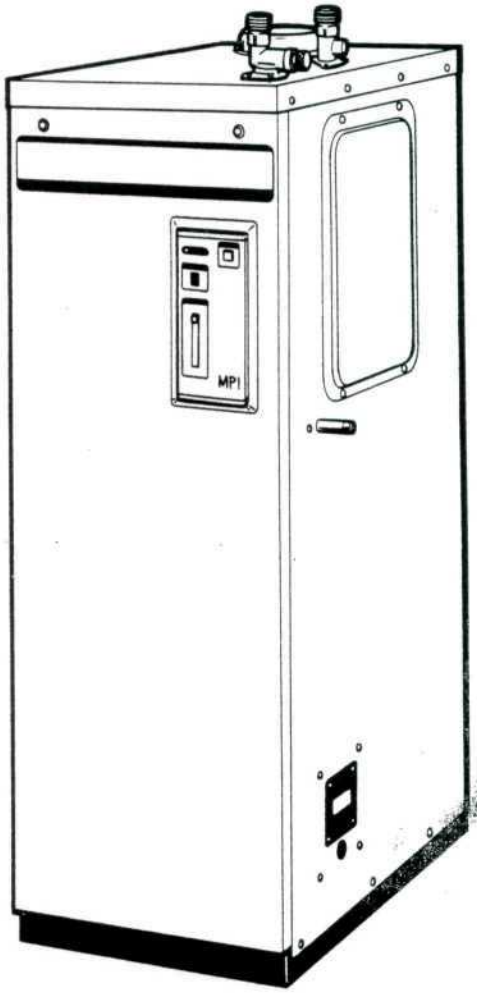
MODEL KWH124™

Instantaneous Kerosene Fired Water Heater

Service Manual



MPI

MONITOR PRODUCTS INC

#1123
4/91

CONTENTS

1 SPECIFICATION

1-1 SPECIFICATION

Model	KWH124		
Type			
Combustion Type	Pressure Vapor		
Air Intake/Exhaust	Indoor/Forced Exhaust		
Heating	Instantaneous		
Source of Water	Direct Connection of Main Supply		
Ignition	High Voltage Discharge Spark		
Fuel	Crystal Clean 1-K Kerosene		
Hot Water OUT PUT	123.000 BTU/H		
Fuel Consumption (Max)	1.1 GAL/H		
Efficiency	86%★		
Capacity of Heat Exchanger	1.057 QT (1.0 L)		
Maximum Pressure Applied	150PSI		
Minimum Water Flow to Activate Burner	0.45 GAL/MIN		
Area of Heat Transmission	620 in^2		
Exterior Dimensions	35in(H) X 11.8in(W) X 20.9 in(D)		
Weight	88 lbs.		
Voltage/Frequency	AC 120V/60Hz		
Rated: Ampere	Ignition: 1.05A (127W)		
(Rated Power Consumption)	Combustion: 1.00A (110W)		
Flue Size (Diameter)	4 in.		
Exhaust Air Temperature	482°F		
Nozzle			
Quantity of Vapor	0.85 GPH		
Spray Pattern	Pattern A		
Spraying Angle	60°		
Temperature Fuse	302°F		
Electric Current Fuse	6 A		
Safety Devices	* Safe Ignition * Flame Sensor * Over Heat Protector * Air Pressure Switch * Surge Absorber		
Pipe Connection			
Water Intake	3/4 NPT Male		
Hot Water Outlet	3/4 NPT Male		
Drain	1/2 NPT Male		
Accessories (supplied)	Fuel Filter		
	Water Intake Insulator Hot Water Outlet Insulator		
Hot Water Outlet (Maximum) Degree Rise	70° F Rise	210 GAL/H	3.5 GAL/MIN
	80° F	184	3.07
	90° F	164	2.73
	100° F	147	2.45
	110° F	134	2.23
	(Maximum hot water supplied by this unit is about 221 GAL/H.)		

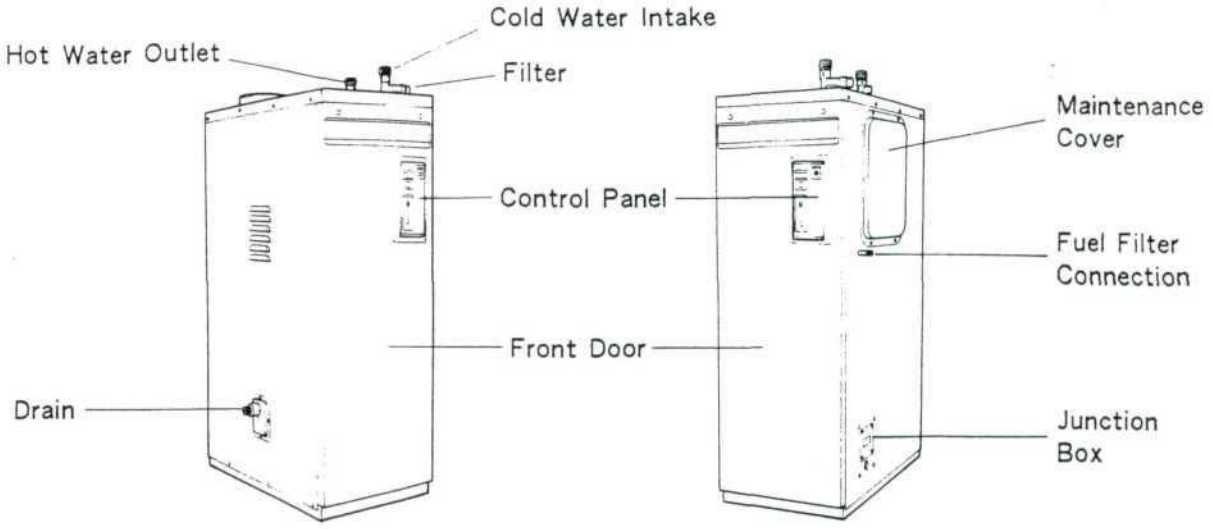
★ This represents efficiency under laboratory conditions. This efficiency rating can vary up to 4%.

"SINCE WE ARE CONSTANTLY IMPROVING OUR PRODUCTS, ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE."

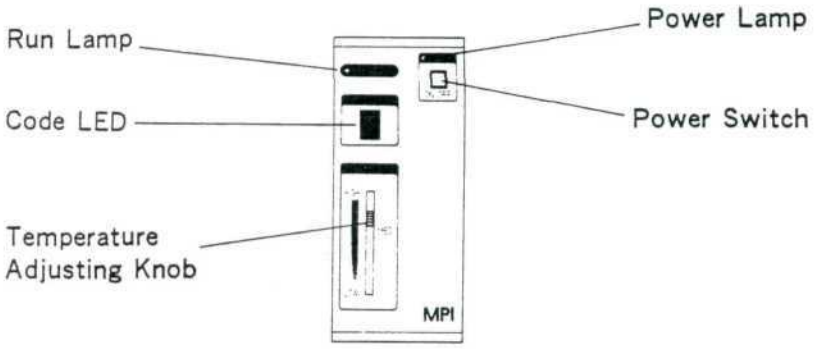
1 SPECIFICATION

1-2 PARTS DESCRIPTION

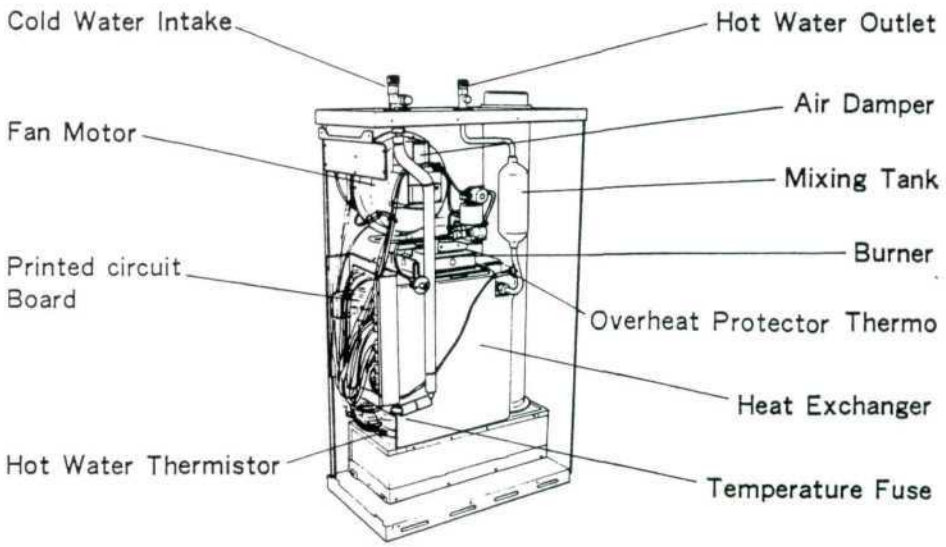
■ APPEARANCE



■ CONTROL PANEL



■ CONSTRUCTION



1 SPECIFICATION

1-3 UNPACKING

Unpack unit carefully.
The following parts are contained in the package.
Locate fuel filter and set aside to use when connecting the fuel line.

Fuel Filter

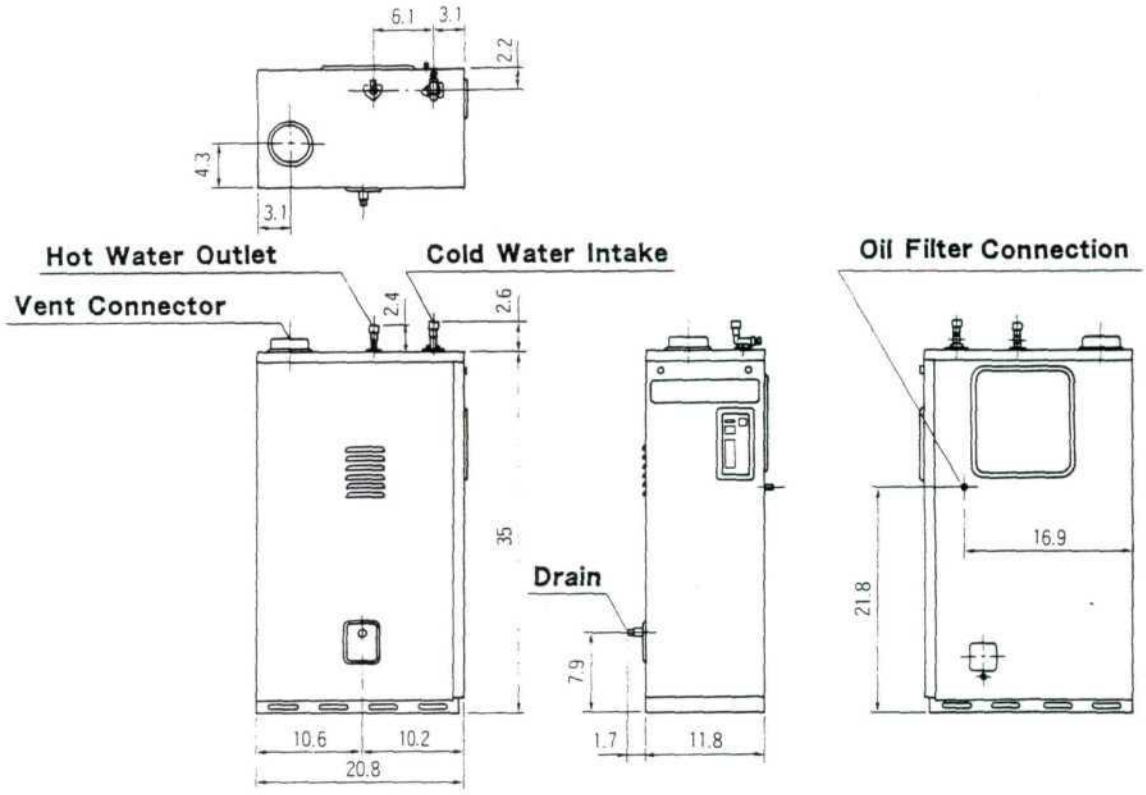
Water Intake Insulator

Hot Water Outlet Insulator

NOTE: These parts are located inside the styrofoam packing at the top of the unit.

1-4 SECTION DESIGNATIONS & MAIN DIMENSIONS

Dimensional Outline Drawing (Unit : Inches)



2 SPECIAL PRECAUTIONS

WARNING

- Use only crystal clear 1-K kerosene. Never use gasoline, white gas, camp fuel or other flammable liquids. Use of such fuels can result in an explosion and cause severe injury.
- A damaged or malfunctioning part should be discarded and be replaced with a new genuine service part. All repairs should be left to professionals. Contact your local authorized service dealer.

CAUTION

- DO NOT STORE flammable liquids or materials such as gasoline near the unit.
- Make sure that the flue is properly installed and connected.
  A separation in the flue during the operation of the unit can cause the release of exhaust gas into the room. The consequences could be dangerous.
- Turn off the unit in case of an accident or an emergency. Stay calm and do not panic. Just turn off the unit.
- In case of a fuel leak, exhaust fumes in home, no hot water. Turn off unit. Call an authorized service person.
- When using a shower, feel the temperature of hot water with your hand first, before moving yourself under the hot water.
- Avoid the use of hard water. In regions where hard water is the only source, take advantage of a water softener.
- This unit is only for indoor use. Avoid its exposure to rain or moisture.

3 OPERATIONAL PROCEDURES

3-1 FUEL

■ **FUEL TYPE**

Use only crystal clear Type 1-K Kerosene.

■ **FUEL SUPPLY**

Precaution

No water or debris should be allowed to enter the fuel tank. When these two are mixed with fuel, imperfect combustion can result thereby shortening the life of the burner.

1. Keep the tank filter cap tight.

2. Do not allow tank to run empty.
   If the KWH124 is allowed to operate without fuel, air must be purged in the following manner:

   a. Refill kerosene tank.

   b. Allow 30 minutes after refilling to activate KWH124.
   (This allows fuel to settle.)

   c. Make sure tank vent is open.

   d. Open shut-off valve on fuel tank.
   Loosen air purge screw at fuel filter.
   Discharge air out of all channels through which fuel runs.

   e. Fill the bowl of the unit fuel filter with kerosene.
   Fasten fuel purge screw back in original position.
   Handle O-Ring of fuel purge screw carefully. A damaged O-Ring can cause fuel leakage and render unit inoperative. Don't misplace O-Ring.

   f. Wipe all fuel spills off thoroughly.

3 OPERATIONAL PROCEDURES

3-2 INSTALLATION

THIS UNIT MUST BE INSTALLED IN ACCORDANCE WITH THESE INSTRUCTIONS. LOCAL CODE, ORDINANCE AND/OR IN THE ABSENCE OF LOCAL CODES, THE LATEST EDITION OF THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA31) CODE.

■ SELECTION OF THE INSTALLATION SITE:

Choose a suitable site with water and electrical connections readily accessible. The following should be taken into consideration in selecting the installation site:

1. An indoor place sheltered from weather.
2. A well-ventilated place (air intake openings should be provided).
3. Side, bottom and top clearance comply with instructions and local codes.
4. A place where there are no combustible materials near the unit.
5. Suitable and non-combustible floor.
6. The fuel tank is installed according to local codes.
7. The exhaust pipe is installed in accordance with instructions.
8. If water starts leaking, measures must be taken so that it does not affect other parts in the same area. recommended that a drain pan is placed underneath the leaking point, until it can be repaired.
9. A place accessible for maintenance after the installation.
10. Noise prevention - the unit does produce some low noise when operating. Carefully consider the location for the installation, if this is objectionable.
11. Unit must always be electrically grounded.
12. If unit is to be installed in an alcove or a closet, its clearance should comply with instructions.
13. Unit must be level. Unit performance is maintained only when it is installed level.

■ PROHIBITED INSTALLATIONS

Do not install the heater in the following locations:

(a) In small, poorly ventilated rooms.
(b) In airtight rooms.
(c) Near vents for heating or cooling.
(d) In places where special chemicals are used.
(e) In bathrooms, bedrooms or any occupied rooms normally kept closed.
(f) In a location where it may be exposed to freezing temperatures.
(g) In a location where heater is subject to vibration.

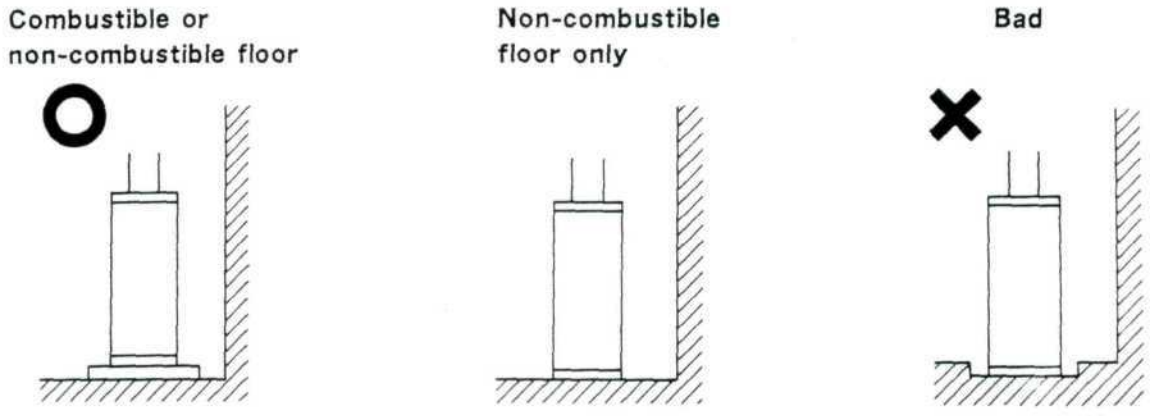
Note: Check local codes for any special requirements concerning the location of a water heater in a garage.

3 OPERATIONAL PROCEDURES

■ BEFORE THE INSTALLATION

Important safety.

1. Unit should be raised off floor two to four inches to prevent contact with combustible material and moisture damage in case of wet basements.
   Use proper and suitable patio block, brick, concrete block or similar non-combustible material.



2. Clearance from wall, ceiling shall be shown as "Standard clearance for installations."
3. Install an exhaust pipe in accordance with the instructions.
4. Make sure proper air intake and ventilation openings are provided.
   a. Indoor air intake: 2 air intake openings should be provided each 150 sq. in. at minimum.

NOTE: Air openings would be needed if unit is drawing air out of an area smaller then 775 square feet.

■ STANDARD CLEARANCE FOR INSTALLATION

Make sure to keep a distance from walls of combustible material.

From Left Side 7 in (180 mm)
From Right Side 19 in. (505 mm)
From Back of Heater 8 in (205 mm)
Heater to Closet Door 29 in (735 mm)
Flue pipe to Combustible Surface, Vertically Chimney Installation 9 in. (229 mm)
Flue pipe to Combustible Surface, Horizontally Chimney Installation 9 in. (229 mm)

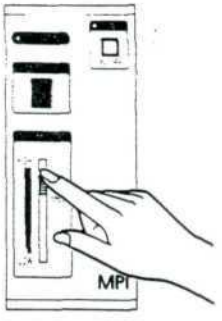
Refer to page 16 for minimum clearance of Flue Pipe on Side Wall Venting.
Pages 19 and 20 for L Type and vertical installations.

Note: Larger space makes service and maintenance easier.
Space for service and maintenance should be reserved.

3 OPERATIONAL PROCEDURES

3-3 OPERATION

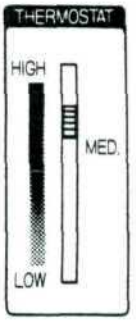
■ ADJUSTMENT OF HOT WATER TEMPERATURES



a. Thermostat has been set at factory to about 104° F (LOW).

b. Slide "Hot Water Temperature Adjuster" knob up toward "High" to raise water temperature. Slide knob down toward "Low" to reduce temperature.

c. When adjusting hot water temperature with hot-cold water mixing valve, control the amount of cold water from main supply without changing the amount of hot water being supplied.



★ Knob at position "HIGH" provides hot water at a temperature around 167° F.
Knob at position "MED" provides hot water at a temperature around 130° F.
Knob at position "LOW" provides hot water at a temperature around 104° F.

WARNING

* High temperature setting increases the risk of SCALD injury.
* Households with small children or invalids may require a 120° F or lower thermostat setting (to prevent accidental contact with "HOT" water.)

NOTE

* Seasonal change in temperature of water from main water supply results in different hot water temperatures supplied. Use hot water supply tap to control hot water temperature, or readjust thermostat setting.

■ UNIT SHUT OFF

1. Shut off hot water supply tap and burner will automatically extinguish.
   (Post purge fan will run approximately 150 seconds after shut off.)
2. Press and turn off "Power" when unit is not going to be used for an extended time. "Power" lamp goe

3 OPERATIONAL PROCEDURES

3-4 WARNINGS

- **BURNS**
  Don't touch the flue.
  The flue reaches a high temperature. Protect yourself from potential burns.

- **WATER FOR DRINKING**
  The quality of water from unit may change depending on water being supplied from main, and deterioration of piping material, scale, etc.
  Never use water that has remained stagnant in heat exchanger and pipes for long periods as drinking water. Turn water on for a couple of minutes before drinking.

- **SHOWER**
  Feel temperature of hot water with your hand before entering shower stall.

- **KEEP DRAIN VALVE SHUT WHILE UNIT IS OPERATING**
  Opening drain valve while unit is in operation will overheat unit and can result in possible heat exchanger damage and blown temperature fuses.

- **LIGHTNING**
  Lightning may cause a temporary power surge, which may damage some electronic parts. Where there is thunderstorm activity, install a surge protector in power circuit.

- **WHEN UNIT WILL NOT BE USED FOR AN EXTENDED PERIOD OF TIME**
  TAKE THE FOLLOWING MEASURES:

  1. Close fuel supply valve at fuel tank.
  2. Turn "Power" switch off.
  3. Purge water from unit (See instructions on Page 10.)

4 FREEZE-PROOFING OF THE PIPING

Freezing must be anticipated, not only in the northern states, but in other areas as well. Therefore, care must be taken to ensure the lines, valves and unit do not freeze.

Water should not be allowed to freeze in the supply or hot water pipes in winter. If water freezes in the supply and hot water supply pipes in winter, frozen pipes could rupture and leak.

Repairs to unit with ruptured pipes could be costly. Such damages are not covered by the warranty. The following preventive measures should be followed:

■ RUNNING WATER

This method will help to prevent water from freezing throughout unit's systems including pipes for inlet water and hot water supplies as well as valves.

1. Turn "Power" switch on control panel to off position.
2. Open a hot water tap and allow a stream to flow continuously at about .1 gal/min. Be sure to check that water continues to run during the period that freezing may occur.

■ PURGING WATER

This method is useful when unit is not going to be used for extended periods of time.

1. Shut off electrical power. Turn off water supply valve at unit.
2. Open fully all hot water faucets (including the shower).
3. Open drain valve of heat exchanger.
   Open inlet water screen and release the pressure relief valve.
   Allow water to drain from inside heat exchanger.

CAUTION

When turning on unit in cold weather, open water faucet and make sure that water comes out. If water does not run smoothly or does not come out at all, chances are water is frozen. Wait until water starts running smoothly, and then turn unit on.

5 MAINTENANCE CHECKLIST

It is recommended that the unit is inspected and cleaned once or so a year to ensure its long life.

■ **FLAMMABLES OR DUST**

Keep the top and vicinity of unit clean.
Keep flammables and dangerous items away from unit.

