

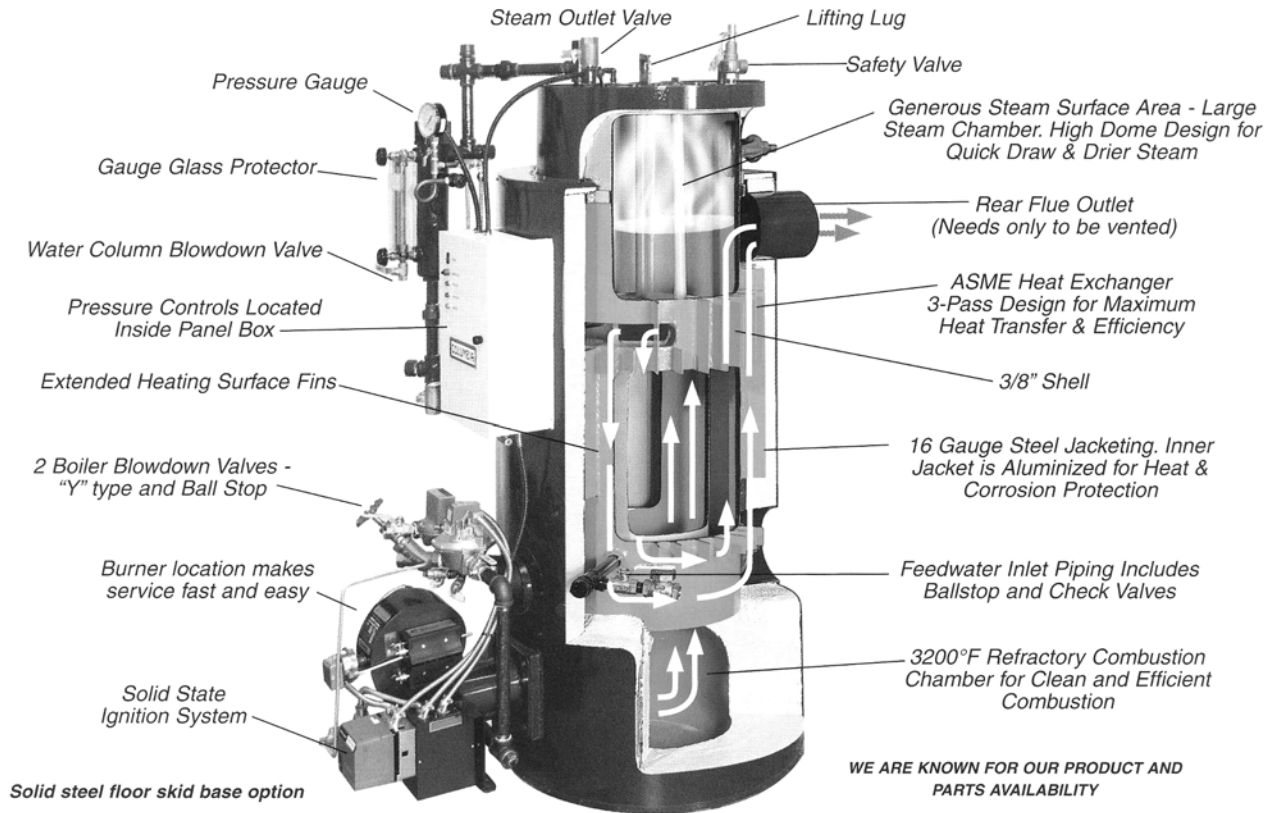


# CT SERIES BOILERS

CT-6 CT-10 CT-15 CT-20  
CT-25 CT-35 CT-50

**INSTALLATION, OPERATION and  
MAINTENANCE MANUAL**

**COLUMBIA BOILER COMPANY**  
POTTSTOWN, PENNSYLVANIA



**CT BOILER WITH PARTIAL SECTION**

*Figure 1*

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# IMPORTANT

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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. **NOTE:** The CT Boiler is not designed for continuous, nonstop operation. Normal burner cycling is required. Continuous operation will eventually damage the boiler, voiding the warranty.
6. Wrapping the CT Boiler with insulation will cause the boiler to overheat, voiding the warranty.

# LIMITED PARTS WARRANTY

The Columbia Boiler company (hereinafter Columbia) 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 installation or 18 months from the date of manufacture, whichever date occurs first, and is subject to warranty approval by the manufacturer of the specific components. This warranty does not extend to equipment subjected to misuse, neglect, accident or improper installation. 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. Motors, fuel units, controls, and transformers should be sent for repair or replacement to an authorized service point or distributor of the manufacturer of such component when reasonably available in Customer's locality.
- b. Where such local service is not available with respect to the above listed components, or where other components are involved, such defective equipment should be returned after receiving authorization from your dealer, freight prepaid, to the Columbia Boiler Co., 390 Old Reading Pike, Pottstown, PA 19464. The use of Columbia returned goods form is mandatory when returning defective material.
- c. Columbia is not responsible for any labor cost for the removal and replacement of equipment.
- d. Equipment which is repaired or replaced will carry a warranty equal to the unexpired portion of the original equipment warranty.
- e. If inspection by Columbia does not disclose any defect covered by this warranty, the equipment will be repaired or replaced at the expense of the Customer, and Columbia's regular charges will apply.

**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 COLUMBIA BOILER CO. BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.** Columbia neither assumes nor authorizes any person to assume for Columbia any other liability or obligation in connection with the sale of this equipment. Columbia's liability and Customer's exclusive remedy being limited to repairs or replacement as set forth above.

## SERVICE POLICY

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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**

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# INSTALLATION

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The Columbia Model CT 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

The CT series boilers are pressure fired steam boilers, and need only to be properly vented. Consult the factory for proper venting of the boiler for any unusual conditions that may exist at the job-site.

For boilers vented into a chimney, be certain the chimney is clean, and clear of obstructions. Connect the boiler flue outlet to the chimney using galvanized flue pipe. 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. 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.

Columbia Boiler approves the use of galvanized "B" type vent that is suitable for 550°F stack temperature as proper and safe for this application, but any and all codes take precedence.

<b>BOILER</b>	<b>PROPER FLUE PIPE SIZE</b>
CT-6	6"
CT-10	6"
CT-15	8"
CT-20	8"
CT-25	10"
CT-35	12"
CT-50	12"

### **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 five inches water column for the CT-6 and CT-10, and seven inches water column for the CT-15, CT-20, CT-25, CT-35 and CT-50. 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	CT-6	CT-10	CT-15	CT-20	CT-25	CT-35	CT-50
NATURAL	252	399	630	840	1050	1470	2100
PROPANE	101	160	252	336	420	735	840

**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.

**WARNING: 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.

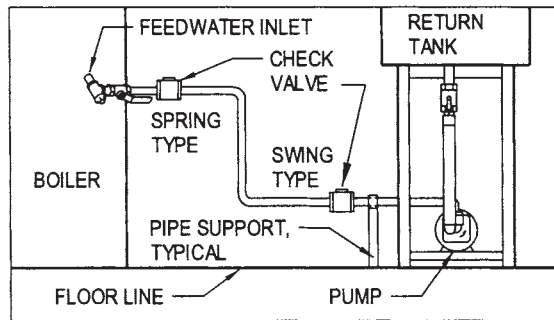
All disconnects should provide overload protection to prevent injury to personnel or damage to equipment.

