use your controller to turn on the outside pump anytime a pump in

your house turns on. See your controller manual or consult an expert in this area. You can also leave the outdoor pump on 24/7, since it only uses 80 watts of power – less than a 100W bulb.

The outside furnace has a hot water thermostat that senses the water temperature of the unit. If the water is not as hot as the thermostat setting, the combustion air blower is automatically turned on (building a hotter fire by feeding oxygen to the base of the fire) and remains on until the desired (set) temperature is attained.

Insulated Pex Pipe

We highly recommend that all Pex Pipe be insulated. You will burn less wood because there will be virtually no heat loss through the Pex pipe. ALWAYS bury it below the frost line for less heat loss and to avoid freezing. The ground temperature below the frost line will be 50-55F or more.

You can purchase insulated pipe in 4" black drain pipe with two 1" Pex pipes and simply lay it in the trench, hassle-free.

You can also get premium, insulated pipe with 4 Pex Pipes inside a 5" pipe (Two x 1" and Two x ¾" in) for approx. \$14 a foot. The 5" pipe has 50% more insulation than the 4" pipe and it has an R value of 14.



With a little effort, you can save a lot of money by insulating it yourself. Try to keep the Pex pipe underground as it enters the house. A 4" or 6" hole in concrete block, is easily made for the PVC pipe. If it has to come above ground, go through the sill plate or attic, it **MUST** be well insulated, as well as if running through an attic or crawl space or any non-heated area.

The insulation of choice is Solarguard™ (or Microfoil or Reflexitix if Solarguard is unavailable). You can find out where to purchase Solarguard locally (close to you) by calling 1-800-231-6200, or you can purchase it from us. One roll 4' x 50' will do approx. 80 linear feet of Pex pipe.

http://www.silvercote.com/solarguard_reflective_insulation.php

It is a state-of-the-art insulation that is only ¼" thick, yet yields an R value just shy of R12 – with one layer. It deals with the following modes of heat transfer: CONDUCTION, CONVECTION or RADIATION. Fiberglass insulation alone only addresses the conduction and convection modes of heat transfer. Solarguard uses a fiberglass core to slow heat transfer through conduction and convection but also has a highly reflective foil backer film to address the **RADIATION** mode of heat transfer. 50-93% of heat loss is through radiation.

Simply cut the rolls into strips, for easy wrapping. Use 6" PVC pipe for easier pulling through of 4 runs of insulated Pex and the wire. Be sure to wrap it inside the back of the furnace as well.

Blue Styrofoam



Cut a 4' x 8' sheet of blue Styrofoam into 2" strips, 4 feet long. This will give you 24 pieces, 4 feet long – sufficient for 96 feet of pipe. Place the Styrofoam strips between the hot and cold Pex pipes. Tie it all together with plastic wire ties.

Wrap loosely with Solarguard™, to create an air barrier, overlapping as you go. The air gap will add extra R value. Tie it all with wire ties again, using tape the seal the ends, with a wire tie over the tape to hold it secure, so that when it dries out it doesn't fall off.

Pex Pipe Routing



Single zone setup with one pump

1. Goes to house heat exchanger
2. Return from house heat exchanger
3. Power to pump, thermostat and blower
4. Inlet to potable water coil (not seen - inside of furnace, in water jacket)
5. Outlet from potable water coil
6. To manual fill valve on front of furnace
7. Water supply to furnace from manual fill valve
8. Optional outdoor hot water supply for a faucet or steam cleaner hookup.
9. Drain
10. Blower/fan to feed oxygen to fire
11. Armstrong Astro-30 Pump, one included (to circulate water)
12. Thermostat (for blower)

#1 and 2 with arrow shows direction of water flow for built-in hot water coil in furnace

Recent research has shown that it's better to have the pump at the bottom and the return line where the pump is shown now!

The furnace shown is an older single zone plus the hot water coil. **All furnaces come with another hookup now for another building, at no cost (not shown).** 2nd Pump not included.

Do not wire as shown. This is not to code and is shown this way for simplicity only.

Location of Furnace **SOME STATES HAVE THEIR OWN LAWS!**

The outdoor furnace should be located at least 10 feet from your home (according to most insurance companies), with the door facing away from the house, so that all fire danger is removed from your home. We recommend 30 feet or more. The furnace may be installed as much as 100-120 feet away with the standard pump (or up to 300' with a bigger pump) and

still heat your house and hot water easily. The chimney should extend at least 2 feet higher than any portion of a building within a horizontal distance of 100 feet. (See page 9)

If the furnace is located more than 100 feet away, you may experience some heat loss in the water going to your heat exchanger (and water heater) – about 2 degrees/100 feet of well-insulated Pex pipe. A larger pump than the one supplied is needed for distances over 120 feet or/and any rise in elevation over 8 feet. For extreme distances (200 ft plus) we recommend that your pump stays on all the time so there is no delay in getting heat because there is always hot water available at the heat exchanger when the furnace fan comes on.

Locate the outdoor wood furnace where it will be convenient for refueling and wood storage. All water and power lines are installed underground between the house and the outside wood furnace in a 4" or 6" PVC pipe that is ALWAYS buried below the frost line.

The furnace should be installed on a 4" thick concrete pad.

- A) It is recommended that the furnace be located with due consideration to any neighboring residences and to the prevailing wind direction.
- B) Do not locate an Outdoor Wood Burning Appliance within 100 ft of a residence not served by the furnace. **Follow local and state laws concerning setbacks.** Please be considerate of neighboring residences, properties, parks, etc.
- C) Review the recommended stack heights on page 9.
- D) Do not locate near any combustible materials, gasoline or other flammable liquids or gases.
- E) Locate away from dry grassy areas, dry leaves, brush and trees.
- F) Place far enough away from any building to minimize fire danger.
- G) Check with your insurance company and local codes or ordinances.
- H) Do not install in an area where nearby structures or trees might cause downdrafts or fires.
- I) Typically, Outdoor Wood Burning Furnaces are located 40 to 100 ft down wind from the served structure.
- J) Transfer lines in excess of 120 ft may require a larger size pump than the one provided with the furnace, especially if there is any head (or incline).**
- K) Locate the furnace to allow easy access to wood supply.
- L) To aid in smoke dispersal, extra chimney lengths may be required depending on the distance to surrounding structures. See page 9 for additional guidance.
- M) The furnace requires 115 V, 15 Amp electrical service to operate.



Failure to keep the Shaver Furnace area clear and free of combustible materials, gasoline and other flammable liquids and vapors can result in severe personal injury, death or substantial property damage.

CONCRETE PAD: The furnace should be installed on a concrete pad with the rear of the furnace 2-3 inches from end of the pad, so that the pipe comes up in the space provided between the back door and the rear of the water jacket, where the pump is.

The space between the inside rear of the furnace and the door will allow space for a 4 or 6 inch water- tight PVC pipe with the plumbing and electrical lines, to run directly into

the ground. We put a large full-size door on the back that will allow you easy access for the connection of the plumbing and electrical lines.

We recommend the pad to be 48" wide and 82" long, minimum. If you add extra length, it will allow ample concrete in front of the furnace to stand, for loading wood and removing ashes. Larger models than the 165 need to have a longer pad.

Shaver Pro Series 140 - 48" x 114" Suggested pad size

Shaver Pro Series 165* - 48" x 120" Suggested pad size

Shaver Pro Series 250 - 48" x 136" Suggested pad size

Shaver Pro Series 290 - 48" x 144" Suggested pad size

Shaver Pro Series 340 - 48" x 154" Suggested pad size



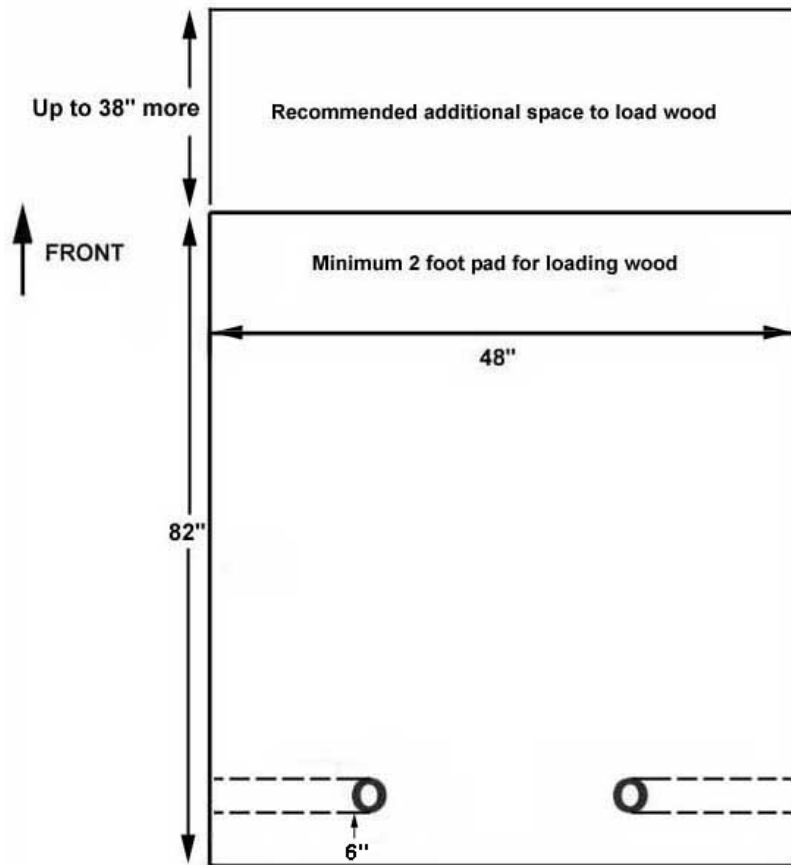
Placement of pipe through the pad and into the ground - shown without the rear door installed,

Recent research has shown that it can be better to have the pump at the bottom and the return line where the pump is shown now!

