

QUANTUM LEAP® SERIES

GAS-FIRED, DIRECT VENT, WET RECUPERATED,

CONDENSING, HOT WATER

BOILERS

INSTALLATION INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler

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.



DUNKIRK BOILERS

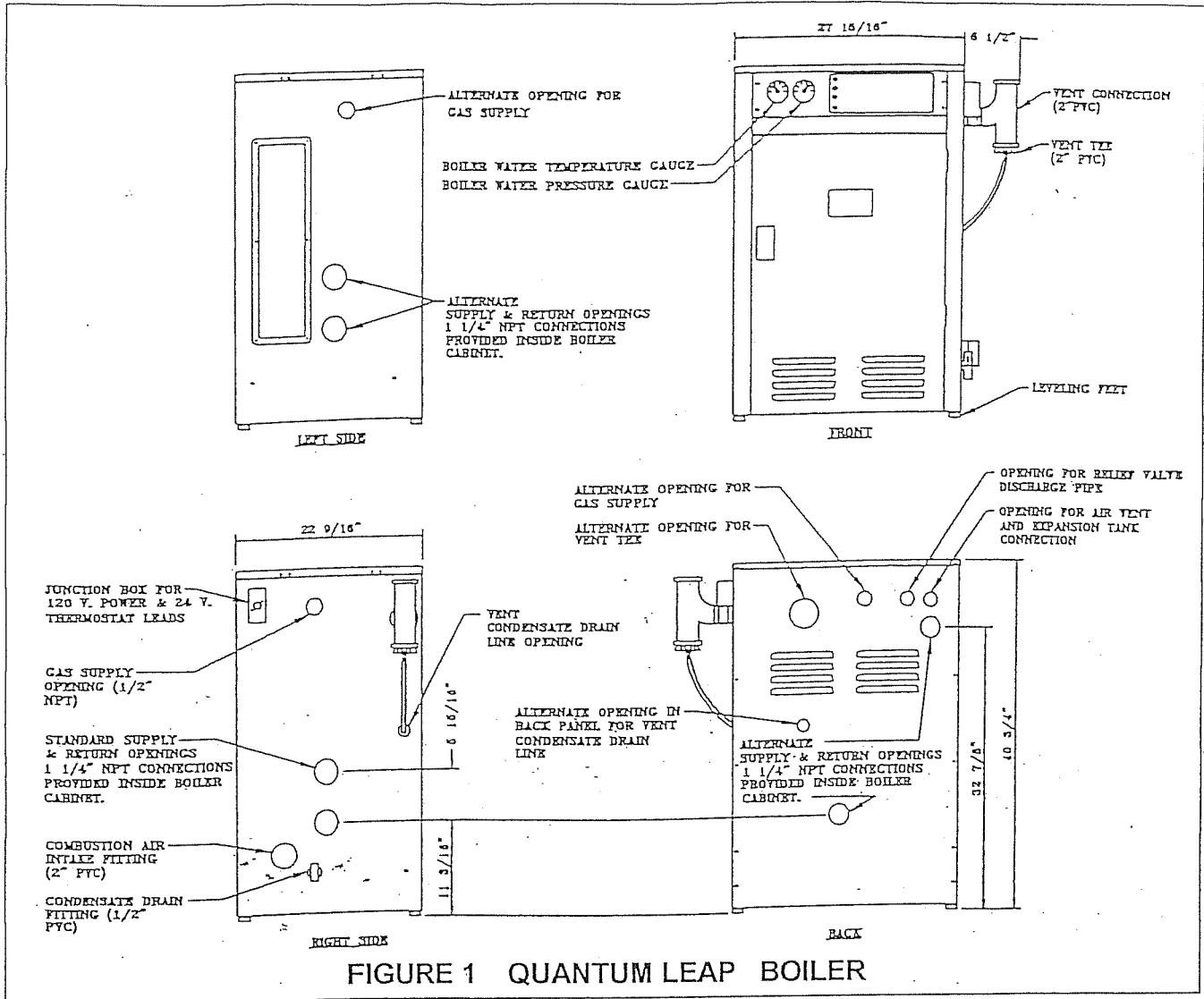
DUNKIRK, NEW YORK 14048 - 716 366-5500

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BOILER RATINGS AND CAPACITIES

TABLE 1 SEA LEVEL RATINGS - NATURAL AND PROPANE GASES

Model	Input *(MBH)	++ Heating Capacity *(MBH)	Net I=B=R Rating *(MBH)	Shipping Weight (lbs.)	Flue Dia.
QL-100	100	95	83	275	2" PVC

*1 MBH = 1,000 Btuh Btuh = British Thermal Units Per Hour

These low pressure gas fired hot water boilers are design certified by CSA International for use with natural and propane gases. The boilers are constructed and hydrostatically tested for a maximum working pressure of 50 psig (pounds per square inch gage) in accordance with A.S.M.E. (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code Section IV Standards for heating boilers.

++ AFUE (Annual Fuel Utilization Efficiency) and Heating Capacity is based on the D.O.E. (Department of Energy) test procedure.

The QL Boilers are certified in accordance with ANSI (American National Standards Institute) Z21.13 standards as gas fired direct vent condensing hot water boilers.

New York City MEA Number 132-97-E.

The **Heating Capacity** indicates the amount of heat available after subtracting the losses up the stack. Most of this heat is available to heat water. A small portion is heat from the jacket and surfaces of the boiler, and it is assumed that this heat stays in the structure. The **Net I=B=R Rating** represents the portion of the remaining heat that can be applied to heat the radiation or terminal units (i.e. finned tube baseboard, cast iron radiators, radiant floor, etc.). The difference between the Heating Capacity and the Net I=B=R Rating, called the piping and pickup allowance, establishes a reserve for heating the volume of water in the system and offsetting heat losses from the piping. The Net I=B=R Ratings shown are based on a piping and pickup factor of 1.15 in accordance with the I=B=R Standard as published by the Hydronics Institute. The Net I=B=R Rating of the boiler selected should be greater than or equal to the calculated peak heating load (heat loss) for the building or area(s) served by the boiler and associated hot water heating systems. The manufacturer should be consulted before selecting a boiler for installations having unusual piping and pickup requirements.

BOILERS FOR USE AT HIGH ALTITUDE

The QL boilers are factory equipped for operation at altitudes ranging from 0-2,000 feet above sea level. For use of these boilers at altitudes above 2,000 feet above sea level, the gas input ratings (MBH) must be reduced.

U.S.A. ONLY : For altitudes above 2,000 feet above sea level, input ratings should be reduced as shown in Table 1A for natural gas fired boilers or in Table 1B for propane gas fired boilers. In most cases the furnished sea level orifices will also be used for higher elevations. Reduced input ratings are achieved by the natural deration of the gas at higher elevations and fine tuned by adjusting the manifold pressure.

CANADA ONLY: For altitudes in the range of 2,000 – 4,500 feet above sea level, boilers may be field equipped for use at high altitude by using a certified high altitude field conversion kit. The change in main burner orifice size results in a 10% reduction of the boiler gas input rating (MBH). The conversion shall be carried out by a manufacturer's authorized representative, in accordance with the requirements of the manufacturer, provincial or territorial authorities having jurisdiction, and in accordance with the requirements of the **CSA-B149.1** and **CSA-B149.2** Installation Codes. The certified field conversion kit includes a conversion data plate, indicating that the boiler has been converted for high altitude use. The correct conversion information must be entered on the conversion data plate.

TABLE 1A QL-100 NATURAL GAS HIGH ALTITUDE RATINGS

ELEVATION (FEET)	0-2000	3,000	4,000	5,000	6,000	7,000	7,500	8,500	9,500	10,500
NOMINAL INPUT (MBH)	100.0	95.9	95.1	94.5	93.7	93.0	92.6	88.9	85.2	81.6
HEATING CAPACITY (MBH)	95.0	91.1	90.3	89.8	89.0	88.4	88.0	84.5	80.9	77.5
NET I=B=R RATING (MBH)	83	79	79	78	77	77	77	73	70	67
GAS ORIFICE DRILL SIZE	44	44	44	44	44	44	44	44	44	44
FAN/OUTLET PRESSURE SWITCH SETPOINT (INCHES WATER COLUMN)	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45
INLET PRESSURE SWITCH SETPOINT (INCHES WATER COLUMN)	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10

TABLE 1B QL-100 PROPANE GAS HIGH ALTITUDE RATINGS

ELEVATION (FEET)	0-2000	3,000	4,000	5,000	6,000	7,000	7,500	8,500	9,500	10,500
NOMINAL INPUT (MBH)	100.0	96.1	95.4	94.8	94.1	93.4	93.1	89.4	85.7	82.0
HEATING CAPACITY (MBH)	95.0	91.3	90.6	90.1	89.4	88.7	88.4	84.9	81.4	77.9
NET I=B=R RATING (MBH)	83	79	79	78	78	77	77	74	71	68
GAS ORIFICE DRILL SIZE	50	50	50	50	50	50	50	50	50	50
FAN/OUTLET PRESSURE SWITCH SETPOINT (INCHES WATER COLUMN)	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45
INLET PRESSURE SWITCH SETPOINT (INCHES WATER COLUMN)	-1.10	-1.10	-1.10 (up to 4500')	-0.85 (over 4500')	-0.85	-0.85	-0.85	-0.85	-0.85	-0.85

INTRODUCTION

The Quantum Leap® (QL) is a gas fired direct vent hot water boiler featuring a wet recuperated combustion system that increases efficiency by recovering latent heat from the exhaust and using water (condensate) as the medium to transfer the heat back into the incoming combustion air. The Quantum Leap's high Annual Fuel Utilization Efficiency means annual energy and cost savings even when compared to similar sized condensing boilers which lack the additional high efficiency features that the Quantum Leap® provides. A revolutionary cast aluminum heat exchanger means better heat transfer and thermal storage than similarly sized cast iron boilers. Sealed combustion, premix gas burner, and low flame temperature means drastically reduced CO and NO_x emissions, which contribute to a cleaner and healthier environment.

The heating system water absorbs large amounts of heat from the cast aluminum heat exchanger, cooling the flue gases and causing condensation. This is the normal limit of condensing boilers - but the Quantum Leap® goes much further! More energy savings are realized as the Quantum Leap® boiler collects, stores and circulates "warm" condensate through a long heat transfer coil in the heat recovery unit removing even more of the valuable energy from the flue gas and creating "hot" condensate. The "hot" condensate from the heat recovery unit is sprayed into the evaporative re-cooling tower, transferring valuable heat to the incoming combustion air. The "hot" condensate, having given up its heat to the combustion air, goes back to the storage sump as "warm" condensate and is again pumped by the condensate pump through the heat recovery unit and then the evaporative re-cooling tower continuously recovering heat. Excess condensate is safely piped to a floor drain.

The Quantum Leap®, unlike normal residential atmospheric and induced draft units, takes its combustion air directly from the outdoors (sealed combustion) and does not compete with building occupants for fresh air. Sealed combustion (also known as "direct vent") is the safest and best way to obtain plenty of clean combustion air. The induced draft fan draws in the outside combustion air, then takes the cooler flue gases from the boiler and heat recovery unit and provides a positive removal of the flue gases from the building through inexpensive and readily available PVC pipe.

RULES FOR SAFE INSTALLATION AND OPERATION

1. Read the entire installation manual before beginning the installation. Failure to follow these rules for safe installation and operation and these instructions could cause a malfunction of the boiler and result in death, serious bodily injury, and/or property damage.
2. Check all applicable state and local building codes and utility company requirements before installation. The installation must conform with these requirements in their entirety. In the absence of these codes, use NFPA Installation Codes and good industry practice.
3. Before servicing the boiler - allow the boiler to cool. Always shut off any electricity and gas supply connected to the boiler prior to servicing.
4. Inspect gas line for leaks.
5. Be certain gas input rate is correct. Over firing may result in early failure of the boiler sections. This may cause dangerous operation. Under firing may result in too much air for the pre-mix burner causing poor or loss of combustion.
6. Never vent the products of combustion from this boiler to an enclosed space. Always vent to the outdoors. Never vent to another room or to inside a building.
7. Be sure there is adequate outdoor air supply to boiler for complete combustion.
8. Follow a regular service and maintenance schedule for efficient and safe operation.
9. Keep boiler area clean of debris and free of combustible and flammable materials.
10. Proper through the wall or through the roof combustion venting shall be in accordance with the materials and methods described in this manual.
11. This boiler and related hot water heating systems are not do it yourself items. They must be installed and serviced by qualified professionals.

WARNING

This boiler has been equipped for residential installations. If used for commercial applications, any additional code requirements must be adhered to for installation. This may require additional controls including but not limited to a low water cut off, a manual reset high temperature limit, and wiring and/or piping modifications. The manufacturer is not responsible for any field installation changes made to a boiler installation which are not described or acknowledged in this manual.

BEFORE INSTALLING THE BOILER

Complete all of the following prior to installing the boiler.

A. CODES

This boiler product is a gas fired direct vent condensing boiler and must be installed in accordance with all applicable federal, state and local building codes including, but not limited to the following :

United States - Installation shall conform with National Fuel Gas Code (NFPA-54/ANSI Z223.1- latest edition)

Canada - Installation shall be in accordance with CSA-B149.1 and .2 Installation codes.

New York City – MEA Number 132-97-E.

Where required by the authority having jurisdiction, the installation must conform to the American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No.CSD-1.

The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1 - latest revision.

Installers - Follow local regulations with respect to installation of CO (Carbon Monoxide) detectors. Follow maintenance recommendations in this manual.

Techniciens - Veuillez vous conformer à la réglementation en vigueur concernant l' installation des détecteurs d'oxyde de carbone. Suivre les consignes d'entretien figurant dans le manuel d'instruction ci-joint.

B. BOILER SIZING

- Check to be sure you have selected the QL boiler with the proper capacity before starting the installation. The I=B=R Rating of the boiler selected should be greater than or equal to the calculated peak heating load (heat loss) for the building or area(s) served by the boiler and associated hot water heating systems. See boiler rating and capacity table in this manual.
- Heat loss calculations should be based on approved methods.

C. CONSIDERATIONS FOR BOILER LOCATION

Before selecting a location for the boiler, the following should be considered. Each boiler considered for installation must be:

- Supplied with the correct type of gas (natural gas or propane).
- Connected to a suitable combustion air intake piping system to supply the correct amounts of fresh (outdoor) air for combustion. (Maximum length 100')
- Connected to a suitable venting system to remove the hazardous products of gas combustion (Maximum length 100').
- Connected to a suitable hot water heating system.
- Supplied with a suitable electrical supply for all boiler motors and controls.
- Connected to a properly located thermostat or operating control. (not included with boiler)
- Placed on level surface (must **NOT** be installed on carpeting)
- Condensate drain line must be pitched down to floor drain or external condensate pump with reservoir at 1/4" per foot (wood frame or blocks may be used to raise boiler).

D. LOCATING THE BOILER

TABLE 2		BOILER CLEARANCES		
UNIT	COMBUSTIBLE CONSTRUCTION	ACCESSIBILITY / CLEANING	SERVICING	
TOP	1"	24"	24"	
LEFT SIDE	1"	24"	24"	
RIGHT SIDE	8"	-	-	
BASE	0	-	-	
FRONT	1"	24"	24"	
INTAKE/VENT PIPING	0	-	-	
NEAR BOILER HOT WATER PIPING	1"	-	-	

1. Select a location which is level, central to the piping systems served and as close to the vent and air intake terminals as possible.
2. The boiler must be located where ambient temperatures (minimum possible room temperatures where boiler is installed assuming boiler is not in operation and therefore contributes no heat to the space) are always at or above 32 F to prevent freezing of liquid condensate.
3. Accessibility clearances, if more stringent (i.e. larger clearances) than required fire protection clearances, must be used for the boiler installation. Accessibility clearances may be achieved with the use of removable walls or partitions.
4. The boiler is approved for installation in closets and on combustible floors. This boiler shall **NOT** be installed on carpeting.

5. The clearances shown in table - 2 indicate required clearances per AGA listing. A minimum 1" clearance must be maintained between combustible construction and each of the left, right, top and back surfaces of the boiler. A minimum 8" clearance is required on the right side, to allow room for the inlet air pipe. An 18" clearance must be maintained at a side where passage is required to access another side for cleaning or servicing, inspection or replacement of any parts that normally may require such attention. Allow at least 24" at the front, top and left side for servicing. No clearances are required to venting or combustion air intake piping.
6. Equipment shall be installed in a location which facilitates the operation of venting and combustion air intake piping systems as described in this manual.
7. Advise owner of boiler to keep venting and combustion air intake passages free of obstructions. Both the venting and combustion air intake piping systems connected to the outdoors must permit flow through the piping systems without restrictions for the boiler to operate.
8. The boiler shall be installed such that the automatic gas ignition system components are protected from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, control replacement, etc.)

E. COMBUSTION AIR AND VENT PIPE REQUIREMENTS

This boiler requires a dedicated direct vent system. In a direct vent system, all air for combustion is taken directly from outside atmosphere, and all flue products are discharged to outside atmosphere.

Combustion air and vent pipe connections must terminate together in the same atmospheric pressure zone, either through the roof or sidewall (roof termination preferred). See Fig.9 & 10 for required clearances.

CAUTION

KEEP BOILER AREA CLEAN OF DEBRIS AND FREE OF FLAMMABLE AND COMBUSTIBLE MATERIALS, VAPORS AND LIQUIDS

WARNING

When vent pipe is exposed to temperatures below freezing, such as when it passes through an unheated space or when a chimney is used as a raceway, vent pipe must be insulated with 1/2" Armaflex or equivalent. In extreme cold climate areas, use 3/4" Armaflex or equivalent.

Combustion air must be clean outdoor air. Combustion air must not be taken from inside structure because that air frequently is contaminated by halogens, which include fluorides, chlorides, phosphates, bromides and iodides. These elements are found in aerosols, detergents, bleaches, cleaning solvents, salts, air fresheners, paints, adhesives and other household products.

Locate combustion air inlet as far away as possible from swimming pool and swimming pool pump house.

All combustion air and vent pipes must be airtight and watertight. Combustion air and vent piping must also terminate exactly as shown in fig.9 or 10.

Vent connections serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

Solvent cements are combustible. Keep away from heat, sparks, and open flame. Use only in well ventilated areas. Avoid breathing in vapor or allowing contact with skin or eyes.

FAILURE TO FOLLOW THE AFOREMENTIONED WARNINGS COULD RESULT IN FIRE, PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH.

F. CONDENSATE DRAIN REQUIREMENTS

Condensate drain line to be pitched down to floor drain at a minimum of 1/4" per foot. An external condensate pump (not furnished) may be used if floor drain is not available. The condensate pump must be designed for flue gas condensate application

NOTE: Condensate trap is built into evaporative recoler sump, external trap is not required and should not be used.

NOTE: Wood frame or blocks may be used to raise boiler to maintain drain pitch or to be above condensate pump reservoir.

G. FOUNDATION REQUIREMENTS

Boiler must be placed on level surface. Boiler is **NOT** to be installed on carpeting.

NOTE: If boiler is not level condensate drain lines will not function properly.

Adjustable feet are located on the boiler to make up for minor surface irregularities or tilt.

NOTE: Wood frame or blocks may be used to raise boiler to maintain drain pitch or to be above external condensate pump reservoir.

H. REMOVAL OF EXISTING BOILER FROM COMMON VENT SYSTEM

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it. At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restrictions, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryer and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhaust, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fire dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliances will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or the smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans and any other gas-burning appliance to their previous condition of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Code, NFPA-54/ANSI -Z223.1-latest revision, or section 5 of CSA-B149 for Canadian standards. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in part 11 in the National Fuel Gas Code, NFPA-54/ANSI- Z223.1-latest revision, or section 5 of CSA-B149 for Canadian standards.

PLACING THE BOILER

The boiler should be placed to provide the most direct connections to the combustion air, vent and system piping as possible.

Place crated boiler as close to selected location as possible and uncrate boiler. The uncrated boiler may be moved into position with an appliance dolly or 2-wheel hand truck. The dolly or hand truck should be inserted under the **left hand side** of the boiler. It is possible to slide the boiler for a short distance on a smooth floor or surface.

NOTE: Refer to manual section "LOCATING THE BOILER" for required clearances for servicing and maintenance.

NEAR BOILER PIPING

CAUTION

Copper supply and return piping must **NOT** be installed directly into aluminum boiler section castings due to galvanic corrosion between dissimilar metals. Iron or steel bushings or pipe nipples should be used between copper system piping and boiler to make final connection to boiler. Also the use of dielectric unions is acceptable. The packaged boiler is furnished with iron piping in the front boiler section for the supply and return connections.

When the installation of the boiler is for a new heating system, first install all of the radiation units (panels, radiators, baseboard, or tubing) and the supply and return mains. After all heating system piping and components have been installed, make final connection of the system piping to the boiler.

A hot water boiler installed above radiation level must be equipped with a low water cut off device. A periodic inspection is necessary, as is flushing of float type devices, per low water cut off manufacturers specific instructions.

A. SUPPLY AND RETURN LINES

The packaged boiler unit is set up to receive 1 1/4" NPT supply and return piping from right side access. The boiler unit can also be piped from the left side by reversing supply elbow and return tee, and from the rear of the unit by removing plugs in the rear boiler section.

NOTE: Rear piping access requires the relocation of the circulator pump.

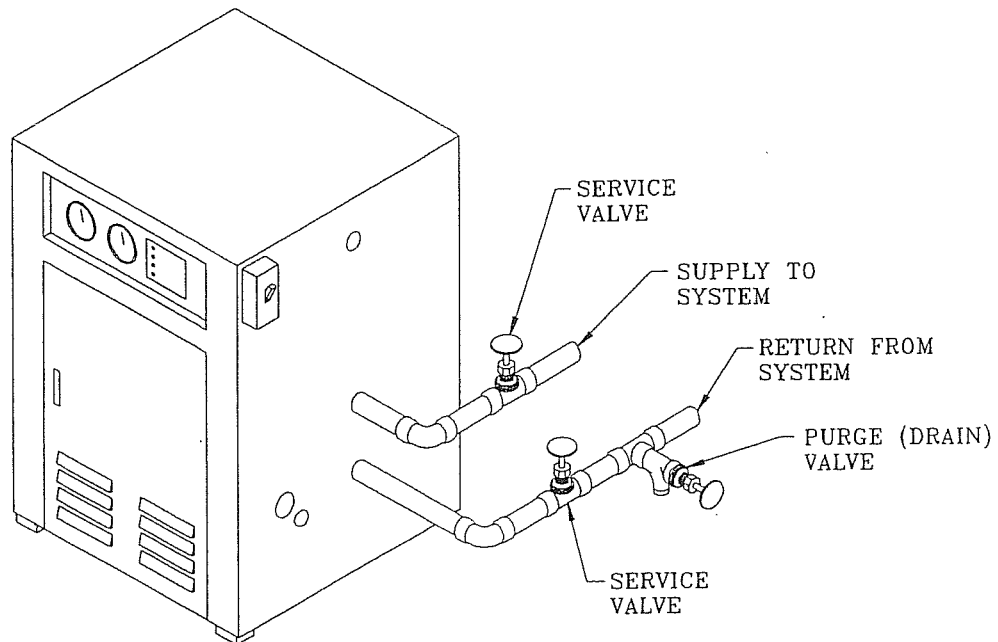


FIG. 2 - SINGLE ZONE BOILER PIPING

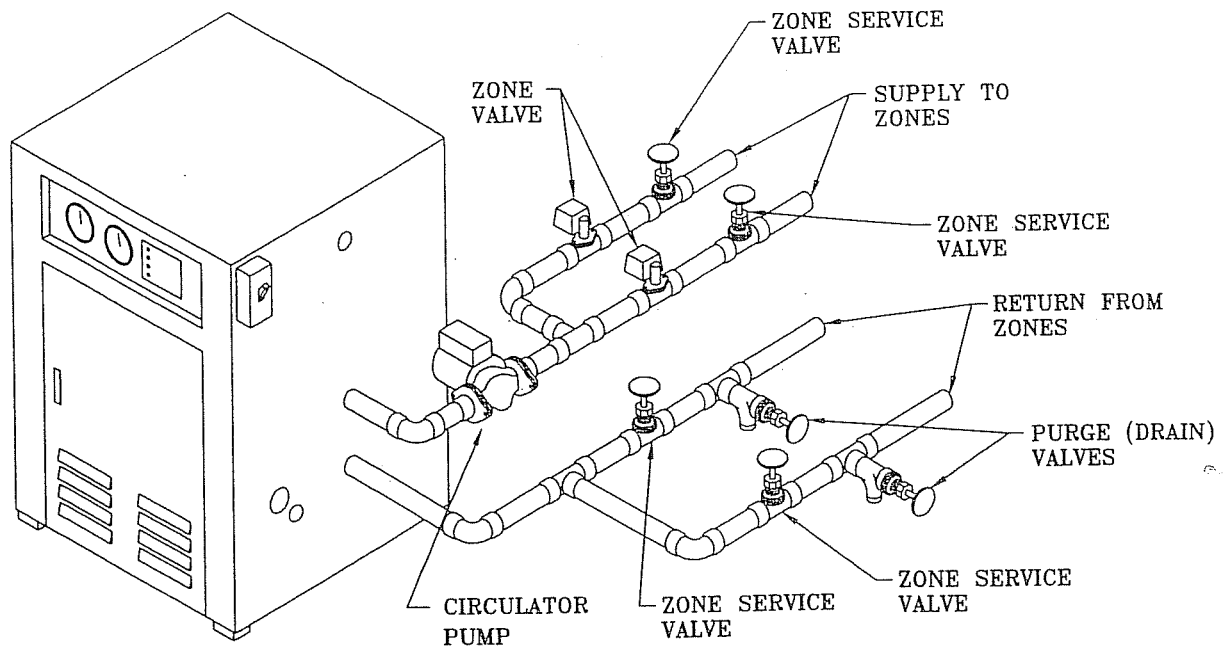
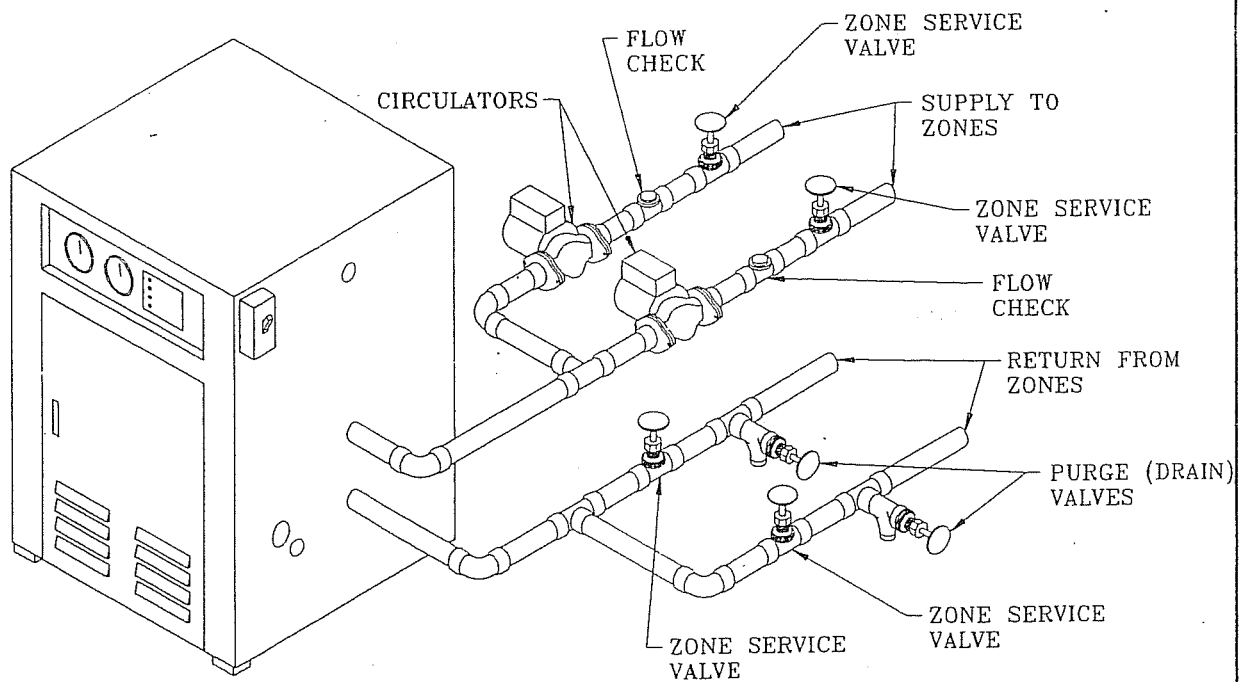


FIG. 3 - MULTI ZONE BOILER PIPING WITH ZONE VALVES



NOTE: When zoning with circulators, the furnished circulator pump should be used as one of the zone pumps. Each stripped end of the electrical wires for the circulator pump inside the junction box should be taped or wire nudded to prevent short circuits. **DO NOT** disconnect (unplug) the circulator pump wiring at the integrated boiler control, or the "Call For Heat" status light will not function

FIG. 4 - MULTI ZONE BOILER PIPING WITH CIRCULATORS

B. PRESSURE RELIEF VALVE

The boiler is furnished with a factory installed relief valve in the top of the boiler. Provide 3/4" piping from the supplied relief valve to a local floor drain, but leave an air gap between piping and drain. No shutoff of any description shall be placed between safety relief valve and the boiler, or on the discharge pipes between such safety valves and the atmosphere. Installation of the safety relief valve shall conform to ANSI/ASME Boiler and Pressure Vessel Code, Section IV. The manufacturer is not responsible for any water damage.

