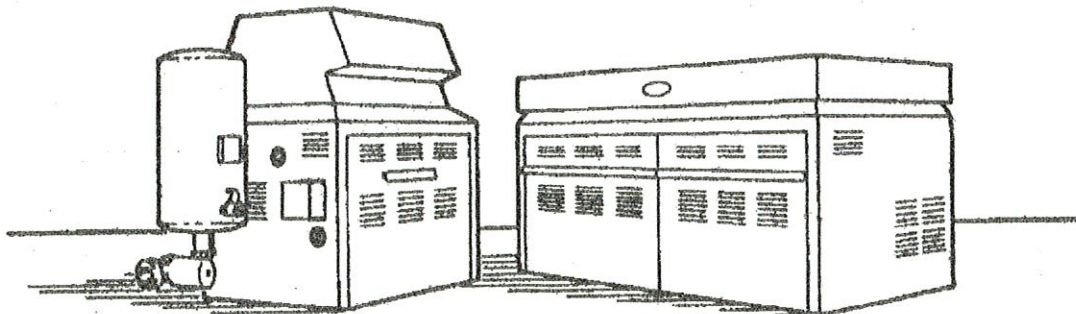


# HEATING BOILERS & DOMESTIC HOT WATER



R  
A  
Y  
P  
A  
K

S  
E  
R  
V  
I  
C  
E  
M  
A  
N  
U  
A  
L

### FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

**WARNING:** Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

### FOR YOUR SAFETY

#### WHAT TO DO IF YOU SMELL GAS

- \*Do not try to light any appliance.
- \*Do not touch any electrical switch; do not use any phone in your building.
- \*Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- \*If you cannot reach your gas supplier, call the fire department.

Operating and Installation Instructions  
Models 0133-4001  
Type H,W,R & N



Raypak, Inc., 31111 Agoura Road, Westlake Village, CA 91361 (818) 889-1500

## TABLE OF CONTENTS

2	RECEIVING EQUIPMENT
2	MODEL IDENTIFICATION
2	HEATING BOILERS
2	DOMESTIC HOT WATER BOILERS
2	INSTALLATION
6	Plumbing
11	Controls
13	START-UP PROCEDURES
19	TROUBLESHOOTING
19	Electrical
20	Mechanical
21	Pumps
21	REPAIR SECTION
Back Cover	WARRANTY

## RECEIVING EQUIPMENT

On receipt of your equipment it is suggested that you visually check for external damage to the carton. If the carton is damaged, it is suggested that a note be made on the Bill of Lading when signing for equipment. Remove the boiler from the carton and if it is damaged report the damage to the carrier immediately.

On occasion, we ship some items loose. Be sure that you receive the number of packages indicated on the Bill of Lading.

When ordering parts, you must specify Model and Serial Number of boiler. When ordering under warranty conditions, you must also specify date of installation.

Raypak recommends that this manual be reviewed thoroughly before installing your Raypak Boiler. If there are any questions which this manual does not answer, please contact the factory or your local Raypak representative.

Claims for shortages and damages must be filed with carrier by consignee. Permission to return goods must be factory authorized and are subject to a stocking charge.

Purchased parts are subject to replacement only under the manufacturer's warranty. Debits for defective replacement parts will not be accepted and will be replaced in kind only per our standard warranties.

## MODEL IDENTIFICATION

Prefix in numbers is the input in thousands of BTU/hr. Suffix represents model, usage, and basic control system.

Rated inputs suitable for up to 2000 feet elevation. For elevations above 2000 feet reduce input 4% for each 1000 feet above sea level.

### ALL MODELS (APPROVED)

National Board Approved. Temperature and pressure gauge standard. Intermittent ignition device standard sizes 0514 and up.

Size 0133 A has a 4-pass heat exchanger -1 tube per pass.

Sizes 0183-1826 have 2-pass heat exchangers-5 tubes first pass, 4 tubes second pass.

Sizes 2100-4001 have 2-pass heat exchangers-9 tubes per pass.

Sizes 926-4001 single pass is optional with Cast Iron Headers only.

## HEATING BOILERS

### MODEL TYPE H MECHANICAL MODULATING

Standard central heating boiler has 120°-240°F mechanical modulating gas valves, pressure relief valve, 45 PSI on 133A-403A, 60 PSI 514-4001. Sizes 133A-403A have Economaster Control and 1/2 HP or less pump relay as standard.

### MODEL TYPE H MOTORIZED MODULATING

Special central heating boiler is the same as above, except with motorized modulating gas valve in lieu of mechanical modulating valves. Standard 2100-4001, available on sized 514-1826 as an option. Modulating controller provided.

### MODEL TYPE H 2 STAGE CONTROLS

Special central heating boiler is the same as Type H except with single two stage gas valve in lieu of mechanical modulating gas valve. Available in all sizes. Two stage controller provided. Available with Y-1 sequencing option.

### MODEL TYPE H DE-ICING

Special central de-icing and hydronic bed heating boiler is the same as the Standard Type H boiler except modulating valves are locked to 140° F. Manual high limit and flow switch are standard.

## HOT WATER SUPPLY BOILER

### MODEL TYPE W WITH ON/OFF CONTROLS

Hot water supply boiler is ASME and A.G.A. certified as hot water boiler in all sizes through 4001, with 125 PSI pressure relief valve. To be used with storage tank systems. Available with integrally mounted pump, factory mounted and wired.

### MODEL TYPE W WITH MODULATING CONTROLS

Hot water supply boiler with 85°-210°F gas modulation and 125 PSI pressure relief valve all sizes. Available with integrally mounted pump factory mounted and wired; to be used with storage tank.

### MODEL TYPE N INSTANT-PAK

Tankless instantaneous direct fired hot water supply boiler with 110°-170°F gas modulation, bronze body or cast iron bronze fitted pump, 125 PSI pressure relief valve and flow switch.

### MODEL TYPE R RESTAURANT-PAK

Restaurant-Pak provides 140°-180°F hot water supply. Sizes 0334-1125 have 21-gallon accumulator. Completely factory supplied with bronze pump and flow switch. Tank thermometer, temperature and pressure relief valve and mixing valve furnished loose for field installation.

## INSTALLATION INSTRUCTIONS

### INSTALLATION CODES

The installation must conform with these instructions and the latest issues of ANSI National Fuel Gas Code Z223.1, and with the National Electric Code ANSI/NFPA 70 and/or with the local codes. All boiler installations must conform to ASME boiler code. Hot water pipes must be installed with minimum clearances to combustible material as required by code.

## INSTALLATION BASE

Boiler should be mounted on a level, non-combustible surface. A combustible flooring base is provided as standard equipment on sizes 183A-824 and Hurricane sizes 926-1758 and is approved for mounting on a combustible surface. A combustible flooring base is optional on size 133A and must be installed by the contractor. No other models other than those previously mentioned are approved for mounting on a combustible surface. Boiler must not be installed on carpeting.

### For combustible flooring when equipped with base part numbers:

Boiler Model No.	Base Part No.	Boiler Model No.	Base Part No.
133A	001749	926	054597
		1083	054598
183A	058313	1178	054599
263A	058314	1287	054600
333A	058315	1414	054601
403A	058316	1571	058378
		1758	058379
334	056197		
404	056198	962	059233
514	056199	1125	059234
624	056200	1223	059235
724	056201	1336	059236
824	056202	1468	059237
		1631	059238
		1826	059239

## CLEARANCES

### ALL BOILERS

For clearances from combustible surfaces, see chart below.

### CLEARANCES FROM COMBUSTIBLE CONSTRUCTIONS

MODEL NO.'S	FLOOR	FRONT	BACK	RIGHT SIDE	LEFT SIDE	VENT *	TOP	
							INDOOR	OUTDOOR
133A	COMB.	See Note	12"	6"	12"	6"	42"	Unobstructed
183A-403A	COMB.	See Note	12"	12"	12"	6"	39"	Unobstructed
334A-824	COMB.	See Note	12"	6"	18"	6"	36"	Unobstructed
926-1826	COMB.	See Note	24"	24"	24"	6"	24"	Unobstructed
2100-4001	NON-COMB.	See Note	24"	24"	24"	6"	24"	Indoor Only

Note: The boiler shall be installed in a space large in comparison to the size of the boiler.

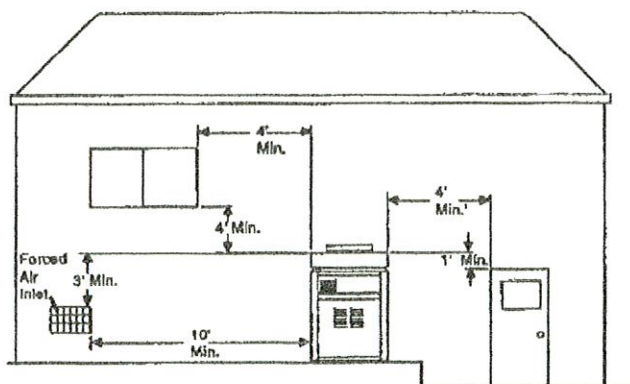
\*Vent includes factory supplied drafthoods and does not include field supplied vent systems above the drafthood. On Models 2100-4001 drafthood is built into boiler.

Service Clearances: Provide at least 24" (Models 133-1826), 48" (Models 2100-4001) in front of unit for removal & servicing of the Controls & Burner Tray. Provide at least 18" on side opposite water connections for delimiting of Heat Exchanger Tubes.

### OUTDOOR BOILERS

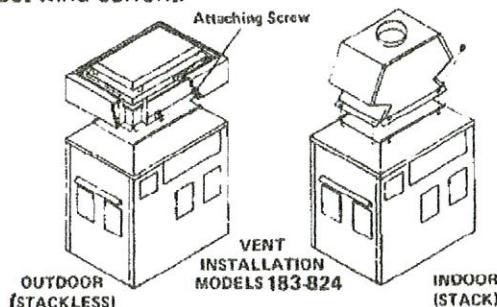
These boilers are designed certified by A.G.A. for outdoor installation. Boilers must not be installed under an overhang of less than three (3) feet from the top on the heater. Three (3) sides must be open in the area under the overhang. Roof water drainage must be diverted away from the boilers installed under overhangs with the use of gutters:

The point from where the flue products exit the boiler must be a minimum of four (4) feet below, four (4) feet horizontally from or one (1) foot above any door, window or gravity inlet to a building. The top surface of the boiler shall be at least three (3) feet above any forced air inlet, or intake ducts located within ten (1) feet horizontally.



### HIGH WIND CONDITIONS (OUTDOOR UNITS ONLY)

In areas where high winds are frequent, it may be necessary to locate the boiler a minimum of 3' from high vertical walls, or install a wind break so the boiler is not in direct wind current.



**WARNING:** Do not use thermal damper with modulating boiler. Asphyxiation may result.

### COMBUSTION AIR

The boiler must have openings for both combustion air and ventilation air. Minimum requirements of **FREE AREA** -defined as area without restrictions such as louvers or screen-are as follows:

1. Combustion air inlet located near floor: 1 sq. in. per 2000 BTU input.
2. Ventilation air inlet located above draft hood: 1 sq. in. per 2000 BTU input.

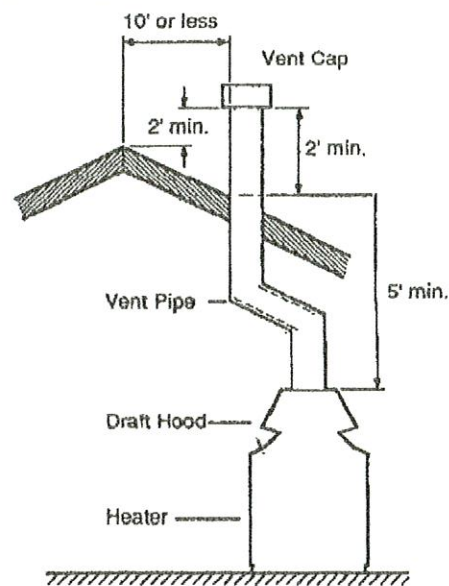
**NOTE:** If the boiler room is located against an outside wall and air openings communicate directly with the outdoors, the openings may be half the size as noted in no. 1 and no. 2. (ANSI2223.1-1984)

### VENTING

Adhere to local codes. Reduction of vent diameter, or alteration of draft diverter voids warranty. Horizontal runs must have a minimum of 1/4 inch per foot rise. We recommend the use of insulated vent pipe spacer through the roof. A raincap must be provided. The vent opening must be a minimum of two feet vertically from the roof surface and at least two feet higher than any part of the building within ten feet. Vent stack shall be at least five feet in vertical height above the draft hood outlet

The weight of the vent stack or chimney must not rest on boiler draft hood. Support must be in conjunction with applicable codes. The boiler top and draft hood must be readily removable for maintenance and inspection. Vent pipe should be adequately supported to maintain proper clearances from combustible construction.