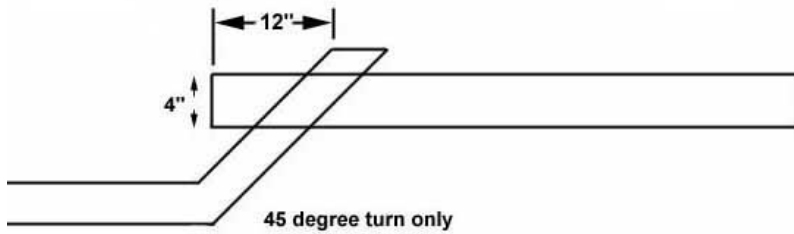
The PVC pipe is always buried below the frost line and **most jurisdictions require a 18-24" minimum depth for the electrical wire, sometimes separated from Pex by 18"**.

See the illustration below for the recommended pad size and pipe placement for a 165 furnace. Other suggested pad sizes shown above.

Have insulation ready to put UNDER the furnace on the pad, before delivery. After placing your new Shaver Furnace on the concrete pad (we normally put it on the pad for you if we deliver it), you are ready to continue the installation process.



Put a 4 or 6" PVC pipe in place, to the left or right, before pouring concrete.



The piping can go in any direction. It just needs to be in the proper spot above the concrete pad.



PREPARING YOUR FURNACE

1. Simply open the large rear door to gain access to the rear of the furnace, to make plumbing and electrical connections.
2. Open the protective cover on the side of the blower. Simply swing it open so the inlet is exposed $\frac{1}{4}$ of the way. Door is shown swung open below.



The fire should be blazing when the fan is on. It should be just smoldering if the fan is off.

Quickly crack open the firebox door to see what the fire is doing. (Leaving the door open any length of time will give you a blazing fire.)

If you have too hot a fire with the fan *off*, close the cover on the side of the fan a little more. The water should never be boiling. If it is, the cover is open too far or there is a downdraft problem.

3. The plumbing and electrical lines for your furnace must be installed underground in a watertight (glued) 4" or 6" PVC pipe OR use pre-insulated pipe. **HOWEVER, some building codes require that the electrical wire be run 18" away from the Pex pipe. Be sure to check YOUR LOCAL BUILDING CODES!**

The water lines must be buried below the frost line to prevent freezing. The depth of the trench varies in different regions of the country. Be completely sure about the correct depth before the PVC pipe and Pex Pipes (or pre-insulated pipe) are installed underground. Call your local building inspector's office for that information.

4. A trench must be dug wide enough to accommodate the pipe that you choose. All plumbing and electrical lines are usually run inside the watertight PVC pipe.
5. **HINT:** Remember to run 2 small ropes or twine through it as well to facilitate pulling anything else through that may be added or changed in the future!
6. If more than one location is to be heated, then additional PVC with Pex pipe, must be installed underground to that location.
7. This pipe will run from the rear of the furnace to the location to be heated. Inside the watertight pipe are the water lines and electrical supply wire (12/3 UF w/ground). **⚠ Some building codes require that the electrical wire be run separately in the trench, 18" away from the Pex pipe (not in the PVC pipe).**

The listing below describes each water line and their function.

1. One water supply line to heat exchanger - placed into existing heating system. This one is attached at the circulating pump. All of these must be 1" pipe.
2. One water return line from heat exchanger. This line is attached at the nipple at the bottom of the furnace, to carry cool water back into the water jacket.
3. One 3/4" water supply line to indoor plumbing for filling the furnace.
4. One #12/3 W/Ground UF underground Romex wire. The extra insulated wire supplies power to your pump, from your furnace fan in your existing furnace (or boiler pump), instead of running a thermostat wire and installing a relay (more to go wrong).

OR

If you are heating your hot water, simply run two 3/4" water lines to your water heater. One of those will supply the water to fill the furnace, so a separate Pex pipe isn't needed. You will have a total of 4 (four) Pex lines running to your house in this scenario.

If more than one location is to be heated, a second 4" watertight pipe (or insulated Pex pipe) will need to be installed underground for the water lines and the 12/3 power wire from the second location. The 2nd location is wired as the first. No thermostat wire is normally needed. Locate this pipe at the opposite side of the outdoor furnace per diagram on page 16, unless it's running in the same direction as the first. In that case both pipes can be on one side or in the middle, as needed.

HINT: Label the water lines before burying the pipe and lines

Filling furnace with water and chemicals

Once your Pex Pipe is hooked up, simply turn on the manual fill valve at the front of the furnace and allow it to fill until water runs out the overflow (Shown left of red corner piece). After starting the pump and bleeding the heat exchanger, top off the water again. Be sure to open the valve at least once a week during heating season to keep the furnace topped off. Failure to do so may result in overheating and circulating pump failure.

DO NOT block off the overflow tube!



To add chemicals to your water you can remove the plate (shown below) that normally covers the hot water coil in the back - above the thermostat and pump. Or use a funnel and hose at the overflow pipe. See below and Page 43 for more pictures.



Plate ^



You can also use an elbow and extension at the 2nd outlet (if not being used) to fill using a funnel. Keep it capped when not using for chemicals.



Alternatively, you can use a funnel and hose on the overflow tube. **DO NOT block off the overflow tube permanently!**

Plumbing Parts Needed

You can get a complete install kit with all the fittings and three shut-off valves.

A. The pump needs a 1" quest-fitting adapter or SharkBite® fitting, to screw into a flange that is supplied and already mounted to the pump. The flange has a female NPT thread. See the picture below to help visualize this. It is the brass fitting on the bottom of the pump. It is shown with a Quest or Pex pipe compression fitting already screwed onto it.

B. The Quest fittings or poly pipe fittings can be purchased locally at any good plumbing store. SharkBite® fittings are now the connector of choice, receiving rave reviews from our customers! These are also available from Alternative Heating and Supplies in CT.

You need 1" Pex Pipe for the main pumps to the heat exchanger.

The Pex Pipe connected at the bottom of the pump runs to the house and normally runs to your heat exchanger (water-to-air or water-to-water).

This will also be your supply line if you have a Hydronic or radiant heating system. A brazed-plate heat exchanger is recommended between the two systems. See end of this section for more information on hooking up a brazed-plate heat exchanger.

You need ¾" Pex Pipe for the hot water heater, which is commonly known as 7/8" Poly Pipe since the OUTSIDE diameter is 7/8".



SharkBite™ fittings are HIGHLY recommended for installing the Pex pipe.

Customers rave about them and their ease of use!

No leaks, the first time – using simple push-on fittings.

No special tools are needed.

Compression fittings are shown to left.

C. The pump comes already mounted directly to the furnace *without* a shut-off valve. However, it is a good idea to install a shut-off valve above the pump (as pictured below) so that if the pump ever has to be changed, the water supply can be shut off so water doesn't flow out of the furnace during the repair or pump replacement.



When you have several large pumps, it's better to have the pumps at the bottom and the return line where the pump is shown now!

Simply reverse what is shown and you will have a better setup!

Simply add a valve and a threaded pipe (threaded on both ends), as shown.

D. It is also a good idea to put TWO shut-off valves on the return lines. This helps bleed the system of air and is a big help when troubleshooting. (Shown on next page.)

ALL of these parts are available as an "installation kit" (saving a lot of running around)..

See the picture on next page. Note that two different types of shutoff valves are used, but they can be the same. Personally, I would reverse them to make bleeding easier.

Adding Shut-off Valves for Testing a New furnace & for Trouble-shooting down the road



(Note PVC Pipe at bottom right (above), is installed in the concrete for future addition of heat to the garage, shop or other building)

Adding two shut-off valves on the return lines is done so that if there is a potential problem with a stopped up heat exchanger or bad pump, it can be diagnosed easily by the owner, without the need for a service call.

See **TESTING** for more information.

Adding two shut-off valves (Available as a kit):

1. You will need a shut-off valve with 1" Poly pipe connectors on both ends.
2. You will need a 1" Poly pipe connectors and adapter to connect the Pex Pipe to the brass valve on the right. .
3. You will need a short piece of pipe with 1" NPT threads on both end to connect the valve to the furnace.

Sealing off the Plate on top of the Hot Water Coil

This is where you add your chemicals – preferably before sealing it off.



Seal off the black plate (with the handle) that covers the hot water coil, with silicone all the way around, after all Pex pipe has been hooked up. See page 43 for pictures.