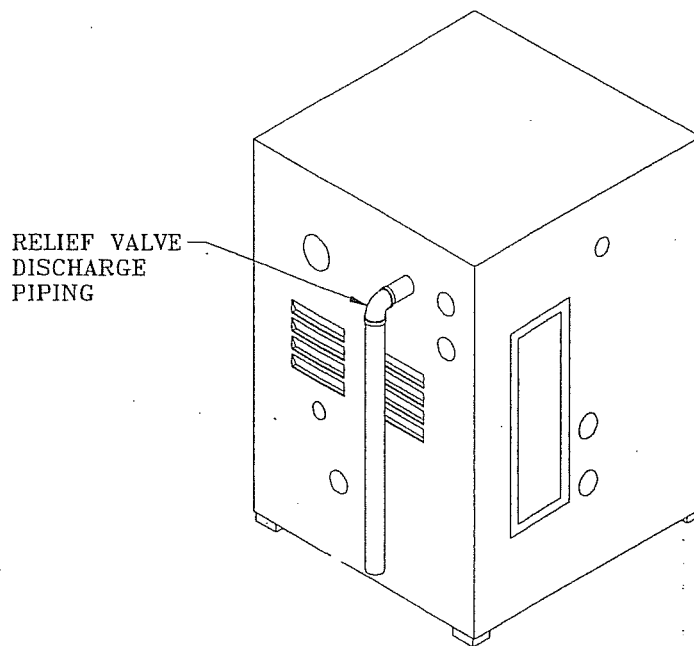


FIG. 5 - RELIEF VALVE DISCHARGE PIPING

C. EXPANSION TANK AND MAKE-UP WATER

Determine required system fill pressure, system design temperature, and system water content. Boiler contains 2.6 gallons (U.S.). Size expansion tank accordingly. Consult expansion tank manufacturer for proper sizing information. Connect properly sized expansion tank (not furnished) as shown in fig.6 for diaphragm type expansion tank and fig.7 for conventional closed type expansion tanks. For diaphragm type expansion tanks, adjust the tank air pressure to match the system fill pressure. Install air vent (furnished) as shown for diaphragm type expansion tank system only. Install make-up water connections as shown and per local codes. If a pressure reducing valve is used, adjust to match the system fill pressure. In connecting the cold make-up water supply to the boiler, make sure that clean water supply is available. When the water supply is from a well or pump, a sand strainer should be installed at the pump.

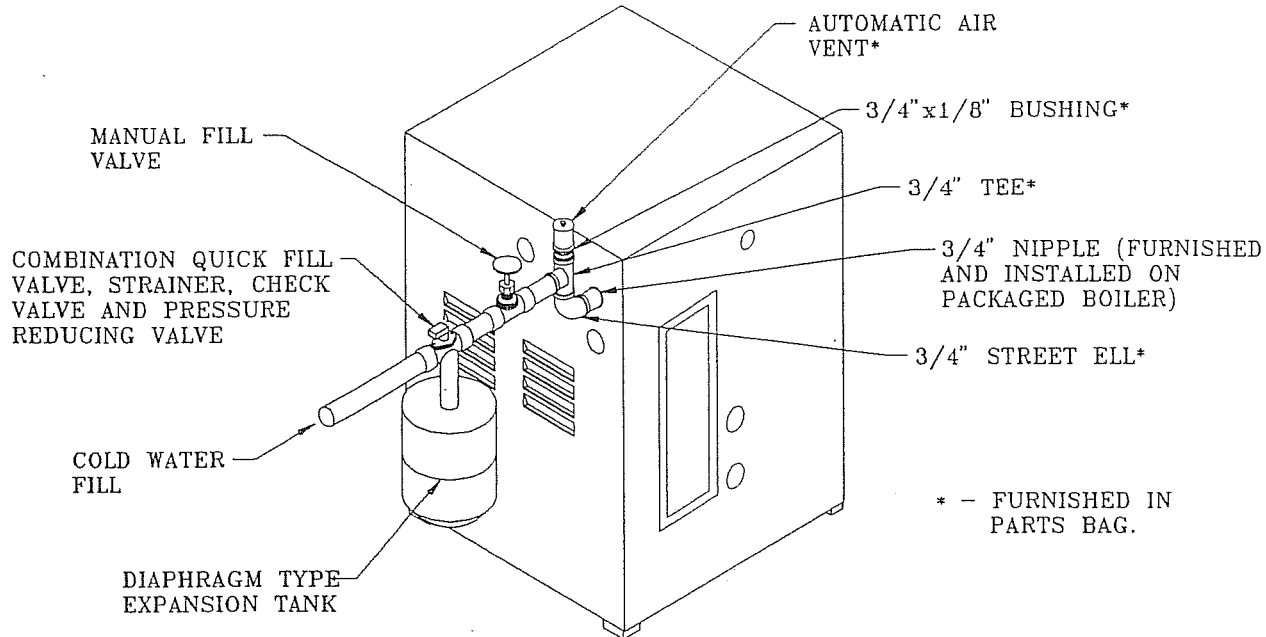


FIG. 6 - DIAPHRAGM TYPE EXPANSION TANK PIPING

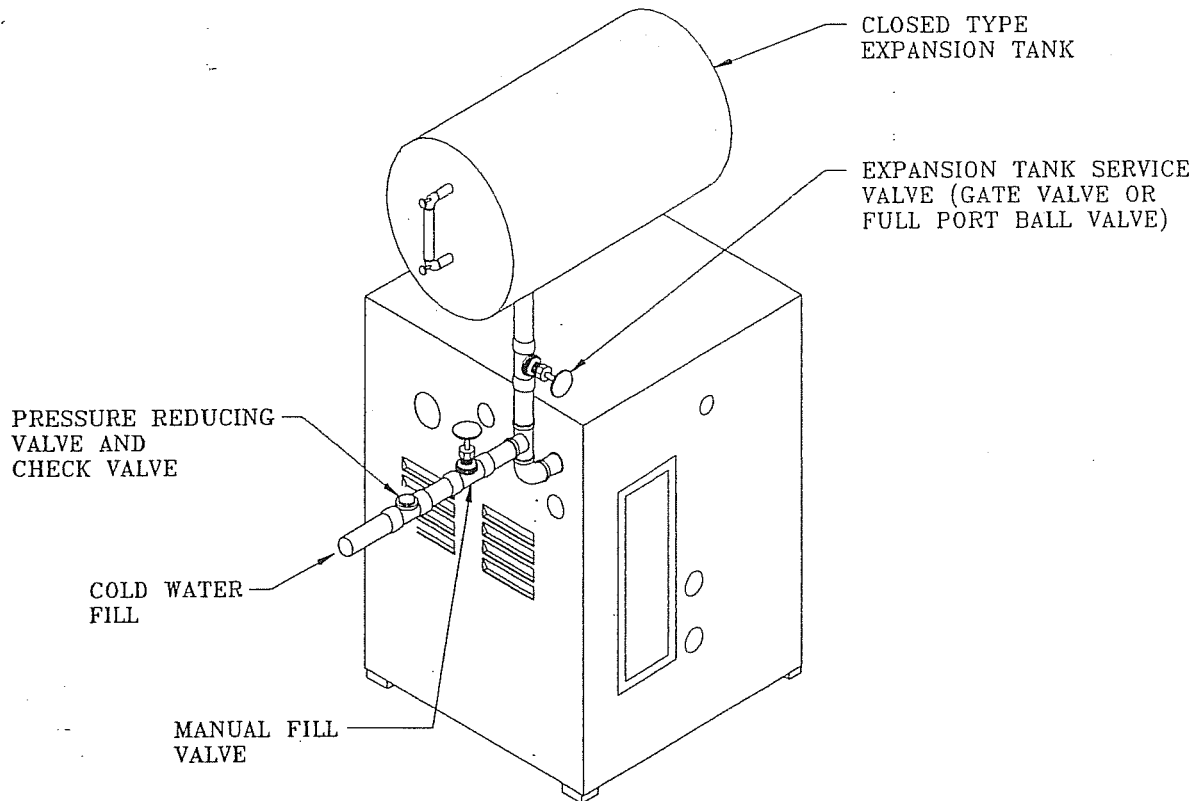


FIG. 7 - CONVENTIONAL (closed type) EXPANSION TANK PIPING

D. CONDENSATE DRAIN PIPING

Condensate trap is built into evaporative recoler sump, external trap is not required and should **NOT** be used.

Provide 1/2" PVC Condensate drain and fittings. Condensate drain to be pitched down to floor drain at a minimum of 1/4" per foot.

Install furnished 1/2" threaded PVC close nipple and 1/2" PVC tee to overflow fitting on evaporative recoler as shown in fig.8.

The 1/2-in. diameter schedule 40 PVC or CPVC condensate drain piping and pipe fittings must conform to ANSI standards and ASTM D1785 or D2846. Schedule 40 PVC or CPVC cement and primer must conform to ASTM D2564 or F493. In Canada, use CSA or ULC certified schedule 40 PVC or CPVC drain pipe and cement.

A condensate pump with a reservoir (not furnished) may be used to remove condensate to a drain line (sanitary line) above boiler if a floor drain is not available or is inaccessible.

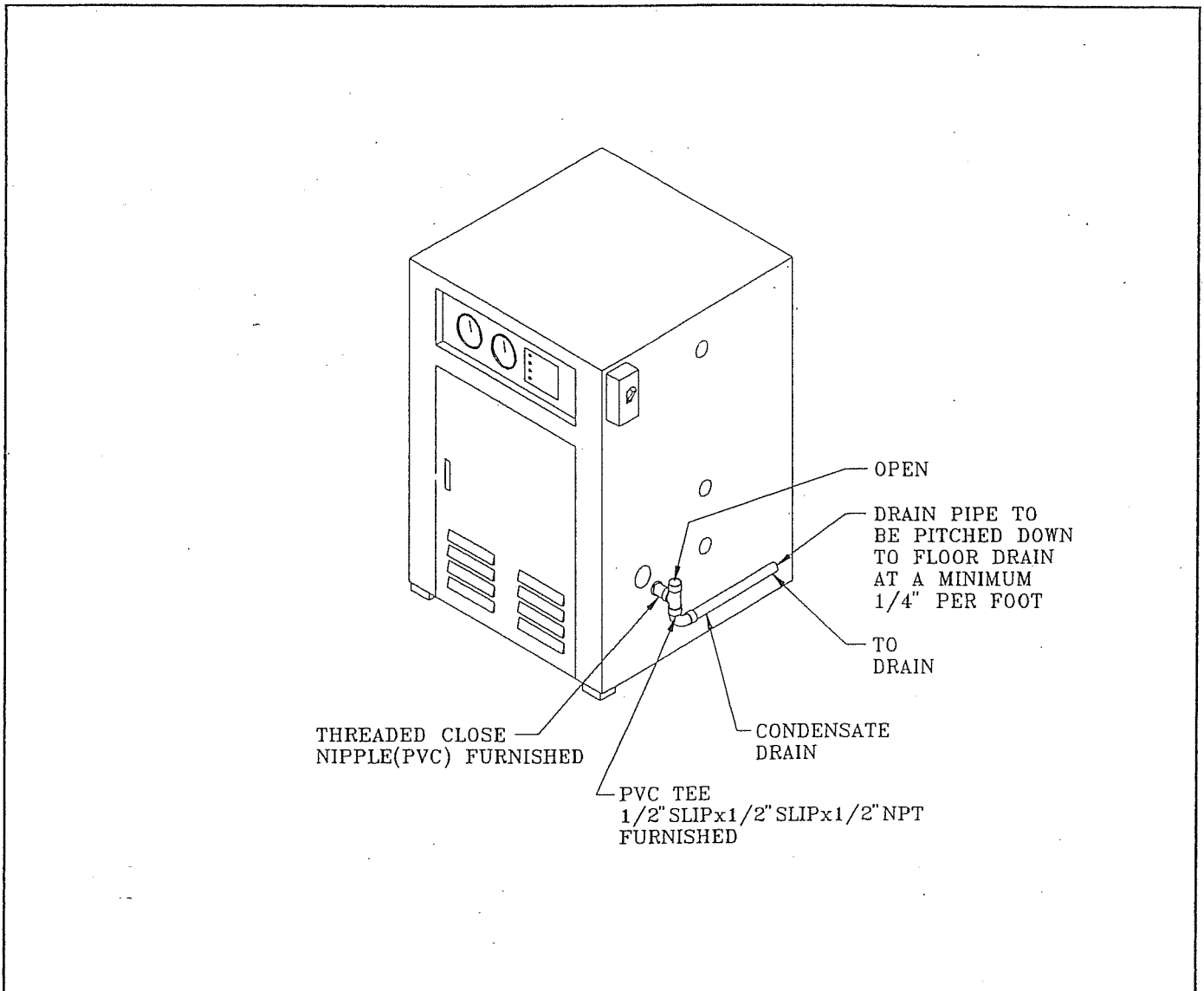


FIG. 8 - CONDENSATE - DRAIN PIPING

E. FILLING EVAPORATIVE RECOOLER SUMP WITH WATER

ON THE INITIAL START UP THE EVAPORATIVE RECOOLER SUMP MUST BE MANUALLY FILLED WITH WATER

The following are the steps required to initially fill the evaporative re cooler sump for start up. These steps should only be required at the initial startup or if maintenance requires draining of the sump:

1. Remove 2-in. Fernco coupling from the air intake fitting on the boiler.
2. Temporarily place a 2-in. 90 degree PVC elbow snugly on the air intake fitting.
3. Pour about five (5) quarts of cold tap water into the elbow on the air intake fitting.
4. Excess water should go through the overflow in the evaporative re cooler and out through the condensate drain line. Verify proper operation of the drain line (or external condensate pump if used).
5. Remove PVC elbow and reinstall 2-in. Fernco coupling.
6. This process can be done without removing the 2-in. Fernco coupling by inserting a flexible hose or tube into the sump through the coupling while the coupling is in place, and filling the sump through the hose.
7. It may be necessary to manually prime the condensate pump. This is accomplished by disconnecting the pump's condensate discharge line from the inlet side of the check valve and manually providing suction on the line to draw water out of the sump and into the pump.

F. CHILLED WATER PIPING

The boiler, when used in connection with a refrigeration system, must be installed so the chiller medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler.

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

COMBUSTION AIR AND VENT PIPE

A. CONNECTIONS AND TERMINATION

For boilers for connection to gas vents or chimneys, vent installations shall be in accordance with part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1-latest revision and applicable provisions of the local building codes.

Provisions for combustion and ventilation air must be in accordance with section 5.3, Air For Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1-latest revision, or applicable provisions of the local building code.

These boilers require a dedicated direct vent system. All air for combustion is taken directly from outdoors through combustion air intake pipe. All flue products are discharged to the outdoors through vent pipe.

1. See Fig.9 & 10 for combustion air and vent pipe roof and sidewall termination. (Roof termination is preferred) Combustion air and vent pipes must terminate together in same atmospheric pressure zone as shown. Construction through which vent and air intake pipes may be installed is a maximum 24 inches, minimum 1/4 inch thickness.

2. Combustion air and vent pipe fittings must conform to American National Standards Institute (ANSI) standards and American Society for Testing and Materials (ASTM) standards D1785 (schedule-40 pvc), D2665 (PVC-DWV), D2241 (SDR-21 and SDR-26 PVC), D2661 (ABS-DWV), or F628 (schedule-40 ABS). Pipe cement and primer must conform to ASTM standards D2564 (PVC) or D2235 (ABS). In Canada construct all combustion air and vent pipes for this unit of CSA or ULC certified schedule-40 PVC, PVC-DWV or ABS-DWV pipe and pipe cement. SDR pipe is NOT approved in Canada.
3. Combustion air and vent piping connections on boiler are sized for 2-in. pipe. Any pipe size change (to 3-in.) must be made outside of the boiler casing in vertical run of pipe to allow for proper drainage of vent condensate. When using 3-in. vent and combustion air intake pipe, the first two (2) feet of vent pipe and the first four(4) feet of combustion air intake pipe at the boiler must be 2" pipe.

NOTE: The transition from 2-in. pipe to 3-in. pipe must be made in a vertical run.

4. Combustion air and vent piping length:
 - 2-in. pipe to have a minimum length of 2 feet with four (4) 90 degree elbows.
 - 2-in. pipe to have a maximum length of 20 feet plus four (4) 90 degree elbows.
 - 3-in. pipe to have a minimum length of 20 feet with four (4) 90 degree elbows including initial length of 2" pipe.
 - 3-in. pipe to have a maximum length of 100 feet plus four (4) 90 degree elbows including initial length of 2" pipe.

For additional elbows, reduce the maximum vent length as shown:

2-in. 90 degree elbow - 1 1/2 feet per additional elbow.

3-in. 90 degree elbow - 3 feet per additional elbow.

Example: To add 2 additional 90 degree elbows to a 3-in. pipe.

- Each elbow is 3 additional feet per 90 degree elbow for a total of 6 feet.

(1 elbow @ 3 feet + 1 elbow @ 3 feet = 6 additional feet of pipe)

The total additional pipe is then subtracted from the maximum allowable pipe length to give the new maximum length of 94 feet with 6, 90 degree elbows.

(original 100 feet max. - 6 feet for 2 additional elbows = new 94 feet maximum length)

5. Combustion air and vent piping to be pitched back to boiler at minimum 1/4" per foot from intake and vent terminals so that all moisture in combustion air and vent piping drains to boiler. Pipes must be pitched continuously with no sags or low spots where moisture can accumulate and block the flow of air or flue gas. Combustion air and vent pipes must be airtight and watertight.
6. Consideration for the following should be used when determining an appropriate location for termination of combustion air and vent piping.
 - Comply with all clearances required as stated in paragraph 7.
 - Termination should be positioned where vent vapors will not damage plants/shrubs or air conditioning equipment.
 - Termination should be positioned so that it will not be effected by wind eddy, air born leaves, snow, or allow recirculation of flue gasses.
 - Termination should be positioned where it will not be damaged or subject to foreign objects, such as stones, balls, etc..
 - Termination should be positioned where vent vapors are not objectionable.

- Put vent on a wall away from the prevailing winter wind. Locate or guard the vent to prevent accidental contact with people or pets.
 - Terminate the vent above normal snowline. Avoid locations where snow may drift and block the vent. Ice or snow may cause the boiler to shut down if the vent becomes obstructed.
 - Under certain conditions, flue gas will condense moisture and may be corrosive. In such cases, steps should be taken to prevent building materials at the vent from being damaged by exhaust of flue gas.
7. The venting system shall terminate at least 3 feet above any forced air inlet (except the boilers combustion air inlet) within 10 feet. The venting system shall terminate at least 12 inches from any air opening into any building. The bottom of the vent shall be located at least 12 inches above grade. Termination of the vent shall be not less than 7 feet above an adjacent public walkway. The vent terminal shall not be installed closer than 3 feet from the inside corner of an L shaped structure. Termination of the vent should be kept at least 3 feet away from vegetation. The venting system shall terminate at least 4 feet horizontally from, and in no case above or below, unless a 4 foot horizontal distance is maintained, from electric meters, gas meters, regulators, and relief equipment.

COMBUSTION AIR AND VENT PIPE TERMINATION CLEARANCES

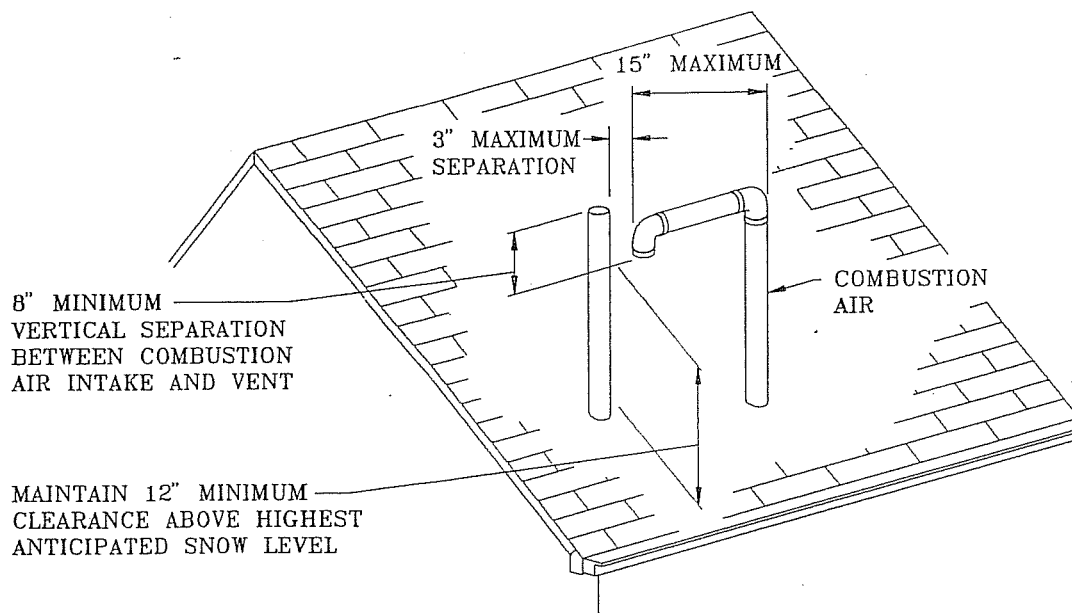
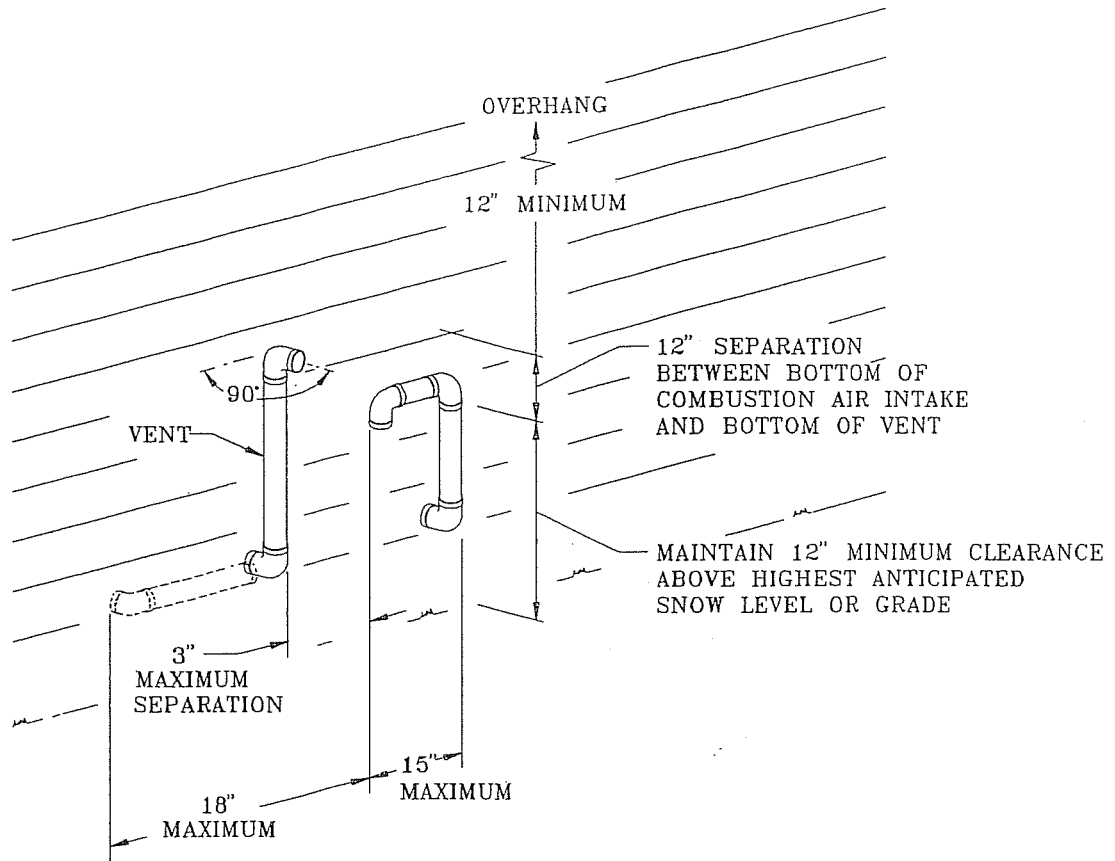
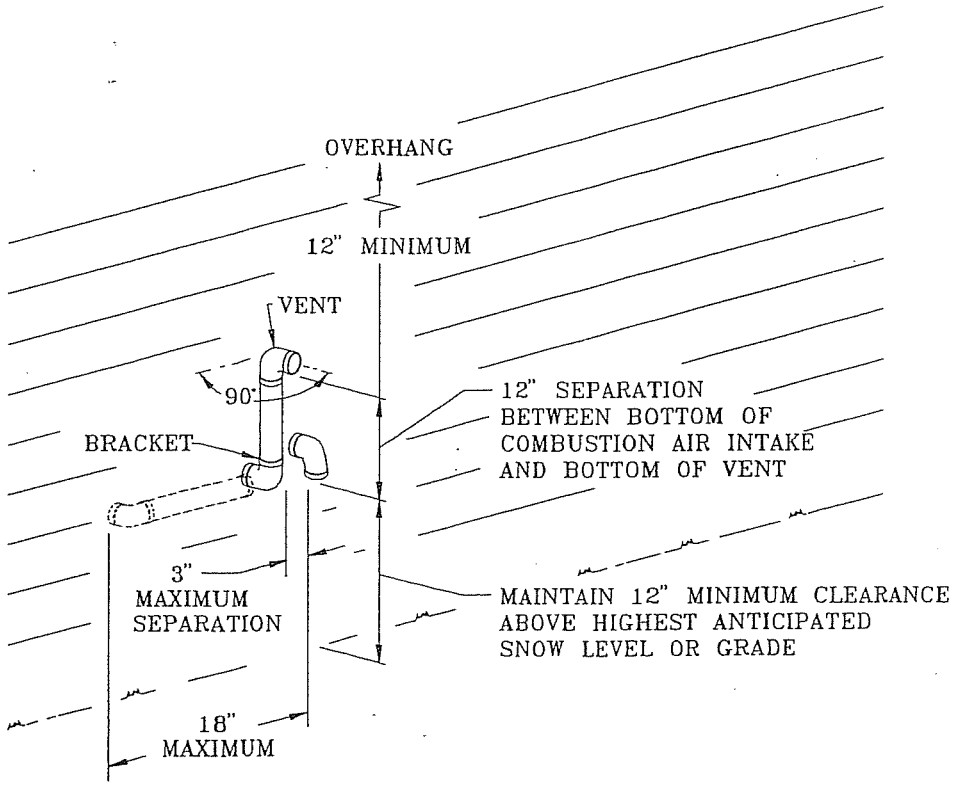


