

YELLOW HEAT™

Waste Oil Burning System

Model Y-100

2009 Patent Pending

Operation Manual

Please read this Operation Manual thoroughly before purchasing, installing or operating the Yellow Heat System.

Manual Version: January 25, 2010

A Product of Homestead Inc.

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- **Yellow Heat Runs on Recycled Vegetable Oil!**
- **Yellow Heat Requires No Oil Pretreatment!**
- **Yellow Heat is Safe, Clean, Easy, and Efficient!**
- **Yellow Heat is the Low Cost Leader in Waste Oil Furnaces!**
- **Yellow Heat has a One-Year Warranty!**

Yellow Heat Furnace TM

1. INTRODUCTION

Welcome to a new option for a low carbon footprint: Sustainable Space Heating. Yellow Heat Furnace efficiently and effectively operates on Yellow Grease, straight out of the kitchen fryer. We like to call yellow grease something more classy, Recycled Vegetable Oil or **RVO**.

Space heating using RVO does no harm to the environment. Although there are exhaust gasses, they are not from fossil sources, and don't lead to Global Warming. Vegetable oil is essentially non-toxic, both in the liquid form and in the exhaust products. EPA lab tests show at least a 50% reduction in soot, unburned hydrocarbons and carbon monoxide in vegetable oil exhaust gasses. Moreover, RVO is still available for little or no cost in many places throughout the USA and other countries. We can show you how to easily obtain and handle RVO as a heating fuel.

Given the high cost of petroleum fuels, RVO can save users money every heating day. Many users will see a payback on their investment in the Yellow Heat System in less than one year. Yellow Heat is the low cost leader for Sustainable Space Heating system.

<p>Save Money - Save the World: Switch to Vegetable Oil Heating</p>

2. RECOMMENDED USES

- a. The Yellow Heat System is suitable for heating greenhouses, shops, barns,

garages, some commercial spaces and selected other larger heating spaces.

Depending on the construction details in the heated space, Yellow Heat is suitable for heating spaces from 1,000 square feet up to 10,000 square feet. Multiple Yellow Heat units can be used for larger spaces. Consult an installing HVAC professional if in doubt about the suitability of this heating equipment for your proposed use.

- b. Yellow Heat will cleanly and efficiently burn new or recycled vegetable oils, B-100 or any other blend of biodiesel, #1 or #2 home heating oil, diesel fuel, used motor oil, hydraulic oil, transmission fluid, or any other combustible oil. Never use flammable liquids such as gasoline, paint thinner, alcohol, or other potentially explosive fuel in the burner.

- c. Please read this Owner's Manual thoroughly before purchasing, installing or using the Yellow Heat System.

3. FEATURES OF THE YELLOW HEAT SYSTEM

- ✓ The lowest cost recycled-oil fired furnace on the market.
- ✓ Utilizes standard and easily obtainable heating system components.
- ✓ All industry endorsed fire-safety features incorporated in design.
- ✓ Uses less than 150 watts power; can be operated from 2 or more solar-electric panels.
- ✓ The only waste oil burner where electric pre-heaters are optional, not required.
- ✓ Requires no pre-filtering of vegetable oils or other fuels. Unique non-clogging system.
- ✓ Operates on wide variety of liquid fuels, including vegetable oils, animal fats, standard heating oils and recycled petroleum oils.
- ✓ Our fuel storage system includes all processing equipment needed for fuel preparation.
- ✓ Biodiesel and vegetable oil compatible pump seals and components.
- ✓ Easily tuned for highly efficient and nearly smokeless operation.
- ✓ Available in models with heat outputs between 20,000 BTU per hour and over 200,000 BTU per hour.

- ✓ Heat output easily adjusted over a range within each model.
- ✓ A complete furnace system, all necessary components included.
- ✓ Burner can be mounted in many standard liquid-burning appliances as a retrofit.
- ✓ The quietest waste oil burner on the market.

4. PRECAUTIONS AND LIMITATIONS

- a. Yellow Heat system may be installed in some commercial shops, greenhouses, barns and other industrial spaces. Yellow Heat should not be used in residential locations, critical use applications, or locations where guaranteed heat has a financial liability. The UL Label has not been applied to Yellow Heat Burner or Yellow Heat Furnace.
- b. The Yellow Heat System will produce clean heat at a cost far below other options. The trade-off is that if your heating system involvement is limited to adjusting the thermostat occasionally, you may not get satisfactory performance out of this innovative system. Since RVO and other waste-oils as fuels can be quite variable, periodic attendance to operating conditions is required.



- c. Maintenance may be required more or less frequently depending on the quality of the fuel oils used. Some vegetable oil fuels require burner attention and maintenance daily, usually a quick brushing of the electrodes with the stainless steel brush included with each Yellow Heat Burner.
- d. Yellow Heat Burner produces between 20,000 BTU's and 200,000 BTU's per hour, depending on model used, appliance conditions, combustion-tuning and fuel type.
- e. Use Yellow Heat in locations where the burner has long run times. The burner should be sized to meet no more than 100% of heating requirements so that the unit operates at full capacity and maximum efficiency.
- f. Waste oil may contain some foreign materials, including foodstuffs, water and petroleum, including gasoline. Therefore, specific precautions on the handling and storage of waste oils should be observed when collecting, using, storing and

cleaning fuel for this heater. Compliance with waste oils laws is paramount.

- g. The Yellow Heat furnace burns unfiltered oil processed through our *Fuel Storage System*. All fuels need to be processed through this System.
- h. Yellow Heat may be operated on new or waste oils, and on oils made from petroleum, animal fats or vegetable oils. Yellow Heat encourages non-petroleum fuels, and specifically yellow grease, which will be the focus of this Owner's Manual. Differences in operating procedure where petroleum oils are used will be pointed out.
- i. Yellow grease yields about 10% less heat than petroleum oils. Wet fuel yields less heat than dry fuel. Contact Homestead Inc. for sizing requirements and custom sizing.
- j. Some vegetable oil fuels will need enhancing with some more combustible fuel, such as waste motor oil or heating oil, in order to get satisfactory heat output. Usually Yellow Heat burner operates on 75% or more vegetable oil.
- k. In the information presented below, words in *italic* are items available in our Products Catalog. Contact Tom at Homestead Inc. with questions on our products at 413 628-4533.

WARNING

This appliance is not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, or atmospheres containing chlorinated or halogenated hydrocarbons (solvents). Do not expose the Power Panel unit to precipitation or high moisture. If installed in a high moisture atmosphere, a special cover for the Power Panel must be obtained from the Homestead Inc. to avoid rusting internal components.