Type "B" Double-Wall (or equivalent) vent pipe is recommended. However single-wall metal vent pipe may be used as specified in the National Fuel Gas Code ANSI Z 223.1-1984.



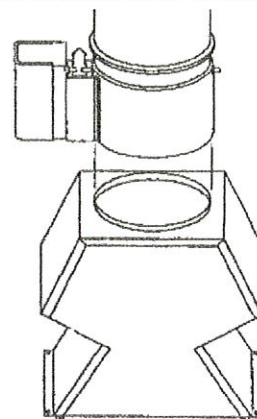
### VENT DAMPER INSTALLATION (MODELS 133A THROUGH 263A)

### LOCATION

The vent damper must be located in the vent so that it serves only the appliance for which it is intended.

If improperly installed, a hazardous condition, such as an explosion or carbon monoxide poisoning, could result. Make certain that it is mounted in an accessible location at least 6 in. (152.4 mm) from any combustible material or the heat exchanger and that the position indicator is in a visible location.

The vent damper must be installed after the appliance draft hood, as close to the draft hood as practicable, and without modification of the draft hood.



## MOUNTING

On vertical vents, the vent damper may be mounted with the actuator in any position. On horizontal vents, do not mount the actuator either directly above or directly below the vent pipe; mount the vent damper actuator to the side of the vent (Fig. 3).

The vent damper is set up for a continuous pilot system. If the vent damper is installed on an Intermittent Pilot or Direct Spark Ignition equipped system, the energy savings of the vent damper can be improved by plugging the hole in the vent damper blade using the knockout plug, Part No. 105612R, provided in the parts envelope.

**DO NOT** plug the hole if installing the vent damper on a continuous pilot system as this will create a hazardous condition.

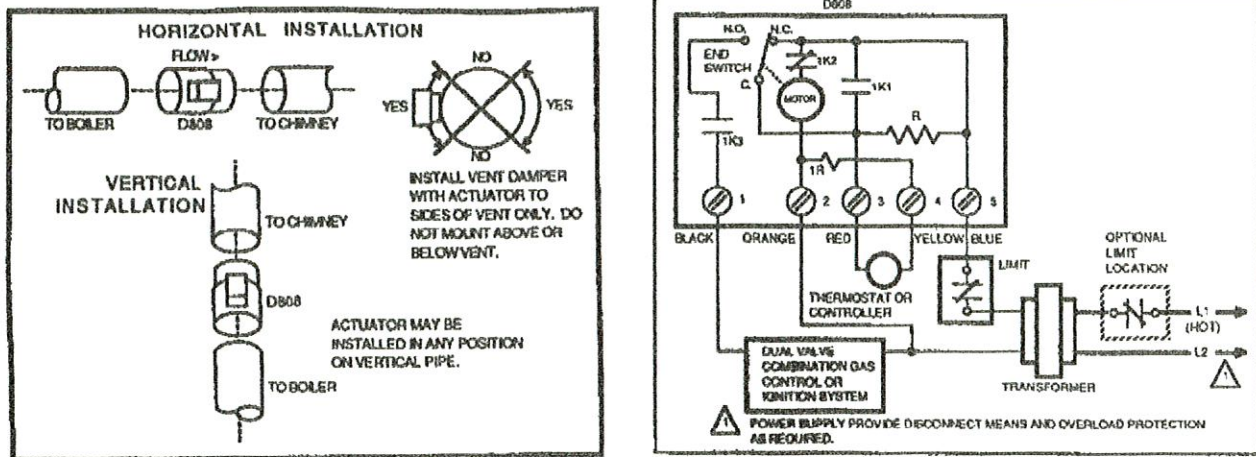


FIG. 3-INSTALLING THE VENT DAMPER IN HORIZONTAL & VERTICAL VENTS.

D80B GENERAL WIRING DIAGRAM

## VENT DAMPER

### NORMAL OPERATION SUMMARY

For safe, efficient operation, the vent damper and all flue product carrying areas of the appliance must be checked annually by you, with particular attention given to deterioration from corrosion or other sources. Check vent damper operation as follows:

1. When the furnace or boiler is off, check that the vent damper position indicator points to the closed position, Fig. 4.

2. Turn the thermostat or controller up to call for heat and check the vent damper indicator points to the open position, Fig. 4.
3. Turn the thermostat or controller down again and check that the vent damper position indicator returns to the closed position.

**THE VENT DAMPER MUST BE INSPECTED AT LEAST ONCE A YEAR BY A TRAINED, EXPERIENCED SERVICE TECHNICIAN. THE NAME OF THE PERSON WHO ORIGINALLY INSTALLED YOUR VENT DAMPER IS SHOWN ON THE INSTALLATION LABEL.**

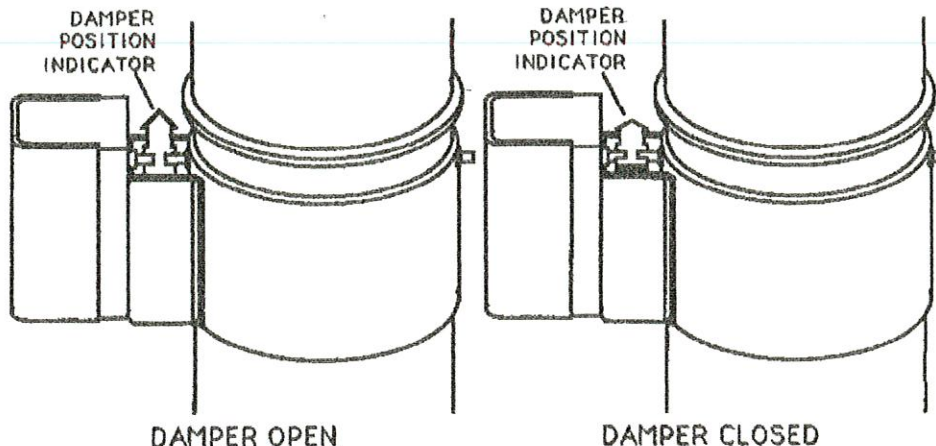


FIG. 4- VENT DAMPER POSITION INDICATOR SHOWING OPEN & CLOSED POSITIONS.

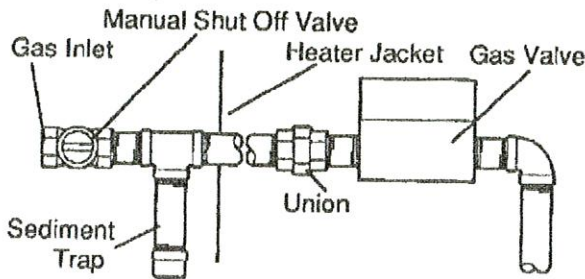
## PLUMBING

### GENERAL

Boiler should be located so that any water leaks will not cause damage to any adjacent areas or structures.

### GAS SUPPLY CONNECTIONS

Gas piping must have a sediment trap ahead of the boiler gas controls, and a manual shutoff valve located outside the heater jacket. All gas piping should be tested after installation in accordance with local codes.



A minimum of 7" W.C. and a maximum of 14" W.C. upstream pressure under load, and no load conditions must be provided for natural gas or a minimum of 12" W.C. and a maximum of 14" for propane gas.

N.P.	MAXIMUM EQUIVALENT PIPE LENGTH															
	NATURAL GAS 1000 BTU/FT <sup>3</sup> @ 0.5" W.C. PRESSURE DROP								PROPANE GAS 2500 BTU/FT <sup>3</sup> @ 0.5" W.C. PRESSURE DROP							
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"
133	15	35	60	145	200	500	—	—	—	—	—	—	—	—	—	—
183	—	15	30	85	95	250	400	—	—	—	—	—	—	—	—	—
253	—	—	10	20	40	60	140	200	560	—	—	—	—	—	—	—
333/334	—	—	—	15	25	35	85	150	360	960	—	—	—	—	—	—
403/404	—	—	—	—	15	25	35	85	100	260	280	—	—	—	—	—
513	—	—	—	—	15	15	35	65	150	130	350	500	—	—	—	—
624	—	—	—	—	—	—	10	25	45	100	95	250	340	—	—	—
724	—	—	—	—	—	—	—	20	35	80	75	180	260	600	—	—
824	—	—	—	—	—	—	—	—	15	25	60	95	130	185	480	500
920/942	—	—	—	—	—	—	—	—	15	20	45	45	110	150	360	480
1083/1128	—	—	—	—	—	—	—	—	10	18	35	35	80	120	300	300
1178/1223	—	—	—	—	—	—	—	—	—	—	25	25	60	85	220	200
1267/1336	—	—	—	—	—	—	—	—	—	—	25	25	60	75	190	170
1414/1460	—	—	—	—	—	—	—	—	—	—	20	15	45	65	150	185
1571/1631	—	—	—	—	—	—	—	—	—	—	15	15	35	50	120	125
1726/1828	—	—	—	—	—	—	—	—	—	—	15	10	30	40	100	100
2100	—	—	—	—	—	—	—	—	—	—	10	10	20	30	80	75
2500	—	—	—	—	—	—	—	—	—	—	—	15	20	55	55	135
3001	—	—	—	—	—	—	—	—	—	—	—	10	15	45	40	85
3900	—	—	—	—	—	—	—	—	—	—	—	—	10	30	30	45
4001	—	—	—	—	—	—	—	—	—	—	—	—	8	20	25	35

### GAS PRESSURE REGULATOR

The gas pressure regulator is preset and sealed at 4" W.C. for natural gas, and 11" W.C. for propane gas. Between the gas valve and the burners is a 1/8" pipe plug. The pressure at this point, taken with a manometer, should be about 3.7" W.C. natural gas and 10.5" W.C. propane gas. If an adjustment is needed, remove seal and turn adjustment screw clockwise to increase pressure or counter-clockwise to decrease pressure.

### GENERAL

#### CITY WATER CONNECTION

See piping diagrams for proper water connections for the type of boiler and system.

**CAUTION:** The boiler and its manual shut off valve must be disconnected from the gas supply during any pressure testing of that system at test pressures excess of 1/2 PSIG (3.45 KPA). Dissipate test pressure in the gas supply line before reconnecting the boiler and its manual shut off valve to gas supply line. **FAILURE TO FOLLOW THIS PROCEDURE MAY DAMAGE THE GAS VALVE. OVER PRESSURED GAS VALVES ARE NOT COVERED BY WARRANTY.** The boiler and its gas connections shall be leak tested before placing the appliance in operation. Use soapy water for leak test do NOT use open flame.

**NOTE:** Do not use teflon tape on gas line pipe thread. A flexible sealant is recommended.

Water Connections			
Model Size	Max GPM	Min GPM	Pipe Size
133	22	5	1 1/4"
183	30	7	1 1/2"
263	42	10	1 1/2"
333	45*	13	1 1/2"
403	45	16	1 1/2"
334	53	13	2"
404	63	16	2"
514	82	21	2"
624	85	25	2"
724	85	29	2"
824	85	33	2"
926	90*	37	2 1/2"
†926	148	37	3"
962	90*	38	2 1/2"
†962	154	38	3"
1083	90*	43	2 1/2"
†1083	173	43	3"
1125	90*	45	2 1/2"
†1125	180	45	3"
1178	90*	47	2 1/2"
†1178	189	47	3"
1223	90*	49	2 1/2"
†1223	197	49	3"
1287	90*	51	2 1/2"
†1287	200	51	3"
1336	90*	53	2 1/2"
†1336	200	53	3"
1414	90*	56	2 1/2"
†1414	200	56	3"
1468	90*	58	2 1/2"
†1468	200	58	3"
1571	90*	62	2 1/2"
†1571	200	62	3"
1631	90*	65	2 1/2"
†1631	200	65	3"
1758	90*	70	2 1/2"
†1758	200	70	3"
1826	90*	73	2 1/2"
†1826	200	73	3"
2100	200	86	3"
†2100	345	86	4"
2500	200	102	3"
†2500	400	102	4"
3001	200	123	3"
†3001	400	123	4"
3500	200	144	3"
†3500	400	144	4"
4001	200	164	3"
†4001	400	164	4"

\*GPM Flow rates limited by maximum acceptable velocity through heat exchanger tubes. Maybe increased by 10% for closed heating systems.  
† Single Pass GPM

## PUMP SELECTION

In order to insure proper hydraulics in your hydronic heating system, you must select the proper size pump. We recommend that a 20°F ΔT. (ΔT is the temperature difference between the inlet and outlet water when the boiler is firing at full rate). If a ΔT larger than 20°F is necessary, the bypass must be adjusted to insure proper hydraulics through the boiler while allowing minimum flow to energize the safety flow switch.

## FEEDWATER REGULATOR

We recommend that a feedwater regulator be installed and set at 12 PSIG minimum pressure. Install a check valve or back flow device upstream of the regulator, with a manual shut off valve. Leave the valve open.

