



PEP

*Pottstown Engineered
Products, Inc.*

VT SERIES

**Installation, Operation
& Maintenance Manual**

WARNING

Have your water tested by a local waer treatment specialist!

Proper Water Chemistry is essential to prevent scale, or other deposits, and corrosion within the boiler. The absence of adequate external and internal treatments can lead to operational upsets or total boiler failure that is not covered under warranty.

Recommended Guidelines for Boiler Water Treatment

ANALYSIS	RECOMMENDED RANGE	COMMENTS
pH	10-11	Low pH promotes corrosion
Total Alkalinity	200-700 ppm	Low promotes corrosion
Phosphates	30-100 ppm	Prevent scale formation
Total Hardness	0-50 ppm	Prevents scale formation
Chlorides	60-200 ppm	A measure of proper blow down
Total Dissolved Solids	2000 ppm Maximum	High solids may cause surging
Sulfites	20-30 ppm	A good oxygen scavenger
Specific Conductance	< 700 micro ohms cm	A measure of proper blowdown
Oxygen	< .007 mg/liter	Prevents corrosion and pitting

ppm = parts per million

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Technical manuals for all controls are provided in the data package including level, pump, gage glass and pressure controls.



Read this manual before installing and using this product. Failure to do so can result in serious injury or death.

You have just purchased a quality steam boiler designed to the ASME Boiler Code and registered with the National Board of Boiler Inspectors. Treat this industrial equipment with care and respect. It is safe when installed, maintained, and used properly. Read the instruction carefully and contact the factory if you have any questions.

This manual contains safety messages. Each of the safety messages are preceded by one of the following signal word panels:

DANGER	Safety messages preceded by this label contain information, that if not followed will result in death or serious injury.
WARNING	Safety messages preceded by this label contain information, that if not followed could result in death or serious injury.
CAUTION	Safety messages preceded by this label contain information, that if not followed could result in minor or moderate injury.
NOTICE	Messages preceded by this label contain important information, but are not hazard-related.

Ensure that this manual is available to the boiler operator at any time.

Read carefully all safety labels attached to the boiler. If any safety label was damaged during shipment, contact the factory immediately:

IMPORTANT SAFETY INFORMATION

- 1. Read and familiarize yourself with this installation, operation, and maintenance manual before installing, operating, or servicing your boiler.**
- 2. All cover plates, enclosures, and safety devices must be installed at all times except while performing maintenance and service.**
- 3. Only trained service technicians should do any work on your boiler.**
- 4. All state and local codes take precedence over any recommendations given in this manual.**
- 5. Normal burner cycling is required. Undersizing the boiler, causing continuous firing without cycling will eventually damage the boiler, voiding the warranty.**
- 6. Wrapping the VT Boiler with insulation will cause the boiler to overheat, voiding the warranty.**
- 7. A draft regulator or barometric damper is required in the breaching to maintain a $-.02$ to $-.04$ draft when the burner has cycled off, and a $-.06$ to $-.10$ draft when firing. (Draft measured in inches of water column)**

LIMITED PARTS WARRANTY

The Pottstown Engineered Products, Inc. (hereinafter PEP) warrants the burner components and controls installed on its boiler/burner units to be free from defects in material and workmanship under normal use and service for 12 months from the date of start-up (proof of start-up date is required) or 18 months from original ship date, whichever date occurs first*, and is subject to warranty approval by the manufacturer of the specific components. Equipment which is defective in material or workmanship and is removed within 12 months from the date of installation will be repaired or replaced as follows:

- a) After receiving authorization from PEP, such defective equipment should be returned after receiving authorization from your dealer, freight pre- paid, to Pottstown Engineered Products, Inc., 390 Old Reading Pike, Pottstown PA 19464. The use of the PEP returned goods form is mandatory when returning defective material. All burner components must be returned with a complete startup report which can be found in PEP's Installation Manual.
- b) PEP is not responsible for any labor cost for the removal and replacement of equipment.
- c) Equipment which is repaired or replaced will carry a warranty equal to the unexpired portion of the original equipment warranty.
- d) If inspection by PEP or manufacturer of the specific component does not disclose any defect covered by this warranty, the equipment will be repaired or replaced at the expense of the Customer, and PEP's regular charges will apply.

***Boiler feed pump warranty is 30 days from date of start-up (proof of start-up date is required) or 90 days from original ship date.**

THIS WARRANTY IS LIMITED TO THE PRECISE TERMS SET FORTH ABOVE, AND PROVIDES EXCLUSIVE REMEDIES EXPRESSLY IN LIEU OF ALL OTHER REMEDIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, ARE EXCLUDED. IN NO EVENT WILL POTTSSTOWN ENGINEERED PRODUCTS, INC. BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.

PEP neither assumes nor authorizes any person to assume for PEP any other liability or obligation in connections with the sale of this equipment. PEP's liability and Customer's exclusive remedy being limited to repairs or replacement as set forth above.

July 15, 2024

SERVICE POLICY

Anything mechanical will inevitably need servicing. Steam and hot water boilers are routinely serviced by the installer or another boiler maintenance company. Occasionally the service technician may be unable to determine the cause of the problem. In this situation, the dealer or service organization should contact the selling distributor for help.

Should the problem persist, the distributor will contact the sales representative for assistance. Depending on the extent of the problem, the representative may request technical assistance from the factory.

If the problem cannot be resolved by the representative, he should contact the Technical Service/Engineering Department at the factory. The sales representative will need the following information. We must insist that this information be available to assure prompt service.

Boiler Model and Size (HP) _____

Boiler Serial Number _____

Boiler National Board Number _____

Date Installed _____

Burner Type and Model _____

Installer's Name _____ Phone (____) _____

Address _____

Distributor's Name _____ Phone (____) _____

Address _____

Sales Representative _____ Phone (____) _____

Address _____

Specific Problem - Detailed

INSTALLATION

The PEP Model VT Steam Boiler is furnished completely piped, wired, and assembled. It has been factory tested and is ready for operation. This steam boiler is designed to operate using No. 2 fuel oil and/or natural, manufactured, or liquid propane (LP) gas, and to be powered by standard AC electrical service.

BEFORE BEGINNING INSTALLATION, CAREFULLY STUDY THESE INSTRUCTIONS AND ALL CHARTS, DRAWINGS, AND DIAGRAMS SHIPPED WITH THE BOILER.

Installation must follow all state and local code requirements. The electrical installation must be in accordance with the National Electrical Code.

CLEARANCES

The boiler is to be placed on noncombustible flooring, in an approved boiler room, with the following clearances to combustible materials.

Underwriters Laboratories (**UL**) approved clearances:

Side:	18 inches
Top:	18 inches
Front:	48 inches
Chimney connector:	18 inches

Reduced clearance installation must follow the recommendations as outlined in NFPA-31. Reduced clearance installations should be avoided if possible, as this will make it much harder for qualified technicians to perform routine maintenance in and around your boiler.

Clearances to noncombustible materials shall be in accordance with state and local codes. In the absence of local codes, it is recommended that the above stated clearances be followed.

FLUE PIPING

The VT Series Boilers are power fired, steam boilers and are considered a Category I - Fan-Assisted Gas Appliance – An appliance that operates with negative static pressure in the vent, a temperature that is high enough to avoid condensation in vent, and an integral fan to draw a controlled amount of combustion supply air through the combustion chamber; and must be vented accordingly. Consult the factory for proper venting of the boiler for any unusual conditions that may exist at the job-site.

CONVENTIONAL VENTING

For boilers vented into a chimney, be certain the chimney is clean, and clear of obstructions. The stack and chimney material shall comply with all local codes. The flue pipe

should be pitched upward at least 1/4" per foot of run. Use only elbows and straight sections. Tees may be used in straight sections with a barometric draft regulator. Tees, however, should not be used for a ninety-degree turn. Each joint should be securely fastened with sheet metal screws. The flue pipe must not be inserted beyond the inside wall of the chimney.

It is recommended that a mechanical draft regulator or barometric damper be installed in the flue and set to maintain a -0.02" to -0.04" water column pressure at the breach when the burner is off and a -0.06" to -0.10" water column pressure while the burner is in operation.

Refer to the following list for proper size of the flue pipe. DO NOT REDUCE THE FLUE OR CHIMNEY SIZE TO LESS THAN THE OUTLET SIZE ON THE BOILER. Consult the factory if the boiler must be vented into a chimney that is smaller than the boiler outlet size.

BOILER	PROPER FLUE PIPE SIZE
VT-10	6"
VT-15	8"
VT-20	8"
VT-25	10"
VT-35	12"
VT-50	12"
VT-60	14"

SIDEWALL VENTING

This section provides instructions for the installation of boiler assemblies for which sidewall venting may be utilized. This includes No. 2 fuel oil, natural gas, or combination No. 2 fuel oil and natural gas sizes 9.5 to 50 H.P. The following criteria is required for installations using sidewall venting:

1. Flue vent piping shall be pitched upward at 1/4" per foot of length.
2. A U.L. Approved draft fan must be installed to provide sufficient draft, minimum (-.02 to -.04") WC pressure) to safely vent the products of combustion.
3. The draft fan should be located as close to the flue outlet from the building as possible.
4. Draft regulation sufficient to lower the draft to between -.02" and -.04" WC pressure may be required. The draft regulator(s) must be between the boiler and draft fan.
5. The draft fan shall have an air flow proving switch wired in series with the boiler air safety switch.
6. The sidewall vent total length from boiler exhaust to termination shall not exceed 40 feet with 4 elbows maximum.

While the instructions and suggestions set forth in this manual are safe and proper, it is the responsibility of the installer and the owner to assure adherence to all local codes.

GAS SUPPLY PIPING

Contact your local gas company to ensure that adequate gas service is available, and to review applicable installation codes for your area.

The minimum gas supply pressure required by the burner is seven inches water column, measured at the first gas valve, for all VT model boilers. The maximum gas supply pressure to the burner is fourteen inches water column. Gas pressure greater than fourteen inches water column will require an additional gas regulator to prevent damage to the primary gas regulator. Gas pressure below the minimum will cause combustion efficiency problems and should be avoided if possible. Low gas pressure may also prevent the boiler from obtaining the desired input rate, which will cause the boiler to be unable to produce the desired output. Consult the factory if your gas supply pressure is not in the recommended range.

Use the following tables to determine the size of the main gas line required for the boiler that is being installed. First determine the required input volume of gas needed at the gas manifold, then determine the correct pipe size for the length of run needed.

REQUIRED INPUT - CUBIC FEET OF GAS PER HOUR

GAS TYPE	VT-10	VT-15	VT-20	VT-25	VT-35	VT-50	VT-60
NATURAL	399	630	840	1050	1470	2100	2520
PROPANE	160	252	336	420	735	840	1008

CAPACITY OF PIPE - CUBIC FEET OF GAS PER HOUR AT 0.2" W.C. PRESSURE DROP

Equivalent Length (ft)	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	425	725	1170	2360	4300	6250	12800
20	300	520	800	1700	3000	4500	9300
30	250	425	690	1400	2500	3750	7500
40	210	360	560	1200	2100	3200	6400
50	190	325	500	1100	1900	2850	5800
60	180	300	480	1000	1800	2300	4800
80	150	260	410	850	1550	2000	4200
100	135	230	370	750	1375	1680	3500
150	110	190	300	600	1100	1200	2750
200	75	165	260	540	950	1000	2000
Fitting	Equivalent Lengths of Standard Pipe in Feet for Listed Fittings						
Std. Tee	5.5	7.5	9.0	12.0	13.5	15	20
Std. Elbow	2.7	3.7	4.5	5.5	6.1	8	11

Vent lines, if required, are to be run outside the building, stopping clear of windows or fresh air intakes. The vent should terminate in a way that will not allow the possibility of water, dirt, insects, animals, and other matter from entering and clogging the vent pipe.

