ALTERNATE HEATING SYSTEMS
USED-OIL FIRED BOILER

Owner's and Operator's Manual

Models PT200, PT300, and PT500

All Installations Must Be In Accordance With
State and Local Codes

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INTRODUCTION

The Alternate Heating Systems, Inc. used oil-fired boilers have been specifically designed for burning No. 2 fuel oil, used motor oil, transmission oil, and mixtures not exceeding 50 SAE. These boilers have unique features not found conventional boiler designs.

Alternate Heating Systems, Inc. manufactures the boiler vessel to ASME standards. Used oil combustion technology differs significantly from burners designed for No. 2 fuel oil only. Additionally, used oil combustion in the boiler can produce adverse results not encountered in warm air heat exchangers.

Fast access to the firetubes is provided by the large door on the rear of the boiler.
CAUTION: Do not open the access door unless the power has been turned off.

The flue cover assembly can be removed by loosening the retainer nuts for ease of cleaning of Heat Exchanger. When replacing the flue cover assembly, attention must be given to tightening the retainer nuts evenly to ensure a proper seating of the gasket on the edge of the Heat Exchanger. These nuts should be checked periodically and tightened if necessary to prevent air leakage.

This boiler must be installed by a qualified technician, knowledgeable in hot water heating system design requirements.

These boilers may have one or more hot water heating coils to produce domestic hot water for car washes, shower, etc. Consult the enclosed diagram for an appropriate method for piping the domestic coils. If the boiler coil serves hand taps it must have a tempering valve to ensure that excessively hot water does not contact humans.

IMPORTANT: Boiler temperature must be set at least 180^0 or higher.
The closer you maintain your boiler temperature at 212^0 the longer your boiler will last.

If anything in this manual is unclear or technical assistance is required, contact your authorized representative or call Alternate Heating Systems, Inc. at 717-987-0099.

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STOP: BEFORE FIRING THE BURNER, THE BOILER & HEATING SYSTEM HAS TO BE FULL OF WATER. Firing the Boiler without boiler being completely full **voids** all warranty.

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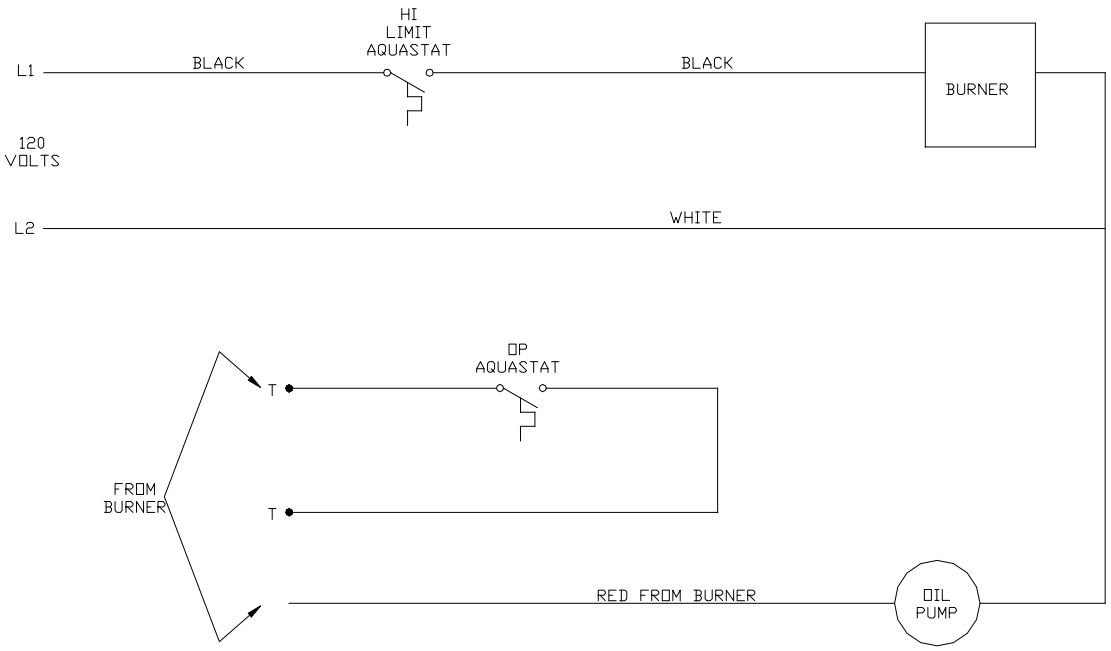
ELECTRICAL CONTROLS