## PIPING - HEATING BOILERS

We recommend that all high points be vented and that purge valves and a bypass valve be installed. A boiler installed above radiation level must be provided with a low water cutoff device. The boiler, when used in connection with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler.

## RECOMMENDED PURGE MANIFOLDS TYPICAL HYDRONIC SYSTEM HOOKUPS

The boiler piping system of a hot water heating boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulating, must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

## AIR-X-TANK

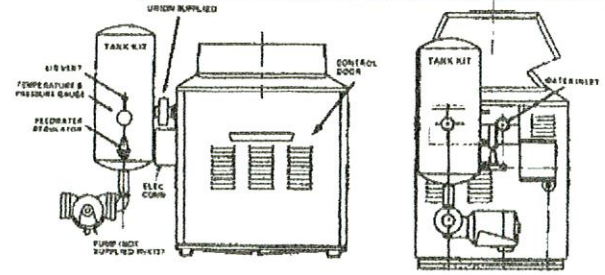
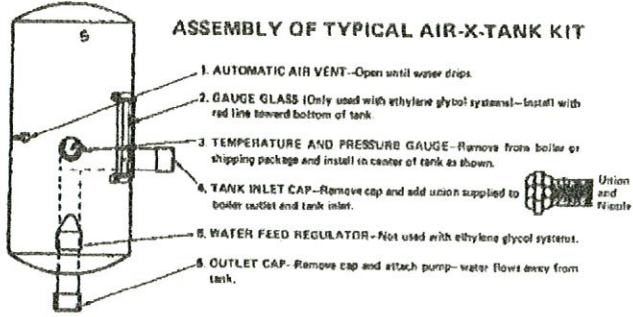
The Air-X-Tank provides a unique feature in that it not only provides for air elimination but also serves as a system expansion tank. The temperature and pressure gauges are mounted to the tank along with the automatic pressure feed regulator. On ethylene glycol systems, a sight glass and top fill opening are provided in lieu of the pressure feed regulator.

## TEMPERATURE & PRESSURE GAUGE

The temperature & pressure gauge is standard equipment on all hydronic heating and hot water supply boilers. All temperature & pressure gauges are factory mounted in the inlet/outlet header except for residential boilers, model 133A, and models 183A through 403A. On these models the temperature & pressure gauge is shipped loose for field installation, and located in the outlet water connection. All fittings required to mount gauge to piping system are supplied by others.

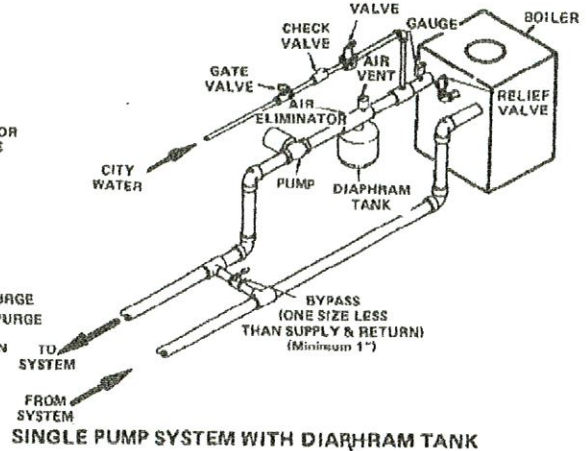
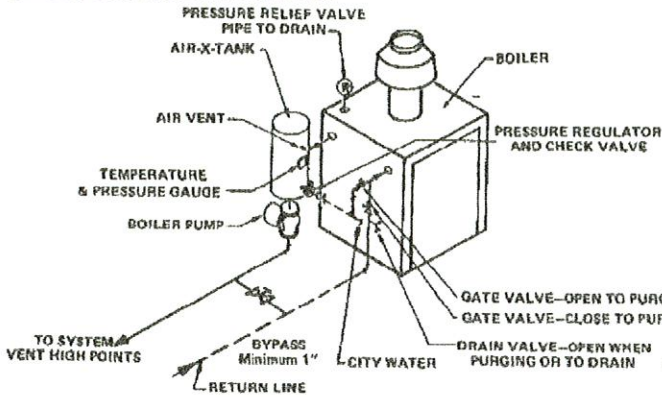


PIPING — HEATING BOILERS

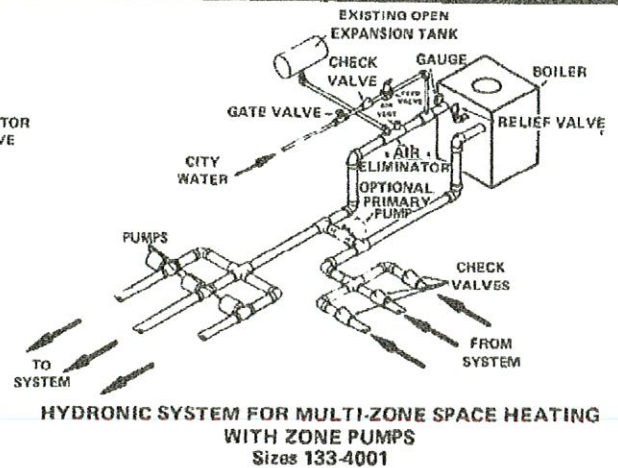
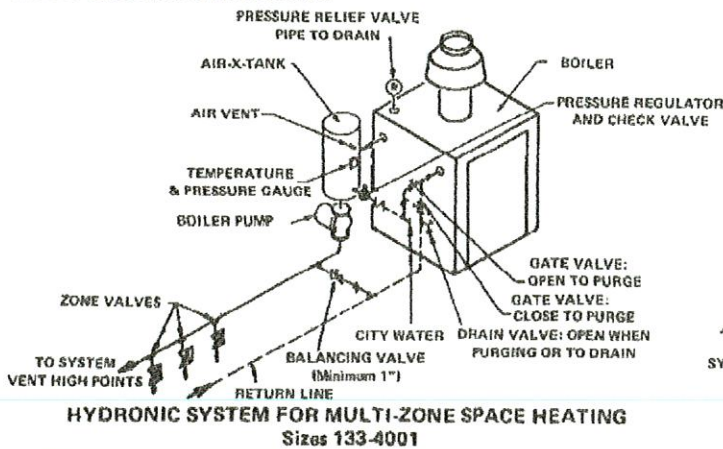


NOTE: Pump oil holes must be facing up to assure proper lubrication (Motor axis horizontal). In some cases it may be necessary to rotate motor.

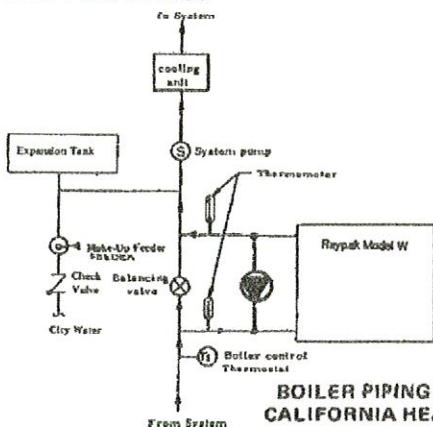
**SINGLE ZONE HEATING SYSTEM**



**MULTI-ZONE HEATING SYSTEM**

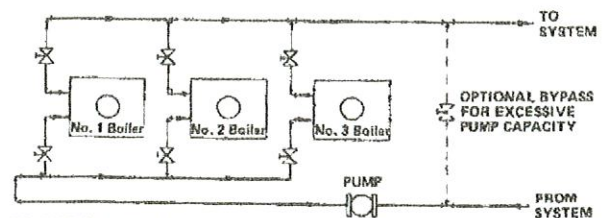


**HEAT PUMP SYSTEM**



1. Select proper size boiler.
2. Use 120°F boiler outlet temperature to determine boiler flow, (usually 60°F ΔT).
3. Select proper pipe size between boiler & main.
4. On start-up, set balancing valve so that boiler has 60°F ΔT.
5. Set T<sub>1</sub> at 70°F.
6. For indoor application, specify the Indoor Model (Stack Type); for outdoor application, specify the Outdoor Model (Stackless).

**MULTIPLE BOILER PIPING DIAGRAM**



REVERSE RETURN, THE PROPER METHOD OF MANIFOLDING MULTIPLE BOILER HOOK-UPS TO ASSURE BALANCED FLOW THROUGH EACH BOILER. VALVES ON SUPPLY AND RETURN ARE NEEDED TO ISOLATE ANY BOILER, AS REQUIRED

REVERSE RETURN MULTIPLE BOILER HOOK-UP

# PIPING - DOMESTIC HOT WATER BOILERS

# FOR RAYPAK UNI-TEMP 80 HOT WATER SYSTEMS

## GENERAL INLINE PUMP AND PIPING SPECIFICATIONS

In order to simplify pump selection use the following table:

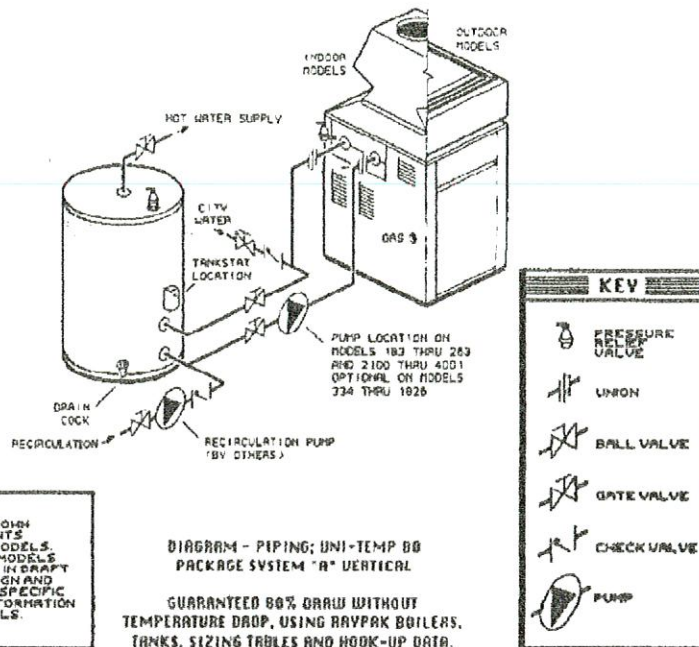
- Flow rates are based on water hardness. (Soft 0-4 G/G, Medium 5-15 G/G, Hard 16+ G/G).
- Maximum flow rates are limited to 22 GPM per tube for all units except 183-403 where maximum GPM is 11 GPM per tube.

- The minimum economical pipe sizing and pump or pumps are selected for each model boiler.
- We have assumed the boiler and tank to be placed five feet apart and the equivalent length of pipe, valves and fittings in the system are:
  - 1 1/4" - 65'
  - 1 1/2" - 70'
  - 2" - 75'
  - 2 1/2" - 80'
- If boiler is more than 2 stories above tank, consult factory.