Gas lines should be tested for leaks using a soap solution. Your gas company may wish to witness this test. **Do not** exceed the maximum pressures allowed by the valve train.

Additional gas piping information is included in the burner section of this manual.

OIL SUPPLY PIPING

Consult the burner section of this manual for oil line type and sizing requirements for proper operation. The size of oil lines is extremely important for proper operation. Suction vacuums must be held to acceptable limits.

All oil feed lines must be air tight. Use as few fittings as possible when assembling the oil lines. The slightest air leak, usually caused by loose fittings or bad gaskets, can cause poor starts, smoky starts, sooting of burner parts, inefficient operation, and a dangerous combustion condition.

A vacuum test should be done on all installation to ensure that all fittings are tight and the oil lines are of proper size. Always use flare fittings instead of compression fittings on oil service lines. Compression fittings allow more of a chance for air to be introduced into the oil supply.



TEFLON® TAPE SHOULD NEVER BE USED WITH ANY OIL LINE CONNECTIONS. THE USE OF TEFLON® TAPE ON BURNER COMPONENTS OR OIL SERVICE LINES WILL VOID MOST BURNER WARRANTIES.

For additional information consult the burner section of this manual.

ELECTRICAL SUPPLY

Connect the electric supply to the boiler and condensate return system as shown in the wiring diagrams. Separate electrical services and disconnects must be provided for both the boiler and the return system. If both 110 volts AC and 220 volts AC are needed, separate disconnects should be provided. The wiring must be installed in accordance with the National Electrical Code and any other state and local codes.

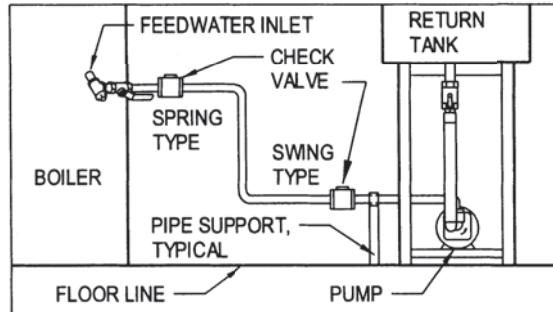
All disconnects should provide overload protection to prevent injury to personnel or damage to equipment.

Be sure that the incoming voltages match that of the appliances before applying power. Make a special point of checking the internal wiring of the blower motor as most motors can be wired for either 110 or 220 volts.

FEEDWATER

Connect the feedwater supply from the condensate return tank to the boiler inlet feedwater connection. See Figure 2 and Piping Layout PL-098 in Appendix. PEP provides one spring type check valve in the feedwater piping. An additional swing type check valve should be installed in the feed line as close to the pump as possible. These valves should be piped in the horizontal position.

Do not use the pump as a piping support. It is very important that the piping be independently supported at the pump.



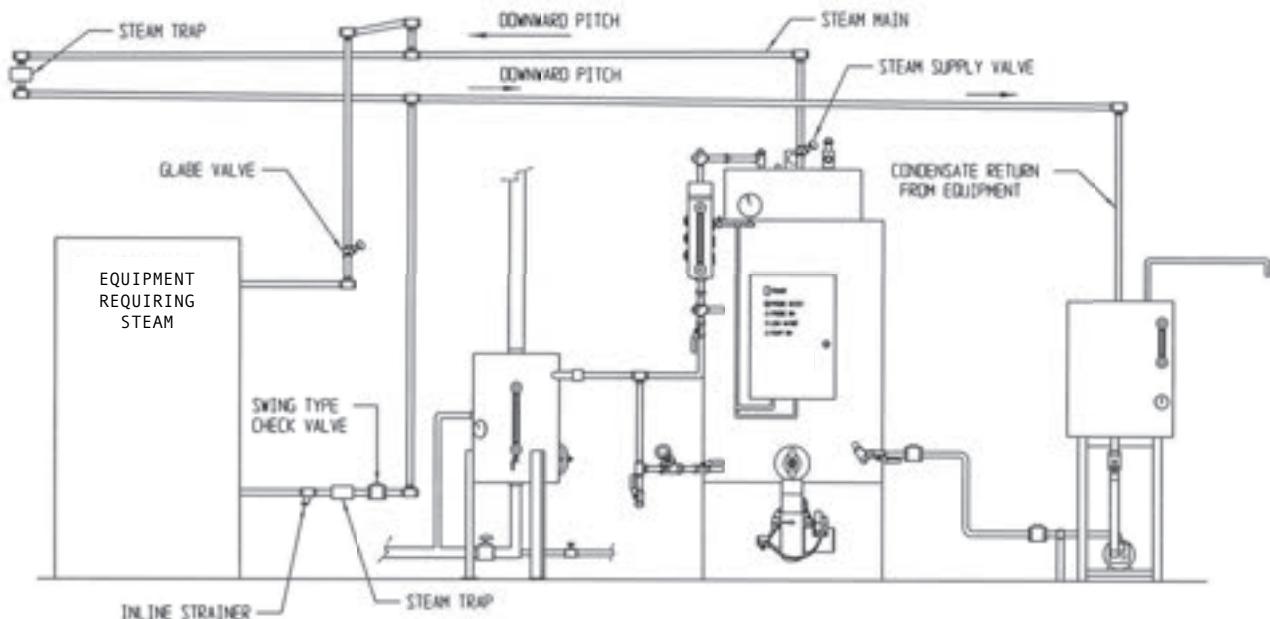
FEEDWATER PIPING

Figure 2

Do not fill the boiler until the installation is complete and you are ready to fire the burner. Firing the burner will then boil the water which will drive off the dissolved oxygen in the water and help maintain the proper boiler water chemical balance.

See the WATER TREATMENT section for important information regarding the proper chemical water treatment required to insure satisfactory service life of the boiler.

On long horizontal runs of piping, it is best to maintain the piping as level as possible. Avoid high spots that will collect air and lead to erratic pumping. Install a check valve to prevent the boiler water from back feeding into the service water supply.



STEAM PIPING

Figure 3

STEAM OUTLET

Connect the field steam piping to the outlet on top of boiler. See Figure 3. If a main steam manifold is used, it should be pitched 1/4" per foot of horizontal run so that condensate will run into a steam trap, rather than back into the boiler. All steam supplies should be taken off the top of the manifold to prevent condensate from entering the process machines.

SAFETY VALVE

Safety valves should be piped so that they cannot discharge on people or damage property. The discharge piping must be supported so that the weight of the piping is not transmitted to the safety valve body. Refer to drawing PL-049 in the Appendix for an example of typical safety valve piping. the weight supported by the valve outlet should not exceed the weight of a drip pan elbow. Use only Schedule 40 pipe for discharge piping. **DO NOT USE Schedule 80, extra strong, or double extra strong discharge pipe or connections.** Installations requiring long discharge piping should not be connected directly to the safety valve.

During installation, be sure that pipe compound or tape is used only on external threads and that the inlet of the valve is free of any foreign material.

DO NOT USE A PIPE WRENCH when working on the safety valve. use only the proper type and size wrench.



**NEVER REDUCE THE INLET OR OUTLET SIZE OF THE SAFETY VALVE;
NEVER HANG PIPING ON THE SAFETY VALVE;
NEVER INSTALL VALVES(S) IN THE SAFETY VALVE PIPING;
NEVER PLUG THE BONNET VENT. SERIOUS DAMAGE OR INJURY
COULD RESULT FROM THE FAILURE OF THE SAFETY VALVE.**

BLOWDOWN PIPING

Connect the boiler, the Warrick Low Water cut Off, and sight glass blowdown lines in accordance with local code requirements. See Figure 4. the blowdown must be piped to a safe place of discharge to prevent injury to personnel or property damage.

It is recommended that a blowdown tank be used to safely discharge the blowdown into the sewers. Check state and local codes concerning the maximum allowable temperature for blowdown entering public sewer systems.

Do not reduce blowdown piping from boiler outlet. All valves, piping, and forged fittings used in the blow-down lines shall be of suitable rating, and in accordance with ASME Code B31-Power Piping. All pipe nipples used shall be Schedule 80 pipe.

WARNING: NEVER REDUCE THE VENT SIZE OF THE BLOWDOWN TANK.

To properly and safely blow down the boiler, the vent must be piped full size for the entire length, and must terminate at a safe place of discharge per local codes.

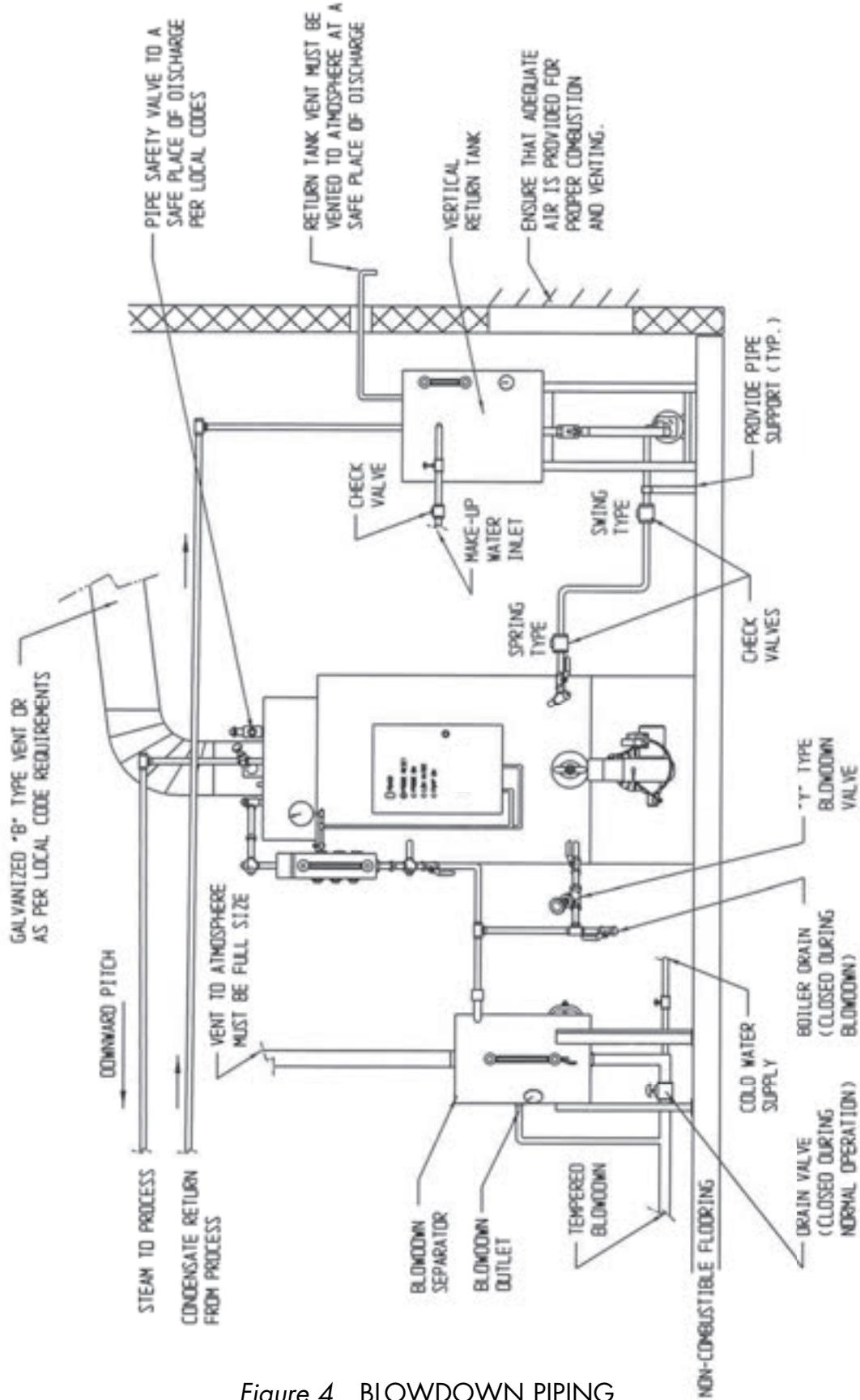


Figure 4 BLOWDOWN PIPING

CLEANING AND FILLING A NEW STEAM BOILER

In order to minimize the corrosive effects of raw water oxidation on the boiler, the water must be heated to at least 180°F immediately after entering the boiler, in order to drive off the corrosive dissolved gases. This applies to all water - whether from a well, a spring, or from the local municipal water system.