The PT Boiler is designed to maintain a constant Boiler Temperature (higher than 180^0) controlled by the Operational Temperature (OP) Aquastat and the High Limit Aquastat (Hi) located at the top of each boiler. The OP Aquastat is in series with the Hi Limit Aquastat. The Hi Limit Aquastat is used only for safety. If by some means the operational aquastat allows the burner to operate over it's set point, the Hi limit Aquastat will shut the burner down some (most Hi Limits have a manual reset).

ELECTRICAL CONNECTIONS

The PT Boiler is designed to operate on 24 Volt (Low Voltage). Heat is provided by the primary control on the burner. Electrical hook up is simple. When installing your burner to the AHS Waste Oil Boiler, just locate the cable with 2 conductor thermostat wire (red, white, black) coming from the junction box on the side of the boiler to your burner. Then find the thermostat "T" terminal screws on the primary control and attach 1 wire to 1 "T" screw and the other wire to the other "T" screw. See Illustration below. The **red** wire is for oil pump power, the **white** wire is neutral and the **black** wire is power.

PT WASTE OIL BOILERS ELECTICAL SCHEMATIC



TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMAL ± FRACTIONAL ± ANGULAR ±				ALTERNATIVE HEATING SYSTEMS	
				PT BOILERS ELECTRICAL DRAWING	
				MAT'L: SEE B-M	
© 1996 THIS INFORMATION IS PROPRIETARY AND CONFIDENTIAL				SCALE: NTS	DRAWN BY: ELT / DATE: 08-08-05 / ACAD FILE:
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CODE INFORMATION

Purchase of an Alternate Heating Systems, Inc. multi-oil boiler is a wise investment. To maximize the return of this investment you must read the manual.

You can expect years of reliable performance with a properly installed and maintained system.

NOTE: THIS BOILER CANNOT BE INSTALLED IN A RESEIDNTIAL HOME.

The installation of the equipment shall be in accordance with the codes and regulations of authorities (state or local) having jurisdiction over environmental control, fuel, fire and electrical safety. The installation of equipment in the United states must consider the requirements of the following publications of the National Fire Protection Association, Battery March Park, Quincy, Massachusetts 02269.

N.F.P.A. No 30	Flammable and Combustible Liquids Code
N.F.P.A. No. 31	Standard for Installation of Oil Burning Equipment
N.F.P.A. No. 88A	Standard for Parking Structures.
N.F.P.A. No. 88B	Standard for repair Garages.
N.F.P.A. No 211	Standard for Chimney, Fireplaces, Vents and Solid Fuel Burning Appliances.

The installation of equipment in Canada must consider the requirements of C.S.A., Standard B 139, Installation Code for Oil Burning Equipment.

NOTE: Installation, operating and maintenance permits from each of the above authorities may be required, as well as municipal permits.

Please read and save your manual for future reference. Read your installation manual thoroughly first in order to insure that you're new heating system operates properly.

Minimum Clearances Between Boiler and Combustibles:

Above 12"	Chimney Connector 18"
Sides 24"	
Rear 36"	
Front 36"	

This boiler is listed for burning #2 fuel oil, used motor oil, and transmission oils with mixtures not exceeding 50 S.A.E.

DO NOT BURN unknown garbage oils, gasoline, and naphtha or chlorinated cleaning solvents in this boiler.