5. RESTRICTIONS ON USE OF YELLOW HEAT



- a. Due to EPA and local regulations, insurance considerations, fire codes and other codes, Yellow Heat is not to be installed in typical residential locations, such as in a basement. Homestead Inc. takes no responsibility for improper installations that may cause any loss or harm if the buyer chooses to ignore this warning. Due to the lack of a UL label, and other considerations, use of this equipment can potentially invalidate homeowner's insurance coverage.
- b. To maintain the gravity-return for unburned fuel, the furnace/boiler must be elevated higher than some conventional heating systems. The burner tube invert (lower edge) must be higher than the maximum level of the fuel in the storage tank. Failure to follow this requirement will keep Yellow Heat from operating properly and could be dangerous. However, a second *fuel pump* may be added to return unburned fuel to a fuel tank at a higher elevation. Contact Homestead Inc. for details and please see our Product Catalog.
- c. Additional restrictions may be placed on waste oil burners by federal, state or local authorities. Most waste oil burners that burn waste petroleum products require EPA registration and often State and/or local permitting.
- d. Check with local heating codes for additional restrictions.

- e. This burner must be installed by a professional heating system installer or other competent person.

**Improper or Inappropriate Installation or Lack of Maintenance
Will Void the Warranty and Could be Dangerous.**

6. SAFETY PRECAUTIONS

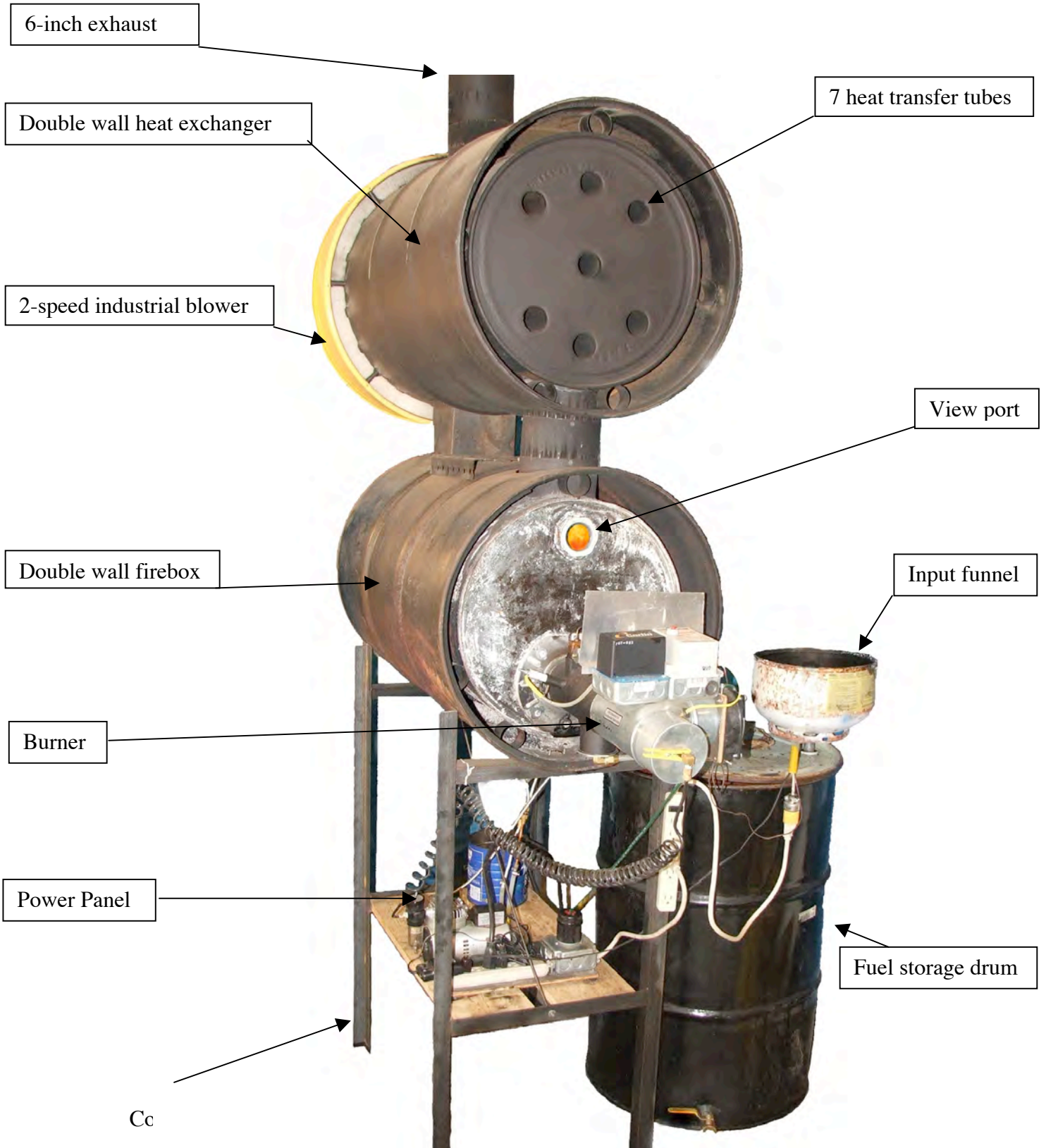
- a. **WARNING:** DO NOT assemble, install, operate, or maintain this equipment without first reading and understanding the information provided in this manual. Installation and service must be accomplished by qualified personnel. Failure to follow all safety precautions and procedures as stated in this manual may result in property damage, serious personal injury or death.
- b. All installations must be made in accordance with state and local codes which may differ from the information provided in this manual.
- c. Save these instructions for reference.
- d. Never try to burn liquids with a flashpoint below 150°F. Use vegetable oils, biodiesel, #2 equivalent oils such as home heating oil or diesel fuel, motor oils, etc. NO gasoline, cleaning fluids, paint thinners, alcohol, etc.
- e. The electrodes have 14,000 volts operating energy. Do Not touch electrodes or wiring to the electrodes when burner is operating.
- f. Your used oil is recycled as fuel for "heat recovery". DO NOT operate your furnace in warm weather just to burn oil.
- g. Burner and surrounding surfaces are hot when burner is in operation. Be aware of burn hazards for skin or combustible materials. Obey all fire code requirements.
- h. The exhaust products from this burner's operation must be vented through a fire rated chimney installed according to NFPA Code 30 and all other applicable fire codes.
- i. Do not use oil at a temperature above 150°F. Hot oils from fryers, heaters or melted fats must be cooled below 150°F before being used in the burner.
- j. The following codes must be complied with in any type of furnace system installation.