PUMP AND PIPING SPECIFICATIONS

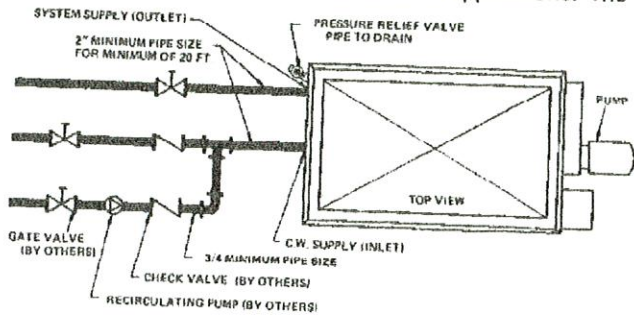
INDOOR	OUTDOOR	NUMBER OF PASSES	GPM									MIN. PIPE SIZE			TTL. SYS. HEAD LOSS			PUMP SIZE		
			WATER HARDNESS									SOFT			MEDIUM			HARD		
			SOFT	MEDIUM	HARD	SOFT	MEDIUM	HARD	SOFT	MEDIUM	HARD	SOFT	MEDIUM	HARD	SOFT	MEDIUM	HARD	SOFT	MEDIUM	HARD
133	133	4	10	15	20	1-1/4	1-1/4	1-1/4	17.00	17.00	17.00	B 110 1/2HP	B 111 1/8HP	B 112 1/3HP						
183	183	2	15	28	40	1-1/2	1-1/2	1-1/2	2.90	11.00	17.50	B 110 1/2HP	B 120 1/6HP	B 131 1/3HP						
263	263	2	21	32	41	1-1/2	1-1/2	1-1/2	5.00	11.00	17.00	B 110 1/2HP	B 120 1/6HP	B 131 1/3HP						
334	334	2	27	38	81	1-1/2	1-1/2	2	5.00	10.00	11.00	B 110 1/2HP	B 120 1/6HP	B 131 1/3HP						
404	404	2	32	55	63	2	2	2	2.40	7.00	10.00	B 110 1/2HP	B 120 1/6HP	B 131 1/3HP						
514	514	2	52	52	63	2	2	2-1/2	7.50	7.50	11.00	B 120 1/6HP	B 120 1/6HP	B 131 1/3HP						
624	624	2	51	51	80	2	2	2-1/2	8.00	8.00	11.25	B 120 1/6HP	B 120 1/6HP	B 131 1/3HP						
724	724	2	50	50	79	2	2	2-1/2	8.25	8.25	11.50	B 120 1/6HP	B 120 1/6HP	B 131 1/3HP						
824	824	2	62	67	78	2	2	2-1/2	11.00	12.75	11.75	B 120 1/6HP	B 131 1/3HP	B 131 1/3HP						
962	926	2	70	79	90*	2-1/2	2-1/2	2-1/2	9.00	11.80	18.20	B 121 1/4HP	B 131 1/3HP	B 133 3/4HP						
1125	1083	2	75	90*	90*	2-1/2	2-1/2	2-1/2	12.50	18.90	20.20	B 131 1/3HP	B 132 1/2HP	B 133 3/4HP						
1223	1178	2	90	90*	90*	2-1/2	2-1/2	2-1/2	17.50	20.70	20.70	B 132 1/2HP	B 133 3/4HP	B 133 3/4HP						
1336	1287	2	89	90*	90*	2-1/2	2-1/2	2-1/2	17.75	21.30	21.30	B 132 1/2HP	B 133 3/4HP	B 133 3/4HP						
1468	1414	2	88	90*	90*	2-1/2	2-1/2	2-1/2	18.00	22.00	22.00	B 132 1/2HP	B 133 3/4HP	B 133 3/4HP						
1631	1571	2	87	90*	90*	2-1/2	2-1/2	2-1/2	18.25	22.20	22.20	B 132 1/2HP	B 133 3/4HP	B 133 3/4HP						
1826	1768	2	88	98	98	2-1/2	2-1/2	2-1/2	18.50	22.50	22.50	B 132 1/2HP	B 133 3/4HP	B 133 3/4HP						
2100	-	2	100	100	190	3	3	3	20.00	20.00	20.00	B 3006 5.2"1HP	B 3006 5.2"1HP	B 4006 5.9"2HP						
2500	-	2	193	193	193	3	3	3	20.00	20.00	20.00	B 4006 5.9"2HP	B 4006 5.9"2HP	B 4006 5.9"2HP						
3001	-	2	200	200	200	3	3	3	30.00	30.00	30.00	B 4006 5.9"2HP	B 4006 5.9"2HP	B 4006 5.9"2HP						
3500	-	2	200	200	200	3	3	3	30.00	30.00	30.00	B 4006 5.9"2HP	B 4006 5.9"2HP	B 4006 5.9"2HP						
4001	-	2	200	200	200	3	3	3	30.00	30.00	30.00	B 4006 5.9"2HP	B 4006 5.9"2HP	B 4006 5.9"2HP						

\*GPM Flow rates limited by maximum acceptable velocity through heat exchanger tubes. May be increased by 10% for closed heating systems. Pressure drop would increase 21%. Single pass heat exchangers are to be used only when flow rates exceed the allowable for two pass.

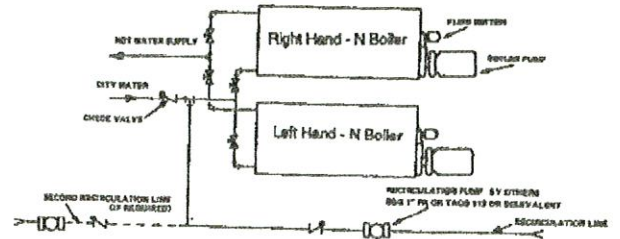


**TYPE N**

Type N boilers provide instant hot water without a tank. For use where scaling is prevalent and where hot water demand is fairly constant throughout the day. Examples are: apartments, hotels, motels and industrial applications. The



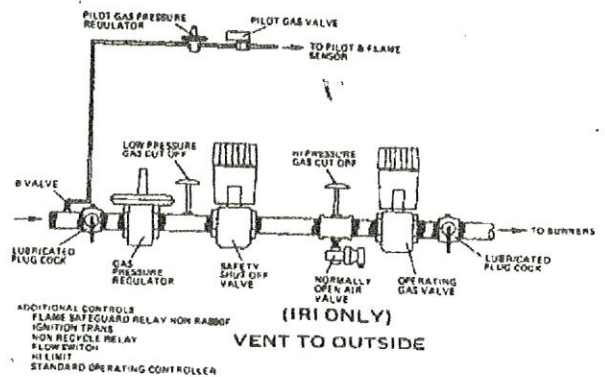
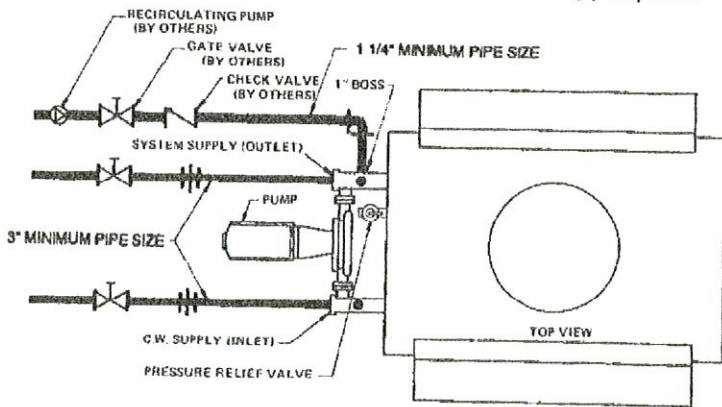
Type N boiler should not be used on apartments and hotels with less than 20 units, nor should the boiler be sized smaller than a 624.



**DUAL N MODELS 334-1826**

- NOTES: 1. Estimate total length of supply and return loop. Refer to table.  
 2. If multiple loops are used:  
 (A) Use multiple pumps and size return pipes according to table; or  
 (B) Use one larger recirculating pump with

- balancing valves on each return line.  
 3. First fixture on supply line must be a minimum of 20 feet from the heater.  
 4. Supply line size must be 2" minimum. If not possible, add a tank between heater and first fixture.

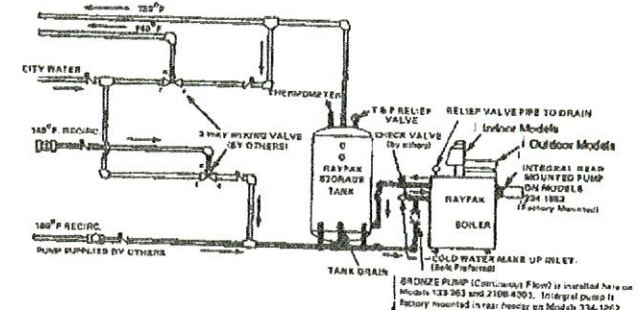
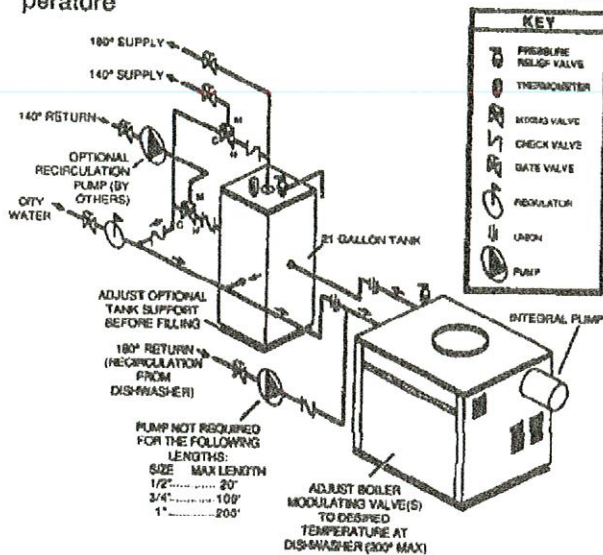


**TYPE N MODELS 2100-4001**

**IRI AND FM-FACTORY MUTUAL-PIPING SCHEMATIC**

TYPE R boilers provide both 140°F and 180°F temperature

MINIMUM INPUT ADJUSTMENT  
 Models Type H, N, R & W have minimum input ratings as specified on their individual rating plates.



DUAL TEMP PACKAGE SYSTEM  
 Minimum input controllers have been pre-set at the factory. Consult with factory representatives if a minimum input problem should occur.

**RESTAURANT-PAK TYPE R BOILER MODELS 334-1125**

## CONTROLS - GENERAL

### ECONOMASTER CONTROLS

The Raytemp Economaster is an electric flue sensor that measures actual residual heat rather than simply a timing device that many boilers offer. The design also allows changes in set point of heater without necessitating readjustment of the Economaster. All components may be factory installed, with the exception of an operating aquastat, which is easily field installed. In a conventional system when the aquastat is satisfied, the main gas valve closes, but the pump continues operating.

With the energy conserving Economaster installed however, a flue sensor allows the boiler pump to continue running only until all usable heat from the combustion chamber is absorbed and stored in the system. The pump then shuts off until the next call for heat is received from the aquastat.

### ELECTRONIC IGNITION

The intermittent ignition device conserves energy by automatically extinguishing the pilot when desired temperature is reached. When additional heat is needed, the pilot re-ignites electrically, eliminating the fuel costs of maintaining a constant pilot. To assure safe operation, the gas valve cannot open until the pilot relights and is confirmed.

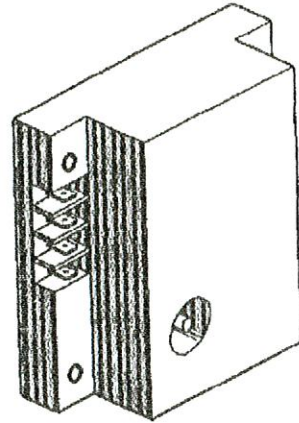
Model	w/out lockout	with lockout
133A-404 Natural Gas	Optional	Optional
133A-404 Propane	N/A	N/A
514-1826 Natural Gas	Standard	Optional
514-1826 Propane	N/A	Standard
2100-4001 Natural Gas	N/A	Standard
2100-4001 Propane	N/A	Standard

### OPERATING CONTROLS

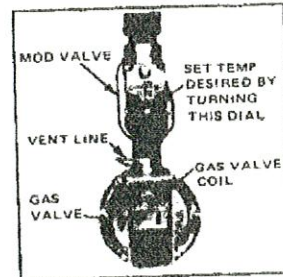
Sizes 133-1826, models with mechanical modulating controls have one or more Honeywell V5155-A Modusnap valves. These valves are furnished in addition to the main electric gas valve. Their purpose is to adjust the firing rate to meet the required load. The modulator will throttle the boiler input to prevent costly fuel consumption, as compared to an on-off cycling boiler. The valve has a remote capillary bulb immersed in a well at the header outlet to maintain a constant outlet temperature. When multiple valves are furnished, they can be staged to give greater flexibility of control. Consult the dial setting tag attached to the control for your desired temperature.

Sizes 2100-4001 are equipped with a single motorized modulating valve, which is controlled by a temperature controller that offers full modulation up to 20% of input BTU.

MODULATING VALVE CHART - V5155A			
DIAL POSITION	TEMPERATURE		
	W	R	H
1	85	150	95-120
2	105	158	110-135
3	120	165	125-150
4	135	173	140-165
5	150	180	155-180
6	165	188	170-195
7	180	195	185-210
8	195	203	200-225
9	210	210	215-240



IGNITION MODULE  
ELECTRONIC SAFETY



MODULATING VALVE LOCATION



THERMOSTAT CONTROL

## LIMIT CONTROLS

### HIGH LIMIT

If your boiler is equipped with a manual reset High Limit, push the reset button and set the limit(s) to 30° F-40° F above operating temperature.

### FLOW SWITCH

Dual purpose control shuts off boiler in case of pump failure or low water condition and is strongly recommended. Mount at boiler inlet and wire in series to the main gas valve. Standard on all models except 133. **NOTE:** Flow switch will not operate if flow is less than 12 GPM.

### 100% PILOT SAFETY

All standard boilers above 400 MBH input employ electronic devices, which close the main gas valve within 8/10 of a second whenever the pilot flame is

interrupted. Pilot flame is automatically lit when the device is powered. Unit performs its own safety check and opens the main valve only after the pilot is proven to be lit.

### LOW WATER CUT OFF

The low water cut off automatically shuts down burner whenever water level drops below probe. 90 second time delay prevents premature lockout due to temporary conditions such as power failure or air pockets. Flush float type devices at beginning of each heating seasons.