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. Columbia Boiler Company 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.



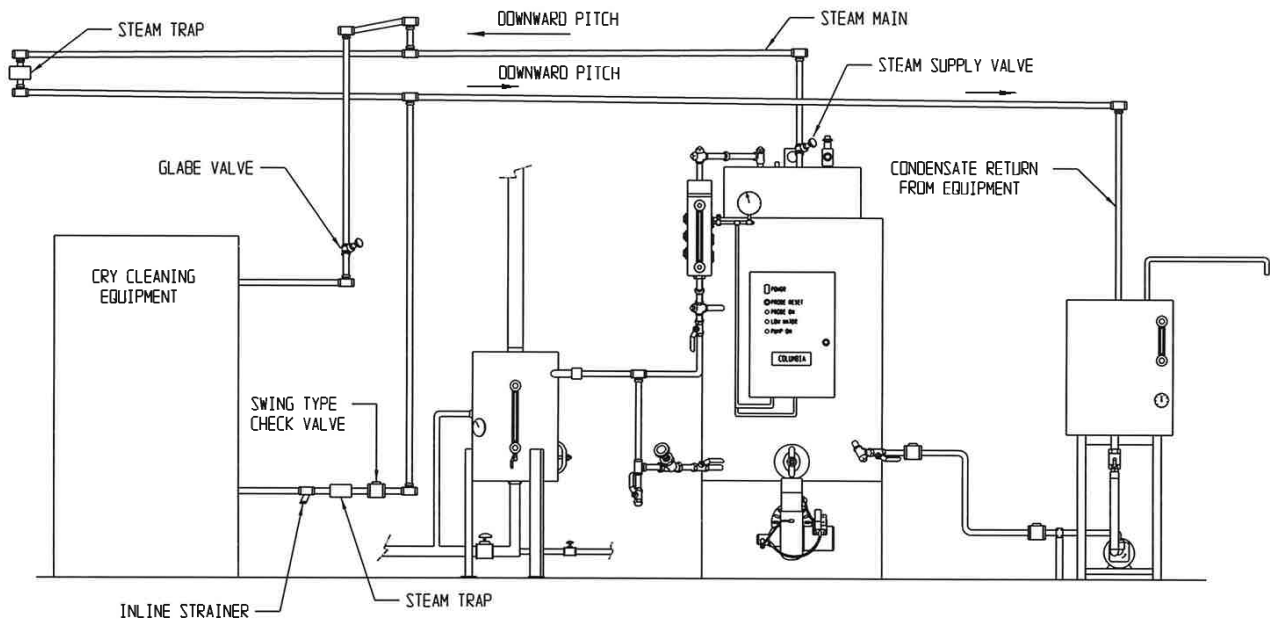
FEEDWATER PIPING

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.

**WARNING: 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.

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.

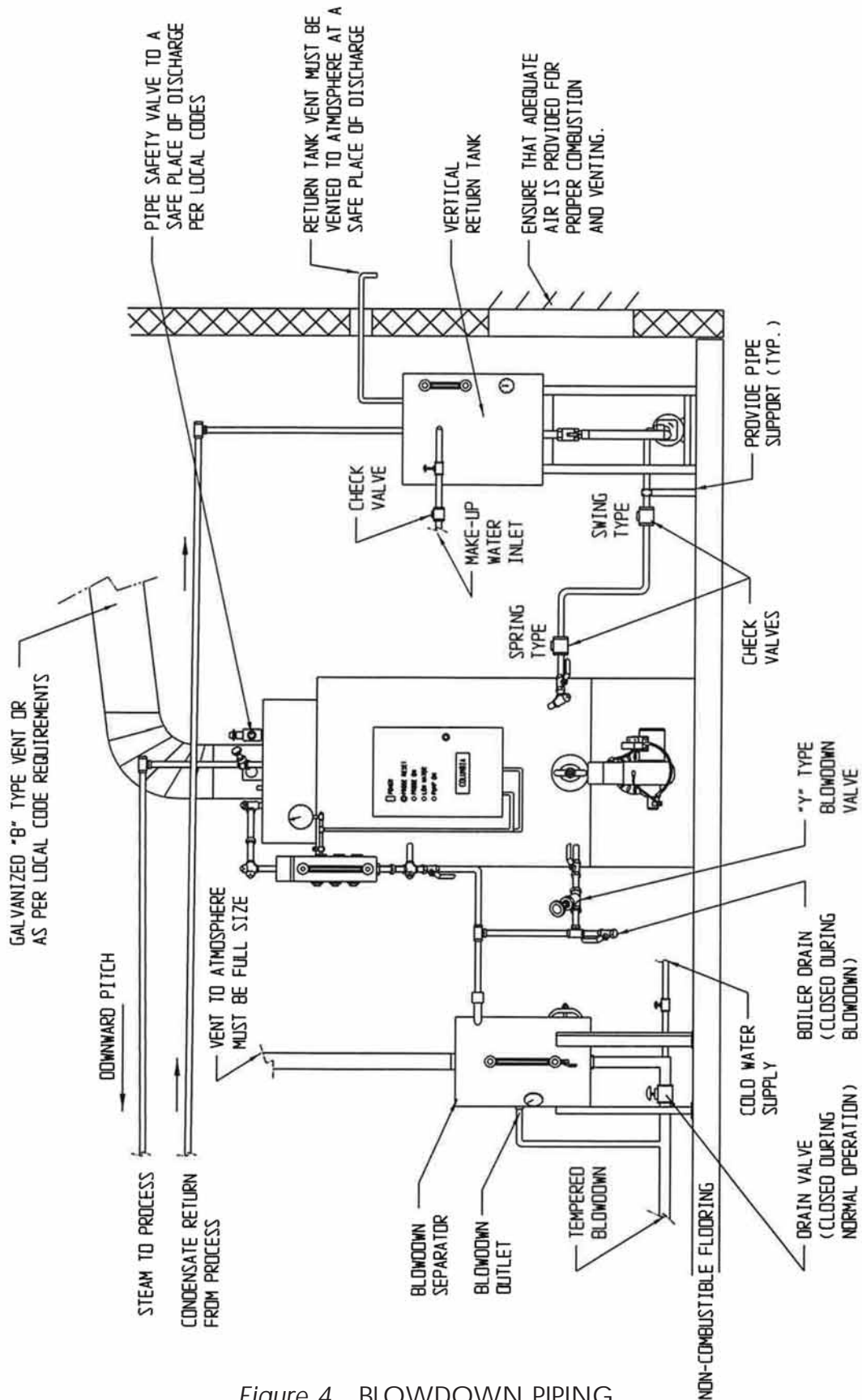


Figure 4 BLOWDOWN PIPING

FM-148 COLUMBIA BOILER COMPANY, REV 6-06

# CLEANING AND FILLING A NEW STEAM BOILER

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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.