The oil and grease that accumulate in a new steam boiler can usually be washed out by boiling as follows:

1. Fill the boiler to the normal waterline.
2. Provide a boil-out compound of caustic soda and trisodium phosphate in the proportions of 2-1/2 lbs. of each chemical per 120 gallons of water.



USE CARE IN HANDLING THESE CHEMICALS. THE CAUSTIC SODA IS EXTREMELY CORROSIVE TO SKIN AND CLOTHING. DO NOT PERMIT EITHER THE DRY MATERIAL OR THE CONCENTRATED SOLUTION TO CONTACT SKIN OR CLOTHING.

3. Mix the chemicals with water and pour into the boiler through any convenient opening in the boiler.
4. Start the firing equipment.
5. Boil the water for at least five hours.
6. Stop the firing equipment.
7. Drain the boiler to a location where hot water can be discharged safely.
8. Wash the boiler thoroughly using a hose with sufficient pressure.
9. Fill the boiler to the normal waterline.
10. Add boiler water treatment as prescribed by a water treatment specialist.
11. Boil or bring water temperature to at least 180°F immediately.
12. The boiler is ready to put into service or on standby.

BOILER MODEL	EQUAL AMOUNTS CAUSTIC SODA AND TRISODIUM PHOSPHATE
VT-10	8 oz.
VT-15	12 oz.
VT-20	1 lb.
VT-25	1 lb. 4 oz.
VT-35	1 lb. 14 oz.
VT-50	4 lbs. 9 oz.
VT-60	8 lbs.

OPERATING THE BOILER

NOTICE **Although your new PEP Boiler has been test fired at the factory, it must be "set up" for the conditions at your location. Improper combustion settings may cause the burner to operate erratically, resulting in boiler shutdowns, lost time, and unnecessary service expenses.**

PRE-START CHECKS AND INFORMATION

A new or relocated boiler should not be put into service until it has been inspected by an authorized inspector for the jurisdiction or the insurance company, and the required certificates have been issued.

Whenever a new boiler is placed in service, operating data should be recorded and saved for future reference. This information is extremely valuable for diagnosing problems if abnormal operation occurs. Record all operating parameters such as pressures, stack temperatures, oxygen or carbon dioxide levels, flows, draft, motor amps, damper positions, and interlock set points. A burner start up and test information sheet has been included at the end of this section for your convenience.

The Gauge Glass Protector must be properly installed prior to operating the boiler, and all cover plates, enclosures, and safety devices must be installed at all times except while performing maintenance and service.

The fuel supply should not be turned on until the combustion chamber has been vented and the pilot light (if gas ignited) checked for proper operation.

All blowdown valves, including water column drain valves, gauge glass drain valves, and gauge cocks should be closed.

The safety valves should be inspected externally to see that they are free to operate, and that the discharge piping and drain piping are open to the atmosphere, and free to expand without imposing a load on the safety valve bodies. Make sure the safety valve is piped to a safe location to prevent injury.

The boiler feed pump(s) should be checked to ensure that they are ready for service. Check the data on rating plates of all electrical equipment to be certain the electrical characteristics match those of the electric supply to which they are connected.

All PEP VT Series boilers are test fired at the factory, however, before attempting start-up, carefully study the instructions included in the burner section of this manual.

It is important to have the proper test equipment in order to adjust the combustion and pilot if equipped. Those items that may be required include a manometer, microammeter, vacu-

um gauge, 0-300 PSI pressure gauge, combustion analyzer and DC volt meter.

STARTING THE BOILER

WARNING: NEVER OPERATE A BOILER WITHOUT BEING SURE IT IS FILLED WITH WATER AND THAT PROPER WATER TREATMENT CHEMICALS HAVE BEEN ADDED.

Turn the boiler disconnect switch to the **ON** position.

Open the feedwater valve and turn on the main disconnect for the condensate pump. The pump should come on and fill the boiler to its normal operating level.

NOTICE The burner will not operate when the boiler has reached its normal water level, until the reset button on the secondary, probe type, low water cut-off is pushed.

Push the **RESET** button on the Control panel Cover. The burner should start.

NOTICE Combustion efficiency must be checked at this time. See the burner manufacturers instructions for correct settings and more detailed information.

Follow the adjustment procedures outlines in the burner section of this manual to set up the burner for proper operation.

NOTICE New VT boilers will normally expel a vapor from joints and openings in the jacket. This is a temporary condition, caused by moisture evaporating out of the refractory insulation behind the jacket, and will eventually disappear.

STOPPING THE BOILER

To stop the boiler turn the main disconnect to the **OFF** position.

INLET GAS PRESSURE

Inlet gas pressure to the main gas valve should be between seven and fourteen inches water column.

If the inlet gas pressure exceeds fourteen inches water column, the pilot regulator and main gas regulator will "lock up" and become inoperative, and damage may occur. Inlet gas pressure above fourteen inches water column will require an additional pressure reducing valve.

If the inlet gas pressure is below seven inches water column the burner may not be capable of the rated boiler output. If the gas pressure is below seven inches water column contact your local gas company. If the local gas company is unable to help, contact the factory for assistance.

BURNER START UP AND TEST INFORMATION: REQUIRED

For a new boiler start up, or for troubleshooting an existing installation, the following information is essential for effective service assistance.

Boiler Model _____ Serial No. _____ N.B. No. _____
Burner Model _____ Invoice No. _____ Serial No. _____
Installation Name _____ Start Up Date _____
Start Up Contractor _____ Phone No. _____
Name of Technician Performing Start Up _____
Fuel Type: Natural Gas LP Gas Fuel Oil (#2) Other _____

Gas Firing

Gas Pressure At Train Inlet Burner in Off Position _____ "W.C.	Flame Signal Readings Pilot _____	Stack Outlet Test Point Draft High Fire _____ "W.C.
Gas Pressure At Train Inlet High Fire _____ "W.C.	CO2 High Fire _____	Over Fire Draft High Fire _____ "W.C.
Gas Pressure At Main Orifice High Fire _____ "W.C.	CO High Fire _____	Net Stack Temperature High Fire _____ °F
Gas Pressure At Pilot Orifice _____ "W.C.	Measured INput Rate - BTU/HR High Fire _____ "W.C.	Gas Pressure At Pilot Orifice _____ "W.C.

Oil Firing

High Fire Vacuum Reading At Oil Pump Inlet Pump Inlet _____ "H.G.	CO2 Low Fire _____ High Fire _____	Stack Outlet Test Point Draft Low Fire _____ "W.C. High Fire _____ "W.C.
Oil Nozzle Supply Pressure Low Fire _____ PSI High Fire _____ PSI	Bachrach Scale Smoke Number Low Fire _____ High Fire _____	New Stack Temperature Low Fire _____ °F High Fire _____ °F
Firing Rate - GPH Low Fire _____ High Fire _____	Over Fire Draft Low Fire _____ "W.C. High Fire _____ "W.C.	

Operational Check of Controls

Operating Limit _____ <input type="checkbox"/>	Aux LWCO _____ <input type="checkbox"/>	Flame Safeguard _____ <input type="checkbox"/>
Safety Limit _____ <input type="checkbox"/>	Low Gas Pressure _____ <input type="checkbox"/>	Ignition Failure <input type="checkbox"/>
Low Water Cut Off _____ <input type="checkbox"/>	High Gas Pressure _____ <input type="checkbox"/>	Flame Failure <input type="checkbox"/>

Comments

BOILER ROOM

Lighting

The boiler room should be well lighted and should have a source of emergency lighting. If a flashlight is used for this purpose, it should be maintained in usable condition, and it should not be removed from the boiler room.

Care should be taken to prevent bright, direct sunlight from shining on the burner, as the flame sensing controls may receive a false flame signal.

Water Supply and Drain Connections

Convenient water supply connections for flushing the boiler and cleaning the boiler room floor should be installed.

Unobstructed floor drains, properly located in the boiler room floor, will aid in the proper cleaning of the boiler room.

Make-up Air

The burner must have adequate air supply, which must be kept clear at all times. Do not run exhaust fans in the immediate proximity of the boiler room, as they will cause a reversal of draft at the burner. Ensure that sufficient make-up air is available, even if that requires a window to the outside to be left open. This air is necessary to insure complete combustion, a clean fire, and to prevent nuisance shutdowns due to excessively dirty burner parts. Air from the outside may be provided through ducts, fixed louvers, or motorized louvers.



WITHOUT SUFFICIENT MAKE-UP AIR, THE BOILER WILL NOT OPERATE PROPERLY, AND BURNER COMPONENT DAMAGE COULD OCCUR.

To calculate the required fresh air opening to the outside, allow 21 square inches for every boiler horsepower. For example a 10-horsepower boiler would require two hundred and ten square inches of free opening. This is equal to a 15" x 15" square hole, or a 18" diameter round hole of free, unrestricted area. If louvers or screens are used, contact the manufacturer for percentages (typically around 40%) that must be added to allow for restriction.

The following table can be used to size the amount of free area needed for the various sizes of VT boilers. A point to remember for round openings - two 10" round openings DO NOT equal one 20" round opening. Four 10" round openings are needed to obtain the same amount of free area.

PEP will not be held liable for damage to the boiler or burner components caused by insufficient burner make up air.

REQUIRED BOILER MAKE-UP AIR

BOILER SIZE (HORSEPOWER)	BTU INPUT	OPENING MIN. SQUARE INCHES	SQUARE HOLE SIZE - INCHES (APPROXIMATE)	ROUND PIPE SIZE - INCHES (APPROXIMATE)
9.5	399,000	210	15 X 15	18
15	630,000	315	18 X 18	20
20	840,000	420	21 X 21	24
25	1,050,000	525	23 X 23	26
35	1,470,000	735	28 X 28	32
50	2,100,000	1050	33 X 33	38
60	2,520,000	1260	35 X 35	40

Housekeeping

Provide adequate space around the boiler for inspection and service. Do not allow the boiler room to become a storage room.

Fire protection apparatus, and fire prevention procedures for boiler room areas shall conform to the recommendations of NFPA and all local codes.



**DO NOT STORE OR USE GASOLINE OR ANY OTHER FLAMMABLE LIQUIDS
AND VAPORS IN THE VICINITY OF THE BOILER OR BOILER ROOM.**

DESCRIPTION OF BOILER COMPONENTS

Refer to the drawings in this manual for the location of the following listed components. See Table of Contents for location of applicable drawing and/or specification sheet.

The standard control circuit for the VT Series Boilers consists of probe type, primary and secondary low water cut off and pump controls enclosed in a panel box; and typical operating and safety limit pressure controls. The standard water column consists of three probes used for the primary low water cut off and pump control, the Operating Pressure control, Safety Limit Pressure Control, and a 0-300 psi pressure gauge.

DESCRIPTION OF PANEL BOX COMPONENTS

Water Level Control

The boiler water level control consists of a combination low water cut-off and pump control. The control handles two separate level functions, one differential, and one single level, using probes and contactors. The differential function uses a low probe (L) and high probe (H) to operate the pump. When the water level in the boiler drops below the level of the low probe, the normally closed contact is energized, which in turn supplies power to the pump motor contactor/starter, causing the pump to feed water to the boiler. The "PUMP ON" light will also come on. As the pump raises the level in the boiler and the water makes contact with the high probe, the contactor is de-energized, breaking the circuit, stopping the pump and turning off the "PUMP ON" light.