Installing the Heat Exchanger in the Plenum or Ductwork

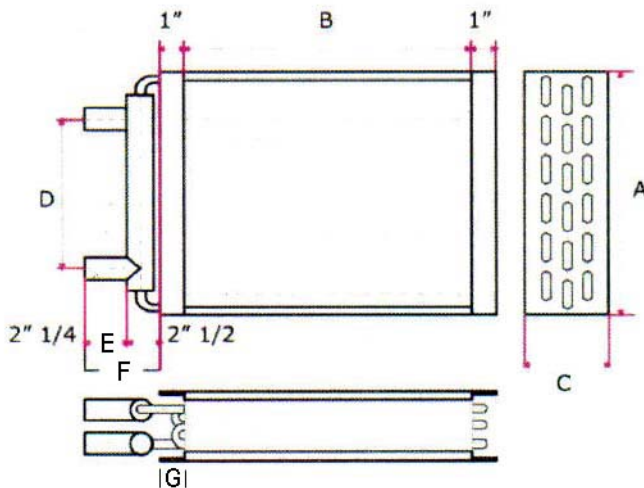
If you have Air Conditioning, the heat exchanger must be installed between the furnace and the evaporator coil. Failure to do so may result in freezing of the heat exchanger. If you can't place the heat exchanger between the furnace and the evaporator coil, you must drain the heat exchanger annually before using the A/C.

The heat exchanger must be installed so that it is airtight. No air must be able to flow around it or out of the ductwork. Use adhesive backed foam tape (used for insulating doors and windows) around the water coil. Use foil tape to seal off the heat exchanger and the hole you make, or consult a local HVAC installer or technician.

Make sure the fittings are easy to get to once it's installed. Ideally, there should be no splices in any water lines! If you have to splice two lines together, use SharkBite® fittings. The IN fitting should be at the bottom of the lowest point (bottom) unless installed horizontally. In that case, see if the heat exchanger is marked in/out.

You should be able to find a heat exchanger to fit most popular sizes of plenums. If you can't, you must have your ductwork modified to accept the heat exchanger. This is best left to a professional, unless your ductwork is made up of fiber board. In all cases wear protective gear, gloves and glasses and a mask. Edges can be SHARP!

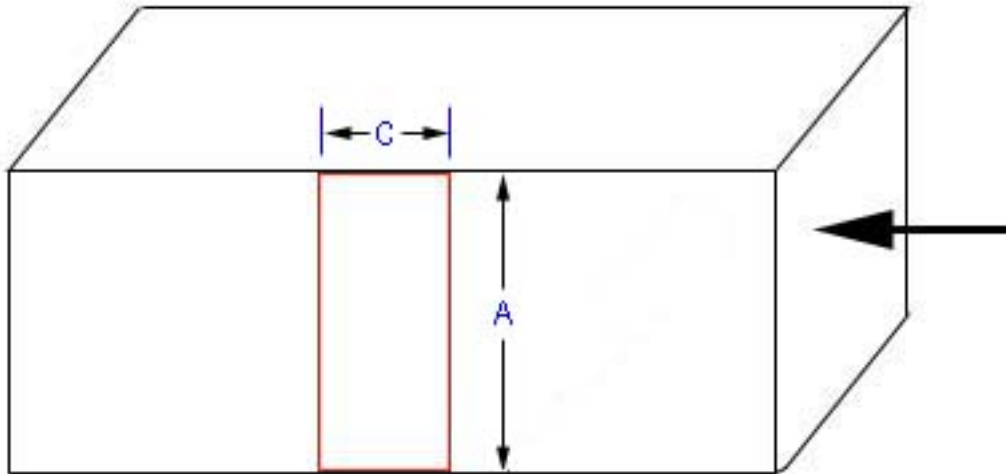
Measure the width of the heat exchanger (Dimension A in next diagram). Measure the thickness of the heat exchanger (Dimension C).



Start by cutting a hole in the side of your ductwork the thickness of the heat exchanger (Dimension C) and the full length of the ductwork (usually Dimension A).



WARNING! Metal edges are very sharp! Wear protective gloves and use caution!



Cross section of plenum showing air blowing in it from right

Cut hole where red lines are

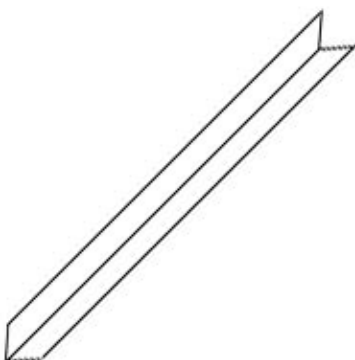
Slide the heat exchanger into the hole for a test fit. Ideally the tubes (D and E) should stick out of the plenum [see diagram on previous page]. The header and tubes (F) can stick out of the plenum as well, if necessary.

As long as the whole coil surface (B) is in the plenum, you should be good even if a little more of the header (F and even G) sticks out.

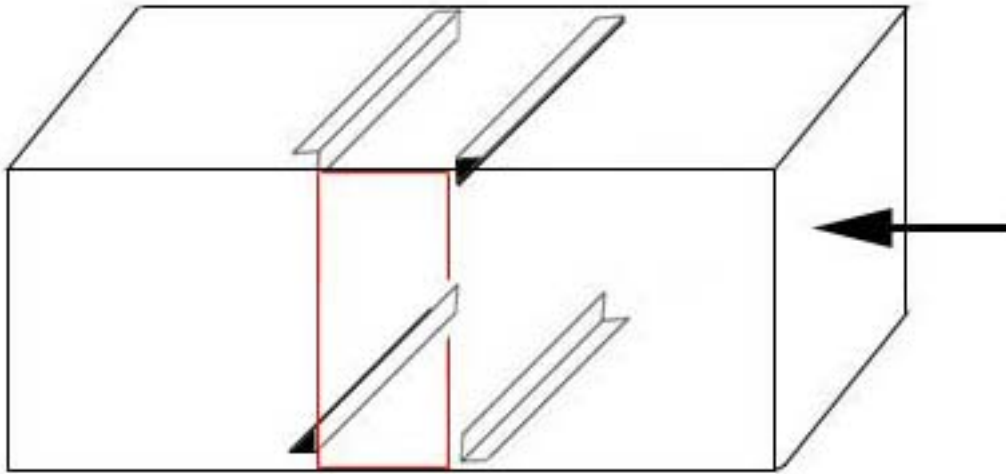
While test fitting it, try to determine how much tape is needed around it. A different amount (thickness) may be needed on different sides. You can purchase different thicknesses of tape so that it will fit and seal properly.

Place foam tape around the outside of the heat exchanger to seal it off so that it fits tight and air can't blow by it.

The heat exchanger needs to be installed so it won't move around. The easiest way is to fabricate some pieces of metal into an 'L' shape, approx. the length of the heat exchanger like shown below.



This is what the braces will look like. Very simple. Rivet or screw into place.

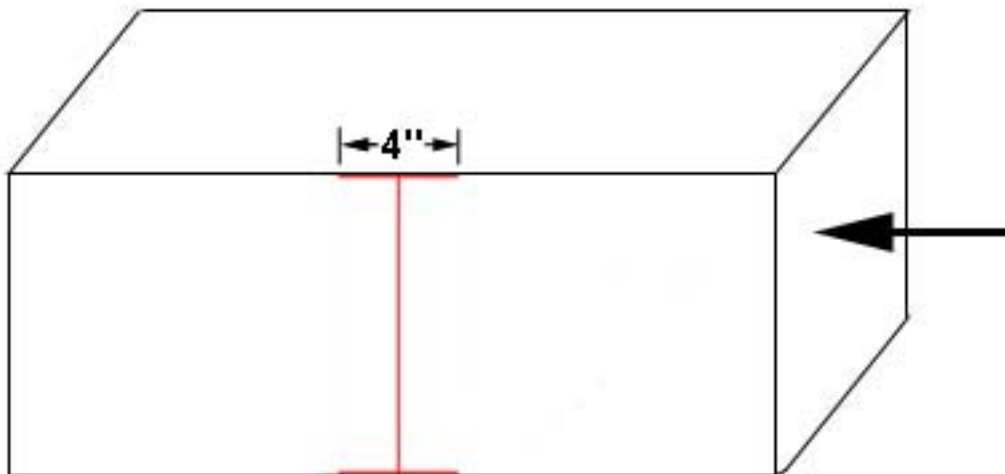


Install the braces as shown above. Simply put them in place, the proper width apart (Dimension C). Drill through the duct work and your newly made 'L' pieces and pop rivet or screw them into place. You will need four pieces, two each on the top and bottom.

Slide the heat exchanger carefully into the plenum to check the fit again. If all looks good, you can seal off the ends of the heat exchanger and the hole you made in the plenum with foil tape made for ductwork. Input lines should be at the bottom, unless otherwise marked.

