YELLOW HEAT ™

Yellow Grease Burning System

Model Y-2000

2015 Patent 9033698

Operation Manual

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

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Yellow Heat™ Burner

INTRODUCTION

Welcome to a new option for a low carbon footprint: Sustainable Space Heating. Yellow Heat Burner efficiently and effectively operates on yellow grease (waste vegetable oil) available from local rendering companies, restaurants or even from your own commercial kitchen fryers.

Unlike heating with fossil fuel sources such as #2 heating oil, heating with yellow grease creates exhaust gases much friendlier to the environment and with a diminished carbon impact. In comparison to heating oil #2, EPA documents demonstrate a 98% reduction in climate changing emissions, as well as 50% reduction in soot, unburned hydrocarbons and carbon monoxide in vegetable oil exhaust gasses.

Moreover, yellow grease 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 yellow grease as a heating fuel.

Given the high cost of petroleum fuels, yellow grease can save users money every heating day. Many users will see a payback on their investment in the Yellow Heat Burner in as little as one year. Yellow Heat is the low cost leader for Sustainable Space Heating.

Save Money - Save the World:
Switch to Vegetable Oil Heating

RECOMMENDED USES

The Yellow Heat Burner is suitable for heating greenhouses, warehouses, shops, barns, garages, certain commercial spaces and selected other larger heating spaces. Yellow Heat Burner is not appropriate for most residential applications due to insurance restrictions.

Depending on the construction details and equipment in the heated space, Yellow Heat is suitable for heating spaces from 1,000 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.

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 most other combustible oils. Never use flammable liquids such as gasoline, paint thinner, alcohol, or other potentially explosive fuel in the burner. Please read this Owner's Manual thoroughly before purchasing, installing or using the Yellow Heat System.

FEATURES OF THE YELLOW HEAT BURNER

- Requires no pre-filtering of vegetable oils or other fuels. Unique non-clogging system.
- Works without electric oil preheating. Moderate electrical power use with low wattage block heater.
- Among the lowest cost recycled-oil fired power burner on the market.
- Utilizes standard heating system components. Industry endorsed fire-safety features.
- Operates on wide variety of liquid fuels, including vegetable oils, animal fats, standard heating oils and recycled petroleum oils.
- Available as a complete oil handling and burning system, all necessary components included.
- Biodiesel and vegetable oil compatible pump seals and components.
- Easily tuned for highly efficient and nearly smokeless operation.
- Adjustable for heat outputs between 60,000 and 150,000 BTUs per hour.
- Burner can be mounted in many standard liquid-burning appliances as a retrofit.

PRECAUTIONS AND LIMITATIONS

a. 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.

b. The Yellow Heat Burner 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 yellow grease and other waste-oils as fuels can be a variable composition, 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. Recommended weekly maintenance for continued satisfactory performance.

d. Yellow Heat Burner produces between 60,000 BTU's and 150,000 BTU's per hour, depending on model used, appliance conditions, combustion-tuning and fuel type.

e. Waste oil may contain some foreign materials, including foodstuffs, water and petroleum contaminants, 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.

f. The Yellow Heat Burner burns unfiltered oil processed through our *Fuel Storage System.* All fuels need to be processed through this System.

g. 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.

h. Yellow grease yields about 5% less heat than standard petroleum oils per unit volume. Wet fuel yield less heat than dry fuel. Performance may be affected by the quality of the waste oils used.

i. When used as a retrofit burner for existing heating appliances, this burner may not be appropriate for small fireboxes. Vegetable oil flames tend to be substantially larger than flames burning heating oil or waste motor oil for a similar heat output.

j. Some vegetable oil fuels may need enhancing with some more combustible fuel, such as waste motor oil or heating oil, in order to get satisfactory heat output. Yellow Heat Burner operates on 100% yellow grease that meets the standard specifications.

k. 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 *Return 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.

l. 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.

m. 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.

n. This burner must be installed by a professional heating system contractor or other competent person.

o. Check with local heating codes for additional restrictions.

p. Contact Homestead Inc. for sizing requirements and custom designs.

q. 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.

RESTRICTIONS ON USE OF YELLOW HEAT

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 Cabinet unit to precipitation or high moisture. If installed in a high moisture atmosphere, a special cover for the Power Cabinet must be obtained from the Homestead Inc. to avoid corrosion of internal components.

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

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 competent 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 future 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 for disposal purposes.

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.

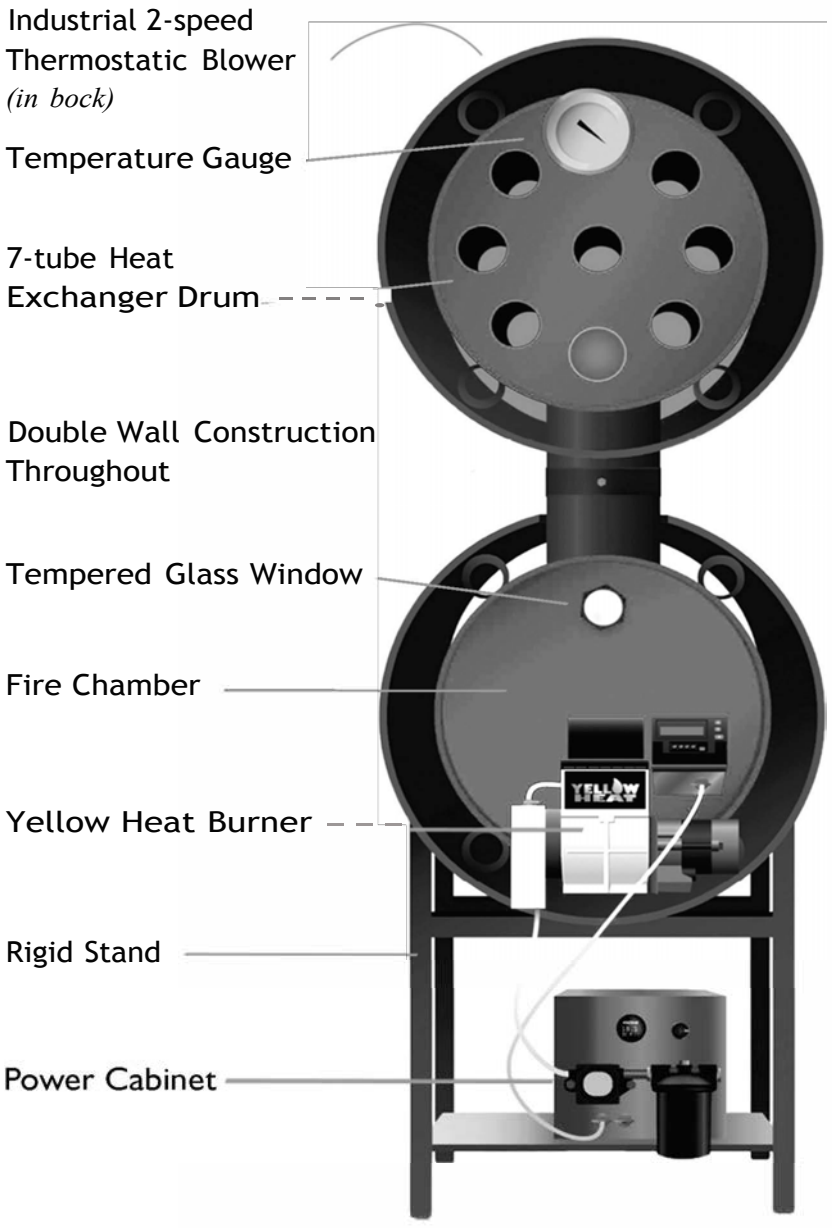
h. The exhaust products from this burner's operation must be vented through a fire rated chimney installed according to NFPA Code 30 and all other applicable fire codes.