■ **FUEL LEAKAGE, SPILLS AND STAINS**

Make sure all fuel connections are tight and are not leaking.
Any spills or stains by unit indicate a leak and must be corrected.

■ **FUEL PIPES REPLACEMENT**

Check fuel pipes at least one a year for distortions and/or cracks. Contact authorized service dealer for replacement of defective pipes.

■ **WATER IN FUEL TANK**

Water and dust can easily go into fuel tank. After accumulating in the tank, they may flow into burner and cause imperfect combustion. Check if there is any water in the tank at least every six months by checking the fuel filter canister at tank. Have any water removed by an authorized service person.

■ **FLUE AND ITS VICINITY**

Periodically, make sure that there are no flammables around and above flue. Also, make sure flue is properly installed and maintained.

■ **CLEANING HEAT EXCHANGER**

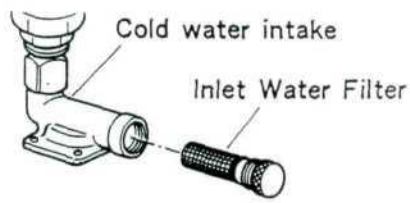
Drain water from heat exchanger at least one a year.

1. Shut water supply valve at main.
2. Open hot water supply faucet.
3. Open drain valve at heat exchanger. Also, open inlet water filter and pressure release valve. Then, drain water from heat exchanger.

■ **CLEANING INLET WATER FILTER**

Check once every three months and remove debris gathered in the inlet water filter.

1. Shut water supply valve at main.
2. Open hot water supply faucet.
3. Open drain valve at heat exchanger.
   Then, remove inlet water filter and wash and clean it.



CAUTION

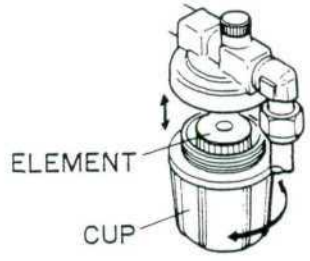
If lime has accumulated, remove it with a commercial compound for dissolving lime. Check water softening equipment if lime is found in the filter.

5 MAINTENANCE CHECKLIST

■ CLEANING FUEL FILTER

To be done by authorized service person. Check at least every six months to see if debris and/or water has gathered in fuel filter.

1. Shut fuel supply valve on fuel tank.
   Turn cup counterclockwise to remove it from the assembly. Dump water and debris from cup.
2. Pull off element. Clean it with kerosene.
3. Reassemble fuel filter.
   Purge air from fuel filter.



■ EXCESSIVE PRESSURE RELIEF VALVE

Once a year, make sure that the pressure relief valve (installed on water supply piping) is functioning.

6 VENTING INSTALLATION

6-1 CHIMNEY INSTALLATION

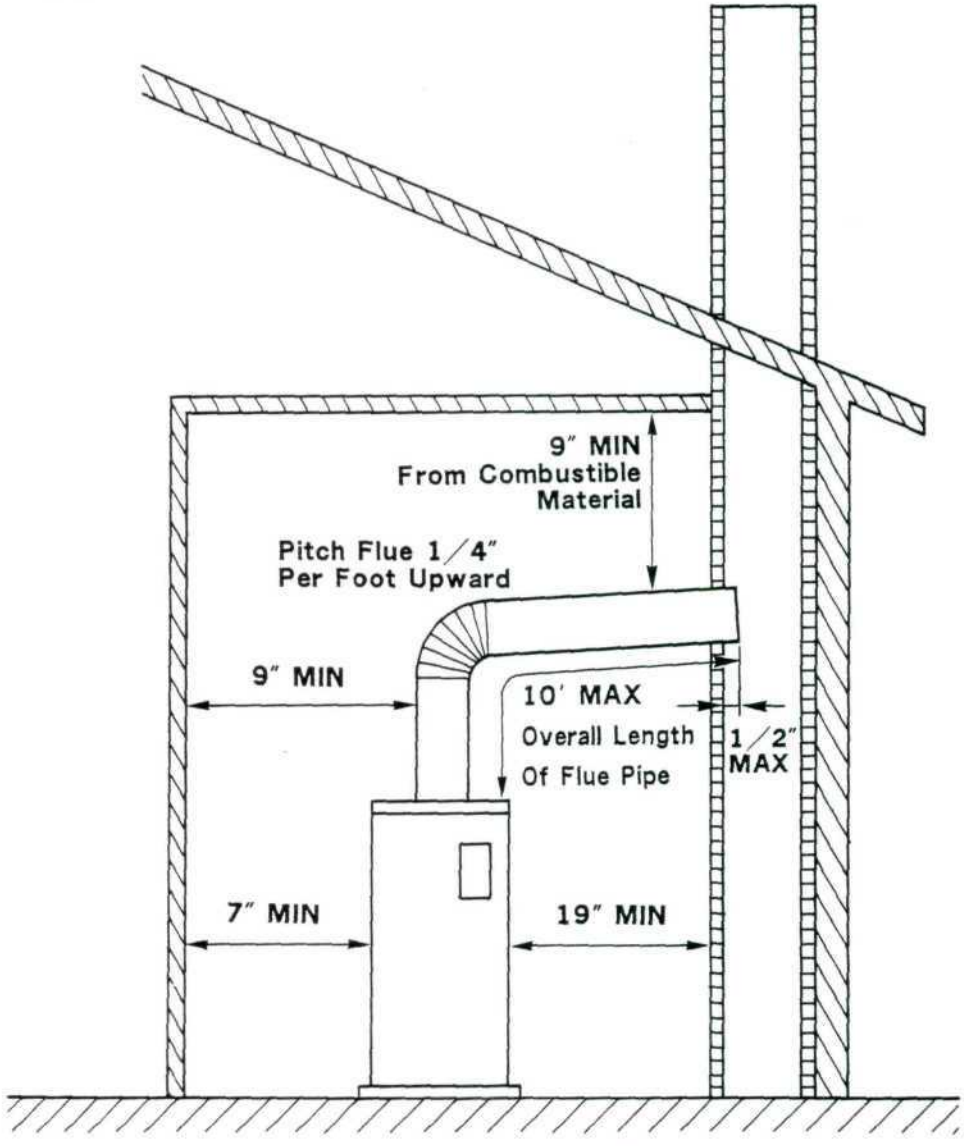
■ FITTING THE FLUE

IMPORTANT

THIS UNIT REQUIRES A DRAFT (AT FLUE CONNECTION OF THE UNIT) OF -2mmH_2O to -5mmH_2O TO OPERATE NORMALLY.

Use flue pipes of 4" inside diameter.

Note: It may be necessary to install a Draft Regulator in the flue to obtain the recommended operating draft.



Chimney Installation Example.

6 VENTING INSTALLATION

■ GUIDELINE FOR ATTACHING THE FLUE

1. Do not make any changes to the diameter of the flue piping.
2. Use durable materials for the flue such as double wall pipes with stainless steel.
3. Seal the connections of the flue.
4. Ensure that minimum distances are met between flue piping and walls and ceiling.
5. Double wall, L-type flue pipes are recommended to prevent injury or burns, if there is contact with flue.

Chimney Connection

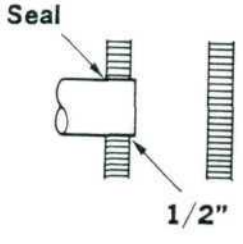
Check local codes and ordinances.

<IMPORTANT GUIDELINE>

1. The flue piping of the unit should be as short as possible, and pitch 1/4" per foot up toward chimney. Do not exceed 10 feet overall length of flue pipe.

2. Do not use more than two bends in the piping.
   Chimney penetration is not considered a bend.

3. The piping, when inserted into the chimney should not extend 1/2" beyond the inside surface of the chimne
   The area around of flue piping should be sealed where it enters the chimney. Refer to the drawing bel



6 VENTING INSTALLATION

6-2 SIDE WALL INSTALLATION

IMPORTANT

1. Use only MPI KWH Vent Kit and Accessories for Side Wall, Vertical, L-Type Venting.
2. This unit must be installed in accordance with these instructions, local code, ordinance and/or in the absence of local codes, the latest edition of The National Fire Protection Association (NFPA 31) code.

■ GUIDELINES FOR ATTACHING THE FLUE:

1. Do not make any changes to the diameter of the flue piping.
2. Seal and lock the connections of the flue.
3. Use an end cap to protect the flue from rain and wind coming in.
4. An insulated wall thimble is required for inserting the flue through any combustible material.
5. Ensure that minimum distances are met between flue pipes and walls and ceilings.
6. Flue piping used through the wall should be pitched down 1/4" per foot toward outside. (Side Wall Venting.)

6 VENTING INSTALLATION

■ SIDE WALL VENTING-FITTING THE FLUE

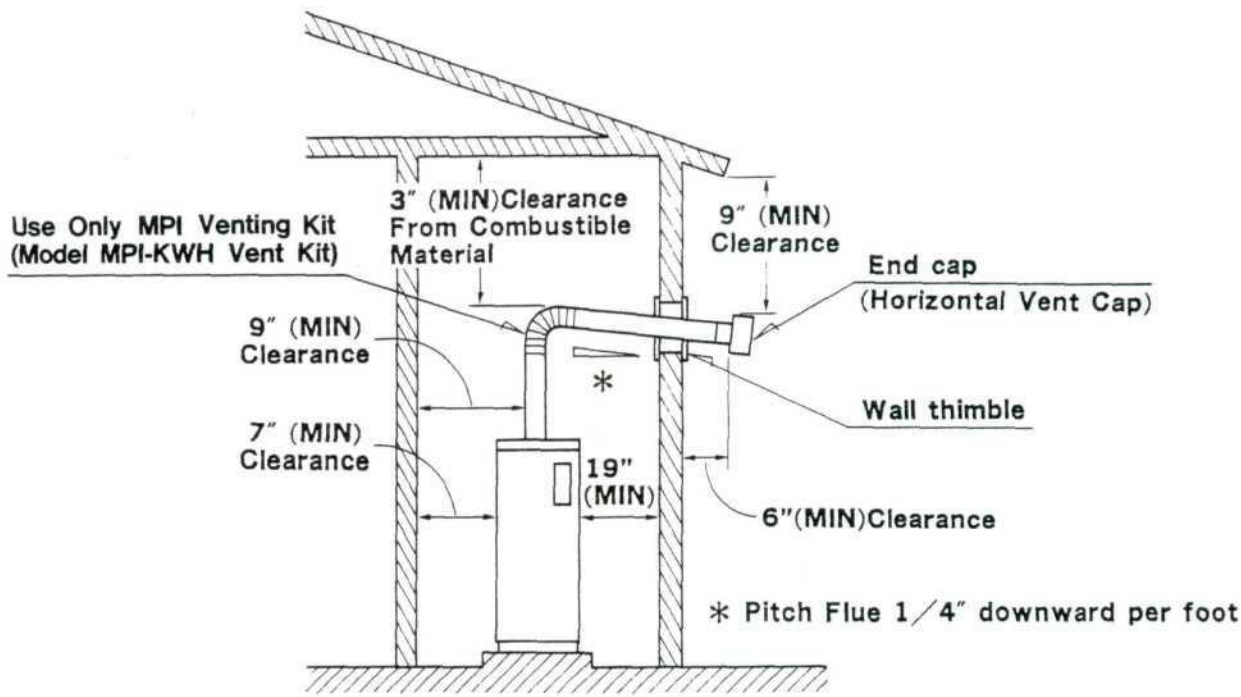
IMPORTANT

Extension Limits of the Flue

Length of the Flue	Number of Bends
10 feet	2
16 feet	1

Note: Extension limits do not include pipe adaptor elbow and end cap.

■ INSTALLATION EXAMPLE (1) - 1 BEND

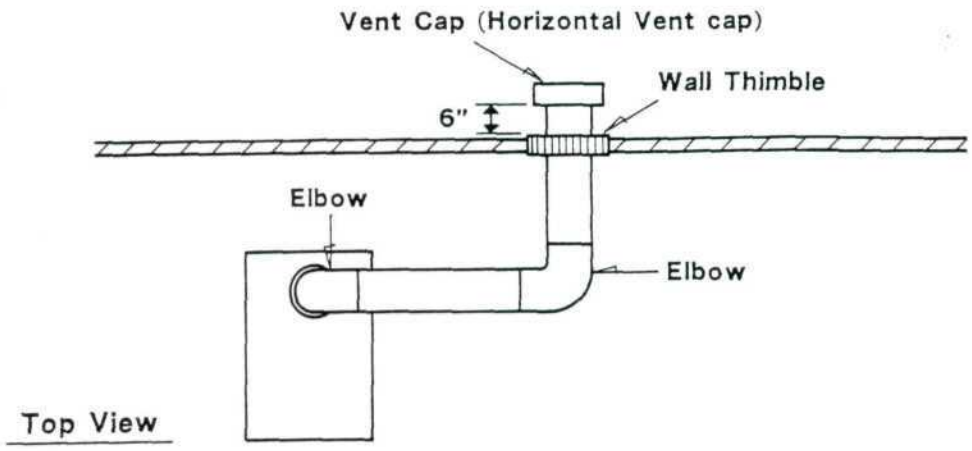


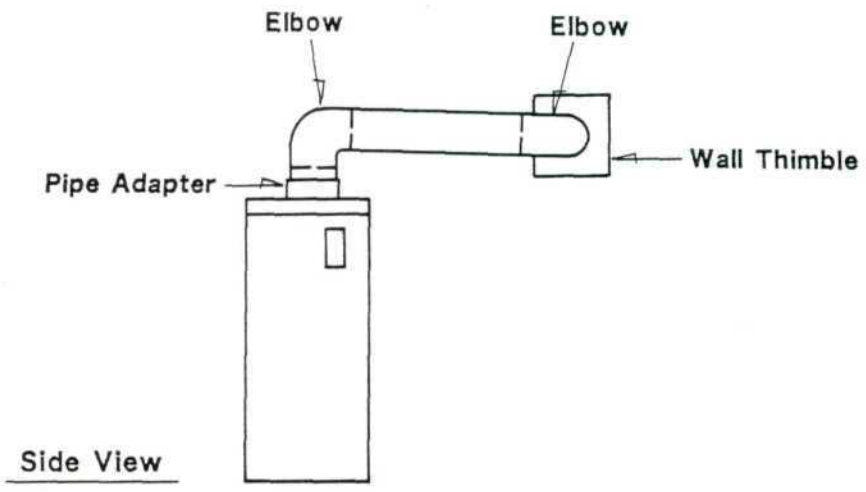
NOTE:

- Maintain 3" min. clearance around flue pipe from any combustible material.
- Maintain 9" min. clearance around end cap and 6" min. clearance outside wall.
- End cap is not considered a bend. In the drawing shown above, the number of bends is one.

6 VENTING INSTALLATION

■ INSTALLATION EXAMPLE (2) - 2 BENDS





NOTE:

- Maintain all min. clearances stated in installation example (1).
- Possible Applications - 2 bends.
  - (1) Up, across, and back
  - (2) Up, back, and across
  - (3) Back and across
  - (4) Across and back
- Length variation may vary depending on place of installation. Length should not exceed extension limits and no more than 2 bends

6 VENTING INSTALLATION

6-3 L-TYPE/VERTICAL VENTING

IMPORTANT

1. Use only MPI KWH Vent Kit and Accessories for Side Wall, Vertical, L-Type Venting.
2. This unit must be installed in accordance with these instructions, local code, ordinance and/or in the absence of local codes, the latest edition of The National Fire Protection Association (NFPA 31) code.
3. Overall length of the flue system is governed by the necessary draft. This system requires a draft (at flue connection of the unit) of -2mmH_2O to -5mmH_2O to operate normally. It may be necessary to install a draft regulator.

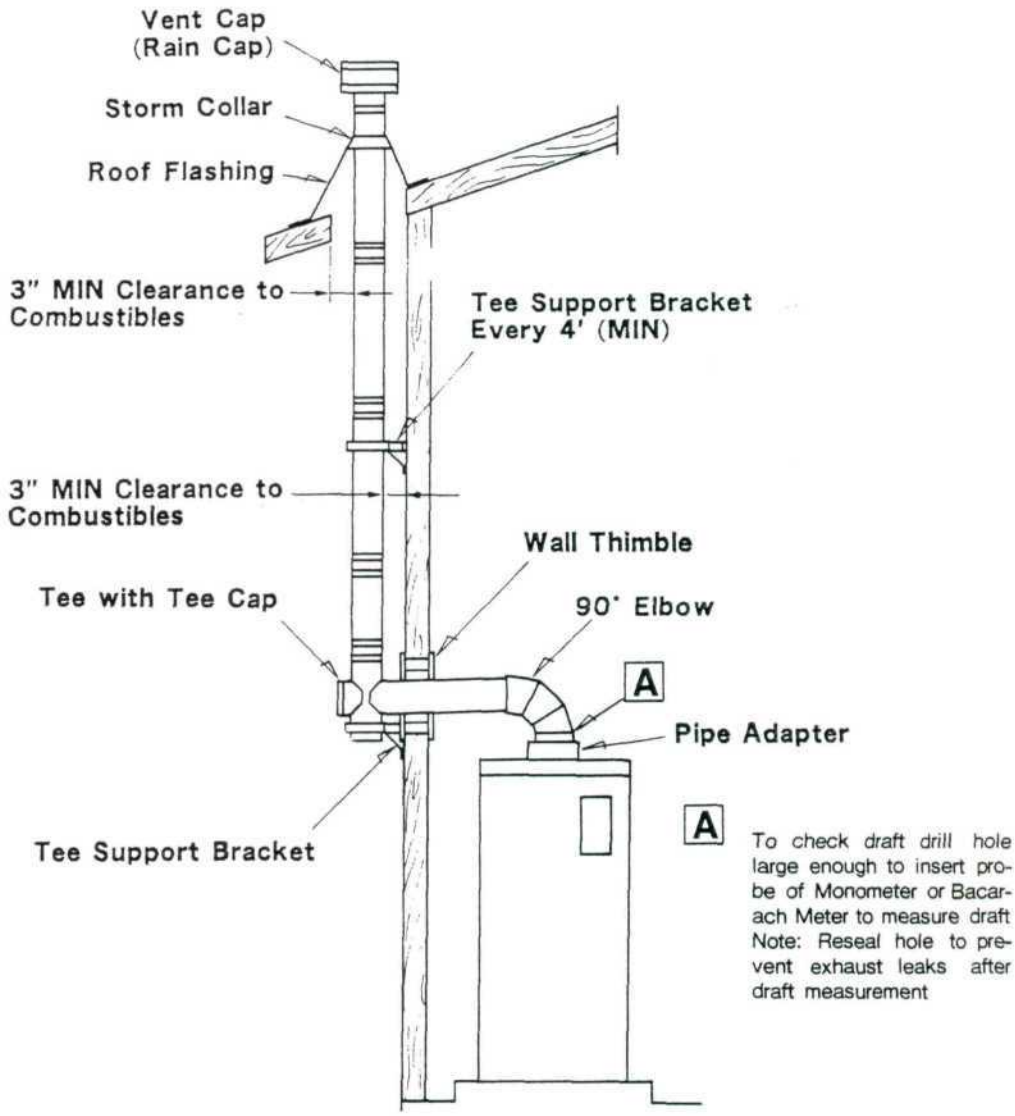
■ GUIDELINES FOR ATTACHING THE FLUE:

(1) Do not make any changes to the diameter of the flue piping.
(2) Seal and lock the connections of the flue.
(3) Use a rain cap to protect the flue from rain and wind coming in.
(4) An insulated wall thimble is required for inserting the flue through any combustible material.
(5) Ensure that minimum distances are met between flue pipes and walls and ceilings.
(6) Flue piping used through the wall should be pitched down 1/4" per foot toward outside. (Side Wall Venting).

6 VENTING INSTALLATION

■ INSTALLATION EXAMPLE (1)

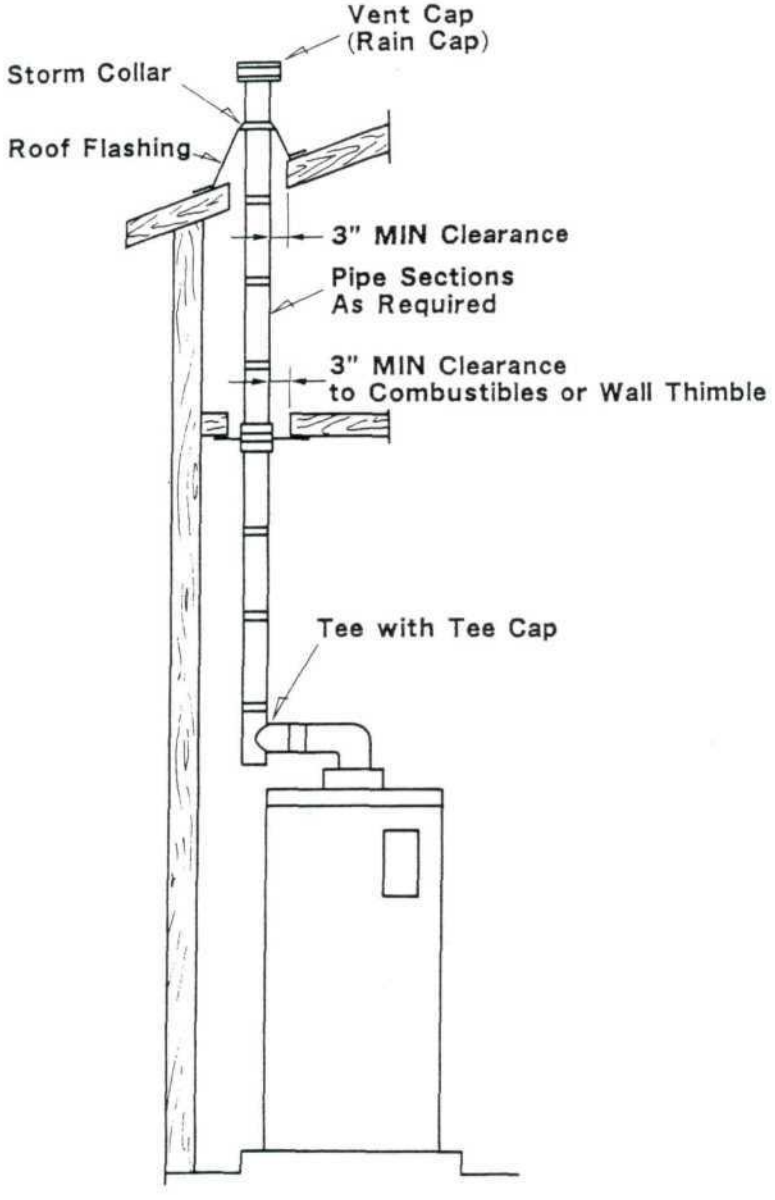
"L"-TYPE VENTING OUTSIDE OR STRUCTURE



6 VENTING INSTALLATION

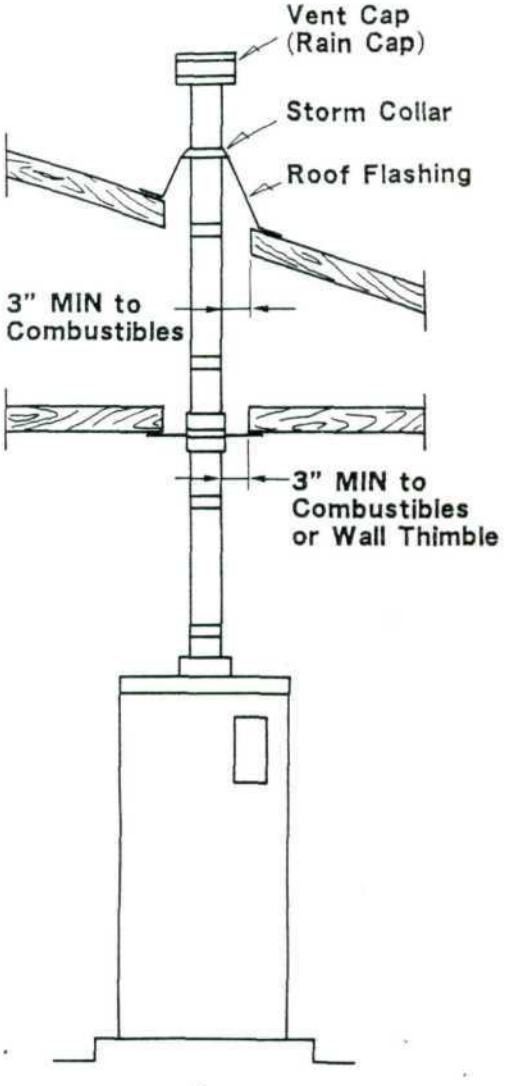
■ **INSTALLATION EXAMPLE (2)**

"L"-TYPE INSTALLATION
Inside of Structure



■ **INSTALLATION EXAMPLE (3)**

VERTICAL VENTING



6 VENTING INSTALLATION

6-4 MPI VENTING KIT & ACCESSORIES

1. MPI-KWH VENT KITS & ACCESSORIES LIST.

All MPI S.W.V. Kit parts can be purchased separately as needed.