If the pump or water supply should fail, and the water level in the boiler continues to fall below the Low Level Cut Off (LLCO) probe, the second contactor de-energizes the normally closed contact, shutting off power to the burner, and energizes the normally open contact, turning on the "LOW WATER" light and/or an optional low water alarm bell.

Contact the factory with your boiler serial number to determine correct probe lengths for your boiler.

The water level control will reset automatically after a Low Water Cut Off. If preferred, a normally closed, Manual Reset push button is available as an option.

Motor contactor or Starter

A Motor contactor or Starter is provided to take the high amperage electrical load off the pump motor switches of the water level control. A Motor Starter also provides electrical overload protection for the feedwater pump motor.

A Motor Contactor is provided as standard equipment on the VT-10 thru VT-25 Boilers, and a Motor Starter is provided as standard equipment on the VT-35 and VT-60 Boilers.

Low Water Cut-Off

The manual reset "probe" is used as a supplementary safety device for protecting the boiler against damage from low water. It is designed to operate if the water level control low water cut-off should fail to operate for any reason. This unit is set to operate at a water level in the boiler lower than that of the water level control. See drawing VT-415 in the appendix for installation of probe rod.

This unit consists of a circuit board design with one normally open (N.O.) non-powered contact. When reset, it completes a circuit between the probe rod and the boiler drum, through the water in the boiler. If the water level falls below the probe rod, the circuit is broken causing the contact to open, breaking the circuit to the burner and energizing an alarm circuit (if equipped).

NOTICE This relay must be reset after a low water condition has been corrected or after any interruption in the electrical supply.

DESCRIPTION OF OPERATING CONTROLS AND SAFETY DEVICES

Operating Pressure Control

This switch opens on pressure rise. It should be set at the maximum operating pressure desired. **Do not** set the operating pressure higher than 135 PSI. The differential determines when the burner will restart. The differential should be set at a value as large as possible to keep the unit from short cycling.

The pressure control must be level in order to operate accurately. It is level when the leveling indicator hangs freely with its pointer directly over the index mark inside the back cover of the case.

The upper operating or cut-off pressure is determined by the main scale set point, while the lower operating or cut-in pressure is determined by the main scale operating point minus the differential.

Adjust the main scale set point for the desired operating pressure by turning the main scale adjusting screw on top of the case until the main scale setting indicator is at the desired pressure. Adjust the differential set point for the desired cut in pressure by turning the adjusting screw on top of the case until the differential setting indicator is at the desired setting.

Safety Limit Pressure Control

The Safety Limit operates essentially the same as the pressure control described previously except this limit is equipped with a reset button and does not have a differential. The purpose of the Safety Limit is to shut down the burner if the operating pressure control becomes inoperable and steam pressure continues to climb. The burner will not start until the situation is corrected and the reset button is pushed. The high limit of the Safety limit must be set above the operating pressure control setting.

Adjust the main scale set point about 20 PSI higher than the operating pressure control by turning the main scale adjusting screw on top of the case until the main scale setting indicator is at the desired pressure.

There are a number of pressure controls that may be used interchangeably. Please see additional information in the manual appendices.

Safety Valve

Safety valves shall be piped so that any discharge cannot cause injury to people or damage to property. The discharge piping must be supported so that the weight of the piping is not transmitted to the safety valve body. The weight supported by the valve outlet should not exceed that of a drip pan elbow. Installations requiring long discharge piping should not be connected directly to the safety valve. Refer to Drawing PL-049 in the Appendix.

In order to achieve the topmost performance and maximum safety valve life, maintain a proper operating gap between the set pressure of the safety valve and the maximum operating pressure of the boiler.

The minimum recommended operating gap for this valve is 10%, but at no time less than 7 PSI. Under no circumstances should this gap be less than 7 PSI or seat leakage can occur. Failure to maintain this operating gap can result in an accumulation of deposits on the seating surface that may impede proper operation of the safety valve.

If the valve discharges on its own, contact a qualified service technician to determine the cause. This may be an indication of equipment or system malfunction.

Gauge Glass Protector

The gauge glass protector is provided to guard against personnel injury and component damage in the event of a breakage of the sight glass. The gauge glass protector must be properly installed prior to operation of the boiler.

DESCRIPTION OF OPTIONAL EQUIPMENT

Manual Dual Pressure (Optional)

A toggle switch is provided in conjunction with an additional Pressuretrol to manually change from a high operating pressure to a low operating pressure. See wiring diagrams enclosed.

Manual Reset Pushbutton (After Low Water Cut off) (Optional)

A normally closed, Manual Reset Pushbutton and Control Board is available. This pushbutton, when installed, must be pressed and held for 10 seconds to start burner operation after a low water condition has been corrected.

Time Control (optional)

A seven-day time clock, when furnished, provides Automatic Dual Pressure or Automatic Off/On Operation, whichever is desired. An adjustable time switch makes one circuit and breaks another simultaneously at as many intervals every 24 hours as required. See wiring diagrams enclosed.

When used for On/Off operation, one side of the circuit is connected in series with the pressure control. The other side is not used. On dual pressure operation an additional pressure control is connected in series, on one side of the time switch.

MAINTENANCE

RECORD KEEPING

All manufacturers' literature, spare parts lists, operating and maintenance procedures should be maintained in the boiler room at all times. A log book should also be provided to record maintenance work, inspections, and other performance test results.

General

Clean the boiler and heating surfaces whenever required. The frequency of the cleaning required to maintain the boiler at peak efficiency will be determined only by frequent inspections. It cannot be predicted. Your operating conditions might be different from your neighbors. When in doubt - check it out.

WARNING **DISCONNECT ALL INCOMING ELECTRICAL POWER BEFORE SERVICING THE BOILER. USE EXTREME CAUTION AROUND BOILER PIPING AND THE WARRICK SERIES DF LOW WATER CUT OFF SINCE THEY MAY BE VERY HOT.**

The life of your boiler will be determined by the level of care given it by those who are responsible for maintenance. A log of the following items should be maintained in the boiler room at all times.

Daily Boiler Check & Maintenance List

1. Water Level Controls and Cut Offs are operating normally.
2. Instrument and equipment settings are normal.
3. Gauge glass is clean and protector is installed. If leaks are detected, replace glass, gaskets, and brass washers immediately. When replacing gauge glass use only 5/8" O.D. x 10-1/4" long Pyrex red line, high pressure, high temperature, glass tubing, with fire polished ends. See gauge glass maintenance section for proper method when installing this gauge glass.
4. Boiler water at proper operating level.
5. Blow down boiler as instructed under BLOWDOWN.
6. Blow down probe type low water cutoff.

Weekly Boiler check & Maintenance List

1. Check flame failure detection system.
 - A. Gas boilers: Close fuel supply to pilot and main gas and check shut down timing.
 - B. Oil boilers: Remove cad cell leads and check shut down timing.
2. Check fuel valves. Open limit switch and make aural and visual check.
3. Check ignition system flame signal.

Monthly Boiler Check & Maintenance List

1. Test all fan interlocks.
2. Check main burner safety shut off valve(s) for operational closure.
3. Oil fired: check fuel pressure interlocks when provided.
4. Gas fired: check high and low fuel pressure switches.
5. Flue or stack dampers; make visual inspection for proper operation.

Semiannual Boiler Check & Maintenance List

1. Inspect burner components. Refer to burner manufacturers' instructions.
2. Check the flame failure system components; Refer to the burner section of this manual.
3. Check piping and wiring of all interlocks and shut off valves.
4. Internal boiler plate inspection. Remove hand-hole assemblies. Use new gaskets when replacing covers.

Annual Boiler Check & Maintenance List

1. Check operating Pressure Control.
2. Check high limit Pressure Control.
3. Test safety valves.
4. Remove the Warrick Series DF Low Water Cut Off and clean inside casting.
5. Oil fired - clean/replace oil filters or strainers if equipped.
6. Oil fired - replace ignition electrodes if equipped.
7. Gas pilots - conduct pilot turndown test.
8. Gas fired - replace ignition and flame rods.
9. Gas fired - check drip leg/strainer.
10. Oil fired - check for refractory hold in.
11. Check Automatic Change Over Control if equipped.
12. Gas fired - perform valve leakage test.

Boiler Lay-Up

When a boiler is taken out of service, the unit should be cooled until the water is below the atmospheric boiling point or to a temperature suitable for site specific requirements. The boiler may then be drained and flushed out and an inspection should be made to determine what repair work, if any, is necessary and what cleaning should be done. A decision should then be made to employ dry or wet storage.

Whenever a package boiler is taken out of service for any purpose, it should be internally cleaned when put back into service or placed in wet or dry storage. Loose material in the form of dirt, trash, mill scale, or deposits should be removed by washing or other mechanical methods.

Dry Storage

Dry storage is a procedure preferable for boilers out of service for extended periods of time or in locations where freezing temperatures may be expected during storage.

The cleaned boiler should be thoroughly dried, since any moisture left on the metal surface would cause corrosion to occur on long standing. Precautions should be taken to preclude entry of moisture in any form, into the water side of the unit.

To prevent moisture attack during dry storage, moisture absorbing material such as quick-lime at the rate of 2 pounds or silica gel at the rate of 10 pounds for 1000 gallon capacity, may be placed on trays inside the boiler to absorb moisture from the air. The hand holes should be closed and all connections on the boiler be tightly blanked. The effectiveness of the materials for such purposes and need for their renewal may be determined through regular internal boiler inspections.

Wet Storage

Wet Storage is preferable when boilers are to be placed in storage condition for short periods of time, typically less than a year. The procedure should not be employed for boilers in locations where freezing temperatures may be expected during standby.

The cleaned boiler should be filled to the top using condensate or feed water, either of which should be conditioned chemically to minimize corrosion during standby and closed. Prescribed concentrations of caustic soda and of scavenger such as sodium sulfite may be employed. Concentrations of approximately 450 parts per million (ppm) of caustic soda and 200 ppm of sodium sulfite may be used for this purpose. **You should consult your boiler water treatment company for the specific requirements at your site.** Water pressure greater than that of the atmosphere should be maintained within the boiler during the storage period.

NOTICE The percentage of soda and sulfite noted above is greater than recommended for operation of the unit. It will be necessary to completely drain the unit prior to placing it on-line and to treat the water during operation according to the recommendation of the boiler water treatment company employed.

Gauge Glass

The water gauge glass must be kept clean. Dirt on or in the glass may be mistaken for the water level. Do not allow steam or water to leak from the water glass, as this may effect the accuracy of the level indication. Leaking of the gauge glass will also reduce the wall thickness of the glass to the point where it may explode.



DO NOT OPERATE THE BOILER WITHOUT THE GAUGE GLASS PROTECTOR INSTALLED. NEVER ATTEMPT TO WORK ON THE GAUGE GLASS WHILE THE BOILER IS UNDER PRESSURE. ALWAYS CLOSE GAUGE VALVES PRIOR TO TIGHTENING GASKETS ON WATER LEVEL GAUGE GLASS. SERIOUS INJURY COULD RESULT.

Gauge Glass Replacement Instructions:

1. Make absolutely certain that the new water level gauge glass is 5/8" o.d. x 10-1/4" long Pyrex red line, high pressure, high temperature glass tubing with fire polished ends.
2. Close gauge glass valves.
3. Remove gauge glass protector.
4. Remove the old glass, gaskets, brass washers, and brass nuts. Be sure threads on the gauge valves are clean.
5. Install brass nuts, brass washers, and gaskets on each end of the gauge glass.
6. Insert glass tube into top gauge valve and lower the glass tube into the bottom gauge valve which contains a seat. Then raise glass 1/16". Do not allow glass to rest directly on the valve.
7. Hand tighten the lower glass nut and then the upper nut. While tightening these nuts, be sure to keep the red line opposite the viewing side.
8. With a wrench, snug up the bottom nut and then the top nut.
9. **Replace gauge glass protector.** Open gauge glass valves fully. Failure to completely open the gauge glass valves renders the ball check safety feature inoperative.
10. Without pressure on boiler and with gauge valves closed, tighten gaskets again after 1 day of operation.