PT WASTE OIL BOILER INSTALLATION

Sizing Boiler Correctly

In order to make a prudent choice when determining the size of a PT Waste Oil Boiler required for an installation, it is necessary to do a heat loss survey of the building.

If the unit is equipped with a domestic hot water coil, this fact will need to be considered when sizing. Drawing hot water at a rate of 3 gallons per minute requires approximately 150,000 BTUH, assuming a temperature rise of 100 degrees F. (55 Degrees C.). Other unusual factors such as supplying heat for a pool or hot tub should be considered.

Rigging and Positioning of Boiler

Do not attempt to move or off-load the boiler without the aide of a crane or dolly. Most waste oil models have a lifting lug in the center of the top while on some units two lifting lugs in the front and rear are provided.

Once on the floor level where it will be installed, the unit may be rolled on pipe or by means of a pallet jack. The waste oil boiler must be placed on a concrete slab, or other rigid pad of non-combustible material, with sufficient strength to adequately support the boiler, including its contents of water.

USED OIL RECYCLING SYSTEM BOILERS SPECS

MODEL	PT200	PT300	PT500
Waste oil GPH approx.	1.25	2.0	3.4
Gross BTUH (approx.)	175,000	285,000	475,000
Heating surface, fireside (sq.ft.)	33	52	72
Furnace Volume (cu. ft.)	7	14	14
Minimum relief valve capacity	462,000	854,000	1,428,000
Water volume (gals) approx.	75	100	120
No. of heat exchanger tubes	1 – 17”	1 – 17”	1 – 17”& 1 – 8”
Boiler length	45”	70”	70”
Boiler width	27”	27”	27”
Boiler Height	55”	55”	55”
Shipping weight (approx.)	1100	1600	1900

Patent Pending

BOILER ROOM REQUIREMENTS

a. Room should be well lighted and should have a source of emergency light.

b. Convenient water supply available for boiler flushing and to clean the boiler room floor.

c. Unobstructed floor drains.

d. Must have adequate air supply, which must be kept clear at all times.

   Since the combustion process requires a supply of air at all times, it is essential that provisions are made to supply adequate air to the boiler room. This air supply is necessary to insure complete combustion, a clean fire and to prevent nuisance shut downs due to excessively dirty burner parts. Air from the outside may be provided through ducts, fixed louvers or motorized louvers.

BOILER CONDITIONER/SEALANT

AHS provides two bottles of Boiler Conditioner/Sealant with the purchase of your boiler. When filling your boiler with water for the **first** time, mix content of each bottle with 2 gallons of warm water. Pour into boiler opening. Replace plug. An MSDS is available upon request.

OTHER INFORMATION

- Each gallon of water circulated through the system delivers a definite quantity of heat which is dependent on the water temperature drop for which the system is designed. Water temperature drop is the difference between the temperatures of the water leaving the boiler and the water returning to the boiler.

- It will be noted that the smaller water temperature drops result in less BTU/H capacity per GPM. This means an increase in the GPM requirements of the pump. It has been found that a 20 degree water temperature drop usually provides the most economical selection of pump and pipe sizes.

- It should be noted that under actual operating conditions the temperature drop usually is considerably less than that for which the system is designed and will not appreciably affect the outputs of the heat distributing units. The temperature drop provides a starting point for determining the number of BTU/H which will be delivered to the heat distributing units by the circulation of each gallon of water per minute.

- In accordance with the definition of a BTU, if one pound of water drops one degree Fahrenheit as it circulates through the forced hot water heating system, then one BTU is given off. A gallon of water, weighing approximately 8.3 lbs. At the temperatures used in a system, will give off 8.3 BTU if it drops one degree as it is circulated through the system. One gallon per minute for 60 minutes, or one hour, will, if it drops one degree, give off 8.3 x 60 = 498 BTU/H.

- Using 500 rather than 498 for easier figuring, the design water temperature drop multiplied by 500 is the BTU/H (BTU per hour) delivered by the system when one GPM is circulated through the system.