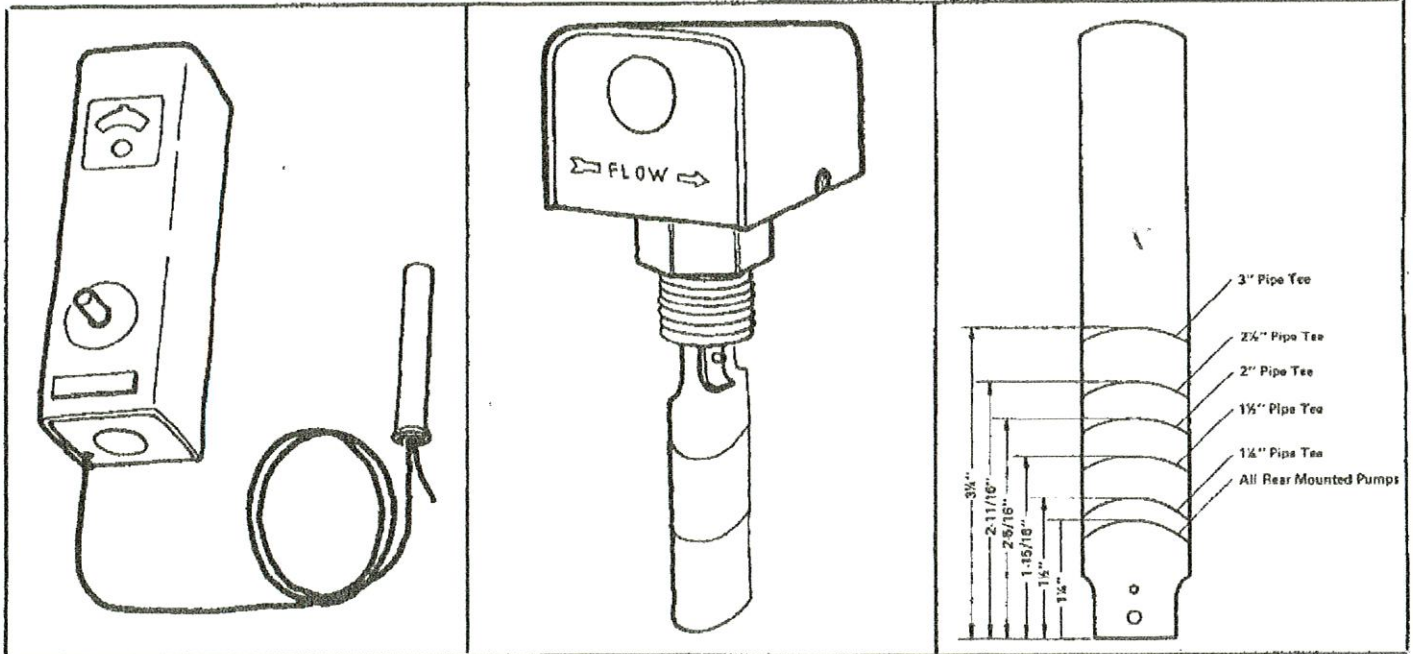
### HIGH AND LOW GAS PRESSURE SWITCHES

These switches sense either high or low gas pressures and automatically shut down burners if abnormal pressures exist.

MANUAL RESET HIGH LIMIT

FLOW SWITCH

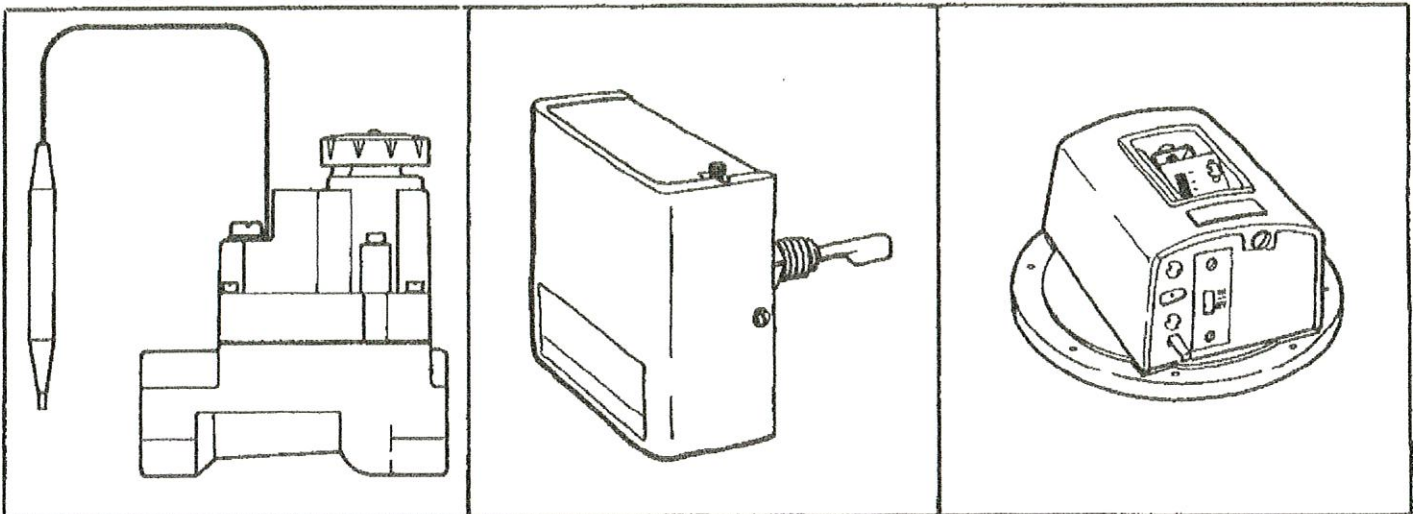
FLOW SWITCH CUTTING DIA.



ELECTRONIC SAFETY CONTROL  
MODULATING VALVE

LOW WATER CUTOFF

GAS PRESSURE SWITCH



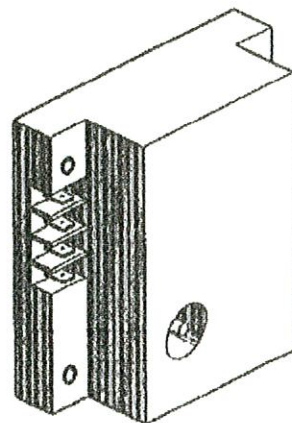
## INTERMITTENT IGNITION PILOT (AUTOMATIC GAS VALVES)

### LIGHTING INSTRUCTIONS

1. Close all gas valves. Turn off electric power supply. Wait 5 minutes.
2. Open manual pilot valve. Turn on electric power. Pilot is automatically lighted.
3. Open main gas valve.
4. Set temperature controls to desired temperature.

### TO SHUT DOWN

Close all manual gas valves. Turn off electric power.



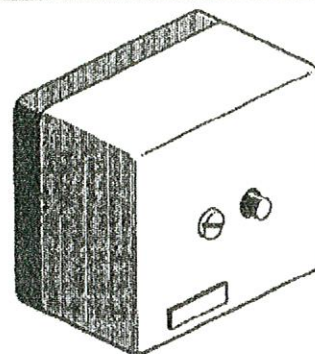
IGNITION MODULE

## INTERMITTENT IGNITION PILOT (CR & IRI UNITS)

1. Close all gas valves. Turn off electric power supply. Wait 5 minutes.
2. Open manual pilot valve. Turn on electric power. Push and release electric control reset button (Center of control cover). Pilot is automatically lighted.
3. Open main gas valve.
4. Set temperature controls to desired temperature.

### TO SHUT DOWN

Close all manual gas valves. Turn off electric power.



FLAME SAFE IID MODULE

## AFTER START-UP


### STANDING PILOT CHECKOUT PROCEDURE CHECKOUT

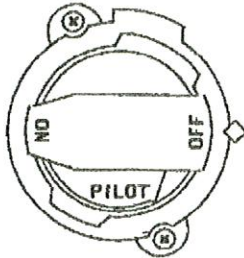
1. Turn on pilot gas supply, light pilot, and check pilot tubing connections for leakage. With main burner in operation, paint tubing connections with a rich soap and water solution. Bubbles indicate a gas leak.
2. Adjust pilot to obtain a normal flame enveloping 3/8 to 1/2 inch [9.5 to 12.5 mm] of the thermo couple or generator tip.
3. Place system in operation, and-
  - a. Check for satisfactory ignition of main burner.
  - b. Make certain the pilot stat "Hold In", and that shutdown occurs within 2-1/2 minutes after the pilot flame is extinguished.
  - c. Observe operation for at least three cycles to be sure the system is functioning normally.


### INTERMITTENT PILOT SYSTEM CHECKOUT PROCEDURE START SYSTEM (S86)

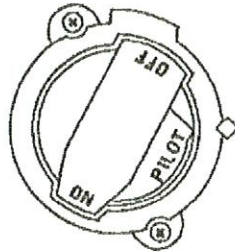
1. Turn on power to the ignition systems and turn gas supply off.
2. Check ignition module as follows:
  - a. Set the thermostat or controller above room temperature to call for heat.
  - b. Watch for continuous spark at the pilot burner.
  - c. Time the spark operation. Time must be within the lockout timing period (15 or 90 seconds).
  - d. Turn thermostat down to end call for heat and wait 60 seconds on lockout models before beginning step 3.
3. Turn on gas supply.
4. Set thermostat or controller above room temperature to call for heat.
5. Systems should start as follows:
  - a. Spark will turn on and pilot gas valve will open at once. Pilot burner should ignite after gas reaches the pilot burner.
  - b. Spark ignition should cut off when pilot flame is established.
  - c. Main gas valve should open and main burner should ignite after gas reaches the burner port.

**START-UP  
STANDING PILOT  
LIGHTING AND RELIGHTING INSTRUCTIONS**


1. Depress the main gas control knob and turn clockwise  to "OFF" position. Wait 5 minutes.

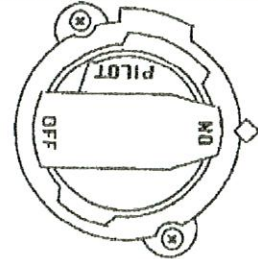


2. Turn main gas control knob counter-clockwise  to "ON" position.




3. Depress the main gas control knob, and light pilot.

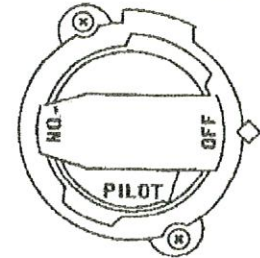
4. Keep the main gas control knob depressed for 60 seconds, or until pilot remains lit.
5. Turn main gas control knob counter-clockwise  to "ON" and set thermostat to desired temperature.



6. If pilot is extinguished, repeat above procedure.


**SHUT-OFF PROCEDURE**

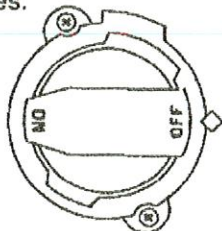
Turn main gas control knob clockwise  to "OFF".




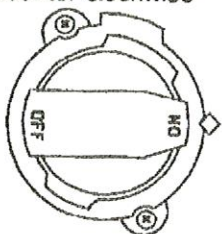
**INTERMITTENT IGNITION PILOT  
(MANUAL GAS VALVES)**

**LIGHTING INSTRUCTIONS:**

1. Turn main gas control knob clockwise  to "OFF" position and turn off electric power supply. Wait 5 minutes.



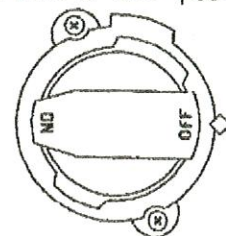
2. Turn main gas control knob counter-clockwise  to "ON" position.



3. Turn on electric power.
4. Set temperature control to desired temperature.
5. Pilot is automatically lighted.

**TO SHUT DOWN:**

Turn main gas control knob to "OFF" position, turn off electric power.



**GENERAL ELECTRICAL CONNECTIONS**

The boiler is normally wired for 120 Volts. The voltage is indicated on the tie-in leads. Consult the wiring diagram shipped with the boiler in the instruction packet. The "TH" leads are for remote tank thermostat connection. 24 Volts are supplied to this connection through the boiler transformer. DO NOT attach line voltage to the "TH" leads on sizes 133A-1826. Before

starting boiler check to insure proper voltage to boiler and pump.