Installing a Heat Exchanger that is Longer than the Plenum

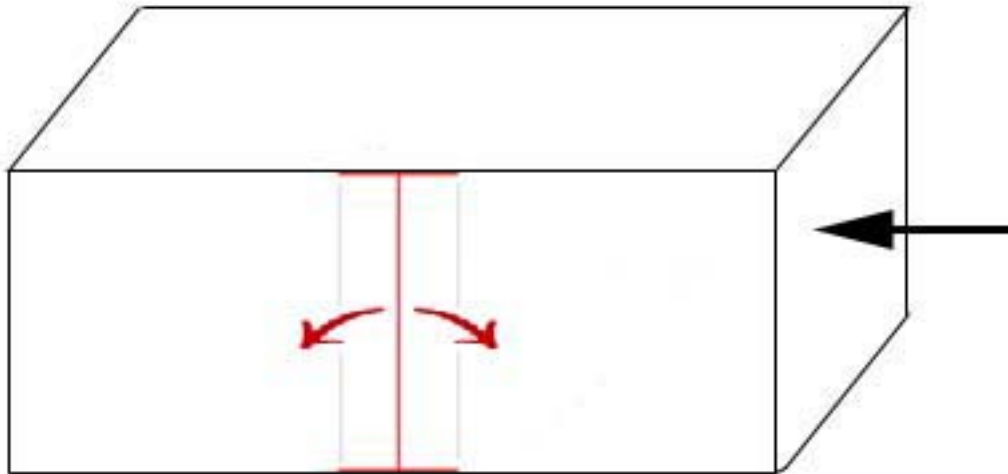
You can install a heat exchanger in a plenum that is smaller than the length of the heat exchanger, as follows. Cut the lines at the top and bottom of the plenum, usually 4 inches long (the width of the heat exchanger).



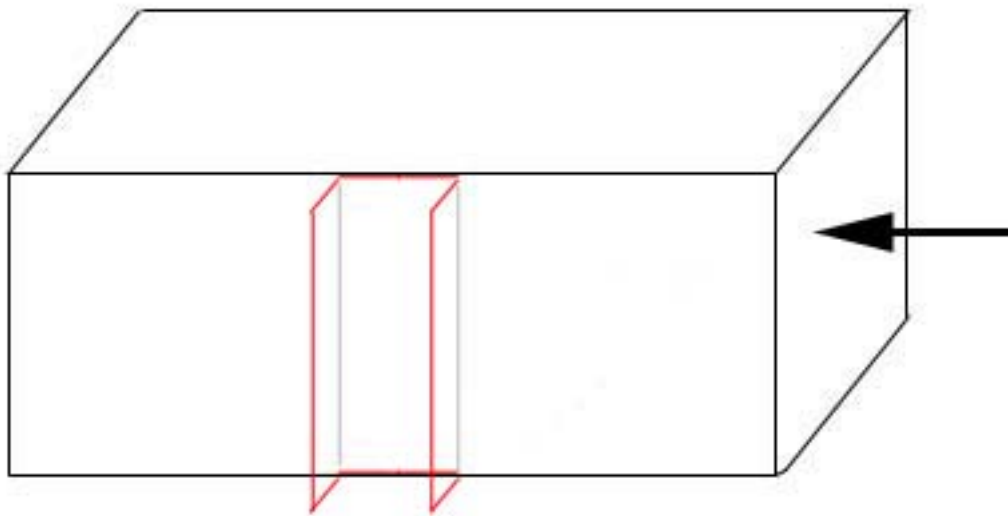
Cross section of plenum showing air blowing in it from right

Cut hole where red lines are

Cut another line vertically, between the other two cuts, right in the middle as shown.



Bend the sheet metal back and out, along the grey lines. Repeat on the back side of the plenum, in the same spot.



Bend the metal pieces back to slightly past 90 degrees.

Slide the heat exchanger through the front hole to the back hole. So that it protrudes front *and* back.

Ideally the core of the heat exchanger will be entirely within the plenum. (Item B)

Crimp the sheet metal to the edge of the heat exchanger. This is item G in the diagram above (Page 23). Using channel-lock pliers to crimp it, it makes a very nice professional looking installation. Input lines should be at the bottom inlet unless otherwise marked.

This not only forms a virtually airtight seal, but it also supports the heat exchanger as well.



A transition was built here so that a larger heat exchanger could be used with smaller ductwork.



A customer's photo of his heat exchanger installation.

Bleeding a Heat Exchanger

With the pump running (turn the thermostat up to 90 F so that the pump comes on), simply close the brass valve on the return line quickly, holding it for 3-4 seconds. Then open the valve. Repeat the procedure at least 4 times.

If you're unsure if all the air is getting out, you can separate the 2 valves (shown on previous page) at the Pex Pipe between them, after turning off both valves so that water won't drain out.

Insert the left plastic valve and pipe in a 5-gallon bucket. Open the valve. Then simply close the plastic valve on the return line quickly, holding it for 3-4 seconds. Then open the valve. Repeat the procedure 4 times. That way you can see if bubbles are coming out of the line.

Insufficient Air Flow through Plenum

You can attain up to 42% higher BTU outputs with higher CFM of air flow. If you need more airflow, the pulleys (if used) can usually be changed on the fan and/or motor to give a higher fan speed. If you can't get enough heat, a slow fan may be an issue

Many furnaces have 2 or 3 speeds or variable speed fans, utilizing the high speed for A/C, which can be beneficial here. Please consult a furnace specialist about this.

How to prevent the water from freezing

As long as there is a fire, the water won't freeze in the outdoor furnace.

The pipes that are underground won't freeze if they are below the frost line, as the ground temperature is 50 degrees or more.



WIRING: A switch can be added to turn off the fan before loading. This will prevent smoke from blowing your face.

An example is shown to left.
See instructions on Pages 30 or 31

A switch can be added to the pump as well, in case you want to have it run 24/7 to prevent freezing, while you are away. Or it can be wired without the third (red) wire, to run 24/7.

Running water won't readily freeze and it will pick up heat from in the house to keep the water warm.

Connection of Power to Furnace



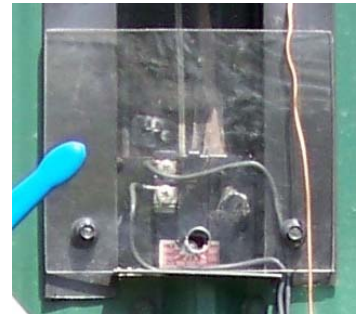
WARNING!

Do not touch the terminals or wires on the thermostat – THEY ARE HOT AND DANGEROUS!!

ALWAYS cover the thermostat with a solid receptacle/box cover (Not shown here) or a piece of Plexiglas, as shown below.

Notch at bottom for wires, if necessary.

Use silicone or screws to attach cover plate to furnace.



This furnace must be wired by a qualified electrician in accordance with the National Local and/or State Electrical Code.

There are three insulated wires in a 12/3 wire; red, black and white plus an uninsulated ground wire.

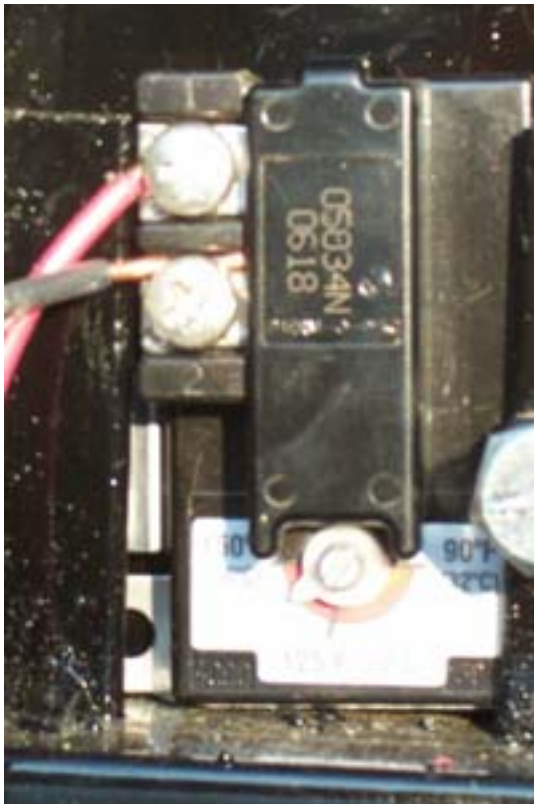
Either terminal on the pump can be connected to the black or white wire.

White is common and also goes to fan/blower

Black wire from the pump runs to house, to fan inside existing furnace.

Red (from 110V source) goes to top terminal on thermostat

Ground (Bare copper wire) is attached to furnace frame and to the green ground screw on both the pump and fan.



Running Pump 24/7

You can also wire up the pump to run 24/7, instead of on demand as shown.

In this case, you only need a 12/2 wire, with ground.

Simply run the hot wire to the pump and to the thermostat.

Common goes to the other terminal on the pump and to the fan.

Ground goes to boiler frame.

Bottom terminal on thermostat goes to fan. Run a new single piece of wire between thermostat and fan. (Shown here and in diagram below as an individual black wire).

FAN SWITCH: You can utilize a standard outdoor light switch in this line, to turn the fan off while refueling the furnace. Simply wire it in the power line to the thermostat or between the thermostat and fan, using an approved outdoor electrical box and cover, to code. See page 28 for picture. A 3-way switch could be used with a reminder light to let you know that the fan is off.

This furnace must be wired by a qualified electrician in accordance with the National or/and County/State Electrical Code.



To add a switch for the pump, so that it will run constantly when you are away, simply wire a switch from the red (hot) wire to the same terminal that the black wire goes to on the pump.