Blowdown

Blowing down the boiler is done to remove excess total dissolved solids. The actual amount of blowdown should be determined through boiler water analysis, done by a water treatment specialist. Until an analysis of your boiler water is made, the following guidelines should be used.

Blow down should be done in the evening after firing equipment has been shut down for approximately 20 minutes and at a pressure between 20 and 40 psi. Some pressure must be left on the boiler for proper blow down. **Important: Boiler water must be settled for proper blowdown.**

Blowdown Instructions

To blow down the boiler, open the slow opening ("Y" type) blowdown valve first. Open boiler blowdown ball valve for 30 seconds then close. Use this same procedure with the low water cut off blowdown ball valve. Then go back to the boiler blowdown valve, open and close the valve, very fast, two more times. Repeat this procedure with the low water cut off valve. This will rid the boiler of most precipitated sediment. **DO NOT EMPTY THE BOILER OF ALL ITS WATER.**

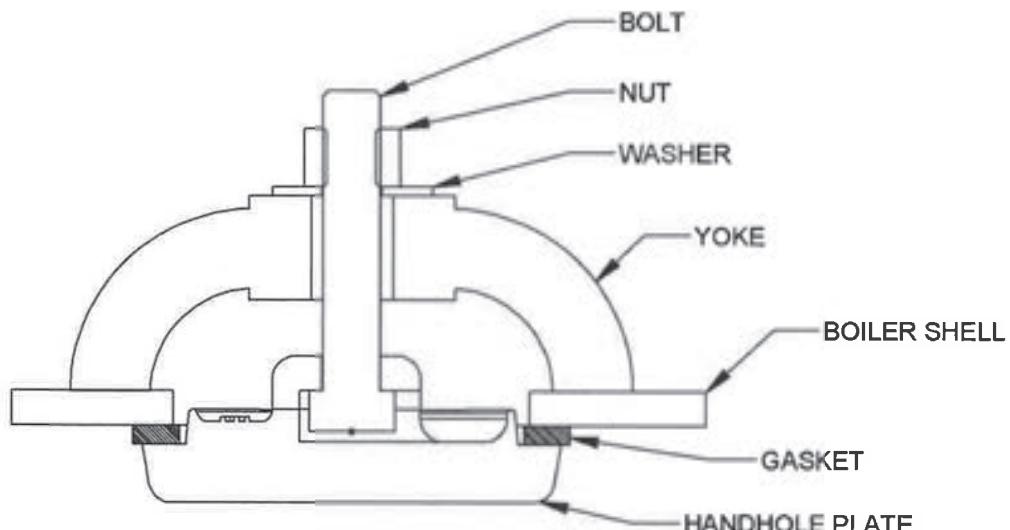
The Warrick Series DF Low Water cut Off & Pump Control should be blown down at least once each day when the boiler is in operation. This is essential to flush accumulation of sediment from the float chamber. Failure to do so will result in the failure of the control to shut off the burner on low water. During the blowdown operation, check to see that all of the control probes are operating properly. To check operation of the probes, open the blowdown valve while the burner is in operation. When the water level drops, the alarm circuit should close and sound the alarm (if alarm is installed) and the burner should stop firing.

Hand Hole Gasket Replacement

Part number 480210 (fits all models)

Remove the old gasket and thoroughly clean the mating surfaces inside the boiler and on the hand hole surfaces. A thin wire or a piece of string tied to the hand hole casting will help prevent "losing" the casting in the boiler when removing or installing gaskets.

Place the new gasket on the hand hole making sure that it fits evenly all the way around. The use of adhesive on the plate gasket is recommended in order to hold the gasket in place while installing the assembly in the boiler.



PROPER PRESSURE ON GASKET OF HANDHOLE PLATE

Figure 7

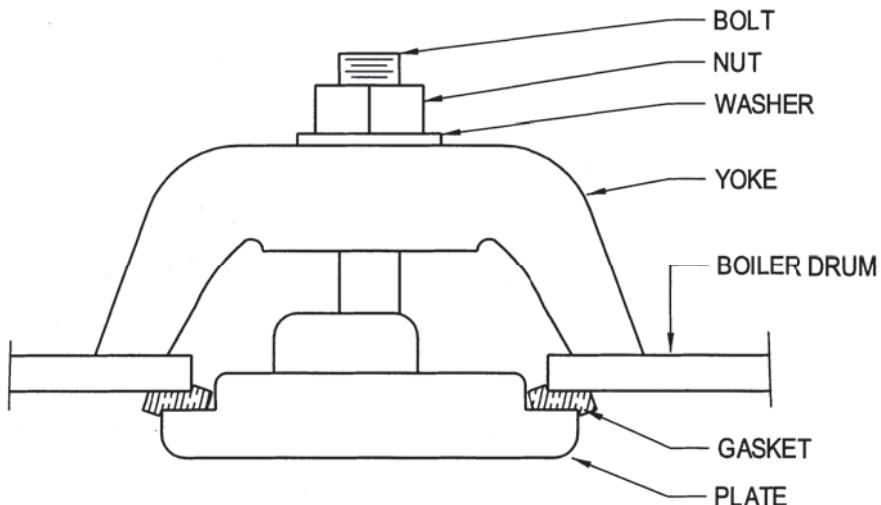
Install the plate assembly in the boiler, evenly spaced as possible. Set the yoke over the bolt, install the nut and make it hand tight to keep the plate from moving.

Using the correct size socket wrench, tighten the nut one quarter turn. See Figure 7. If the gasket leaks while the pressure is being brought up on the boiler, tighten the nut only enough to stop leaking. See Figure 8.

Check the gaskets for leakage for the next three days after installation and if leakage is detected tighten only enough to stop it.



EXCESSIVE TIGHTENING WILL FLATTEN OUT THE GASKETS TO A POINT WHERE THEY WILL NO LONGER BE ABLE TO SEAL. DO NOT TIGHTEN MORE THAN IS REQUIRED TO SEAL



IMPROPER PRESSURE ON GASKET OF HANDHOLE PLATE

Figure 8

Cleaning the Flue Passages

Under normal operating conditions the flue passages do not need to be cleaned. If soot has built up on the flue passages due to improper burner set up or poor combustion, the following procedure can be used to clean the boiler. Before cleaning have your boiler technician check the stack temperature and combustion efficiency to make sure that cleaning is necessary.

Do not disassemble the jacket top ring without first obtaining a millboard top gasket. This gasket can become brittle over time and will be impossible to reinstall after removing. This can cause combustion gases to leak and can cause a dangerous situation. If your boiler was built after February 1991 you will **also need** an upper hand hole gasket, part number 480210.

Contact the factory and tell them your boiler serial number. They will advise the correct part number for millboard for your boiler. Instructions for installing the millboard will be included.

MAINTENANCE LOG

MAINTENANCE LOG

TESTING OF BOILER COMPONENTS

Refer to **Boiler Check & Maintenance Lists** earlier in this section for frequency of testing.

Low Water Cut-Off and Pump Control

Testing while operating. (Red LED **ON** indicates normal operating condition.)

1. Fill the boiler to a level higher than the normal operating water level.
2. With the burner running, lower the water level in the boiler by using the bottom blow down valve. At about the normal boiler water level the pump should come on and start pumping water into the boiler.
3. When the water level drops approximately 1-1/2 inches below the level at which the pump turned on, the burner should turn off and the alarm circuit will close, and activate the optional alarm bell (if so equipped).

Testing while not in operation.

1. Fill the boiler to a level higher than the normal operating water level.
2. Open the Panel Box and locate the terminal blocks; **TB1** is the upper block, **TB2** is the lower block.
3. Using an AC Continuity Tester, Check for continuity between terminal "**PH**" and **Ground**, indicating the high Water probe circuit is functioning properly.
4. Check for continuity between terminals **TB1-A2** and **TB2-3**, indicating the burner circuit is making, and the burner would be operating.
5. Terminals **TB2-M** and **TB2-M2** should be open, indicating the pump circuit is not energized.
6. Open the bottom blow down valve and allow the water level to drop below the normal operating water level.
7. Check for continuity between terminals **TB1-A2** and **TB2-3**, indicating the burner circuit is making, and the burner would be operating.
8. Continuity across Terminals **TB2-M1** and **TB2-M2** signifies the boiler feed pump circuit is energized, causing the pump to operate.
9. Open the bottom blow down valve and allow the water level to drop below the Low probe level. Check for continuity between terminals **TB1-A2** and **TB2-3**.

The burner circuit should be open, signifying the burner circuit is broken.

10. Continuity across Terminals **TH2-M1** and **TH2-M2** signifies the boiler feed pump circuit is energized, signifying the pump is attempting to fill the boiler.

Probe Type Low Water Cut-Off

Testing While Operating. (Red LED **ON** indicates normal operating condition.)

1. While the boiler is operating normally, open the lower blow down valve and allow the water level to drop below the level of this probe.
2. The probe relay should open and lockout.
3. Fill the boiler to a level higher than the probe. The relay should not reset automatically.
4. After the water level has risen to the normal operating level, depress the **Probe Reset** switch on the front of the panel box. The burner should start operating normally.

Testing While Not in Operation.

1. Energize the control circuit and fill the boiler to the normal operating water level.
2. Depress the **Probe Reset** switch on the front of the panel box. Open the panel box and locate the terminal blocks; TB1 is the upper block, TB2 is the lower block.
3. Using an AC Continuity Tester, Check for continuity between terminal "**P2**" and **Ground**, indicating that the Secondary Low Water probe circuit is functioning properly.
4. Open the lower blow down valve and allow the water level to drain below the level of the probe. The relay should open and continuity between terminals "**P2**" and **Ground** should be broken.
5. Close the lower blowdown valve and fill the boiler to the normal operating water level. The relay should not reset automatically and continuity between terminals "**P2**" and **Ground** should remain broken.

Operating Pressure Control

Testing While in Operation.

1. Start the burner and allow the boiler pressure to rise to the main set point. The burner should shut off.
2. Open the steam valve and relieve pressure until the pressure is below the lower set point. The burner should now start. The lower set point is determined by taking the differential from the main set point.

Testing while not in operation.

1. To test operation of pressure controls while unit is not in operation requires the use of an external source of pressure such as an air compressor.
2. Close all valves and connect the pressure source to the boiler.
3. Increase the pressure in the boiler until the pressure is higher than the setting on the controller. The mercury switch should rock over such that continuity is now broken.
4. Decrease the pressure in the boiler until the differential is satisfied. The mercury switch should rock back to a position that causes continuity to be made across the switch.

Safety Limit Pressure Control

Testing while in operation.

1. Adjust the safety limit set point below the main set point.
2. Start the burner and allow the boiler pressure to rise to the safety limit pressure level.
3. The burner should shut off and not restart until the manual reset lever is depressed.

Testing while not in operation.

1. To test operation of pressure controls while unit is not in operation requires the use of an external source of pressure such as an air compressor.
2. Close all valves and connect the pressure source to the boiler.

3. Increase the pressure in the boiler until the pressure is higher than the setting on the controller. The switch should open such that continuity is now broken and the manual reset switch should open.
4. Decrease the pressure in the boiler. The switch should close to a position that causes continuity to be made across the switch but should not close until the manual reset lever is depressed.

Safety Valve



USE CAUTION PRIOR TO PERFORMING A "TRY LEVER TEST" SINCE LOUD, VERY HOT AND HIGH VELOCITY STEAM WILL DISCHARGE FREELY FROM THE DISCHARGE PORT AND THROUGH THE DRAIN HOLE PROVIDED IN THE SIDE OF THE VALVE BODY.