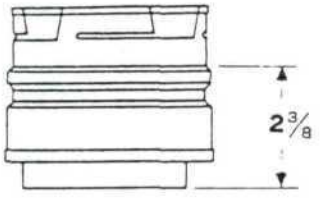
KIT No.	PART NAME	
#8501 S.W.V. Kit	Pipe Adapter	#8517
	90° Elbow	#8518
	Wall Thimble	#8519
	Horizontal Vent Cap	#8520
#8503	Straight Length Pipe	1' Length
#8504	Adjustable Length	1' Length
#8505	Straight Length Pipe	2' Length
#8506	Straight Length Pipe	3' Length
#8507	Straight Length Pipe	5' Length
#8508	45° Elbow	
#8509	Tee With Tee Cap	
#8510	Adjustable Roof Flashing	
#8511	Tall Cone Roof Flashing	
#8512	Rain Cap	
#8513	Storm Collar	
#8514	Tee Support Bracket	
#8515	House Shield	
#8517	Pipe Adaptor	
#8518	90° Elbow	
#8519	Wall Thimble	
#8520	Horizontal Vent Cap	

6 VENTING INSTALLATION

2. MPI-KWH VENT KITS

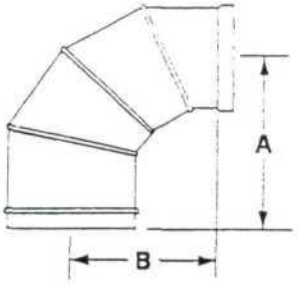
■ **MPI S.W.V. KIT #8501 INCLUDES THE FOLLOWING:**

1 - Pipe Adapter
1 - 90° Elbow
1 - Wall Thimble
1 - Horizontal Vent Cap



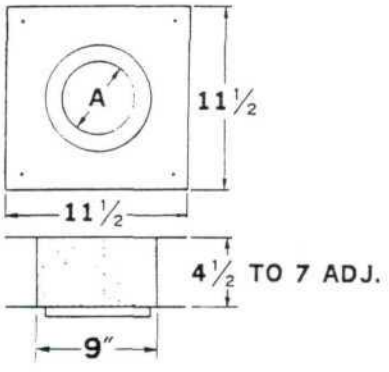
Pipe Adapter

SIZE	4"
A	2 3/8
Unpainted Stock #	8517



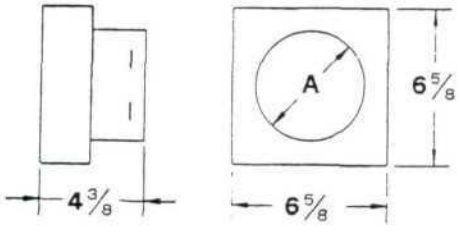
90° Elbow

SIZE	4"
A	6 3/4
B	5 1/4
Stock #	8518



Wall Thimble

SIZE	4"
A	4 3/4
Wall Hole Required	9"
Stock #	8519

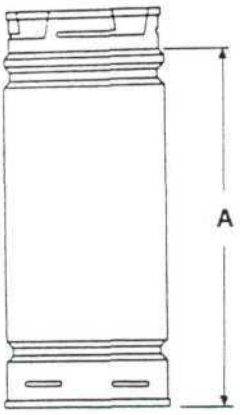


Horizontal Vent Cap

SIZE	4"
A	4 5/8
Stock #	8520

6 VENTING INSTALLATION

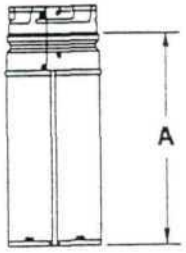
■ **ACCESSORIES**



Straight Length Pipe

SIZE	4"
1' length	8503
2' length	8505
3' length	8506
5' length	8507

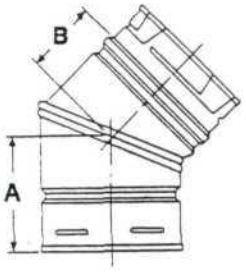
Carries a 3" clearance to combustibles and can be used i n both vertical and horizontal applications. Inner Liner is .012 stainless steel-type #430. Outside casing is .018 aluminized steel.



Adjustable Length

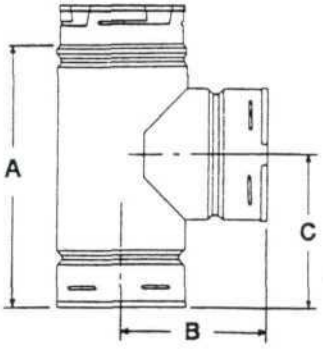
SIZE	4"
A	10 1/2
1' length	8504

Used whenever fixed lengths on MPI Vent Kits are not appropriate because of interior obstructions.



45° Elbow

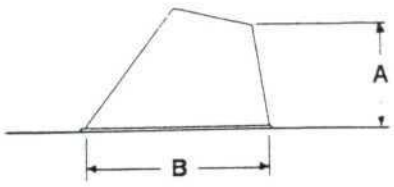
SIZE	4"
A	3 3/4
B	2
Stock #	8508



Straight Length Pipe

SIZE	4"
A	9 1/2
B	5 9/16
C	5 1/2
Stock #	8509

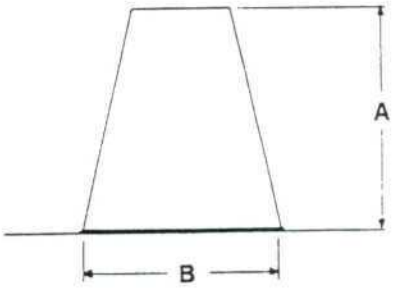
6 VENTING INSTALLATION



Adjustable Roof Flashing

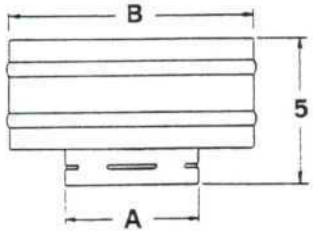
SIZE	4"
A	4 1/4"
B	9"
Stock #	8510

Accommodates roof pitches from 0/12 - 6/12. Tall cone flashing allows 0/12 - 12/12.



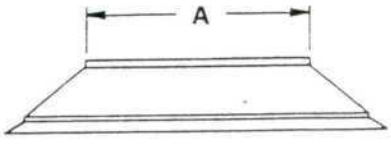
Tall Cone Roof Flashing

SIZE	4"
A	11"
B	9 1/4"
Stock #	8511



Rain Cap

SIZE	4"
A	4 5/8"
B	8 3/8"
Stock #	8512

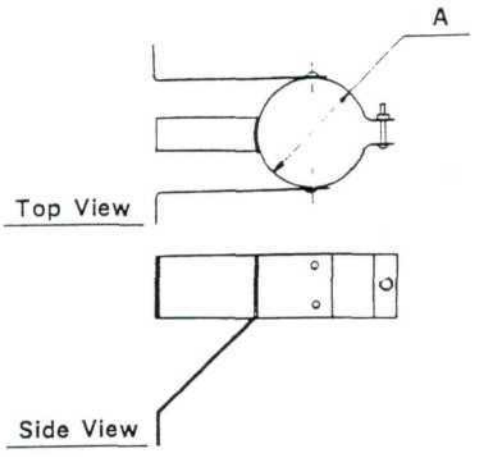


Storm Collar

SIZE	4"
A	4 5/8"
Stock #	8513

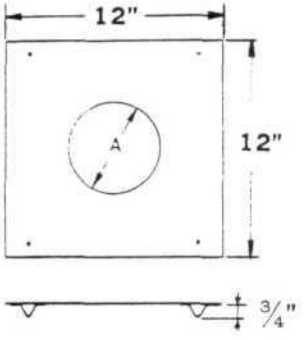
The storm collar slips around the pipe just above the flashing. Seal the inner edge to the chimney with mastic.

6 VENTING INSTALLATION



Tea Support Bracket

SIZE	4"
A	4 3/4"
Stock #	8514



House Shield

SIZE	4"
A	4 3/4"
Stock #	8515

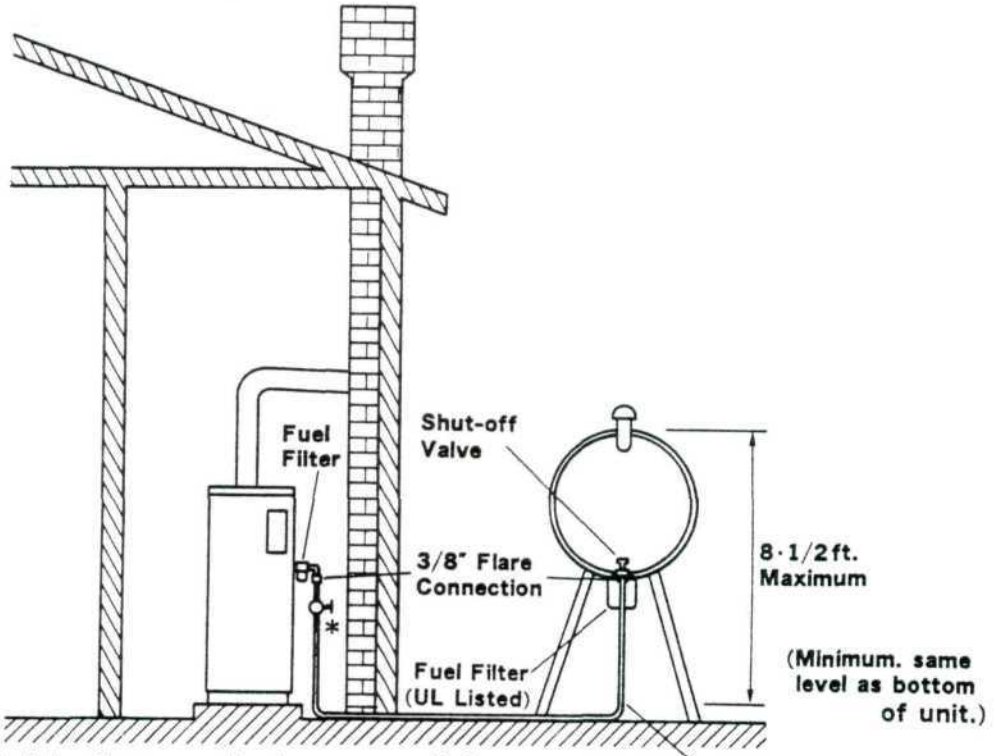
For blower discharge protection in horizontal venting situations.

7 INSTALLATION OF FUEL PIPES

Use only fresh, crystal clear Type 1-K Kerosene (usually referred to simply as "kerosene").
Avoid using deteriorated kerosene.

■ INSTALLATION OF FUEL TANK

1. Fuel tank must be equipped with a shut-off valve that can effectively cut supply of fuel in case of emergency, and with a UL listed fuel filter and drain valve.
2. Fuel tank must be installed in a well-ventilated location. Avoid excessive exposure to sun.
3. When installing fuel tank indoors, check local codes, ordinances and/or NFPA31.
4. When installing fuel tank indoors, a 3 ft. or more open space must be provided around it, and a 6 ft. or more open space must be kept from a source of heat.
5. The KWH124 is fed by gravity from the fuel tank. The inlet fuel pressure must not exceed 2.5PSI. If the inlet pressure exceeds 2.5 P.S.I., a pressure reducer must be used.
6. Insure the top of the tank is no more then 8 1/2 ft. high and the bottom of the tank is the same level as the bottom of the unit.



* Fusible link valve connection is recommended.

CAUTION

When locating the KWH124 below the level of the fuel tank (i.e. in basement), a pressure reducer must be used to prevent the fuel inlet pressure from exceeding 2.5PSI.

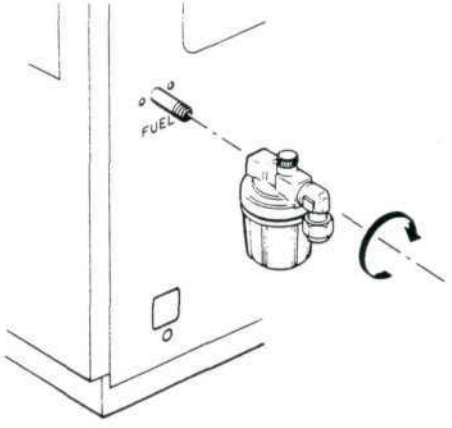
7 INSTALLATION OF FUEL PIPES

■ **INSTALLATION OF FUEL FILTER**

Install a UL listed fuel filter at the tank outlet.
Specifications required of this fuel filter are as follows:
Type of Fuel: Type 1-K Kerosene
Rated Filtering Capacity: 2 G/H (Minimum)

HOW TO INSTALL FUEL FILTER (A Standard Accessory)

1. Wrap the threads (on the right side of the unit) with a sealing tape, or compound to ensure a tight fit.
2. Attach the fuel filter onto the pipe on right side of unit.



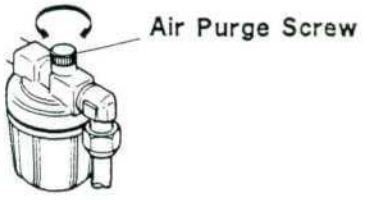
■ **FUEL PIPE**

1. When using copper pipe 3/8 in. (9.52mm dia.), its length should be no more than 50 feet.
2. Prevent any debris from entering the fuel line.
3. Fuel pipe should be kept straight. Bending can hold air bubbles and cause irregular combustion. Do not crimp the fuel line. Piping should include no inverse U-type bends (avoid air locks, which could block the fuel supply).
4. Fuel filter must meet required specifications, and should be installed so that it can be removed for maintenance service.
5. Be professional. Clean up the work area before testing the unit.

HOW TO PURGE AIR (Note: Place a drain pan under filter before purging air)

1. Open fuel supply valve at fuel tank.
2. Loosen air purge screw at fuel filter installed on unit and allow air to escape.
3. Loosen bowl of fuel filter until it fills itself with kerosene. Tighten air purge screw back to its original position.

Caution: Wipe off all kerosene spilled over vessel.



Fuel Filter

■ **MATTERS OF SPECIAL IMPORTANCE**

8 HOT & COLD WATER PLUMBING WORK

1. A licensed plumber familiar with local codes and ordinances should install the KWH124.

2. A water softener is recommended in regions where hard water may be a concern.

3. Do not apply any heat to the unit nipples.

4. Use standard copper alloy unions and nipples for the connections to the unit.

5. • Copper piping is recommended for the hot water supply line.
   Refer to local codes when considering piping materials.
   • Steel piping is not recommended as it may cause rust in the piping.
   • Use NPT for piping of hot and cold water.

6. Connecting plumbing to the unit, hold unit fittings securely with a wrench to prevent damage to the unit.

7. Provide a shut-off valve and a check valve on the cold water supply.

8. An ANSI-listed pressure relief valve should be installed at the hot water outlet connection of the heater at the time of installation. Local codes should govern the installation of the relief devices.
   For safe operation of the heater, be sure that:
   (a) No valve is placed between the relief valve and the heater.
   (b) Discharge from the relief device is routed to a suitable place for disposal when relief occurs.
   (c) No reducing coupling or other restrictions are installed in discharge line.
   (d) Discharge line is installed to allow complete drainage of the device and line.

   Note: Manual operation of pressure relief valves should be done at least once a year.

9. Connection between the heater and places where hot water is used should be as short and direct as possible, and a uniform pipe size of sufficient diameter to carry the full capacity of hot water should be used.

10. Be sure to connect the water inlet and the hot water outlet as shown on the heater. Reversing the two connections will damage the unit.

11. When hot water flows through the supply line there is an inevitable heat loss, regardless of type of heater. Thus, insulation or protection of hot water piping is encouraged.

12. Flush the piping before connecting to the unit.

13. Water flow of 0.45 G/min. or greater is required for igniting the burner.

    Note: To obtain full capacity the unit should have 20PSI (min) of water flow.

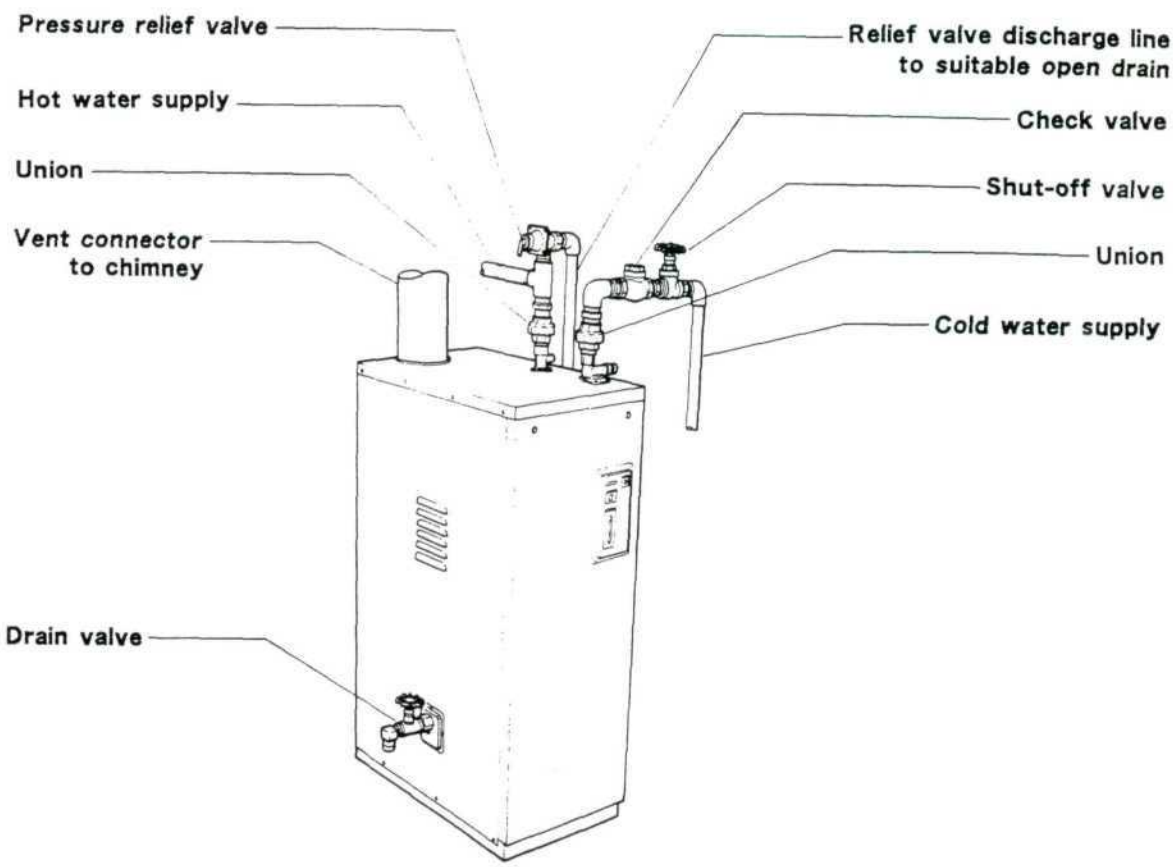
NOTE: Hardness is defined as a characteristic of water which represents the total concentration of calciun.

8 HOT & COLD WATER PLUMBING WORK

magnesium expressed as their calcium carbonate equivalent. When other polyvalent metal ions are present in significant amounts they also are determined and reported as hardness.

The hardness of water originally was defined in terms of its ability to precipitate soap. Calcium and magnesium ions are the principle causes although iron, aluminum, manganese, strontium, zinc and hydrogen ions are capable of producing the same effect. Hardness concentrations originally were expressed as grains per gallon. Now they are reported commonly as milligrams per liter (1 grain PER GALLON = 17.2 mg/L). Levels above 500mg/L hardness are undesirable for domestic use and most drinking water supplies average about 250 mg/L.

■ TYPICAL INSTALLATION



Typical Installation

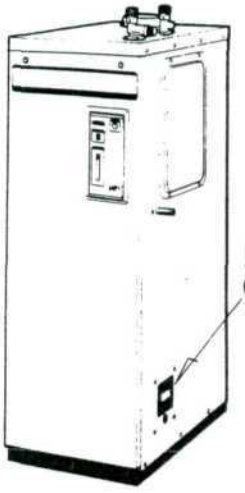
CAUTION

- Do not allow pipes or valve to freeze.
- Refer to FREEZE-PROOFING OF THE PIPING on Page 10 and see owner's manual.
- Do not use this unit as an auxiliary heat source for a solar hot water system, nor hydronic heating.

9 ELECTRIC WIRING

The KWH124 is designed to be permanently connected on the installation site.

1. Power source: 120 volts, 60 Hz single-phase.
2. A licensed electrician should make all electrical power connections.
3. Make certain electrical grounding is provided for the unit.
4. Maximum fuse size for electrical supply should be 15 amp.

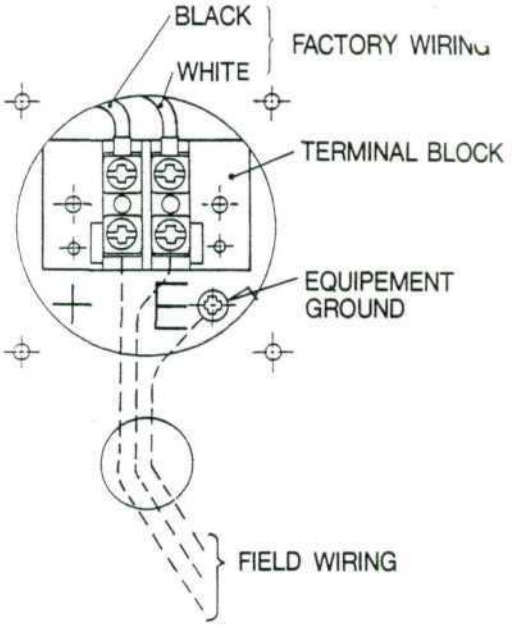


■ CONNECTING POWER SUPPLY

1. Unfasten 4 screws holding the Electric Outlet Cover at the Right Side Exterior cover.

2. Unfasten the 2 screws holding the plastic cover over the Terminal.

3. Please connect the power supply Hot and Neutral wires to the Terminal Block and connect the Ground wire with the Earth or "E" position.