FIG. 9 - ROOF VENT/INTAKE TERMINATIONS



LESS THAN 12" CLEARANCE



12" OR MORE CLEARANCE

FIG. 10 - SIDEWALL VENT/INTAKE TERMINATIONS

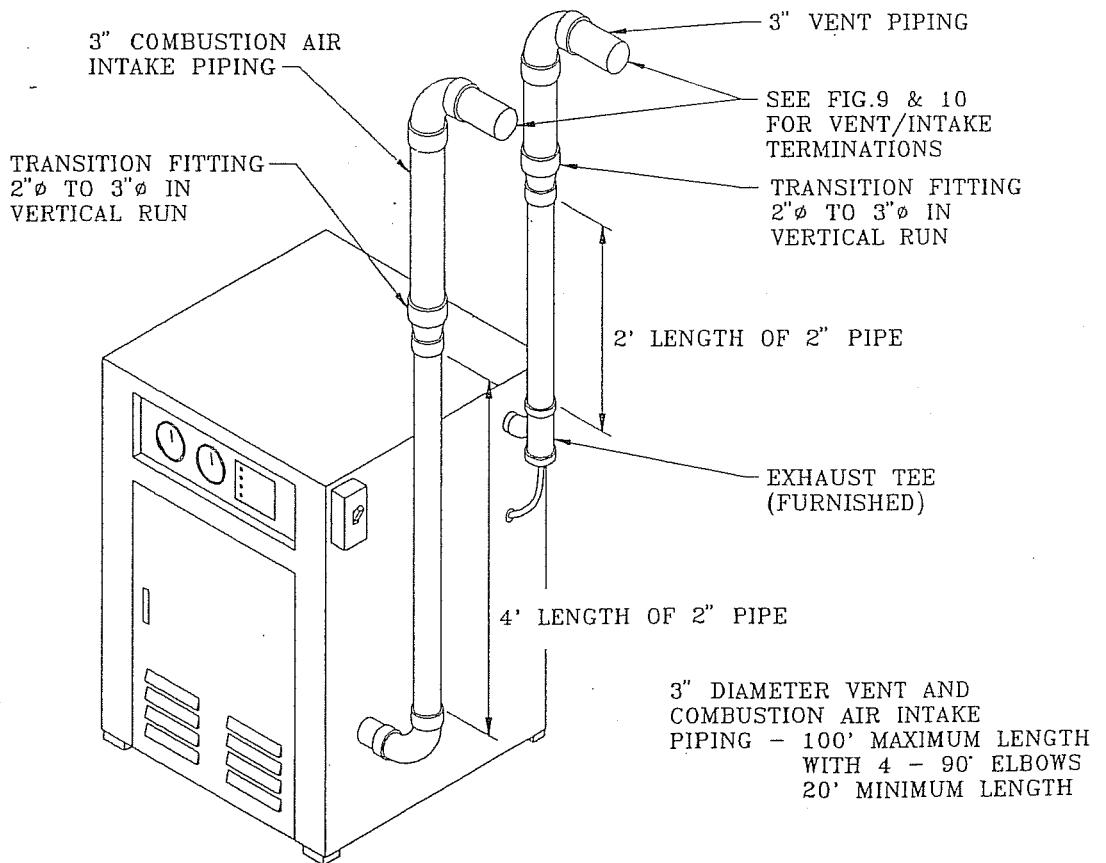
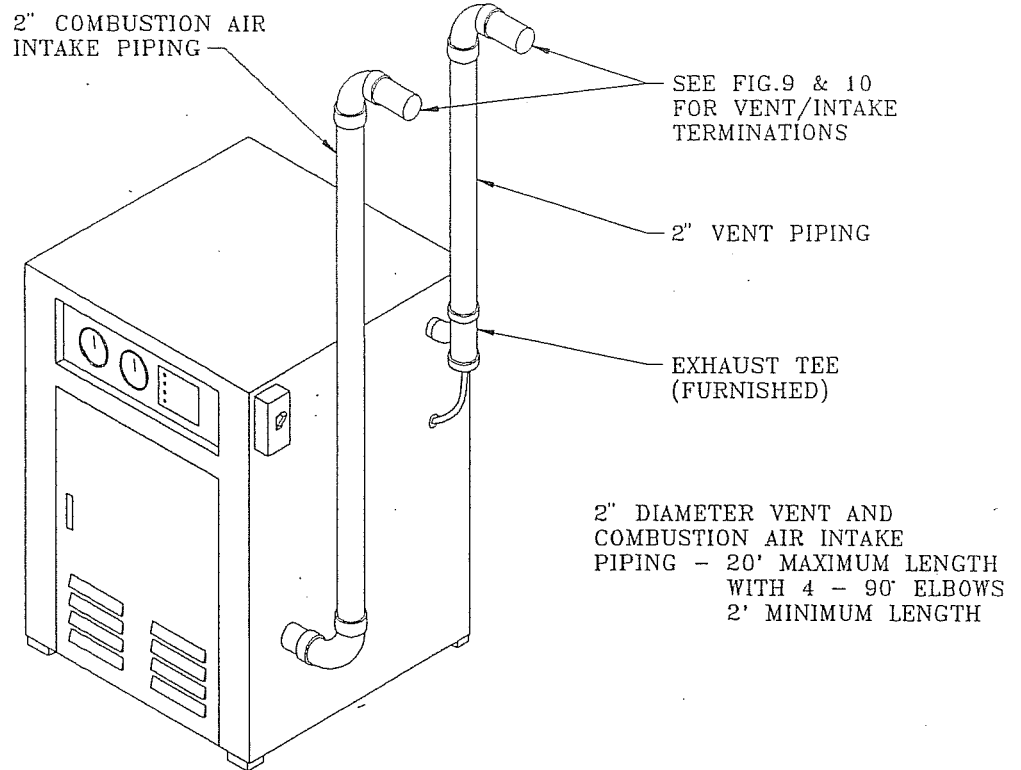


FIG. 11 - COMBUSTION AIR AND VENT PIPING

B. INSTALLATION

1. Attach combustion air intake piping to supplied Fernco 2" coupling in evaporative recoler. Attach vent piping to furnished 2" PVC exhaust tee on draft inducer outlet.

NOTE: All pipe joints are to be water tight.

2. Working from the boiler to the outside, cut pipe to required length(s).
3. Deburr inside and outside of pipe.
4. Chamfer outside edge of pipe for better distribution of primer and cement.
5. Clean and dry all surfaces to be joined.
6. Check dry fit of pipe and mark insertion depth on pipe.

NOTE: It is recommended that all pipes be cut, prepared, and pre assembled before permanently cementing any joint.

7. After pipes have been cut and pre assembled, apply cement primer to pipe fitting socket and end of pipe to insertion mark. Quickly apply approved cement to end of pipe and fitting socket (over primer). Apply cement in light, uniform coat on the inside of socket to prevent buildup of excess cement. Apply second coat.
8. While cement is still wet, insert pipe into socket with a 1/4 turn twist. Be sure pipe is fully inserted into fitting socket.
9. Wipe excess cement from joint. A continuous bead of cement will be visible around perimeter of a properly made joint.
10. Handle pipe joint carefully until cement sets.
11. Support combustion air and vent piping a minimum of every 5 feet using pre formed metal hanging straps.
12. Slope combustion air and vent pipes toward boiler a minimum of 1/4" per linear foot with no sags between hangers.
13. Use appropriate methods to seal openings where vent and combustion air pipes pass through roof or side wall.

GAS SUPPLY PIPING

A. CHECK GAS SUPPLY

The gas pipe to your boiler must be the correct size for the length of run and for the total BTU per hour input of all gas utilization equipment connected to it. See table - 3 for the proper size. Be sure your gas line complies with local codes and gas company requirements.

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of ½ psig (3.5kPa).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than ½ psig (3.5kPa).

The **MAXIMUM GAS SUPPLY PRESSURE** is 14.0-inches w.c.

The **MINIMUM GAS SUPPLY PRESSURE** is 5.0-inches w.c.

B. CONNECTING THE GAS PIPING

Refer to Fig. 12 for the general layout at the boiler. It shows the basic fittings you will need. The gas line enters the boiler from the right side jacket panel. The boiler may receive the gas supply pipe through the left side, or rear jacket panel by rotating the gas valve and pipe assembly. The boiler is equipped with a 1/2-in. NPT connection on the gas valve for supply piping. The following rules apply:

1. Use only those piping materials and joining methods listed as acceptable by the authority having jurisdiction, or in the absence of such requirements, by the National Fuel Gas Code, ANSI Z223.1- latest revision. In Canada, follow the CSA B149.1 and .2 installation Codes for Gas Burning Appliances and Equipment.
2. Use pipe joint compound suitable for liquefied petroleum gas on male threads only.
3. Use ground joint unions.
4. Install a sediment trap upstream of gas controls.
5. Use two pipe wrenches when making the connection to the gas valve to keep it from turning.
6. Install a manual shutoff valve in the vertical pipe about 5 feet above floor.
7. Tighten all joints securely.
8. Propane gas connections should only be made by a licensed propane installer.
9. Two stage regulation should be used by the propane installer.
10. Propane gas piping should be checked out by the propane installer.

C. CHECKING THE GAS PIPING

After all connection have been made, check immediately for leaks. Open the manual shutoff valve. Test for leaks by applying soap suds (or a liquid detergent) to each joint. Bubbles forming indicate leak. **CORRECT EVEN THE SMALLEST LEAK AT ONCE.**

WARNING

NEVER USE A MATCH OR OPEN FLAME TO TEST FOR LEAKS.

GAS PIPE SIZES

TABLE 3 NATURAL GAS				
Length of Pipe - Ft.	Pipe Capacity - BTU Per Hour Input Includes Fittings			
	1/2"	3/4"	1"	1 1/4"
20	92,000	190,000	350,000	625,000
40	63,000	130,000	245,000	445,000
60	50,000	105,000	195,000	365,000

PROPANE GAS				
Length of Pipe - Ft.	Pipe Capacity - BTU Per Hour Input Includes Fittings			
	Copper Tubing*		Iron Pipe	
	5/8"	3/4"	1/2"	3/4"
20	131,000	216,000	189,000	393,000
40	90,000	145,000	129,000	267,000
60	72,000	121,000	103,000	217,000

* Outside diameter

The length of pipe or tubing should be measured from the gas meter or propane second stage regulator

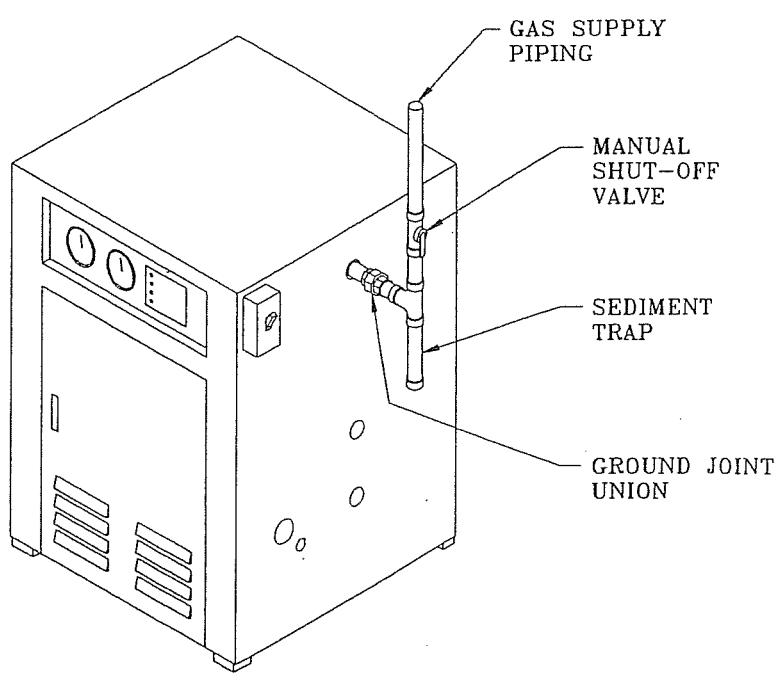


FIG. 12 - GAS PIPING

ELECTRICAL WIRING

WARNING

TURN OFF ELECTRICAL POWER AT FUSE BOX BEFORE MAKING ANY LINE VOLTAGE CONNECTIONS. FOLLOW LOCAL ELECTRICAL CODES.

All electrical work must conform to local codes as well as the National Electrical Code, ANSI/NFPA-70, latest revision. In Canada, electrical wiring shall comply with the Canadian Electrical Codes, CSA-C22.1 and .2.

A. ELECTRIC POWER SUPPLY

Prior to making any line voltage connections, service switch at boiler should be in the off position and the power turned off at the fuse box.

Run a separate 120 volt circuit from a separate over current protection device in the electrical service entrance panel. This should be a 15 ampere circuit. A service switch has been pre-wired and located on the exterior boiler jacket. See fig.13 for diagram showing location of service switch junction box and power supply connection points. Connect black (hot) lead from the power supply to the unused terminal on the service switch. Connect the white (neutral) lead from the power supply to the white lead in the service switch junction box. Connect the green (ground) lead from the power supply to the ground in the service switch junction box.

The boiler, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA-70, latest revision. In Canada, electrical wiring shall comply with the Canadian Electrical Codes, CSA-C22.1 and .2.

Run a 14 gauge or heavier copper wire from the boiler to a grounded connection in the service panel or a properly driven and electrically grounded ground rod.

B. INSTALL YOUR THERMOSTAT

The thermostat location has an important effect on the operation of your boiler system. BE SURE TO FOLLOW THE INSTRUCTIONS INCLUDED WITH YOUR THERMOSTAT.

Locate the thermostat about five feet above the floor on an inside wall. It may be mounted directly on the wall or on a vertical mounted outlet box. It should be sensing average room temperature.

Avoid the Following:

DEAD SPOTS:

Behind doors
Corners and alcoves

COLD SPOTS:

Concealed pipes or ducts
Stairwells - drafts
Unheated rooms on
other side of wall

HOT SPOTS:

Concealed pipes
Fireplace
TV sets
Radios
Lamps
Direct sunlight
Kitchens

Set heat anticipator at 0.6 amps. Connect 24 volt thermostat leads to the two(2) red wires located in service switch junction box, located on outer jacket of boiler. See fig.13 for service switch junction box and thermostat field wiring connections.

CAUTION

LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION. VERIFY PROPER OPERATION AFTER SERVICING.

C. Connect Circulator Pump Wiring

See Fig.13 for service switch junction box and circulator pump field wiring connections. Connect the circulator pump to the service switch junction box. If the two 120 volt circulator wire terminals inside the junction box are not used, please leave the two wire nuts to prevent the short circuit.

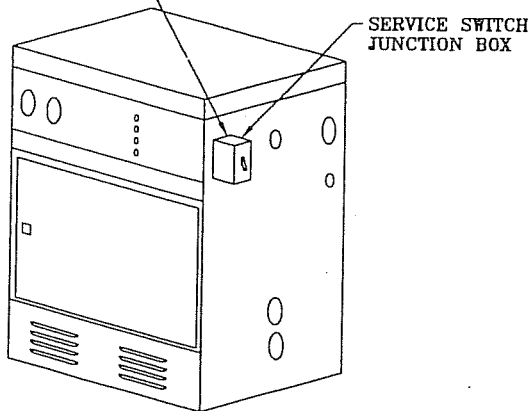
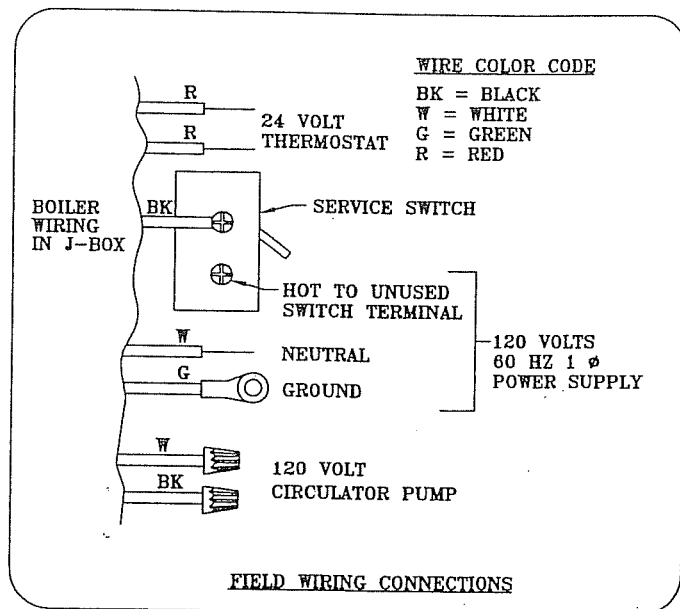
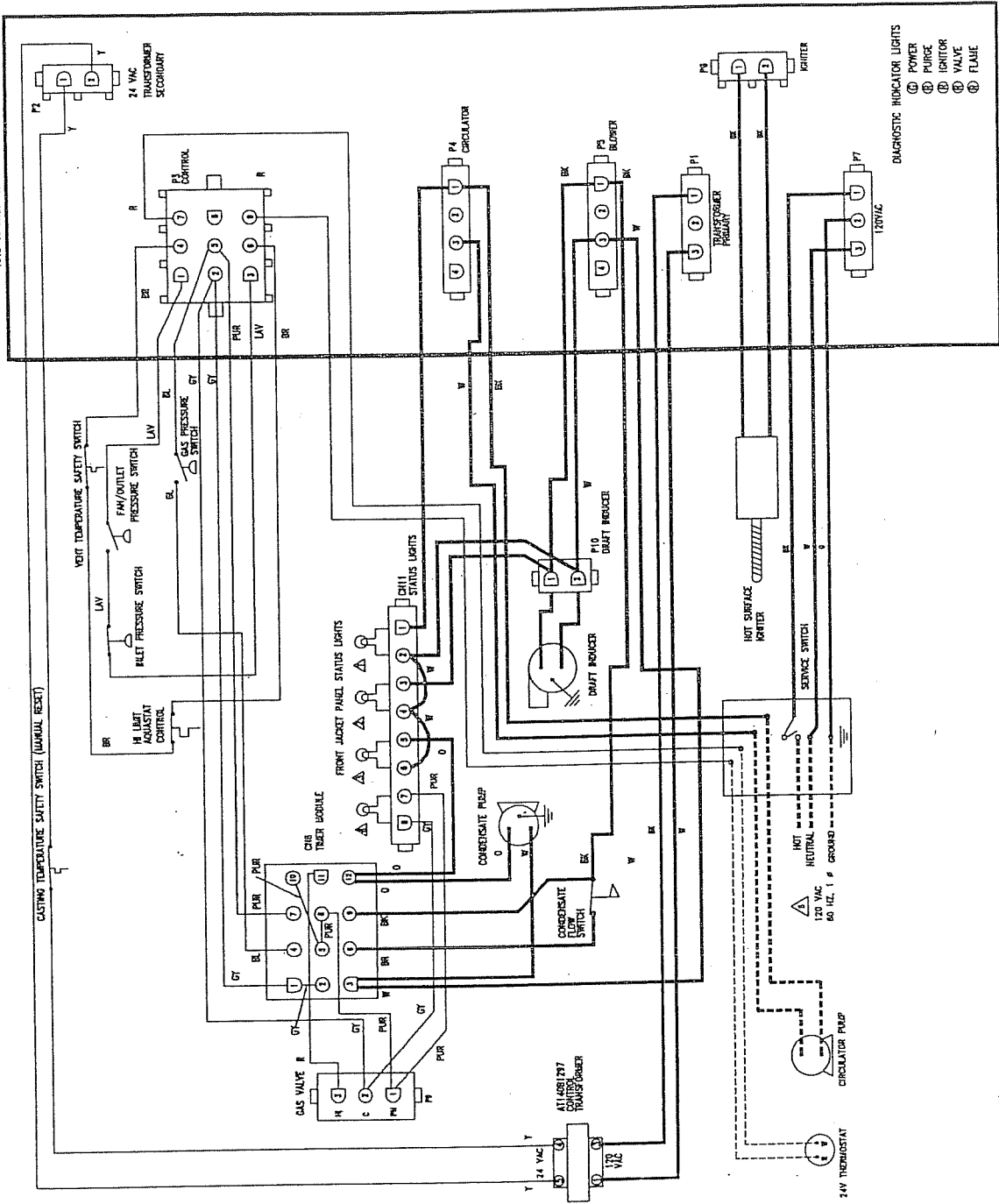


FIG. 13 - FIELD WIRING CONNECTIONS

1013-10 INTEGRATED BLOWER CONTROL



- COLOR DESIGNATION**
- W = WHITE
 - BK = BLACK
 - Y = YELLOW
 - C = GREEN
 - PK = PINK
 - R = RED
 - V = VIOLET
 - BL = BLUE
 - BR = BROWN
 - PUR = PURPLE
 - O = ORANGE
 - LAV = LAVENDER
 - GT = GRAY

- 24 VOLT WIRING
- - - 24 VOLT FIELD WIRING
- 120 VOLT WIRING
- - - 120 VOLT FIELD WIRING

- △ = CIRCULATOR PUMP/CALL FOR HEAT STATUS LIGHT
- △ = DRAFT INDUCER STATUS LIGHT
- △ = CONDENSATE PUMP STATUS LIGHT
- △ = BURNER STATUS LIGHT

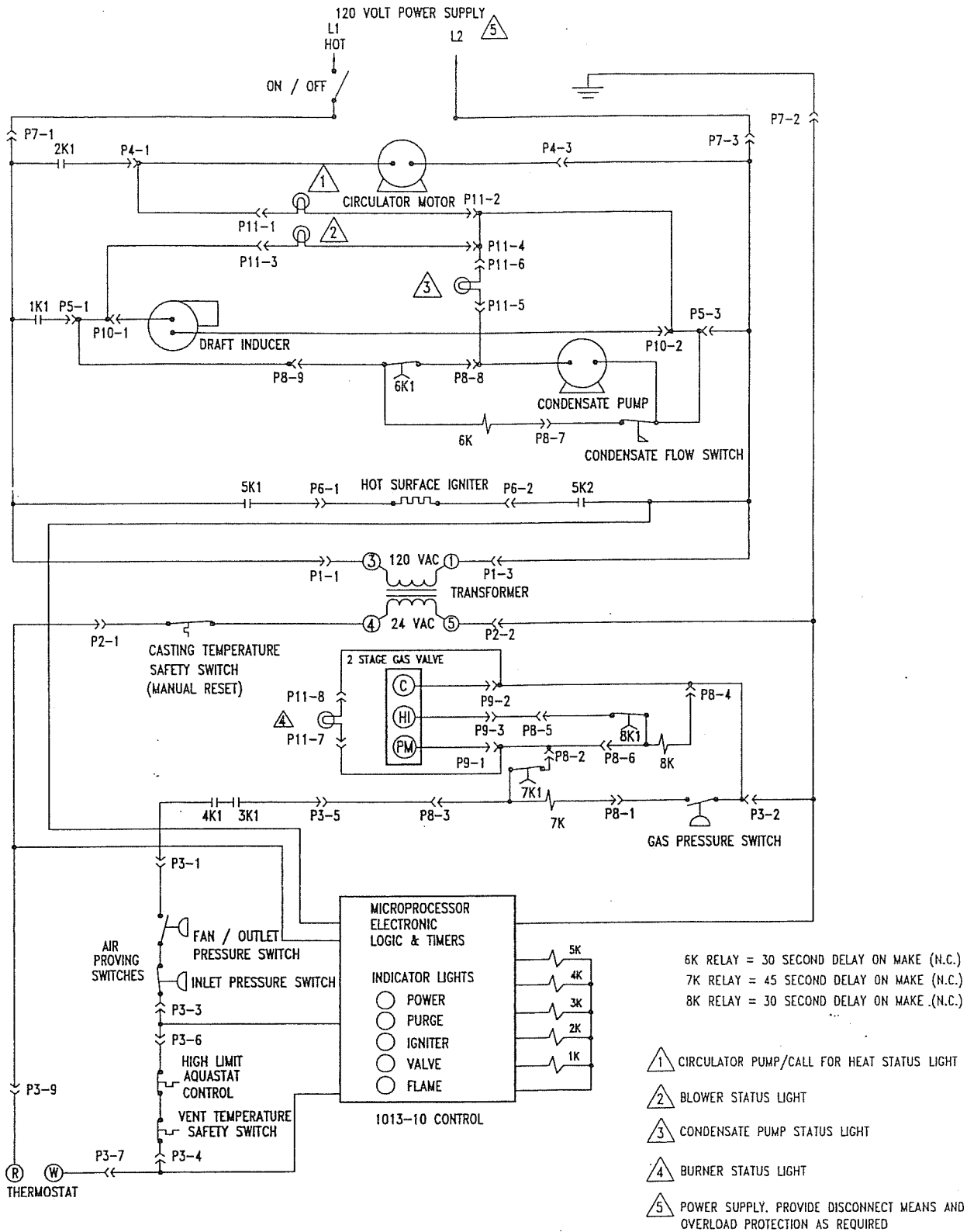
△ POWER SUPPLY, PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED

NOTE: "P" LABELS ARE FOR REFERENCE BETWEEN SCHEMATIC AND LADDER DIAGRAM.

ALL CONDUCTORS ARE 18 AWG, ANN STYLE 1015, CSA TYPE TEW, 105C WITH .105" PVC INSULATION

If any of the original wire as supplied with this appliance must be replaced, it must be replaced with type 150 °C Thermoplastic wire or its equivalent.

D. FIG. 14 - SCHEMATIC WIRING DIAGRAM



E. FIG. 15 - LADDER WIRING DIAGRAM

CONTROLS AND ACCESSORIES

This section provides a brief description of the key controls and accessories found in the Quantum Leap Wet Recuperated Boiler.

See the Troubleshooting section of the Service Hints chapter of this installation manual for detailed sequences of operation and troubleshooting procedures. See the Repair Parts chapter of this manual for locations of all control components and accessories described.

A. INTEGRATED BOILER CONTROL (IBC)

The Integrated Boiler Control (IBC) is a microprocessor based controller for a high efficiency gas boiler that monitors all safety controls and which controls the operation of the combustion air blower, circulator pump, burner, and a combination hot surface igniter/flame sensor. This controller is not intended for use with a vent damper. This controller is mounted on the control panel inside of the boiler and contains four (5) diagnostic indicator lights.

B. TRI-TIMER TIME-DELAY RELAY MODULE

The Tri-Timer Module is connected to the IBC. The module controls the timed sequences of operation for the gas pressure switch, gas valve regulator, and condensate flow switch.

C. 2-STAGE GAS CONTROL VALVE

The electrically controlled 24 Volt 2-Stage Combination Gas Control Valve is designed to meet the requirements for use with hot surface ignition systems found in the Quantum Leap. The valve is piped to both the gas/air mixer and gas pressure switch. The valve facilitates both the high and normal fire (hence 2 stages) gas pressures as timed by the Tri-Timer.

D. HOT SURFACE IGNITER

The 120 volt Hot Surface Igniter heats up to 1800°F to initiate combustion of the gas in the Quantum Leap burner. The igniter is mounted next to the burner through the gas/air mixer. The igniter also serves as a means for proving the main burner flame by flame rectification. In the event of a lack of flame signal on three (3) consecutive trials for ignition, the IBC will lockout. The "VALVE & FLAME" diagnostic indicator lamps (lamp "D" & "E" on the IBC, See Fig. 16) will blink indicating the failure mode as a lack of flame signal. The IBC is manually reset from lockout by either removing and reestablishing the thermostat's call for heat, or by turning the service switch off, then back on.

E. HIGH LIMIT AQUASTAT CONTROL

The High Limit Aquastat Control determines the maximum boiler water temperature and also provides a means for protecting the boiler and heating system from unsafe operating conditions which could damage the boiler. The aquastat is mounted in the ½" NPT control well and ¾" x ½" bushing on the top of the front boiler section at the hot water outlet connection to the circulation pump. The aquastat is tied in with the IBC and is factory set at 180°F water temperature. The high limit setpoint is field adjustable and may be set anywhere between 100°F and 200°F. The field setpoint adjustment for each installation depends on heating system requirements.

F. VENT TEMPERATURE SAFETY SWITCH

The Vent Temperature Safety Switch is a disc thermostat (145°F setpoint) located on the induced draft fan outlet port. The switch protects the PVC vent pipe from a potential high temperature condition for the discharging flue gases. This condition would typically be a result of running without the condensate pump. The condensate pump facilitates the saturation of the incoming combustion air. The absence of condensate pump operation translates to higher flue gas vent temperatures. This condition often points to a condensate pump shutdown in response to a dry condensate sump condition. The vent temperature safety switch automatically resets when the vent temperature decreases. (15°F switch differential)

G. CASTING TEMPERATURE SAFETY SWITCH

In the event of lack of or loss of water in the boiler, the Casting Temperature Safety Switch installed on the top of the aluminum boiler section shuts off the boiler by shutting off power to the Integrated Boiler Control (IBC) and causes the Power Indicator Light to go out. This fault requires manual reset of the casting temperature safety switch to restart the boiler. Verify that the boiler is properly filled with water before resetting this switch.

H. FAN/OUTLET PRESSURE SWITCH

The diaphragm type fan/outlet pressure switch is connected by vinyl tubing to the draft inducer suction port. The fan/outlet pressure switch monitors flow by sensing the fan suction pressure measured in inches of water ("w.c.). The factory setting on this switch is -0-45" w.c. The contacts are normally open. (negative sign means vacuum or negative pressure sensed). The fan/outlet pressure switch shuts off the main burner if fan suction is inadequate due to a blocked vent pipe or weak or blocked draft inducer. After five (5) minutes of lack of adequate fan suction, the IBC will lockout. The "PURGE" indicator light will blink, indicating a failure to prove adequate combustion air flow or flue gas flow. The IBC is manually reset from lockout as described in the Sequence of Operation section of this chapter.