IMPORTANT! You will also need to put a switch on the black wire going to the pump, to interrupt that circuit so that when you power up the pump (24/7) it doesn't cause the furnace fan to run all the time.

A 3-way switch would probably work well here.

~~~~~

The **fan switch** is wired to the red wire that powers up the thermostat for the fan. Use an outdoor box if mounting on the outside.

### Wiring running to house

12/3 with Ground runs from inside house.

Red goes to 110V 15 Amp circuit breaker in house.

White is common (to circuit breaker box - common connections).

Ground wire is grounded in circuit breaker box and to the furnace frame.

Black goes to fan on existing furnace so that when fan comes on, power goes to the pump at the same time. Power comes from fan power source - **ONLY if inside fan is 110V AND a single speed fan!**



**Consult a local heating contractor if you're not sure about this part or if you are dealing with an indoor fan (in your furnace) that is 220V.**



## Wiring up your house thermostat

These instructions are for a forced air furnace, with a single-speed fan. **If you have other than a single-speed fan, a boiler or are unsure about anything, you will need to consult an HVAC technician.**

Most existing thermostats have a fan switch that you can set to ON or AUTO. Simply remove the thermostat cover and you will see a wire running to that switch, usually marked as terminal G.



Disconnect the wire that runs to the G terminal on your existing thermostat.

Purchase a simple, 2-wire thermostat (a simple ON/OFF switch). Usually less than \$15.

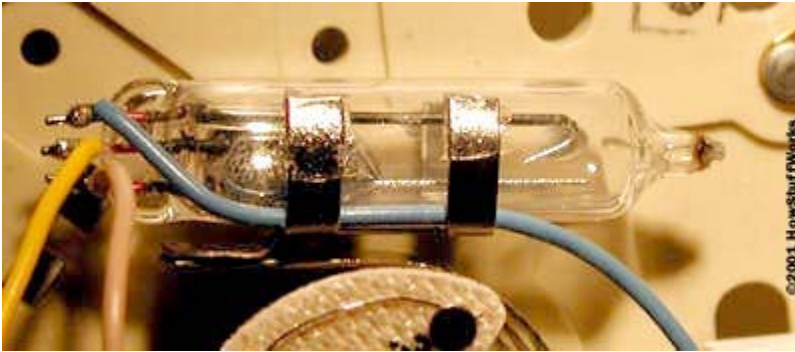
If you have a simple 2-wire thermostat, just use those 2 wires to connect to Terminal G and the wire you just removed.

If you are using a thermostat with more than 2 wires, find the two wires that run to the mercury switch shown below (or bi-metal switch or thermistor on a digital thermostat) that make a connection when you turn the thermostat up. Those 2 wires are wired into the fan switch wire(s) above at to Terminal G and the wire you just removed on the existing thermostat.

(The two wires are shown below (next page), as tan and blue on a 3 terminal mercury switch)

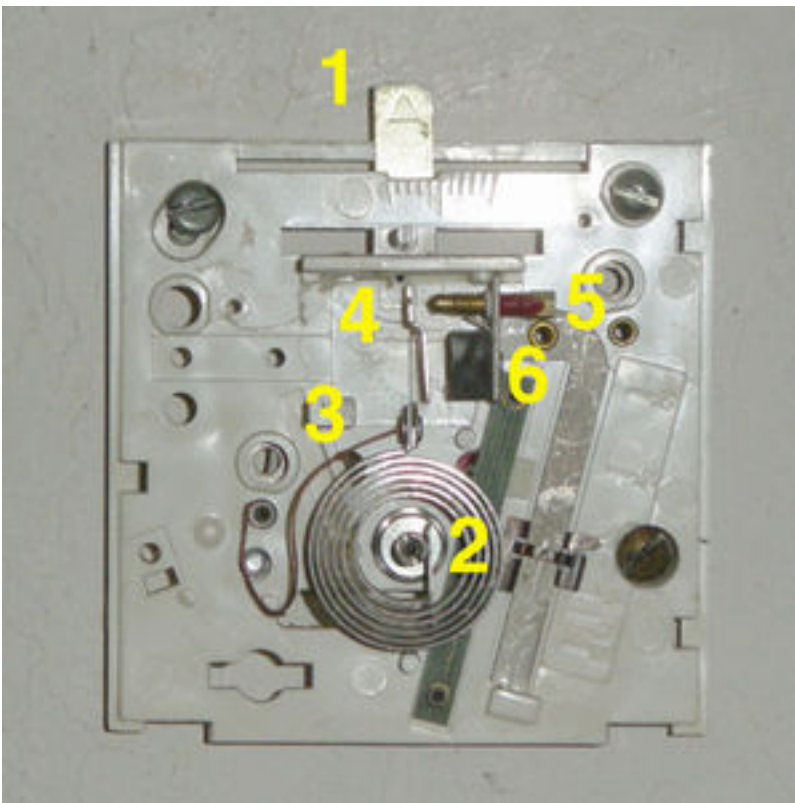
**Never assume that a wire color (or letter code) is correct for the function it should perform; check it out first**

Assemble the new thermostat on the wall and turn the fan switch on the existing thermostat to ON. That's it! You're done!



Mercury Switch

Top and Bottom wires in the switch are typically used.



2-wire bi-metal thermostat

The two wires you need to connect are at 3 and 5 in this example of a 2-wire bi-metal thermostat. They are wired to the G Terminal on the existing thermostat and to the wire that went to the G terminal, that you removed.

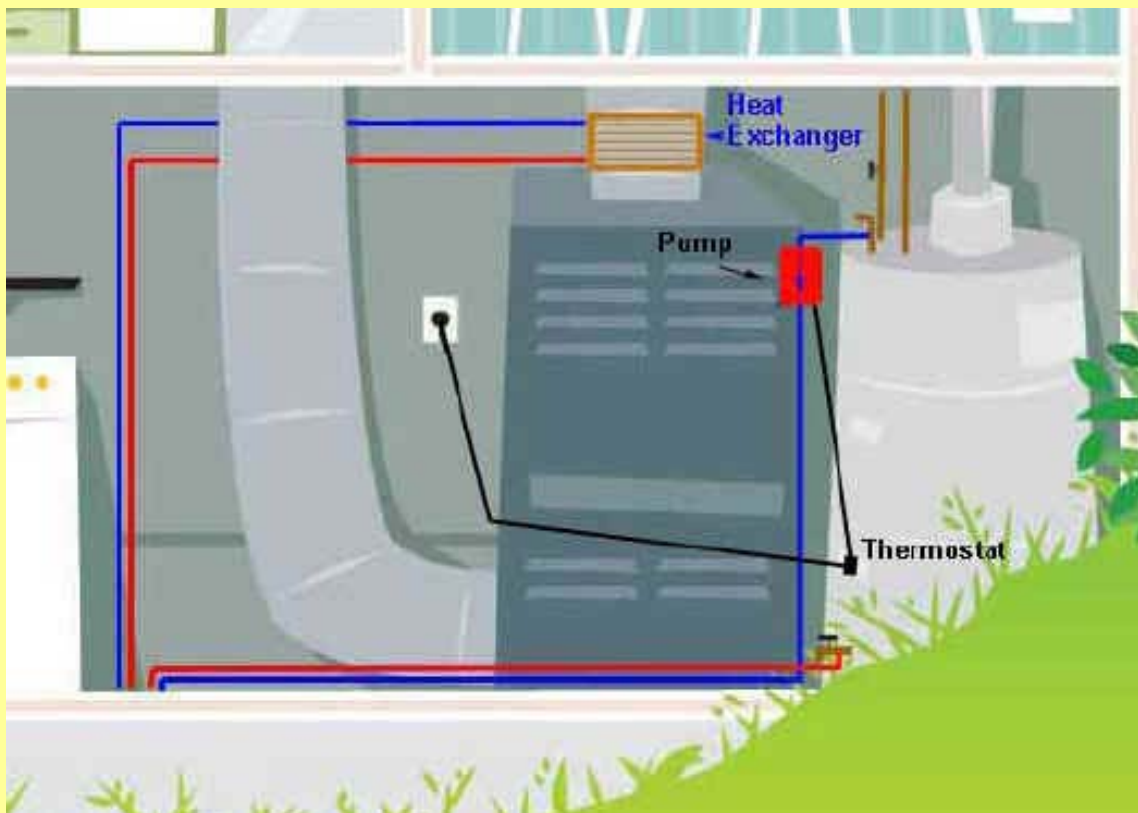
## Hooking up the Hot Water Heater

With an electric hot water heater, we recommend that you unscrew the pop-up valve and replace it with a 'T' fitting (using Teflon or plumbers tape). Screw the pop-up valve back on one side of the T and mount the circulating pump on the other side of the T. Attach the Pex pipe to the pump (outgoing cool water).

Remove the drain and do the same, putting in a T with the drain screwing back in on one side and the Pex Pipe connector (incoming heated water) on the other.

Remove the lower access plate on the hot water heater. Mount a hot water heater thermostat on the tank with silicone around the outside edge - above, below or beside the existing thermostat, at the bottom element. It's about \$8 at your local hardware store. Smear the bottom of the thermostat with dielectric grease (available at auto parts stores) before installing it. This facilitates better heat transfer to the thermostat. Wire it so that 110V is on one terminal and the pump on the other, just like a light switch. Common and ground wires go to the pump.

You just saved \$200 for a side-arm heat exchanger! You can still use the heater as normal in the summer and as a backup. Just turn your Hot Water heater circuit breaker off during the winter or turn the thermostat down lower, than the one you just installed. Turn the breaker back on in the summer and turn up thermostat.

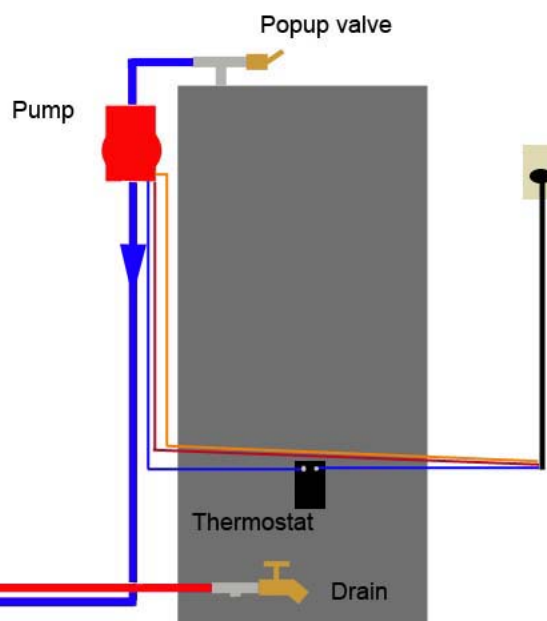
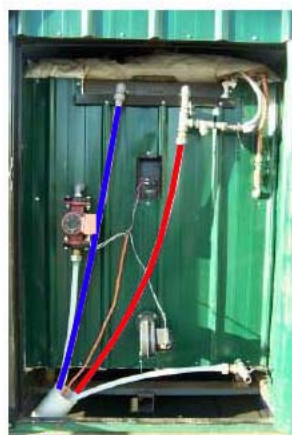


**NOTE:** The Hot Water coils are submerged in water, in the tank of the outdoor furnace.

Alternatively, you can run the incoming (hot) Pex pipe to a brazed plate heat exchanger for your hot water heater – before running to your heat exchanger for your furnace. It is usually about \$175. In this case, you would only need 3 Pex lines running to your house, which may save a little, if the furnace is going to be a long distance away. The downside is that your pump on the furnace would have to run continuously (24/7), instead of cycling on and off as needed. They don't use a lot of electricity (about 80 watts) but it is increased wear and tear. Eliminating the built-in water coil reduces the cost of the furnace by \$75. Our system is a LOT better because you have accurate temperature control. You don't end up with scalding water as is possible with the external plate HE or side-arm.

### Gas Hot Water Heater

For a gas heater, there is usually a plate that can be removed to gain access to the tank itself (or cut an access hole). Simply mount the thermostat on the tank and follow the other instructions for water hookup above.





Customer supplied photograph: Make sure using a single wire is to code in your area.



## Hooking up a Pool or Spa

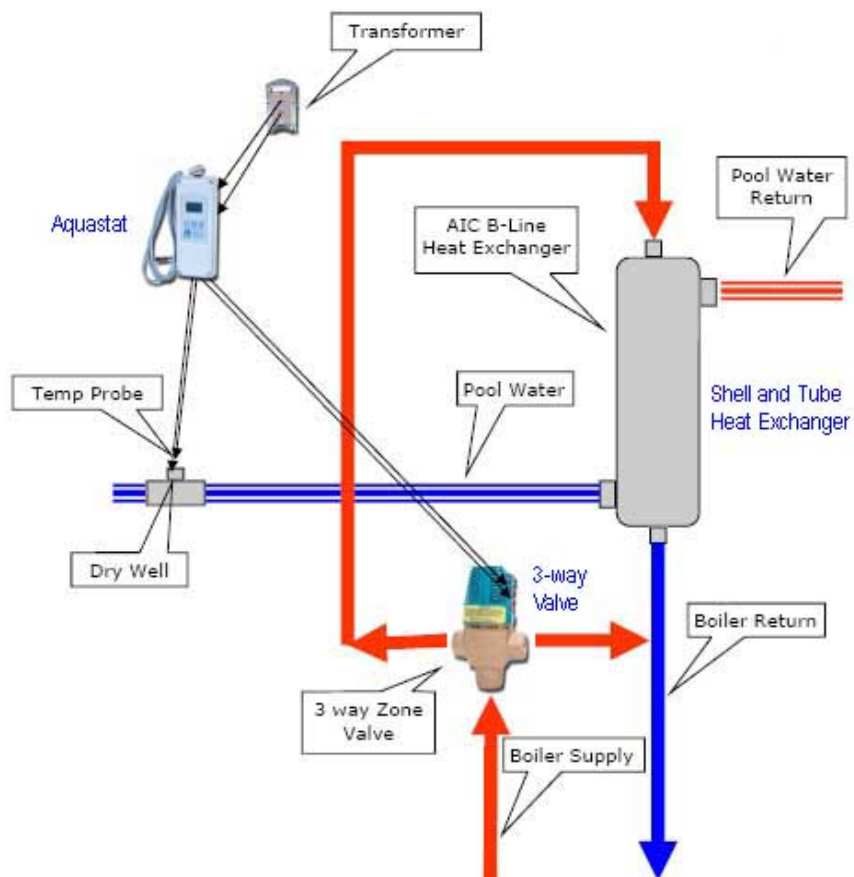
A heat exchanger should be used to transfer heat from the outdoor wood furnace to the pool or spa. You don't want old dirty furnace water mixing with nice clean pool water!

Never use a brazed plate heat exchanger for a pool as the chlorine will destroy it in short order. ALWAYS use a Stainless Steel shell and tube heat exchanger for this purpose.

If the spa isn't too big and you are NEVER going to use the built-in domestic hot water heat exchanger to heat your hot water, you can utilize that for your spa or hot tub.

We have tried many different ways of hooking up pools with different systems; thermostats, etc., where the pump goes off and on to control the water temperature. The main problem is that when no heat is being extracted out of the furnace, the water can boil. It is best to utilize a system whereby the pump runs all of the time so that the water can't just sit stagnant in the furnace, overheat and boil.