i. The following codes are referenced and must be complied with in any type of furnace system installation where they are applicable:

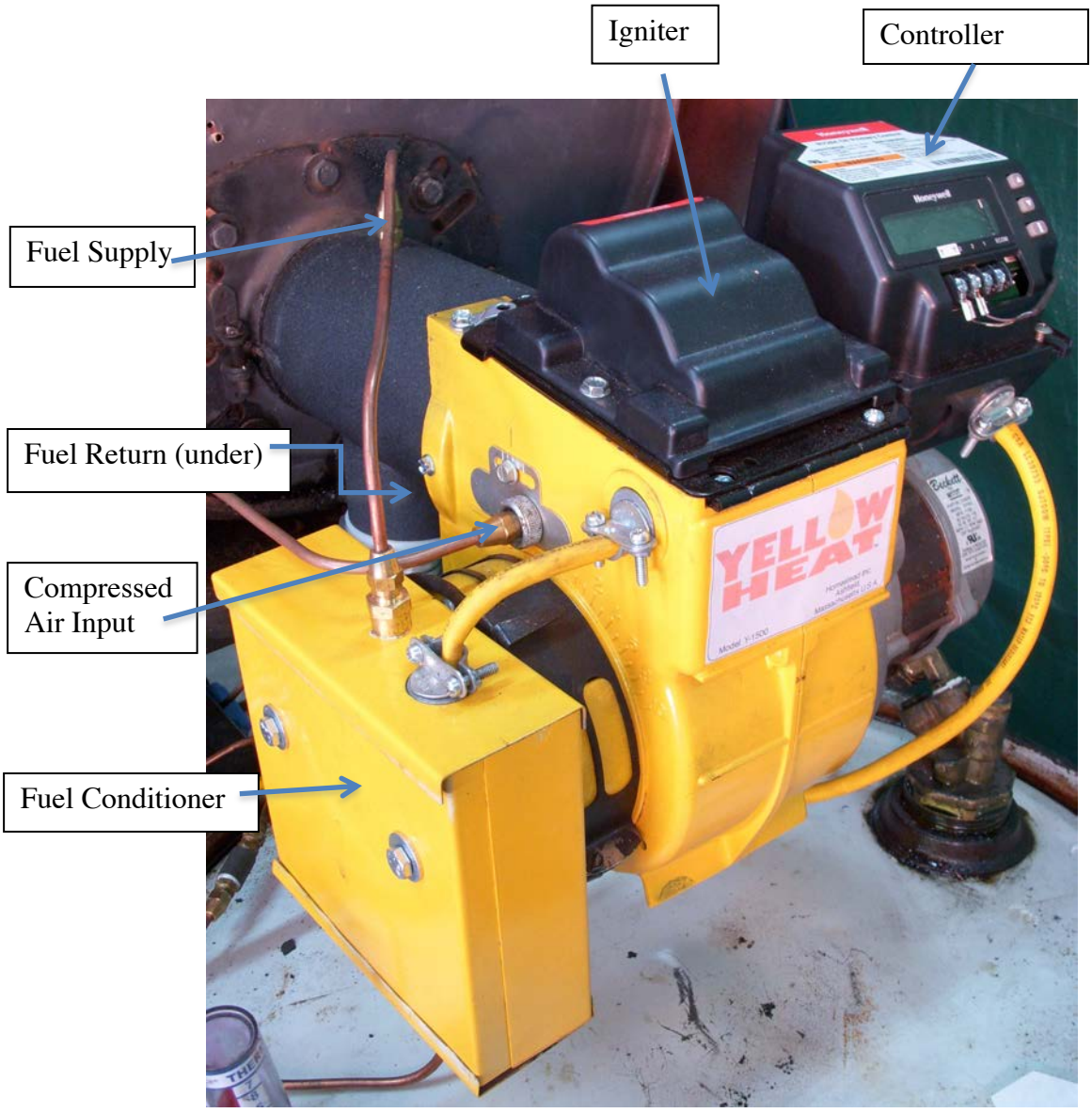
- NFPA 30 Flammable and Combustible Liquids Code
- NFPA 30A Automotive and Marine Service Station Code
- NFPA 31 Standard for the Installation of Oil Burning Equipment
- NFPA 211 Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances
- NFPA 88B Repair Garages
- NFPA 70 National Electrical Code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

THE YELLOW HEAT FURNACE

The Yellow Heat Furnace is a high-efficiency furnace matched to the heat output of the Yellow Heat Burner. Double-walled construction throughout provides fire safe operation. Made from 80% recycled steel, it has the same steel quality and thickness as most other furnace systems. Our 7-tube heat exchanger provides better heat transfer to the heated space than the industry standard. A two-speed industrial blower is energy efficient, quiet and effective. A heat-tempered glass window provides the necessary view of the flames for fine-tuning the heat output. The Yellow heat furnace may be used in greenhouse operations with the duct option available at low cost.