1. Bring the boiler pressure up to maximum operating pressure, but not less than 75% of maximum pressure (112 PSI), otherwise distortion could occur. If necessary adjust operating and high limit controls to a higher setting.
2. Test the valve at or near maximum operating pressure by holding the test lever fully open for approximately five seconds to flush the valve seat free of any debris or sediment and then permit the valve check to snap shut.
3. If lift lever does not activate and there is no evidence of valve discharge, shut down equipment immediately and replace the valve.
4. Adjust operating and high limit controls to their normal settings.

WATER TREATMENT

NOTICE Boiler feedwater should be tested by a local water treatment specialist and treatment to meet the requirements in this manual should be followed.

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

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

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

Recommended Guidelines for Boiler Water Treatment

ANALYSIS	RECOMMENDED RANGE	COMMENTS
pH	10-11	Low pH promotes corrosion
Total Alkalinity	200-700 ppm	Low promotes corrosion
Phosphates	30-100 ppm	Prevent scale formation
Total Hardness	0-50 ppm	Prevents scale formation
Chlorides	60-200 ppm	A measure of proper blow down
Total Dissolved Solids	2000 ppm Maximum	High solids may cause surging
Sulfites	20-30 ppm	A good oxygen scavenger
Specific Conductance	< 700 micro ohms cm	A measure of proper blowdown
Oxygen	< .007 mg/liter	Prevents corrosion and pitting

ppm = parts per million

Use proper water treatment **to prevent the buildup of scale** on the boiler. After scale has built up on the walls of the boiler it is almost impossible to remove it from the boiler. The introduction of acids into the pressure vessel is thoroughly discouraged, since virtually any solution that will chemically attack the scale will also attack the boiler metal.

pH

The pH value of the boiler water is a number between zero and fourteen. Values below seven are acidic, seven is neutral, and values above seven are alkaline.

The pH factor is the most important factor influencing scale formation and the corrosive tendencies of boiler water. The pH should be maintained between a minimum of 10.0, and a maximum of 11.0 to prevent acidic corrosion of boiler tubes and plates, and to provide for the precipitation of scale forming salts before scale is deposited.

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

Dissolved Oxygen

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

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

Direct or mechanical removal of dissolved oxygen is done through the use of a deaerator or by heating the water to a temperature above 180°F. Heating the water can be done with a preheater or a sparge tube installed in the return system.

Chemical deaeration is done through the introduction of specific chemicals in the boiler to react with the oxygen. The dissolved oxygen content should be maintained at a minimum but at no time should it exceed 0.007 mg/l.

Sulfites

Sodium sulfite is generally used for the chemical removal of dissolved oxygen within the boiler water. To assure the rapid and complete removal of the oxygen entering the boiler feedwater system the concentration of sulfite in the boiler must be maintained at a minimum of 20 PPM. (parts per million)

Solids

Solids can be broken up into two categories: suspended solids, and dissolved solids. Suspended solids are those which can be removed by filtration, while dissolved solids are in solution with the water. The best test for the determination of solids content of the boiler water is through a conductance test.

The conductance value of boiler water varies by the various ionized salts present. The con-

ductance can be used to measure the total dissolved solids in the boiler water and to serve as an accurate means for the control of solids through the use of blowdown.

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

High boiler solids will lead to foaming, priming, surging and carry over. These problems can be overcome by proper, daily blowdown of the boiler.

Alkalinity

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

High boiler alkalinity, which is in excess of 700 PPM should be avoided. Values higher than this can lead to embrittlement of the steel.

Phosphates

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

Hardness

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

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

Oils

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

RETURN SYSTEMS (Optional)

Pump Operation

The boiler feedwater pump is controlled by probes sensing the water level in the combination water column, level control, and low water cut off. Operation of the specific control is described in the component section of this manual. Whenever a pump is used to feed water to a boiler, it is recommended that a motor starter be used with the pump. The motor starter will take the electrical load off the switch in the level control.

Detailed instructions for the maintenance of the boiler feedwater pump are provided with the Return System.

Make-up Water Control

The field water supply enters the boiler feedwater tank through the make-up valve assembly. The water level in this tank is maintained at a level near the center of the tank by a float operated valve. This make-up valve is built into the boiler feedwater return tank.

The maximum allowable pressure to the make-up valve is 40 PSI. Pressures in excess of this value must be reduced.

BLOWDOWN SEPARATOR (Optional)

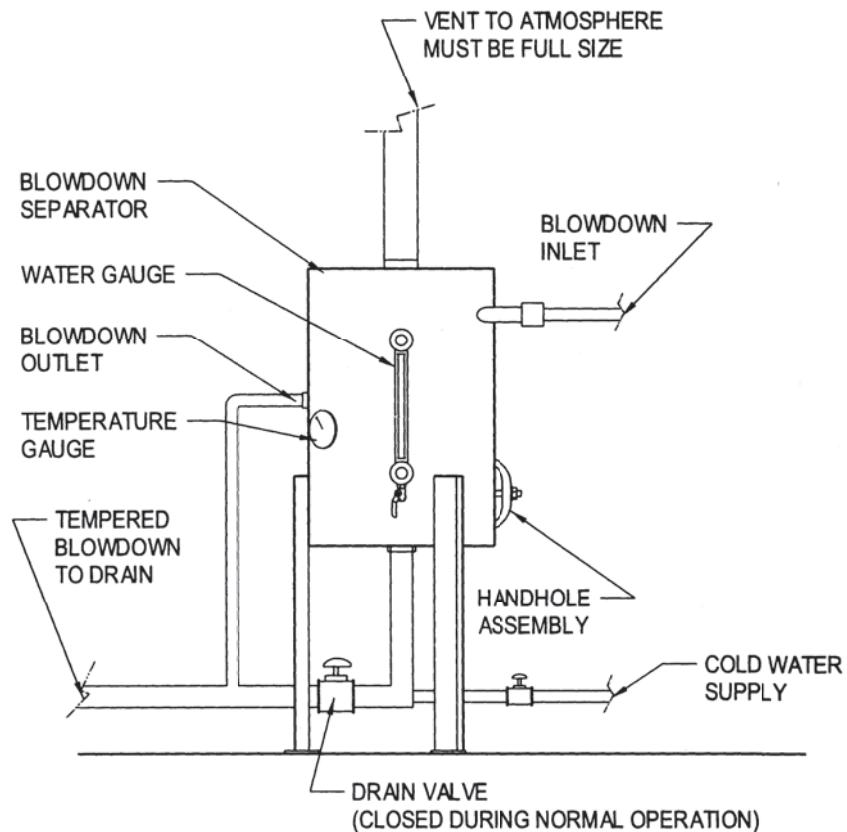
A blowdown separator is essential to control boiler water quality and to safely remove boiler water to a drain.

The blowdown separator design incorporates an internal water seal at the outlet, which permits the operator to introduce cold water from the bottom to mix with the hot water from the boiler blowdown. This reduces the outlet water temperature for safe discharge.

If the separator is less than half full of water after the boiler is blown down, cold tap water must be added to bring the water level to the half-way mark before the next blowdown.

The vent must be piped, full size, to a safe location so that steam flashing off the blowdown will not injure individuals or damage equipment.

Do not reduce the outlet pipe or vent pipe size coming off of the tank.



BLOWDOWN SEPARATOR

Figure 9

TROUBLE SHOOTING

The first step in trouble shooting is to have a qualified service technician, with the required instruments and expertise, diagnose your system and attempt to fix the problem. Please adhere to the Service Policy at the beginning of this manual.

Surging or bouncing water level

Surging or bouncing water levels are caused by boiler water which has a high concentration of solids or oils. It is recommended that the frequency of blowdown be increased until the surging condition is corrected. Extreme cases may require the boiler to be boiled out following the previously outlined procedures. A water treatment specialist should be consulted immediately.

Pump runs but does not put water in the boiler.

Check that the feedwater piping is not clogged between pump and boiler. Insure that all of the steam traps in the system and the check valves between the pump and boiler are working properly. Many times, steam in the impeller area of a pump will cause cavitation and damage.

Refer to pump manufacturer for instructions.

Boiler flooded in the morning.

When the boiler is shut off and the steam in the system condenses, a vacuum is created. On tight or new systems there may be no way for air to enter the system to eliminate the vacuum. When this happens, water is drawn through the return system into the boiler. This will also cause flooding of the return tank.

The replacement of a swing type check valve and manual valve on the boiler with the direction of flow into the boiler, will eliminate this problem. It is recommended that the manual valve be closed during normal operation so that a failure of the check valve will not result in steam being released into the boiler room.

Fan motor runs but burner does not light.

The air switch has not proved an air flow. Check for continuity across the terminals of the air switch and replace the air switch if it is defective.

If a S8600 Series control is used, try resetting the control. If the S8600 Series control loses the pilot signal, the control will "lock out" until it reset, and the fan will continue to run.

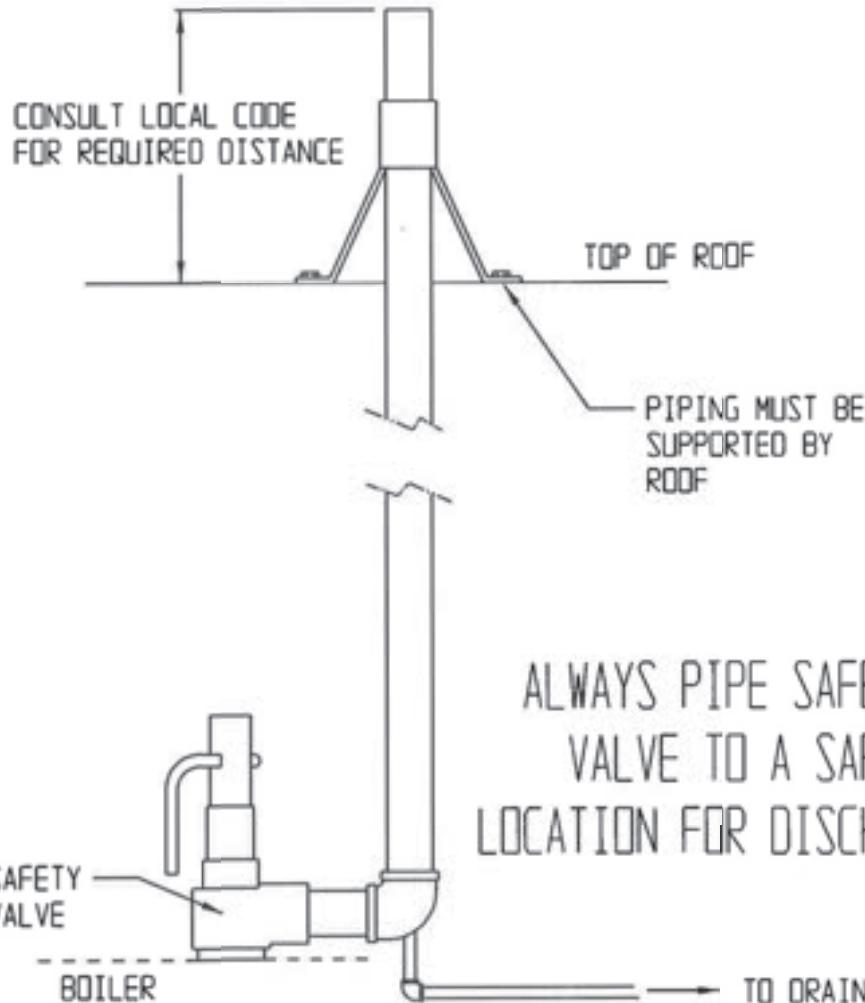
NOTES

BOILER WIRING DIAGRAM

SEE THE BURNER SECTION
IN THE BOILER MANUAL BINDER
FOR THE APPLICABLE WIRING DIAGRAMS
FOR THIS BOILER.