The thermostat is connected so that it controls a 3-way valve. When the water needs to be heated up, the circulating water is routed to the heat exchanger. When the water reaches a preset temperature, the 3-way valve bypasses the heat exchanger and sends the water back to the outdoor furnace, keeping the water circulating. This system works the best. A kit is available with complete instructions and every bit and piece needed (including wiring for the controller), to make the installation super easy! Diagram by Alternative Heating & Supplies.



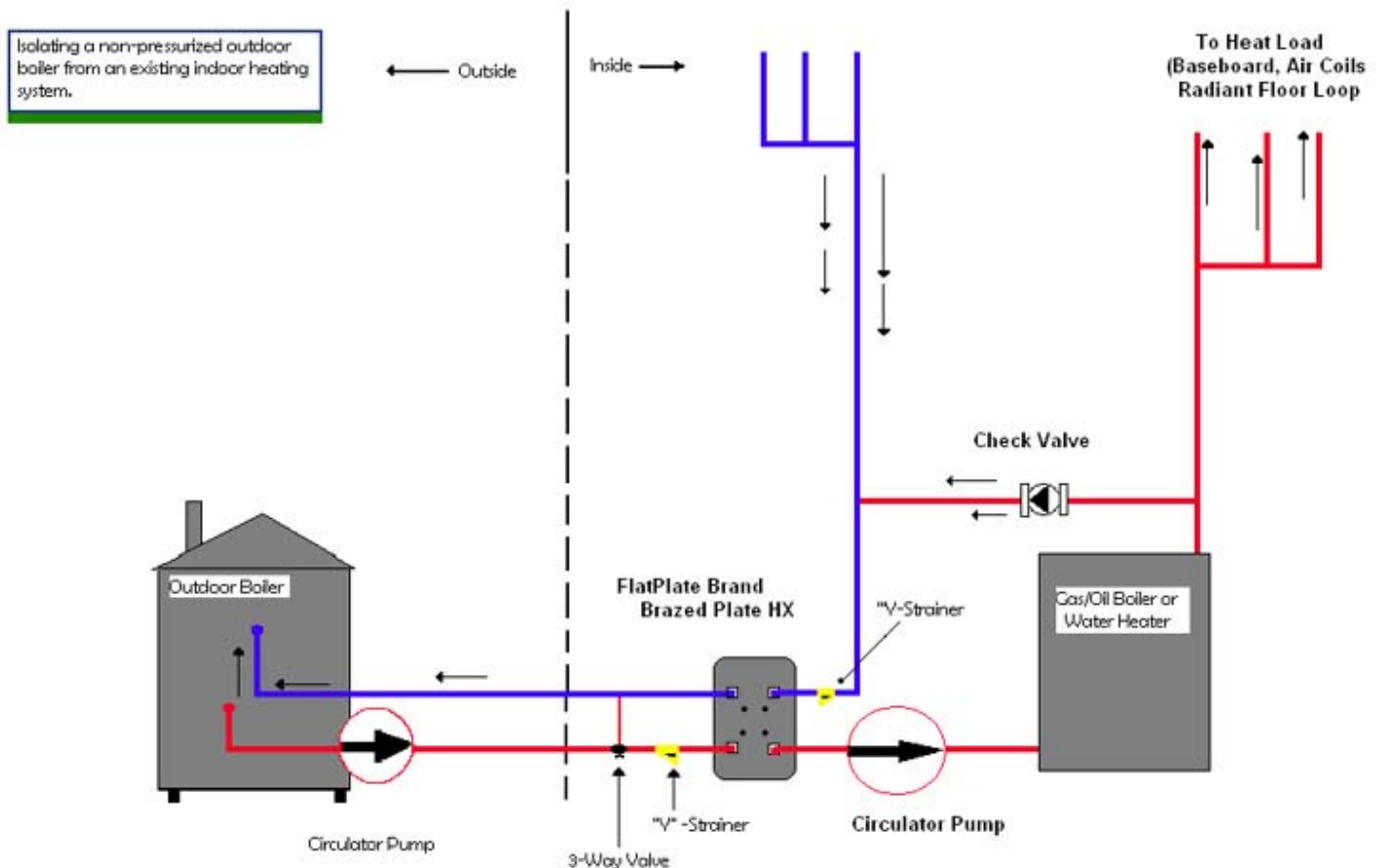
**Pool / Spa Kit**

| Part                                                                                  | SKU     | Qty                   |
|---------------------------------------------------------------------------------------|---------|-----------------------|
|  | BRS01   | 1                     |
|  | AQ002   | 1                     |
|  | PR01    | 8                     |
|  | PT01    | 1                     |
|  | PMS01   | 3                     |
|  | TR11024 | 1                     |
|  | ZV103   | 1                     |
|  | PM0101  | 2                     |
|  | DW001   | 1                     |
|  | B-Line  | Not Included with Kit |

## Hooking up the Outdoor Furnace to an Existing Boiler

Again, we need to use a heat exchanger to transfer heat from the outdoor furnace to the boiler or hydronic system so that the two systems remain isolated from each other. A water-to-water plate heat exchanger is used in this type of system. No thermostat is normally needed since we trick the boiler into thinking no heat was extracted!

The hookup is very similar to that shown above and a complete kit is available.



The 2 systems are totally isolated from each other so that the existing hydronic system (usually pressurized) remains undisturbed and functions exactly as it did before. All pumps and controls remain the same. The system's return water goes through the heat exchanger (on the right) and gets reheated before entering the existing boiler. This tricks the boiler into thinking that no heat was extracted and it will not turn on.

The water circulates from the outdoor furnace, to the heat exchanger on the left side (red line), out the top of the heat exchanger and back to the return (blue line) on the outdoor furnace. Water that circulates through the furnace is never circulated through the home's hydronic system – or visa versa.

The 3-way valve (shown above) is not needed. Strainers are optional. The pump shown is an existing pump (if used).

Set the existing boiler water thermostat lower than the temperature of the outdoor boiler.

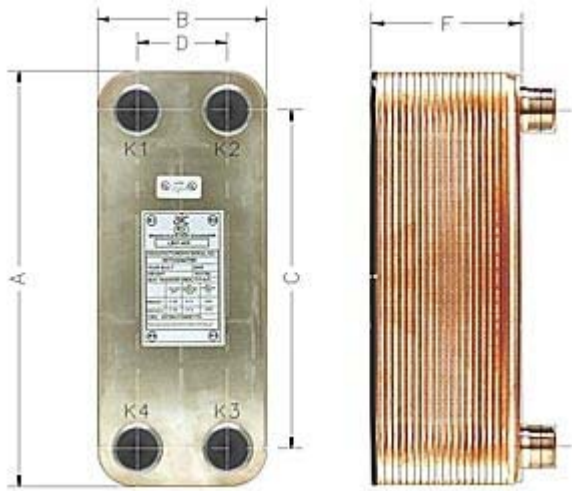


Plate exchanger



Stainless Steel Shell and Tube Heat Exchanger for pool or spa



## **Starting a Fire**

Use small pieces of split kindling together with crumbled newspaper or cardboard, adding larger pieces as the flame grows. Remember: The smaller the better; the drier the better.

### **If it is difficult to start the fire the reasons could be:**

**Not enough air:** Make sure that fan is on or open the ash door (approx. 1 cm gap).

**Bad/wet kindling:** Use small pieces of split kindling together with crumbled newspaper or cardboard, and add larger pieces. Remember: The smaller and drier the better.

**Down draft/cold chimney:** Heat up the chimney by twisting some newspaper into a torch and hold it up into the stove until the draft is reversed.

### **Boiling water:**

1. Draft cover for fan in back of the furnace is open too far.
2. A defective or loose thermostat could also be the culprit.
3. Try reversing input and output, by putting pump at bottom of furnace.

Be sure that the thermostat in the rear of the furnace is secure and up against the body of the boiler. Dielectric grease (available from an automotive store) applied to the back of the thermostat, can help in heat transfer. Using an aftermarket digital thermostat is an alternative and will have a sensor that can be placed in the water possible getting more accurate readings. This goes against our philosophy of keeping it simple and inexpensive, but some people do this upgrade (\$100 vs. \$5),

If the fan stays on all of the time and the water is boiling, you may have a bad or loose thermostat. Be sure the fan cover is adjusted properly first before checking thermostat!

Watch the fan to see if it comes on when the water temperature drops in the furnace. You can test the fan by connecting the two wires at the thermostat together **AFTER TURNING OFF THE POWER!**

If the fan comes on when you connect the two wires, but it won't come on by itself when the water temperature drops, you need to replace the thermostat. These are standard hot water heater thermostats available for about \$5-8 at any good hardware store.

In most cases the flap on the side of the fan should only be open  $\frac{1}{4}$  to  $\frac{1}{3}$ .

### **If the water is boiling and excessive water usage**

Simply close the cover more, on the side of the fan.

The fire should be blazing when the fan is on. It should be just smoldering if the fan is off.

Quickly crack open the firebox door to see what the fire is doing. (Leaving the door open any length of time will give you a blazing fire.)

If you have too hot a fire with the fan off, close the cover on the side of the fan a little more. The water should never be boiling. If it is, the cover is open too far or there is a downdraft problem.

If you still have a boiling problem or you are using too much water (and the cover is completely sealed – page 22), **you can move the pump to the bottom of the furnace (what is now the return line) and have the return line go to where the pump is now.**

### **STEAM inside furnace. Wet insulation, water dripping from inside roof:**

99.9% of the time the hot water coil cover was not sealed with silicone!

### **TESTING a new furnace for water flow**

**This should be done when the furnace and heat exchanger are first installed so that you will know that the water flow is like in *your* system, for future reference. (Heat exchanger installation is on page 23.)**

#### **Perform these Steps on a new furnace:**

1. After the furnace has been filled and running, separate the 2 valves shown above at the Pex Pipe between them, after turning off both valves so that water won't drain out.
2. Insert the left plastic valve and pipe in a 5-gallon bucket. Open the valve. Turn on the pump by turning on the furnace (raising the thermostat will do this, if necessary).
3. Record the amount of time it takes to fill the 5-gallon bucket. If it is 45 seconds, for example, write that figure down on the inside of the furnace with a permanent magic marker, near the valve for future reference. Turn off the plastic valve.