I. INLET PRESSURE SWITCH

The diaphragm type inlet pressure switch is connected by vinyl tubing to a hose tee in a vinyl tubing line which connects to both the evaporative recoler suction port and the mixer suction port. The inlet pressure switch monitors and senses pressure measured in inches of water ("w.c.) for proving combustion air flow at the mixer inlet and at the evaporative recoler inlet. The reason for this "averaged" pressure indication is to permit the inlet pressure switch to monitor the potential blockage of combustion air inlet piping and potential high condensate level in sump due to blocked condensate drain. The factory setting on this switch is -1.10" w.c. (negative sign means vacuum or negative pressure sensed). The contacts are normally closed. The inlet pressure switch closes or opens as described in the Sequence of Operation section of this chapter.

J. GAS PRESSURE SWITCH

The (differential) gas pressure switch is used to provide feedback to the IBC to track the successful transition from the initial high gas firing rate (4.5" w.c. gas pressure - duration 30 seconds from gas valve energizing) to the normal gas firing rate (3.0" w.c. gas pressure). The normal firing rate is used for the duration of the call for heat after the initial high fire period. If this timed transition to the lower gas pressure is not sensed by the gas pressure switch, the gas valve closes and flame extinguishes. The IBC then goes through another ignition sequence. Continuous cycling of the boiler on and off every two (2) minutes is an indication that the gas valve may be stuck on high fire.

K. CONDENSATE PUMP

The condensate pump takes the cooler condensed flue gas solution which collects in the condensate sump of the evaporative re-cooler and pumps it through the recovery heat exchanger coil in counterflow with the hot flue gases being drawn from the boiler to the induced draft fan. The cooler condensate absorbs valuable heat from the flue gases prior to their discharge through the vent piping to the outdoors. Additional condensate is produced from the contact of the hot gases with the cool surface of the recovery coil. After having picked up heat, the condensate is then pumped to the evaporative re-cooler and sprayed over the tower fill material in counterflow with the incoming combustion air. The combustion air absorbs heat and moisture from the hot condensate, increasing energy efficiency and allowing lower flame temperature which helps reduce NOx levels contributing to a cleaner and healthier environment. During normal boiler operation the overall condensate volume is simultaneously reduced by its absorption by the incoming combustion air and increased by condensation of flue gas occurring in the cast aluminum boiler sections and recovery heat exchanger. When the condensate level in the sump rises to the overflow level, the net condensate produced drains through connecting piping (not provided with boiler) to a floor drain. For this purpose, the boiler must be installed so that proper pitch of piping to the floor drain can be accomplished. Use wood frame or blocks to raise the boiler as required for proper installation.

L. CONDENSATE FLOW SWITCH

The condensate flow switch is located in the condensate pump discharge piping downstream of the check valve, and is mounted on the side of the evaporative re-cooler. The switch protects the condensate pump from dry operation (running with the condensate sump empty) by shutting off the condensate pump and allowing boiler to run without the pump. On each call for heat, the condensate pump starts and the flow switch verifies that condensate flow is adequate to allow the condensate pump to continue to run. The factory setting on the flow switch is 0.25 gpm. The flow switch has normally closed contacts.

M. DRAFT INDUCER

The draft inducer (blower) provides a means for pulling combustion air into and through the evaporative re-cooler, mixer, burner, the flue ways of the cast aluminum boiler sections and the recovery heat exchanger before being discharged through the vent piping to the outdoors. See applicable sections for proper sizing and installation of combustion air and vent piping in this manual.

N. CIRCULATOR PUMP

Every forced hot water system requires at least one circulating pump. The circulating pump imparts the necessary energy to move the water through the closed loop supply and return piping systems, terminal heating equipment (i.e. finned tube radiators, etc.) and back through the boiler for reheating. To provide the required hot water flow rates, the circulator pump must be properly sized to overcome frictional losses (usually measured in feet of water, also referred to as "pump head loss") of the supply and return piping systems and boiler. The circulator pump is furnished in a carton within the boiler cabinet for a single zone or zone valve controlled heating system and should be correctly located on the downstream (i.e., pumping away) side of the expansion tank. For a pump controlled system (where there is a circulator for each zone) the circulator provided with the boiler can work for one zone. For more details on piping and circulators, see Near Boiler Piping section of this manual.

O. DRAIN VALVE

The manual drain valve provides a means of draining the water in the heating system, including the boiler and hot water supply and return piping systems installed above the drain valve. This drain valve is installed in the 3/4" tapping at the bottom of the front boiler section. Any piping installed below the elevation of this drain valve will require additional drain valves to be installed at low points in the piping systems in order to drain the entire system.

P. A.S.M.E. RATED PRESSURE RELIEF VALVE

Each boiler must have a properly sized and installed American Society of Mechanical Engineers rated pressure relief valve. Water expands as it is heated by the burner/boiler sections. If there is no place for the water to expand its volume, (i.e. a properly sized and properly functioning expansion tank) pressure on the inside of the boiler and heating system will increase. The relief valve will automatically open at 30 psig pressure to relieve the strain on the boiler and heating system from the increasing pressure. The pressure relief valve discharge must be piped with piping same size as the valve discharge opening to an open drain, tub or sink, or other suitable drainage point not subject to freezing, in accordance with A.S.M.E. specifications. Failure to provide the pressure relief valve with piping as herein described may cause water damage and/or serious bodily injury. The boiler manufacturer is not responsible for any water damage.

Q. FLAME ROLLOUT SAFETY SHUTOFF

As required, this boiler is equipped with a manual reset flame rollout safety shutoff means, which shuts off main burner gas in the event that the flow of combustion products through the flueways is reduced. In the event of blocked flueways, enough air will not be available to support combustion, and the Intergrated Boiler Control (IBC) will lockout due to loss of flame signal (after 3 trials for ignition). The "VALVE & FLAME" diagnostic indicator lamps (lamp "D" & "E" on the IBC, see Fig. 16) will blink indicating the failure mode as a lack of flame signal. The IBC is manually reset from lockout by either removing and reestablishing the thermostat's call for heat, or by turning the service switch off, then back on. If the boiler cannot be restored to normal operating condition by resetting the control, contact a qualified service agency to check heat exchanger flueways for blockage.

R. (OPTIONAL) EXTERNAL CONDENSATE PUMP

For installations where there is no floor drain or other appropriate drainage receptacle available to receive net condensate pump with integral sump is required. This unit can be installed to pump the condensate to a remote tie in point to a sanitary sewer system. For this application, the boiler must be installed so that proper pitch of piping to the external condensate reservoir (sump) can be accomplished. Use wood frame or blocks to raise boiler as required for proper installation.

S. **STRAINER**

The polypropylene strainer is located on the suction side of the condensate pump. The strainer is equipped with a 20 mesh 304 stainless steel screen, which prevents dirt and debris from entering the condensate pump. The strainer screen can be cleaned if necessary.

T. **CHECK VALVE**

The PVC plastic ball type check valve is located in the condensate pump discharge piping. The check valve keeps the circulating condensate inside the recovery coil from draining back to the sump after each run cycle. This helps prevent inadvertent loss of prime in the condensate pump, and also avoids the condensate pump having to purge air from inside the recovery coil at the start of each run cycle.

U. **SUMP FEEDER**

The Quantum Leap propane fired boilers are equipped with an automatic water feeder for the condensate sump. The sump feeder is required due to the lower water vapor content of flue products produced from burning propane gas, as opposed to natural gas combustion products that have significantly higher water vapor content. This is due to the fact that the hydrogen content is lower in propane gas than in natural gas. Therefore the combustion of propane gas produces less condensate than the combustion of the equivalent Btu's of natural gas.

The Sump Feeder consists of (3) major components. (1) Liquid Level Control Assembly, which is located at the base of the condensate sump. (2) Solenoid Valve Assembly which is mounted to the base pan support rail. (3) Sump Feeder Wiring Harness, which is linked to the Solenoid Valve and Liquid Level Control in a J-Box located at the base of the QL boiler. This component assembly is powered by the 24 volt transformer.

With a low water level condition in the sump this will close the contacts in the liquid level control. This powers the solenoid valve, which opens and fills the sump. Once the desired level is reached, the liquid level control contacts open, removing power from the solenoid valve.

START - UP

A. WATER TREATMENT AND FREEZE PROTECTION

1. When filling the boiler and heating system, water treatment is generally not required or desired. For localities where the water is unusually hard (above 7 grains hardness) or for low pH water conditions (below 7.0), consult a local water treatment specialist.
 - a. This boiler is designed for use in a closed hydronic heating system ONLY!
 - b. Excessive feeding of fresh make-up water to the boiler may lead to premature failure of the boiler sections.
2. Use clean fresh tap water for initial fill and make-up of boiler.
 - a. A sand filter must be used if fill and make-up water from a well is to be used.
 - b. Consideration should be given to cleaning the heating system, particularly in retrofit situations, where a new boiler is being installed in an older piping system.
 - c. In older systems, obviously discolored, murky, or dirty water, or a pH reading below 7, are indications that the system should be cleaned.
 - d. A pH reading between 7 and 8 is preferred.
3. Antifreeze if needed, must be of a type specifically designed for use in closed hydronic heating systems.
 - a. Choice and use of antifreeze must be in accordance with local plumbing codes.
 - b. Do not use automotive antifreeze as the type of corrosion inhibitors used will coat the boiler's heat transfer surfaces and greatly reduce capacity and efficiency.
 - c. Consult antifreeze manufacturer's literature for compatibility of antifreeze with aluminum boiler. Some brands have corrosion inhibitors that break down more rapidly or become ineffective at higher operating temperatures when used with aluminum. Follow the antifreeze manufacturers instructions on determining the proper ratio of antifreeze to water for the expected low temperature conditions, and for maintaining the quality of the antifreeze solution from year to year.
 - d. Use of antifreeze in any boiler will reduce capacity by as much as 10 to 20%, due to differing heat transfer and pumping characteristics. This must be taken into consideration when sizing the heating system, pump(s), and expansion tank. Consult antifreeze manufacturer's literature for specific information on reduced capacity.
 - e. Water content of the boiler is 2.6 gallons. (10 liters)
 - f. For recommended manufactured antifreeze (NFP-50) please contact Interstate Chemical Co. New York Customer Service at 1-800-422-2436.

B. FILLING BOILER WITH WATER AND PURGING AIR FOR SYSTEMS WITH DIAPHRAGM TYPE EXPANSION TANKS

Refer to appropriate "Near Boiler Piping" diagrams.

1. Close all zone service valves on the supply and return piping. Open the feed valve and fill boiler with water. Make sure air vent is open. Hold relief valve open until water runs air free for five seconds to rapidly bleed air from boiler, then let the relief valve snap shut.
2. Open the zone service valve on the supply pipe for the first zone. Open the purge valve on the first zone. Feed water will fill the zone, pushing air out the purge valve. Close the purge valve when the water runs air free. Close the zone service valve.
3. Repeat step 2 for all remaining zones.
4. Open all service valves. Any air remaining trapped in the return lines between the service valves and the boiler will be pushed towards the air vent when the boiler is placed in operation.
5. Inspect piping system. Repair any leaks immediately.

C. FILLING BOILER WITH WATER AND PURGING AIR FOR SYSTEMS WITH CONVENTIONAL CLOSED TYPE EXPANSION TANKS

Refer to appropriate "Near Boiler Piping" diagrams.

1. Close all zone service valves on the supply and return piping and close the expansion tank service valve. Drain expansion tank. Open the feed valve and fill boiler with water. Hold relief valve open until water runs air free for five seconds to rapidly bleed air from boiler, then let the relief valve snap shut.

2. Open the zone service valve on the supply pipe for the first zone. Open the purge valve on the first zone. Feed water will fill the zone, pushing air out the purge valve. Close the purge valve when the water runs air free. Close the zone service valve.
3. Repeat step 2 for all remaining zones.
4. Open the expansion tank service valve and the tank vent. Fill the tank to the proper level and close the tank vent. Remove the handle from the expansion tank service valve so the homeowner doesn't accidentally close it.
5. Open all service valves. Any air remaining trapped in the return lines between the service valves and the boiler will be pushed towards the expansion tank when the boiler is placed in operation.
6. Inspect piping system. Repair any leaks immediately.

NOTE: DO NOT use stop leak compounds. Leaks in threaded connections in the aluminum boiler sections must be repaired immediately. Aluminum threads will not seal themselves.

D. PLACING BOILER IN OPERATION

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. **BEFORE OPERATING** smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

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 the 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.

C. Use only your hand to turn the gas control knob. Never use tools. If the knob will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. DO not try to light the burner by hand.

5. Open the door, and remove the top jacket panel.
6. Rotate the gas control knob either clockwise or counterclockwise to "OFF".
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, **STOP!** Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
8. Rotate the gas control knob either clockwise or counterclockwise to "on".
9. Close the door, and replace the top jacket panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Open the door and remove the top jacket panel.

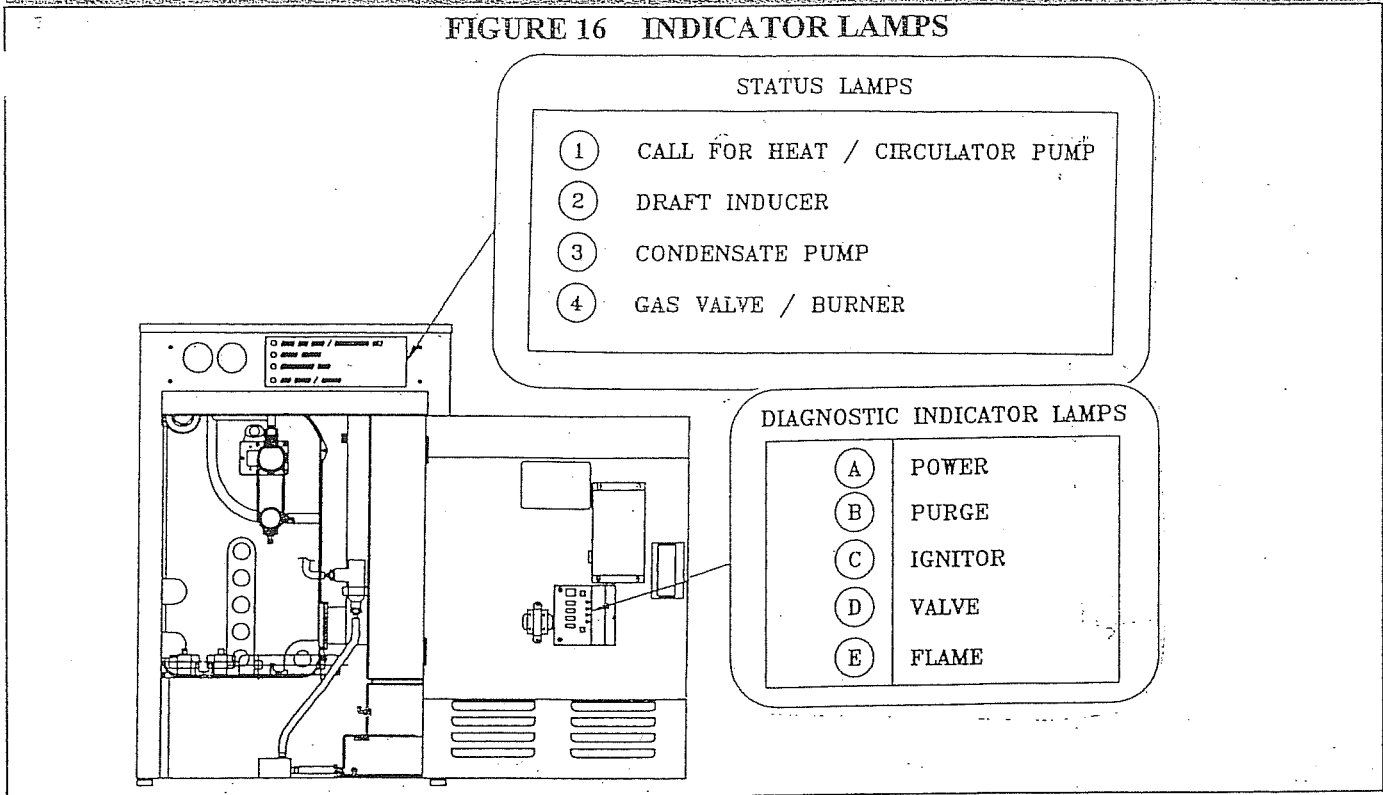
4. Turn gas control knob either clockwise or counterclockwise to "OFF". Do not force.
5. Close the door, and replace the top jacket panel.

Quantum Leap Boiler

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 Z21.13-latest revision.

CHECK OUT PROCEDURE AND ADJUSTMENTS

FIGURE 16 INDICATOR LAMPS



A. **VERIFY PROPER SEQUENCE OF OPERATION.** The sequence can be followed via the diagnostic indicator lamps on the integrated boiler control, and with the status lamps on the upper front panel of the boiler Fig.16. This is the normal sequence of operation. A more detailed sequence of operation containing potential faults can be found in the service hints section.

SEQUENCE OF OPERATION	STATUS LAMPS	DIAGNOSTIC INDICATOR LAMPS
Power ON, boiler standing by. Lamp A is illuminated indicating 24 volt power is being supplied to the integrated boiler control.	1. ○ 2. ○ 3. ○ 4. ○	A. ● B. ○ C. ○ D. ○ E. ○
Thermostat calls for heat, energizing system circulator and illuminating lamp 1.	1. ● 2. ○ 3. ○ 4. ○	A. ● B. ○ C. ○ D. ○ E. ○
Integrated boiler control goes through self check of internal circuitry (1-2 seconds) and energizes draft inducer and condensate pump, illuminating lamps 2 and 3.	1. ● 2. ● 3. ● 4. ○	A. ● B. ○ C. ○ D. ○ E. ○

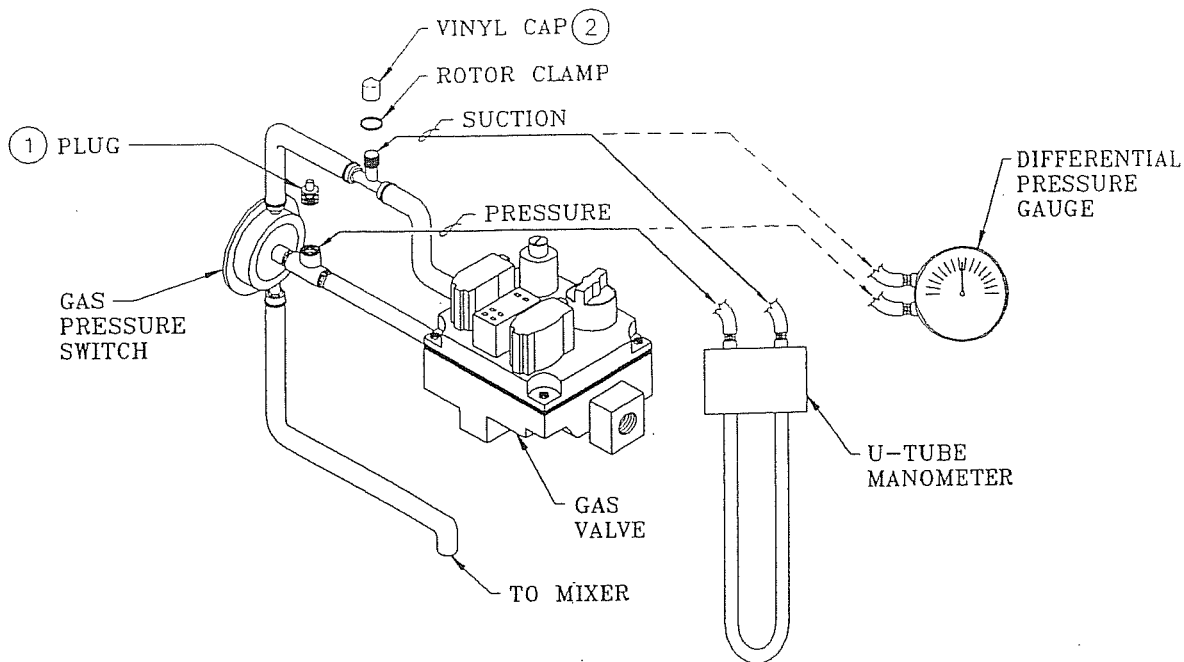
Draft inducer comes up to speed and establishes combustion airflow, causing the normally open fan/outlet pressure switch contacts to close and to verify that the normally closed inlet pressure switch contacts are closed. Lamp B is illuminated indicating that combustion airflow is proved and the 15 second pre purge cycle is under way.	1. ● 2. ● 3. ● 4. ○	A. ● B. ● C. ○ D. ○ E. ○
Condensate is pumped through the recovery heat exchanger and, evaporative re-cooler condensate loop by the condensate pump. Normally closed condensate flow switch contacts open when condensate flow is established.	1. ● 2. ● 3. ● 4. ○	A. ● B. ● C. ○ D. ○ E. ○
After pre purge, Lamp B goes out and Lamp C illuminates, indicating the hot surface igniter is powered for the 20 second igniter warm-up period. The bright yellow orange glow of the hot surface igniter can be observed through the observation port in the front boiler section just above the igniter.	1. ● 2. ● 3. ● 4. ○	A. ● B. ○ C. ● D. ○ E. ○
After igniter warm-up, the two stage gas valve is energized, and opens on the high firing rate regulator (4.5" w.c.) for a 6 second trial for ignition. Lamps 4 and D illuminates. The blue orange glow of the burner can be seen through the observation port.	1. ● 2. ● 3. ● 4. ●	A. ● B. ○ C. ● D. ● E. ●
Two seconds later, Lamp C goes out as power is turned off to the hot surface igniter. During the last two seconds of the 6 second trial for ignition, main burner flame is proven by flame rectification through the hot surface igniter, providing a flame signal to the integrated boiler control. The gas valve remains energized, and the boiler runs.	1. ● 2. ● 3. ● 4. ●	A. ● B. ○ C. ○ D. ● E. ●
Thirty seconds after the gas valve is energized, the gas valve switches to the normal firing rate regulator (3.0" w.c.). The boiler runs for the duration of the call for heat.	1. ● 2. ● 3. ● 4. ●	A. ● B. ○ C. ○ D. ● E. ●
Thermostat ends call for heat, de-energizing gas valve and system circulator. Burner stops firing. Lamps 1, 4, and D go out. Draft inducer remains powered and condensate pump remain powered. Lamp B illuminates, indicating draft inducer is running for 30 second postpurge. Condensate pump runs during postpurge period.	1. ○ 2. ● 3. ● 4. ○	A. ● B. ● C. ○ D. ○ E. ○
After 30 seconds, draft inducer and condensate pump are de-energized. Lamp 2, 3, and B goes out. Boiler stands by for next call for heat.	1. ○ 2. ○ 3. ○ 4. ○	A. ● B. ○ C. ○ D. ○ E. ○

NOTE: First couple of cold starts may be rough due to gas line not being completely purged of air, causing low firing rate and high excess air levels.

- B. Operate the boiler. **INSPECT VENTING AND AIR INTAKE SYSTEM.** Verify that all vent/air intake connections are gastight and watertight. Repair any leaks immediately.
- C. **INSPECT CONDENSATE DRAIN.** Verify that all connections are watertight, and that condensate flows freely. Repair any leaks immediately.
- D. **INSPECT SYSTEM PIPING.** Verify that all connections are watertight. Repair any leaks immediately.

- E. Test ignition system safety SHUTOFF device as follows:
1. turn off manual gas valve
 2. set thermostat to call for heat
 3. boiler begins normal sequence of operation
 4. after approximately 45 seconds (pre purge and igniter warm-up period), lamps 4 and D illuminate, indicating gas valve is powered
 5. after 6 seconds, gas valve closes, lamps 4 and D go out as integrated boiler control senses that flame is not present
 6. to restart system, follow operating instructions under "Start-up-Place in Operation"
- F. TEST HIGH LIMIT CONTROL AND ADJUST. While burner is operating, move indicator on high limit control below actual boiler water temperature. Burner should go off while circulator continues to operate. Raise limit setting above boiler water temperature and burner should reignite after pre purge and igniter warm-up period. Set the high limit control to the design temperature requirements of the system. Maximum high limit setting is 200°F. Minimum high limit setting is 100°F.
- G. TEST OTHER SAFETY CONTROLS. If the boiler is equipped with a low water cut off, a manual high limit, or additional safety controls, test for operation as outlined by the control manufacturer. Burner should be operating and should go off when controls are tested. When safety controls are restored, burner should reignite.
- H. SET THERMOSTAT HEAT ANTICIPATOR (IF USED) AND VERIFY THERMOSTAT OPERATION. For a single thermostat connected to the red thermostat lead wires in the furnished field wiring junction box, the heat anticipator should be set at 0.6 amps. For other wiring configurations, refer to the instructions provided by the thermostat manufacturer regarding adjustment of heat anticipator. Cycle boiler with thermostat. Raise the thermostat to the highest setting and verify boiler goes through normal start up cycle. Lower thermostat to lowest setting and verify boiler goes off.
- I. MEASURE THE NATURAL GAS INPUT RATE. Correct input rate is essential for proper and efficient operation of the burner and boiler.
1. Determine elevation at installation site.
 2. Refer to the Boiler Ratings and Capacities section of this manual to determine the correct input rate for the local elevation.
 3. Obtain the yearly average heating value of the local gas supply from the gas utility. At sea level elevation, it should be approximately 1000 Btu's per standard cubic foot.
 4. Operate boiler for 5 minutes.
 5. Turn off all other gas appliances, extinguishing standing pilots where applicable.
 6. At gas meter, measure time in seconds required to use one cubic foot of gas.
 7. Calculate input rate according to the following formula:

$$\text{Btuh input rate} = \frac{3600 \times \text{heating value from step 3}}{\text{Time for step 6}}$$
 8. Measured input rate should be within +/-2% of the input rating from step 2. If within 2%, go to step 9. If not, adjustment is required, proceed as follows:
 - a. Turn boiler off.
 - b. Set up U-tube manometer or differential pressure gauge for measuring manifold pressure, see FIG.17.
 - c. Manometer or gauge must be able to read at least 0.0 to 5.0 inches water column of differential pressure, and resolve to at least 0.1 inches water column.
 - d. Turn boiler on.



THE FOLLOWING STEPS AND DIAGRAM INDICATE THE LOCATION OF THE CONNECTION POINTS REQUIRED TO MEASURE THE MANIFOLD PRESSURE.

THE MANIFOLD PRESSURE MAY BE MEASURED USING A U-TUBE MANOMETER OR A DIFFERENTIAL PRESSURE GAUGE. THE DIAGRAM SHOWS THE CONNECTION OF BOTH MEASURING DEVICES BUT ONLY ONE DEVICE IS REQUIRED TO MEASURE THE MANIFOLD PRESSURE.

- ① REMOVE 1/8" PLUG. INSTALL APPROPRIATE BARBED FITTING AND CONNECT THE PRESSURE SIDE LINE FROM THE U-TUBE MANOMETER OR THE DIFFERENTIAL PRESSURE GAUGE.
- ② REMOVE THE VINYL CAP, CONNECT THE SUCTION SIDE LINE FROM THE U-TUBE MANOMETER OR THE DIFFERENTIAL PRESSURE GAUGE.

REFER TO "CHECK OUT PROCEDURE AND ADJUSTMENTS" IN THIS MANUAL WHEN READING MANIFOLD PRESSURE.

WHEN MEASUREMENT IS COMPLETE, DISCONNECT U-TUBE MANOMETER OR DIFFERENTIAL PRESSURE GAUGE. BE SURE TO REINSTALL 1/8" PLUG, USING APPROPRIATE PIPE THREAD SEALANT APPROVED FOR USE WITH NATURAL AND LIQUIFIED PETROLEUM GASSES AND ALSO TO REPLACE VINYL CAP ON SUCTION LINE.

FIG. 17 - MANIFOLD PRESSURE MEASUREMENT DETAIL

- e. Verify that high fire manifold pressure is 4.5 inches w.c., just after burner ignites. If within ± 0.2 (4.3 to 4.7) inches w.c., proceed to step f. If not, adjustment is required. This adjustment must be made during the first thirty seconds of burner firing, before the gas valve switches to normal firing rate. Prepare for adjustment as follows: (see fig. 18 for gas valve detail)
 - I. Remove high fire regulator cover screw from outlet side of gas valve.
 - II. Insert 3/32" Allen wrench (hex key wrench) into adjustment screw.
 - III. Remove and reapply call for heat to recycle burner so ignition sequence starts again.
 - IV. Just after the burner ignites, turn adjustment screw clockwise to increase pressure, or counter clockwise to decrease pressure. Hi fire pressure should be set at 4.5 inches w.c.
 - V. Remove Allen wrench and replace cover screw.