YELLOW HEAT BURNER COMPONENTS



PRINCIPLE OF OPERATION

a. The Yellow Heat Burner operates on the Babington Principal where moderate air pressure (30 to 40 psi) eminating from a hollow sperical surface has shearing action on a laminar film of fluid flowing down the surface. The film of oil flows across a small hole or thin slot, 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 or orifice, there is no chance that the burner can be clogged by unfiltered oil.

b. The Yellow Heat Burner operates on liquid vegetable oil or other liquid fuels. Saturated hydrogenated oils, including congealed oils may be combusted if they are liquified sufficiently. The high efficiency Fuel Conditioner elevates the fuel temperature just before combustion to reduce viscosity. This is a low-wattage device, consumes less than 1 KWH per day in normal operation.

c. Experience will quickly show which oils are better than others. Wet or emulsifed oils do not burn as easily as fully separated oils that are drier. The Yellow Heat Burner operates on oil, not water or sludge. Purchased yellow grease or waste vegetable oil should contain less than 2% M.I.U. (Moisture, Inert materials and Unsponifiable substances).

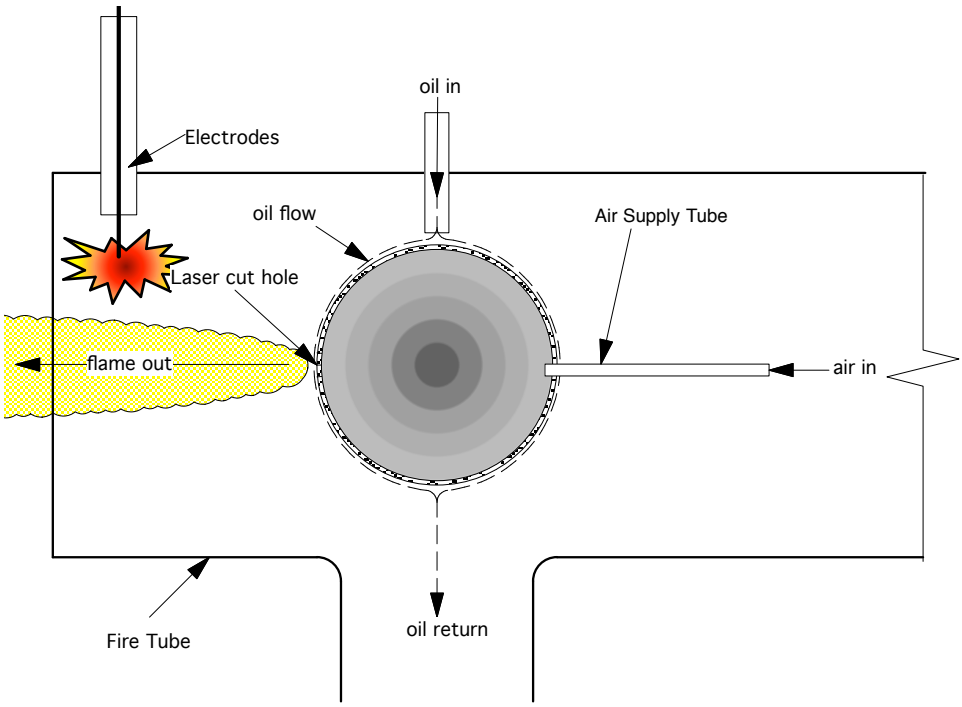
d. When adding fuel to the Yellow Heat Burner storage tank, observe the entering liquid stream. At least some light should be able to pass through the stream when poured into the Straining Bucket. If the entering stream is opaque, that is not oil, that's sludge! A separate process is usually required to effectively separate oil from sludge.

e. The Yellow Heat Burner is available with two burner head options. These are interchangeable burner heads allow a wider range of heat outputs to match the heating applicance chosen. For example, a domestic hot water heater has a smaller firebox than a whole house furnace. For the smaller firebox the burner is to be equipped with Burner #1. For larger firebox, use Burner #2.

Burner Head	Shape	Heat Output (BTU's per hour)	
		Low Range	High Range
Burner #1	1-1/2" ball with 0.010" hole	60,000	100,000
Burner #2	1-1/2" ball with 0.10" x 0.006" slot	80,000	150,000

f. To change the burner head, remove compressed air line and thumb screw from the Fuel Supply Tube. Remove burner head assembly. Unscrew existing Burner Head from Fuel Supply Tube. Do not use pipe joint compound or teflon tape, screw new Burner Head on Oil Supply Tube. Hand tighten only. If Head #2 is used, the final position of the burner head slot should be horizontal to intercept as much of the oil film as possible.

Image 3: The Babington Ball Principle



BABINGTON BALL SCHEMATIC CROSS SECTION

The schematic diagram above describes the process of atomization and combustion of the oil.

The diagram below is from the Patent 9033698 “Burner for Unprocessed Waste Oils”