**CAUTION: 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.

<b>BOILER MODEL</b>	<b>EQUAL AMOUNTS CAUSTIC SODA AND TRISODIUM PHOSPHATE</b>
CT-6	5 1/3 oz.
CT-10	8 oz.
CT-15	12 oz.
CT-20	1 lb.
CT-25	1 lb. 4 oz.
CT-35	1 lb. 14 oz.
CT-50	4 lbs. 9 oz.

# OPERATING THE BOILER

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**NOTE:** Although your new Columbia 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 Columbia boiler company CT 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, carbon dioxide or oxygen analyzer, carbon monoxide tester, smoke gun, and stack thermometer.

## **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.**

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.

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

**NOTE:** 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.

**NOTE:** Combustion efficiency must be checked at this time. See the burner manufacturer's instructions for correct settings and more detailed information.

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

**NOTE:** New CT 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.



## GAS BURNERS

BOILER MODEL	BURNER	NATURAL GAS ORIFICE SIZE AND ORIFICE PRESSURE (INCHES WATER COLUMN)	LIQUID PROPANE GAS ORIFICE SIZE AND ORIFICE PRESSURE (INCHES WATER COLUMN)
CT-6	POWER FLAME JR15A-10	5/16 (.313) / 3.5"	"D"(.242) / 3.5"
CT-10	POWER FLAME JR15A-10	3/8 (.375) / 3.5"	19/64 (.297) / 3.5"
CT-15	POWER FLAME JR15A-10	15/32 (.469) / 3.5"	"T"(.358) / 3.5"
CT-20	POWER FLAME JR30A-12	9/16 (.563) / 3.5"	15/32 (.469) / 3.5"
CT-25	POWER FLAME JR30A-12	23/32 (.719) / 3.5"	1/2 (.500) / 3.5"
CT-35	POWER FLAME JR50A-15	11/16 (.688) / 3.5"	19/32 (.594) / 3.5"
CT-50	POWER FLAME JR50A-15	None x 3.5"	25/32 x 3.5"

### 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

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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

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

## Oil Firing

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

## Operational Check of Controls

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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

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# OPTIONAL SIDEWALL VENTING (and Combustion Air intake)

## Installation Instructions

### General

This section provides instructions for the installation of UL listed Gas-Fired Boiler Assemblies with Side Wall Venting and Combustion Air intake Assemblies, MEA number 15-95-E. 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.

### Equipment (Available with Power Flame Burners Only)

Note: All Columbia boilers ordered for Sidewall Venting will be provided with a Combustion Air Intake Adapter.

- CT-6 Boiler with Power Flame JR15A-10 Burner
- CT-10 Boiler with Power Flame JR15A-10 Burner
- CT-15 Boiler with Power Flame JR15A-10 Burner
- CT-20 Boiler with Power Flame JR30A-10 Burner
- CT-25 Boiler with Power Flame JR30A-12 Burner
- CT-35 Boiler with Power Flame JR50A-15 Burner

BOILER MODEL	VENT SIZE DIAMETER (INCHES)	INTAKE SIZE DIAMETER (INCHES)
CT-6	6	6
CT-10	6	6
CT-15	8	6
CT-20	8	6
CT-25	10	6
CT-35	12	8
CT-50	NOT UL OR MEA APPROVED FOR THIS OPTION	

### Vent Caps

Use only UL listed vent caps for the combustion vent termination and the combustion air intake. The following vent cap model is shipped with your boiler when the direct vent option kit is ordered.

Heat-Fab Incorporated  
 38 Haywood Street  
 Greenfield, MA 01301  
 (800) 772-2356

**“Saf-T CI Vent Rain Cap”**

## Installation

The Columbia Model CT Direct Vent Series Steam Boiler is furnished completely piped, wired, and assembled. It has been test fired at the factory and is ready for installation. This steam boiler is designed to operate with natural gas, and is suitable for standard AC electrical service. The CT Series requires the following minimum clearances to combustible material: top, sides, and rear - 18", front - 36", flue vent duct - 18".

## Location

The CT boiler must be mounted on a level non-combustible floor, or the floor must be protected in accordance with the requirements of accepted building code practices. In the absence of local codes, it is suggested that NFPA-31 section 4-4.1.5 be followed.

## Flue Vent Duct

For direct venting, galvanized smoke pipe is acceptable, but local codes take precedence. The maximum length of flue vent duct allowed is 40 feet, and at no time can the diameter of the flue vent duct be less than the diameter of the smoke outlet of the boiler, see Table on the previous page for size. The flue pipe should be sloped upward 1/4" per horizontal foot of run. All sections of flue pipe should be joined and fastened securely with sheet metal screws. The maximum number of 90° elbows in the flue vent duct is four. A barometric swing type draft regulator may be installed in the flue vent duct if desired, but is not necessary.

The vent must end with the UL listed vent cap that was shipped with your boiler. The vent cap can be installed either horizontally (Figure 5-A below) or vertically with a tee (Figure 5-B below). It is suggested that a screen or vent pipe plug be inserted into the bottom of the tee to prevent animals and other matter from entering.

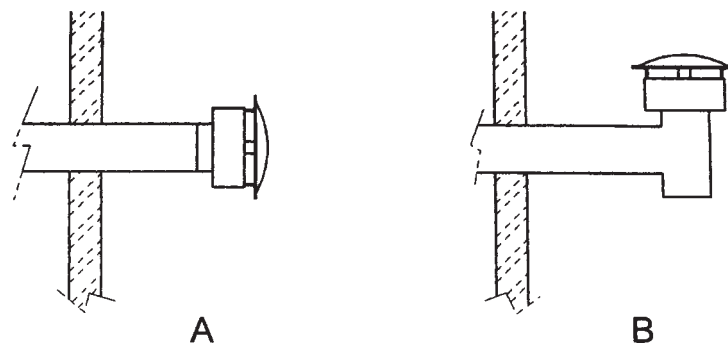


Figure 5

All through the wall connections must adhere to safety standards set forth by standard building practices and local codes. In the absence of local codes, UL listed wall thimbles and through the wall connectors should be used.