NOTE:

NORMAL FIRE REGULATOR COVER SCREW MUST BE INSTALLED AT ALL TIMES UNLESS ADJUSTING MANIFOLD PRESSURE. NORMAL FIRING RATE AND MANIFOLD PRESSURE MUST ONLY BE MEASURED WITH COVER SCREW FIRMLY INSTALLED.

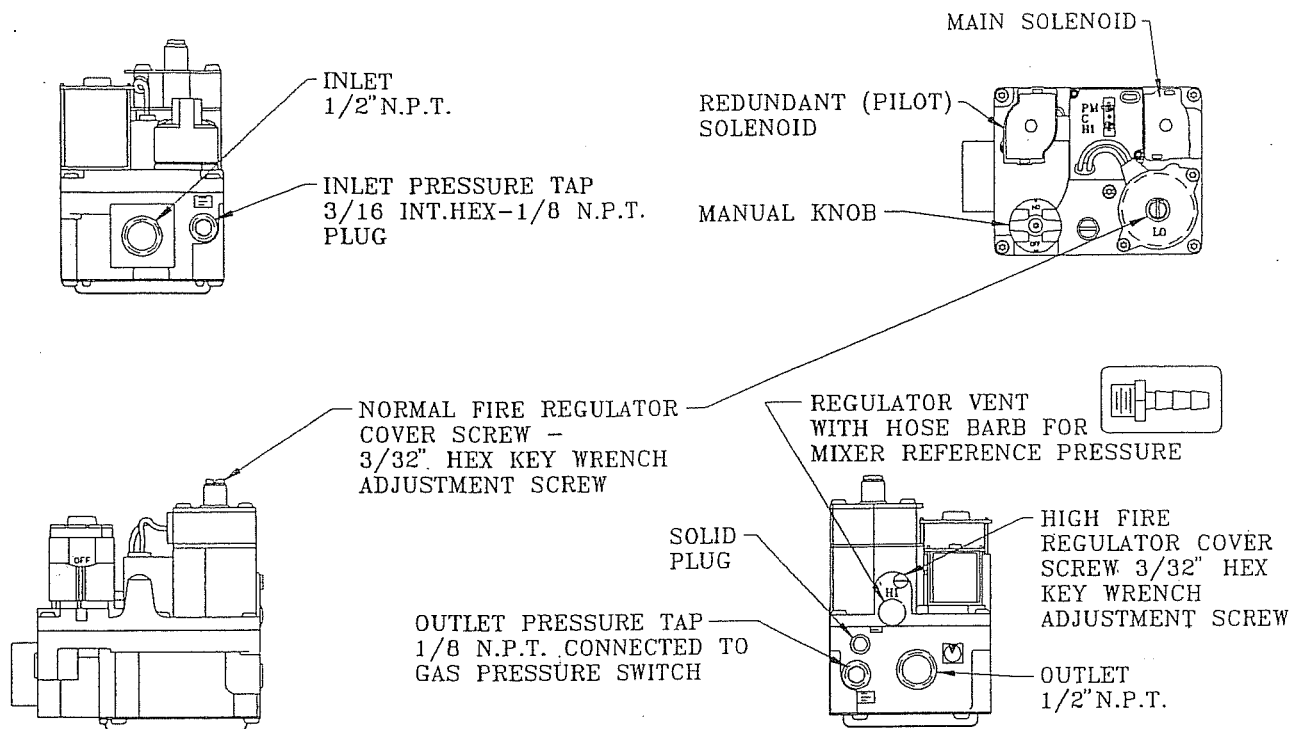


FIG. 18 - GAS VALVE

- f. Normal fire manifold pressure has been nominally set at 3.0 inches w.c. Normal fire manifold pressure and input rate must always be measured with normal fire regulator cover screw installed. Cover screw must be removed for adjustment. Manifold pressure reading will change (increase) when cover screw is removed.
- I. Remove normal fire regulator cover screw on top of gas valve, and insert 3/32" Allen wrench into adjustment screw.
 - II. Turn adjustment screw clockwise to increase input rate, or counter clockwise to decrease input rate.
 - III. Replace cover screw, or cover hole temporarily with your finger to check new manifold pressure setting. Do not set manifold pressure lower than 2.5 inches w.c. or higher than 3.5 inches w.c. when adjusting input rate.
 - IV. Measure new input rate (cover screw must be installed). Repeat steps I.-IV. until the input rate is within $\pm 2\%$ of the nameplate input rating.

- V. If the actual input rate can not be set to within 2% of the correct input rating by adjusting manifold pressure, a change in main burner orifice size is required. Consult the boiler manufacturer for information on correct orifice sizing. The specific gravity (G) and the higher heating value (HHV) of the local natural gas must be obtained from the local gas utility in order to determine the proper orifice size.
- g. After adjusting input rate, turn boiler off, remove manometer or pressure gauge, reinstall 1/8" plug in gas pressure switch line, and reinstall vinyl cap on reference pressure line. Turn boiler on.
- 9. Restore all gas appliances that may have been shut off (while measuring boiler input rate) to normal operating conditions.
- J. SET THERMOSTAT TO DESIRED ROOM TEMPERATURE. Observe several operating cycles to verify proper operation.
- K. REVIEW ALL INSTRUCTIONS shipped with this boiler with owner or maintenance person. Instructions must be affixed on or adjacent to the boiler.
- L. COMPLETE AND SIGN THE INSTALLATION AND CHECK-OUT CERTIFICATE ON THE FOLLOWING PAGE.

INSTALLATION AND CHECK-OUT CERTIFICATE

Boiler Model _____ Serial # _____ Date Installed _____

- Installation instructions have been followed Measured BTU/HR input _____
- Checkout procedure and adjustments performed
- Maintenance and Service issues reviewed with owner/ maintenance person
- Installation instructions booklet affixed on or adjacent to boiler

Installer (Company) _____

Address _____

Phone _____

Installer's Name _____

Signature _____

MAINTENANCE AND CLEANING

Maintenance as outlined below can be performed by the owner unless otherwise noted.

The acidic nature of flue gasses condensing on the aluminum boiler sections (i.e. the primary heat exchanger) will cause the formation of aluminum oxide. This oxide formation is normal, is generally uniform throughout the boiler sections, and represents a negligible mass of aluminum that is consumed by oxidation during the life of the boiler. If left unchecked, this buildup may eventually cause blockage of the flue gas passages in the boiler sections, reducing efficiency, and ultimately shutting down the boiler due to lack of combustion air flow. Aluminum oxide formation is negligible in the recovery heat exchanger because the condensate is diluted, and because the flue side of the recovery coil never dries out, even during extended periods between run cycles. **Regular service and maintenance by a qualified service agency must be performed to assure safe trouble free operation and maximum efficiency.**

A. Beginning of each heating season

1. Annual service call by a qualified service agency, which includes:
 - a. Examine flue passages between boiler sections, burner, recovery heat exchanger, evaporative re cooler sump, and condensate lines, and clean if necessary following the annual examination and cleaning instructions in paragraph "F" on the next page.
 - b. Visually inspect venting and air intake system for proper function, deterioration or leakage. If the vent or air intake show any signs of deterioration or leakage, repair or replace them immediately. Insure proper reassembly and resealing of the vent and air intake system.
 - c. Check for and remove any obstruction to the flow of combustion air or venting of flue gases.
 - d. Follow instructions for "Placing boiler in Operation".
 - e. Follow instructions for "Check Out Procedure and Adjustments".
 - f. Visually inspect condensate drain line for proper operation and deterioration. Check for plugged condensate drain line.
 - g. Check the silicone rubber seals between boiler sections. Insure that there are no leaks. Use RTV silicone rubber adhesive sealant (available in caulking gun tubes) rated for at least 400° F to replace or repair seals in locations where original seals have deteriorated.
 - h. Check all gasketed joints for leakage, and tighten bolts or replace gaskets if necessary.
 - i. Open jacket door and remove jacket top panel and check for piping leaks around circulator, relief valve, and other fittings. Repair, if found. DO NOT use stop leak compounds.
2. Check that boiler area is free from combustible materials, gasoline, and other flammable vapors and liquids.
3. Circulator pump, condensate pump, and blower motor furnished with boiler are permanently lubricated from the factory and require no further lubrication. Additional or non-factory supplied pumps and/or motors should be lubricated according to the pump and/or motor manufacturer's instruction.

B. Daily during heating season

1. Check for and remove any obstruction to the flow of combustion air or venting of flue gasses.
2. Check that boiler area is free from combustible materials, gasoline, and other flammable vapors and liquids.

C. Monthly during heating season

1. Open jacket door and remove jacket top panel and check for piping leaks around circulator, relief valve, and other fittings. If found, contact a qualified service agency to repair. DO NOT use stop leak compounds.
2. Test relief valve. Refer to valve manufacturers instructions packaged with relief valve.
3. Visually inspect venting and air intake system for proper function, deterioration, or leakage. If the vent or air intake show any signs of deterioration or leakage, contact a qualified service agency to repair or replace them immediately and to insure proper reassembly and resealing of the vent and air intake system.
4. Visually inspect the clear vinyl condensate lines and the PVC condensate drain pipe for proper operation, leakage, and deterioration. If the condensate lines or drain pipe show any signs of blockage, leakage, or deterioration contact a qualified service agency to clean, repair, or replace them immediately.
5. Check air vent(s) for leakage.

D. Periodically during heating season

1. Where low water cut offs are used, a periodic inspection of the low water cut off is necessary, including flushing of float type devices. Refer to low water cut off manufacturer's specific instructions.

E. End of each heating season - annual shut down procedure

1. Follow instructions "To Turn Off Gas To Appliance".
2. If heating system is to remain out of service during freezing weather, and does not contain antifreeze, drain system completely. If boiler will be exposed to freezing temperatures, drain condensate sump and condensate lines. Otherwise, do not drain system or boiler.

F. Annual examination and cleaning of boiler components.

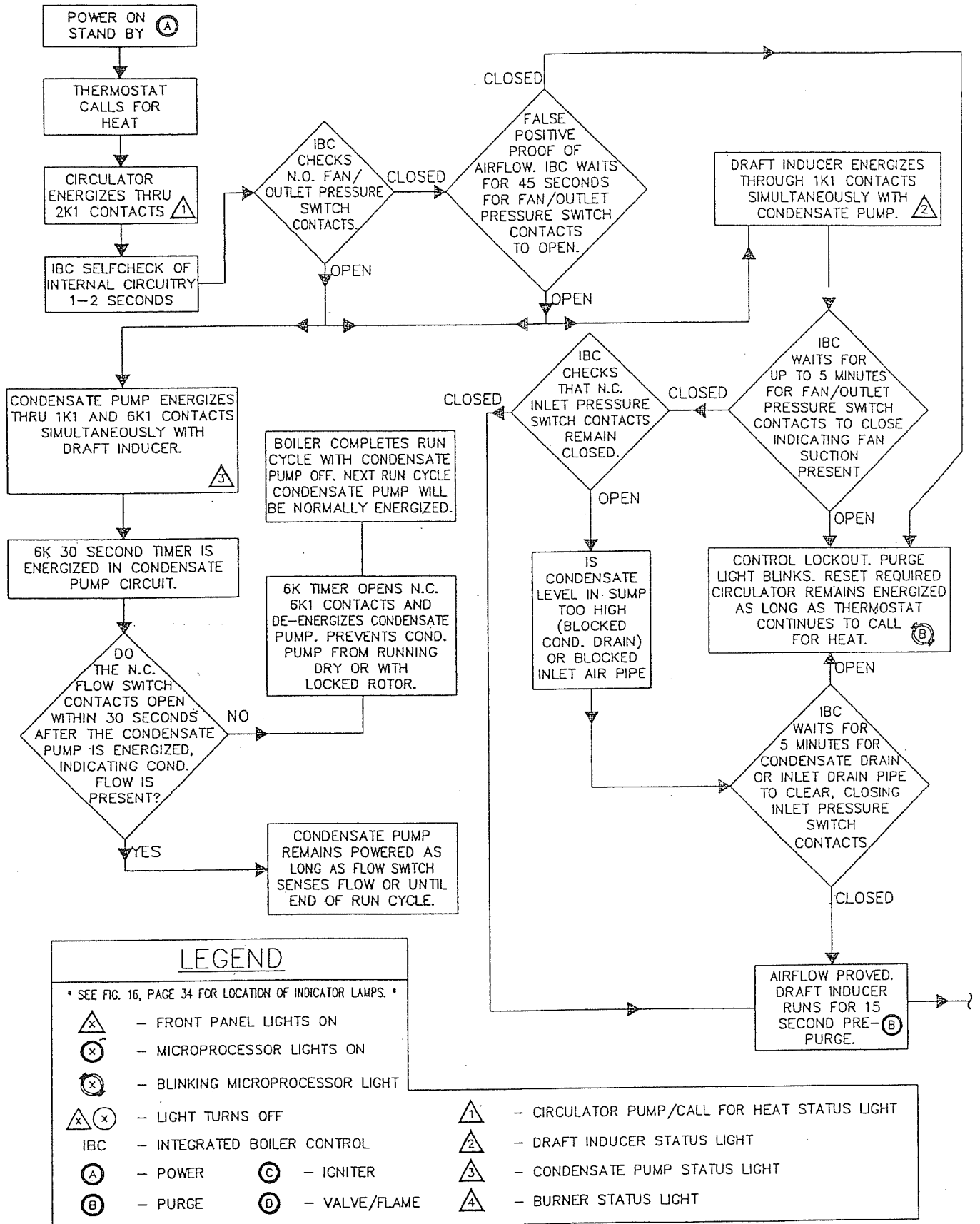
The following service procedures must be performed only by a qualified service agency. Boiler owner should not attempt these procedures.

1. **Before Servicing**, turn off electrical power to boiler at service switch. Close manual gas valve to turn off gas supply to boiler.
2. **Flue passages between boiler sections are examined** by removing six (6) sheet metal screws and the inspection plate on the left side jacket panel, and then removing the twenty socket head cap (20) screws and the exposed cleanout cover plate on the boiler sections, being careful to not damage the gasket. Refer to repair parts diagram, QL-block and piping assembly. The procedure for **examining and cleaning the burner** is also described below.
 - a. Any buildup of sediment or aluminum oxide (white powdery or flaky substance) in the flue passages **must be cleaned as follows:**
 - b. Open jacket door and remove jacket top panel. Disconnect condensate drain lines from barbed fittings on the bottom of the boiler and the bottom of the mixer. Keep the open ends of the drain lines above the water level in the condensate sump to prevent the sump from draining. Remove inlet pressure switch hose from barbed elbow fitting on mixer. Remove blue 2" diameter combustion air hose from mixer.
 - c. Confirm that manual gas valve is closed and disconnect gas line to gas valve at union. disconnect wires to gas valve, gas pressure switch and igniter.
 - d. Loosen but do not remove five (5) nuts attaching mixer assembly to boiler. Remove two (2) igniter screws and very carefully remove the igniter. **Use care when removing the igniter, it is very brittle!!**
 - e. Remove five (5) nuts and remove mixer assembly. Remove burner.
 - f. Aluminum oxide deposits are water soluble and may be rinsed away with spraying or running water. Before rinsing, connect a 1/2" I.D. hose to the barbed fitting on the bottom of the boiler and run the hose to a bucket or drain.

- g. Use a flexible handle nylon brush to loosen sediment and aluminum oxide on all heating surfaces of boiler, being careful to not damage the refractory fiber insulation in the combustion chamber area. Moisture will not harm the refractory fiber, but poking with a cleaning brush may. Refer to the repair parts diagrams.
 - h. After brushing and rinsing, remove any remaining loosened sediment using a shop vac with a snorkel attachment. Again, be careful to not damage the refractory fiber insulation in the combustion chamber area.
 - i. Inspect burner for any foreign matter in the flame ports or inside the burner. Any foreign matter should be removed by blowing with compressed air or vacuuming.
 - j. Inspect interior of mixer for any signs of sediment or aluminum oxide and clean if necessary.
 - k. Reinstall burner and position mixer assembly over studs. Install five (5) nuts but do not tighten. Reinstall igniter and igniter gasket and fasten with two (2) screws. **Use care when installing the igniter. It is very brittle!!** Tighten five (5) nuts holding mixer assembly.
 - l. Connect:
 - gas line to gas valve
 - condensate drain lines to mixer and boiler
 - inlet pressure switch hose to mixer
 - blue combustion air hose to mixer
 - gas pressure switch wires
 - igniter wires
 - gas valve wires
 - m. Install cleanout cover plate and gasket. Fasten with screws.
 - n. Install inspection plate and fasten with screws.
3. **Visually inspect evaporative re cooler sump. Visually inspect condensate lines** leading from the mixer, the boiler sections, the recovery heat exchanger, the sump, and the exhaust tee to the drain manifold. Refer to repair parts diagrams. Any foreign material or debris that is visible in the sump or the condensate lines needs to be cleaned out as follows:
- a. Remove condensate line from the barbed fitting on the bottom of the mixer, and insert the open end into a bucket or pan that is positioned on the floor in front of the boiler below the sump, or route the open end to a floor drain. This will cause the condensate sump and the condensate lines to drain out. *As an option, disconnect the condensate pump discharge line from the inlet side of the check valve, and arrange the condensate pump discharge line to run into a bucket. Turn the power to the boiler on at the service switch, and initiate a call for heat. The condensate pump will run, emptying the sump contents into the bucket. (The pump will only run for thirty seconds since the flow switch will not sense flow with the discharge line disconnected. Turn service switch off then back on to repeat pump cycle.) Turn the service switch off after the sump is drained.*
 - b. Once the sump and condensate lines are emptied of water, the remaining lines can be disconnected from the fittings on the recovery heat exchanger, the boiler, the exhaust tee, and the sump.
 - c. Remove the drain manifold and condensate line assembly. Run cold water through the condensate lines to thoroughly flush out any sediment or debris in the lines and/or manifold.
 - d. Remove the screen from the strainer and clean out any debris. Reassemble the strainer.

- e. Remove the 1 ½" PVC cleanout plug from the top surface of the sump. Inspect the interior of the sump and the sump inlet and outlet fittings. Any blockage of the sump inlet and outlet fittings must be cleared. Reinstall the cleanout plug in the top of the sump.
 - f. Reinstall and connect the drain manifold assembly, using the hose clamps to secure the various condensate lines to their fittings.
 - g. If the condensate pump discharge line is not already disconnected from the check valve inlet (from step "a" above), disconnect it now. Follow the instructions under "Near Boiler Piping" for "filling evaporative recooling with water". (Having the condensate pump discharge line disconnected allows the condensate pump to prime.)
 - h. Reconnect the condensate pump discharge line to the inlet side of the check valve.
4. **Inspection of the recovery heat exchanger** requires the following steps (Refer to the repair parts diagram.)
- a. Loosen the clamp on the draft inducer end of the 2" flexible coupling that connects the vent pipe to the draft inducer. Disconnect (unplug) wiring harness from draft inducer motor and vent temperature safety switch. Disconnect 3/8" O.D. pressure switch tubing from draft inducer suction pressure port. Remove four (4) bolts that attach draft inducer to recovery heat exchanger housing.
 - b. Remove draft inducer, gasket, and air orifice plate from top of recovery heat exchanger housing.
 - c. Disconnect ½" O.D. and ¾" O.D. condensate lines from barbed fittings at top of recovery coil inside recovery heat exchanger housing, and pull disconnected condensate lines out through the wall of the housing.
 - d. Lift the recovery coil up and out of the recovery heat exchanger housing.
 - e. Examine the recovery coil for any signs of corrosion or oxidation. If damage is extensive or there are any signs of leaks replace coil. Coil may be cleaned with any commercially available condenser coil cleaner designed for aluminum condenser coils. Be sure to rinse thoroughly to remove all traces of coil cleaning solution before reassembling recovery heat exchanger.
 - f. Reinstall recovery coil into recovery heat exchanger housing.
 - g. Insert and attach ½" and ¾" condensate lines and clamp.
 - h. Reinstall air orifice plate, insuring that orifice plate is properly located in mounting flange on top surface of recovery heat exchanger housing. Position the draft inducer gasket and the draft inducer and fasten with four (4) screws. Be sure to connect ground wire from draft inducer motor to one of the four mounting screws.
 - i. Connect wiring harness leads to the draft inducer motor and the vent temperature safety switch. Connect 3/8" pressure switch tubing to draft inducer suction pressure port.
 - j. Connect the 2" flexible coupling to the draft inducer outlet.

SERVICE HINTS



LEGEND

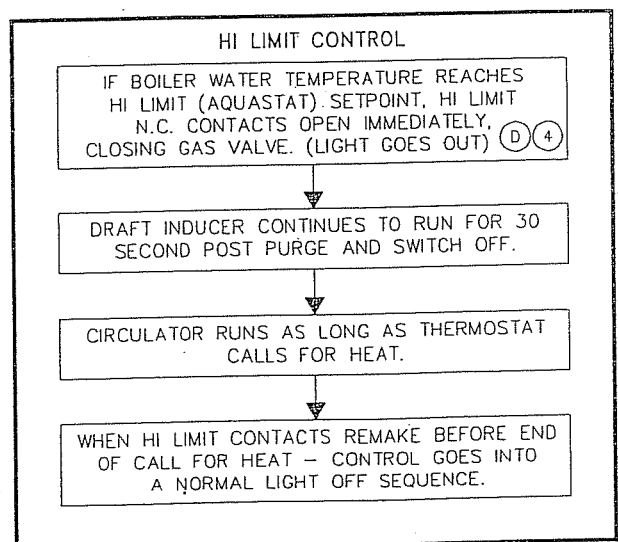
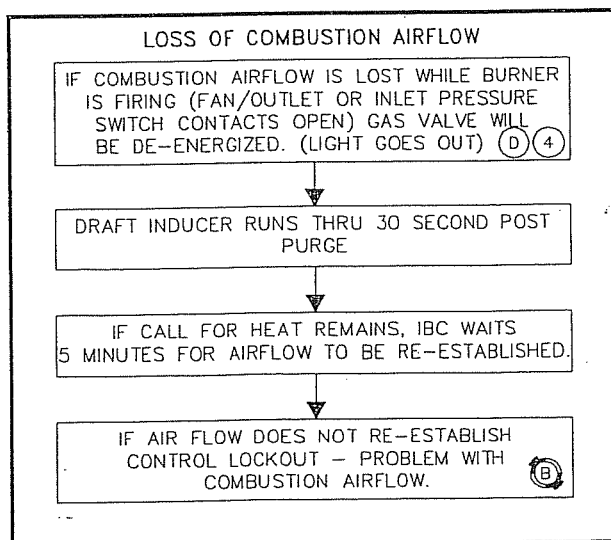
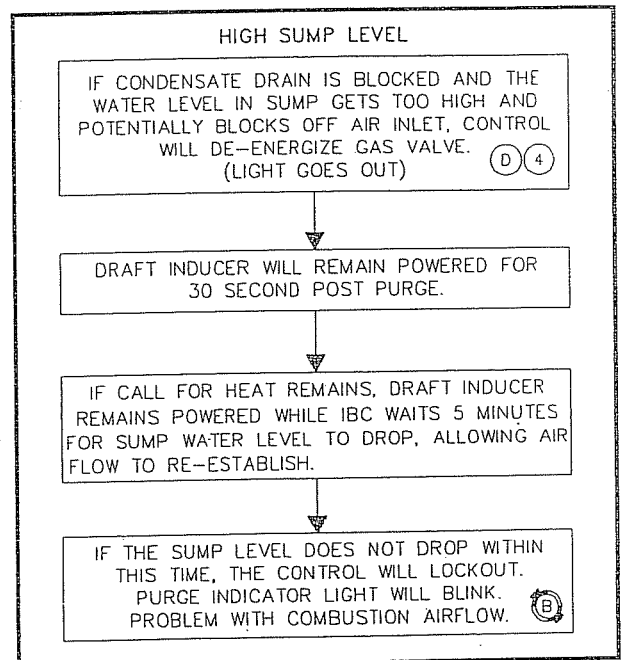
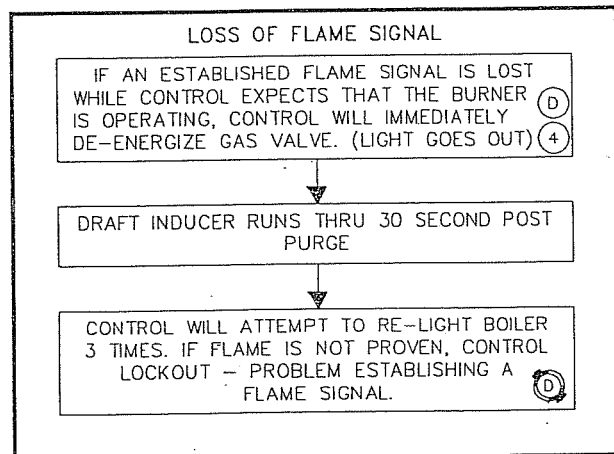
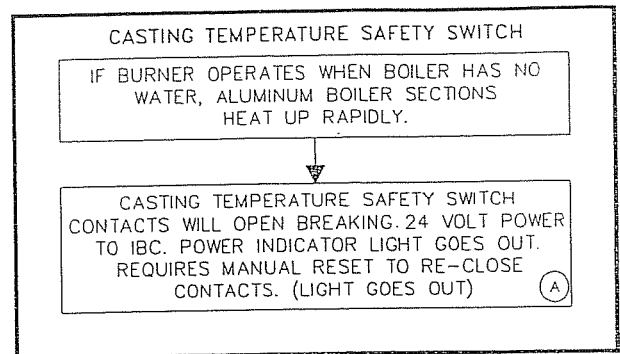
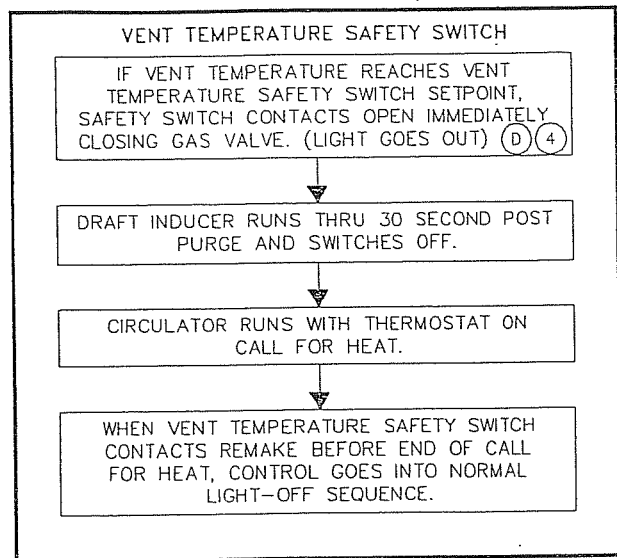
* SEE FIG. 16, PAGE 34 FOR LOCATION OF INDICATOR LAMPS. *

- ⊠ - FRONT PANEL LIGHTS ON
- ⊗ - MICROPROCESSOR LIGHTS ON
- ⊗ - BLINKING MICROPROCESSOR LIGHT
- ⊠ ⊗ - LIGHT TURNS OFF
- IBC - INTEGRATED BOILER CONTROL
- Ⓐ - POWER
- Ⓑ - PURGE
- Ⓒ - IGNITER
- Ⓓ - VALVE/FLAME

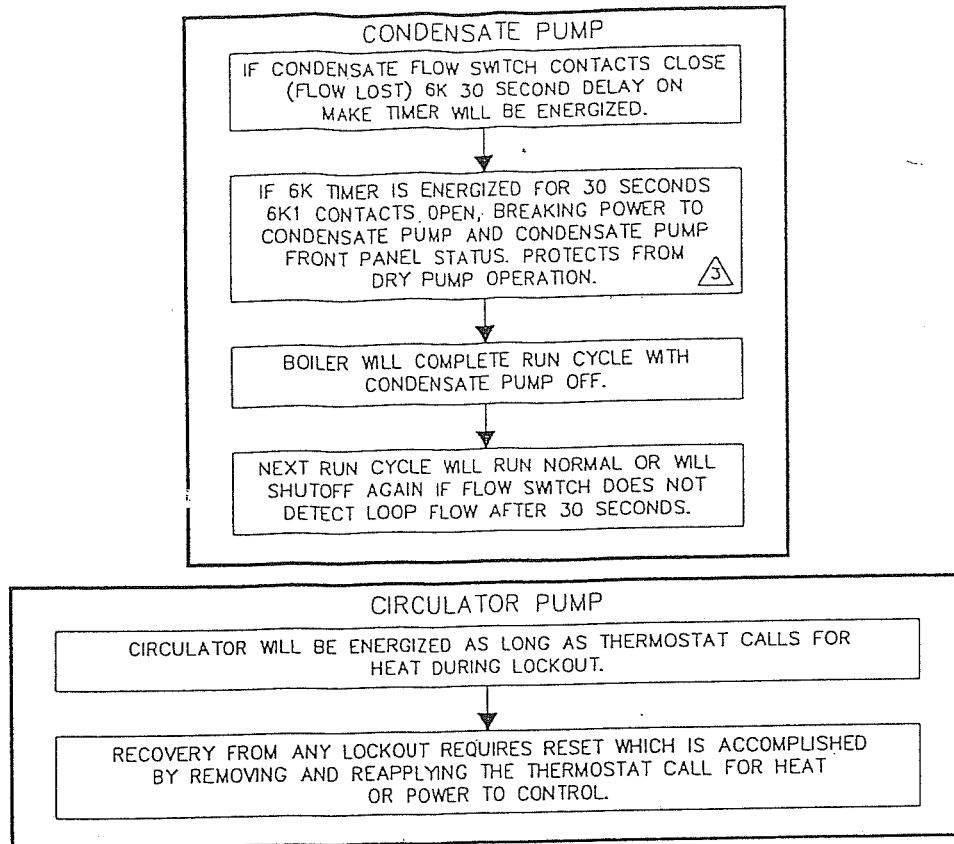
- ① - CIRCULATOR PUMP/CALL FOR HEAT STATUS LIGHT
- ② - DRAFT INDUCER STATUS LIGHT
- ③ - CONDENSATE PUMP STATUS LIGHT
- ④ - BURNER STATUS LIGHT

DETAILED SEQUENCE OF OPERATION

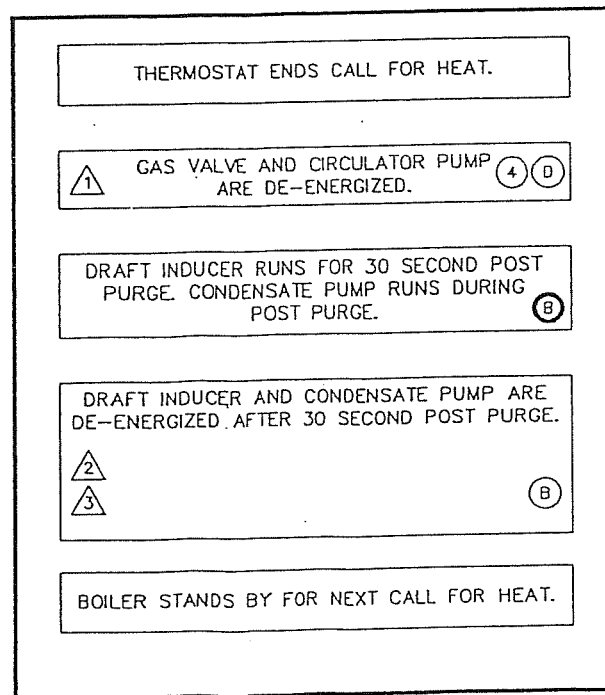
SAFETY SEQUENCES DURING OPERATION



SAFETY SEQUENCES DURING OPERATION (CONT.)