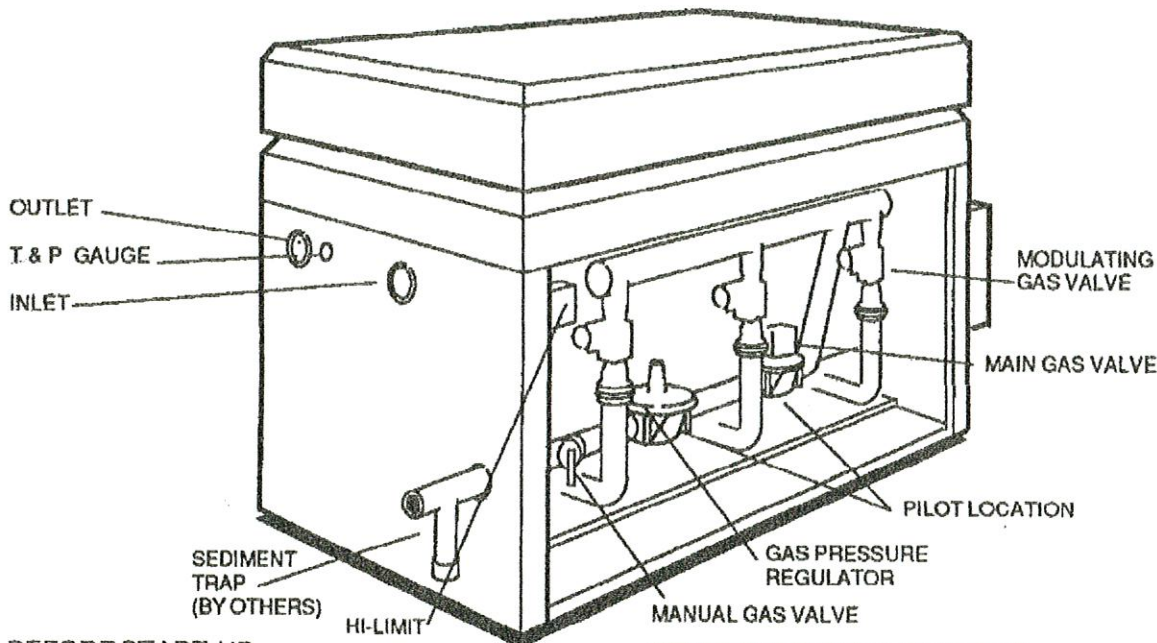
Boiler must be electrically grounded in accordance with National Electrical Code ANSI/NFPA No 70.

**NOTES:**

1. Field installed ground to inside of junction box.
2. If any of the original wire as supplied with the boiler must be replaced, it must be replaced with 105°C wire or its equivalent.

**START-UP PROCEDURES**

**GENERAL LOCATION OF CONTROLS**



**BEFORE START-UP**

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler when the boiler underwent tests specified in ANSI-Z21.13a 1983 Standard.

**ETHYLENE GLYCOL SYSTEMS - HEATING BOILERS**

Fill through filler opening on the top on the Air-X-Tank to solution desired. Always maintain solution level in sight glass.

**GENERAL**

Before lighting up a new installation, water should be flowing through the boiler.

**INITIAL START-UP - PUMP AND MOTOR**

Many pumps are now direct drive. They have no coupler or bearing assembly. These pumps do not require lubrication. Others require SAE-30 non-detergent oil to lubricate both the motor and the bearing assembly.

**CAUTION:**

Liquified petroleum gas is heavier than air and sinks to the ground. Exercise extreme care in lighting boiler in confined areas.

Clean dust and lint from pump and motor. Check pump coupler and tighten if necessary.

**FILLING SYSTEM-HEATING BOILERS**

Fill system with water. Purge all air from the system using purge valve sequence. After system is purged of air, lower system pressure. Open valves for normal system operation, fill system through feed pressure regulator to minimum 12 PSI. Manually open air vent on the compression tank until water appears, then close vent.

Flush system before putting into operation to assure that foreign material does not damage pump seals.

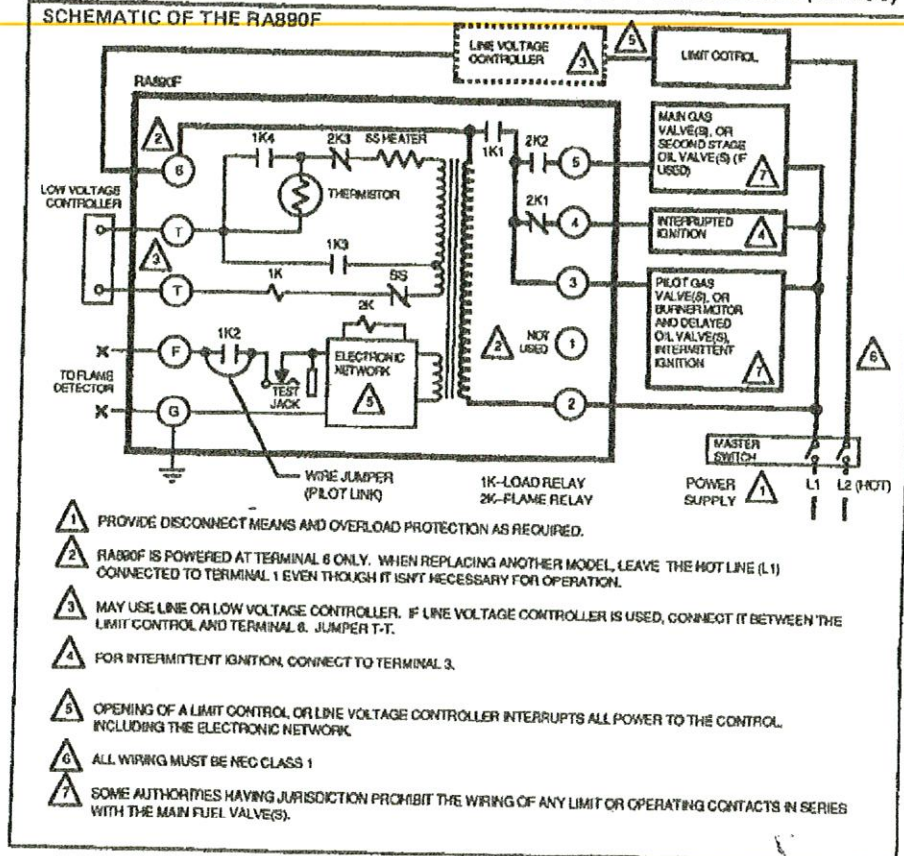
**CAUTION:**

- A. Pump must be off to check oil in bearing assembly.
- B. Do not run pump without water in system.



# INTERMITTENT PILOT SYSTEM CHECK-OUT PROCEDURE (RA890)

## SCHEMATIC OF THE RA890F



### CAUTION

Use utmost care while testing the RA890F; line voltage can be present on most terminals when power is on.

### PRELIMINARY CHECKS

Before placing the system in operation complete the following preliminary checks:

1. Check through wiring. Use a meter to check the continuity of all circuits.
2. Check flame detector installation.
3. Check burner adjustments.
4. Purge gas piping thoroughly.
5. Reset the safety switch by pushing in and then releasing the green safety switch button.
6. If the system has a standing pilot, make sure that the pilot link is removed and the pilot is lit.

### CHECKOUT REQUIRED

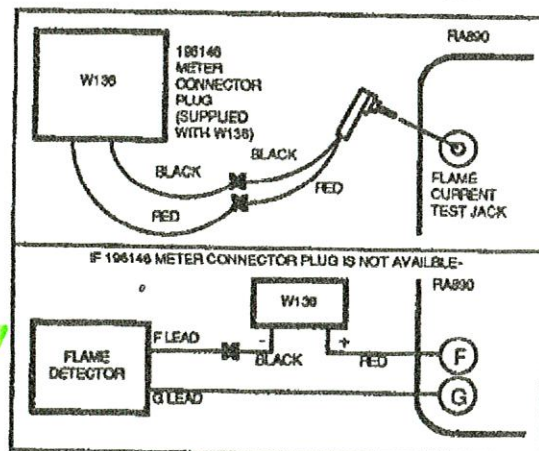
Before installation is complete, all checkout tests indicated below must be satisfactorily accomplished:

FLAME CURRENT CHECK (all installations).

PILOT TURNDOWN TEST (all installations that require proof of pilot before main fuel valve is opened).

SAFE SHUTDOWN CHECKS-Flame failure, power failure, limit action (all installations).

HOT REFRACTORY HOLD-IN (photocell applications only).



### CONNECTING METER TO READ FLAME CURRENT

#### FLAME CURRENT CHECK

The flame current check is the best indicator of proper flame detector application. The check should be done at the time of installation, at any time service is done on the system, and at least once a month, or more often, while the system is in operation. This will prevent shutdowns due to poor flame signal.

The test is done by connecting a W136 (or equivalent) micrometer in series with the flame detector and reading the flame signal while the burner is operating.

Insert a 196146 Meter Connector Plug, wired color-to-color to the W136 leadwires, into the test jack on the RA890F. This automatically puts the micrometer in series with the flame detector.

If a meter connector plug is not available, disconnect the flame detector lead from the F terminal; then connect this lead to the BLACK lead of the micrometer, and connect the RED lead of the micrometer to the F terminal.

When reading the flame current, ensure that the following criteria are met:

1. The flame current must be steady; meter should not vary more than a needle width.
2. The flame current must be at least 2 microamperes for a rectification type detector such as is used with the RA890F. The normal operating range will be 2-5 microamperes.

**IN A STEADY READING OF AT LEAST MINIMUM STRENGTH CANNOT BE OBTAINED, ONE OR MORE OF THE FOLLOWING CONDITIONS MAY EXIST:**

- Improper supply voltage.
- Defective flame detector wiring, including-
  - open circuits
  - short circuits.
  - high resistance shorts caused by moisture,
  - accumulated dirt, or an improper choice of detector leadwire for the particular installation.
- Improper application of a flame rod, including-
  - insufficient ground area.
  - poor location of flame rod in flame.
  - excessive heat on flame rod insulator (greater than 600° F [316° C]).
  - ignition interference.
- Defective sensor.

### PILOT TURNDOWN TEST

#### CAUTION

The pilot turndown test should be performed only by qualified personnel, and the instructions should be followed carefully.

On systems that prove a pilot before the main fuel valve can be opened, perform a pilot turndown test to prove that the main burner can be lighted by the smallest pilot that will hold in the flame relay. A flame current check should be performed before and after the pilot turndown test.

1. Open the main power switch.
2. Shut off the fuel supply to the main burner only by closing the manual main burner shutoff cock. Do not shut off the fuel supply to the pilot valve.
3. Restore power to the relay.
4. Start system by raising the set point of the controller (or pressing the start button). The pilot will light and pull in the flame relay.
5. Reduce the size of the pilot flame to the turn down condition by slowly closing the manual valve on the pilot gas line. At the turndown condition, the pilot will be small enough to just barely hold in the flame relay (2K).

- a. Turn down the pilot until relay 2K drops out.
  - b. Turn the pilot back up slowly just until relay 2K pulls back in.
  - c. Again turn the pilot down slightly, but not enough so the relay drops out. If the relay drops out again, simply turn the pilot up and try again. The closer the pilot is to the dropout condition, the more conclusive the test will be.
6. Check that the pilot is lit and relay 2K is pulled in.
  7. Open the manual burner shutoff cock. Main flame should light smoothly within 1 second. If the burner does not light within 1 second, close the shutoff cock and shut off power to the relay. Proceed to step 9.
  8. If the burner lights, repeat step 7 two or three times to verify smooth lightoff.
  9. If the lightoff is unsatisfactory, readjust the flame detector to require a larger pilot flame to hold in the flame relay. This usually requires-
    - a. resighting an ultraviolet or photocell type detector farther out on the axis of a pilot flame, or
    - b. adjusting a flame rod detector so that a larger minimum pilot is required.

#### CAUTION

If the pilot needs to be adjusted and rechecked, allow 5 minutes for the purge of unburned gases in the combustion area before proceeding to the next step.

10. Repeat the entire turndown test until the flame is established promptly in step 7.
11. Turn the pilot up to full flame at the completion of the test. A flame current check should be performed before leaving the job.

#### SAFE SHUTDOWN CHECKS LIMIT ACTION

With the burner operating, lower the high limit setting to simulate an overheated boiler. Normal shutdown should occur. Restore the normal limit setting, and the burner should restart.

The use of manual reset limits is desirable with the RA890F to prevent the system from cycling off the high limit and to insure that the condition which causes the limit action is detected as soon as possible.

#### FLAME FAILURE

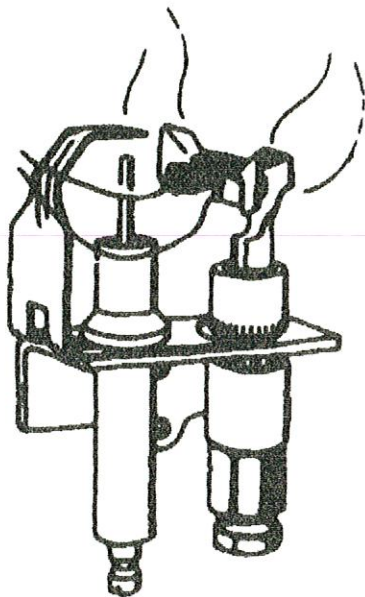
With the burner operating, close the manual fuel valves to simulate a flame failure. System should lock out in safety switch timing (15 or 30 sec). After the safety switch has cooled, open the manual valves and reset the safety switch, and the burner should restart.