The combustion vent cap must extend a minimum of four feet from the building, and must be located as far from the combustion air intake as possible. The combustion vent must terminate a minimum of seven feet above the ground where pedestrian traffic can be expected. It shall also terminate at least three feet above any forced air inlet within ten feet, and shall terminate at least four feet below or four feet horizontally from, or one foot above and two feet horizontally from, any door, window, or gravity air inlet into any building as provided in the National Fuel Gas Code NFPA 54. See Figure 6. **Both the Combustion Flue Vent and the combustion Air Intake must be in the same wall.**

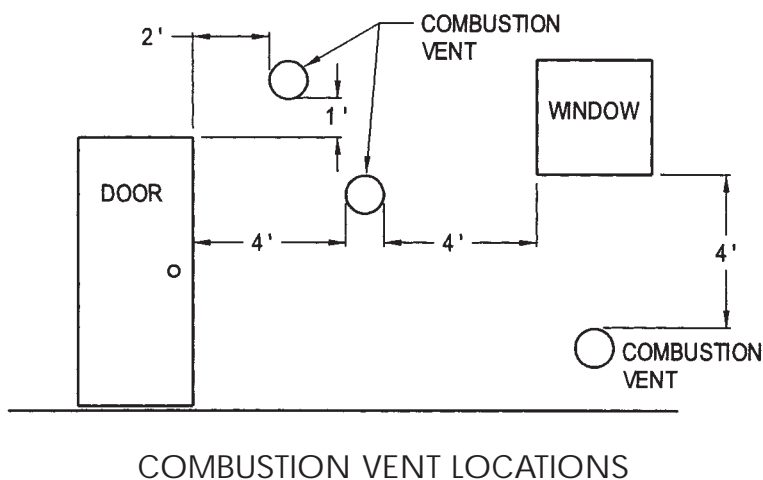


Figure 6

### Combustion Air Intake

The air for combustion must be ducted directly to the burner intake and must terminate outside with the applicable Intake Air cap listed in the Table on page 15. The vent cap can be installed either horizontally or vertically in conjunction with a tee. It is suggested that a screen or vent pipe plug be inserted into the bottom of the tee to prevent animals and other matter from entering. The maximum length of combustion air intake duct shall be 40 feet. The combustion air intake shall be full size for the complete run and shall not have more than four 90° elbows. The combustion air intake cap must be at least one foot off the ground in an area that is always free from obstructions. **The Combustion Air Intake must be in the same wall as the Combustion Vent.**

**Important Note: Surface discoloration of the building may occur due to improper boiler/burner adjustment and maintenance. Columbia Boiler Company will not accept any liability for such discoloration.**

# BOILER ROOM

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## 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.

**WARNING: 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 CT 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.

**Columbia Boiler Company 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)
<b>6</b>	252,000	126	12 X 12	14
<b>9.5</b>	399,000	210	15 X 15	18
<b>15</b>	630,000	315	18 X 18	20
<b>20</b>	840,000	420	2 X 21	24
<b>25</b>	1,050,000	525	23 X 23	26
<b>35</b>	1,470,000	735	28 X 28	32
<b>50</b>	2,100,000	1050	33 X 33	38

#### 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.

**WARNING: 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**

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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.

### **PANEL BOX WITH WARRICK SERIES 3K ELECTRODE FITTING**

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The standard control circuit for the CT 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 the Warrick Series 3K Electrode fitting which houses the three probes used for the primary low water cut off and pump control, the Honeywell L404A Operating Pressure control, the Honeywell L404C Safety Limit Pressure Control, and a 0-300 psi pressure gauge.

### **DESCRIPTION OF PANEL BOX COMPONENTS**

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#### **Warrick Series DF (Dual Function)**

The boiler water level control consists of the Warrick Series DF (Dual Function) combination low water cut-off and pump control. The Series DF 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.

The three probe lengths in the Series 3K are:

A - High Probe	-	6.0"
B - Low probe	-	7.5"
C - LWCO Probe	-	9.0"

Boilers built before September 2006 will have 2" longer probes.

The Warrick Series DF Control will reset automatically after a Low Water Cut Off. If preferred, a normally closed, Manual Reset push button is available as an option.

Electrical contact ratings for the Warrick Series DF Control are 10 amps at 120 volts.

#### **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 Warrick Series DF Low Water cut Off and Pump Control. A Motor Starter also provides electrical overload protection for the feedwater pump motor.

A Motor Contactor is provided as standard equipment on the CT-6 thru CT-25 Boilers, and a Motor Starter is provided as standard equipment on the CT-35 and CT-50 Boilers.

### **Warrick Series 26 Probe Type 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 Series DF 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 Warrick Series DF. See drawing CT-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).

**NOTE: 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**

The operating pressure consists of a pressure actuated switch with an adjustable differential. 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

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### **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

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## 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 Pressuretrol.
2. Check high limit Pressuretrol.
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.

## 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.

**WARNING: 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 tub 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 n 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.**

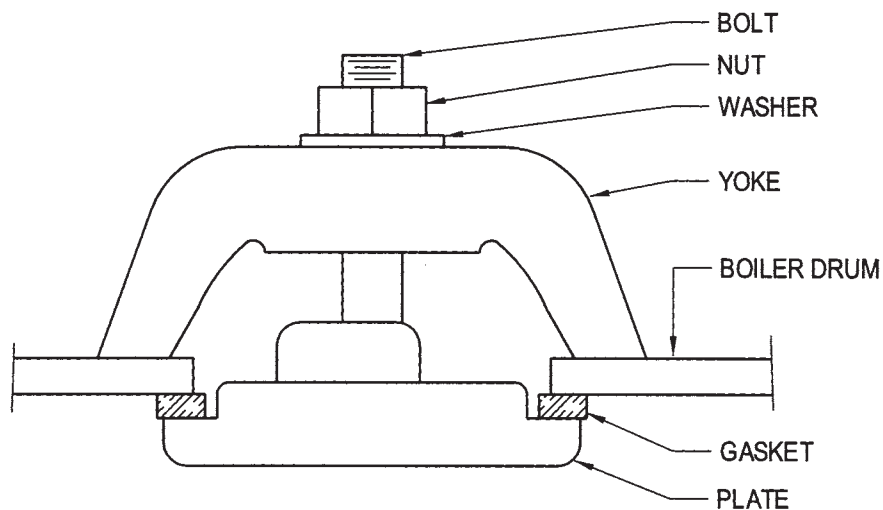
The Warrick Series DF Low Water cut Off & Pump Control should be blown down at least once each day when the boiler is in operation. This is essential to flush accumulation of sediment from the float chamber. Failure to do so will result in the failure of the control to shut off the burner on low water. 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 basket 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

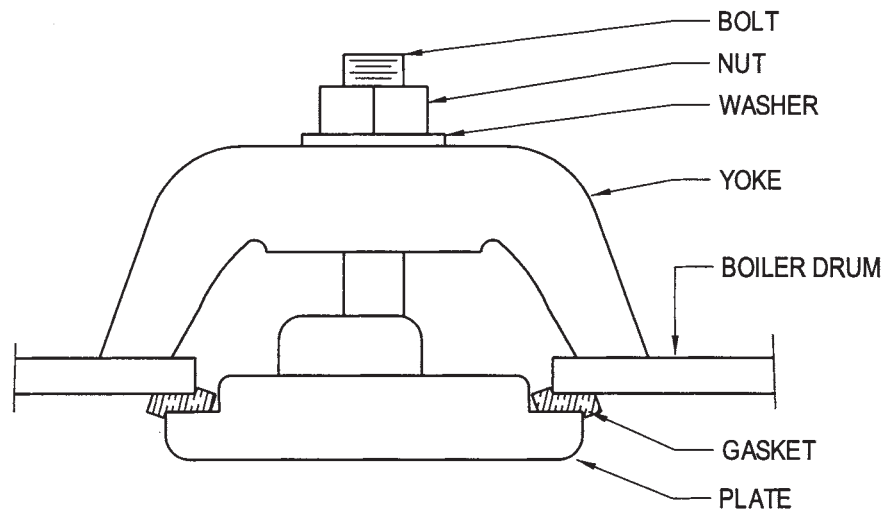
*Figure 7*

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.