FIGURE 1

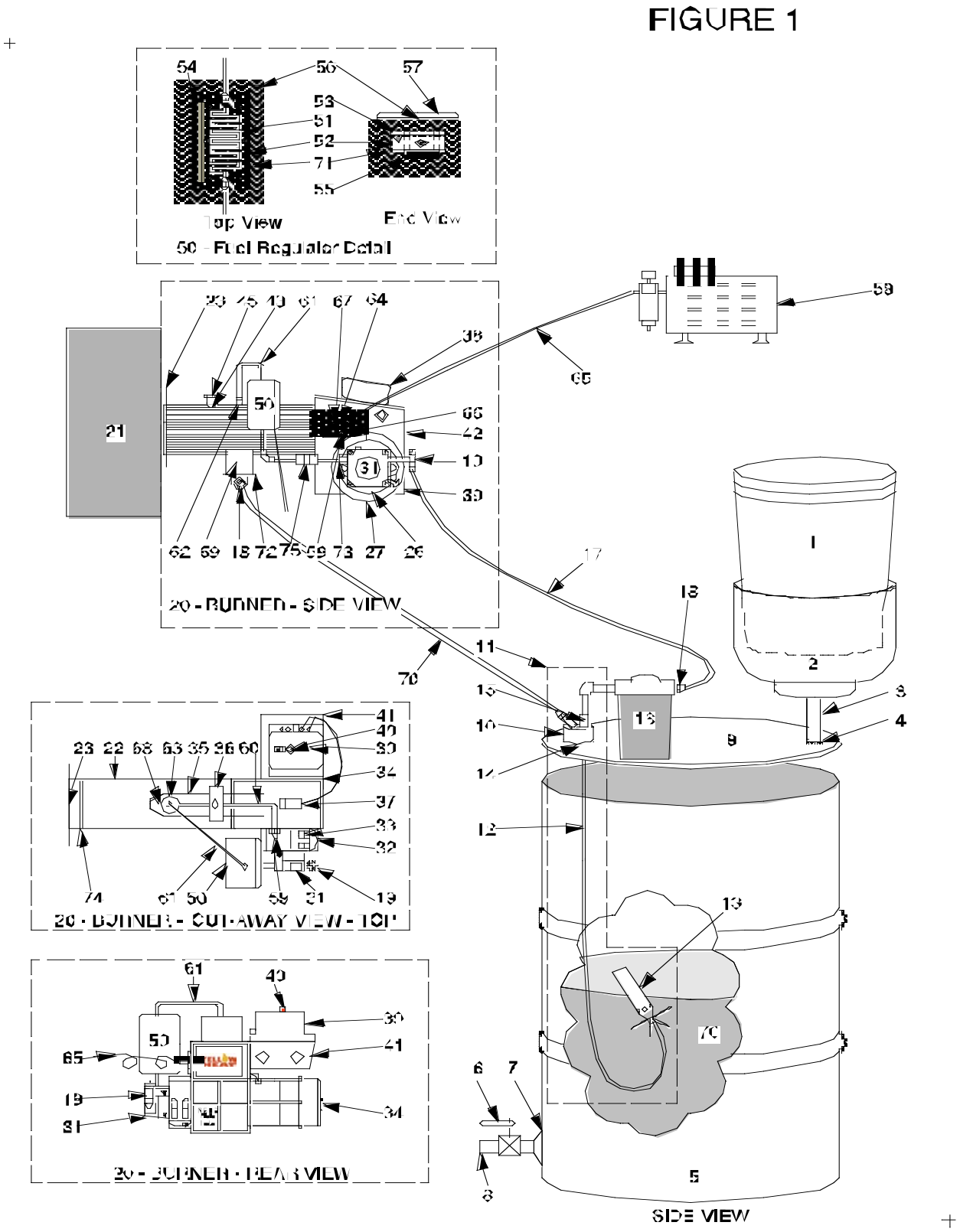


Illustration from Patent 9,033,698

Item	Component Description
1	straining bucket
2	drum funnel
3	3/4" x 3" NPT nipple
4	bung hole
5	storage drum
6	ball valve 1/2"
7	tank fitting 1/2"
8	bottom drain
9	drum lid
10	draw-off assembly
11	floating draw-off
12	flexible hose
13	float
14	2" bung hole
15	check valve
16	suction strainer
17	fuel supply tube
18	flare connector(s)
19	firematic valve
20	Yellow Heat Burner
21	heating applicance
22	fire tube
23	furnace flange
26	adjustable shutter
27	squirrel cage blower
31	waste oil burner pump
32	combustion air fan
33	air shutter
34	electric motor
35	electrode (2)
36	electrod holder
37	fire eye
38	igniter
39	flame controller
40	on-off control
41	electrical box
42	burner chassis
43	electrode port
45	threaded plug
47	speed controller
48	temperature sensor
50	fuel regulator
51	flow channel
52	heating block
53	gasketed cover
54	cartridge heater
55	thermostat
56	heater box
57	heater box cover
58	air compressor
59	air input connection
60	air supply tube
61	oil supply tube
62	inlet fitting
63	burner head
64	slide control
65	air pressure tube
66	knirled ring
67	setscrew
68	burner head opening
69	oil sump
70	return oil tube
72	oil sump base
73	fuel pump outlet
74	fire tube baffles
75	check valve
76	liquid fuel

SPECIFICATIONS
YELLOW HEAT BURNER
MODEL: Y-2000

Yellow Heat is a non-flame retention burner coupled with an automatic fuel decanting system that allows the operation on unfiltered and non-preheated yellow grease fuel.

VOLTAGE:	115 Volts	
POWER USAGE:*	300 Watts	
FUEL CONDITIONER:	100 Watts additional (thermostatic)	
	Power consumption for heater element is typically 1 KWH per day.	
YELLOW HEAT FURNACE:	230/290 Watts additional	
2-speed Industrial Blower Option		
	Low Fire	High Fire
BTU OUTPUT**	60,000 per hour	150,000 per hour
FUEL USAGE (gallons/hour)***	0.4	1.0
FLUE SIZE:	6-inch diameter	6-inch diameter
WEIGHT:	24 lbs for burner	
PHYSICAL SIZE:	18 inches long x 14 inches wide x 11 inches tall.	
COMBUSTION EFFICIENCY:	86.5% (Standard Tuning) ***	
SHIPPING WEIGHT	90 lbs (with oil storage and dispensing drum, etc.)	

* with Motor, Compressor and Electronics.

** Heat output is also dependent on the type and quality of the fuel being used.

*** assumes yellow grease as the fuel. Refer to Section 13 for details of tuning.

INSTALLATION AND OPERATION GUIDELINES

WARNING

ONLY Authorized Technicians strictly complying with Homestead Inc.'s instructions and national, state and 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 some types of existing liquid-fuel fired boilers and furnaces as a retrofit. Yellow Heat Burner will operate correctly in most existing waste oil furnaces with little or no modifications required. This will add the capability to burn up to 100% yellow grease 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 recommended so the size and characteristics of the flame can be observed for proper tuning purposes. The Yellow Heat Furnace is equipped with a removable glass window.

e. Gravity return-oil line to be 1/2" minimum diameter metal pipe. Pumped return-oil lines are not length limited.

f. Do not fill the *Fuel Storage Container* more than 7/8 full of vegetable oil fuel. Because of the possible addition 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.

g. Maintain fuel level in storage container between 7/8 full and ¼ full, according to the fuel level indicator. Using fuel below the ¼ cutoff may result in entrained water being uptaken and performance will deteriorate if this occurrs.