Yellow Heat Operation Manual

- ◆ NFPA 30 Flammable and Combustible Liquids Code
- ◆ NFPA 30A Automotive and Marine Service Station Code
- ◆ NFPA 31 Standard for the Installation of Oil Burning Equipment
- ◆ NFPA 211 Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances
- ◆ NFPA 88A Parking Structures
- ◆ NFPA 88B Repair Garages
- ◆ NFPA 70 National Electrical Code
- ◆ The International Mechanical Code
- ◆ The International Building Code
- ◆ The International Fire Code
- ◆ The International Fuel Gas Code

7. SYSTEM LAYOUT

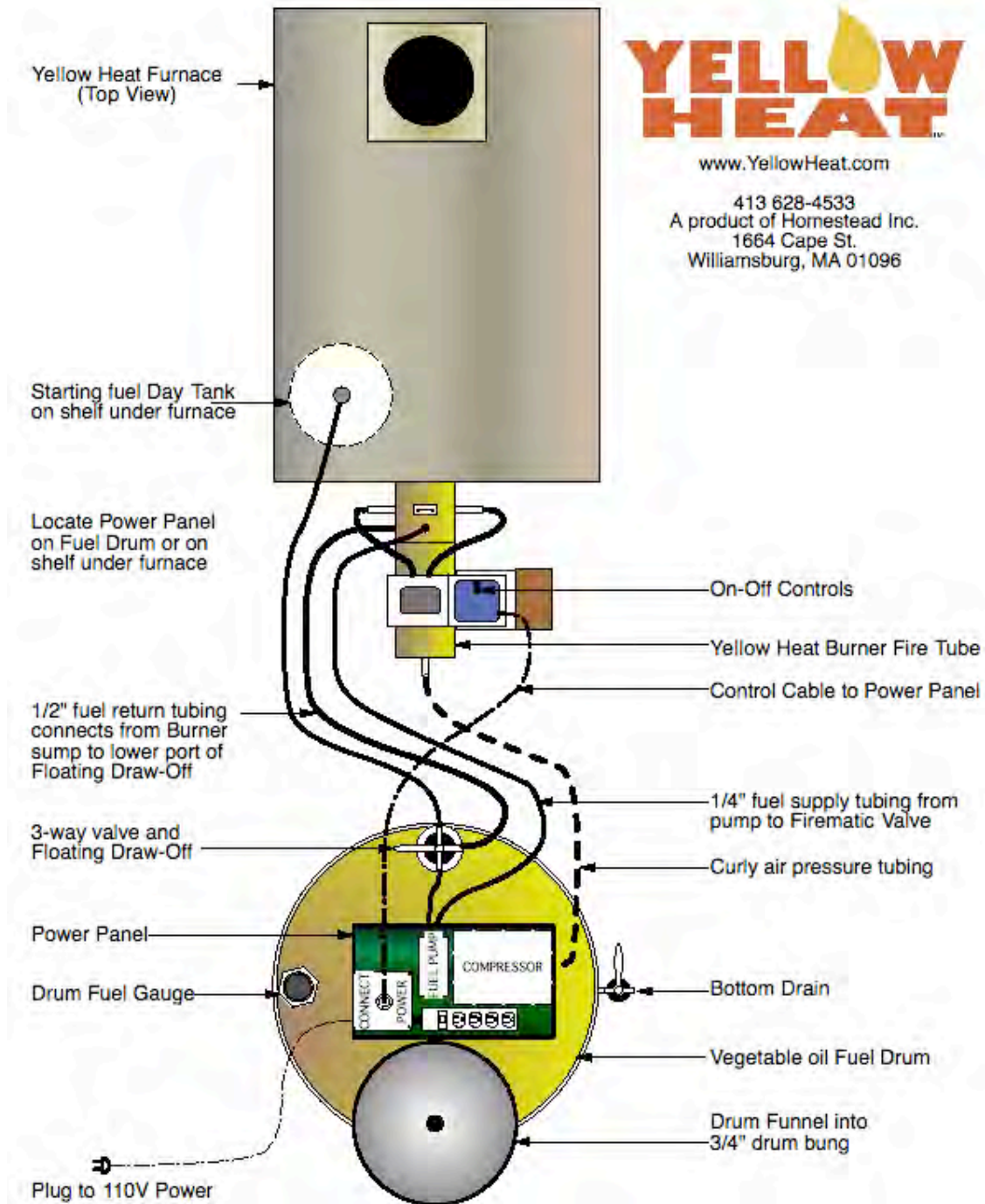
The Yellow Heat Furnace.



Support stand

Water drain

SCHEMATIC DIAGRAM OF CONNECTIONS



YELLOW HEAT
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Schematic Layout of the Yellow Heat Furnace

TECHNICAL INFORMATION

- a. The Yellow Heat Furnace is sized for the Yellow Heat Burner. It is equipped with a glass observation window. The Yellow Heat Furnace is as efficient in heat production as the best Waste Oil Furnace manufactured anywhere. Homestead Inc. may require the Yellow Heat Burner to be installed in the Yellow Heat Furnace rather than in an otherwise unsuitable location.
- b. Yellow Heat Burner consists of two assemblies: the Power Panel and the Fire Tube. Each assembly consists of several components. See labeled photographs and schematics below.