END OF NORMAL SEQUENCE OF OPERATION



DETAILED SEQUENCE OF OPERATION

!! WARNING !!

FIRE, EXPLOSION OR SHOCK HAZARD MAY CAUSE PROPERTY DAMAGE, SEVERE INJURY OR DEATH. DO NOT ATTEMPT TO MODIFY THE PHYSICAL OR ELECTRICAL CHARACTERISTICS OF THIS BOILER IN ANY WAY.

IMPORTANT

1. IN A RESET FROM LOCKOUT CONDITION, ALL ELECTRICAL METER READINGS AT THE GAS CONTROL VALVE (24 VAC) MUST BE TAKEN WITHIN THE TRIAL FOR IGNITION PERIOD.
2. IF ANY COMPONENT DOES NOT FUNCTION PROPERLY, MAKE SURE IT IS CORRECTLY INSTALLED AND WIRED BEFORE REPLACING IT.
3. STATIC ELECTRICITY DISCHARGE CAN DAMAGE THE INTEGRATED BOILER CONTROL (IBC). TOUCH METAL SURFACE TO DISCHARGE STATIC ELECTRICITY BEFORE TOUCHING IBC.
4. THE IBC CANNOT BE REPAIRED. IF IT MALFUNCTIONS IT MUST BE REPLACED.
5. ONLY TRAINED, EXPERIENCED SERVICE TECHNICIANS SHOULD SERVICE THE IBC SYSTEMS. FOLLOWING TROUBLESHOOTING, CHECK OUT THE SYSTEM FOLLOWING THE SEQUENCE OF OPERATION SECTION OF THIS CHAPTER FOR A NORMAL LIGHT OFF SEQUENCE.
6. ALL CONTROLS ARE FACTORY TESTED AT LEAST ONCE IN THE ASSEMBLY PROCESS AND A DEFECTIVE CONTROL IS GENERALLY THE LEAST LIKELY CAUSE. IF YOU SUSPECT YOU HAVE A DEFECTIVE CONTROL, DOUBLE CHECK YOUR PATH THROUGH THE TROUBLESHOOTING CHART BEFORE YOU REPLACE IT.
7. IT IS ALSO IMPORTANT TO REMEMBER THAT THE LIKELIHOOD OF COMING ACROSS TWO IDENTICAL DEFECTIVE CONTROLS IN A ROW IS ALMOST NIL. IF IT SEEMS TO BE HAPPENING, CHANCES ARE THAT EITHER THERE IS NOTHING WRONG WITH THE CONTROL OR IT IS BEING DAMAGED BY SOME OTHER PROBLEM (A SHORT BURNING OUT A TRANSFORMER, FOR EXAMPLE).

INITIAL SERVICE CHECKS

1. BEFORE TROUBLESHOOTING:
 - A. MAKE SURE THAT CIRCUIT BREAKER IS ON OR FUSE IS OK AT ELECTRICAL PANEL.
 - B. MAKE SURE THAT SERVICE SWITCH IS ON.
 - C. MAKE SURE THAT GAS IS ON AT THE GAS METER, AT ALL APPROPRIATE MANUAL SHUTOFF VALVES AND AT THE GAS CONTROL VALVE.
 - D. MAKE SURE THAT THE THERMOSTAT IS CALLING FOR HEAT.
 - E. CHECK THAT WIRE CONNECTORS AT THE INTEGRATED BOILER CONTROL AND AT THE ORIGINATING CONTROL ARE SECURELY PLUGGED IN OR CONNECTED.
 - F. CHECK THAT HOSES ARE SECURELY CONNECTED AND ARE NOT PLUGGED OR DAMAGED.
2. TROUBLESHOOTING TOOLS:
 - A. VOLTMETER TO CHECK 120 VAC AND 24 VAC.
 - B. CONTINUITY TESTER.
 - C. INCLINED MANOMETER OR PRESSURE GAUGE WITH 0-1.5" RANGE (0.01" SCALE) FOR MEASURING SUCTION PRESSURES AT PRESSURE SWITCHES.
 - D. U-TUBE MANOMETER OR DIFFERENTIAL PRESSURE GAUGE WITH 0-14" RANGE (0.1" SCALE) FOR MEASURING INLET AND MANIFOLD GAS PRESSURES.
3. WHAT IS SYSTEM STATUS?
 - A. CONSULT THE CHART ON THE FOLLOWING PAGE.
 - B. FIGURE 16 ON PAGE 34 SHOWS THE LOCATION ON THE BOILER OF THE DIAGNOSTIC INDICATOR LAMPS AND BOILER STATUS LAMPS.

SYSTEM STATUS

THE INDICATOR AND STATUS LIGHTS TRACK THE OPERATING SEQUENCE. IF THE SYSTEM LOCKS OUT, THE LIGHTS INDICATE THE POINT IN THE SEQUENCE OF OPERATION WHERE LOCKOUT OCCURS. IF THIS TABLE DOES NOT READILY PROVIDE THE REASON FOR BOILER MALFUNCTION OR NON-OPERATION, REFER TO THE FOLLOWING PAGES FOR MORE DETAILED TROUBLESHOOTING PROCEDURES.

LIGHT	SYMBOL	STATUS	INDICATES
POWER	Ⓐ	ON	IBC IS ENERGIZED THROUGH 24 VOLT TRANSFORMER.
	Ⓐ	OFF	IBC IS NOT ENERGIZED.
PURGE	Ⓑ	ON	IBC IS ENERGIZING THE DRAFT INDUCER AND AIR FLOW IS PROVEN.
	Ⓑ	OFF	OFF DURING PURGE CYCLE - DRAFT INDUCER IS NOT POWERED OR AIR FLOW IS NOT PROVEN. OFF DURING IGNITER AND RUN CYCLE - NORMAL OPERATION, PURGE CYCLE COMPLETE.
	Ⓑ	BLINKING	IBC IS LOCKED OUT. PROBLEM COULD INDICATE CONDENSATE LEVEL TOO HIGH IN SUMP, FALSE POSITIVE PROOF OF AIR FLOW OR BLOCKED VENT OR INTAKE AIR PIPE OR BLOCKED EVAPORATIVE RECOOLER.
IGNITER	Ⓒ	ON	IBC IS ENERGIZING IGNITER.
	Ⓒ	OFF	IGNITER IS NOT ENERGIZED
VALVE/ FLAME	Ⓓ	ON	IBC IS ENERGIZING 2-STAGE GAS CONTROL VALVE TO OPEN.
	Ⓓ	OFF	2-STAGE GAS CONTROL VALVE IS CLOSED.
	Ⓓ	BLINKING	IBC IS LOCKED OUT. PROBLEM IS FLAME HAS NOT BEEN PROVEN IN THREE (3) IGNITION ATTEMPTS. MAY BE DUE TO BROKEN IGNITER OR LACK OF OR LOW FLAME SIGNAL, OR NO GAS, OR BLOCKED FLUEWAY OR RECOVERY HEAT EXCHANGER.
CIRCULATOR PUMP/ CALL FOR HEAT	Ⓙ	ON	IBC IS ENERGIZING CIRCULATOR PUMP CIRCUIT.
	Ⓙ	OFF	CIRCULATOR PUMP IS NOT ENERGIZED.
DRAFT INDUCER	Ⓚ	ON	IBC IS ENERGIZING DRAFT INDUCER CIRCUIT.
	Ⓚ	OFF	DRAFT INDUCER IS NOT ENERGIZED.
CONDENSATE PUMP	Ⓛ	ON	IBC IS ENERGIZING CONDENSATE PUMP CIRCUIT.
	Ⓛ	OFF	CONDENSATE PUMP IS NOT ENERGIZED.
BURNER	Ⓜ	ON	IBC IS ENERGIZING 2-STAGE GAS CONTROL VALVE CIRCUIT. (GAS VALVE OPEN).
	Ⓜ	OFF	2-STAGE GAS CONTROL VALVE IS NOT ENERGIZED (GAS VALVE CLOSED)

TROUBLESHOOTING CHART 1

!! WARNING !!

ELECTRICAL SHOCK HAZARD.
MAY CAUSE SERIOUS INJURY OR DEATH.

THE FOLLOWING PROCEDURES MAY EXPOSE YOU TO DANGEROUS LINE VOLTAGE. USE CAUTION TO AVOID TOUCHING LIVE ELECTRICAL CONTACTS. SERVICE MUST BE PERFORMED BY A TRAINED, EXPERIENCED SERVICE TECHNICIAN.

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 NEIGHBORS PHONE. FOLLOW THE GAS SUPPLIER'S INSTRUCTIONS.
- IF YOU CAN NOT REACH YOUR GAS SUPPLIER, CALL THE FIRE DEPARTMENT.

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, DO NOT TURN OFF OR DISCONNECT THE ELECTRICAL SUPPLY TO THE PUMP. INSTEAD, SHUT OFF THE GAS AT A LOCATION EXTERNAL TO THE APPLIANCE.

DO NOT USE THE BOILER IF ANY PART OF THE GAS CONTROL SYSTEM HAS BEEN UNDER WATER. A QUALIFIED SERVICE TECHNICIAN SHOULD INSPECT THE BOILER AND REPLACE ANY PART OF THE CONTROL SYSTEM AND ANY GAS CONTROL WHICH HAS BEEN UNDER WATER.

USE ONLY YOUR HAND TO TURN THE GAS CONTROL KNOB. NEVER USE TOOLS. IF THE KNOB WILL NOT TURN BY HAND, DON'T TRY TO REPAIR IT. FORCE OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.

GREEN POWER INDICATOR LIGHT IS ILLUMINATED ON THE IBC (A) NO → }
CHART 2

YES

CHECK SYSTEM STATUS. IF LOCKED OUT NOTE FAILURE MODE. WHICH INDICATOR LIGHT IS BLINKING? RESET SYSTEM BY TURNING SERVICE SWITCH OFF THEN ON. IF NOT LOCKED OUT, SET THERMOSTAT TO CALL FOR HEAT.

CIRCULATOR STARTS? (T) NO

YES

CHART 2

FALSE POSITIVE: PROOF OF AIRFLOW. CHECK FAN/OUTLET PRESSURE SWITCH CONTACTS, IF CONTACTS ARE CLOSED WITH NO AIRFLOW, REPLACE PRESSURE SWITCH.

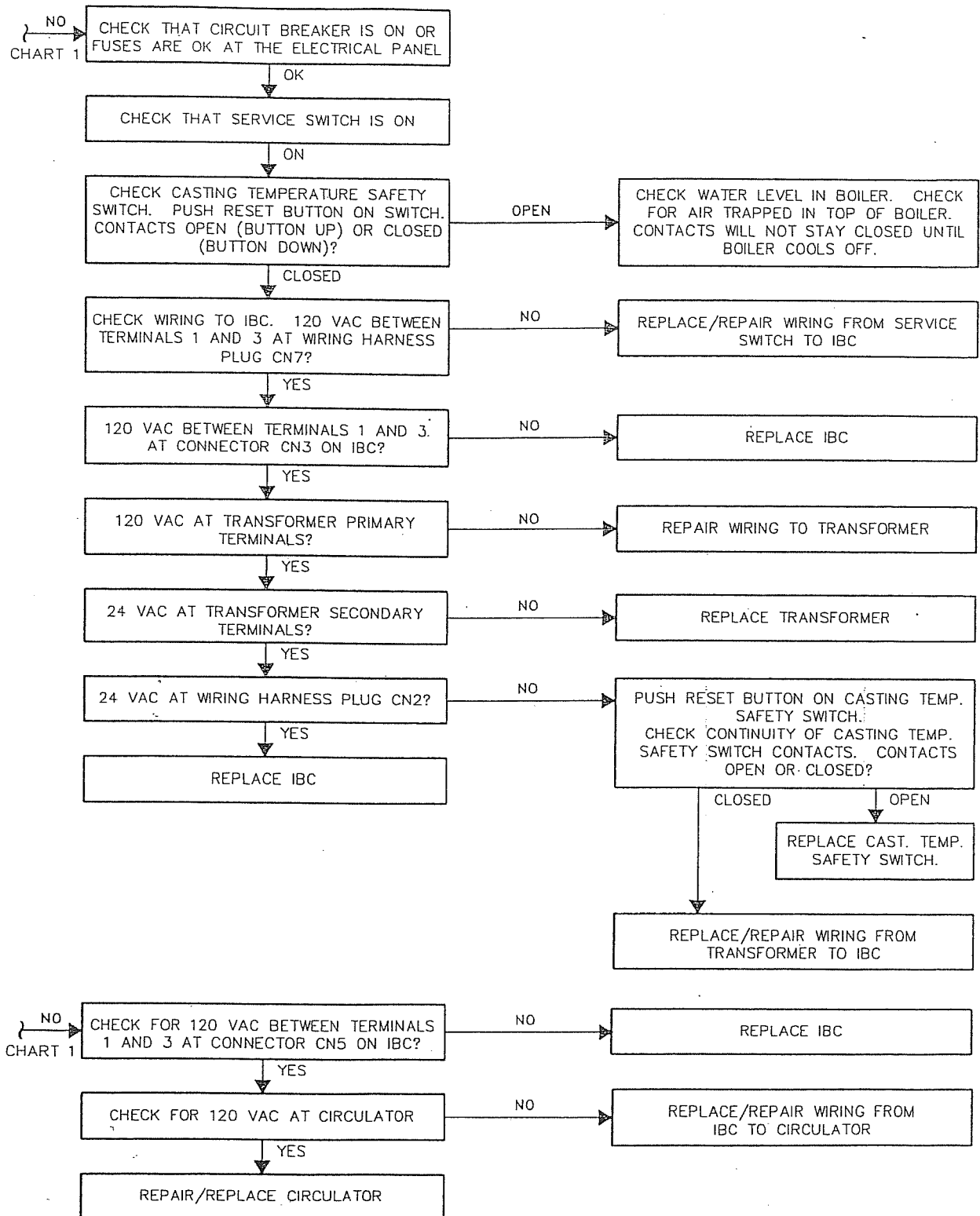
CLOSED

IBC CHECKS NORMALLY OPEN FAN/OUTLET PRESSURE SWITCH CONTACTS

OPEN

CHART 3.

TROUBLESHOOTING CHART 2



TROUBLESHOOTING CHART 3

CHART 1
OPEN → CHART 4

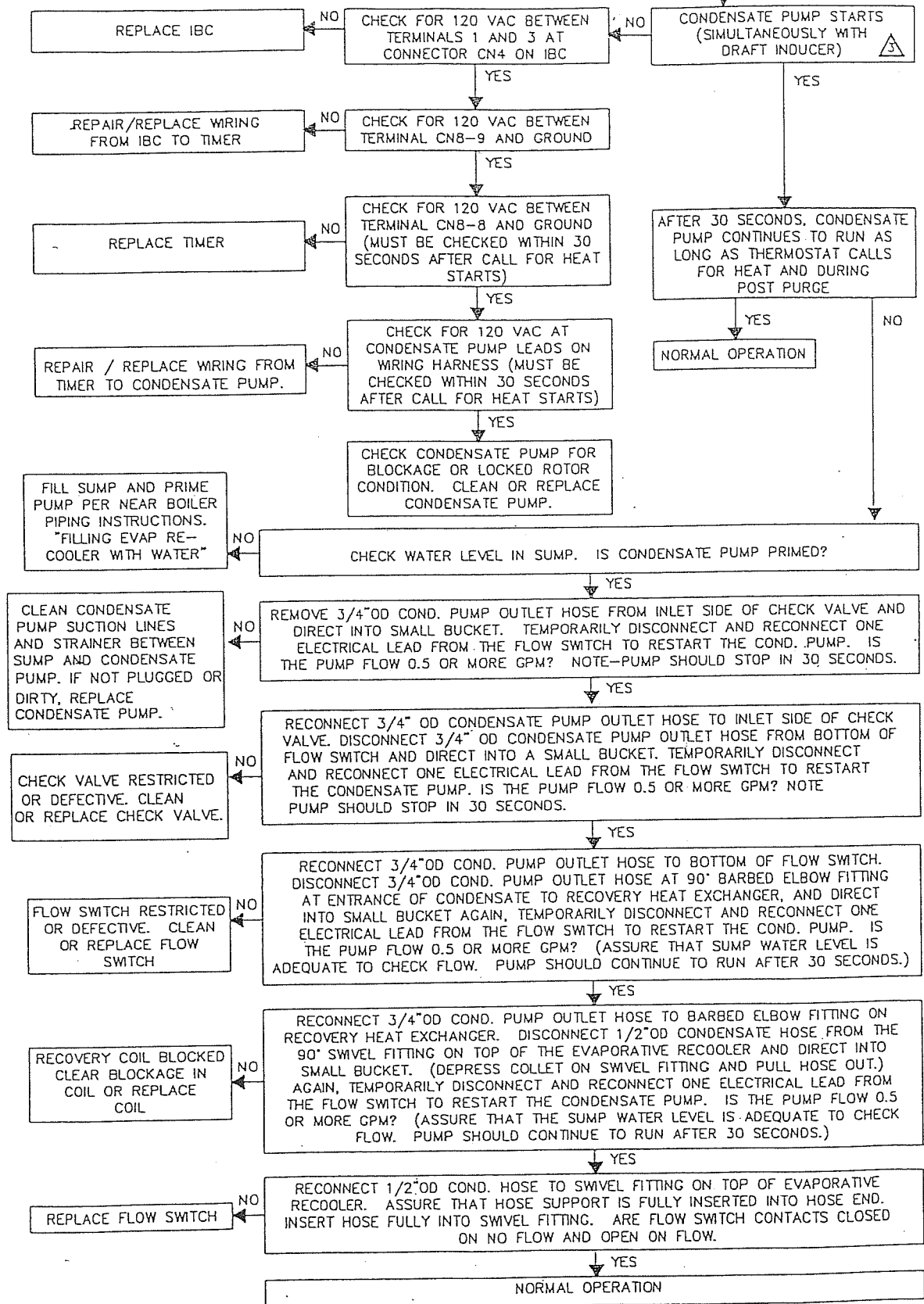
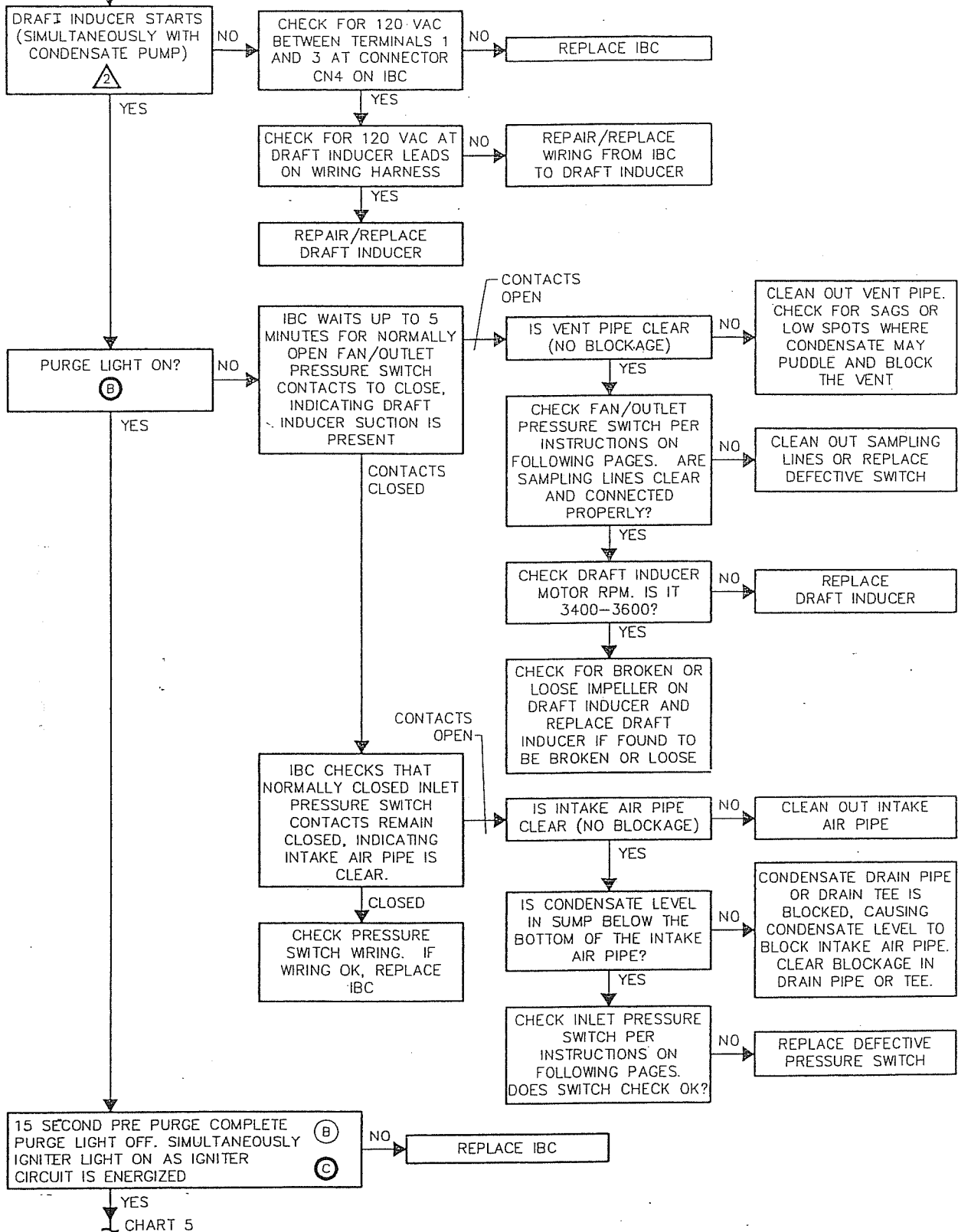
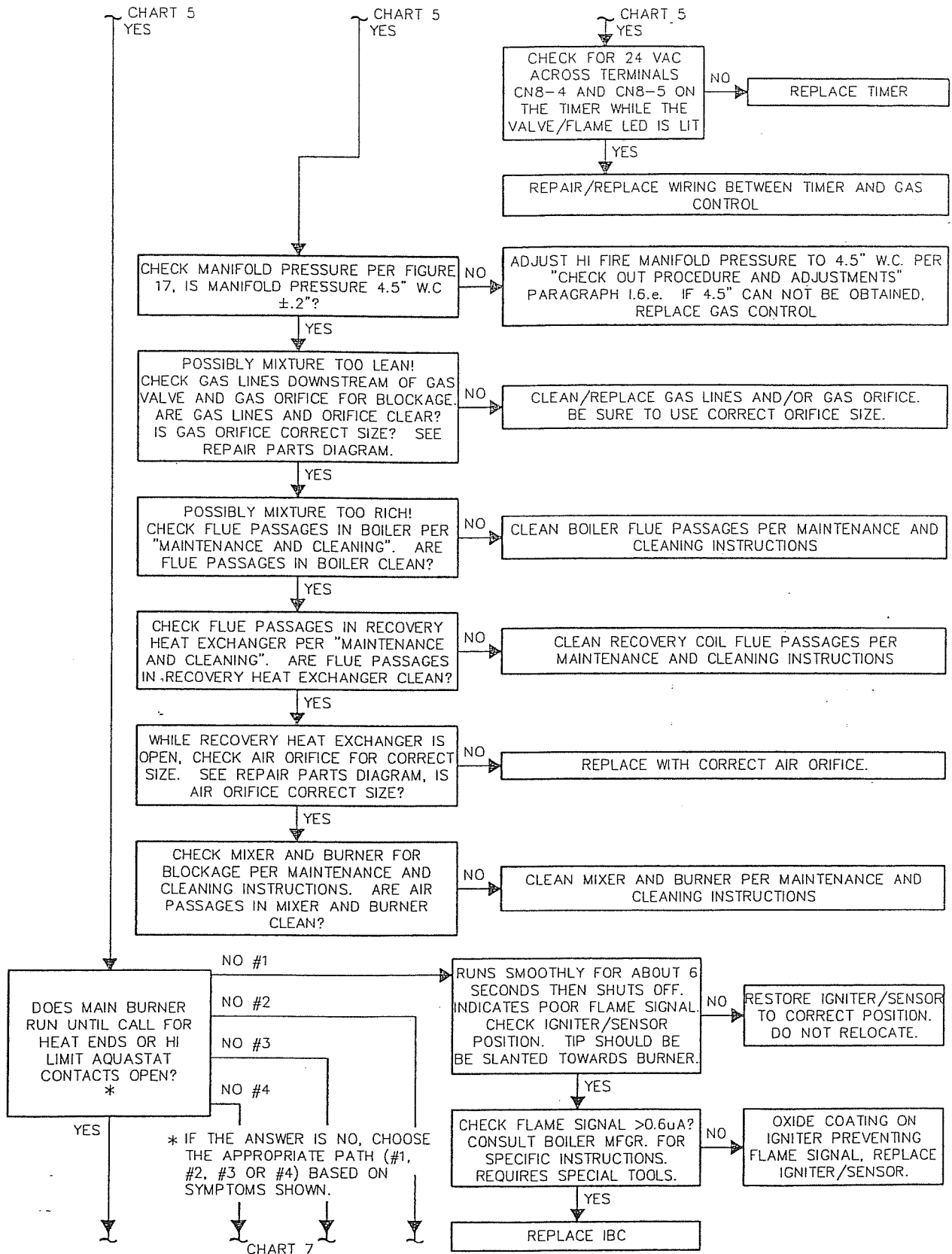