FUEL REQUIREMENTS

a. Yellow Heat Burner vegetable oil fuel should meet the minimum standards of yellow grease with less than 1% particulate matter and 1% water by weight. The specification for purchased yellow grease to operate in the Yellow Heat burner is 2% MIU (Moisture, Inert materials and Unsaponifiable materials).

b. 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 and in our video training program at YellowHeat.com if you wish to collect your own yellow grease from the producers. Many thousands of restaurants and commercial or institutional kitchens produce this yellow grease as a waste stream.

c. Our built-in fuel handling system will process 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 yellow grease 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.

d. A 60-mesh strainer is included between the Floating Draw-Off and the Fuel Pump. This is a large capacity strainer but will need to be cleaned at least yearly, or more often if especially dirty oils are used. The straining element is cleanable and reusable.

e. The fuel pump has a screen with 160 mesh surrounding the intake. This screen will need to be cleaned annually. A new strainer screen and pump gasket are recommended.

f. 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 the 40-mesh screen. Any resulting solid waste is potentially hazardous or toxic and must be legally disposed.

g. 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 may 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 5% less heat per gallon compared to petroleum oils. Wet oils yield less heat than dry oils.

h. Some wet or thick yellow grease will burn at a substantially higher heat with the addition on a small amount (5 to 10%) of petroleum, such as home heating oil, diesel fuel or kerosene.

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 furnace flange hold burner in place. Install Fire Tube using a split furnace flange. Make sure Fire Tube extends all the way into the firebox in case the fuel drips. The Fire Tube should be set essentially level so any liquid oil runs to the return line.

c. All metal fuel tubing is to be connected with flare fitting as per fuel codes.

d. Connect air pressure hose from compressor to Flame Control threaded end.

e. 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 height, return pumping is required. See our Product Catalog for a *return fuel pump* and contact Homestead Inc. for more installation details.

f. Connect Compressor and Power Cabinet to a power source. Use a 20 amp maximum dedicated circuit breaker.

g. 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.

START-UP

a. Yellow Heat will burn up to 100% unfiltered yellow grease or other medium weight oils. All fuel should be processed through our *Fuel Storage System*.

b. We recommend initial installation be conducted with standard heating oil or other light oil before attempting to burn 100% vegetable oil. Learn the operating characteristics of the Yellow Heat Burner before transitioning to a vegetable oil fuel.

c. For easiest operation, fuel should be at least room temperature (greater than $50^{\circ F}$). Cold startup can be accomplished with the Fuel Enhancement Procedure. Congealed oils will require additional heating prior to use.

d. First ignition of yellow grease may be slow to start if the fuel is cold and/or wet. Yellow Heat Burner has a starting procedure that uses a more volatile fuel to help establish normal operating conditions. Add 10% of the volume of the Fuel Storage Tank in standard heating oil on top of any existing vegetable oil fuel in the tank. Experience in blending various fuels, care in dewatering some yellow grease, keeping the fuel storage tank warm, and general system maintenance will diminish any need for special start-up procedures.

ESSENTIAL REQUIREMENTS FOR PROPER BURNER OPERATION:

Got Spark?

Make sure electrodes are clean. Electrode operation may generate spark noise to confirm. Electrode gap is recommended at 3/8" separation. Clean weekly to remove char and keep ceramic barrel from being conductive.

Reasonable Fuel?

We can't burn water. The bottom of the fuel tank has the least effective fuel. Keep the fuel tank more than ½ full. Cold or damp fuel requires the Fuel Enhancement Procedure, below. Start with conventional heating fuel to confirm operation, then add up to 100% yellow grease.

Fuel Pumping?

Confirm oil pumped to burner. Confirm vacuum tight oil feed. Bleed pump through clear tubing to observe any bubbles. Using fuel from the lowest section of the fuel tank may uptake very dirty fuels, requiring the uptake screen be cleaned. Extreme cases of dirty oils require screen on fuel pump to also be cleaned.

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. Flame Control too far forward may produce too low a flame. Too far rearward is possibly too much fuel and the flame too large for the firebox. Adjust Flame Controls to keep ohm readout on the Controller below 1,000 ohms on average. Adjust the position in small increments and hand-tighten knurled ring to hold in place. Look for a yellow flame and minimal smoke, if any. Adjust Motor Speed Control to size flame to the size appropriate for the firebox. Never have flames more than ½ fill any firebox. When observed, flame should be yellow in color. An orange flame indicates too much fuel is being fed to the flame, resulting in an inefficient and smoky combustion.

TUNING

a. Yellow Heat Burner is easily tuned and can produce a long-term, smokeless and stable flame. Simple Rules:
Fire-box no more than 1/2 filled with flames.
Flame too big? Adjust Flame Control Forward. Reduce pump speed control.
Flame too small? Adjust Flame Control Rearward. Increase pump speed control.
CAD cell resistance should read no more than an average of 1,000 ohms on the Controller during operation. A lower ohm value indicates a cleaner and more complete burn and brighter resulting flames. When stable flame established, read average ohm meter value, rounded to nearest 100. This establishes a baseline to compare to the daily meter readout. If the ohm meter value rises more than 30% above the baseline, either the electrodes are starting to foul, requiring the cleaning proceedure, or the oil being combusted is particularly wet. If the oil is wet, a small percentage of petroleum fuel supplement, such as home heating oil or diesel fuel, 2 to 10% by volume, added to the imput screen often improves flame quality and reduces ohm meter reading.

b. To adjust flame size, loosen set screw on Flame Control, see Diagram, below. Set screw should be loose enough for Flame Control to be easily adjustable. Loosen Knurled Ring which should be only hand tight. Adjust Flame Control forward or back so fire is appropriate size for heating appliance, as shown by color, smoke, heat output and other indicators. If lowest adjustment produces a flame size larger than desired, the Flame Control may be reversed for reduced heat output. After proper tuning is achieved, tighten Knurled Ring.

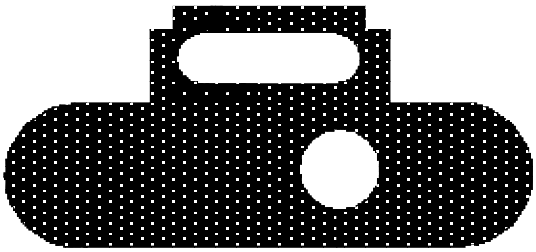


Image 5: Flame Control.

c. There should be no visible emissions from the exhaust stack for the burner when in normal operation and appropriate tuning. If excessive emissions are seen adjust Flame Control 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 adjust the Flame Control forward and follow the tuning procedure. If the smoke is created because of under-firing, adjust the Flame

Control rearward by a small increment.