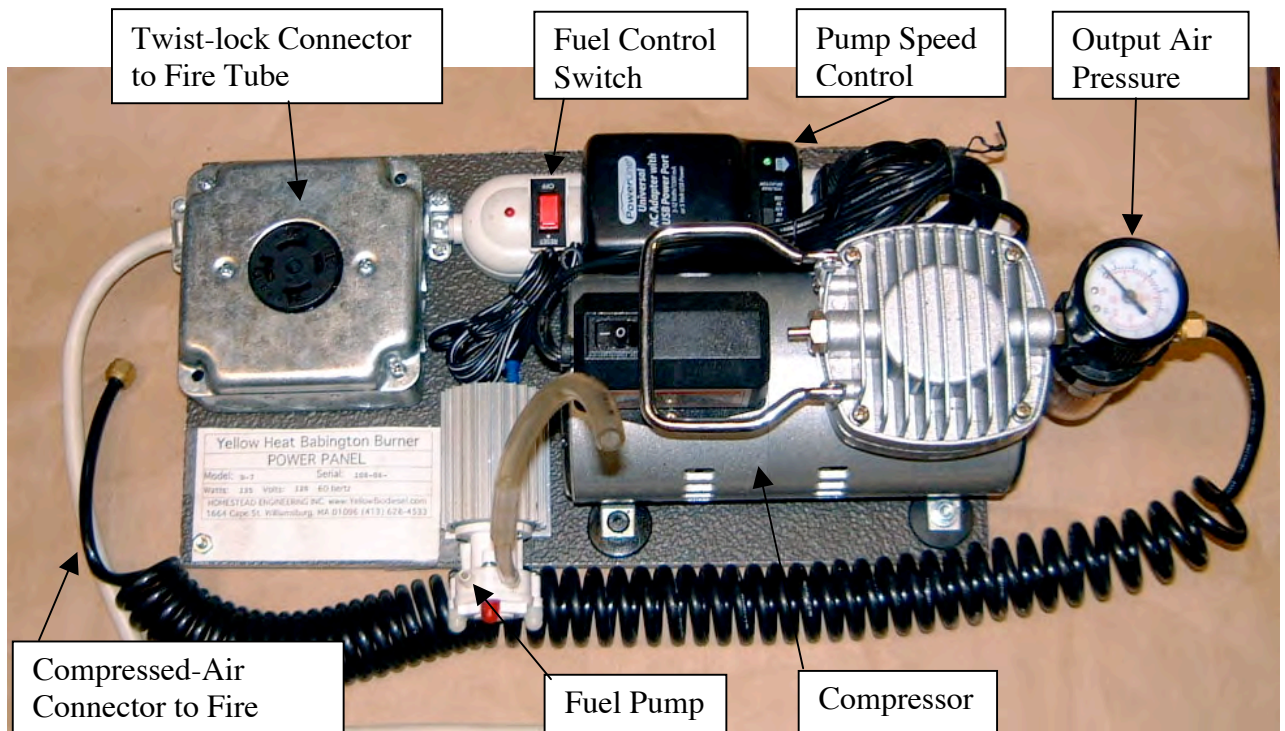


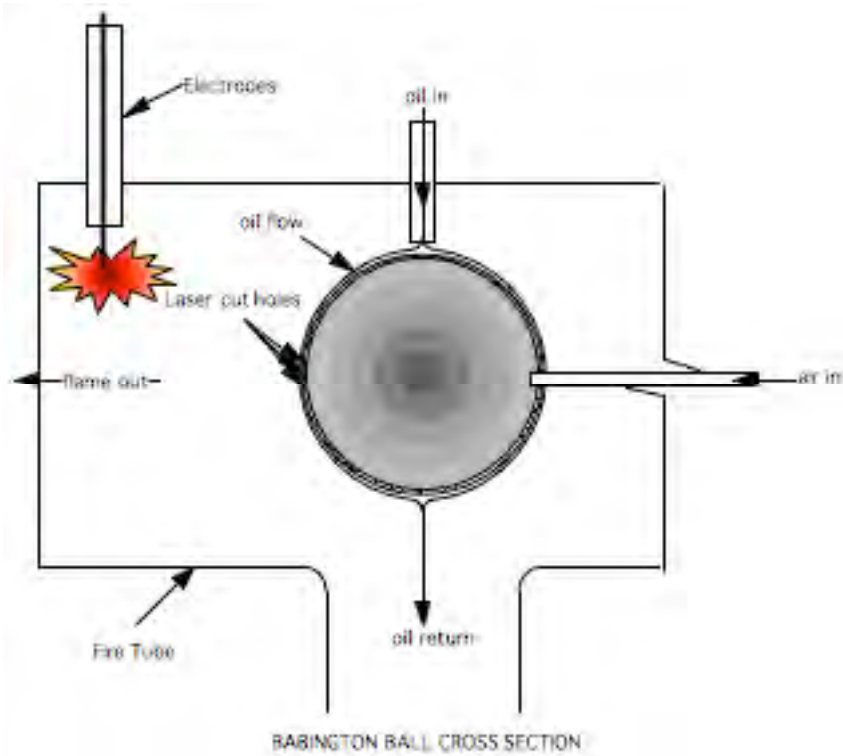
IMAGE 1. POWER PANEL (TOP VIEW)

FIRE TUBE:	24 inches long x 8 inches wide x 6 inches tall.
EFFICIENCY:	Combustion Efficiency: 86% (Standard Tuning)
Weight:	20 lbs
SHIPPING WEIGHT	80 lbs (with oil storage and dispensing drum, etc.)

- * with Pump, Compressor and Electronics.
- ** Heat output is also dependent on the type and quality of the fuel being used.
- *** assumes RVO as the fuel. Refer to Section 13 for details of tuning.

9. PRINCIPAL OF OPERATION

- a. Babington technology utilizes a physical principal where moderate air pressure has greater shearing action on a fluid film when it is exiting through a very small hole. Oil flowing down the surface of a steel ball crosses one, two or three 0.010-inch diameter holes, causing the exiting air stream to break up the oil film into a fine mist. The adjacent electrodes then ignite the mist to cleanly combust. Some of the oil is not combusted, but runs off the bottom of the Babington ball and is returned to the oil reservoir. Because the oil is not forced through a constricted opening, there is no chance that the burner can be clogged by unfiltered oil.



- b. Yellow Heat Burner can operate on unheated vegetable oil, including congealed oils. The included oil pre-heater is recommended when waste vegetable oils may

contain trapped moisture. Using a separate starting circuit, conventional fuel is initially fed to the burner resulting in quick start and the return of warmed oils to the oil storage tank. The returning oil melts the congealed oil and allows the switch to the oil storage tank for continuous operation.

10. INSTALLATION AND OPERATION GUIDELINES

WARNING

ONLY Authorized Technicians strictly complying with Homestead Inc.'s instructions and national, local or other applicable codes should perform installation, maintenance and service on the unit's components. Installation and use of this used oil-burning appliance shall be in accordance with the standard for the Installation of Oil Burning Equipment ANSI/NFPA 31, 1987, and National Electric Code, ANSI/NFPA 70, 1990 and the requirements of the inspection authorities having jurisdiction.

- a. The Yellow Heat Burner may be installed as part of a complete heating system using the Yellow Heat Furnace, or it may be installed in many types of existing liquid-fuel fired boilers and furnaces as a retrofit. Yellow Heat Burner will operate correctly in most waste oil furnaces with little or no modifications required. This will add the capability to burn up to 100% RVO to an existing waste oil furnace. For other types of existing oil-fired equipment, several considerations are recommended before a retrofit application is attempted.
- b. The return-oil line requires the Yellow Heat Burner to be elevated above the level of the fuel in the oil storage tank. If this is not practical, a Return Fuel Pump may be installed. Contact Homestead Inc. for details.
- c. The firebox of an existing furnace or boiler should be large enough to accommodate the larger size of a vegetable oil fired flame, which is up to twice the size of a petroleum-oil fired flame. Too small a firebox may lead to the premature burn-out of the heat exchanger or other problems.
- d. A high-temperature glass window or view-port in any heating appliance is needed so the size and characteristics of the flame can be observed for tuning purposes. The Yellow Heat Furnace is equipped with a removable glass window.
- e. Gravity return-oil line to be 1/2" minimum diameter, insulated aluminum or steel pipe or durable, biodiesel-compatible hose. Keep total return-oil line length to a minimum. Pumped return-oil lines are not length limited.
- f. Do not fill the Fuel Storage Container more than 2/3 full of vegetable oil fuel. Because of the additional of starting fuel to this container in the start-up mode, it

is necessary to have some free storage capacity for returned fuel so that the storage container does not become over filled.