- The proper pump capacity is determined by dividing the calculated BTU/H heat loss of the structure by the BTU/H carrying capacity of each gallon per minute calculated. In a system designed for a 20 degree water temperature drop, one GPM equals 10,000 BTU/H.

Source: Better Heating-Cooling Council handbook

WATER TREATMENT

Proper treatment of make up water and boiler water are necessary to prevent scale or other deposits and corrosion within the boiler. The absence of adequate external and internal treatments can lead to operation upsets or total boiler failure. Where a choice is available the pretreatment external to the boiler is always preferred and more reliable than treatment within the boiler.

Instructions for feed water treatment as prepared by a competent feed water chemist should be followed. Do not experiment with homemade treatment methods or compounds.

Representative samples of feed water and boiler water need to be analyzed frequently to ensure that they are in specification. The following terms and guidelines are to be used in conjunction with the advice of a water treatment specialist.

PH

- The Ph value of your boiler water is a number between zero and fourteen. Values below seven are acidic while values above seven are basic.

- The Ph factor is the most important factor influencing scale forming or the corrosive tendencies of boiler water. It should be adjusted to between a minimum of 10.5 and a maximum of 11.0 to prevent acidic corrosion of boiler tubes and plates and to provide for the precipitation of scale forming salts.

- Below a Ph of 5.0 the water is acidic enough to dissolve the steel boiler plates. Under these conditions the steel gradually becomes thinner and thinner until its destruction. At a Ph between 5 and 9.4 pitting of steel plates will occur at a rate depending on the amount of dissolved oxygen in the boiler.

DISSOLVED OXYGEN

- Dissolved oxygen is caused by the solubility of atmospheric oxygen into the supply water. Aeration of city water supply is frequently used to remove other noxious gasses. Efficient aeration results in saturation of the water with oxygen.

- The majority of corrosion problems are directly related to the quantity of dissolved oxygen in the boiler water. Elimination of the corrosive effect of dissolved oxygen can be accomplished both directly or chemically.

- Direct or mechanical removal of dissolved oxygen is done through the use of dearator. Chemical dearation is done through the introduction of specific chemicals in the boiler to react with the oxygen.

- The dissolved oxygen content should be maintained at a minimum but at no time should it exceeded 0.007 mg/l.

SULFITES

- Sodium sulfite is generally used for the chemical removal of dissolved oxygen within the boiler water. To assure the rapid and complete removal of the oxygen entering the boiler feed water system the concentration of sulfite in the boiler must be maintained at a minimum of 120 p.p.m. (parts per million).

SOLIDS

- Solids can be broken up into two categories of either suspended and dissolved. Suspended solids are those which could be removed by filtration while dissolved solids are in solution with the water.

- The best test for the determination of solids content of the boiler water is through a conductance test.

- The conductance value of boiler water varies by the various ionized salts present. The conductance can be used to measure the total dissolved solids in the boiler water and to serve as an accurate means for the control of solids through the use of blow down.

- Another test which is sometimes used as a gauge of solids is to measure the chloride present in the boiler water. The ratio of chlorides in the boiler water to that of the feed water can be used as a means to determine the amount of blow down required. The chloride test is unsuitable for feed water with low incoming concentrations and the concentrations in the feed water must be averaged over time for accuracy.

- High boiler solids will lead to foaming, priming, surging, and carry over. These items may only be over come by proper daily blow down of the boiler.

ALKALINITY

- The alkalinity of boiler water should be sufficiently high enough to protect shell and plates against acidic corrosion, but not that high to produce carryover. A minimum value for alkalinity for adequate protection is 200 p.p.m.

- High boiler alkalinity those which are in excess of 700 p.p.m. should be avoided. Values higher than this can lead to embritlement of the steel.

PHOSPHATES

- Phosphates are used to react with calcium hardness in the boiler water. In order for this reaction to take place it is important to maintain a Ph at a minimum value of 9.50. It is desirable to keep the concentration of phosphates in the water to 30-50 p.p.m. in order for the complete reaction of the phosphates with the calcium hardness entering the boiler through the feed water.