Good Tuning: Yellow Flames, No Smoke

d. IMPORTANT: The size of the flame may vary depending on oil temperature, especially for yellow grease. From a cold startup, flame size may increase as the fuel is heated. Adjust flame size with the Flame Control as temperature equilibrium is achieved.

e. Air pressure should be between 30 and 40 pounds per square inch (psi). Adjust pressure regulator on the Power Cabinet to achieve this value. If pressure falls below this range the oil mist droplets get larger and combustion may be incomplete. Higher pressures are capable of handling more visous oils. Maximum pressure is 100 psi.

f. If you run the oil storage container to the lower levels, there is an increased chance of the float encountering water or wet fuel. This may make the flame unreliable. Monitor all fuel additions to minimize water additions. Remove any accumulated water from the bottom drain periodically.

MAINTENANCE

a. **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 be cleaned with compressed air annually for maximum performance.

b. **Yellow Heat Burner:** Periodic maintenance is required for all liquid fuel burners and more often for waste oil burners. Weekly, monthly and annual maintenance chores should be planned.

c. **Fire Tube:** The steel reducing elbow on the bottom of the Fire Tube may be removed annually to eliminate any char build-up. 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. The fire tube interior should be cleaned with a steel 4” diameter flue brush. Remove burner tube from chassis at the rear and brush into firebox.

d. **Oil Heater:** Unplug heater element if burner is not being used seasonally or for an extended period of time. Annual maintenance includes removing oil heater coverplate and cleaning the oil channel of any adhered debris. Tighten coverplate evenly and completely to compress gasket.

e. **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 or misdirect 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 (30+ psi) inside the Babington ball while cleaning its surface to keep the extremely small exit hole from becoming clogged. The 2-year warranty on the operation of the Babington ball burner head is void if this proceedure is not followed in every instance.
A partially clogged Babington ball may sometimes be restored by immersing the ball in a container of 100% biodiesel while maintain pressure inside of the ball, as above. Any resulting mist should not be breathed as it may be harmful. An alternative method is to use a propane torch on the surface of the ball while air pressure is being applied.

f. **Fuel Strainers:** The strainer has a 40 mesh screen that protects the pump from excessive solids. Clean screen by using compressed air when solids are seen building up. Use paper towels on both surfaces to absorb any remaining oils that might polymerize if left in place. The second in-line fuel strainer has a 60 mesh cleanable strainer. All fuel strainers need annual cleaning in normal operation. If significant sludge is entered into the Yellow Heat Burner, additional cleaning cycles may be required.

g. **Oil Pump**: The oil pump is not self-priming. The priming proceedure is to open the pump bleed valve on the lower edge with a 3/8" open end wrench a couple of turns. Turn on pump and watch outcoming stream for bubbles. When all bubbles are past, the oil pump is fully bled and the bleed valve is to be closed. There is a 160 mesh screen surrounding the pump mechanism under the cover.

h. **Electrodes:** Build-up of carbon residue on the electrode points or insulators can cause ignition failure. Electrodes may need to be cleaned as often as twice per week, depending on the suspended matter and consistency of your fuel.

   Turn off Power. Use a 7/16" wrench to remove compressed air inlet line. Remove finger-tight knurled ring. Open burner hinged cover and remove Ignition Drawer. Loosen ceramic insulator clamp. Clean ceramic insulators with towels until essentially white along their length. A B-100 cleaning solution is appropriate for the ceramic. Emery cloth may be used to clean ceramic. Do not use steel wool as it may encourage voltage leakage.

   The metal electrodes should be cleaned with emery cloth as required to achieve bare metal. Never touch the Babington Ball surface with emery cloth. Return cleaned Igniters to the Ignition Drawer. The gap between electrode points should be set to approximately 3/8" for proper operation. Reinstall Ignition Drawer. This process may take less than 5 minutes to complete.

i. **Compressed Air Stream:** The compressor regulator 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 may be set between 25 psi minimum to 100 psi maximum. Check pressure hose for leaks and tighten fittings as required. The ideal pressure should be between 30 and 40 pounds per square inch.

j. **Fuel Storage System:** The 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 the 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 tank limit are needed, use a *3-way valve* to gang a second drum on line or connect across the bottom drains.

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. View inside drum with a flashlight from time to time. The Yellow Heat Burner does not handle scum layers well. Any accumulation should be removed.