10 TEST RUN

■ PREPARATION

1. Has the flue been installed properly? Adequate clearances? Air intake?
2. Is fuel in fuel tank? Has air been purged from fuel supply pipe? Make sure there is no fuel leakage.
3. Open hot water faucet and see if water comes out. Make sure there is no water leaking from piping.
4. Have electrical connections and grounding been wired properly?

■ OPERATION

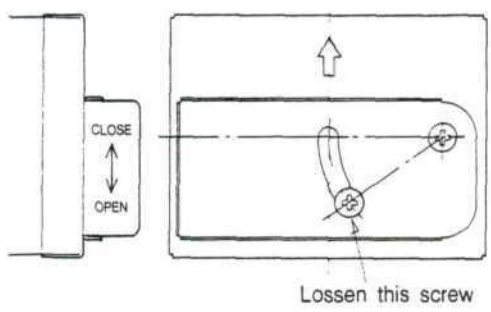
- TURNING ON
  1. Set the hot water temperature adjustment on control panel.
  2. Press the power switch on control panel to turn unit on. "Power lamp goes on."
  3. Fully open hot water faucet and unit will ignite in a few seconds.

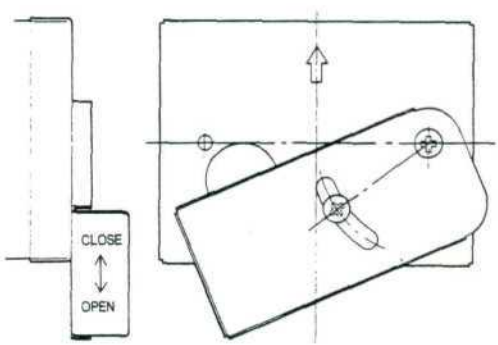
  Caution: Be careful of scald injury when hot water faucet is open.

NOTE

When the unit is installed at about 3,200 feet or higher, please open the air volume control damper.

1. Remove the Front Panel and Access Cover.
2. Loosen the lower screws and adjust the damper.
3. When adjusting the damper, please check the state of burner combustion by checking the draft.





11 OPERATING INFORMATION

11-1 WORKING PRINCIPLES

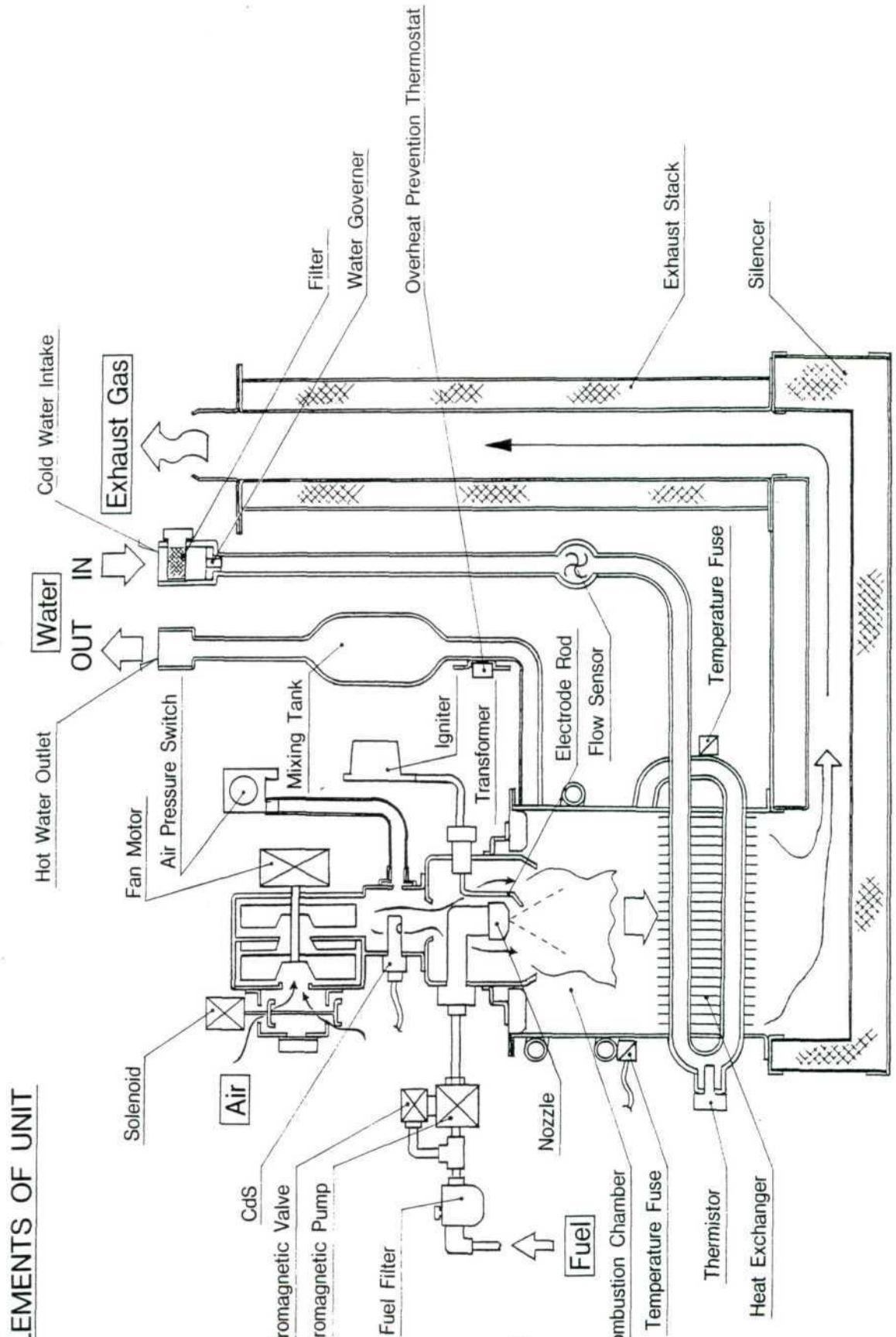
1. Press the power switch on the control panel. "Power" lamp is illuminated and unit is ready for operation.
2. Open a hot water outlet valve or tap. Opening a valve starts the flow of water from the water inlet through the flow sensor, heat exchanger and mixing tank. When the water flow reaches approximately .45 G/min. the fan motor turns on. When fan motor comes up to speed, air pressure is closed and unit is ready for ignition.
3. The prepurge lasts about 5 seconds, after which the ignitors and fuel pump are energized. The unit starts in low mode and as the CDS senses flame intensity building, the "Combustion" lamp comes on. As the burn chamber becomes hot, the heat is transferred to the heat exchanger and, in turn, to the water. If temperature setting and water flow is high enough, the unit will operate at the high burn rate. The thermister senses the temperature of the water as it's being heated, keeping it at a constant level by controlling the high and low burning rate on cycling the unit on and off.
4. Hot water tap is closed. As water flow drops below .32G/min. the flow sensor sends a signal to stop the electromagnetic pump and thus the flame extinguishes inside the burn chamber. At this point, the combustion lamp goes off, followed by a post purge of approximately 150 seconds. After the post purge, the unit will shut off completely unless the hot water tap is opened again in which case the unit will go into prepurge and restart.

■ PATTERNS OF BURNER OPERATION

(○ = ON ● - OFF)

Pattern Load	Electromagnetic Pump	Pump Pressure	Damper Solenoid	Remarks
Low Burn	○	○	○	Output 79,360 BTU/H
High Burn	○	●	●	Output 124,000 BTU/H
Post-Purge	●	●	○	Ready for Operation
Extinquishment	●	●	●	Suspension of Operation

11 OPERATING INFORMATION



11 OPERATING INFORMATION

11-2 PERFORMANCE DATA

■ **QUANTITIES AND TEMPERATURES OF HOT WATER SUPPLIED**
(The maximum quantity of hot water that can be supplied is about 220 G/H.)

Season	Temp of Water Intake	Output of Water/Hr.	Outlet Temp. of Hot Water	Temp. Increases	Outlet Of Hot Water/Min
Summer	77° F	204.76 G	149° F	72	3.41 G
Spring/Fall	59° F	163.80 G	149° F	90	2.73 G
Winter	35.6° F	129.46 G	149° F	113.4	2.16 G

11-3 ERROR CODES

Error codes on the control panel blink to inform the user of irregular operation:

Code Indicators	Cause(s)
4	Loss of ignition in burner. Flame out. CDS wiring disconnection.
5	False flames or short-circuited CDS.
6	Thermister wiring disconnection.
7	Thermister defective or short-circuited. Trouble with the lead wire or the terminal.
8	Overheat prevention thermostat tripped 194° F. Trouble with the lead wire or the terminal.
9	Error in control panel.
E	Problem between control and main PCB. Trouble with the lead wire or the terminal.
H	Main PCB has problem.
P	Fan motor has problem and fails to turn. Trouble with the lead wire or the terminal.

11 OPERATING INFORMATION

11-4 RECOMMENDED MAINTENANCE PROCEDURE

WARNING

Disconnect electrical power before proceeding. Unit should also be cool.

■ **ON A YEARLY BASIS**

- Replace fuel filter at storage tank.
- Check for water due to condensation. Drain if necessary.
- Check and clean fuel filter at unit.
- Check fuel lines and all connections for leaks, kinks, or obstructions. Tighten or replace if necessary.
- Inspect electrical wiring for cracks, signs of deterioration, bare wires, and/or loose connections.

■ **COMBUSTION BLOWER ASSEMBLY -** Remove combustion blower assembly for cleaning and inspection.

- Remove CDS. Check and clean.
- If heavy dust build up, clean out combustion blower.

Note: If gasket is damaged, replace it.

- Check air pressure switch hose for blockage.
- Wire brush and vacuum burner head ring and stabilizer. Inspect for cracks and deterioration.
- Inspect igniter rods for cracks in the ceramics or distortion. Also check rod spacing.
- Vacuum inside of burn chamber. Caution: Be careful not to distort heat exchanger fins located at bottom of burn chamber and be careful not to scratch burn chamber.

■ **ADDITIONAL PROCEDURES -** (On a two- to three-year basis.)

Note: Before proceeding, shut off water supply and drain unit.

- Change nozzle.
- Remove flow sensor and thermistor. Check for scale, mineral deposits or corrosion. Clean or replace if necessary.
- Inspect the water passages of heat exchanger for scale or deposits. Flush and clean if necessary.

■ **FOUR- TO FIVE-YEAR BASIS**

- Remove burn chamber heat exchanger and clean thoroughly all carbon and soot deposits.
- Clean and vacuum silencer assembly.

Note: Gaskets should be replaced.

- Check O-Ring seals for cracks or deterioration and replace if necessary. Inspect burner head replace if cracked or distorted.

12 TROUBLE SHOOTING

A.) TROUBLE SHOOTING: GUIDELINE & CORRECTIVE MEASURES

The following information is submitted for you to better understand the operation of the KWH124.

- Minimum water flow is required. This unit does not ignite the burner unless there is a flow of water running through the unit at .45G/min.

- Change in hot water temperature when a multiple of hot water valves are opened. When more than two hot water valves are opened concurrently, the volume and temperature of water from each of these outlets can differ depending on the piping layout and to the extend at which valve is opened. Especially, change in the temperature and flow of water from the shower is likely to occur when hot water is tapped from another outlet(s) concurrently.

- Opaque hot water. Hot water may look opaque immediately after it is dispensed. The opaqueness goes away eventually and hot water becomes transparent. The reason for this is that the heated air mixed in the water is compressed and expands to the atmospheric level once it is out of the outlet, turning into minute bubbles. Nothing is wrong with this.

- White smoke off the exhaust of the flue. In winter, the vapor in the exhaust gas can turn into water drops and come off from the exhaust port in the form of white steam. Nothing is wrong with this.

- Sound of fan motor is audible awhile after the hot water dispenser valve is shut. The fan motor continues run awhile in order to drive exhaust gas out of the combustion chamber even after the hot water valve is shut off. Fan motor will stop in about 150 seconds.

12 TROUBLE SHOOTING

B.) ERROR CODES - THEIR POSSIBLE CAUSES AND POSSIBLE SOLUTIONS

[4] *DETECTION OF BURNER IGNITION FAILURE AND LOSS OF FLAME*

Causes of Troubles	Countermeasures
(1) Defective flow of fuel a. No fuel in the fuel tank b. The fuel valve on the fuel tank is in the off position. c. The fuel line is broken. d. Water and/or dust in the fuel line. e. Fuel filter is clogged with dust and debris. f. Insufficient fuel filter air purge.	Loosen the air purge screw at the fuel filter and see if fuel comes out. If no fuel comes out, check 1 through 3 again.
(2) Irregular sparking at igniter rods a. Improper fitting of igniter terminal b. Soot or carbon has gathered on igniter rods. c. Improper positioning, spacing and contact of igniter rods. d. Voltage is low (sparks are weak). e. Defective igniter (does not spark.) f. Crack in insulator of electrode.	Remove the burner. Pull and disconnect the terminal of the "electromagnetic pump" from the baseboard. Turn on hot water supply switch and see whether or not the igniter rods spark. (If not, check 1 through 3 again). Caution: Igniter rods operate at high voltages. Be careful to avoid electric shock hazard.
(3) No fuel running from nozzle or vaporizing trouble. a. Defective electromagnetic pump. b. Clogged nozzle.	Remove the burner. Place on a metal box with burner head facing away from source. With igniter leads disconnected, open up a hot water outlet. Unit will start at which time the spray pattern is observed for even spray. If no spray, pump is bad. If uneven, nozzle is clogged. (Dealer should do this at his shop to avoid fuel spray damage.)
(4) CDS is not working properly. a. Accumulation of soot on CDS light reception surface. b. Accumulation of soot on Burner Head. c. CDS is not properly fitted in place. d. CDS has wiring problem or CDS has too high a resistance value.	Pull and disconnect the terminal of CDS from the base. Use a tester to check the resistance of CDS. While doing so, turn on hot water supply switch, and measure the resistance value immediately after the electromagnetic pump was activated. If the value is more than 60K ohm, check a through d above.
(5) Exhaust gas recycles inside the unit.	Check the flue and its installation.
(6) Insufficient air supply.	Check air intake grill and air damper for blockage.
(7) Trouble with the printed circuit board.	Check 1 through 6. If nothing is wrong after having checked 1 through 6, replace the printed circuit board.

12 TROUBLE SHOOTING

[5] *DETECTION OF FALSE FLAMES CDS SHORT-CIRCUIT*

Causes of Troubles	Countermeasures
(1) CDS short-circuit (resistance 0 ohm). (2) CDS detects false flames. a. CDS is not fitted properly in place. b. Front panel doors are left open when the unit was turned on. c. Burner stabilizer gathered so much soot that flames do not go out when the unit is shut off.	Pull off the terminal of CDS from the main board. Use a tester to measure the pre-operation resistance value of CDS. If the value measured is less than 80k ohm, check a through c.

[6] *BROKEN WIRE OF THERMISTER*

Causes of Trouble	Countermeasures
(1) Broken wire of thermister or thermister terminal has come off the PCB or a defective connector.	Pull off the thermister terminal from the main board. U a tester to measure its resistance value. If the va measured is more than above 30k ohm (at 32° F), check the connections at the terminal. If the connections are good, then replace the thermister.

12 TROUBLE SHOOTING

[7] *(1) THERMAL OVERHEAT PROTECTOR WAS ACTIVATED (2) THERMISTER VALUE IS TOO LOW*

Causes of Troubles	Countermeasures
(1) Thermal overheat protector. Trouble with the printed circuit board.	Replace with another printed circuit board, and see if the cause of the trouble has been removed.
(2) Thermister value is too low. Thermister resistance value is low compared to the temperature of water in the heat exchanger. (Refer to chart further in this manual on page 54.)	Use a tester to measure the resistance value of the thermister. If the value measure is less than 800 ohm, replace the thermister.

[8] *OVERHEAT SENSOR WAS ACTIVATED 190° F*

Causes of Troubles	Countermeasures
(1) Trouble with the thermister is the cause of overheating.	Measure the resistance value of the thermister. Compare the value measured with the specific characteristics graph (on page 53). If the comparison shows that the measured resistance of the thermister is not up to par, replace the thermister.
(2) Trouble with the printed circuit board.	Replace with another printed circuit board, and see if the cause of the trouble has been eliminated.
(3) Broken wire of the thermostat.	Use a tester to see if there is continuity.

12 TROUBLE SHOOTING

[9] *TEMPERATURE CONTROL SLIDE REOSTAT*

Causes of Troubles	Countermeasures
(1) Temperature control reostat is corroded, has a burnt spot or broken wire.	Slide control up and down several times if burnt or broken Replace the printed circuit board of control panel.

[E] *TROUBLE WITH COMMUNICATION CIRCUIT*

Causes of Troubles	Countermeasures
(1) Trouble with connections and/or wiring of either the printed circuit board of the unit or of control panel.	Check the continuity of the cord with a tester. Check the connections on the PCB, and also the screw connection on control panel.

[H] *DETECTION OF IRREGULAR PERFORMANCE OF PRINTED CIRCUIT BOARD*

Causes of Troubles	Countermeasures
(1) Irregular performance of the printed circuit board of the unit. Diagnose for whole PCB and safety. Governed in microprocessor.	Replace the printed circuit board.

[P] *FAN MOTOR STOPS WHEN IT SHOULD NOT/TROUBLE WITH AIR PRESSURE SWITCH*

Causes of Troubles	Countermeasures
(1) The combustion blower gathered dust and/or foreign substance, therefore, the fan cannot turn.	Clean the fan and motor blade.
(2) Temperature inside the unit has risen excessively tripping thermal overheat protector on blower motor.	Check if there is any leaking exhaust gas from the packing of the combustion chamber silencer, etc. Also check if there is trouble with the heat exchanger. If this is the case, replace it.
(3) Trouble with the fan motor capacitor.	Change to a new capacitor.
(4) In extremely windy conditions, operation may stop.	Wait for wind to diminish, then reset.

12 TROUBLE SHOOTING

(C) CAUSES OF TROUBLES AND IRREGULARITIES WHICH ARE NOT REFLECTED IN MONITOR INDICATOR LAMPS.

[1] *DESIRABLE TEMPERATURE OF HOT WATER IS UNOBTAINABLE* - *(Power Source & Combustion Lamps Are ON)*

Causes	Countermeasures
(1) Piping for water intake and supply of hot water have been installed in reverse order.	Correct Piping arrangement.
(2) Trouble with fuel line. (Fuel is not running through adequately).	
a. There is water and/or dust in the fuel line.	Clean.
b. Fuel filter is clogged with debris.	Clean.
c. Inadequate fuel filter air purge.	Purge air from fuel filter.
d. Fuel line is broken.	Repair fuel line.
(3) Burner-related troubles.	
a. Combustion area has gathered soot and carbon.	Clean soot.
b. Quantity of fuel has been reduced due to trouble with the electromagnetic pump.	Check and replace.
c. Fuel nozzle has clogged.	Check and replace.
(4) Trouble with temperature controller.	Check and replace the printed circuit board for control panel.
(5) Trouble with the thermister sensor.	Check and replace.
(6) The unit has exhaust gas cycling in it.	Check the flue, and make sure that exhaust gas does not come back into the unit.
(7) Scaling in heat exchanger.	Flush or replace heat exchanger.

12 TROUBLE SHOOTING

[2] *NO HOT WATER/BURNER DOES NOT IGNITE - (Power Source Lamp ON - Combustion Lamp OFF)*

Causes of Troubles	Countermeasures
(1) Flow sensor does not sense running water. a. Flow sensor has clogged. b. Lead wire of flow sensor has been disconnected. c. Thermister of flow sensor has a broken wire.	Dismantle and clean the flow sensor. Check the lead wire. Measure resistance value.

[3] *POWER LAMP DOES NOT LIGHT - (Power Source Lamp and Combustion Lamp OFF)*

Causes of Troubles	Countermeasures
(1) Circuit breaker has tripped.	Check the circuit breaker.
(2) Trouble with control panel circuit board. A defective transformer.	Change control panel. Take out the transformer. Check resistance between terminals.
(3) Improper connection on control panel PCB (printed circuit board) corrosion or poor contact at terminal block of incoming power supply.	Check all connectors for proper connections. Disconnect, clean and re-tighten all connections.
(4) The control cord is broken.	Check the control cord.
(5) The fuse (6A) of PCB has blown.	Correct the problem that caused the fuse to blow. Then replace the 6A fuse (if fuse blows again, replace PCB). Check transformer for resistance or short.
(6) Over temperature fuse has a broken wire or has tripped.	Correct the problem that caused the over temperature to blow. Then replace the over temperature fuse.

12 TROUBLE SHOOTING

[4] *STRANGE SOUND IN COMBUSTION/SOOT IS PRODUCED/SMELL OF KEROSENE*

(Power Source Lamp & Combustion Lamp is ON)

Causes of Troubles	Countermeasures
(1) Fuel/fuel pipe-related problems.	
a. Fuel has run out.	Supply fuel and purge air.
b. Clogged fuel filter.	Clean fuel filter.
c. Dust and/or water in pipe.	Clean fuel piping.
d. There is moisture in fuel tank.	Clean fuel tank.
(2) Burner-related problems.	
a. Combustion chamber gathered soot.	Clean soot.
b. Wrong size of nozzle, ignition & stabilizer.	Use right sizes.
c. Trouble with electromagnetic pump (bypass solenoid, return-pipe, accumulator).	Check and replace.
d. Clogged nozzle.	Check and replace.
e. Fan motor is unable to turn.	Check for obstruction , a bad capacitor or bad motor.
(3) The flue is not installed/connected properly or it has clogged.	Check and clean the flue.
(4) Other fuels (such as light oil) other than kerosene was used.	Drain all bad fuel off. Use kerosene only.
(5) The unit is not receiving sufficient air. There is no intake louvers in the room where the unit is located.	Provide air intake ports or louvers.
(6) The unit is installed at high altitudes (3,200 feet or higher).	Open the damper at the Blower and check the state of burner combustion (see page 31).

12 TROUBLE SHOOTING

[5] *SMOKE IS COMING OFF THE UNIT/PAINT ON THE EXTERIOR HAS BURNED DUE TO EXCESS HEAT*

(Power Source Lamp and Combustion Lamp ON)

Causes of Troubles	Countermeasures
(1) Burner is not installed properly. (Screws are loose, burner packings are not in place.)	Check and repair.
(2) Silencer is not installed properly. (Screws need tightening, burner gaskets are not in place.)	Check and repair.
(3) Heat exchanger has warped resulting in leaking gas. Heat exchanger has a hole.	Check and repair.