HARDNESS

- The hardness of water is caused by calcium and magnesium ions, which will vary greatly throughout the country depending on the source of the water.

- In boilers the hardness of the water can cause the formation of scale and sludge or mud. The hardness must be removed in the makeup water to the return system. Total hardness should not exceed 50 p.p.m.

OILS

- Every effort should be made to prevent oils from getting into the boiler water. Oil causes foaming or combines with suspended solids to form a sludge, which can cause the overheating of boiler plates. If oil does get into the boiler, the boiler should be taken immediately out of service and thoroughly cleaned.

BOILER MAINTENANCE

- Disconnect all incoming electrical power prior to servicing this boiler.

- Use Extreme caution around boiler piping and the McDonnell & Miller low water cut off since they may be hot (if provided).

- Accumulation of ash produces numerous adverse effects. Reduced heat transfer (U.S. Bureau of Mines) Research by the U.S. Bureau of Mines has determined that 1/32-inch of soot coating causes 9.5% loss of boiler efficiency. The following table shows how soot thickness effects efficiency

1/32 – inch of soot	9.5% loss of efficiency
1/16 – inch of soot	26% loss of efficiency
1/8- inch of soot	45% loss of efficiency
3/16 – inch of soot	69% loss of efficiency

- The life of your boiler can only be measured by the care given to it by those who are charged with the responsibility of boiler maintenance. A log of the following items should be maintained in the boiler room at all times. A sample recording sheet is the rear of the section.

Daily boiler check/maintenance list

1. Observe operating pressures are normal.
2. Observe operating temperatures are normal
3. Listen for any unusual noises and correct as necessary.

Weekly boiler check/maintenance list

1. Observe condition of flame.
2. Check fuel valves-open limit switch and make aural and visual check.
3. Check fuel supply.
4. Observe operation of circulating pump(s).

Monthly boiler check/maintenance list

1. Safety relief valve – try lever test.
2. Test flame detection devices.
3. Oil boilers-fuel temperature and pressure interlocks.
4. Test limit controls
5. Test operating controls
6. Check boiler room floor drains for proper operation
7. Inspect fuel systems in boiler room.
8. Check condition of heating surfaces.
9. Perform draft and combustion test.
10. Test low water cut-off.
11. Check coil plate and spud gaskets.

Annual boiler check/maintenance list

1. Routine burner maintenance.
2. Routine maintenance of circulating pump(s).
3. Relief Valve Pop test.
4. Combustion and draft tests.
5. Inspect expansion tank.
6. Inspect boiler room louvers or fresh air intake.