TROUBLESHOOTING GUIDE

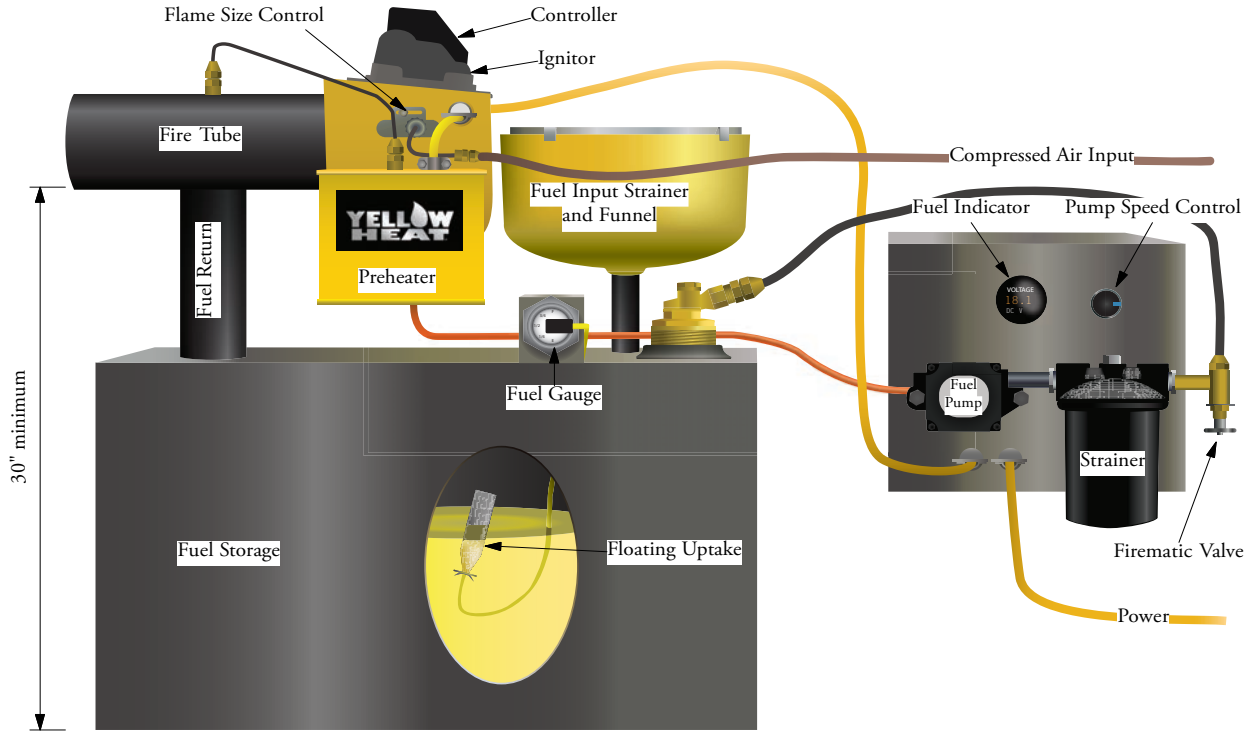
START-UP STEPS	DETAILS
Check for Spark	If spark is absent, clean electrodes with included stainless steel brush. Gap between electrodes should be 3/16” or less.
Check for Fuel	Adjust Flame Control out an increment. You should be able to see a fine mist of fuel in the Electrode Port. See caution above as this mist is potentially explosive!
	Operating pressure on the pump should be between 30 and 40 psi.
If No Fuel Mist	Check fuel level in Storage Drum. It should be at least ½ full.
	Check fuel strainer screen and clean as necessary.
	Compressed air being delivered?
If No Spark	Check electrodes for fouling. Clean 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 1/4” gap.
If Flame Goes Out	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 *Floating Draw-Off* from our Products Catalog. 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. 30 to 40 psi.
	Fire eye sees residual flame from accumulated carbon residue and stops re-ignition. Wait until residual flame dies out.
Flame Wrong Size	Adjust position of Flame Control relative to fuel intake. If flame is too large, push Flame Control to the front of the burner, if too small, move Flame Control to the rear. Use small increments of change, approximately 1/16 inch at a time.
Smoke Visible from Chimney	Either over-firing or under-firing may cause smoke. Adjust Control Rod accordingly.
Pump or Compressor	Shop air, i.e. a remote air compressor is the preferred source of compressed air. An on-board small compressor is available as an option. 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.

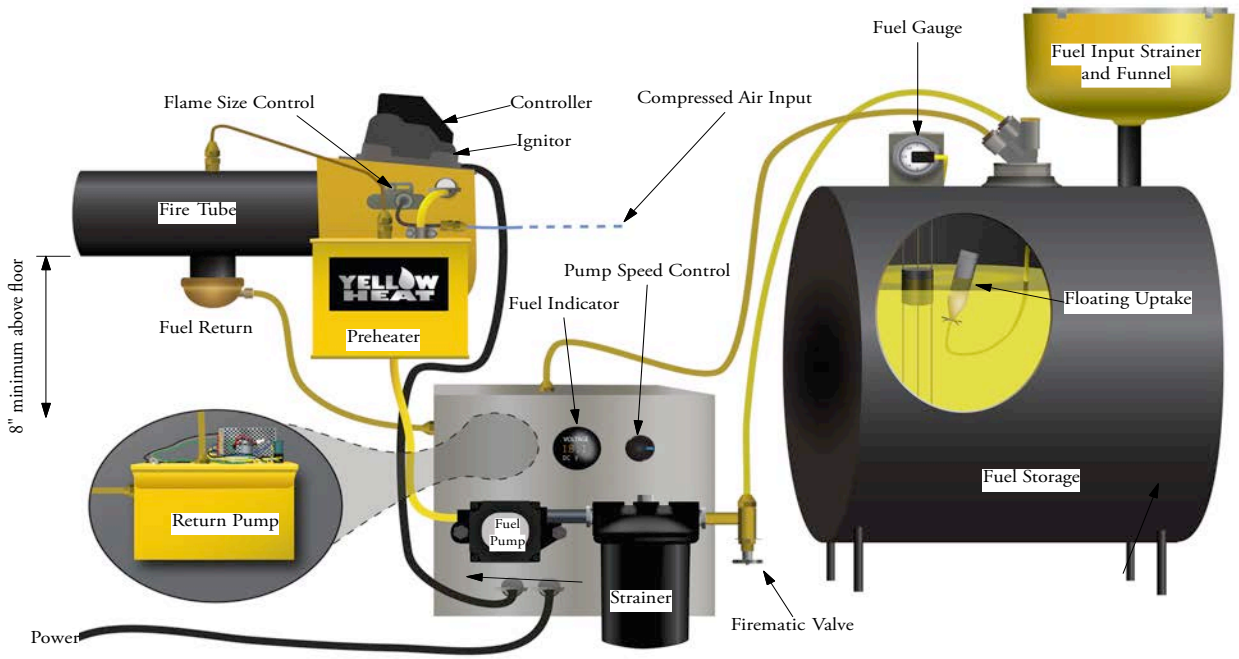
CONFIGURATION

The Yellow Heat burner consumes about 50% of the oil pumped to the burner head. The rest of the oil must flow back to the oil storage tank. If the burner is located higher than the oil storage tank, the return flow may be by gravity return. If the burner is installed at a lower elevation than the top of the oil storage tank (plus 8"), the return stream needs to be pumped back to the tank.

Yellow Heat with Gravity Return configuration.