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

1) BURNER & BURNER HEAD

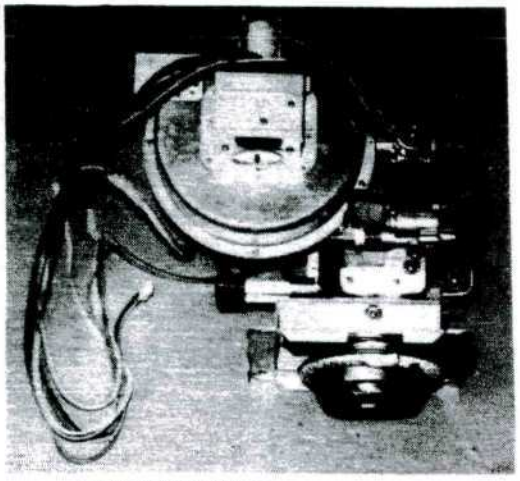
The unit is equipped with a newly developed "one nozzle, two-stage combustion burner." This burner is capable of creating two different levels of combustion, high and low, by changing the output pressure of the electromagnetic pump. The burner controls the air damper so that the right amount of air is fed into the combustion chamber in accordance with change in the output pressure of the electromagnetic pump.

BURNER HEAD UNIT

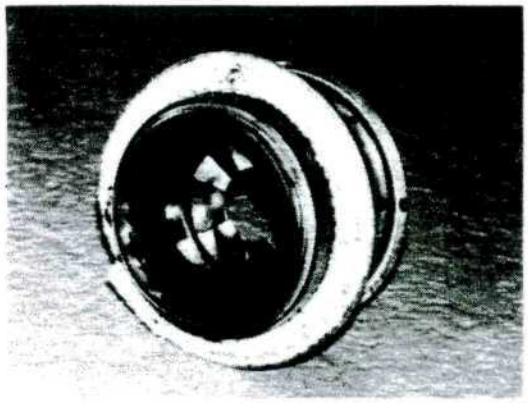
In order to create combustion in the most efficient way, something else in addition to vaporized kerosene from the nozzle ignition and air from the fan motor is needed. This is the stabilizer.

The stabilizer (combined with the burner head) make up a component (stabilizer is also called flame securing system).

The stabilizer can gather carbon and may cause the burner to malfunction. One of these symptoms is called vibrating combustion. It is, therefore, important to clean the stabilizer on a regular basis.



BURNER UNIT



BURNER HEAD UNIT

HOW TO CHECK

The best method to check the state of burner combustion is to ignite it in the atmosphere, and check the condition of ignition and flames.

Major checkpoints are:

1. There is no electric discharge at the tip of the ignition rods.

   Igniter transformer is defective.
   Ignition rods are defective.
   Soot has gathered on ignition rods.

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

	HOW TO CHECK

2. Burner gets ignited, but flames do not hold up
   Nozzle is defective.
   Stabilizer is defective.
   Electromagnetic pump unit is defective.

3. Flames stretch out perpendicularly (Long Lazy Flame).

   Rectifier tube which is a can-shaped perforated cylinder through which combustion air passes is clogged.
   Fan motor is malfunctioning.

4. Delayed ignition or burner cannot be ignited.

   Position and size of ignition rods are incorrect.
   Nozzle is defective (does not vaporize properly).
   Electromagnetic pump is defective (gets insufficient pressure).
   Either solenoid or damper is defective (solenoid does not work).

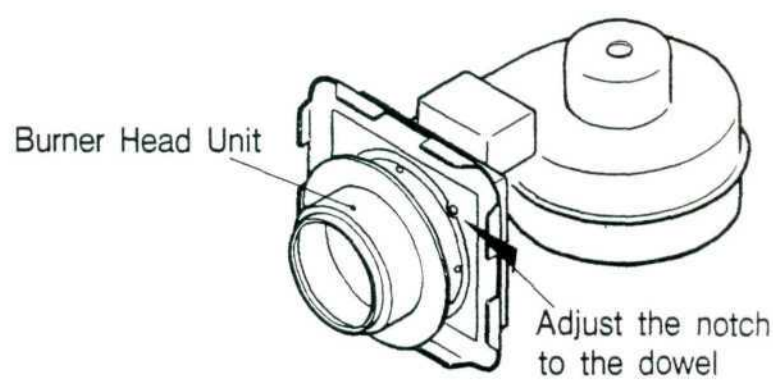
5. Burner gets ignited, but flames are not normal.

   Electromagnetic pump is defective.

NOTE:

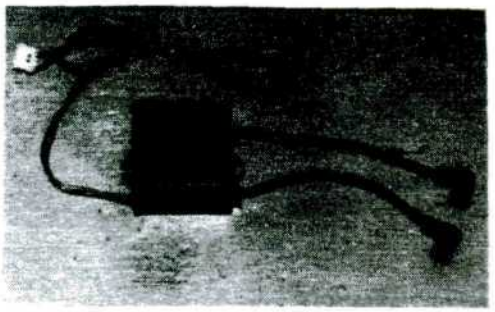
- If the fuel pipe has been disconnected for atmospheric combustion, the stability of flames will not be achieved if air inside the fuel pipe is not completely purged out.

- **Installing Direction of Burner Head Unit**
  Please adjust the notch of Burner Head Unit to the dowel,
  which will set position, and then fasten 4 screws.



13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

2) IGNITER TRANSFORMER

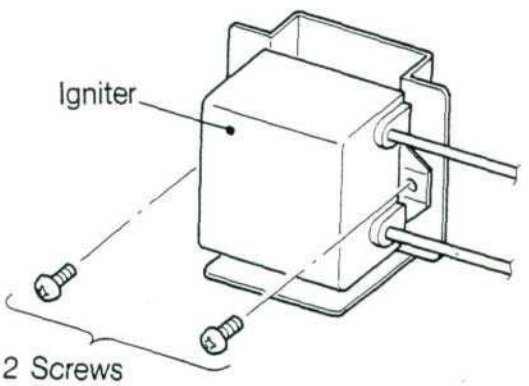


To ignite vaporized kerosene from the nozzle, two ignition rods are placed close to the nozzle, and high voltage is applied to the tips of these rods to create sparks. Kerosene is ignited by these sparks. The igniter transformer increases the incoming voltage of 120 volts up to 17,000 volts. The igniter transformer for this unit is of the electronic type.

HOW TO CHECK	NORMAL	TROUBLE
1. Disconnect the connector of the electromagnetic pump lead wire from the PCB.		
2. Turn the unit on and listen for the sound of the electrodes to be audible	There is audible sparking sound.	Spark sound is inaudible.

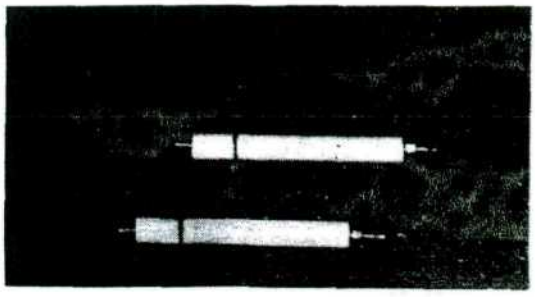
PRECAUTION

- Handle igniter carefully as high voltage runs through igniter.
- Grounding the Ignitor Transformer.
  Make sure the two transformer mounting screws are tight and secure so that they provide a good ground.



13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

3) ELECTRODES



Electrode is the instrument used to ignite vaporized fuel. When the electrode gathers soot, current leaks occur, causing weak discharge at the top end of electrode. If ignition does not occur even after cleaning the electrode, it must be replaced.

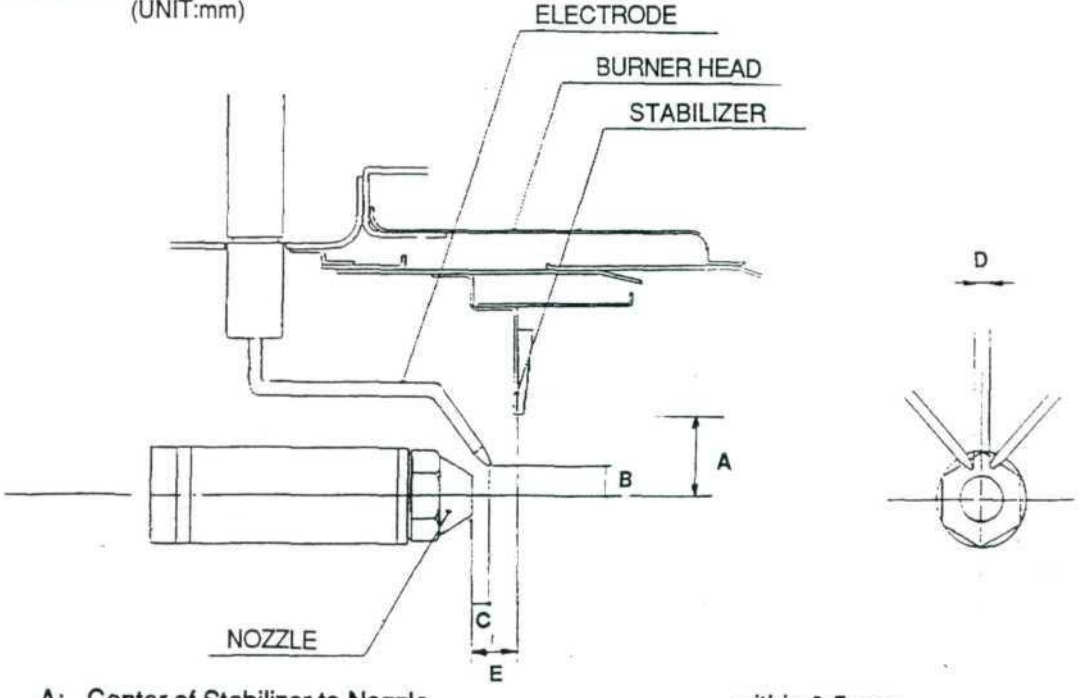
If correct distance is not maintained between electrode and nozzle ignition may not occur even if there is discharge at the tope end of electrode. This situation can be corrected by adjusting the distance between the two.

Check the resistance of Flame Sensor (CDS) and the electrodes positioning first if there are frequent ignition failures.

HOW TO CHECK (See Pages 80 and 81)

Check if there are any cracks in the ceramics.
Check if carbon has accumulated which could cause possible voltage leaks.

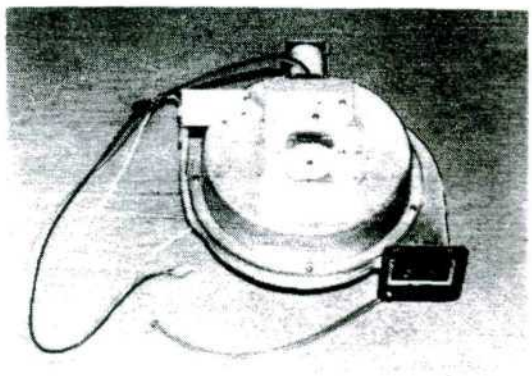
Relative position of electrodes. (UNIT:mm)



A:	Center of Stabilizer to Nozzle	within 0.5 mm
B:	Center of Nozzle to Electrode Rod Tip	6.0 - 6.5 mm
C:	Surface of Nozzle to Electrode Rod Tip	3.0 - 3.5 mm
D:	Distance between Electrode Rods	2.25 - 2.75 mm
E:	Distance from Surface of Nozzle to Stabilizer	10 mm

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

4) FAN MOTOR UNIT



Fan motor sends compressed air, necessary for combustion, to combustion chamber.

Air damper is fitted at the air intake port of fan motor, so that proper combustion air has been adopted for this system. There is high and low, automatically changed in accordance with the quantity of fuel being burned. An air volume control (a delicate control) is attached by a screw on the damper casing. This control may need to be adjusted for altitudes above 3,000 ft. (see page 31). This adjustment would be determined by exhaust draft readings.

Fan blades must be kept clean. Dirty fan blades may not produce enough air for effective combustion. Dirty blades need cleaning. Clean the blades once a year.

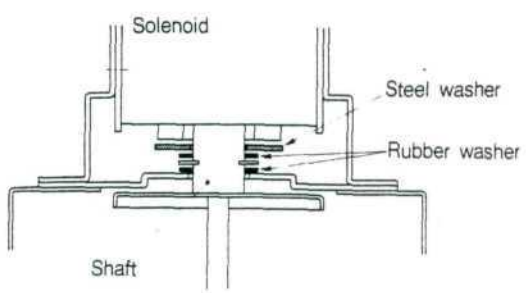
The fan motor is of a condenser type. A double turbo is used for the blades.

The motor has a built-in overload prevention system, which comes into play when the motor has trouble or when the temperature in the inside of the unit rises excessively. The overload protector will reset automatically when motor cools to normal operating temperatures.

HOW TO CHECK	STANDARD VALUE
MOTOR (1) Pull off the fan motor terminal from the printed circuit board. (2) Using a multi-meter, measure resistance at the terminals coming from the fan motor.	Resistance Value About 33 ohm - 38.5 ohm (at 68° F)
SOLENOID (1) Pull off the solenoid terminal from the printed circuit board. (2) Using a multi-meter, measure resistance at the terminals coming from the fan motor.	Resistance Value 1.5k ohm 15% (at 68° F)

NOTE:

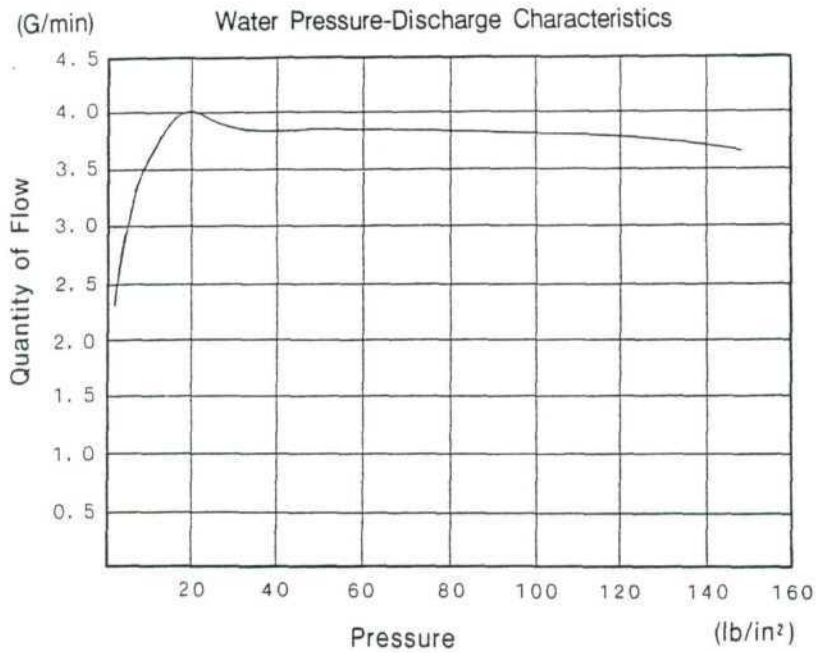
- When changing a solenoid, position rubber washers correctly.
- ★ Don't forget to install the restrictive plate.

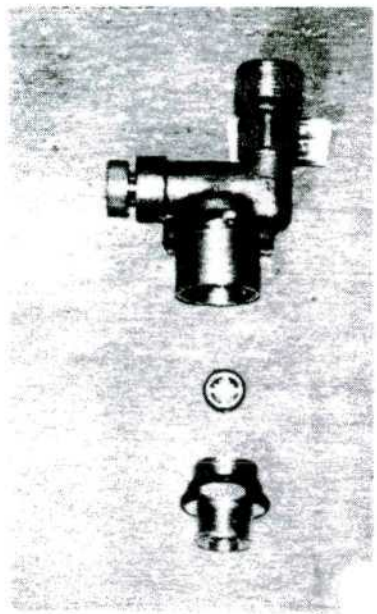


13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

5) WATER GOVERNOR

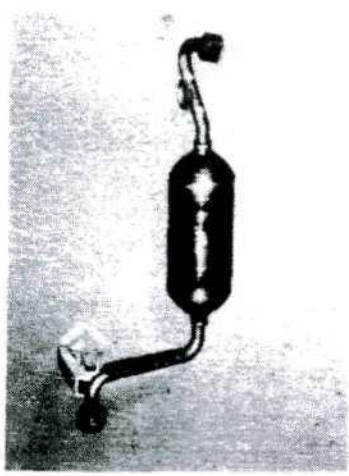
The water governor ensures a constant quantity of water to flow into the unit irrespective of change in tap water pressure. Maximum water flow approx.. 220 gal/hr.





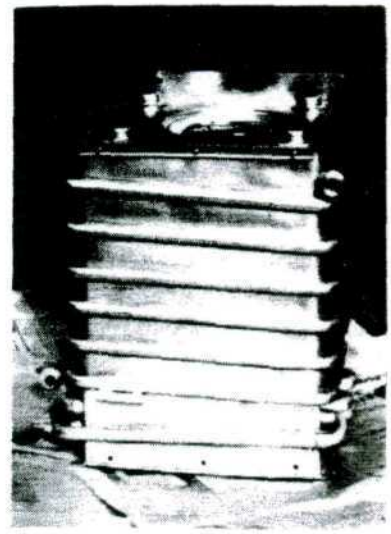
6) MIXING TANK

Hot water from the heat exchanger is mixed here, to obtain an even temperature at the outlet.



13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

/) HEAT EXCHANGER (BURN CHAMBER)



The heat exchanger transfers heat from the burning process to the water. The heat exchanger used for the unit has copper fins. It is small and light, but has a high thermal efficiency.

This heat exchanger's capacity for water holding is only 0.264G. Water, therefore, is heated quickly.

This heat exchanger is equipped with a thermister (for hot water temperature control), and a set of over temperature fuses.

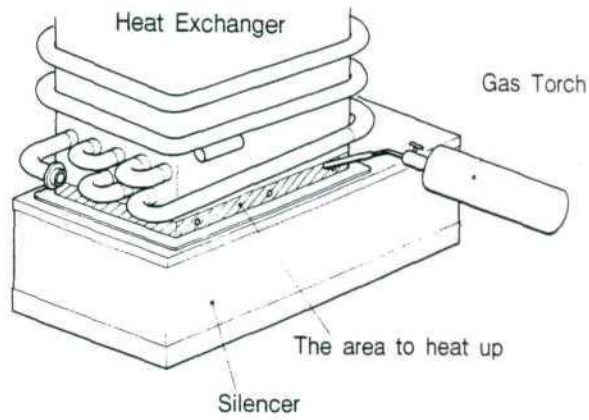
NOTE:

- Removal of Heat Exchanger

  You may experience difficulty in trying to remove the Heat Exchanger from the silencer. This may be due to hardening of the sealant which can be heated with a propane gas torch to soften and loosen sealant.

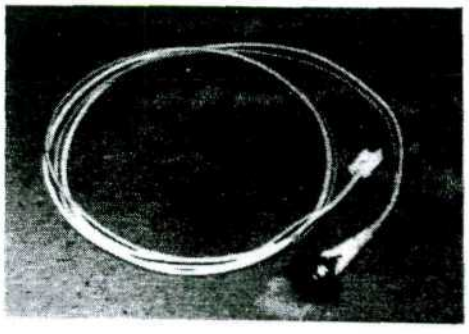
- Handling Heat Exchanger

  The Heat Exchanger/Burn Chamber is constructed primarily of copper be careful not to scratch or dent since it is soft.



13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

8) THERMOSTAT FOR PREVENTION OF OVERHEATING



This thermostat will be activated when the burner operations stays on due to trouble with the temperature controller, or thermister. The thermostat overheat protector is located on the hot water outlet line under the mixing tank.

When the temperature of the heat exchanger rises to about 190° F, the contact point of the thermostat is cut, and stops the unit while triggering the alarm.

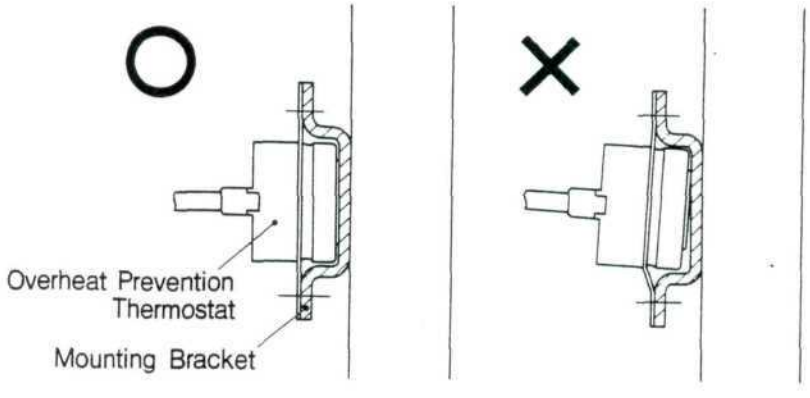
When the temperature gets down to the normal level, below 174° F, the user is required to press the on/off switch on control panel to restart the unit.

HOW TO CHECK	NORMAL
(1) Pull off the thermostat from PCB (2) Bring the probe of a multi-meter to the terminal of the thermostat and measure resistance.	Less than 50m ohm

NOTE:

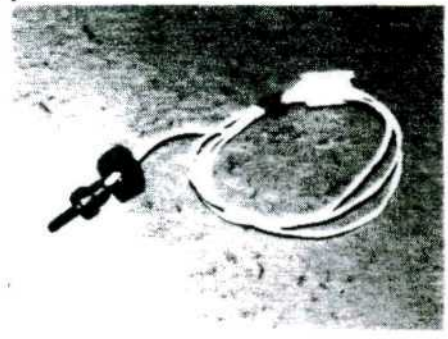
Thermostat for Prevention of Overheating

Please attach the Thermostat securely to the Mounting Bracket so that it makes good contact.



13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

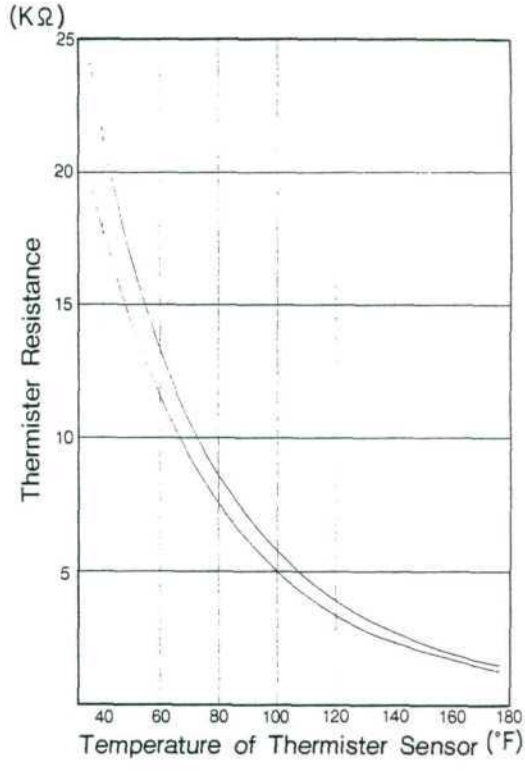
9) THERMISTER SENSOR (TEMPERATURE DETECTOR)



The temperature control system for this unit is made of (1) thermister sensor (temperature detector), (2) temperature adjuster (for presetting of a desirable temperature), and (3) PCB (printed circuit board).

The thermister sensor is fitted in the heat exchanger and senses the current temperature of hot water. Thermister sensor unit has a copper casing containing a thermister.

Thermister's resistance changes to a great extent, as shown in the graph, subject to the prevailing temperature of hot water. The temperature control circuit in PCB detects thermister resistance, and controls the temperature of hot water to be supplied.



Checking thermister sensor can be made by measuring its resistance before the unit goes into operation (before water is heated) and its resistance after the unit goes into operation (when water is heated), and then compare these resistance values measured with the specific values shown on the graph.