**WARNING: 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 poor combustion has been experienced and soot has built up on the flue passages they can be cleaned following this procedure. 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 gasses 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.



Millboard top gasket part numbers:

<b>CT-6</b>	332200	<b>CT-10</b>	332210	<b>CT-15</b>	332220	<b>CT-20</b>	332225
<b>CT-25</b>	332230	<b>CT-35</b>	332232	<b>CT-50</b>	332233		

### **Disassembly, Cleaning and Assembly Instructions**

1. Obtain a top refractory millboard ring from your local supplier before attempting to look inside the flue passages.
2. Take off the top jacket by removing the three screws that connect it to itself and the four screws that connect it to the top cover small mounting angles. Set the top jacket and the fiberglass insulation strip found behind it to the side.
3. Scribe or mark a line on the outer jacket and top cover to aid in aligning the top cover during reassembly. This is important to assure that the screw holes will line up later.
4. Remove the sheet metal screws around the outside of the top cover and save for reassembly.
5. Remove the upper hand hole assembly if your boiler was manufactured after February 1991.
6. Lift the top and place as far up and out of the way as possible. The piping and electrical connections do not have to be disconnected but the top ring will not come all the way off.
7. Remove the millboard refractory ring.
8. The flue passages should now be visible and can be cleaned as desired. It is suggested that the soot be brushed down to the bottom and vacuumed out by pushing a long hose or pipe down between the baffles.
9. Clean the baffle area as desired.
10. Place the new millboard refractory ring in place of the old one and seal between the sections and any other small openings with a small amount of furnace cement or high temperature caulk.
11. Place the top jacket back over the millboard making sure to line up the marks made in Step #3 above.
12. Reinstall the sheet metal screws in the top cover, starting at one side and working around the boiler. The use of a pry bar is suggested to pull the outer edge down far enough to line up the holes.
13. Replace the gasket on the hand-hole plate (see previous pages of part number and instructions), and reinstall the top hand hole assembly.
14. Reinstall the top jacket fiberglass insulation strip. Replace this insulation strip with a new one if necessary.
15. Reinstall the top jacket and secure it to the top cover and to itself with the seven (7) screws that were removed.

# MAINTENANCE LOG

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# MAINTENANCE LOG

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# TESTING OF BOILER COMPONENTS

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

## Warrick Series DF 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 high 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-MI** and **TH2-M2** signifies the boiler feed pump circuit is energized, signifying the pump is attempting to fill the boiler.

### Warrick Series 26 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.

## **Danfoss 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.

## **Danfoss 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 mercury switch should rock over such that continuity is now broken and the manual reset switch should open.
4. Decrease the pressure in the boiler. The mercury switch should rock back 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

**WARNING: 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.

## Honeywell S8600 Series Intermittent Pilot Modules - Gas Fired Units

The following is a list of tests that may be required. For more information see Honeywell publication form number 68-0085-2 (Rev 12-89), located in the appendix of this manual.

Pilot turndown test  
Flame failure test  
Power failure test

The S8600 Series control is used to prove a pilot flame. This test insures that the main burner flame can be lit by the smallest pilot flame that will prevent loss of pilot shut down.

1. Shut off the main fuel supply to the burner by closing the manual main burner shut off cock. **Do not shut off fuel supply to the pilot valve.**
2. Connect a Honeywell W136A tet meter, or equivalent microammeter, in series with the flame rod. Connect a standard electrical meter, set for 24 volt range, to terminals MV-MV on the control.

3. Start the burner. After the prepurge is complete, the pilot will light and indicate between 1-1/2 and 4 microamps. The main gas valve should try to open and indicate power between terminals MV-MV.
4. Reduce the size of the pilot flame to the turndown position by slowly closing the manual valve on the pilot gas line. At the turndown condition, the pilot will be small enough so it just barely causes the main gas valve to open (about 1 to 1-1/2 microamps.).
  - a. slowly turn down the pilot until the main gas valve will not open and the burner shuts down on flame failure. **NOTE: The burner motor will continue to run.**
  - b. Allow the burner to complete prepurge. If the control locked out, reset the control by depressing the reset switch for sixty seconds and restart the burner.
  - c. As the control attempts to restart the pilot, turn the pilot back up slowly until the gas valve tries to open.
  - d. Again turn the pilot down slightly but not enough so the flame drops out. If the relay drops out simply repeat step c above. If the control locks out allow the safety switch to cool, reset the switch, and repeat step c.
5. Check that the pilot is lit and the gas valve is trying to open.
6. Open the manual main burner gas cock. Main flame should light within one second. **If the burner does not light within one second, close the shutoff cock and shut off power to the relay.** Proceed to step 8.
7. If the burner lights, repeat step 6 a number of times to verify the light off. Proceed to step 10.
8. If the light off is unsatisfactory, readjust the flame detector to require a larger pilot flame to cause the main gas valve to open.
  - a. Adjusting the flame rod detector so that a larger minimum pilot flame is required by moving the flame rod farther from the grounding rods.
9. repeat the entire turndown test until the flame is established promptly in step number 6.
10. **Turn the pilot up to full flame** at the completion of the test.



### Flame Failure Test

1. Let burner operate normally for five minutes, then manually shut off the fuel supply to simulate flame failure.
2. The system should drop out and fuel valves should close.  
**NOTE: The burner motor will continue to run.**
3. Let the safety switch cool, reopen manual fuel valve, and reset safety switch.
4. Burner should start.

### Power Failure Test

1. Let the burner operate normally for five minutes. Simulate power failure by opening a line switch. All relays should drop out and the fuel valves should close.
2. After a minimum of five seconds, close the line switch.
3. The control should go through a normal operating cycle.

# WATER TREATMENT

---

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 10.5, and a maximum of 11.0 to prevent acidic corrosion of boiler tubes and plates, and to provide

for the precipitation of scale forming salts 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 gasses. Efficient aeration results in saturation of the water with oxygen.

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

Direct or mechanical removal of dissolved oxygen is done through the use of 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 deaerator 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 conductance can be used to measure the total dissolved solids in the boiler water and to serve as an accurate means for the control of solids through the use of 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.

In boilers the hardness of the water can cause the formation of scale and sludge or mud. The hardness must be removed in the makeup water to the return system. Total hardness should not exceed 50 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 mercury 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 50 PSI. Pressures in excess of this value must be reduced.