## INSPECTION PROCEDURES

### BURNERS

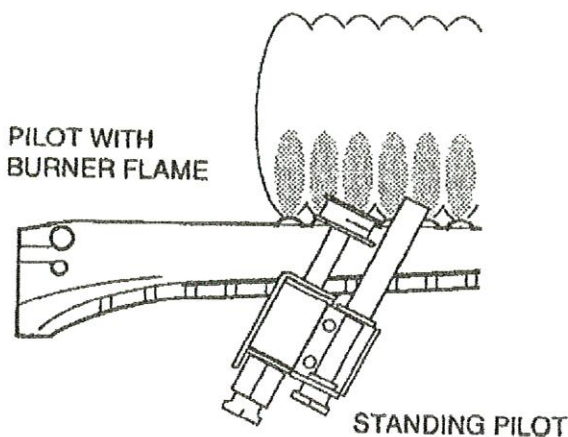
Clean main burners and air louvers of dust, lint and debris. Keep boiler area clear and free from combustibles and flammable liquids. Do not obstruct the flow of combustion and ventilating air. Make visual check of burner and pilot flame. Yellow flame indicates clogging of air openings. Lifting or blowing flame indicates high gas pressure. Low flame indicates low gas pressure.

*NOTE: Modulating burner flame varies in height from approximately 1/4" at low fire to approximately 4" in high fire.*



ELECTRONIC IGNITION TYPE PILOT

PILOT FLAME SHOULD ENGULF THERMO-  
COUPLE

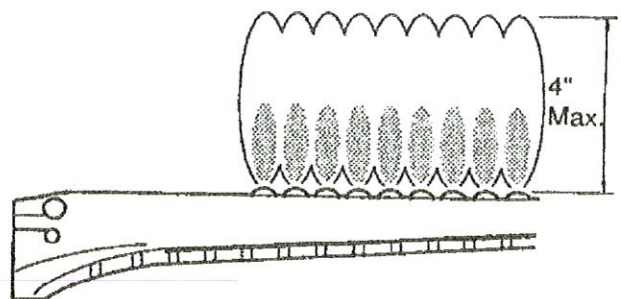


STANDING PILOT

### CONTROLS

Check all controls to see that they are operational. To check electronic safety, turn off main burner. Observe pilot burner when shutting off pilot gas. Ignition spark should go on. Main gas valve will also drop out.

High Limit Switch - to check high limit switch, turn dial setting down to a point slightly below the temperature of the water leaving the heater. The reset button should snap out and the burner should shut off. Reset dial to 190°F, and push reset button. Burner should light.



MAIN BURNER FLAME

### NORMAL INSPECTION PROCEDURES

First and third month after initial start up and then on an annual basis. If problems are found, refer to Trouble Shooting Guide for additional directions.

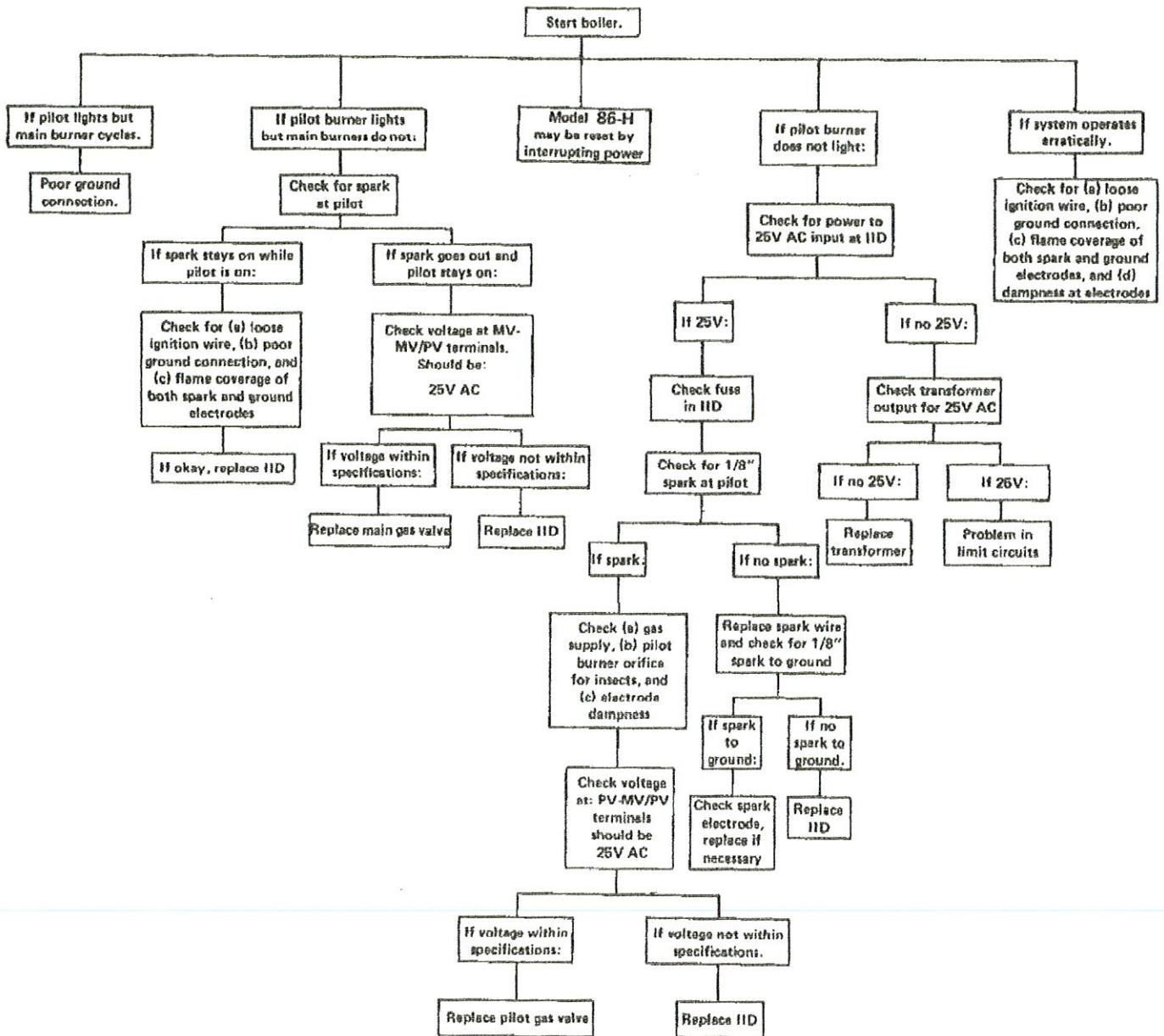
1. Remove top of heater and inspect heat exchanger for soot and examine venting system.
2. Remove rear header and inspect for scale deposits.
- \*3. Inspect pilot and main burner flame and firing rate.
- \*4. Inspect and operate all controls and gas valve.
- \*5. Visually inspect system for water leaks.
- \*6. a. Oil pump motor and bearing assembly, if oil cups are provided.  
b. Disconnect pump from header and check condition of pump impeller. Check condition of bearing by attempting to move impeller from side to side. Replace any parts showing wear.  
c. Check pump coupler for wear and vibration.
7. Check flow switch paddle.
8. Clean room air intake openings to assure adequate flow of combustion and ventilation air.
9. Keep boiler area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.

\*Should be checked monthly. (Takes approximately 15 minutes).

# Troubleshooting

## ELECTRICAL

### Intermittent Ignition Device (IID) Check-Out Procedure For Service Technicians



**WARNING**  
**HIGH VOLTAGE**  
For Qualified Technicians ONLY

**MECHANICAL PROBLEM**

When boiler is turned on nothing happens.

Thermostat in "ON" position causes relay and pump to operate, but boiler does not fire.

Continuous shut down of manual reset High Limit.

Sooting  
CAUTION-Soot may be combustible. Wet down and exercise caution when cleaning.

Continuous shut down of low water cutoff or flow switch.

Low flame.

Outer jacket very hot (blistered paint).

**POSSIBLE CAUSE**

**CORRECTIVE ACTION**

Pilot is not lit.....	Light pilot.
No power to the boiler.....	Check the circuit breaker, outdoor controller, etc., upstream of boiler.
Bad transformer.....	If power to Leads L1 and L2 of transformer, but no power on 24V side, replace.
Inoperative thermostat.....	Jumper thermostat, replace with new if boiler fires.
Inoperative toggle switch.....	If power to toggle switch, but not through switch, replace.
Inoperative relay.....	If power to relay, but not operating, replace.
"A" valve closed.....	Open "A" valve.
Plugged bleed line on gas valve or gas pressure regulator.....	Loosen bleed line and clean.
Broken pump coupler.....	Replace coupler. Inspect bearing assembly, and if frozen, lubricate or replace.
Shutdown on low water cutoff, caused by air.....	Bleed air from system.
Gas valve defective.....	Check for power to gas valve. If valve has power but will not open, check vent tube for blockage. If clear, replace valve.
Temperature setting too low.....	Reset High Limit to higher temperature.
Low water flow.....	Check system water pumps.
Interrupted pump operation.....	Oil and check pump.
Modulating control set too high.....	Reset modulator to a lower number.
Mechanical modulating control.....	Check and replace if necessary.
Air starvation.....	Refer to installation instructions regarding combustion air requirements.
Condensation.....	Set bypass valve to prevent boiler outlet temperature from dropping below 100° F.
Toxic fumes which cause a chemical reaction with copper tubes or destroy combustion.....	Remove all sources of fumes, such as freon, chloride, or isolate the boiler.
Improper venting.....	Follow recommended vent installation instructions.
Insufficient system flow.....	Check pumps and piping.
Low water due to leaking.....	Inspect for leaking and repair.
Air in system.....	Inspect for leakage and repair. Install an automatic air vent.
Line strainer dirty.....	Clean.
Lime in Heat Exchanger.....	Rout tubes.
Gas supply.....	Debris in gas line (pipe dope, rocks, etc.). Gas line too small. Improper size gas meter. Gas regulator adjustment.
Insects or debris clogging.....	Clean burners.
Burner intake ports low gas pressure.....	Adjust gas pressure.
Venting or combustion air.....	Refer to installation instructions regarding combustion air requirement.
Broken refractory caused by shipping or improper combustion.....	Replace refractory panels.

## PUMPS

### FAILURE TO PUMP

1. Pump not properly primed.
2. Wrong direction of rotation.
3. Speed too low.
4. Total head too high.

### REDUCED CAPACITY AND/OR HEAD

1. Air pockets or leaks in suction line.
2. Clogged impeller.
3. Foot valve strainer too small or clogged.
4. Excessive suction lift...over fifteen(15) feet.
5. Insufficient positive suction head (for hot water).
6. Total head more than that for which pump is intended.
7. Excessively worn impeller and wearing rings.

### RAPIDWEAR OF COUPLING

1. Misalignment or a bent shaft.
2. Sagging motor mounts (over-oiling).

### PUMP LOSES PRIME

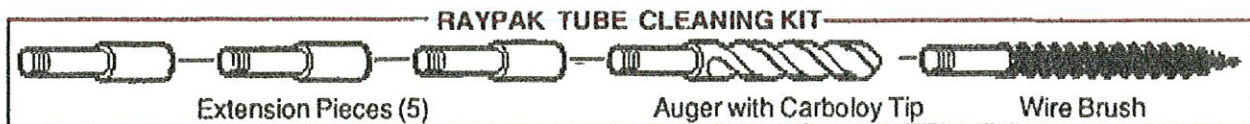
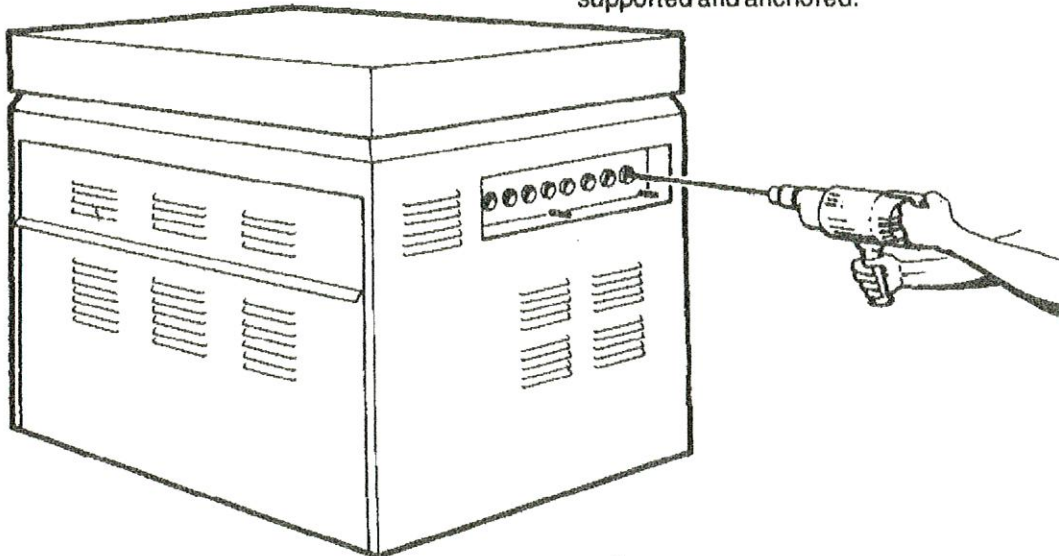
1. Air leaks in suction line.
2. Excessive amount of air in water.
3. Water seal in stuffing box not functioning.
4. Excessive suction lift and pump operating too near shut-off point.