CHART 3
OPEN

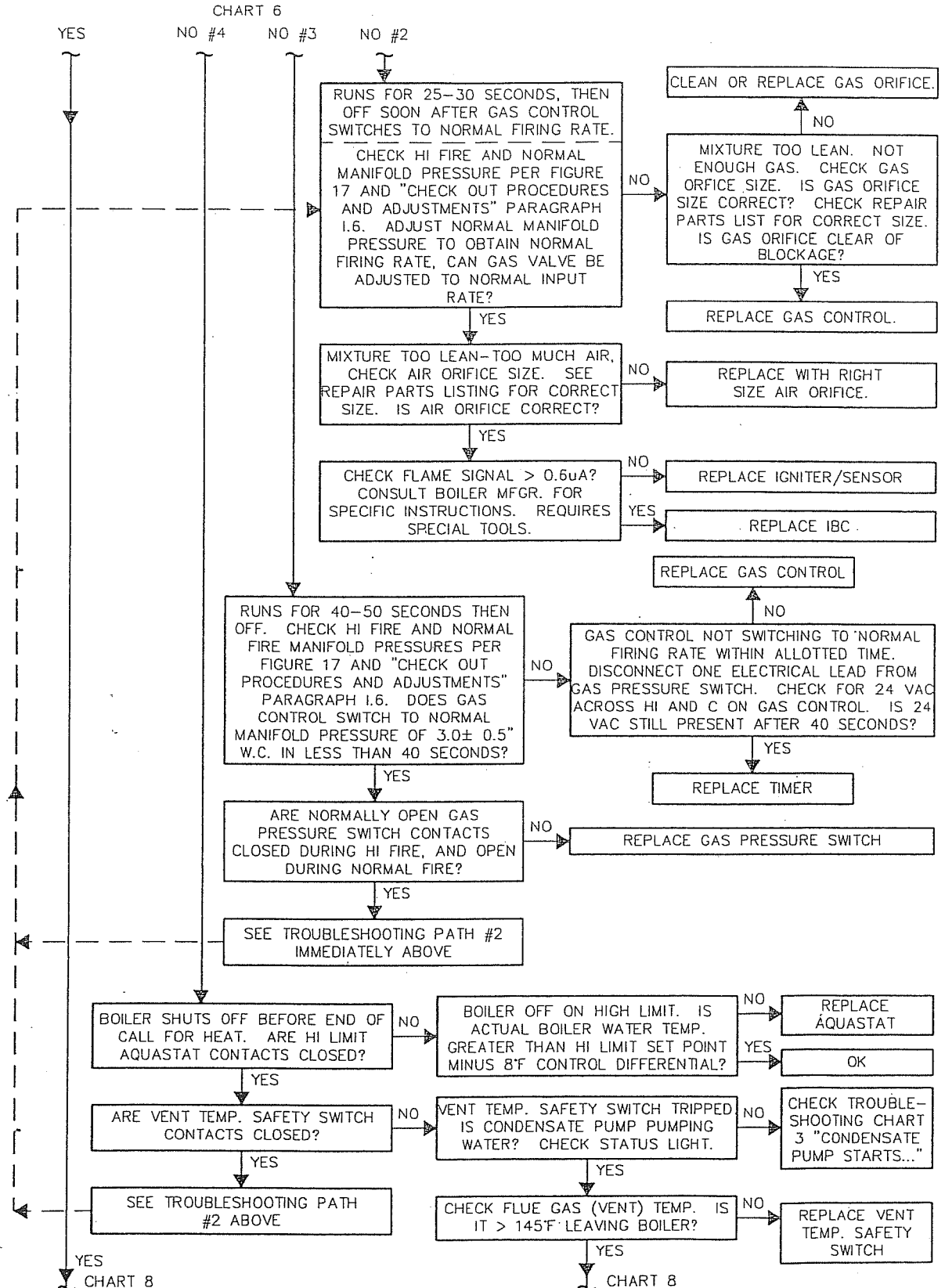
TROUBLESHOOTING CHART 4



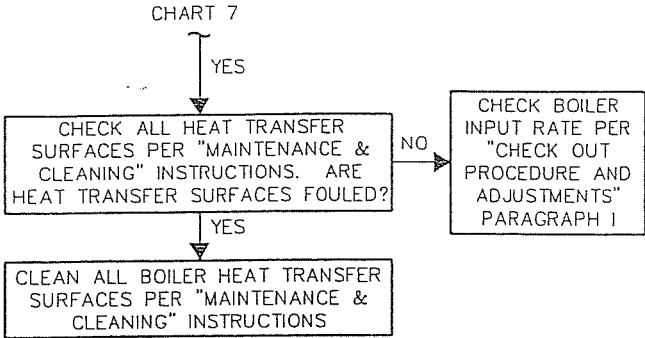
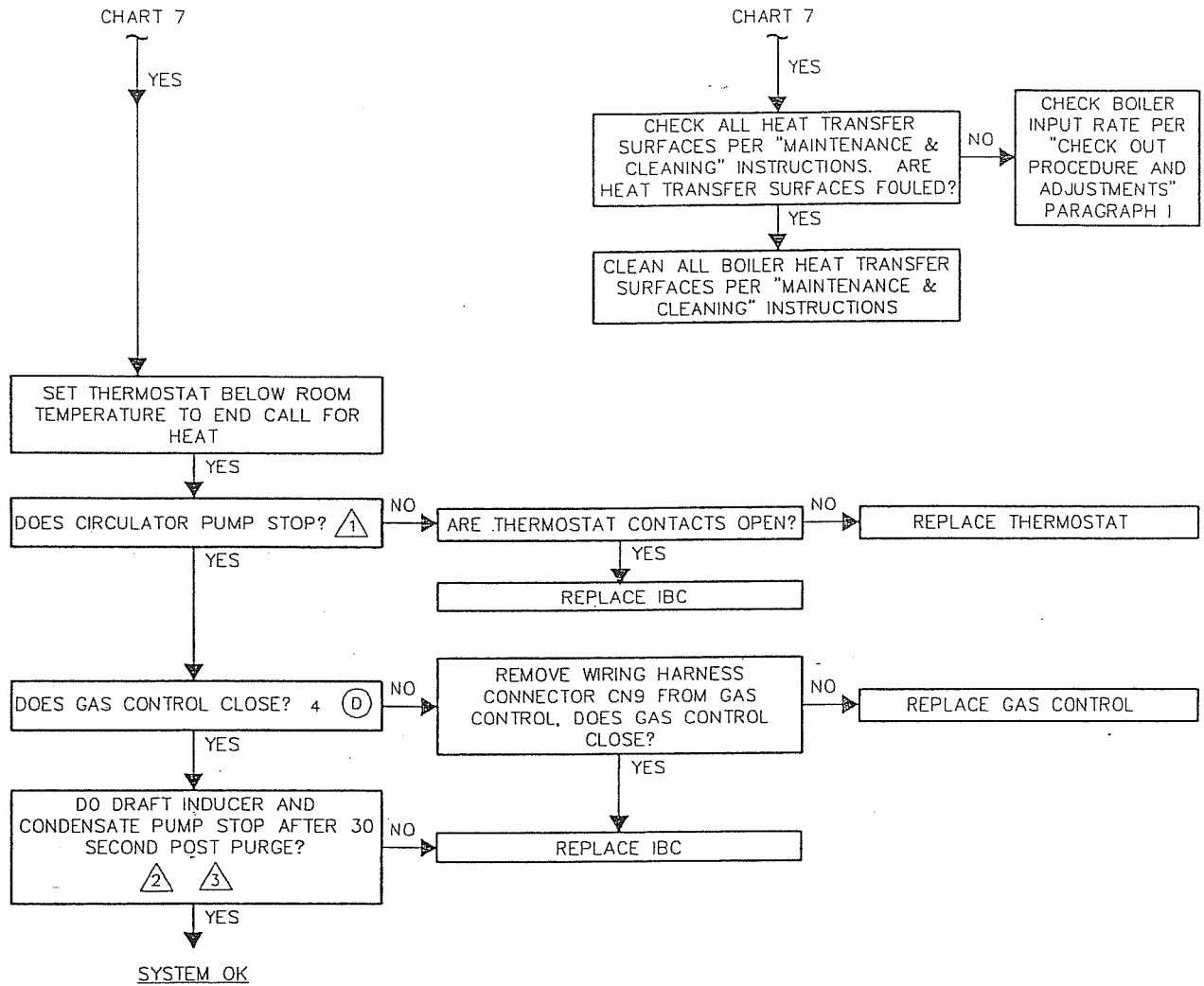
TROUBLESHOOTING CHART 6



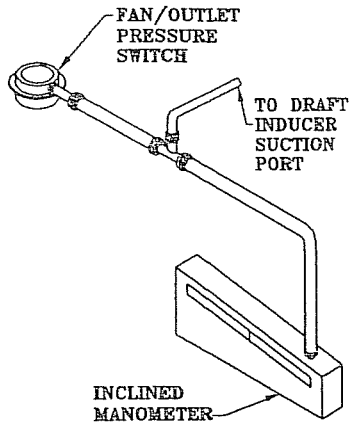
TROUBLESHOOTING CHART 7



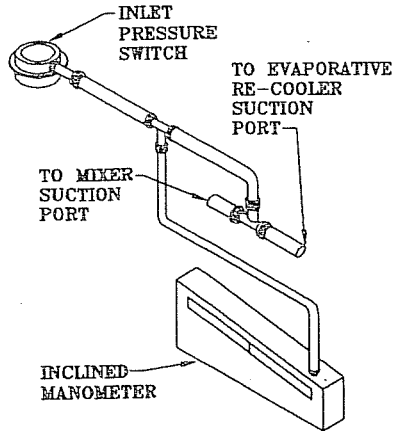
TROUBLESHOOTING CHART 8



REPEAT PROCEDURES UNTIL
SYSTEM STARTS NORMALLY



**FAN/OUTLET
PRESSURE SWITCH**



**INLET
PRESSURE SWITCH**

THE FOLLOWING STEPS AND DIAGRAM INDICATE THE LOCATION OF THE CONNECTION POINTS REQUIRED TO CHECK THE FAN/OUTLET OR INLET PRESSURE.

THE FAN/OUTLET OR INLET PRESSURE SWITCH IS A SAFETY DEVICE WHICH WILL PREVENT THE BOILER FROM FIRING IF THERE IS AN AIR INTAKE OR VENT BLOCKAGE.

TURN OFF SERVICE SWITCH, OR LOWER THERMOSTAT SETTING.

REMOVE SUCTION LINES FROM PRESSURE SWITCH(ES) AND INSTALL TEE AND HOSE HOOK-UPS.

INSTALL TEES AND SUCTION LINES AS SHOWN TO INCLINED MANOMETER OR PRESSURE GAUGE WITH THE ABILITY TO READ .01" TO 1.5" W.C.

TURN ON SERVICE SWITCH AND SET THERMOSTAT TO CALL FOR HEAT.

FAN/OUTLET PRESSURE SWITCH		
BOILER STATUS	SUCTION W.C.	PRESSURE SWITCH CONTACTS
NOT RUNNING	0"	NORMALLY OPEN
SETPOINT	-.45"	
RUNNING WITH NO BLOCKAGE	-.55" TO -1.25"	CLOSED
RUNNING WITH BLOCKAGE	LESS THAN OR EQUAL TO -.45"	OPEN

INLET PRESSURE SWITCH		
BOILER STATUS	SUCTION W.C.	PRESSURE SWITCH CONTACTS
NOT RUNNING	0"	NORMALLY CLOSED
SETPOINT	-1.10"/QL-100	
RUNNING WITH NO BLOCKAGE	LESS THAN SETPOINT	CLOSED
RUNNING WITH BLOCKAGE	GREATER THAN SETPOINT	OPEN

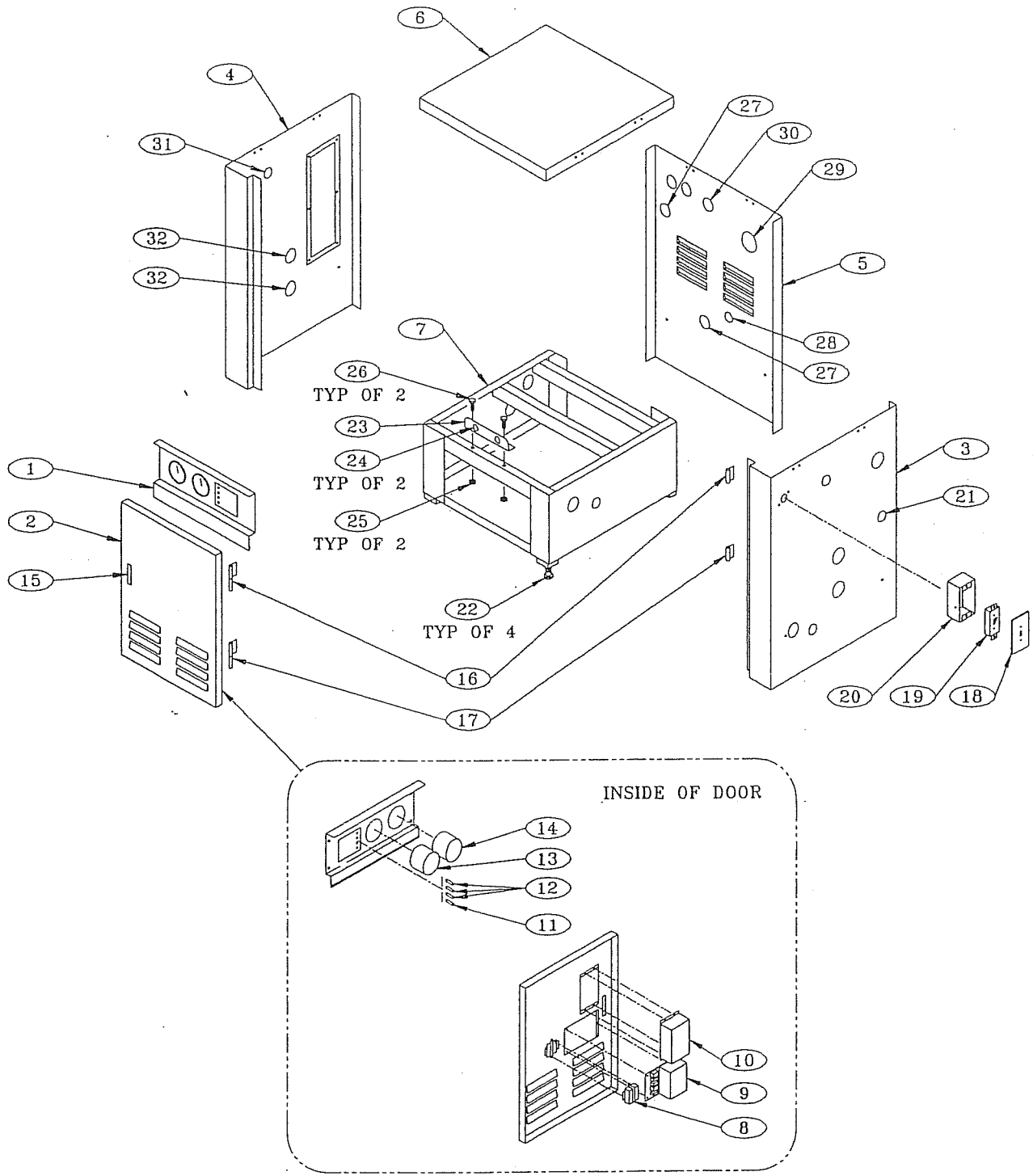
IF MANOMETER READINGS DO NOT CORRESPOND TO THE CHART ABOVE, CHECK FOR POSSIBLE CAUSES:

- BLOCKAGE OR MOISTURE IN SUCTION LINES TO SWITCH.
- BLOCKAGE IN AIR INTAKE OR VENT PIPES.
- UNDERSIZED AIR INTAKE OR VENT PIPES.
- LOOSE BLOWER WHEEL ON MOTOR SHAFT.
- BLOWER MOTOR NOT AT PROPER RPM.
- INCORRECT PRESSURE SWITCH OR PRESSURE SWITCH SETPOINT.

WHEN PRESSURE READING IS PROPER AND THE PRESSURE SWITCH IS OPERATING PROPERLY, REMOVE TEES AND REINSTALL SUCTION LINES TO THE PRESSURE SWITCH(ES).

FAN/OUTLET AND INLET PRESSURE SWITCH CHECK

REPAIR PARTS

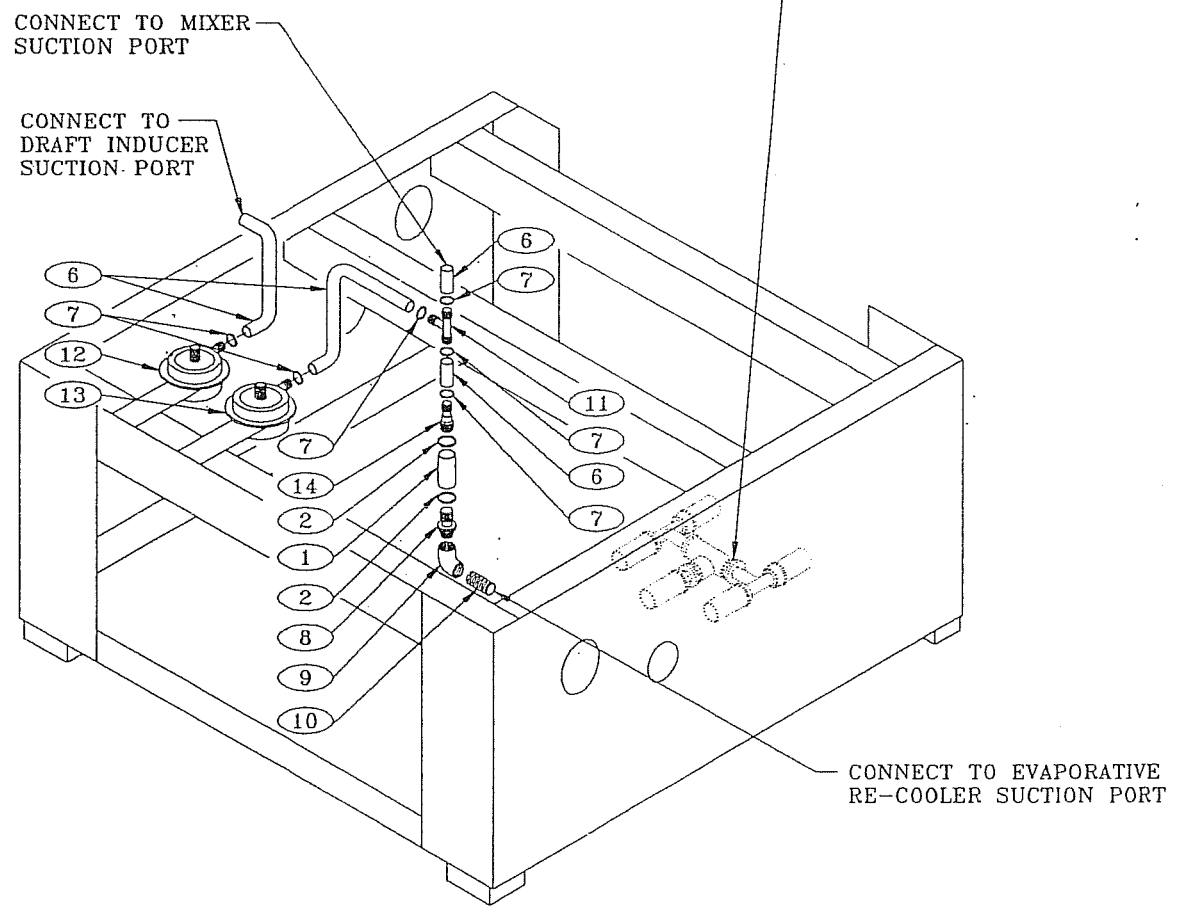
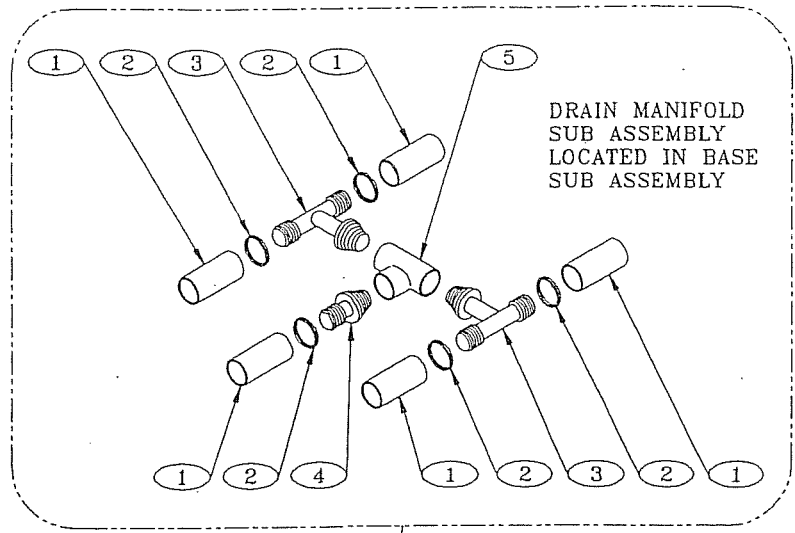


QL - JACKET AND BASE ASSEMBLIES

QL - JACKET AND BASE ASSEMBLIES

KEY #	ITEM NUMBER	DESCRIPTION	QUANTITY
1	740001072	QL-2 FRONT DISPLAY PANEL - BLUE	1
2	43100020	QL-2 DOOR PANEL - BLUE	1
3	43100019	QL-2 RIGHT PANEL - BLUE	1
4	740001042	QL-2 LEFT PANEL - BLUE	1
5	74001022	QL-2 BACK PANEL - BLUE	1
6	740001012	QL-2 TOP PANEL - BLUE	1
7	43100018	QL-2 BASE WITH GLIDES	1
8	14662801	AT140B1016 TRANSFORMER 24 VAC	1
9	14662803	S9301A1027 INTEGRATED BOILER CONTROL	1
10	14631079	EP-1290 TIME DELAY RELAY MODULE	1
11	14631153	IDI 1091M5-24V GREEN LED PANEL MOUNT STATUS LAMPS	1
12	14631152	IDI 1091M5-125VAV GREEN LED PANEL MOUNT STATUS LAMPS	3
13	14631121	J6246 PRESSURE GAUGE - MARSH	1
14	14631122	RRT2.5UAC2-30-240FC TEMPERATURE GAUGE	1
15	14631095	P1-30-101-11 DOOR PULL	1
16	14631099	HINGE SET Z-05315 (UPPER)	2
17	14631098	HINGE SET Z-05800 (LOWER)	2
18	14631083	RACO 865 SWITCH COVER	1
19	14631081	P & S 660 SWITCH	1
20	14631082	RACO 660 2"x 4" BOX	1
21	14631120	HEYCO OCB-1500 BUSHING	1
22	14631091	CO-2366 GLIDE	4
23	740004005	QL-2 DOOR LATCH BRACKET	1
24	14631096	02-20-611-10 MAG CATCH	2
25	14695013	5/16" HEX. NUT	2
26	14695302	5/16"-18x3/4" HEX. HEAD CAP SCREW	2
27	14631174	419-1AA1 2 1/2" PLUG	2
28	14631171	415-1AA1 1 1/2" PLUG	1
29	14631176	BPF 3 1/2" PLUG	1
30	14631172	416-1AA1 1 3/4" PLUG	1
31	14631173	417-1AA1 2" PLUG	1
32	14631175	421-1AA1 3" PLUG	4
‡	14631085	WIRING HARNESS	1
‡	14631097	1/8"x1/8" STAINLESS STEEL RIVET (FOR HINGES)	8
‡	43100027	JACKET COMPLETE	-

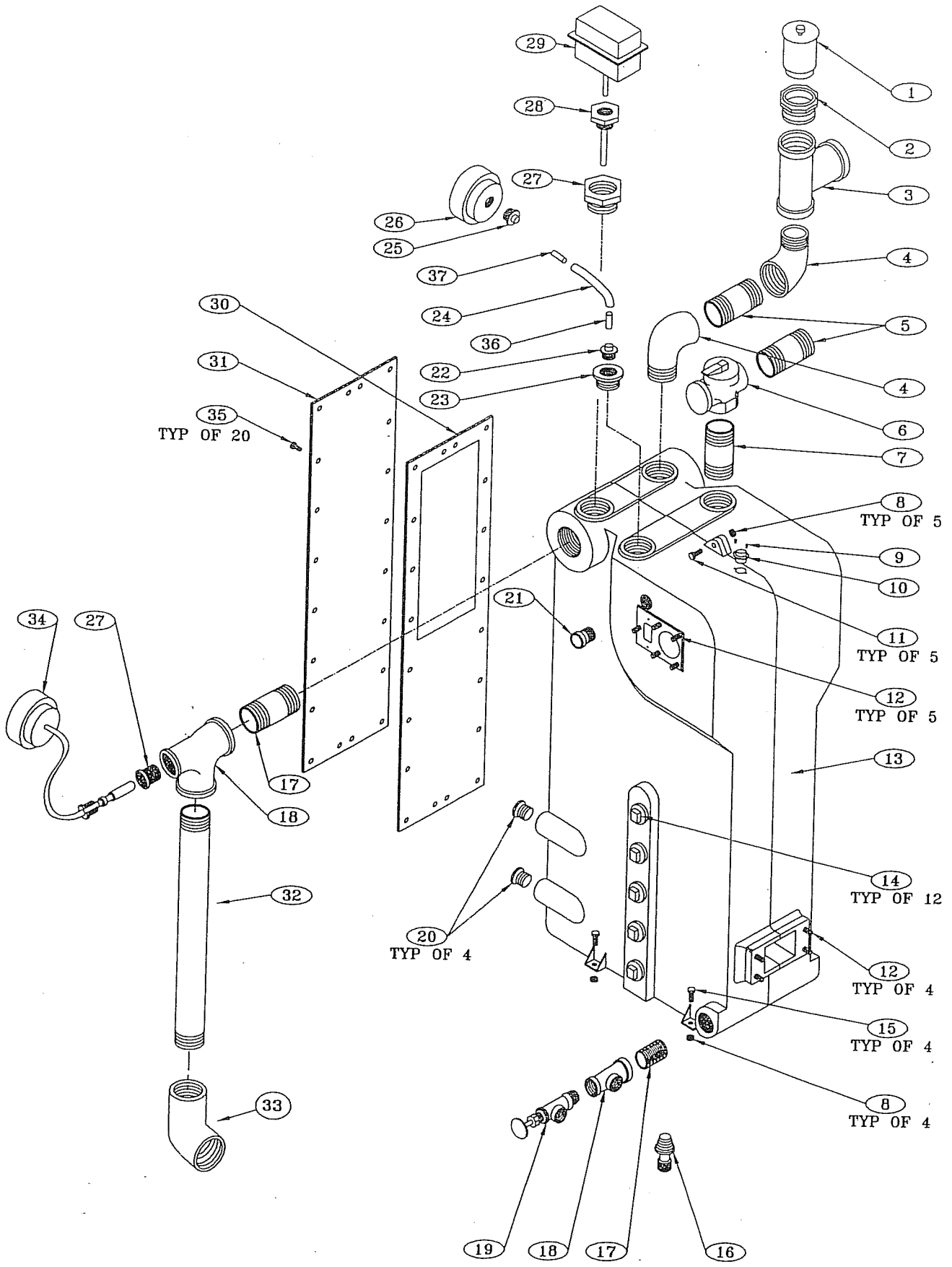
‡ - NOT SHOWN



QL - PRESSURE SWITCH & DRAIN MANIFOLD ASSEMBLY

QL - PRESSURE SWITCH AND DRAIN MANIFOLD ASSEMBLIES

KEY #	ITEM NUMBER	DESCRIPTION	QUANTITY
1	14631035	59019 1/2"IDx1/8" THK VINYL TUBING	AS REQUIRED
2	14631141	57134 3/4" SNAP GRIP CLAMP	7
3	14631110	62128 1/2"IDx1/2"IDx1/2NPT TUBE TEE	2
4	14631101	62017 1/2"NPTx1/2"ID TUBE STRAIGHT	1
5	14631131	1/2"NPT PVC SCH 40 TEE	1
6	14631033	59006 1/4"IDx3/8"OD VINYL TUBING	AS REQUIRED
7	14631143	3/8" HOSE CLAMP HC-6ST	6
8	14631139	3/8"NPTx1/2ID TUBE ADPT 62012	1
9	14631115	3/8" PVC 90 EL S-80 SP 808-003	1
10	14631114	3/8"xCLOSE PVC NIP S-80 SP 881-005	1
11	14631104	1/4"ID TUBE TEE	1
12	14631075	FS6110A-1985 FAN / OUTLET PRESSURE SWITCH	1
13	14631076	FS6111A-1986 INLET PRESSURE SWITCH	1
13A	43331108	HIGH ALTITUDE INLET PRESS. SW. (QL-100 PROPANE OVER 4500' ELEVATION ONLY)	1
14	14631140	1/2"ID TUBE x1/4"ID TUBE HOSE ADAPT 62055	1