REVISED

REV	DESCRIPTION	BY	DATE
A	REDRAWN ON CAD	R.L.T.	27 OCT 94



NEVER !!!

1. REDUCE OUTLET SIZE
2. REDUCE INLET SIZE
3. HANG ANY PIPING WEIGHT ON VALVE BODY
4. PLUG BONNET VENT
5. INSTALL VALVES BETWEEN BOILER AND SAFETY VALVE

PEP BOILER

SAFETY VALVE PIPING
TYPICAL

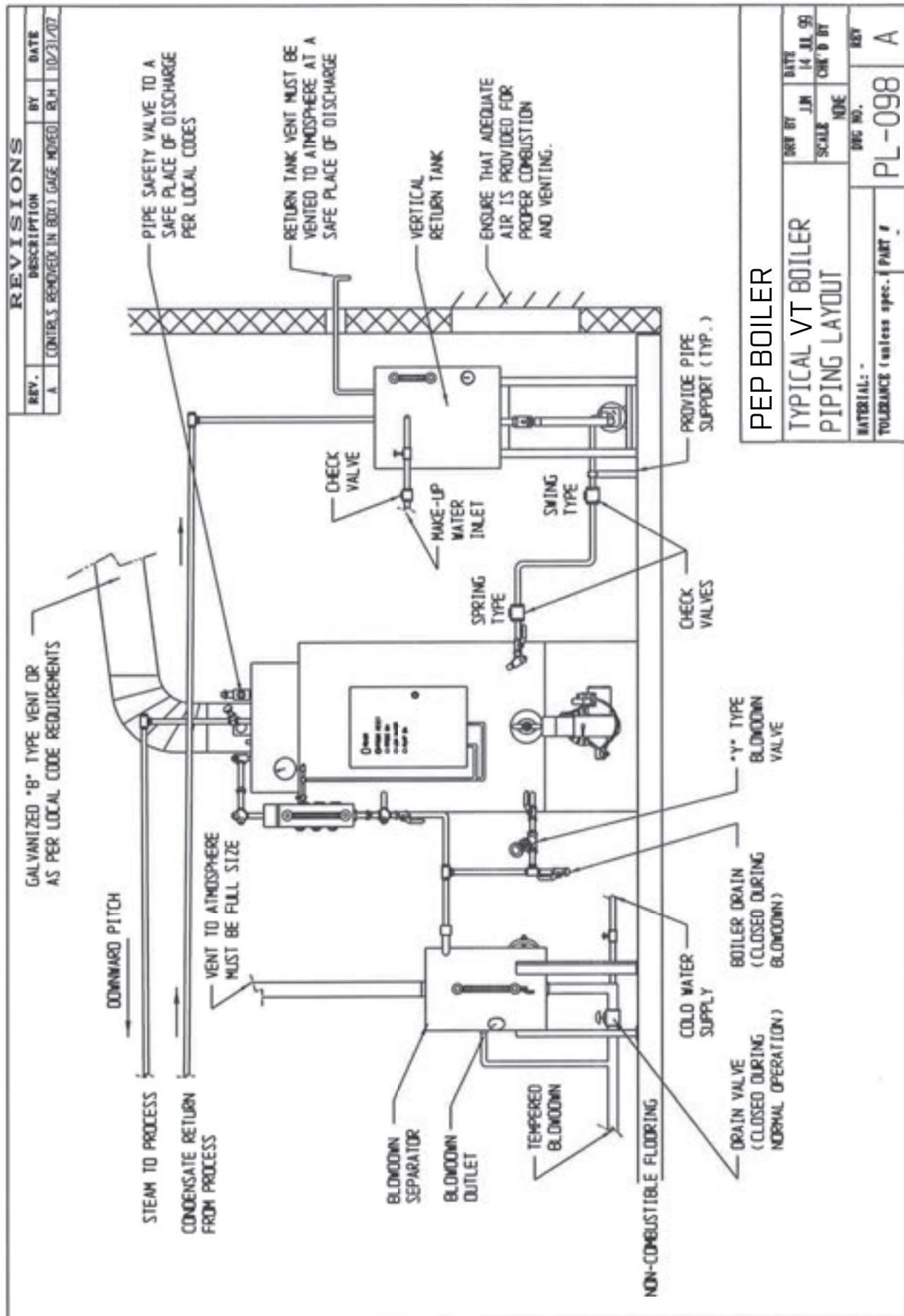
DRW BY R Tetley	DATE 27 OCT 94
SCALE 1/4 th	CHK'D BY

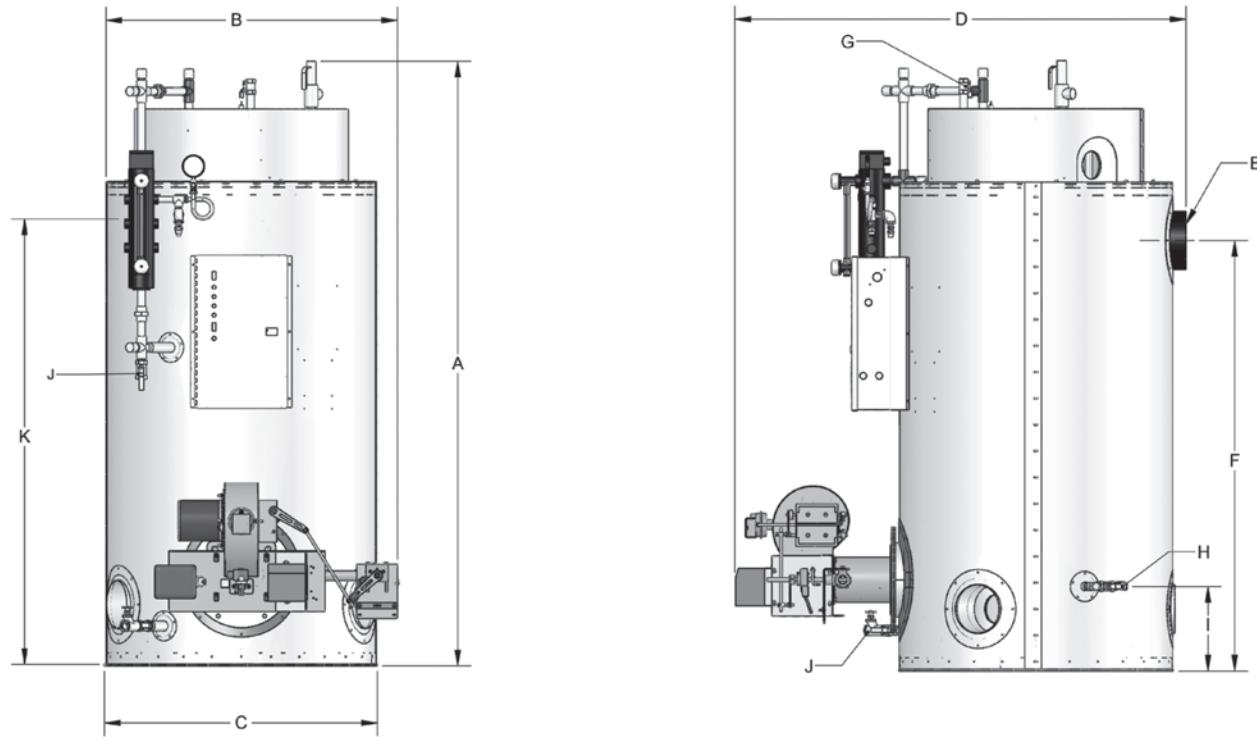
MATERIAL: -

TOLERANCE (unless spec.) PART #

DWG NO.

PL-049 A





VT SPECIFICATIONS AND DATA

MODEL NUMBER:	VT-10	VT-15	VT-20	VT-25	VT-35*	VT-50*	VT-60*
RATINGS							

Horsepower	9.5	15	20	25	35	50	60
Gas Input (BTU per hour)	399,000	630,000	840,000	1,050,000	1,470,000	2,100,000	2,520,000
Oil Input (Gals. per hour)	2.85	4.50	6.00	7.50	10.50	15.00	18.00
Output (BTU per hour)	320,000	504,000	672,000	840,000	1,176,000	1,680,000	2,016,000
Output (Lbs. steam per hour)	320	517	690	862	1207	1725	2070
Maximum Allowable Working Pressure	150	150	150	150	150	150	150
Water Capacity (Gals.)	52	70	86.5	110	140	240	414
Steam Release Surface Area	389 sq in	389 sq in	501 sq in	627 sq in	817 sq in	1402 sq in	1887 sq in
Hand Hole Sizes	(3)3x3-3/4	(3)3x3-3/4	(4)3x3-3/4	(4)3x3-3/4	(4)3x3-3/4	(4)3x3-3/4	(4)3x3-3/4

BOILER DIMENSIONS

A Boiler Height (includes piping)	72"	80"	82"	90"	96"	103"	103.75"
B Boiler Diameter (left to right, packaged including M & M)	34"	36"	39"	42"	43"	56"	63"
C Boiler Diameter (left to right, less trim & piping)	30"	34"	37"	40"	43"	56"	63"
D Burner to Flue Outlet (approx.)	56"	58"	59-1/2"	64"	71"	94"	96"
E Flue Outlet (diameter)	6"	8"	8"	10"	12"	12"	14"
F Flue Outlet to Floor (centerline)	48-1/4"	56-1/4"	57-1/4"	61-5/8"	69"	76-1/4"	77"
G Steam Outlet (IPS)*	1"	1"	1"	1-1/4"	1-1/4"	2"	3"
H Feedwater Inlet (IPS)	1/2"	1/2"	3/4"	3/4"	3/4"	1"	1"
I Feedwater Inlet to Floor (centerline)	6-1/2"	9-1/4"	11-1/4"	11-3/4"	13-1/2"	15-1/2"	16"
J Blowdown Outlet (IPS)	1"	1"	1"	1"	1"	1-1/4"	1-1/4"
K Normal Water Line to Floor	42"	59"	59-1/2"	67"	71-1/2"	81-1/2"	83-1/2"
Approx. Floor Space	3.25'x5.5'	3.25'x5.5'	3.25'x5.5'	4' x 6'	5' x 8'	6' x 10'	6' x 10'