### OVERLOADED DRIVING UNIT

1. Head much lower than that for which pump is designed.
2. Speed too high or higher than that contemplated.

### MECHANICAL TROUBLES AND NOISE

1. Misalignment.
2. Excessive suction lift or vapor binding (hot water).
3. Bent shaft and/or damaged bearings.
4. Suction and discharge piping not properly supported and anchored.



## REPAIR SECTION

### TUBE CLEANING PROCEDURE (TYPICAL)

Establish a regular inspection schedule, the frequency depending on the local water condition and severity of service. Do not let the tubes clog up solidly. Clean out deposits over 1/16" in thickness.

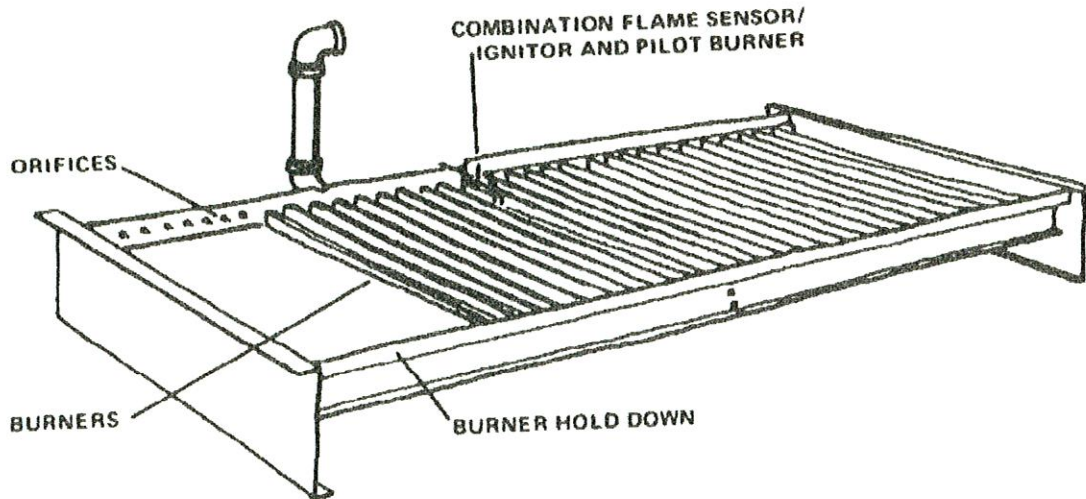
Although the illustration shows the mechanical cleaning procedure of a small boiler, it is typical of all sizes. The boiler may be cleaned from the right side as shown, without breaking pipe connections. It is preferable, however, to remove both right and left headers for

better visibility through the tubes and to be sure the residue does not get into the system.

Note that you do not remove the top pan or the heat exchanger generally.

After reaming with the auger, mount the wire brush and clean out the debris remaining in the tubes.

Another method is to remove the heat exchanger, ream tubes and immerse heat exchanger in non-inhibited de-scale solvent.



### BURNER DRAWER REMOVAL

1. Shut off power and gas supply to the boiler. Disconnect union(s) and pilot tubing, then loosen and remove burner hold down screws.
2. Disconnect wires at gas valve and slide burner drawer out.

### GAS VALVE REMOVAL

1. Shut off gas supply to the boiler. Remove gas piping to gas valve inlet.
2. Disconnect wires, pilot tubing and bleed line, if required.
3. Turn vertical gas pipe from manifold slightly and unscrew gas valve.
4. Reverse above procedure to re-install.

### MAIN BURNER AND ORIFICE REMOVAL

1. Remove screws and burner hold down bracket.

*NOTE: If the heat exchanger is sooted badly, the burner hold down bracket and spacer can become distorted from direct flame impingement and this usually necessitates replacement of these parts.*

2. Lift burners from slotted spacer and slide from orifices. Clean with a wire brush.
3. Orifices usually do not need to be replaced. To clean, run either copper wire or wood through orifice. Do not enlarge hole. To remove orifice, use a socket wrench and remove the manifold. DO NOT overtighten when reinstalling.

### MECHANICAL MODULATING VALVE OPERATOR REMOVAL

1. Shut off gas and disconnect electrical power.
2. Remove front inspection panels.
3. Remove wedge or retaining clip holding sensing bulb in control well. Remove bulb and capillary.
4. Loosen four (4) screws holding modulator to valve body. Lift off valve body and replace. After installing new modulator, check gasket and test for gas leaks.

### MECHANICAL MODULATING VALVE CALIBRATION

If dial numbers do not correspond with temperatures on valve tag, set valve to a known temperature. Remove center screw and dial plate without moving shaft. Replace dial plate so that dial plate number matches known temperature.

### PILOT REMOVAL AND CLEANING

1. Disconnect pilot tubing at pilot and sensor/ignitor wire. Remove screws holding pilot bracket to burner drawer.
2. Remove pilot and bracket, clean pilot of debris, small bugs, etc., with wire or small brush.
3. Replace pilot, pilot tubing, sensor ignition wires and check for leaks.

### HIGH LIMIT OR TANKSTAT REMOVAL

1. Turn off electrical power.
2. Remove front inspection panel.
3. Remove wires to high limit and loosen screws holding high limit to cabinet.
4. Remove wedge clip holding sensing bulb in control well.
5. Remove high limit and install a new one.
6. Check control operation before leaving job.

### HEAT EXCHANGER REMOVAL

1. Shut water, gas and electricity off, close valves and relieve pressure, remove relief valve. Remove side inspection panels.
2. Remove top holding screws.
3. Remove draft diverter, lift and remove top and flue collector on stack type models. Remove inspection panels.
4. Loosen bolts and disconnect flange nuts on inlet-outlet header, loosen union (s) at gas pipe, and slide boiler away from piping until studs clear the heater.

### CONTROL WELL REPLACEMENT

Remove top, sensing bulb and clip. Collapse well tube at the open end with a chisel, push through into header and remove the well through header. Insert a new well and roll into place. If a roller is not available, solder the well in place with silver solder.

### TUBE REPLACEMENT PROCEDURE

1. Remove heat exchanger from boiler following instructions outlined under HEAT EXCHANGER REMOVAL above.
  2. Remove inlet/outlet and return headers. Remove "V" baffle from damaged tube.
  3. Remove damaged tube by cutting with a hack saw or shearing with a chisel adjacent to each tube sheet.
  4. Collapse stub ends in tube sheets using a chisel or screwdriver. **DO NOT** cut into tube sheet or mar surface in tube hole in any way.
  5. Insert replacement tube by inserting the end with the most fins removed in the opening of one tube sheet. Slide tube until the opposite end clears the other tube sheet and fit the tube into the hole.
  6. Insert the tube roller into tube opening up to stop, making certain that 1/8" of tube projects beyond the tube sheet.
  7. Attach drill to tube roller, holding it straight and level.
- Note: Use a 3/8" heavy duty, reversible, electric drill or larger. Proceed to expand tube until tool starts to grab. Approximately 1/2 to 1" of the tool shank will be visible.*
8. Reverse drill motor and withdraw tube roller, if necessary wrench out by hand.
  9. **DO NOT** apply excessive torque during rolling operation and avoid thinning any wall of the tube beyond 0.015".
  10. Use same procedure on opposite end.
  11. Apply line pressure test. Re-roll if necessary.
  12. Reinstall as outlined under HEAT EXCHANGER REASSEMBLY.

### PROCEDURE FOR CLEANING FLUE GAS PASSAGEWAYS

Soot will clog areas behind fins and cause eventual tube failure. Any sign of soot at base of burners or around outer jacket indicates a need for cleaning.

1. Lift off draft hood and flue collector by removing bolts and screws.
2. Remove "V" baffles from heat exchanger.
3. Remove burner tray as shown on page 17.
4. Take garden hose and wash heat exchanger, making sure soot is removed from between fins. (Avoid excessive water against refractory).
5. Reassemble; when boiler is fired, some steam will form from wet refractory. This is normal.

*NOTE: In extreme cases it may be necessary to remove the heat exchanger completely for cleaning. The simplest method is steam cleaning at a local car wash. DO NOT WIRE BRUSH!*

### CAUTION:

*Soot is combustible, so exercise extreme care.*



**LIMITED PARTS WARRANTY  
COMMERCIAL BOILERS  
MODEL H - SIZES 0514 TO 4001  
MODELS N, R & W - SIZES 0133 TO 4001**

**SCOPE:**

Raypak, Inc. ("Raypak") warrants to the original owner that all parts of this boiler which are actually manufactured by Raypak will be free from failure under normal use and service for the specified warranty periods and subject to the conditions set forth in this Warranty. Labor charges and other costs for parts removal or reinstallation, shipping and transportation are not covered by this Warranty but are the owner's responsibility.

**HEAT EXCHANGER WARRANTY:**

- **Five (5) Years** from date of boiler installation. This includes only the copper, bronze and cast iron waterways.
- **Twenty (20) Years** from date of boiler installation against "Thermal Shock" (excluded, however, if caused by boiler operation at large changes exceeding 150°F between the water temperature at intake and boiler temperature, or operating at boiler temperatures exceeding 230°F).

**ANY OTHER PART MANUFACTURED BY RAYPAK:**

One (1) Year warranty from date of boiler installation, or eighteen (18) months from date of factory shipment based on Raypak's records, whichever comes first.

**SATISFACTORY PROOF OF INSTALLATION DATE, SUCH AS INSTALLER INVOICE, IS REQUIRED. THIS WARRANTY WILL BE VOID IF THE BOILER RATING PLATE IS ALTERED OR REMOVED.**

**ADDITIONAL WARRANTY EXCLUSIONS:**

This warranty does not cover failures or malfunctions resulting from:

1. Failure to properly install, operate or maintain the boiler in accordance with our printed instructions provided;
2. Abuse, alteration, accident, fire, flood and the like;
3. Sediment or lime buildup, freezing, or other conditions causing inadequate water circulation;
4. High velocity flow exceeding boiler design rates;
5. Failure of connected systems devices, such as pump or controller;
6. Use of non-factory authorized accessories or other components in conjunction with the boiler system;
7. Failing to eliminate air from, or replenish water in, the connected water system;
8. Chemical contamination of combustion air or use of chemical additives to water.

**PARTS REPLACEMENT:**

Under this Warranty, Raypak will furnish a replacement for any failed part. The failed part must first be returned to Raypak if requested, with transportation charges prepaid, and all applicable warranty conditions found satisfied. The replacement part will be warranted for only the unexpired portion of the original warranty. Raypak makes no warranty whatsoever on parts not manufactured by it, but Raypak will apply any such warranty as may be provided to it by the parts manufacturer.

**TO MAKE WARRANTY CLAIM:**

Promptly notify the original installer, supplying the model and serial numbers of the unit, date of installation and description of the problem. The installer must then notify his Raypak distributor for instructions regarding the claim. If either is not available, contact Service Manager, Raypak, Inc., 31111 Agoura Road, Westlake Village, CA 91361 or call (818) 889-1500. In all cases proper authorization must first be received from Raypak before replacement of any part.

**EXCLUSIVE WARRANTY - LIMITATION OF LIABILITY:**

This is the only warranty given by Raypak. All other warranties, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are excluded. No one is authorized to make any other warranties on Raypak's behalf.

The sole remedy against Raypak with respect to defective parts shall be as provided in this Warranty. It is agreed that Raypak shall have no liability, whether under this Warranty, or in contract, tort, negligence or otherwise, for any special, consequential, or incidental damages.

**SIZING OF RAYPAK BOILERS/WATER HEATERS**

Raypak boilers should always be sized in accordance with standard Raypak sizing guides. Should claimed increased performance, based on the installation of a field installed heat recovery device, cause the designer and/or purchaser to modify the size of the Raypak equipment downward from Raypak's recommendations, Raypak will accept no responsibility for either the efficiency of the combined system or its ability to generate the proper amount of hot water for the application.



31111 AGOURA ROAD, WESTLAKE VILLAGE, CALIFORNIA 91361 (818) 889-1500  
RAYPAK THERMONICS, 120 SKYWAY AVENUE, TORONTO, CANADA