11. FUEL REQUIREMENTS

- a. Yellow Heat vegetable oil fuel should meet the minimum standards of yellow grease. Yellow grease is a commodity that has less than 1% particulate matter by weight and less than water 1% by weight. Yellow grease is often supplied by Rendering Companies or regional Yellow Grease Brokers. Check on-line to find the name of your nearest possible supplier. Alternatively, we provide some guidance at the end of this document if you wish to collect your own RVO from the producers. Many thousands of restaurants and commercial or institutional kitchens produce this RVO in a waste stream.
- b. Our built-in fuel handling system will directly convert RVO into yellow grease for use as a combustion fuel. This consists of several components, including a stainless steel 40-mesh screen bucket in a funnel, a water and sludge draining system, and a floating draw-off. With our unique processing system, one can add large volumes of RVO directly to the *Oil Handling System* and the fuel processing is nearly automatic. If the fuel is not processed through the *Oil Handling System*, make sure it meets the requirements of yellow grease.
- c. If waste petroleum oils are used, we recommend only motor oil, gear oil of SAE 80 weight or less, hydraulic oils, ATF, #1 or #2 furnace oil, or diesel fuel. Pour all fuels through a 40-mesh screen. Any resulting solid waste is hazardous or toxic and must be legally disposed.
- d. A consistent fuel or blend of fuels will provide consistent burner operation. While the Yellow Heat Burner can operate on a blend of oils, varying the consistency or blend of the fuel will require periodic attendance and tuning to optimize safe and efficient performance. Temperature, viscosity, moisture and grade of the oils affect flame size. Vegetable oils yield approximately 10% less heat per gallon compared to petroleum oils. Wet oils yield less heat than dry oils.
- e. Some wet or thick RVO will burn at a substantially higher heat with the addition on a small amount (10 to 20%) of petroleum, such as home heating oil or kerosene. See our **Fuel Enhancement Procedure**, below.

12. INSTALLATION

- a. Disconnect fuel and power systems to the existing burner to be replaced, if any.
- b. Remove existing burner and set aside. Usually set-screws or bolts in the flange

- hold burner in place. Leave existing flange in place.
- c. Install Fire Tube using existing flange. Make sure Fire Tube extends all the way into the firebox in case the fuel drips. The Fire Tube should be slightly sloped to the rear so any liquid oil runs to the return line and not into the firebox.
 - d. Install Power Panel on shelf under Yellow Heat Furnace. Alternatively, place the Power Panel on the surface of the oil storage drum.
 - e. Flexible tubing with a 3/8 inch inside diameter overlaps the inlet tube on the Fuel Pump. Seal overlaps with the spring clamps. Connect output side of Fuel Pump in copper inlet pipe of the Fire Tube. Reverse power supply wires to reverse pump direction.
 - f. Connect black spiral pressure tubing to Control Rod threaded end. Make connection airtight with Teflon tape.
 - g. Establish a gravity return fuel line, minimum 1/2" diameter, to original fuel storage container. This requires bottom of Fire Tube to be higher than the maximum height of the fuel in the storage container. This is critical to safe operation. If maximum oil-storage level is above the Fire Tube invert, return pumping is required. Please see our Product Catalog for a second *fuel pump* and contact Homestead Inc. for more installation details.
 - h. Connect Burner to Power Panel with twist-lock plug.
 - i. Plug Fuel Pump and Compressor into power strip on Power Panel. Set variable voltage power supply to 3V initially. Leave power strip in OFF position until spark at electrodes is confirmed.
 - j. Connect standard plug to wall outlet. Use a 20 amp maximum circuit breaker.
 - k. A thermostat calling for heat must be attached to the Controller "T" terminals for the unit to operate. For testing purposes, a jumper-wire between these terminals will allow unit to operate. Set dead-band on thermostat to a close control so the burner operates more frequently.

13. START-UP

- a. Yellow Heat will burn up to 100% unfiltered vegetable oil or other medium weight oil. Note that to date, despite our best efforts, this heater will not burn excessively wet oil or accumulated water. All fuel should be processed through our *Fuel Storage System*. Remove any accumulated water or sludge through the bottom drain.
- b. We recommend initial installation be conducted with standard heating oil or other waste oil before attempting to burn 100% vegetable oil. Learn the operating characteristics of the Yellow Heat System before transitioning to a vegetable oil fuel.

- c. For easiest operation, fuel should be at least room temperature (greater than 60°F.). Cold startup can be accomplished with the Fuel Enhancement Procedure.
- d. Essential requirements for proper burner operation:

Got Spark?

Make sure electrodes are clean. Turn off Power Strip to temporarily stop Fuel Pump. Press Red Burner Start button to make sure electrodes have spark at electrode gap. Do not let unit time-out (45 seconds), or you will have to wait approximately two minutes for unit to recycle. If in doubt, open spark view port to confirm spark visible in tube. Handle of view port may be hot. When spark is confirmed, turn Power Strip back on.

Reasonable Fuel?

We can't burn water. The bottom of the drum has the least effective fuel. Cold or damp fuel requires the Fuel Enhancement Procedure, below. Start with conventional heating fuel to confirm operation, then add up to 90% RVO. Higher amount of RVO can be burned with practice.

Fuel Pumping?

Confirm oil pumped to burner. For pumps with transparent sections of tubing, you can see if fuel is flowing. In other situations, you can hear the fuel return stream reentering the drum. A small piece of grit might stop the pump from operating properly, which can be cleaned out.

Air OK?

Confirm atomization. Looking into the view port of the furnace, a light mist should be visible. Caution, this mist is explosive! Turn off system if mist is present without spark and wait 5 minutes before restarting. If atomization is inadequate this usually means that the air pressure is too low (20 p.s.i. or less), or the air is not being delivered to the Babington ball.

Good Tune?

Find the sweet spot in the middle. Control Rod too far in is too low. Too far out is too much fuel. Adjust the rod in small increments. Look for a yellow flame and minimal smoke, if any. Rotate the Control Rod left or right a few degrees for finer adjustment.