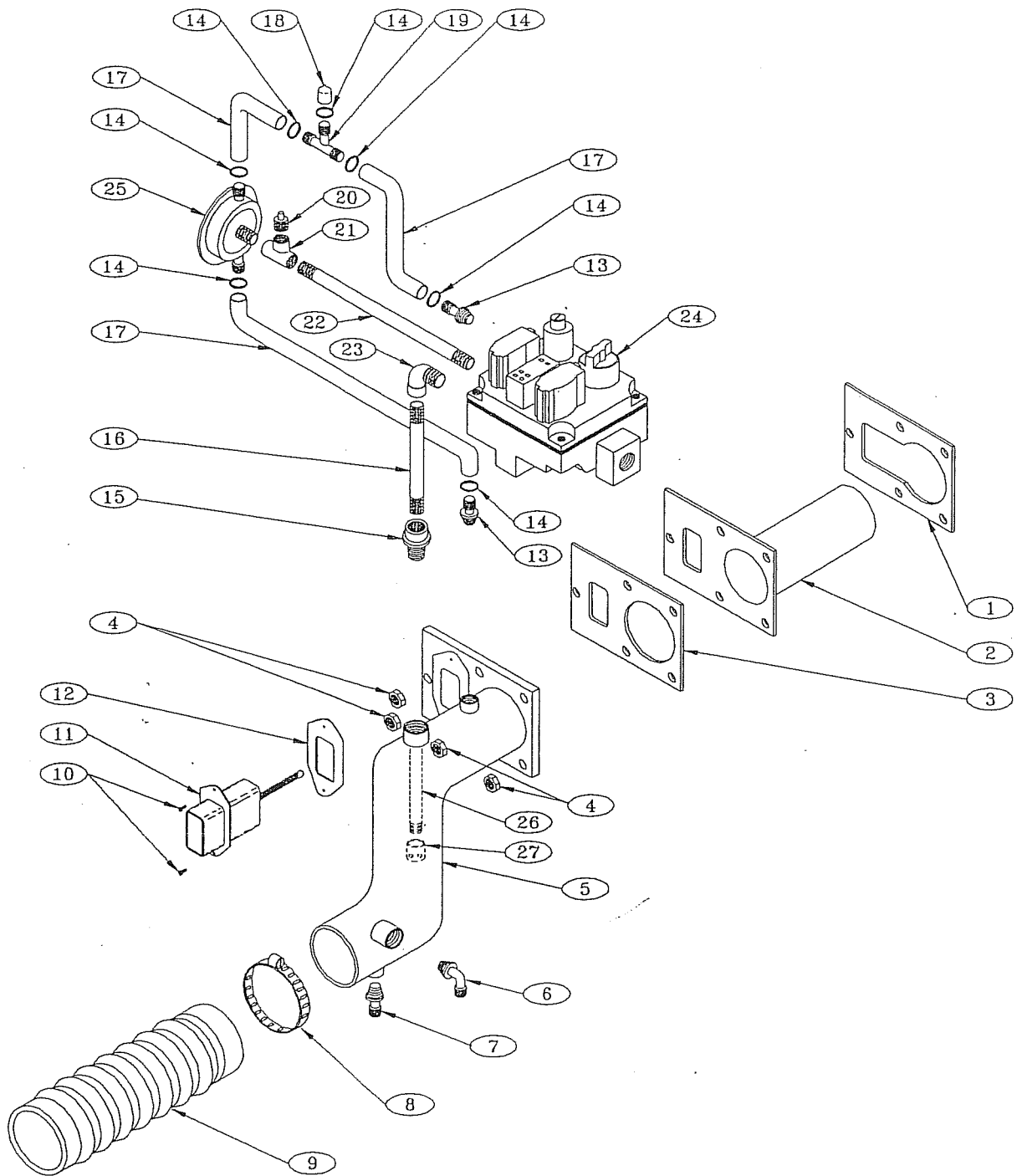


QL - BLOCK AND PIPING ASSEMBLY

QL - BLOCK AND PIPING ASSEMBLY

KEY #	ITEM NUMBER	DESCRIPTION	QUANTITY
1	14631156	HOFFMAN VENT #77	1
2	14693001	3/4" x 1/8" BUSHING	1
3	14693076	3/4" BLACK TEE	1
4	14693040	3/4" x 90 STREET ELBOW	2
5	14607005	3/4" x 4 NIPPLE	2
6	14622011	3/4" ASME RELIEF VALVE	1
7	14607201	3/4"x 2 NIPPLE	1
8	14695810	1/4"-20 HEX NUT W/SERRATED WASHER HEAD	9
9	14695802	8-32X3/16" SOC HD CAP SCREW	2
10	14631002	36T26-6539 CASTING TEMP. SAFETY SWITCH	1
11	14695801	1/4"-20x1 1/2 SOC HD CAP SCREW	5
12	14695805	1/4"-20x1 1/4 STUD	9
13	41700210	QL-2 TESTED BLOCK (INCLUDES 8,11,14 AND 20)	1
14	14693126	1 1/4" SQ HEAD PLUG	12
15	14695040	1/4"x1 1/4" CARRIAGE BOLT	4
16	14631101	62017 1/2"NPTx1/2"ID TUBE STRAIGHT	1
17	14607805	1 1/4" x 2" NIPPLE STD BLACK	3
18	14693049	1 1/4"x3/4"x1 1/4" TEE	2
19	14622000	3/4" DRAIN VALVE	1
20	14693056	1" SQ SOCKET PLUG	4
21	14619002	EMPIRE SIGHT GLASS	1
22	14631194	1/4"NPTx1/4"OD MALE COMPRESS ALIGN FITTING	1
23	14693003	3/4"x1/4" BUSHING	1
24	14631196	PP-43-0500 1/4"OD POLYPROPYLENE TUBING (15" LONG)	1.25 FEET
25	14631193	1/4"NPTx1/4OD FEM COMPRESS ALIGN FITTING	1
26	14631121	J6246 PRESSURE GAUGE	1
27	14693004	3/4" x 1/2" BUSHING	2
28	14662804	123869A CONTROL WELL 1/2" NPT	1
29	14662802	L4080D1192 HI LIMIT AQUASTAT	1
30	14631021	CLEANOUT COVER PLATE GASKET	1
31	740004004	CLEANOUT COVER PLATE	1
32	14631055	1-1/4" x 13-1/2" Nipple	1
33	14693042	1-1/4" Elbow	1
34	14631122	RRT2.5UAC2-30-240FC TEMPERATURE GAUGE	1
35	14695803	1/4"-20 X 5/16" SOC HD CAP SCREW	20
36	14631198	63PT-4-40 TUBING INSERT	2
‡	14626043	DUNKIRK BALL VALVE SET	1
‡	14626049	FLANGE SET WITH BOLTS AND NUTS	1
‡	14626045	GRUNDFOS CIRCULATING PUMP	1
‡	14626047	TACO CIRCULATING PUMP	1

‡ - NOT SHOWN

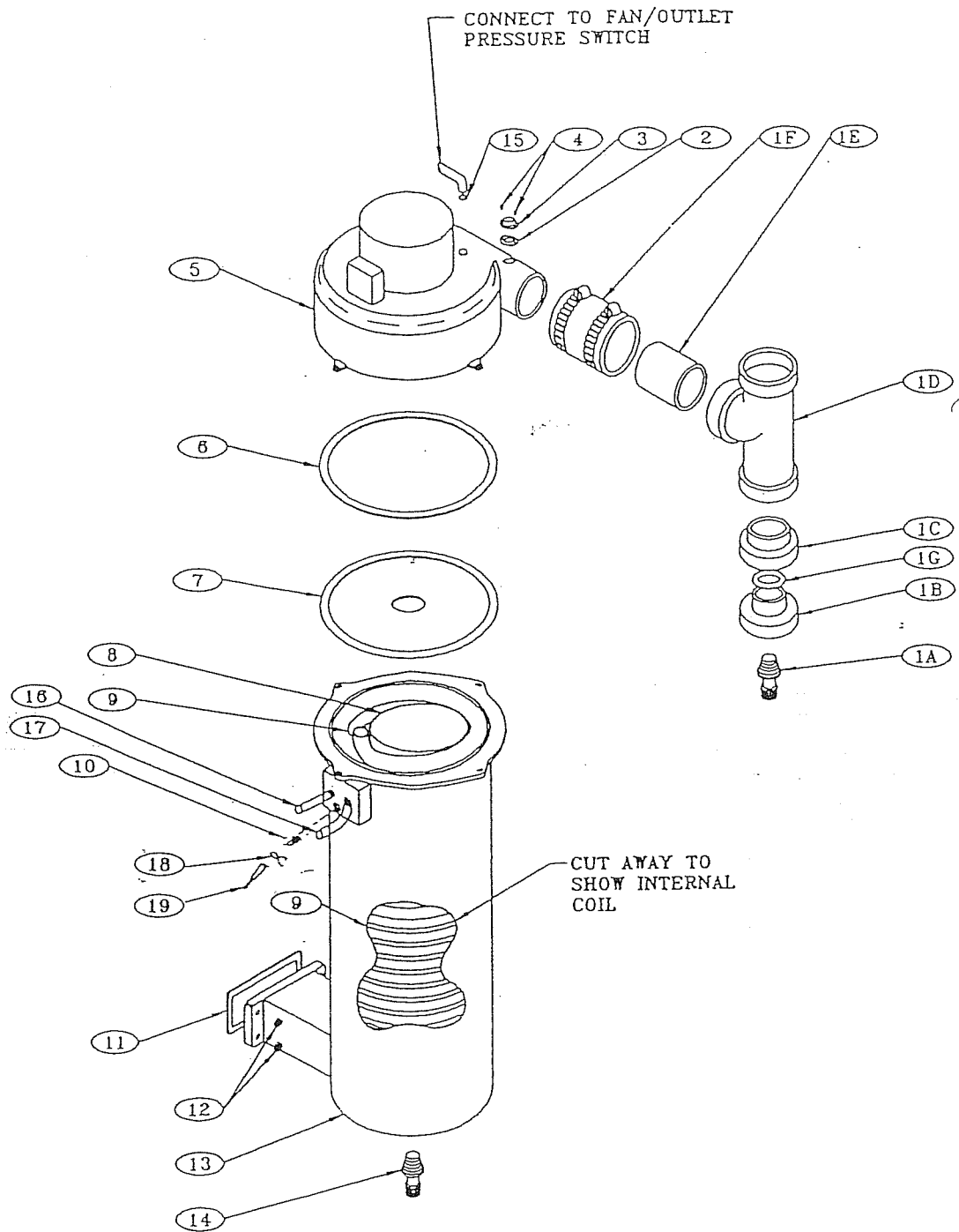


QL - MIXER ASSEMBLY

QL - MIXER ASSEMBLY

KEY #	ITEM NUMBER	DESCRIPTION	QUANTITY
1	14631023	BURNER GASKET	1
2	14631052	BURNER	1
3	14631025	MIXER GASKET	1
4	14695810	1/4"-20 HEX NUT W/SERRATED WASHER HEAD	5
5	41700004	QL MIXER CASTING MACHINED	1
6	14631105	62030 1/8"NPTx1/4"ID TUBE ELBOW	1
7	14631101	62017 1/2"NPTx1/2"ID TUBE STRAIGHT	1
8	14631039	2" STAINLESS STEEL CLAMP	1
9	14631017	2" FLEXADUX R-3	1.92ft.
10	14695809	10-32"x3/8" MACHINE SCREW	2
11	43100003	QL-2 HOT SURFACE IGNITER	1
12	14631024	HOT SURFACE IGNITER GASKET	1
13	14631106	62002 1/8"NPTx1/4"ID TUBE STRAIGHT	2
14	14631143	3/8" HOSE CLAMP HC-6ST	7
15	14631060	MIXER BUSHING	1
16	14607803	1/2"NPTx4 1/2" BLACK NIPPLE	1
17	14631033	59006 1/4"IDx3/8"OD VINYL TUBING	AS REQUIRED
18	14631151	VINYL CAP	1
19	14631104	62064 1/4"ID TUBE TEE	1
20	14693804	1/8"NPT ALLEN HD STEEL PLUG	1
21	14693803	1/8"NPT BLACK TEE	1
22	14607804	1/8"NPTx2 1/2" BLACK PIPE NIPPLE	1
23	14693801	1/2"NPT BLACK STREET ELBOW	1
24	14631071	GAS VALVE 36E96-236 (NATURAL AND PROPANE GASES)	1
25	14631074	GFS-4560-1963 GAS PRESSURE SWITCH	1
26	14607801	1/8"x4 1/2" 304 ST. ST. NIPPLE	1
27	14631066	GAS ORIFICE - NATURAL GAS #44 100,000 BTU/HR	1
27	14631063	GAS ORIFICE - PROPANE GAS #50 100,000 BTU/HR	1
*	43331102	QL-100 NATURAL TO PROPANE CONV KIT (0-4,500')	1
*	43331103	QL-100 NATURAL TO PROPANE CONV KIT (4,500-10,500')	1
*	43331106	QL-100 PROPANE TO NATURAL CONV KIT (0-4,500')	1
*	43331107	QL-100 PROPANE TO NATURAL CONV KIT (4,500-10,500')	1

* = NOT SHOWN

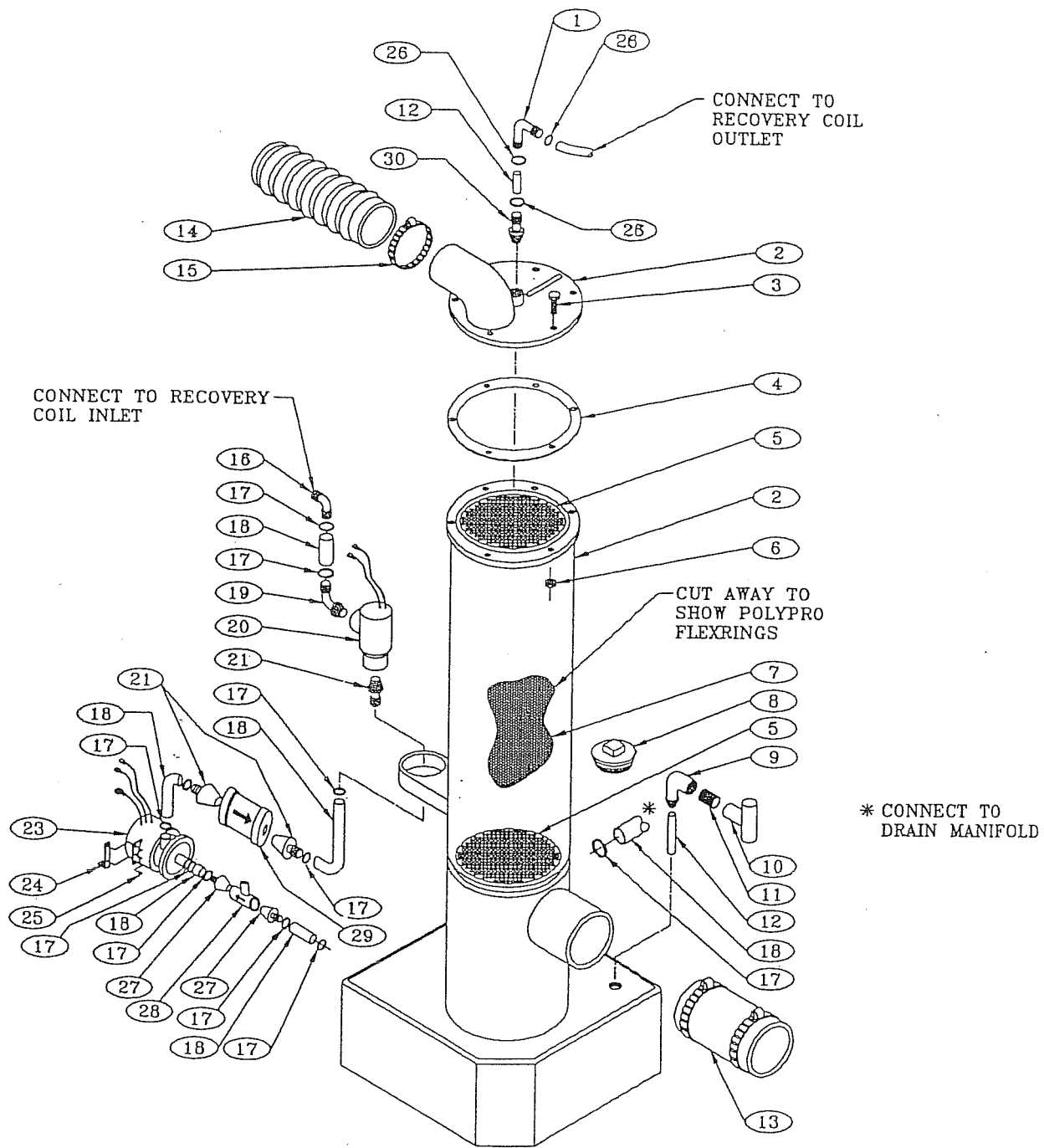


QL - RECOVERY HEAT EXCHANGER ASSEMBLY

QL - RECOVERY HEAT EXCHANGER ASSEMBLY

KEY #	ITEM NUMBER	DESCRIPTION	QUANTITY
1	43100004	QL-2 EXHAUST TEE ASSEMBLY (INCLUDES 1A-1G)	1
1A	14631101	62017 1/2" NPT x 1/2" ID TUBE STRAIGHT	1
1B	14631013	PVC 1 1/2" MALE SLIP x 1/2" FEMALE NPT	1
1C	14631014	PVC SCH 40 2" x 1 1/2" REDUCER	1
1D	14631016	2" PVC SCH 40 SANITARY TEE	1
1E	14631161	2" PVC PIPE SCH 40 x 2"	1
1F	14631015	2" FERNCO COUPLING	1
1G	14695815	3/4" ALUMINUM FLAT WASHER	1
2	14631028	VENT SWITCH GASKET	1
3	14631003	36T x 11-10734 VENT TEMP SAFETY SWITCH	1
4	14695808	#4-20 x 1/4" HWH PLASTIFORM SCREW	2
5	14631077	116516-11 INDUCED DRAFT BLOWER	1
5A	43100029	QL-2 REPLACEMENT BLOWER ASSY (INCLUDES 2,3,4,5,6)	1
6	14631026	BLOWER GASKET	1
7	740004023	AIR ORIFICE PLATE 1 3/4" - 100,000 BTU/HR	1
8	14631042	COIL INSERT	1
9	14631040	RECOVERY COIL	1
10	14631005	1/8" NPT 1/4" HOSE ID BRASS BARB FITTING	1
11	14631027	RECOVERY COIL GASKET	1
12	146958101	1/4" - 20 HEX NUT W/SERRATED WASHER BLOCK	4
13	41700005	RECOVERY COIL HOUSING MACHINED	1
14	14631101	62017 1/2" NPT x 1/2" ID TUBE STRAIGHT	1
15	14631143	3/8" HOSE CLAMP HC-6ST	1
16	14631200	3/8" ID x 1/2" OD NORPRENE TUBING (COIL OUTLET)	AS REQUIRED
17	14631201	1/2" ID x 3/4" OD NORPRENE TUBING (COIL OUTLET)	AS REQUIRED
18	14631151	PC250-12 VINYL CAP	1
19	14631143	3/8" HOSE CLAMP HC-6ST	1
A(*)	14631199	CTT6079PP POLYPROPYLENE CLAMP CABLE TIE	4
B(*)	14631133	3/8" ID x 3/8" ID TUBE ELBOW	1
(*)	43100001	RECOVERY COIL ASSEMBLY (INCLUDES 8,9,16,17,A & B)	1

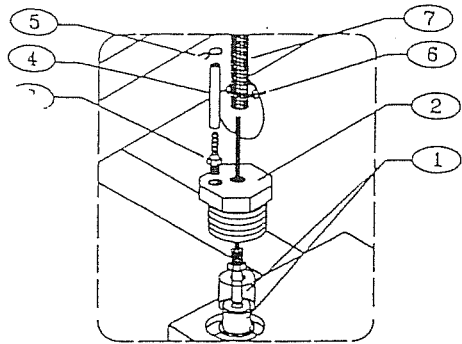
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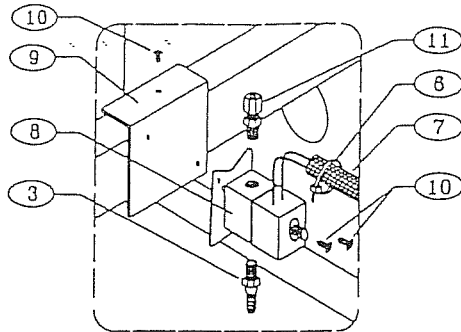
QL-EVAPORATIVE RECOOLER ASSEMBLY

QL - EVAPORATIVE RECOOLER ASSEMBLY

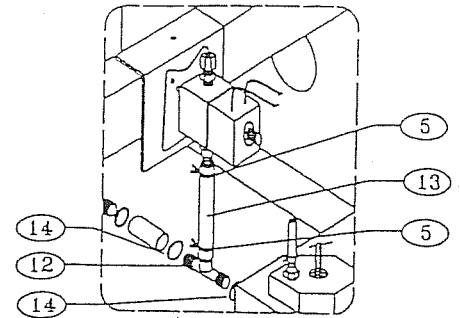
KEY #	ITEM NUMBER	DESCRIPTION	QUANTITY
1	14631133	3/8"IDx3/8"ID TUBE ELBOW	1
2	14631041	EVAP RECOOLER & CAP - 2 PCS	1
3	14695811	6-32x3/4" MACHINE SCREW	6
4	14631022	EVAPORATIVE RECOOLER GASKET	1
5	14631043	GRID CAP 3/8" TH. 1069	2
6	14695812	6-32 ESNA NUT NM 18-8 SS	6
7	14631031	5/8" POLYPRO FLEXRINGS	0.4 CU. FT.
8	14631011	1 1/2" NPT PVC SCH 40 HEX HD PLUG	1
9	14631012	1/2" NPT PVC SCH 40 STREET ELBOW	1
10	14631020	1/2"SLIPx1/2"SLIPx1/2"NPT PVC TEE	1
11	14631019	1/2"NPT PVC SCH 80 CLOSE NIPPLE	1
12	14631034	59012 3/8"IDx1/16" THK VINYL TUBING	AS REQUIRED
13	14631015	FERNCO COUPLING	1
14	14631017	2" FLEXADUX R-3	AS REQUIRED
15	14631039	2" STAINLESS STEEL CLAMP	1
16	14631132	62052 1/2"ID x 1/2"ID TUBE ELBOW	1
17	14631141	57134 3/4" SNAP GRIP CLAMP	11
18	14631035	59019 1/2"IDx1/8" THK VINYL TUBING	AS REQUIRED
19	14631103	62043 1/2"NPTx1/2"ID TUBE ELBOW	1
20	43100017	QL-2 REPLACEMENT FLOW SWITCH W/BUSHINGS	1
21	14631101	62017 1/2"NPTx1/2"ID TUBE STRAIGHT	3
23	43100002	CONDENSATE PUMP MARCH AC-1A-MD-1/2" W/ TERMINALS	1
24	740004002	CONDENSATE PUMP BRACKET	1
25	14695807	#6x1/2" SHEET METAL SCREWS	2
26	14631142	57131 9/16" SNAP GRIP CLAMP	3
27	14631139	62012 3/8"NPTx1/2"ID TUBE STRAIGHT	2
28	14631197	P777-20 3/8" PLASTIC STRAINER	1
29	14631195	U45BC-V 1/2" PVC BALL CHECK VALVE	1
30	14631116	62011 3/8"NPTx3/8"ID TUBE STRAIGHT	1



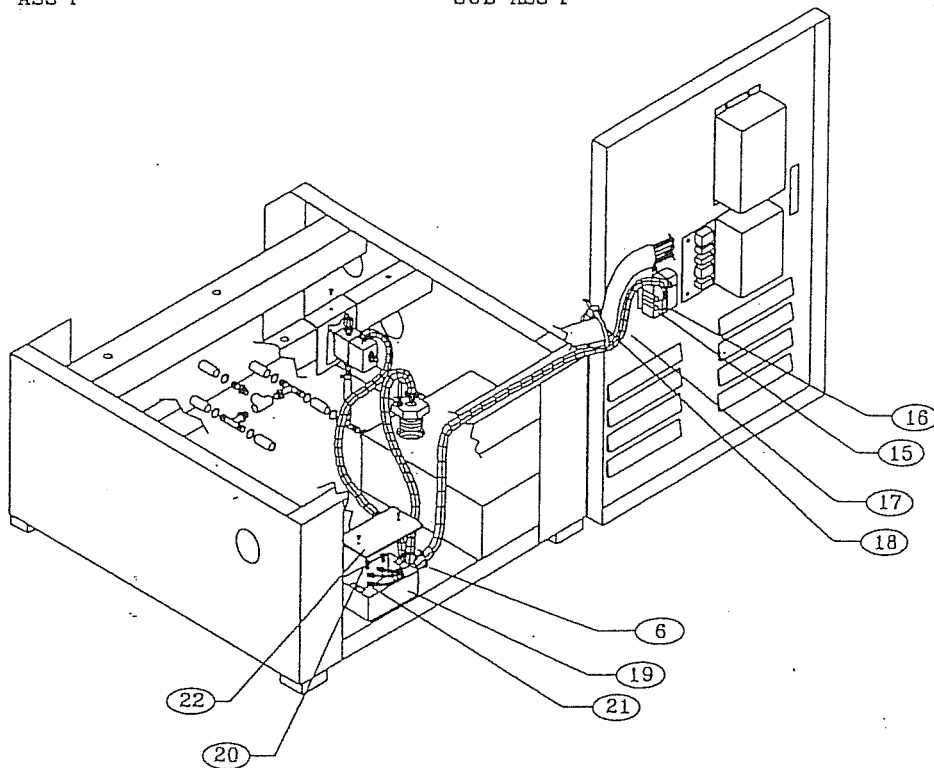
LIQUID LEVEL CONTROL
SUB ASS'Y



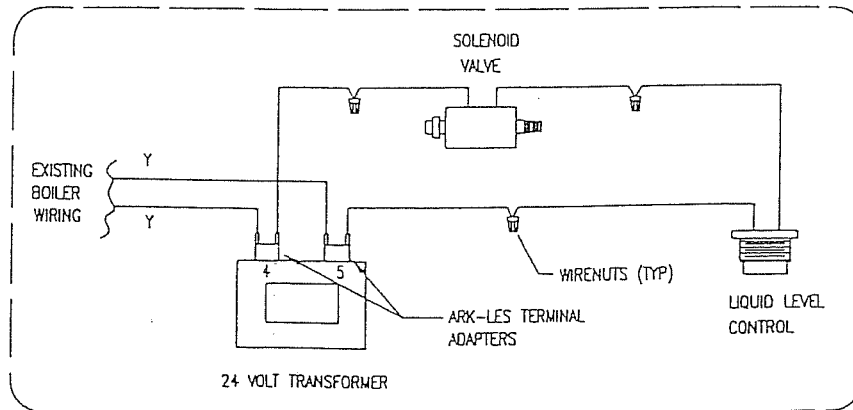
SOLENOID VALVE
SUB ASS'Y



DRAIN MANIFOLD
SUB ASS'Y



QL SUMP FEEDER ASSEMBLY



QL SUMP FEEDER WIRING DIAGRAM

QL - SUMP FEEDER ASSEMBLY

KEY #	ITEM NUMBER	DESCRIPTION	QUANTITY
1	14631046	LIQUID LEVEL CONTROL SENSOR	1
2	43100050	1 1/2" NPT PVC TAPPED PLUG	1
3	14631106	1/8" NPT X 1/4" ID HOSE BARB ADAPTER - PLASTIC	2
4	14631033	2 1/4" X 1/4" ID CLEAR VINYL TUBING	1
5	14631143	3/8" HC-6ST ROTOR CLAMP	3
6	14691002	NYLON TIE	6
7	14631086	20" #2 BRAIDED SHIELD	2
8	14631045	SOLENOID VALVE 152J2DGM	1
9	42531004	SOLENOID VALVE BRACKET	1
10	14695074	#10 X 1/2" SL SCREWS	3
11	14631047	1/8" NPT X 1/4" OD COMPRESSION ADAPTER - BRASS	1
12	14631050	1/2" X 1/2" X 1/4" HOSE BARB TEE - PLASTIC	1
13	14631033	8" X 1/4" ID CLEAR VINYL HOSE	1
14	14631141	3/4" SNAP GRID CLAMPS	2
15	14634040	ARK-LES 3000 S-10 -1 TERMINAL ADAPTERS	2
16	43300827	SUMP FEEDER WIRING HARNESS	1
17	14631086	42" #2 BRAIDED SHIELD	1
18	14631199	TIE CABLE TYTON	1
19	14631082	2" X 4" J-BOX	1
20	14695060	#10 X 1/2" TEK SCREWS	1
21	14634047	72 B WIRE NUTS	1
22	14631049	2" X 4" J-BOX COVER PLATE	1