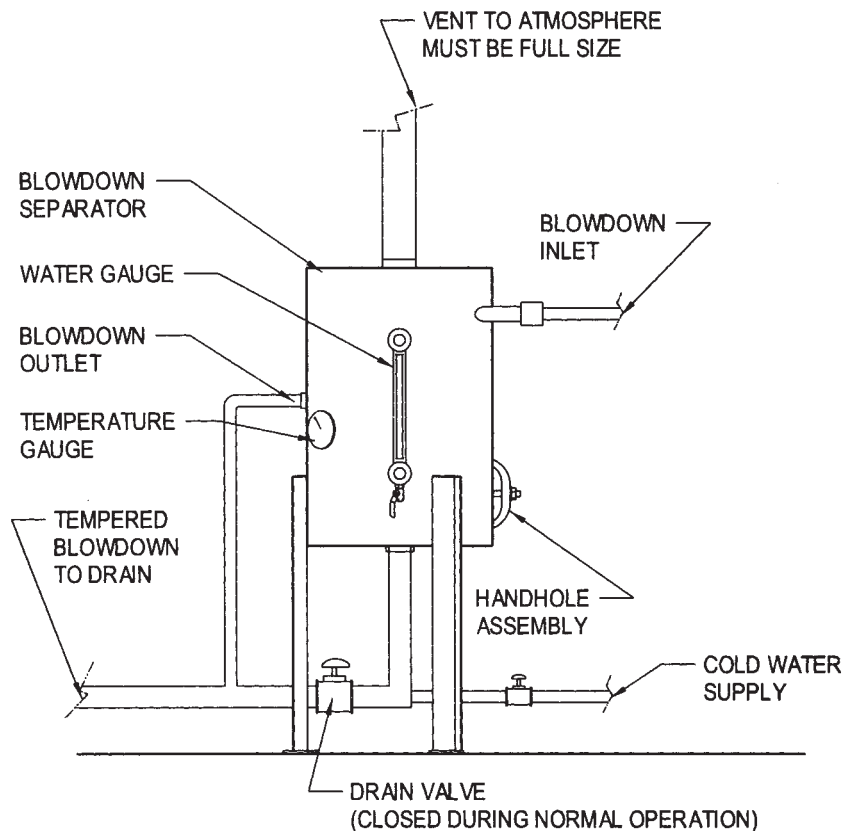
## BLOWDOWN SEPARATOR (Optional)

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

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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.

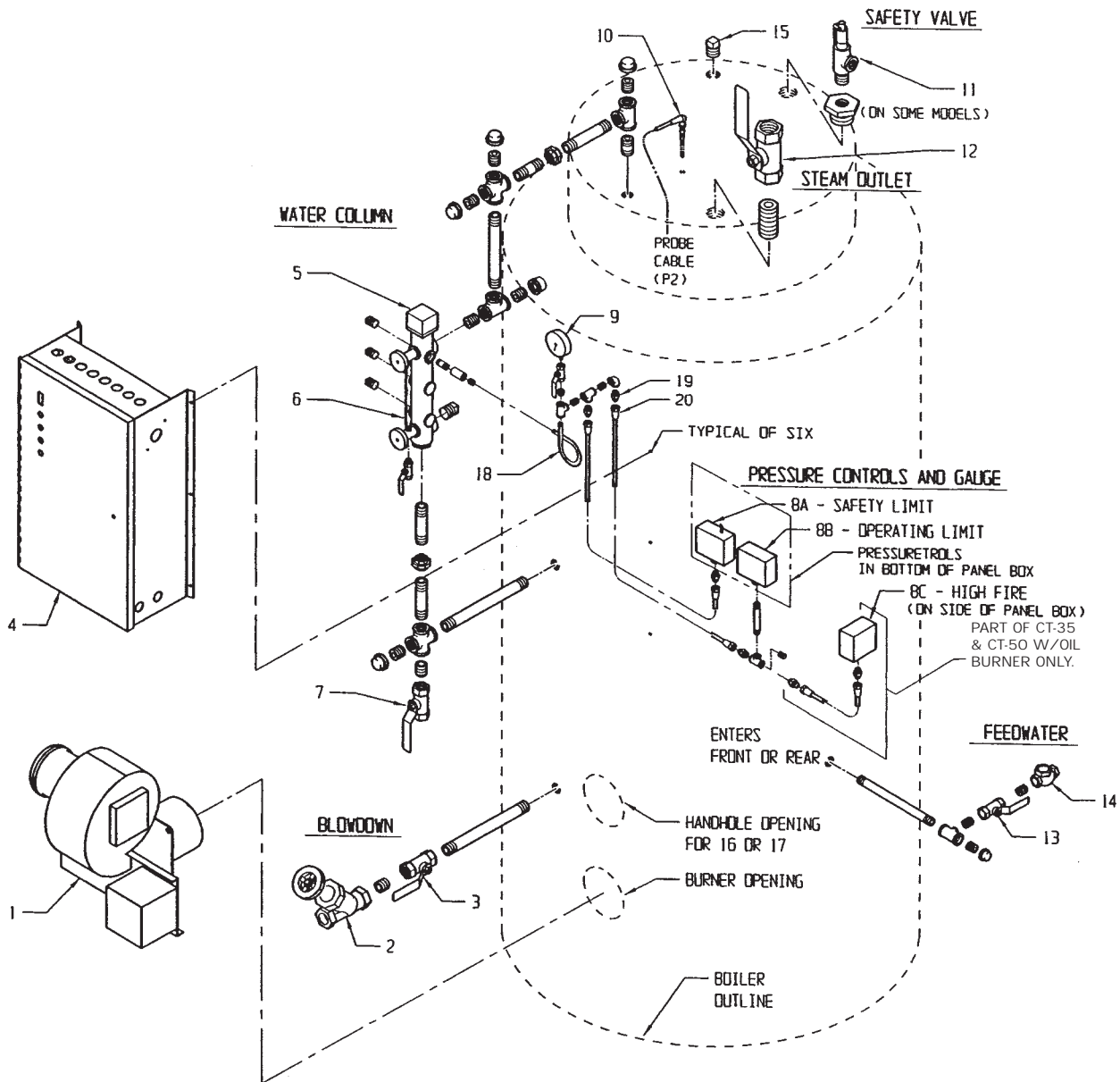
### **Fan motor runs but burner does not light.**

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.