- e. First ignition of RVO may be slow to start if the fuel is cold and/or wet. Yellow Heat Burner has a starting circuit that uses a more volatile fuel to help establish normal operating conditions. After a minute or two of enhanced operation, normal fuel may be used without further requirements. Experience in blending various fuels, care in dewatering some RVO, keeping the fuel storage tank warm, and general system maintenance will diminish any need for special start-up procedures



f. **START-UP STEPS:**

1. **Turn fuel flow to Day Tank.**
2. **Open Fire Plug.**
3. **Press Start Button, verify spark.**
4. **IMMEDIATELY replace Fire Plug.**
5. **Tune for start-up fuel in Day Tank.**
6. **In a minute or two switch to standard fuel.**
7. **Tune for standard fuel.**
8. **If flame does not stabilize in a few seconds, repeat this procedure.**

14. TUNING

- a. Yellow Heat Burner is easily tuned and can produce a long-term stable flame.

Simple Rules:

Fire-box no more than 1/2 filled with flames.

Fire too big? Push Control Rod IN.

Flame too small? Pull Control Rod OUT.

- b. Minimal smoke emissions should be visible from the exhaust stack for the burner when in normal operation. If excessive emissions are seen, adjust Control Rod for optimum performance. Smoke can be generated from either under- or over-firing. To check which condition is causing smoke, shut-off burner control. If the flame persists for more than 10 seconds, the smoke was caused by over-firing. After the flame is extinguished, restart the burner as before, but push the Control Rod in an inch and follow the adjustment procedure. If the smoke is created because of under-firing, pull the Control Rod out 1/4" and restart the burner.

Good Tuning: Yellow Flame, No Smoke

- c. **Adjusting Burner Control Rod:** With the center of the Babington ball under the oil supply pipe fitting in the fire tube, the fuel supply to the jets is at the minimum sustainable level. This may also be determined by the louder sound of the burner as the flame is shortened. Pulling the Control Rod back will increase the fuel supplied to the jets. Use small increments of approximately 1/16 inch in either forward or backward adjustment.
- d. Remember this: push the Control Rod IN and the flame gets smaller. Pull the Control Rod OUT and the flame gets larger. Turning the Control Rod from side to side also has a large impact on flame size. Experiment with care and observation.
- e. Adjust Control Rod so the flame size is appropriate for the combustion chamber and heating appliance. The flame should be adjusted in size so that its volume does not exceed 1/2 the volume of the firebox of the heated appliance. A view port of the fire should be available in any appliance heated with the Yellow Heat Burner. Using the view-port, adjust for yellow flames, an orange color indicating excess partially unburned fuel. Reduce flame size if orange colored flames are observed.
- f. **IMPORTANT:** The size of the flame may vary depending on oil temperature, especially for RVO. From a cold startup, flame size may increase as the fuel is heated. Adjust flame size with the Control Rod as temperature equilibrium is achieved.
- g. Because of the wide range of heat outputs from the Yellow Heat Furnace, some indicator of heat intensity is advised. The best indicator of flame characteristics is a view port into the firebox, as is provided by the Yellow Heat Furnace. A stack temperature thermometer also provides feedback to assist in adjusting the Control Rod for the correct flame size. The optimum stack temperature depends largely on the heating appliance, but an internal stack temperature between 250^oF to 400^oF indicates an efficient flame size.
- h. The *Compressor* output pressure does not require adjustment or regulation. Pressure should be between 20 and 30 pounds per square inch (psi). If pressure falls below this range, check compressor maintenance, below.
- i. The *Fuel Pump* has multiple voltage/speed settings. In most instances the lowest speed setting is sufficient. If the Burner is to be located more than five feet higher than the Power Panel, a higher speed may be required. Once set, the fuel pump usually does not need to be adjusted. If the pump is running backwards, reverse the electrical leads. Use higher speeds for priming the fuel delivery system.

15. MAINTENANCE

- a. **Furnace:** Heating appliances burning recycled oils require periodic cleaning as do all oil fired heating appliances. Due to the presence of carbonate char, recycled oil-fired equipment requires more frequent cleaning. At a minimum, disassemble the boiler or furnace sufficiently to remove char buildup from the firebox and the Fire Tube on an annual basis. Some systems may require more frequent maintenance.

The steel drop-tube on the bottom of the Fire Tube has a cleanout plug at the lower end. Remove cleanout plug monthly, or as otherwise required, to remove any loose char buildup and avoid clogging of return oil system. Burners operating on dirty oil, such as from a fryer operation that fries a lot of breaded product, will require more frequent maintenance than from a cleaner oil source.

- b. **Babington Ball:** The Babington ball is a low maintenance item, but check the surface of the ball every 100 hours of operation to see if there is any carbon buildup that might interrupt the flow of oil. If carbon buildup occurs, clean surface of the ball with paper towels and a good solvent, such as biodiesel. Always maintain air pressure inside the Babington ball while cleaning its surface to keep the extremely small exit holes from becoming clogged.
- c. **Electrodes:** Build-up of carbon residue on the electrode points or insulator can cause ignition failure. Electrodes may need to be cleaned as often as once per day, depending on the suspended matter and consistency of your fuel. Included with each burner is a stainless steel brush sized for cleaning the inside of the electrode holders.

Turn off Power Strip. Use a razor type scraper for the insulator and a steel brush or emery cloth strips to remove built-up carbon residue on the electrodes. The steel tubes holding the electrodes should be cleaned with the included steel tube brush. The gap between electrode points should be set to approximately 1/8 inch for proper operation. A cracked or very dirty ceramic insulator may leak voltage to ground.

- d. **Compressor:** The compressor has a visible water separator and air filter. Review periodically to assure clean air is delivered to the Babington ball. Clean as required. Pressure from pump is not otherwise regulated.

Check pressure hose for leaks and tighten fittings as required. The pressure should be between 20 and 30 pounds per square inch. If pressure falls below this level, the compressor may need to have the head cleaned. To do this, remove cylinder head, clean two vane-valves and head surface and carefully reassemble.

- e. **Pump:** The plastic gear-pump does not normally require periodic maintenance. For proper operation, make sure that the 40-mesh intake screen is clear. If you see

fine bubbles in the pump hoses, suspect the intake screen is becoming clogged and needs cleaning, or there is an air leak in the intake tubing. Note that even small amounts of grit may temporarily stop the gear pump because of close tolerances.

Do Not pump oil in excess of 150°F or serious damage to pump may occur.

With our unique *Floating Draw-off* available from our Products Catalog, an intake screen in the 55-gallon oil storage drum is not necessary as the cleanest oil is always the oil drawn into the burner.

Normal pump control setting is 3 volts DC. Higher voltage settings are available for burners located at a significantly higher elevation than the oil reservoir, but are not normally required. Use higher speed for establishing the pump prime. Once the pump speed is established, it is not necessary to adjust it.

- f. **Fuel Storage System:** The 55-gallon drum based Fuel Storage System allows fuel to be added without the need for any preprocessing. The *40-mesh Straining Funnel* should always be used to remove the largest particles. This item needs cleaning whenever the fluid slows while passing through. Invert funnel on layers of newspapers and use a compressed air blast to remove accumulated solids.