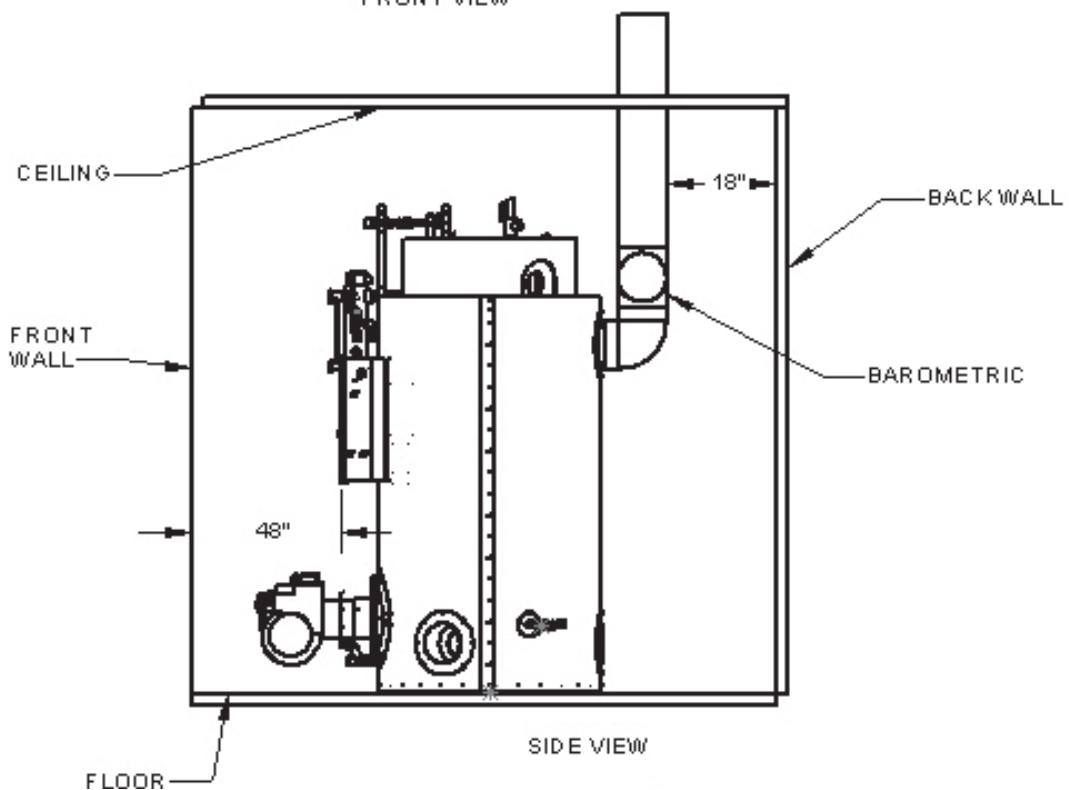
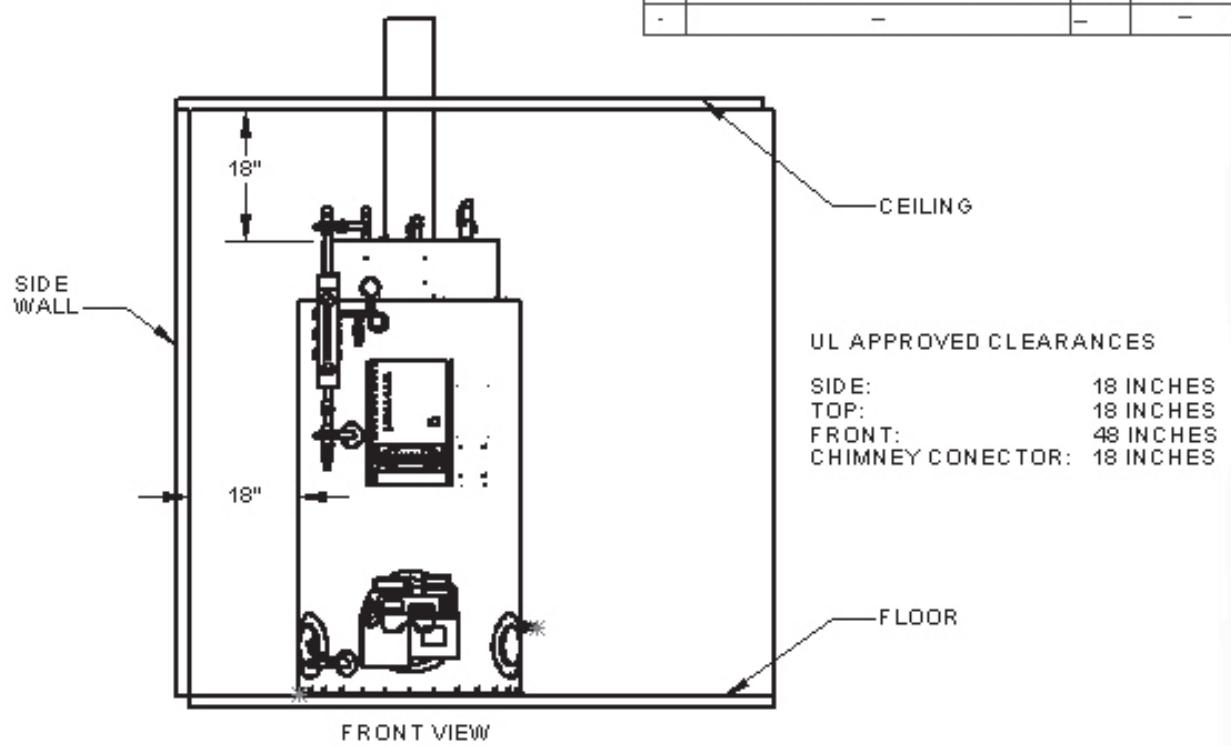
CRATED DIMENSIONS

Left to Right	41-1/2"	41-1/2"	44"	44"	45-1/2"	56"	63"
Front to Rear	67"	67"	72"	72"	77"	96"	98"
Height	86"	86"	95"	95"	95"	104"	105"
Approx. Shipping Wt. (skidded & crated)	1900 lb	2500 lb	3150 lb	3450 lb	4650 lb	6200 lb	7000 lb

VT BOILER/BURNER UNITS: Completely assembled, piped, wired & factory tested with steam pressure gauge, water level gauge, gauge cocks with ball checks, gauge glass protector, steam safety valve, steam supply ball valve, boiler and water column blowdown valves, hand hole inspection plate assemblies, feedwater inlet ball valve & check valve, jacket and 3" poured refractory insulation, water column with probe type low water cut-off and pump control, additional probe type low water cut-off with manual reset, steam pressure control, steam hi-limit pressure control with manual reset, feed pump motor contactor, and UL listed burner with safety and operating controls. CSD-1 approval is standard on all boilers.

*VT-35 skid base 45" x 75" *VT-50 skid base 56" x 84" *VT-60 skid base 63" x 92" VT Boilers built for 15 psi steam have 3" outlet

REVISIONS			
REV	DESCRIPTION	DATE	BY
-	-	-	-



BURNER START UP AND TEST INFORMATION: REQUIRED

For a new boiler start up, or for troubleshooting an existing installation, the following information is essential for effective service assistance.

Boiler Model _____ Serial No. _____ N.B. No. _____
Burner Model _____ Invoice No. _____ Serial No. _____
Installation Name _____ Start Up Date _____
Start Up Contractor _____ Phone No. _____
Name of Technician Performing Start Up _____
Fuel Type: Natural Gas LP Gas Fuel Oil (#2) Other _____

Gas Firing

Gas Pressure At Train Inlet Burner in Off Position _____ "W.C.	Flame Signal Readings Pilot _____	Stack Outlet Test Point Draft High Fire _____ "W.C.
Gas Pressure At Train Inlet High Fire _____ "W.C.	CO2 High Fire _____	Over Fire Draft High Fire _____ "W.C.
Gas Pressure At Main Orifice High Fire _____ "W.C.	CO High Fire _____	Net Stack Temperature High Fire _____ °F
Gas Pressure At Pilot Orifice _____ "W.C.	Measured INput Rate - BTU/HR High Fire _____ "W.C.	Gas Pressure At Pilot Orifice _____ "W.C.

Oil Firing

High Fire Vacuum Reading At Oil Pump Inlet _____ "H.G.	CO2 Low Fire _____ High Fire _____	Stack Outlet Test Point Draft Low Fire _____ "W.C. High Fire _____ "W.C.
Oil Nozzle Supply Pressure Low Fire _____ PSI High Fire _____ PSI	Bachrach Scale Smoke Number Low Fire _____ High Fire _____	New Stack Temperature Low Fire _____ °F High Fire _____ °F
Firing Rate - GPH Low Fire _____ High Fire _____	Over Fire Draft Low Fire _____ "W.C. High Fire _____ "W.C.	

Operational Check of Controls

Operating Limit _____ <input type="checkbox"/>	Aux LWCO _____ <input type="checkbox"/>	Flame Safeguard _____ <input type="checkbox"/>
Safety Limit _____ <input type="checkbox"/>	Low Gas Pressure _____ <input type="checkbox"/>	Ignition Failure <input type="checkbox"/>
Low Water Cut Off _____ <input type="checkbox"/>	High Gas Pressure _____ <input type="checkbox"/>	Flame Failure <input type="checkbox"/>

Comments

Pottstown Engineered Products, Inc.

Limited (Five-Year) Warranty For Commercial/Industrial Boilers

Effective July 15, 2024

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

LIMITED WARRANTY

Pottstown Engineered Products, Inc. ("PEP") hereby warrants to the original consumer purchaser ("purchaser") that the pressure vessel of its Commercial/Industrial boilers models LE, WLE, VT, MPH and WHE, are free from defects in materials and workmanship, and if such pressure vessel proves to be so defective within five (5) years of the date of installation, PEP shall, at its option, furnish a replacement for, or repair such pressure vessel, provided PEP is notified of the defect within thirty (30) days of the discovery of such defect. Purchaser's remedy shall be limited to such repair or replacement. Adjustment Policy: In the event that a pressure vessel is found to be defective one year or more following installation and is replaced by PEP, the purchaser shall pay a proportionate charge for the time the defective pressure vessel has been in service based upon a percentage of the list price of such vessel at the time PEP is notified of the defect as follows: 2nd year - 30%, 3rd year - 40%, 4th year - 50%, and 5th year - 60%.

THIS SHALL BE THE BUYER'S EXCLUSIVE REMEDY.

PEP SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM BREACH OF THIS OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.

PRODUCTS COVERED BY THIS WARRANTY

This warranty is applicable only to the pressure vessel of those models of Commercial/Industrial boilers specified above that are installed in accordance with the basic BOCA Building Code and local statutes or ordinances, whichever shall be more restrictive. This warranty shall not apply to components of other manufacturers such as controls, instantaneous tankless heaters, burners, and other accessories, used or incorporated by PEP. **ALL IMPLIED WARRANTIES RELATING TO SUCH COMPONENTS, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED. ANY IMPLIED WARRANTY RELATING TO THE PRESSURE VESSEL COVERED BY THIS LIMITED WARRANTY, INCLUDING THAT OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL BE LIMITED TO THE PERIOD OF THIS LIMITED WARRANTY.**

Some states do not allow limitations on how long an implied

warranty lasts, so the above limitation may not apply to you.

Some states do not allow the exclusion or limitations on relief such as incidental or consequential damages, so the above limitation or exclusion may not apply to you.

PURCHASER RESPONSIBILITIES

This limited warranty shall not apply and PEP shall have no obligation thereunder unless the card attached hereto is completed and mailed to PEP within thirty (30) days from the date of installation.

In the event the original consumer purchaser believes that there is a defect in material or workmanship of the pressure vessel, he shall, within thirty (30) days of the discovery of the defect, notify PEP, in writing. PEP or its authorized representative will inspect the pressure vessel to determine whether a defect exists and recommend repair or replacement if necessary under the terms of the warranty. If PEP determines that no such defect exists, purchaser may still pursue its remedies by commencing a civil action, but must do so **WITHIN ONE (1) YEAR AFTER THE CAUSE OF ACTION HAS ACCRUED**. Some states do not allow this one year limitation, so it may not be applicable to you.

This warranty does not cover expenses for removal or reinstallation. The Purchaser shall be responsible for the cost of removing the defective pressure vessel and reinstalling the replacement vessel including freight, labor and material connected therewith. Upon request of PEP, it shall be the obligation of the purchaser to ship pre-paid to PEP the defective pressure vessel for inspection or repair.

This limited warranty is applicable only to defects in material and workmanship and shall not cover failure of the pressure vessel due to any other reason including, but not limited to (a) lack of water, (b) freezing, (c) floods, (d) fire, (e) acts of God, (f) negligent or improper operation or installation, (g) corrosion of tubes or plates, (h) mud or scale accumulation, (i) leaky gaskets, (j) improper water conditioning, (k) improper maintenance of external and fireside surfaces.

A Start-Up Report detailing combustion analysis and draft measurements is required for all warranty claims.

POTTSTOWN ENGINEERED PRODUCTS, INC.

390 Old Reading Pike, Pottstown, PA 19464

Telephone 610-323-3477

July 15, 2024

Manufactured in the USA by
Pottstown Engineered Products, Inc.
390 Old Reading Pike, Pottstown, PA 19464
(610) 323-3477 • FAX (610) 323-3977
www.pepboiler.com