Note: If scale or mineral deposits form on sensor its sensitivity may be impaired, and sensor may need to be cleaned or replaced.

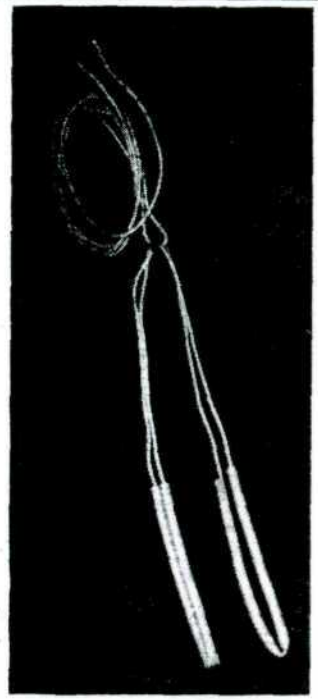
13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

HOW TO CHECK	NORMAL	TROUBLE
To check thermister resistance: (1) While keeping "ON-OFF" switch on control panel in the off position, open the hot water dispenser valve. When cold water starts running out of the faucet, close the valve.	Corresponds to the graph on page 53.	Does not correspond to the graph on page 53.
(2) Disconnect the thermister terminal from PCB. Measure its resistance with a multi-meter.	3.485k ohm ± 10% (at 122° F)	
(3) While keeping the tester in contact with the terminal, swing and pull lightly the lead wire of the thermister. Watch if the tester needle swings (includes momentary swings).	Resistance does not change.	Resistance changes.

NOTE: If the overheating prevention device turns OFF when hot water is tapped in small quantity, it is possible that thermister has become insensitive and has ceased to change resistance. In this case, check thermister resistance, also check sensor itself for build-up.

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

10) OVER TEMPERATURE FUSE



There are two temperature fuses wired in series, and mounted one on each side of Heat Exchanger.

These fuses activate when the temperature of the heat exchanger rises extremely high. Primary reasons being burst heat exchanger or drain valve opened with unit turned on.

When either fuse is blown out, power will be suspended, turning off all lamps on control panel.

The over temperature fuse will be blown when the temperature of the heat exchanger reaches 302° F.

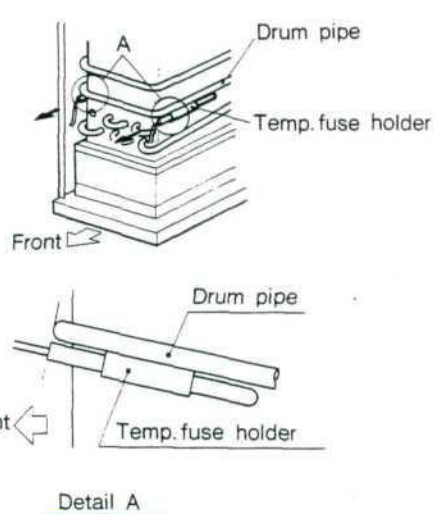
When either fuse is blown, replace both, trouble shoot and repair the unit, then replace the blown out over temperature fuses with a new one.

HOW TO CHECK	NORMAL
(1) Pull off the terminal of the temperature fuse from PCB. (2) Bring the probe of a multi-meter to contact with the terminal of the fuse and measure resistance.	Resistance Value. Less than 1.5m ohm.

Note:

- The temperature fuse comes as a set and thus has to be replaced as a set.
- Check the position of Over Temperature Fuse.

1. Remove the temp. fuse from temp. fuse holders which are set at left and right side of the Heat Exchanger.
2. Set the new one into the temp. fuse holders. Please make sure to line up the insulation tube of temp. fuse and the surface of drum pipe.



Detail A

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

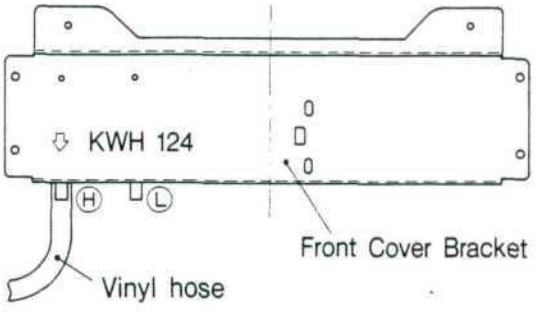
11) AIR PRESSURE SWITCH

This is a safety device which is tripped when fan motor stops for some reason. When this switch is activated, the indicator [P] starts blinking.

HOW TO CHECK	NORMAL	TROUBLE
(1) Disconnect this switch from PCB. Bring the probes of a multi-meter in contact with the terminal of the switch. (2) Blow air lightly into the pressure sensing side of the switch, and see if the needle changes its position.	Before blowing air infinity ohm reading. After blowing air lightly less than 500m ohm.	No change in needle position.

Note:

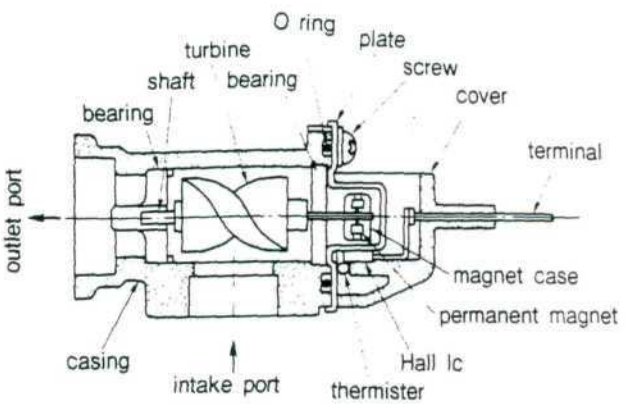
- Extremely strong gusts of wind blowing into flue pipe or chimney may cause this switch to trip.
- The vinyl hose plugs into the high side of the switch which is marked with an arrow for easy identification.

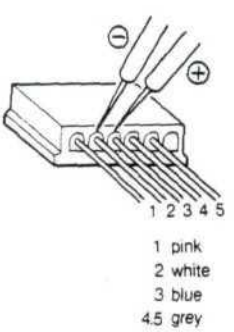


13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

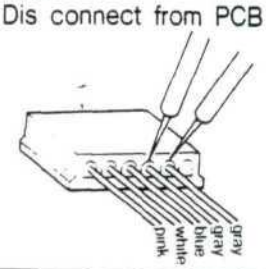
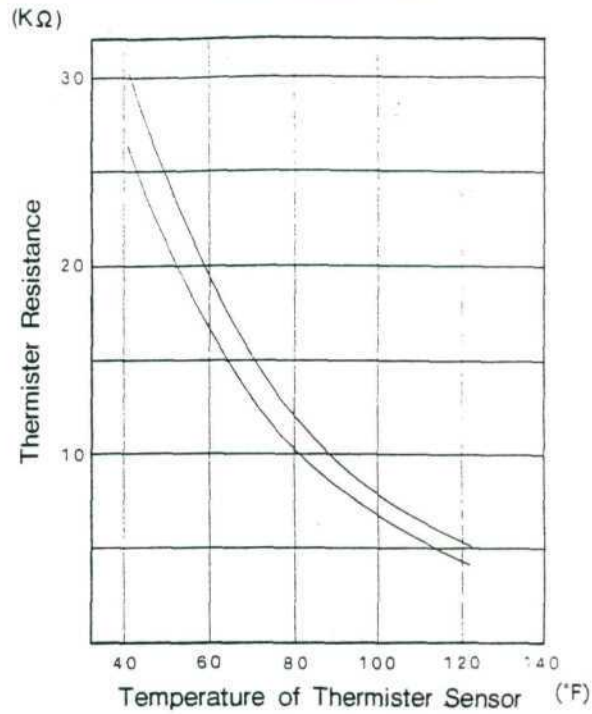
12) FLOW SENSOR

The flow sensor measures water flow and quantity of flow. The sensor used for this unit is of the impact turbine type. The turbine has a spiral shape with two wings. Both water intake port and outlet port are shaped to have a 90 degree angle. The opening of the intake port has a semi-circle shape. Water coming into the turbine from this opening turns the turbine; that is, the turbine's rotation is in proportion to the speed and quantity of water that comes in. A magnet installed in the turbine rotates in conjunction with the turbine, and helps tap signals to take advantage of hall effect. Hall IC is separated from water current by a plate. The temperature of water coming into the heat exchanger is measured by a thermister.



HOW TO CHECK	NORMAL	TROUBLE
(1) A simple way to check on flow signals: It takes an oscilloscope for a precise reading of the flow signals (<wave pattern). The following is a simpler alternative:	Tester needle moves.	Tester needle stands still at OV or 12V.
a. Turn "ON-OFF" switch ON. Open the hot water dispenser valve slowly until hot water running from it reaches slightly over the minimum quantity required to start the unit (burner), that is about .45 gal./min.		
b. While keeping the terminal of the flow sensor on PCB, touch it (the terminal) with the probe of a multi-meter and measure voltage.	Tester needle moves around 2.3V.	
(Measuring Method)		
a. Adjust the tester to the DC voltage range 10V.	Tester needle moves.	Tester needle stands still at OV or 12V
b. Bring the negative side probe of the tester to come in contact with the "white" terminal, and the positive side probe with the "blue" terminal. 	Tester needle moves around 2.3V	

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

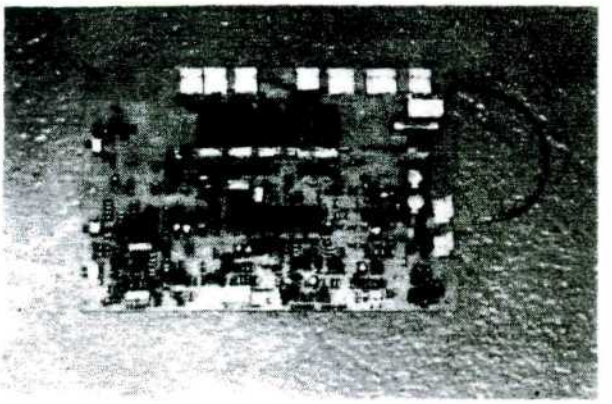
HOW TO CHECK	NORMAL
(2) Checking built-in thermister: a. Pull the terminal of the flow sensor from the PCB. Check on resistance by bringing the probe of a multi-meter to come in contact with the terminal. When the thermister is operating properly, its resistance should correspond with the specific characteristics shown on the graph. (Method of Measuring Resistance) a. Adjust the tester to the resistance range. b. Touch the two grey terminals with the probe as illustrated here. Dis connect from PCB  	

Note:

If incoming water temperature is above 104° F the thermister will now allow the unit to come on.

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

13) PRINTED CIRCUIT BOARD (CONTROL CIRCUIT)



PCB plays the role of controlling the performance of each part/component to ensure the safe operation of the unit. Communications technology using a micro-computer is used to properly operate various circuits for safe operation of the unit. Also, various self-diagnostic functions have been built into this PCB.

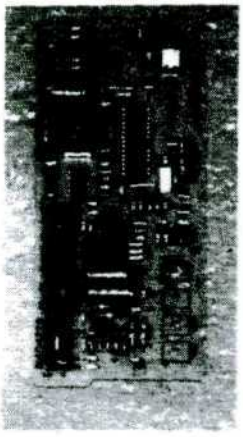
The following are the circuits built in PCB. PCB also provides connections for terminals of various functioning parts/components.

- False flame detection circuit & prevention of burner from operating when there is no flow of water.
- Pre-purge circuit, and post-purge circuit.
- Post-ignition circuit.
- Temperature control circuit and lost flames circuit.
- Ignition failure and lost flames alarms circuits.
- Broken thermister wire detection circuit.
- Broken wire of temperature control resistance detection circuit.
- Prevention of overheating circuit (hi-limit).
- Over-current prevention device (fuse 6A).
- Over-voltage prevention device.
- Monitor indicators circuit.

HOW TO CHECK	NORMAL	TROUBLE
Printed Circuit Board:		
(1) Make certain that monitor indicator [H] is blinking.		PCB is malfunctioning.
Fuse:		
(1) Remove the fuse cover. (2) Look through the glass tube to find out if the fuse inside is blown out either visually or by using a multi-meter.	Not blown.	When the fuse is blown, check out unit for possible short-causing short circuit.
* The PCB which should be checked for shorted, burnt or cracked components, or a shorted component outside the PCB such as a motor or coil.	There is conductivity.	

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

14) CONTROL PANEL BASE BOARD



This circuit board starts/stops the burner and controls the temperature of hot water to be supplied through the user's operation of "ON-OFF" switch and the temperature control knob on control panel. This circuit board also incorporates circuits to operate monitor lamps including the emergency code lamp (which blinks in case of a failure).

HOW TO ADJUST TEMPERATURE OF HOT WATER TO BE SUPPLIED

- Power Source Lamp: is lighted when the switch is turned ON.
- Operation Lamp: is lit while the electromagnetic pump is working.
- Monitor Indicators: blink in case of trouble (2, 4-8, E, H, P).
  Press the switch on control panel off and then back on for resetting

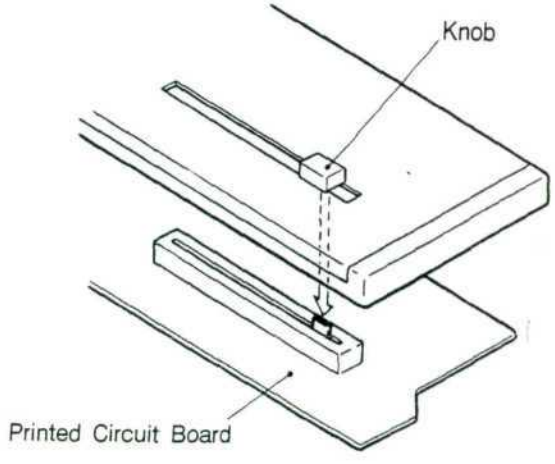
HOW TO ADJUST TEMPERATURE OF HOT WATER TO BE SUPPLIED

Thermostat has been set at the factory to about 104° F to reduce the risk of scald injury.

Temperature of hot water rises as the hot water temperature control knob is turned to "High," and decreases as it is turned to "Low."

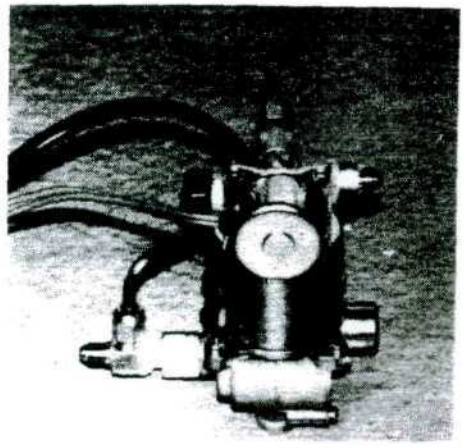
Temperature range is about 167° F for "High," 130° F for "Med," and 104° F for "Low."

NOTE: When reinstalling a control panel circuit board make sure the thermostat slide is lined up with the panel cover so that knob can be installed back on correctly.



13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

15) ELECTROMAGNETIC PUMP UNIT BYPASS VALVE



Electromagnetic pump unit consists of (1) a high pulsating voltage electromagnetic pump (2) a pressure control valve to keep output pressure constant, and (3) an electromagnetic bypass valve which changes output pressure in two stages, high to low, or visa-versa.

When the electromagnetic bypass valve is ON, output pressure is low (about 92.4 lb/in^2) and when OFF, output pressure is high (about 213.3 lb./in^2). There is lock-out valve which interlocks with the plunger inside electromagnetic pump. This valve prevents fuel from leaking during suspended operation.

HOW TO CHECK PUMP	NORMAL	ABNORMAL
(1) Check pump resistance across blue yellow wiring connector to pump.	47.0 +- 15% ohm	
(2) Remove flair nut on the outlet side of the electromagnetic pump.		
(3) Run the burner while covering the outlet so that fuel does not splash out.	Kerosene gushes out.	Kerosene does not come out.
HOW TO CHECK BYPASS VALVE	**NORMAL**	**ABNORMAL**
(1) Check valve resistance across red-red wiring connector to valve.	700 +- 15% ohm	
(2) Connect 120V AC to the two red terminals feeding the valve and listen for noise.	Click Sound Working.	No sound defective.

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

16) FLAME SENSOR (CDS)

Flame sensor watches out for ignition failure or loss of flames, and if necessary, activates proper circuitry on PCB to stop the burner. CDS undergoes significant change in its resistance depending on the brightness of its surroundings.

Sensitivity of CDS deteriorates when its light reception surface becomes dusty or sooted. It needs regular cleaning (once a year).

When CDS continues to stay with a high or low level of resistance, it triggers the safety and stops operation.

Checking on CDS is possible by measuring its resistance with a multi-meter during combustion and immediately after the suspension of combustion.

HOW TO CHECK	STANDARD VALUE	UNACCEPTABLE VALUE
CHECKING OUT CDS (1) Turn power switch off. Open the front panel of the unit and pull off CDS terminal from PCB. Then, pull CDS out from the fan motor. (2) If the light reception surface of CDS is dirty, clean it with a soft cloth. (3) Use a multi-meter across CDS terminal and measure resistance. Resistance (value) changes depending on surrounding brightness.	Resistance Varies	Resistance does not change with changes in light levels.
CHECKING OUT CDS WHILE OPERATING UNIT (1) Set temperature control at position "high." (2) While keeping the hot water dispenser valve fully open, pull CDS terminal off from PCB, and turn "ON-OFF" switch on control panel on. (3) When the burner has ignited and combustion starts, measure resistance between terminals of CDS with a multi-meter. **NOTE**: Measure resistance after the five-second pre-purge, but within 15 seconds after the unit was started. After 15 seconds, the code No. 4 will start blinking. If resistance could not be measured in time, then turn "ON-OFF" switch once again and measure resistance.	During good combustion reads less than 30k ohms. Loss of flame detected at more than 85k ohms. After unit shutdown, no combustion more than 100k ohms.	

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

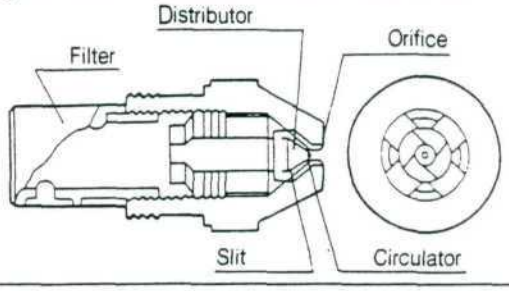
17) NOZZLE

The fuel compressed to the required level by the electromagnetic pump is injected as vapor from the little hole of the nozzle into the combustion chamber. The nozzle changes the compressed fuel into vapor that atomizes faster than liquid.

Nozzles come in a variety of sizes. Do not attempt to change the size as fuel consumption and clean, efficient combustion depends on nozzle size. Nozzles allegedly of the same size, in fact, are not exactly identical. Fuel consumption could sometimes change by merely changing the nozzle to one that is claimed to be of the same size.

NOZZLE TO BE USED:

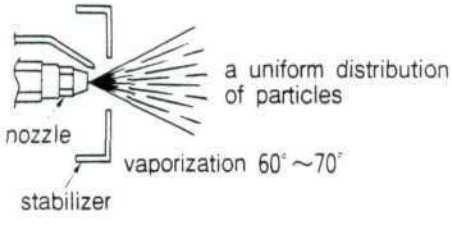
Size:	0.85 GPH
Vapor Injection Angle:	60
Vapor Type:	A Pattern
Service Parts No.:	7011

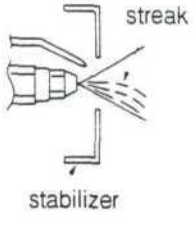


HOW TO CHECK

Remove the burner from the unit. Ignite the burner in the atmosphere.

(Normal Vaporization)





DEFECTIVE VAPORIZATION

1. Vapor is not uniform.
2. Vapor angle is wrong.
3. Streaks are visible instead of mist.

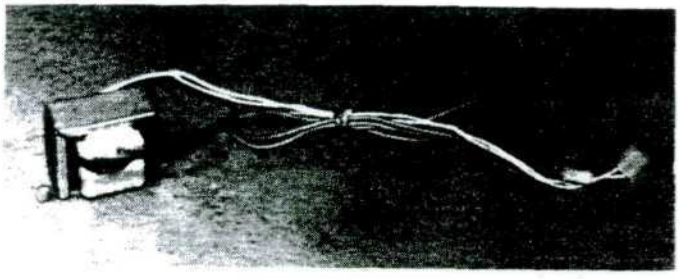
If a problem is suspected the recommended procedure is replacing the nozzle rather than trying to check it. Only if a nozzle was not readily available it could be checked by: removing the burner from the unit. Igniting the burner into an open non-combustible atmosphere and surroundings.

Warning

The checking procedure is not recommended in a consumer's home since the burner will produce kerosene vapor on pre-purge and a long open flame upon ignition which could cause a hazard.

13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

18) POWER TRANSFORMER

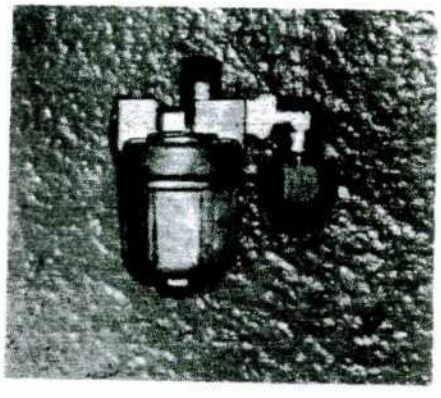


HOW TO CHECK	NORMAL
(1) Pull the terminal of the transformer from PCB. (2) Measure resistance between Red-Red, White-White, and Red-White terminals.	Red-Red about 30-37 ohm White-White 0.47 - 0.59 ohm Red-White infinity ohm (at 68 F)

19) FUEL FILTER

Fuel filter separates impurities (water and/or dirt) from fuel, and ensures only clean fuel to be fed into the system.

When the element gathers a lot of dirt and a lot of impurities, fuel does not run properly to the electromagnetic pump, thus impeding the burner operation. (Clean the element at least once a year.)