4. Next, disconnect the Pex line at the pump output. Install a short piece of Pex Pipe or washing machine hose about 4-6 feet long and insert the pipe/hose into a bucket. Turn on the pump by turning on the furnace (raising the thermostat if necessary).
5. Record the amount of time it takes to fill the 5-gallon bucket. If it is 35 seconds, for example, write that figure down on the inside of the furnace, next to the pump for future reference. Turn the pump off.

You can use the circuit breaker to turn the pump off and on if you have already raised the thermostat high enough to make the pump come on.

## **Maintenance**

**⚠ Clean out ash!! Moisture combined with ash will eat through a furnace in short order and ash or/and coal corrosion IS NOT COVERED under warranty.**

Green wood can also cause a lot of water to get into the ash area as well, so keep a sharp eye on that.

With our grate and ash door, you can remove the ashes while the fire is still burning.

### **Creosote – Formation and Need for Removal:**

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire.

The chimney should be inspected at least once a month during the heating season to determine when a creosote buildup has occurred. When creosote has accumulated, it needs to be removed to reduce the risk of a chimney fire.

All creosote and ash must be cleaned from firebox twice a year, preferably halfway through the heating season and immediately after the heating season.

### **Steam escaping from door - Door Seals**

Periodically, during the heating season, check the sealing of the silicone seal. The silicone seal withstands high heat and molds itself to the shape of the door, providing an excellent seal that won't deteriorate like a rope seal. High temperature silicone can be purchased in a tube, from an automotive supply house, to repair/replace the silicone seal.

### **END OF SEASON:**

- Power: Turn off power supply at the appropriate circuit breaker
- Chimney: Clean and inspect chimney. **Cap the chimney to keep rain water out.**
- Firebox & Ash trough: Remove ashes, soot, and hardened deposits from the fire chamber by using putty knife or wire brush. Coat inside of firebox with a light coat of motor oil to protect the steel during the off-season.
- Doors: Oil door hinges and latches.
- Plumbing: Ensure fittings on both ends of tubing are tight at all locations.
- If antifreeze is not being used, the water jacket must be drained and flushed yearly right before each heating season. Always dispose of antifreeze according to state and local codes. The water testing company will advise if you can leave the old water in.



**Moisture from rain or condensation must not be allowed to accumulate in the firebox or ash pan at any time, including the off-season. Failure to perform preventive maintenance may result in corrosion damaging the boiler resulting in possible severe property damage. This IS NOT COVERED under warranty.**

## Replacing the hot water coil in the furnace

In areas where there is a lot of lime or other minerals (or hard water), it may be necessary to clean out or replace the hot water coil in the furnace. Thankfully, this is an easy job. On some other models, it can take 2 hours or more to do this – if they even *have* a built-in coil!



The water coil is under a steel plate at the back/top of the furnace. We've lifted up the insulation to make it easier to see.



Simply cut through the silicone seal and lift it off. Place safely out of the way.



You can see the water coil now. This is where you add your chemicals! Simply loosen and remove the compression fittings and slide the coil out the top.

A 50-foot copper coil is readily available at most hardware and home improvement stores, already coiled up! Simply straighten the ends and reattach the Pex pipe.

Alternatively, you could take the coil to a radiator shop to have it cleaned out. With current copper prices, this may be cheaper!

Reinstall the steel plate and **seal it all the way around with silicone**. Pull the insulation back down.

## Trouble-shooting: Poor Water Flow or little or No Heat

1. Check to make sure that the furnace is full of water. Simply open the valve on the front until water flows out of the overflow tube. DO NOT block off the overflow tube!
2. Make sure you have a good fire!
3. A. Check to be sure the pump is running when the thermostat is raised.  
B. Your inside furnace fan should come on at the same time.  
C. See if air is blowing out of the vents.
4. Make sure that the water is hot. You can check this at the drain on the stove, or at the pump by removing the Pex Pipe and turning on the pump.

An infrared thermometer is VERY useful for trouble-shooting and they are very inexpensive now – as little as \$10 from Harbor Freight!

5. Watch the fan to see if it comes on when the water temperature drops in the furnace. You can test the fan by connecting the two wires at the thermostat together **AFTER TURNING OFF THE POWER!**

If the fan comes on when you connect the two wires, but it won't come on by itself when the water temperature drops, you need to replace the thermostat. These are standard hot water heater thermostats available for about \$5-8 at any good hardware store.

In most cases the flap on the side of the fan should only be open  $\frac{1}{4}$  to  $\frac{1}{3}$ .

6. Turn off both valves so that water won't drain out. Separate the two valves (shown on previous page) at the Pex Pipe between them.
7. First open the right shutoff valve with the large handle. If water flows out freely, then you know that there isn't a blockage there. Close the valve.
8. Insert the left plastic valve and pipe in a 5-gallon bucket. Open the valve. Turn on the pump by turning on the furnace (raising the thermostat if necessary).
9. Record the amount of time it takes to fill the 5-gallon bucket. Turn off the plastic valve. Compare that figure to the one you wrote down on the inside of the furnace, near the valve, when it was installed. If the figures are the same or very close to it, you can assume that the pump is working properly and that there aren't any blockages. However, you may have a heat exchanger with a coating of minerals on it such as lime. This will need to be cleaned as it will inhibit heat transfer. (See heat exchanger cleaning procedure at end of this section)
10. If the figures are lower than original, proceed to step 11 to find out why the flow is so low.

11. Remove the pump and open the valve above it. If water flows freely, you know that there is no blockage there. If good, proceed with next step.