# APPENDICES

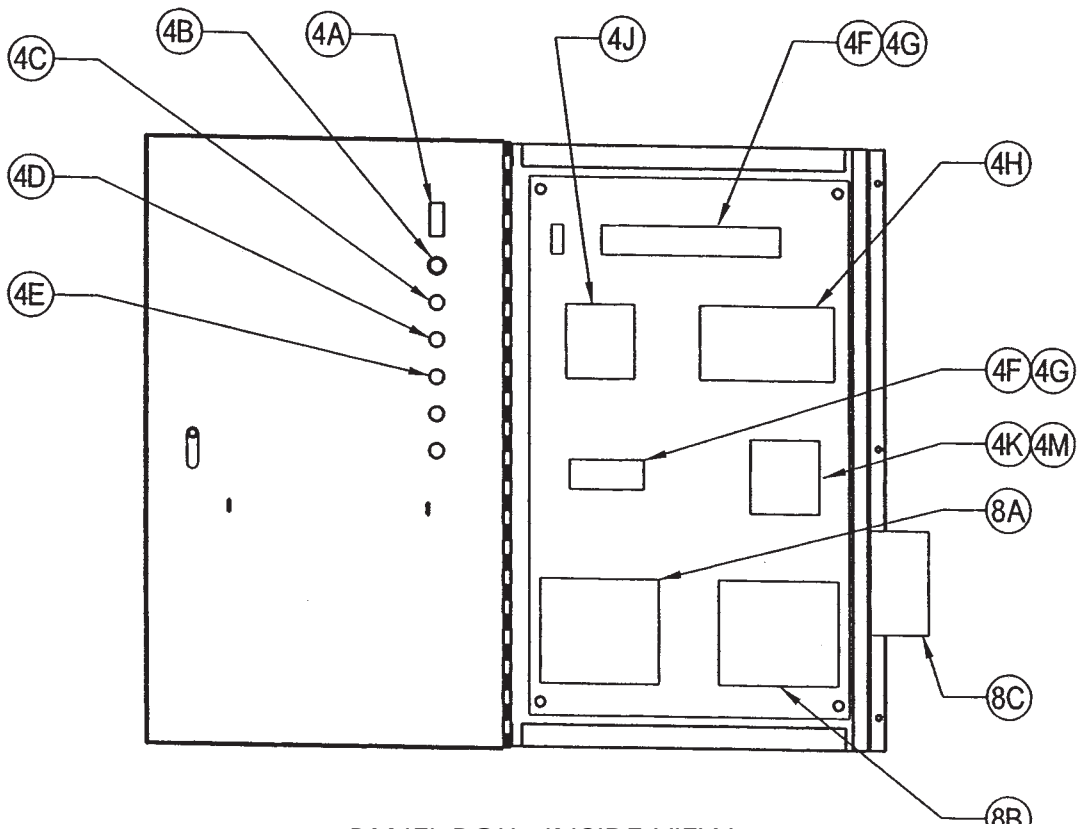




DWG. CT-545-A  
 FOR USE WITH REPLACEMENT PARTS LIST

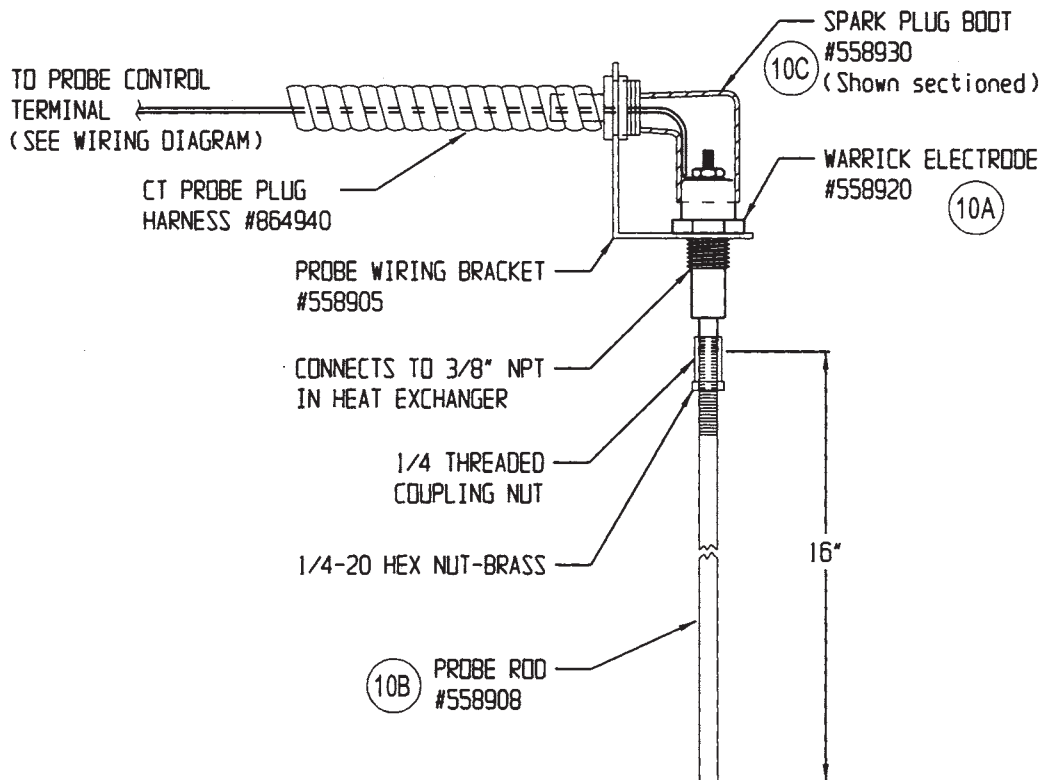
### REPLACEMENT PARTS FOR CT BOILERS

WITH PANEL-BOX & WARRICK DF LWCO,  
 WITH PRESSURECONTROLS IN/ON PANEL BOX



PANEL BOX - INSIDE VIEW

DWG CT-546-A  
FOR USE WITH REPLACEMENT PARTS LIST



WARRICK PROBE ASSEMBLY - CT SERIES

DWG. CT-415



# REPLACEMENT PARTS FOR CT SERIES BOILERS

150 PSI w/ Panel Box with Pressure Controls & Warrick LWCO/Pump Control

REF. No.†	DESCRIPTION	BOILER MODEL	ITEM NUMBER
1	BURNER – CONSULT FACTORY	ALL	SEE PARTS LIST
2	BOILER BLOWDOWN 1" Y-VALVE	ALL X/C CT-50	579005
	BOILER BLOWDOWN 1-1/4" Y-VALVE	CT-50	579006
3	BOILER BLOWDOWN 1" BALL VALVE	ALL X/C CT-50	570118
	BOILER BLOWDOWN 1-1/4" BALL VALVE	CT-50	570132
4	CONTROL PANEL-BOX (SEE DWG. CT-546)	CT-6 THRU CT-25	558850
	CONTROL PANEL-BOX (SEE DWG. CT-546)	CT-35, CT-50	558854
4A	SWITCH, "POWER" ON-OFF	ALL	558858
4B	SWITCH "PUSHBUTTON, "PROBE RESET"	ALL	558904
4C	LAMP ASSEMBLY "PROBE ON" (RED)	ALL	558860
4D	LAMP ASSEMBLY "LOW WATER" (RED)	ALL	558860
4E	LAMP ASSEMBLY "PUMP ON" (AMBER)	ALL	558862
4F	TERMINALS (SUPPLIED IN 3-TERMINAL UNITS)	ALL	558864
4G	TERMINAL BLOCK MOUNTING END	ALL	558866
4H	WARRICK DUAL FUNCTION CONTROL MODULE	ALL	558800
4J	WARRICK PROBE LWCO MODULE, 26C1C0-C	ALL	558885
4K	MOTOR CONTACTOR	ALL	558885
4M	MOTOR STARTER, 3-PHASE	CT-35, CT-50	901716
5	WARRICK LWCO & PUMP CONTROL	ALL	558840
5A	HIGH PROBE, "PUMP OFF", 8"	ALL	
5B	LOW PROBE, "PUMP ON", 9-1/2"	ALL	
5C	PRIMARY LOW WATER CUT-OFF PROBE, 11"	ALL	
6	WATER GAUGE SET	ALL	571020
6A	5/8" X 10-1/4" GAUGE GLASS	ALL	571090
6B	TRI-COCKS (3) – (OPTIONAL)	ALL	571080
6C	GAUGE GLASS PROTECTOR, LEXAN	ALL	966044
7	LWCO BLOWDOWN VALVE, 1" BALL VALVE	ALL	570118
8	PRESSURE CONTROLS		
8A	SAFETY LIMIT W/ MANUAL RESET	ALL	553615
8B	OPERATING LIMIT, KP36	ALL	553610
8C	HIGH FIRE, KP36	CT-35 & CT-50 oil only	553610
9	STEAM PRESSURE GAUGE, 0-300 PSI	ALL	559305
10	SECONDARY LOW WATER CUT-OFF PROBE ASSY. w/MANUAL RESET, WARRICK	ALL	(ALSO SEE "4J")
10A	SECONDARY LWCO PROBE PLUG	ALL	558920