13 FUNCTIONING PARTS DATA & HOW TO CHECK THEM

20) DISMOUNTING & DISMANTLING OF PARTS/COMPONENTS

PROCEDURES AND PRECAUTIONS

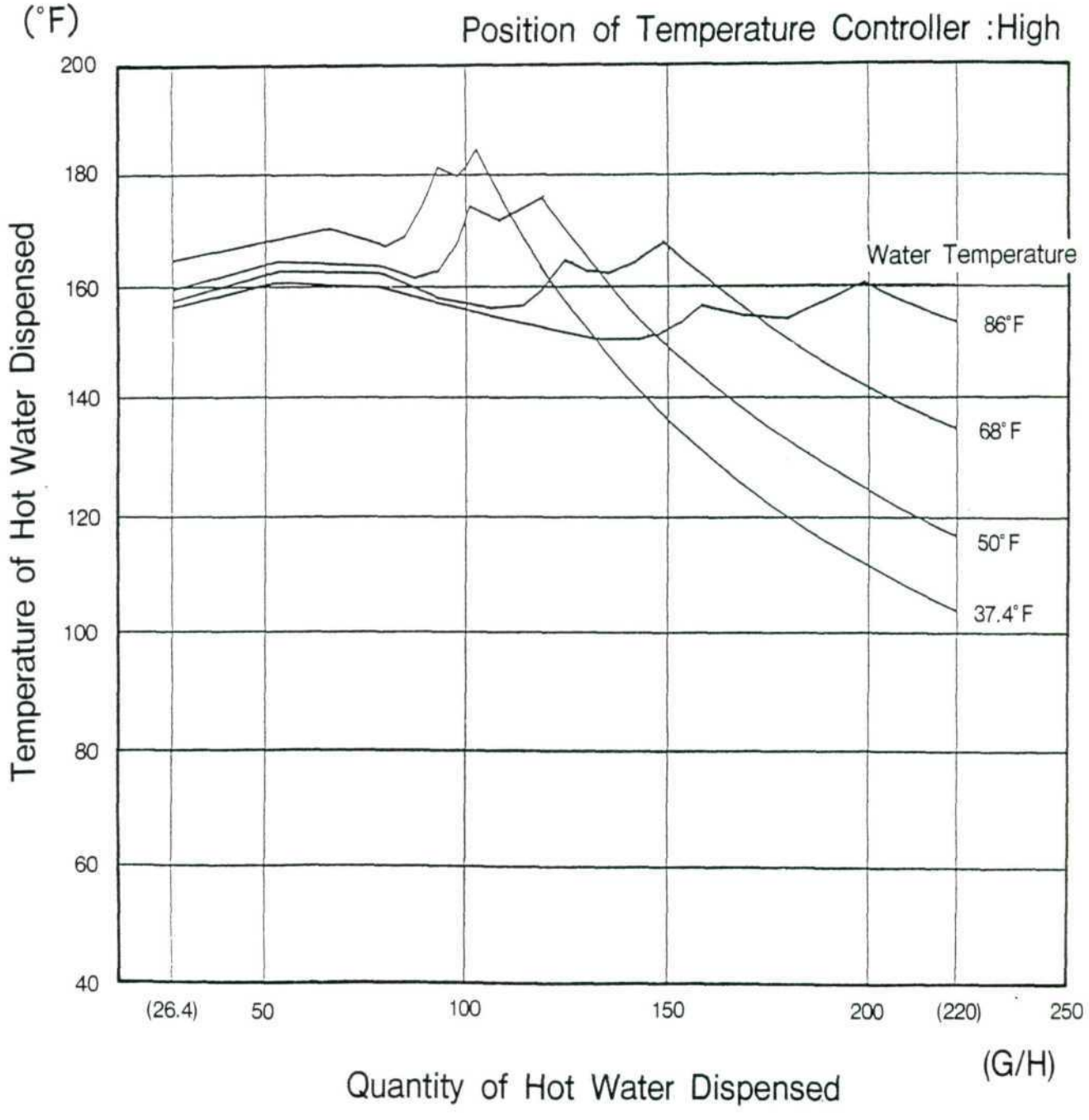
1. Before removing any part/component from the unit or a system, close the fuel supply and water intake valves. Shut off power supply.

2. Special attention must be paid to the number of and the order in which these parts have been dismantled. Re assembling must follow the reverse order and should leave nothing unassembled.

3. Once reassembling is completed, first check for the possibility of leaking water, fuel and/or exhaust gas. Also make certain that the state of combustion is normal.

14 CAPACITY DATA GRAPH

1) QUANTITY OF HOT WATER DISPENSED HOT WATER TEMPERATURE CHARACTERISTICS (PARAMETER:WATER TEMPERATURE)



14 CAPACITY DATA GRAPH

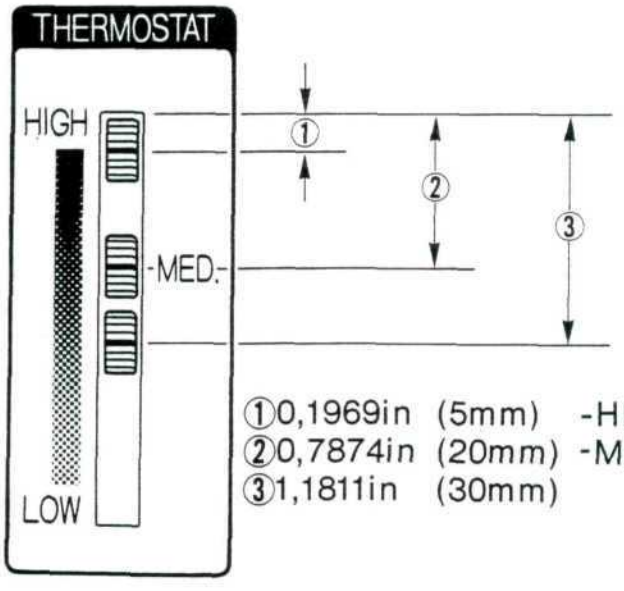
2) HOT WATER OUTLET (MAXIMUM) DEGREE RISE

(Maximum hot water supplied by this unit is about 220 Gal./HR.)

70° F	210 Gal./HR.	3.5 Gal./Min.
80° F	184	3.07
90° F	164	2.73
100 ° F	147	2.45
110° F	134	2.23

3) TIME - HOT WATER TEMPERATURE CHARACTERISTICS (PARAMETER:POSITION OF TEMPERATURE CONTROLLER)

Position of Temperature Controller (Knob)

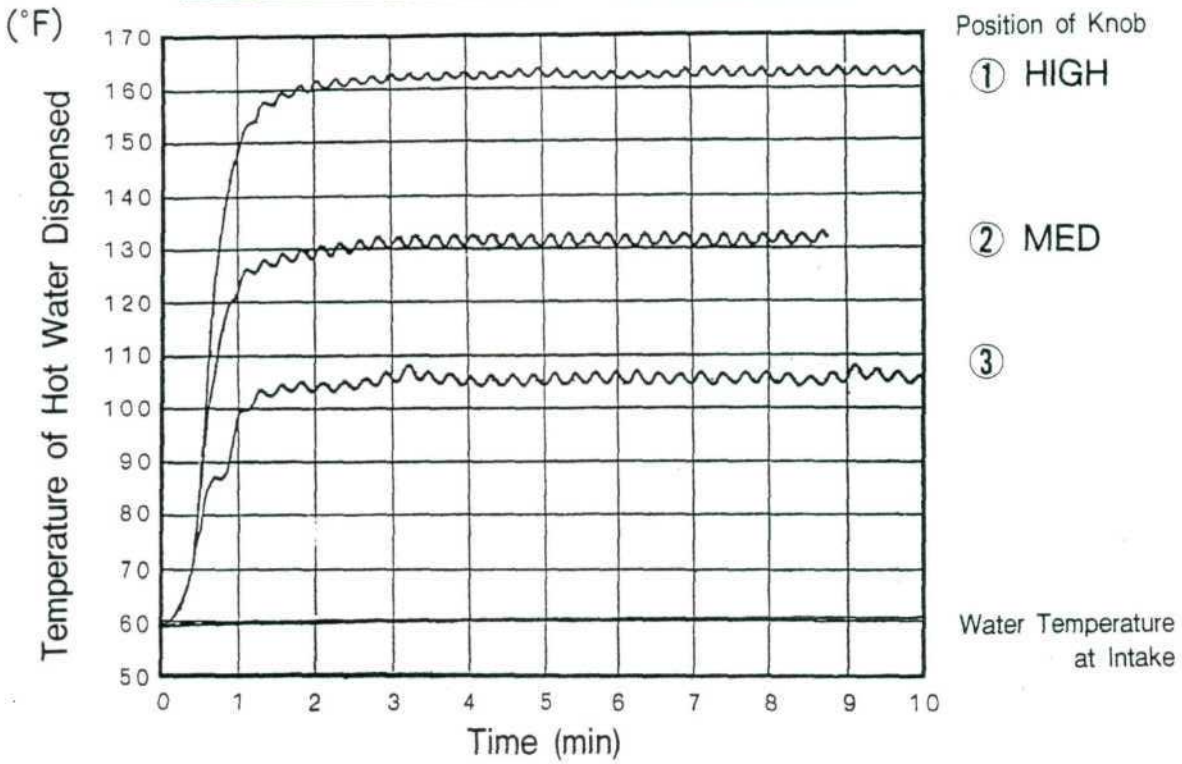


①0,1969in (5mm) -HIGH Position
②0,7874in (20mm) -MED. Position
③1,1811in (30mm)

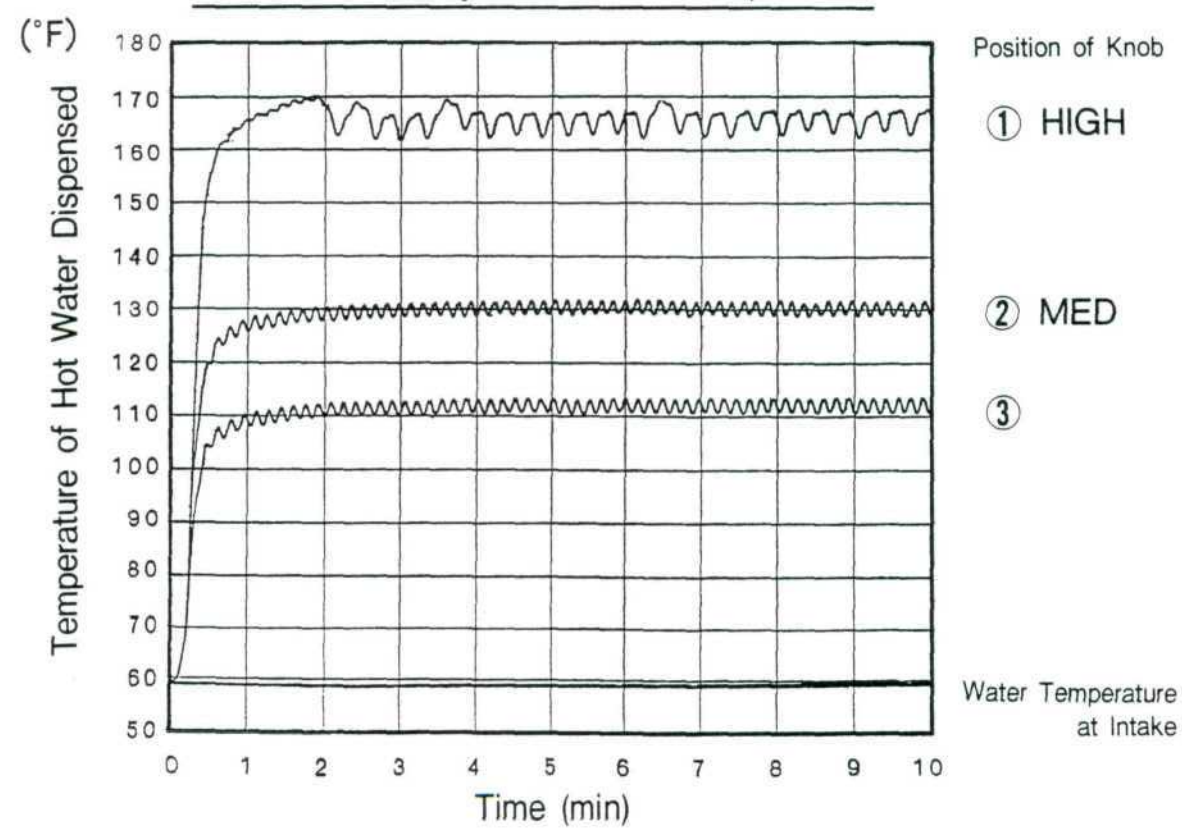
Water Temperature at Intake was measured at the Cold Water Intake.
Temperature of Hot Water Dispensed was measured at the Hot Water Outlet.

14 CAPACITY DATA GRAPH

52.8G/H : Quantity of Hot Water Dispensed.

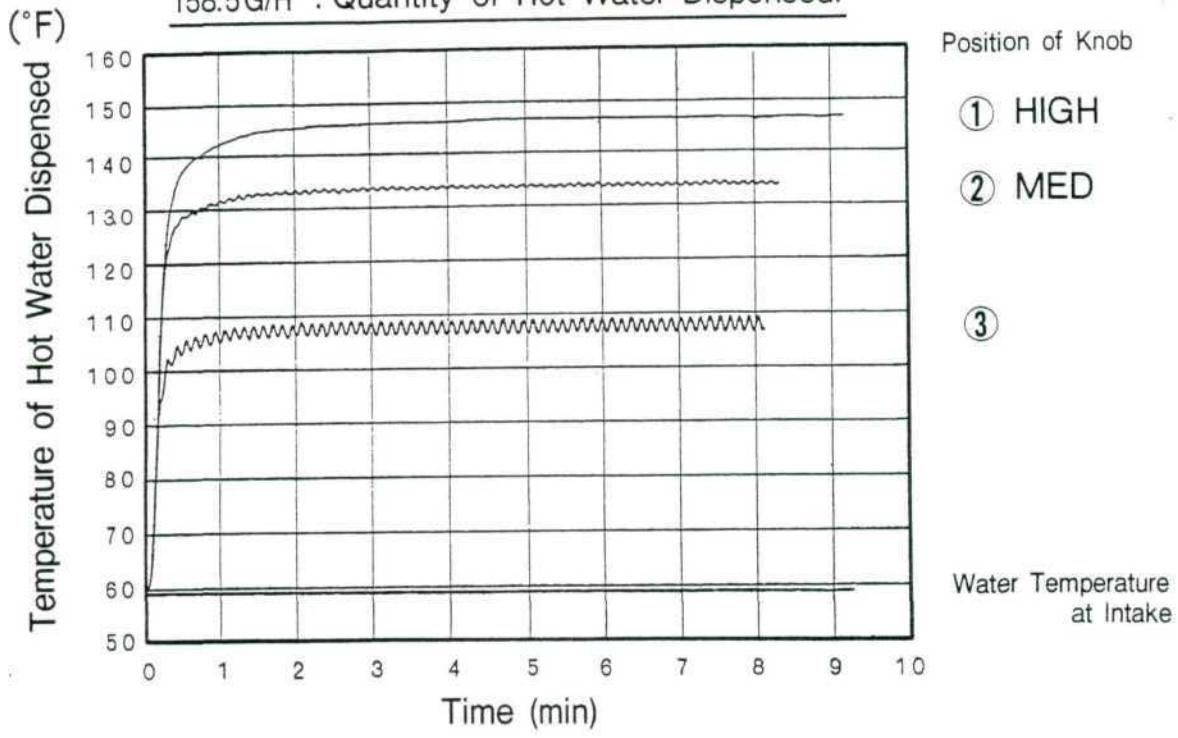


105.6G/H : Quantity of Hot Water Dispensed.

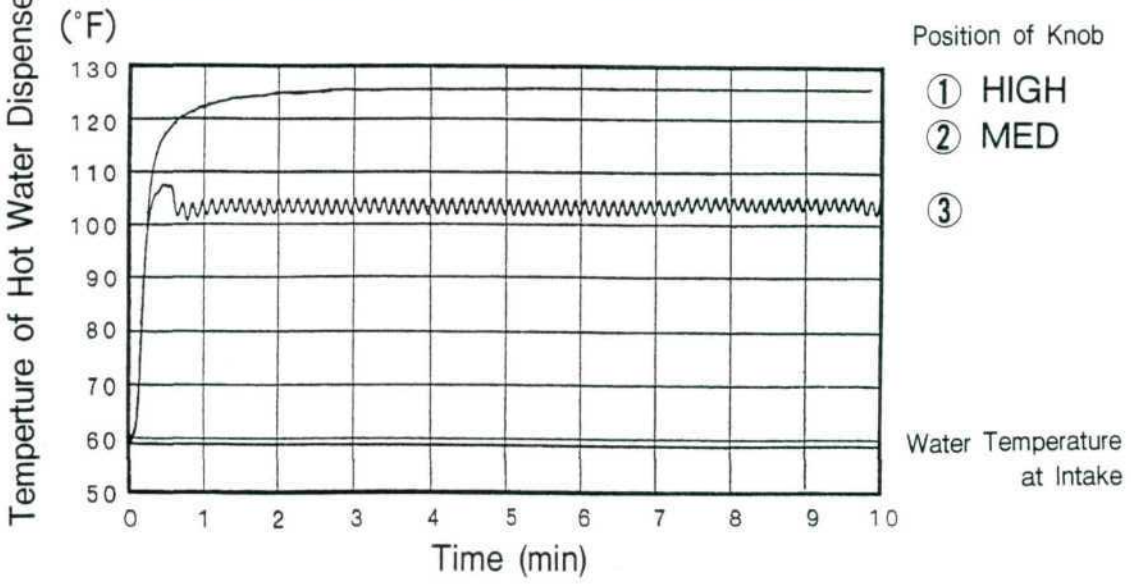


14 CAPACITY DATA GRAPH

158.5G/H : Quantity of Hot Water Dispensed.



211.3G/H : Quantity of Hot Water Dispensed.



15 ELECTRIC SPECIFICATIONS

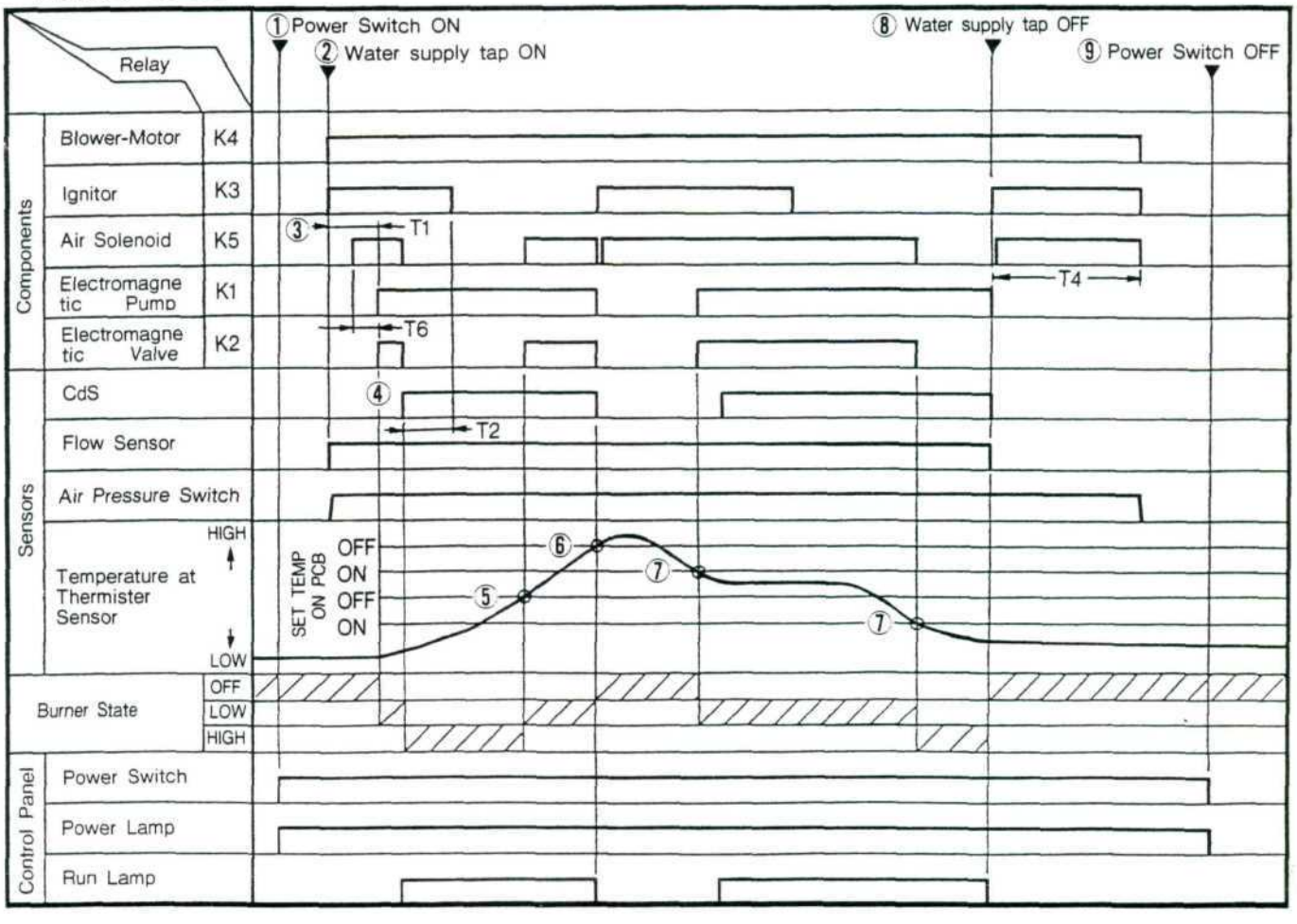
A) TIMING SEQUENCE GRAPH

■ SEQUENCE OF MOTIONS

Variable Timing of Sequence

T1: Preignition Prepurge	5	+-	1 sec.
T2: Post Ignition	10	+-	2 sec.
T3: Ignition Trial	15	+-	3 sec.
T4: Post Purge	150	+-	30 sec.
T5: Flame Response	1.5		MAX sec.
T6: Pre-Air Solenoid	1.5	+-	0.5 sec.
T7: Air Pressure Switch ON Delay	12	+-	3 sec.
T8: Air Pressure Switch OFF Delay	58	+-	12 sec.

Normal Mode



15 ELECTRIC SPECIFICATIONS

TEMPERATURE CONTROL GRAPH AT NORMAL MODE OF OPERATION

1. Power switch pushed to "ON" position on control panel.

2. When a faucet is opened, the flow sensor senses a min. of .45 gal/m of flow then the operation sequence starts as long as the set temp. is higher than the water temp. at thermister sensor.

3. Blower motor and ignitors start the operation. After completion of T1' electromagnetic pump and valve turn "ON" (low mode).

4. Once "CDS" senses flame, the electromagnetic valve turns off and air solenoid releases thus allowing the unit to go to "high" mode.

5. The temp. at thermister rises to an "OFF" point (level 1) which turns the unit to "low" mode.

6. The temp. at thermister rises higher to "OFF" point (level 2) stopping the electromagnetic pump and the burner light turns off.