12. Next, disconnect the Pex line at the pump output. Install a short piece of hose or Pex pipe, about 4-6 feet long and insert the pipe into a bucket. Turn on the pump by turning on the furnace (raising the thermostat if necessary).
13. Record the amount of time it takes to fill the 5-gallon bucket. Turn the pump off. Compare that figure to the one you wrote down on the inside of the furnace, near the valve, when it was installed. If the figures are lower you know there is a problem with the pump.
14. At this point you should have been able to determine if the flow rate is good at all points and where the problem might be or if there is a blockage.
15. If you have a fire and the water is hot and circulating without restriction and the furnace fan is on, you should have heat! **In many cases, air might be trapped in the heat exchanger and the bleeding procedure below will need to be performed.**

**NOTE: If you have poor draft or a downdraft, heat up the chimney by twisting some newspaper into a torch and hold it up into the stove until the draft is reversed.**

### **If the water is boiling and excessive water usage**

Simply close the cover more, on the side of the fan.

The fire should be blazing when the fan is on. It should be just smoldering if the fan is off.

Quickly crack open the firebox door to see what the fire is doing. (Leaving the door open any length of time will give you a blazing fire.)

If you have too hot a fire with the fan off, close the cover on the side of the fan a little more. The water should never be boiling. If it is, the cover is open too far or there is a downdraft problem.

If you still have a boiling problem or you are using too much water (and the cover is completely sealed – page 22), **you can move the pump to the bottom of the furnace (what is now the return line) and have the return line go to where the pump is now.**

## Heat Exchanger Cleaning Procedure

If you use the proper chemical additives from **Wood Boiler Solutions LLC** you should never have to clean your heat exchanger. This is a wise idea and keeps your warranty valid.

**A specialist experienced in chemical cleaning should perform this procedure.**

**The easy way out – if you didn't use the proper chemicals for protection:**

(1) Remove Heat Exchanger (takes about 10 minutes). (2) Drop off at local radiator shop. (3) Pick up serviced and repainted heat exchanger, cost \$20. (4) Reinstall unit- another 10 - 15 minutes. (5) Job done, have a glass of wine..... What could be easier?

CLR works fine to clean exchangers. Even the label suggests cleaning heating coils, coffee makers, etc.

Some people recommend using Phosphoric acid or Ph-Oshop-Ric. Muriatic acid causes hydrogen embrittlement of metals over time, which Phosphoric acid (mostly) avoids.

**Muriatic acid** is a MAJOR hazard if it spills - especially on you!

You can also try Marsolve (203-834-8278) or <http://www.marsolve.com/marsdis.htm>

Also recommended and much safer, is Safe-React Formula E is designed as a direct replacement for Muriatic acid. It is effective for pH adjustment, industrial descaling, cleaning heat exchangers and many other jobs that normally require hazardous acids. Safe-React Formula E is a concentrated formula, to be used the same way Muriatic acid is normally used. [http://www.safe-react.com/formu\\_e.htm](http://www.safe-react.com/formu_e.htm)

Fill a 5-gallon bucket with Safe-React or CLR per the instructions for dilution - or riskier - a 10-12% solution of Hydrochloric acid (sometimes called Muriatic Acid) or Phosphoric acid to water. It can be purchased at your local swimming pool supply store. MURIATIC ACID is a liquid cleaner that dissolves rust, lime and other minerals on hard surfaces.

See [http://www.athea.com/label\\_PDFs/140muriaticlabel.pdf](http://www.athea.com/label_PDFs/140muriaticlabel.pdf)

Place both the supply lines and return lines in bucket with a submersible pump on the supply side. You may have to run the pump for three to eight hours. You should be able to see the process working as water flows into the bucket.

Sometimes reversing the flow can free up deposits encrusted in the heat exchanger in stubborn cases.



## Disclaimer



All installation, wiring and operation must follow Federal, Provincial, State and local codes, ordinances and laws.

Do Not consider outdoor wood furnaces for built up urban areas.

The Shaver furnace is not intended to be the only source of heat. Therefore a backup system should always be in place and be ready for use.

A backup generator is HIGHLY recommended so that you can have heat during power outages!

The standard pump and fan only draw 120 watts together. The furnace fan can draw 1350 watts or more on start-up. A small 2000 watt generator will power it all AND give you extra power for lights.

Do Not Operate under Pressure.

Keep the overflow tube clean and free of debris, bugs, etc, DO NOT close it off! It is supposed to steam and release pressure through this tube!

All electrical and plumbing should be done by qualified personnel and conform to national and local state/county building, electrical, plumbing, fire and building codes.

Manufacturer is not liable for damages to personnel or property for misuse, improper installation of equipment or for knowing local installation codes. Owner assumes all responsibility for this. This is just a general manual to aid in installation. We cannot know all applicable codes in your area!

**Please fill in the following information and mail this copy by mail to:**

**Weld Rite, Inc., 328 Hwy 62 West, Salem, AR 72576**

**Your name and address:**

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**Phone number(s):** \_\_\_\_\_

**Shaver Model:**

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**Date of Purchase:**

\_\_\_\_ / \_\_\_\_ / \_\_\_\_

**Serial Number: (Only applicable only if financed)**

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**Date of Installation and who installed (Proper self-installation, following the instructions. will not void the warranty):**

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**Dealer Purchased from (if purchased from the factory, put Weld Rite, Inc.):**

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**Dealer Address:**

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**Dealer Phone Number:** \_\_\_\_\_

Please keep this manual with all other important papers. The information in this manual is necessary for the installation, operation and proper use of this furnace. If you should ever have a problem or question please refer to this manual or have it available when you call your Shaver dealer or Weld Rite, Inc. Phone: **870-895-3104 or 3111**