Yellow Heat Burner with Pumped Fuel Return



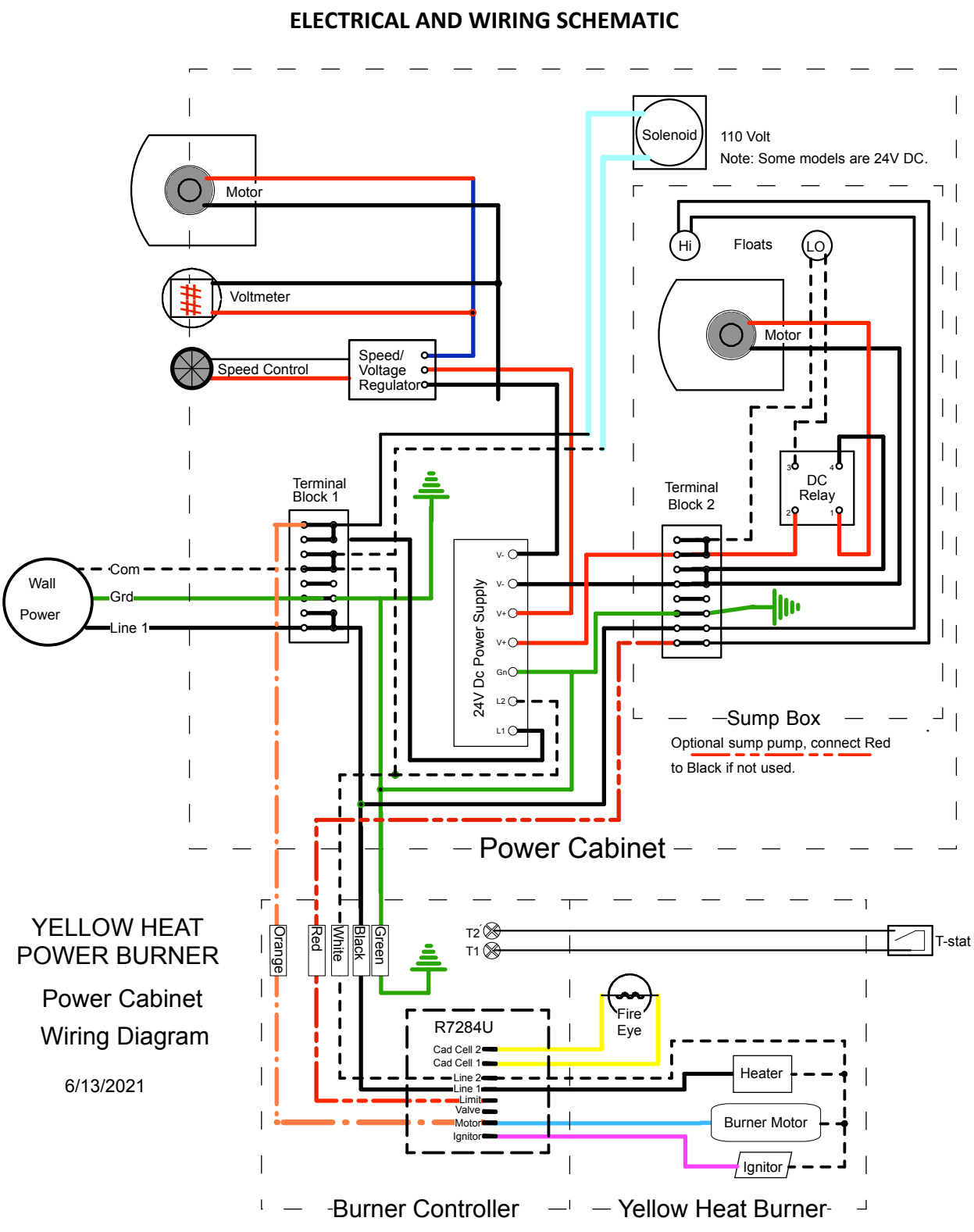


Image 6: Wiring Diagram

ABOUT COLLECTING AND PROCESSING VEGETABLE OIL

a. 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. Yellow grease is non-toxic both in the liquid form and in the exhaust products, although it must be handled like conventional fuels in most aspects.

b. Here are a few hints about how to obtain and handle yellow grease.

- Don't be a "Grease Bandit"; always get permission to collect yellow grease from restaurants, etc. Many restaurants will give permission to careful, dedicated collectors for little or no charge.
- An electric suction pump with a ¾" hose to a 55-gallon drum constitutes a collection system. Don't use a rubber impeller pump, but most others will do.
- 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.
- Put all collected oil through a 60-mesh screen. See Homestead Inc.'s Product Catalog for our *Stainless Steel Straining and Drum Funnel* that allows cleaned oil to be put directly into fuel storage drums. The *Straining and Funnel* accepts a entire standard disposable oil jug of yellow grease at a time. These are included with each Yellow Heat burner system.
- Always allow a few days for a yellow grease cube to settle in a warm environment so the layers will separate. You can see the amount of available oil in the yellow grease cube through the sidewall. Only the top layer is useful.
- Utilize settled oils from the top down: "The Good Stuff's On Top". See Product Catalog for our *Floating Draw-off* that always uses the best oil in any drum or oil storage tank.
- Observe the stream of oil as its poured into the Straining Bucket. Oil allows at least some light to pass through the incoming stream out of the settled yellow grease cube. If the stream is totally opaque, that's sludge!
- Avoid pouring large amounts of water or sludge into the Yellow Heat Burner to minimize maintenance.
- 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 yellow grease 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.

- Yellow grease 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 yellow grease. Check local codes.

TRADEMARKS

"YELLOW HEAT" AND THE YELLOW HEAT LOGO ARE REGISTERED TRADEMARKS OF HOMESTEAD ENGINEERING INC.

"YELLOW BIODIESEL" AND THE YELLOW BIODIESEL LOGO ARE REGISTERED TRADEMARKS OF HOMESTEAD ENGINEERING INC.

ALL OTHER BRAND OR PRODUCT NAMES MENTIONED ARE REGISTERED TRADEMARKS OF THEIR RESPECTIVE OWNERS.

WARRANTY

a. Your satisfaction is important to us. You may return the Yellow Heat Furnace and/or the Yellow Heat Burner to us, shipping pre-paid, if you are not satisfied within the first 3 months of operation for a full refund.

b. The Yellow Heat Burner comes with a full 2-year Limited Warrranty for the burner head against clogging when the fuel handling and system cleaning proceedures are followed.

c. Yellow Heat Burner carries a one-year warranty on all other 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 Burner is covered.

d. Homestead Inc. sends out an annual User Survey to judge user response and to tabulate the amount of yellow grease 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.

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WARRANTY VALIDATION RETURN

Please fill out and return to Homestead Inc., 1664 Cape St. Williamsburg, MA 01096.
Phone 413 628-4533, e-mail Vegheat@gmail.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: Vegheat@gmail.com

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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. The MANUFACTURER also warrants the burner head for two (2) years from the date of purchase against clogging when the operating proceedures in the Operation Manual are followed.

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).