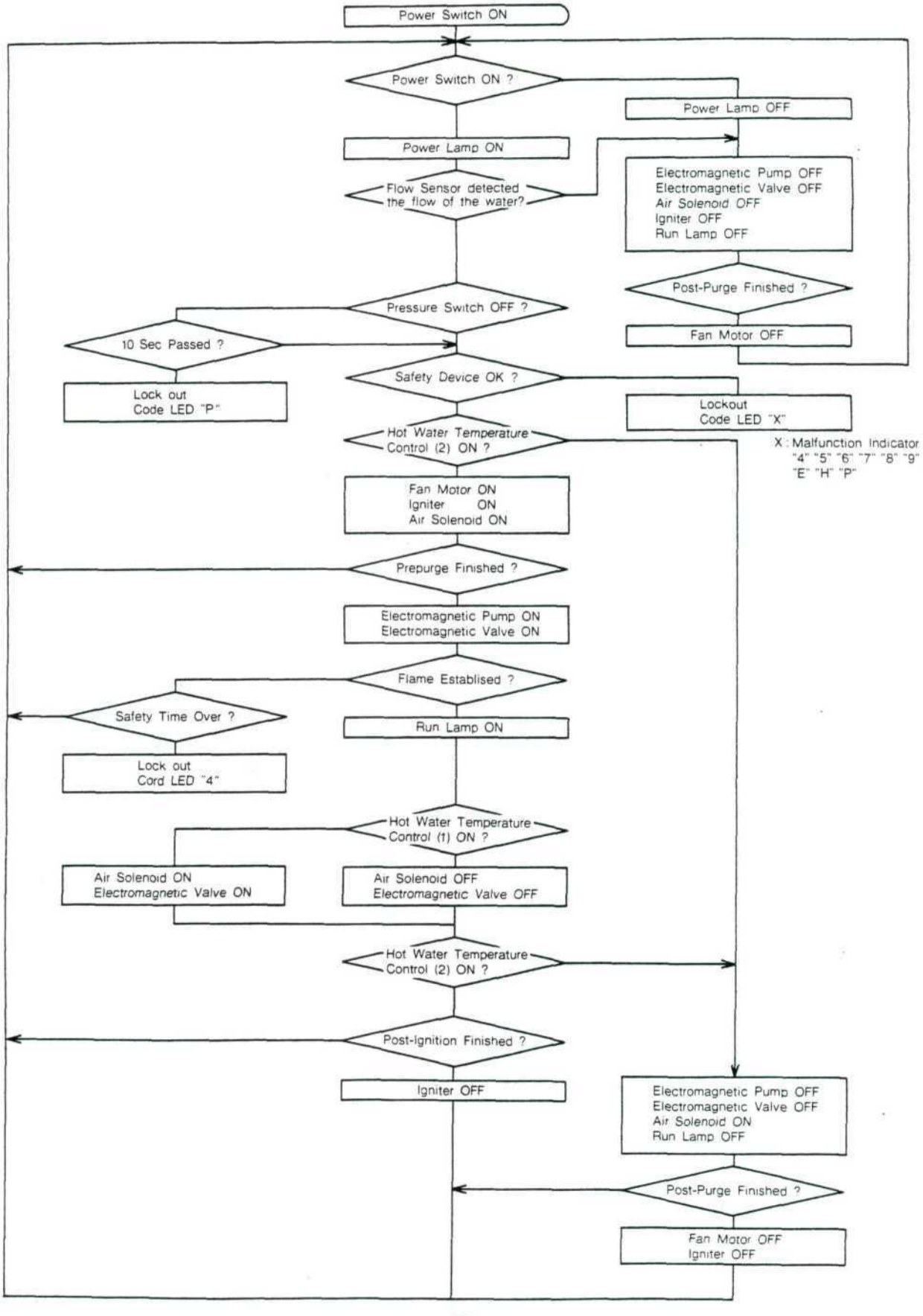
7. a.) The temp. at thermister sensor drops down to "ON" point (level 2) then unit turns onto "low" mode.

   b.) Temperature drops further to "ON" point (level 1) then unit goes to "high" mode.

8. When the faucet is closed, the burner stops and the unit goes to post-purge mode. The blower motor stops after passing T4.

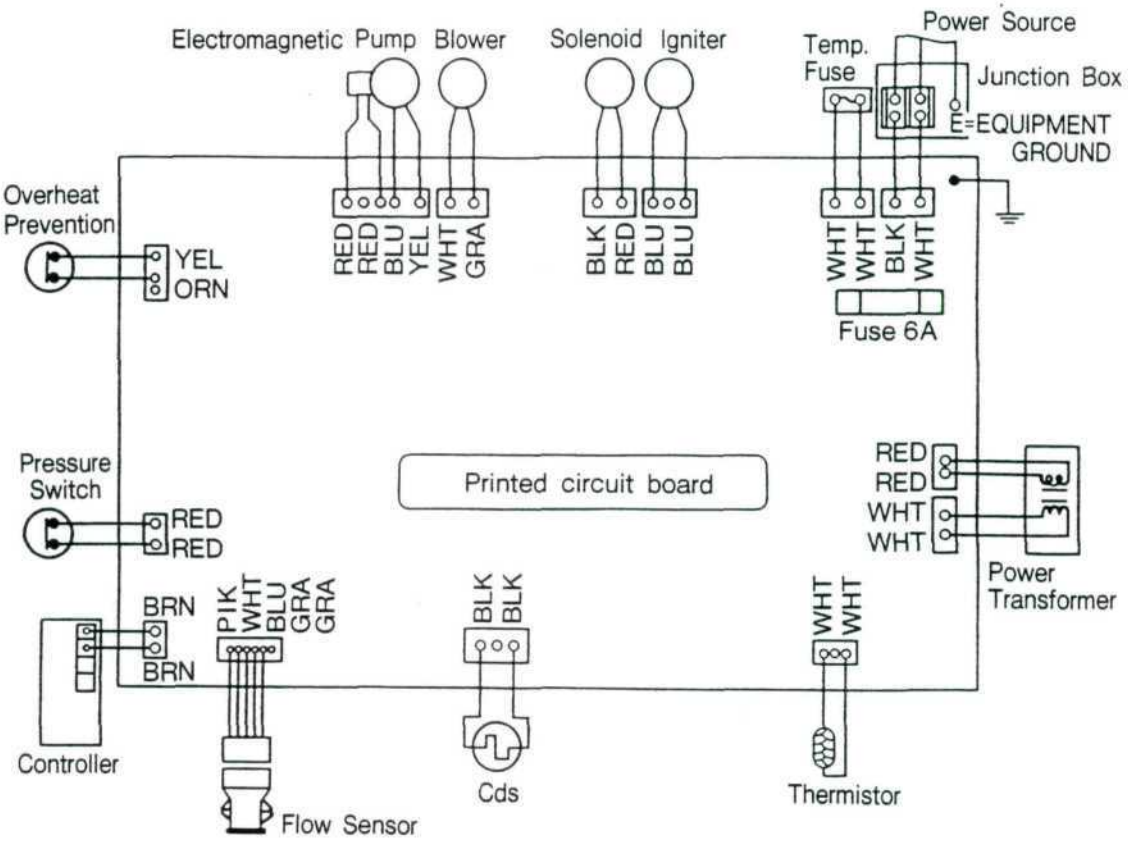
9. The power switch at the control panel is turned "OFF" then power lamp turns "OFF."

15 ELECTRIC SPECIFICATIONS



15 ELECTRIC SPECIFICATIONS

C) WIRING DIAGRAM



15 ELECTRIC SPECIFICATIONS

D) RESISTANCE VALUES

Component		Approx. OHMS
Blower Motor		33 ohm - 38.5 ohm (at 68° F)
Electromagnetic Pump	RED - RED	47.0 +- 15% ohm
Electromagnetic Valve	BLUE - YELLOW	700 +- 15% ohm
Air Solenoid		1.5 +- 15% K ohm (at 68 ° F)
Thermister for temperature control		3.485 + - 10% K ohm (at 122° F)
Pressure Switch		Less than 500m ohm
Overheat Prevention Thermostat		Less than 50m ohm
Thermister in the flow sensor		18.4 +- 8% K ohm (at 59° F)
Temp Fuse		Less than 1.5m ohm
Power Transformer	RED - RED	30 ohm - 37 ohm (at 68 ° F)
	WHITE - WHITE	.047 ohm - .059 ohm (at 68° F)
	RED - WHITE	∞ ohms

WARNING

DISCONNECT POWER BEFORE MAKING ANY RESISTANCE TESTS

15 ELECTRIC SPECIFICATIONS

E) VOLTAGE VALUES ON PCB CONNECTOR

Component	Reading Taken at PCB Connectors	Voltage Reading	
		AC	DC
Blower Motor	WHT - GRA	120	-
Ignitor	BLU - BLU	120	-
Electromagnetic Pump	BLU - YEL	120VAC half-wave rectified	
Electromagnetic Valve	RED - RED	120	-
Air Solenoid	BLK - RED	120 VAC full-wave rectified DC 108V	
Thermistor for temperature control	WHT - WHT	-	5V
Pressure Switch	RED - RED	-	5V
Overheat Prevention Thermostat	YEL - ORN	-	5V
Thermistor in the Flow Sensor	GRA - GRA	-	5V
Power Transformer	RED - RED	120	-

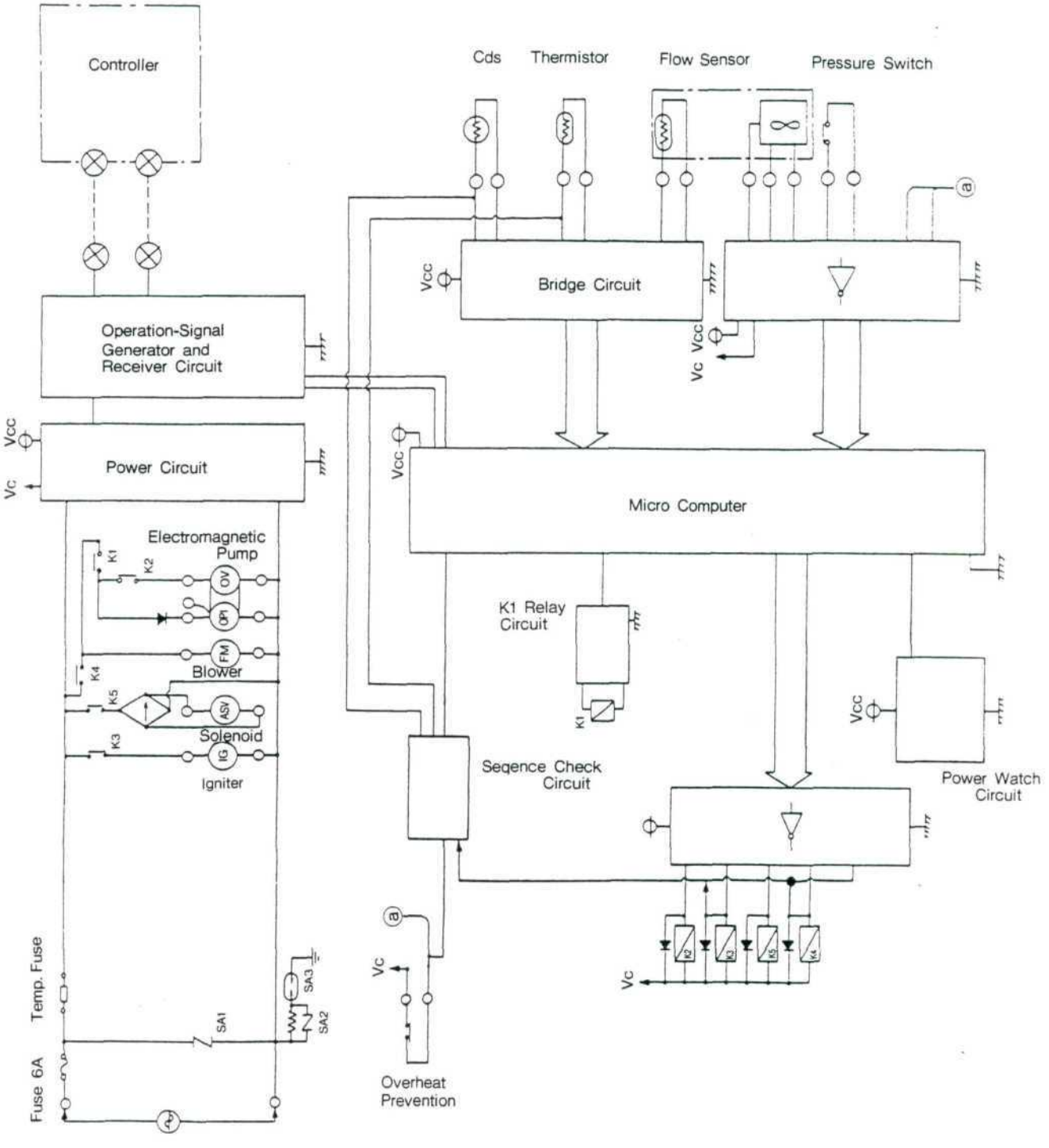
15 ELECTRIC SPECIFICATIONS

F) FAILURE MODE AND EFFECTS

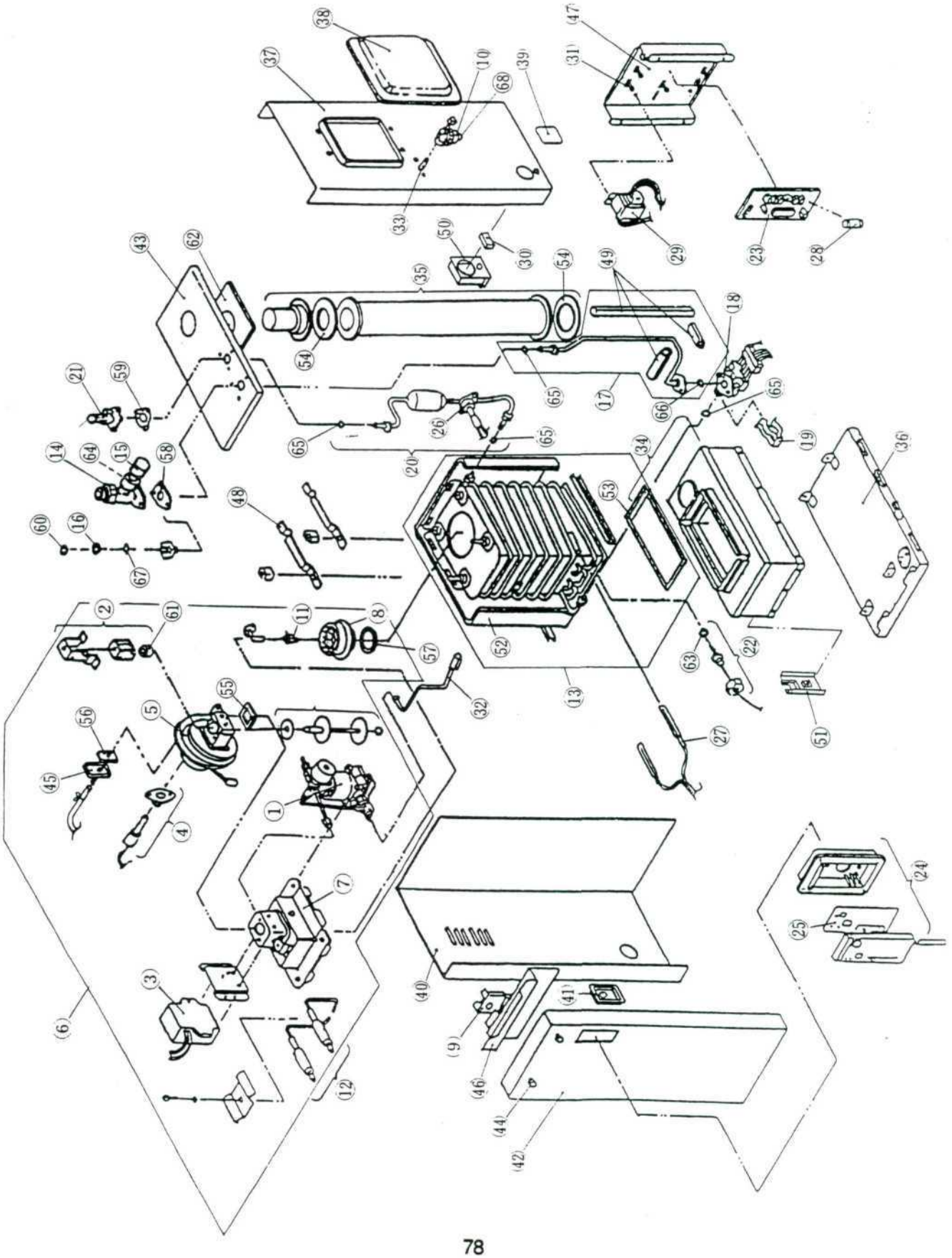
Component	Failure Mode	Effect on system operation.
Blower Motor	Short	When blower motor starts, the main fuse cuts off.
	Open	Blower Motor does not start. Code LED blink "P" and system lockout.
Ignitor	Short	When ignitor starts, the main fuse cuts off.
	Open	Ignitor does not start. Code LED blink "4" and system lockout.
Electromagnetic Pump	Short	When electromagnetic pump starts, main fuse cuts off.
	Open	Electromagnetic Pump does not start. Code LED blink "4" and system lockout.
Electromagnetic Valve	Short	When electromagnetic valve starts, the main fuse cuts off
	Open	Electromagnetic Valve does not start.
Air Solenoid	Short	When Air Solenoid starts, main fuse cuts off.
	Open	Air Solenoid does not start.
Thermistor sensor in the flow sensor.	Short	System does not start.
	Open	System does not start.
Thermistor Sensor	Short	Code LED blink "7" and system lockout.
	Open	Code LED blink "6" and system lockout.
CDS	Short	Code LED blink "5" and system lockout.
	Open	Code LED blink "4" and system lockout.
Air Pressure Switch	Short	Code LED blink "P" and system lockout.
	Open	Code LED blink "P" and system lockout.
Overheat Prevention	Short	NO Change.
	Open	Code LED blink "8" and system lockout.
Flow Sensor	Short	System does not start.
	Open	System does not start.
Temp. Fuse	Short	No Change.
	Open	System does not start.
Power Transformer	Short	Primary side: main fuse cuts off. Secondary side: Main fuse cuts off. Primary - Secondary: leakage.
	Open	System does not start.
Controller	Short	System lockout.
	Open	System does not start.

15 ELECTRIC SPECIFICATIONS

G) CIRCUIT BLOCK DIAGRAM



16 SCHEMATIC DISASSEMBLY



17 MPI KWH124 SERVICE PARTS LIST

Item No.	Part No.	Description	Item No.	Part No.	Description
1	7001	Fuel Pump Ass'y	41	7041	Drain Cover
2	7002	Air Damper Solenoid	42	7042	Front Cover
3	7003	Ignitor Transformer	43	7043	Top Cover
4	7004	Photo Sensor (CDS)	44	7044	Front Cover Screws/Collar
5	7005	Combustion Blower Ass'y	45	7045	Air Pressure Sensor
6	7006	Burner Ass'y	46	7046	Front Cover Bracket
7	7007	Burner Base	47	7047	PCB Mounting Bracket
8	7008	Burner Head Ring	48	7048	Burner Retaining Bracket Ass'y
9	7009	Air Pressure Switch	49	7049	Water Inlet Insulation Set
10	7010	Fuel Filter	50	7050	Junction Box
11	7011	Nozzle	51	7051	Drain Retainer
12	7012	Ignition Rod Set (Right & Left)	52	7101	Heat Exchanger Insulated Wrap
13	7013	Heat Exch. Ass'y (w/insulated wrap gasket)	53	7102	Heat Exchanger Base Gasket
14	7014	Water Inlet Connector	54	7103	Exhaust Stack Gasket
15	7015	Filter	55	7104	Fan Motor Gasket
16	7016	Water Governor	56	7105	Flange Gasket
17	7017	Inlet Pipe Set	57	7106	Burner Heat Gasket
18	7018	Flow Sensor	58	7107	Water Inlet Gasket
19	7019	Flow Sensor Bracket	59	7108	Water Outlet Gasket
20	7020	Mixing Tank	60	7109	Water Governor Gasket
21	7021	Water Outlet Connector	61	7110	Damper Cushion
22	7022	Hot Water Thermister Set	62	7111	Exhaust Stack Outlet Insulator
23	7023	Printed Circuit Board	63	7201	O-Ring (Thermister P6 4C)
24	7024	Control Panel Ass'y	64	7202	O-Ring (Water Filter P10A 1A)
25	7025	Control Panel Circuit Board	65	7203	O-Ring (Multiple Use P14 4C)
26	7026	Thermo Overheat Protector	66	7204	O-Ring (Flow Sensor Inlet P18 4C)
27	7027	Over Temperature Fuse Set	67	7205	O-Ring (Water Governor P22A 1A)
28	7028	Main Fuse 6A	68	7052	Fuel Filter Element
29	7029	Power Transformer	69	7206	GLUE (for burner head gasket)
30	7030	Terminal Block	70	7207	GLUE (heat exch. base & exhaust stack gasket)
31	7031	PCB Spacer Clip	71	7208	Lead Wire (fan motor)
32	7032	Fuel Pipe	72	7209	Lead Wire (flow sensor)
33	7033	Fuel Filter Mounting Bracket	73	7210	Lead Wire (air pressure switch)
34	7034	Silencer Ass'y (w/gasket)	74	7211	Lead Wire (power supply)
35	7035	Exhaust Stack Ass'y Base	75	7212	Lead Wire (control panel)
36	7036	Base	76	7213	Owner's Manual
37	7037	Exterior Cover (right side)	77	7214	Installation Manual
38	7038	Access Cover	78	7215	Carton Box
39	7039	Electric Outlet Cover	79	7216	Packing Kit
40	7040	Exterior Cover (left side)			

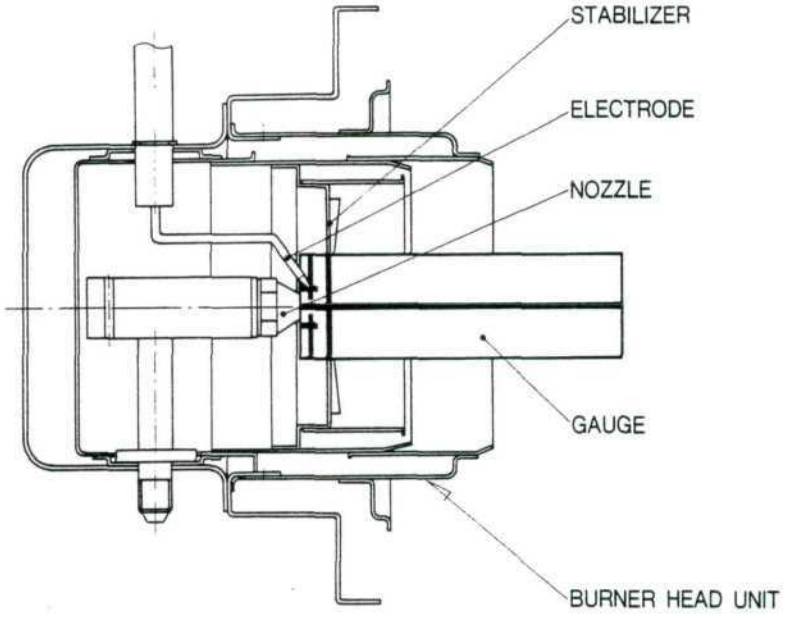
18 GAUGE

The drawing on the attached sheet can be cut out and used as a gauge.

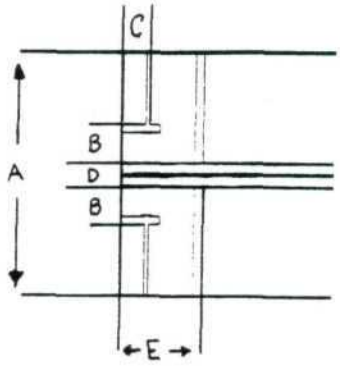
■ DIRECTIONS FOR USE

(1) Checking the position of an electrode.

a.) Please press a gauge against the nozzle through the hole of a stabilizer.



b.) Check if the position of an electrode A, B, and C (refer to page 48) stays within the range of each marking.



18 GAUGE

(2) Adjusting the position of electrodes.

a.) Check and make sure the center point of the nozzle is centered inside the hole of the stabilzer (marked "A" centered within .5mm). After adjusting, remove the burner head unit.

b.) Adjust the height from surface of nozzle to electrodes (marked "C" 3 - 3.5mm).

c.) Adjust distance from center point of nozzle to electrodes (marked "B" 5.5 - 6.5mm).

d.) Adjust gap between electrode points (marked "D" 2.25 - 2.75mm).

e.) Reinstall burner head unit. Adjust height from surface of nozzle stabilizer (marked "E" 10mm).

GAUGE

Cut gauge out carefully. Reuse if possible.