If water or watery sludge is added to the system, the drum bottom drain should be operated weekly to remove any accumulation.

When fuel storage amounts greater than the 55-gallon tank limit are needed, use a *3-way valve* to gang a second drum on line.

Note that if any fuel storage system other than the one developed by Homestead Inc. is used, operating characteristics of the Yellow Heat Burner may change significantly.

- g. **Yellow Heat Furnace:** Proper operation of the Yellow Heat Burner should require only minimal maintenance on the Yellow Heat Furnace. If the observation window becomes too obstructed to use, remove when flame is off and clean with a razor scraper, included with each Yellow Heat Furnace. Annually, the burner should be removed from the front of the furnace and any accumulated ashes should be removed with the supplied custom trowel. The heat exchanger should not require frequent maintenance. An observation port for the heat exchanger is located under the fan at the rear of the unit. Remove fan and port cover and observe the interior with a flashlight.

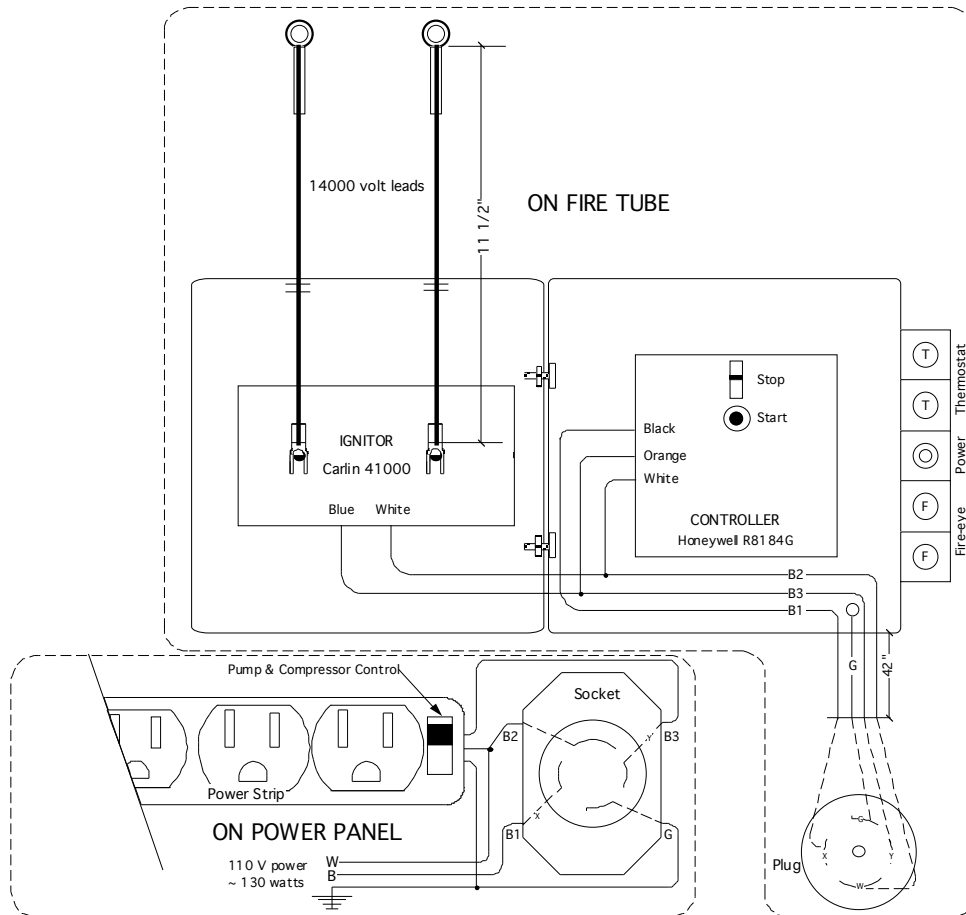
16. TROUBLESHOOTING GUIDE

<u>START-UP STEPS</u>	<u>DETAILS</u>
<u>Check for Spark</u>	Turn fuel supply off at Power Panel, Turn one Fire Stop about 180 degrees so you can observe spark. Spark must not jump to the Fire Tube or additional cleaning is required. Gap should be 1/4" or less. Return Fire Stop to original position after flame starts.
<u>Check for Fuel</u>	Adjust Control Rod out an increment. Repeat 1 to 3 times more. You should be able to see a fine mist of fuel in the spark. See caution above as this mist is potentially explosive!
<u>If No Fuel Mist</u>	Check fuel intake screen and clean as necessary. Compressed air being delivered?
<u>If No Spark</u>	Check electrodes for fouling. Clean or replace as necessary. Replace cracked insulators on electrodes. Confirm transformer is producing adequate voltage by evaluating the spark to ground. The unit should be able to bridge at least 3/8" gap.
<u>If Flame Goes Out</u>	Is the thermostat calling for heat? Out of fuel? Go get some. Adjust flame size slightly larger. Fuel excessively wet? Warm fuel to break emulsions, drain off water on bottom. Use Fuel Enhancement Procedure. Clogged intake screen. Drain off sludge, don't draw fuel from bottom of fuel container. Use <i>Floating Draw-Off</i> from our <u>Products Catalog</u> . Only the best available fuel is burned with this unique system. Check the fire eye for any soot accumulation, clean as necessary. Check air pressure is adequate, i.e. 20 to 30 psi. Fire eye sees residual flame from accumulated carbon residue and stops re-ignition. Wait until residual flame dies out.
<u>Flame Wrong Size</u>	Adjust position of Control Rod relative to fuel intake. The Control Rod works like the controls on a nuclear reactor, if flame is too large, push Control Rod in, if too small, pull Control Rod out. Use small increments of change, approximately 1/16 inch at a time. If far too hot, turn burner off, until flame subsides, then restart. Make changes in small increments.

Smoke Visible from Chimney Either over-firing or under-firing may cause smoke. Adjust Control Rod accordingly.

Pump or Compressor Won't Run Try plugging appliance into regular wall plug. If it still won't run, contact Homestead Inc. for replacement pump or compressor under one year warranty or for repair parts.

17. ELECTRICAL AND WIRING SCHEMATIC



18. ABOUT COLLECTING AND PROCESSING VEGETABLE OIL

- a. Recycled Vegetable Oil (RVO) is an excellent fuel with none of the drawbacks of petroleum fuel. It is far more energy efficient to use RVO than any other type of liquid fuel for space heating.