Cleaning the Flue Passages

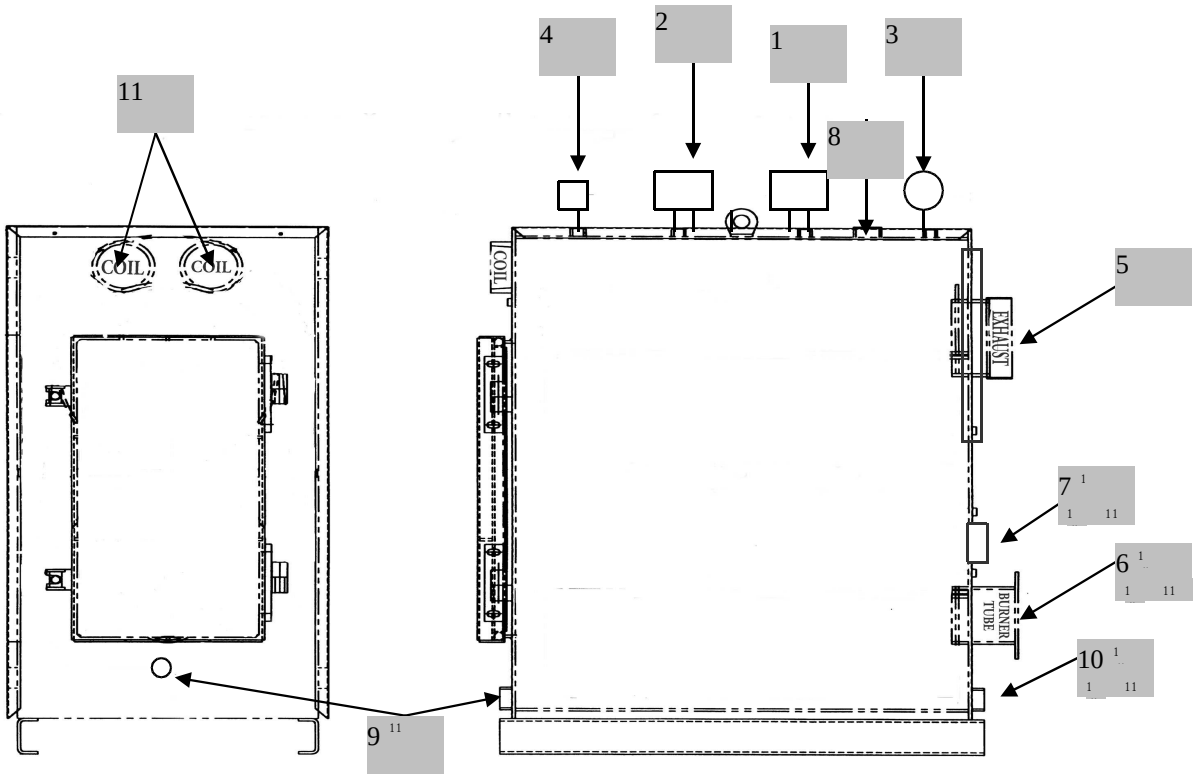
NOTE: Be sure electric power s off before opening access doors.

Under normal operating conditions the flue passages will need to be cleaned. If excessive soot has built up on the flue passages they can be cleaned following this procedure.

1. Open the front and rear cleanout doors. Be sure electric power is off to prevent accidental burner firing.
2. Using a flue brush, brush the accumulated soot and scale staring in the rear of the boiler brushing the top, proceed to brush down the heat exchanger.
3. Brush the side wall of the firebox through the burner opening.
4. Carefully vacuum the soot and scale which is now laying in the chamber of the boiler.

PT WASTE OIL BOILER DIAGRAM

1) Operation Temperature Aquastat (Low Voltage – 24V)**. IMPORTANT: MUST BE SET ABOVE 180^0**
2) Hi Limit Aquastat (Voltage – 120V)
3) Pressure/Temp Gauge
4) Pressure Relief Valve
5) Flue Adapter for easy Heat Chamber Cleaning
6) Burner Flange
7) Flame View Port
8) Boiler Outlet
9) Boiler Inlet
10) Boiler Drain
11) Hot Water Coils



Maintenance, Testing and Inspection Log Hot Water Heating Boilers	Building:	Month:	Year:
	Address	Fuel Type:	
Person(s) to be notified in Emergency (Name & Telephone No.)		Boiler No:	

DAILY CHECKS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
(1) Record Pressure																															
(2) Record Boiler Water Temperature																															
(3) Record Flue Gas Temperature																															

WEEKLY CHECKS (Enter Date)

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
(1) Observe Flame Condition				
(2) Observe Circulating Pumps				

MONTHLY CHECKS (Enter Date)

(1) Manual Lift Relief Valve				
(2) Review Condition of or Test each Item	(A) Flame Detection Devices		(F) Refractory	
	(B) Limit Controls		(G) Stop Valves	
	(C) Operating Controls		(H) Check Valves	
	(D) Floor Drains		(I) Drain Valves	
	(E) Fuel Piping		(J) Linkages	
(3) Observe Gage Glass on Expansion Tank				
(4) Combustion Air Adequate / Unobstructed				

General Comments:

#59901