- b. Vegetable oils are used to cook all kinds of foods, and are often available from local restaurants or commercial kitchens. When cooking oil ages, it is thrown out and is often available for collecting from the restaurants for little money or free. Now it is ready to be a warming fuel that is available at far better costs than petroleum oils, and is far better for the environment. RVO is non-toxic both in the liquid form and in the exhaust products, although it must be handled like conventional fuels in most aspects.
- c. Here are a few hints about how to obtain and handle RVO.
- Don't be a "Grease Bandit"; always get permission to collect RVO from restaurants, etc. Many restaurants will give permission to careful, dedicated collectors for little or no charge.
 - Put multiple layers of newspaper down when you pour vegetable oils to catch any drips. Remove one layer at a time when they become contaminated. Use the newspapers as safe fire-starters in woodstoves.
 - Allow the contents of jugs of RVO to settle in a larger container, such as an open-top drum with a bottom valve, to separate water and contaminants.
 - Put all collected oil through a 40-mesh screen. See Homestead Inc.'s [Product Catalog](#) for our *Straining Bucket and Drum Funnel* that allows cleaned oil to be put directly into fuel storage drums. The *Straining Bucket and Drum Funnel* accepts an entire standard disposable oil jug of RVO at a time. Hint: order 2 *Straining Buckets and Funnels* so you can process RVO faster.
 - Utilize settled oils from the top down: "The Good Stuff's On Top". See [Product Catalog](#) for our unique *Floating Draw-off* that always uses the best oil in any drum or oil storage tank.
 - Look for oils that are liquid at 60°F or below, as opposed to thicker or solid fats. Viscous oils may need preheating to screen or pump into burner. Do not exceed 150°F to protect plastic system parts.
 - Quality RVO is dark in color, while wet oils and viscous hydrogenated oils are usually lighter in color. Darker oils are generally easier to use.
 - Yellow Heat handles partially hydrogenated vegetable oils, but fully hydrogenated vegetable oils and solid animal fats will need to be pre-heated and diluted with liquid oils for pumping and burner operation.
 - RVO is often collected in disposable 5-gallon plastic jugs that the restaurants bought the oil in. These jugs are often not recyclable unless particularly clean. Empty jugs may be compacted in a standard trash-masher appliance for handling and disposal.
 - A few state and localities may require permits for collecting RVO. Check local codes.

19. TRADEMARKS

THE YELLOW HEAT LOGO IS A TRADEMARK OF HOMESTEAD ENGINEERING INC. ALL OTHER BRAND OR PRODUCT NAMES MENTIONED ARE THE REGISTERED TRADEMARKS OR TRADEMARKS OF THEIR RESPECTIVE OWNERS.

20. COPYRIGHT

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21. WARRANTY

- a. Your satisfaction is important to us. You may return the Yellow Heat Furnace and/or the Yellow Heat Burner to us, post pre-paid if you are not satisfied within the first 3 months of operation for a full refund.
- b. Yellow Heat carries a two-year warranty on parts and manufacturing from the date of purchase. Contact Homestead Inc. for replacement parts and warranty service. Please fill out and return to Homestead Inc. the enclosed “Warranty Validation Return” form to ensure your Yellow Heat System is covered.
- c. Homestead Inc. sends out an annual User Survey to judge user response and to tabulate the amount of RVO used and the amount of global warming pollution saved. Your response to the annual survey helps us develop this technology and we will offer you guidance with operational issues indefinitely, although mechanical systems are still replacement limited to the one-year period.

WARRANTY VALIDATION RETURN

Please fill out and return to Homestead Inc., 1664 Cape St. Williamsburg, MA 01096.

Phone 413 628-4533, Fax 413 628-3973, e-mail Tilapia@AOL.com.

See our websites at www.YellowBiodiesel.com and www.YellowHeat.com

Please return following warranty information to Homestead Inc. within thirty (30) days of purchase. (Please print or type in ink).

Yellow Heat Burner Model _____

Purchase Date _____ Dealer _____

Customer Name _____

Address _____

City _____ State _____ Zip Code _____

Email Address _____

Installed at _____

Type of Installation (shop, greenhouse, garage, etc.): _____

Primary Fuel to be used _____

Please tell us what you think of this burner.

Contact: Tilapia@AOL.com

22. WARRANTY INFORMATION

Homestead Engineering, Inc., MANUFACTURER, hereby warrants that the MANUFACTURER's products shall be free from defect in material and workmanship under normal use according to the provisions and limitations herein set forth.

MANUFACTURER warrants Yellow Heat Furnace and Yellow Heat Burner, for a period of **one (1) year** from the date of purchase by the purchaser.

LIMITATIONS:

The obligation of MANUFACTURER for breach of warranty shall be limited to products manufactured by MANUFACTURER (1) that are installed, operated and maintained according to MANUFACTURER's instructions furnished and/or available to the purchaser upon request; (2) that are installed according to all other applicable Federal, State and local codes or regulations; and (3) that the purchaser substantiates were defective in material and workmanship notwithstanding that they were properly installed and correctly maintained as set forth above and were not abused or misused. The obligation of MANUFACTURER shall be limited to replacing or repairing the defective product, at the option of the MANUFACTURER. MANUFACTURER shall not be responsible for any labor or costs of removal or reinstallation of its products and shall not be liable for transportation costs to and from its plant at Leola, Pennsylvania. Use of parts for modification or repair of the product or any component part thereof not authorized or manufactured by MANUFACTURER specifically for such product shall void this warranty. This warranty shall not apply to any damage to or defect in any of MANUFACTURER's products that is directly or indirectly caused by (1) *force majeure*, Act of God or other accident not related to an inherent product defect; or (2) abuse, misuse or neglect of such product, including any damage caused by improper assembly, installation, adjustment, service, maintenance or faulty instruction of the purchaser. Other than as expressly set forth hereinabove, MANUFACTURER makes no other warranty, express or implied, with respect to any of MANUFACTURER's products, including but not limited to any warranty of merchantability or fitness for a particular purpose. And in no event shall MANUFACTURER be responsible for any incidental or consequential damages of any nature suffered by purchaser or any other person or entity caused in whole or in part by any defect in any of MANUFACTURER's products. Any person or entity to whom this warranty extends and who claims breach of warranty against MANUFACTURER must bring suit thereon within one year from the date of occurrence of such breach of warranty or be forever barred from any and all legal or other remedies for such breach of warranty. MANUFACTURER is not responsible for and hereby disclaims any undertaking, representation or warranty made by any dealer, distributor or other person that is inconsistent with or in any way more expansive than the provisions of this limited warranty. This warranty grants specific legal rights and shall be read in conformity with applicable state law. In some jurisdictions, the applicable law mandates warranty provisions that provide greater legal rights than those provided for herein. In such case, this limited warranty shall be read to include such mandated provisions; and any provision herein that is prohibited or unenforceable in any such jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions and without affecting the validity or enforceability of such provision in any other jurisdiction(s).