# REPLACEMENT PARTS FOR CT SERIES BOILER

150 PSI w/ Panel Box with Pressure Controls & Warrick LWCO/Pump Control

REF. No.†	DESCRIPTION	BOILER MODEL	ITEM NUMBER
10B	SECONDARY LWCO PROBE ROD, 16"	ALL	558908
10C	SEC. LWCO RUBBER BOOT – PROBE PLUG	ALL	558930
11A	SAFETY VALVE, 150 PSI, 3/4" X 3/4"	CT-6 THRU –25	
11B	SAFETY VALVE, 150 PSI 1" X 1-1/4"	CT-35, CT-50	570420
12A	MAIN STEAM BALL VALVE, 3/4"	CT-6, CT-10	570110
12B	MAIN STEAM BALL VALVE, 1"	CT-15, CT-20	570118
12C	MAIN STEAM BALL VALVE, 1-1/4"	CT-25, CT-35	570132
12D	MAIN STEAM BALL VALVE, 2"	CT-50	570140
13A	FEEDWATER BALL VALVE, 1/2"	CT-6 THRU –15	570100
13B	FEEDWATER BALL VALVE, 3/4"	CT-20 THRU –35	570110
13C	FEEDWATER BALL VALVE, 1"	CT-50	570118
14A	FEEDWATER SPRING CHECK VALVE, 1/2"	CT-6 THRU –15	579150
14B	FEEDWATER SPRING CHECK VALVE, 3/4"	CT-20 THRU – 35	579160
14C	FEEDWATER SPRING CHECK VALVE, 1"	CT-50	579170
15	PLUG, 1-1/4" (FOR OPTIONAL SURFACE BLOWDN.)	ALL	328250
>>>	(SEE. DWG. CT-385 FOR ITEMS 16 & 17		
16	HANDHOLE ASSY. 3" X 4", COMPLETE	CT-6	970680
16A	PLATE, #35	CT-6	970610
16B	YOKE	CT-6	970650
16C	GASKET	ALL	480210
16D	BOLT, 5/8" – 11 C 3" SQ. HD.	CT-6	311150
16E	NUT, 5/8" – 11 HEAVY HEX	CT-6	310250
16F	WASHER, 5/8" FLAT, PLAIN	CT-6	312210
17	HANDHOLE ASSY. 3" X 3-3/4, COMPLETE	CT-10 THRU –50	970670
17A	PLATE, #36B	CT-10 THRU –50	970620
17B	YOKE	CT-10 THRU –50	970650
17C	GASKET	ALL	480210
17D	BOLT, 5/8" – 11 X 3" SQ. HD.	CT-10 THRU –50	311150
17E	NUT, 5/8" - 11 HEAVY HEX	CT-10 THRU –50	310250
17F	WASHER, 5/8" FLAT, PLAIN	CT-10 THRU –50	312210
18	SYPHON, 1/4", 90°	ALL	559312
19	BRASS FITTING, 1/4" NPT X 3/8" FLARE FITTING	ALL	322720
20	BRASS FITTING, 3/8" NPT X 3/8" FLARE	ALL	322750

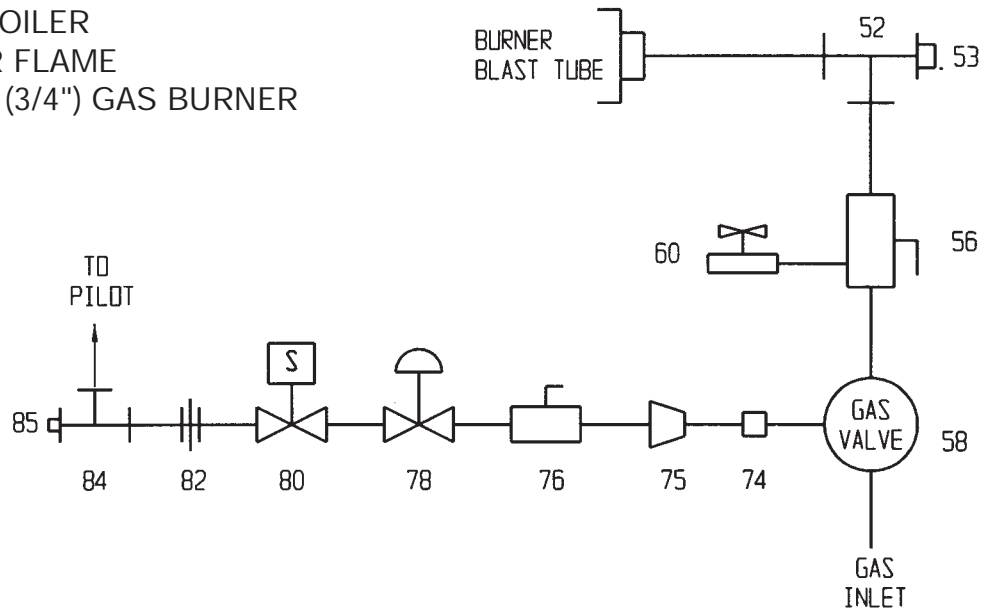
REFERENCE NUMBERS ABOVE REFER TO DWG. CT-545 EXCEPT REFERENCE NO. 4 SERIES REFERS TO DWG. CT-546. WHEN ORDERING PARTS, SUPPLY THE BOILER MODEL NUMBER, SERIAL NUMBER, AND THE SIX DIGIT ITEM NUMBER.

CTPRTSLSTMY03.wpd

REV. MAY 2006

GAS TRAIN PIPING DIAGRAM for

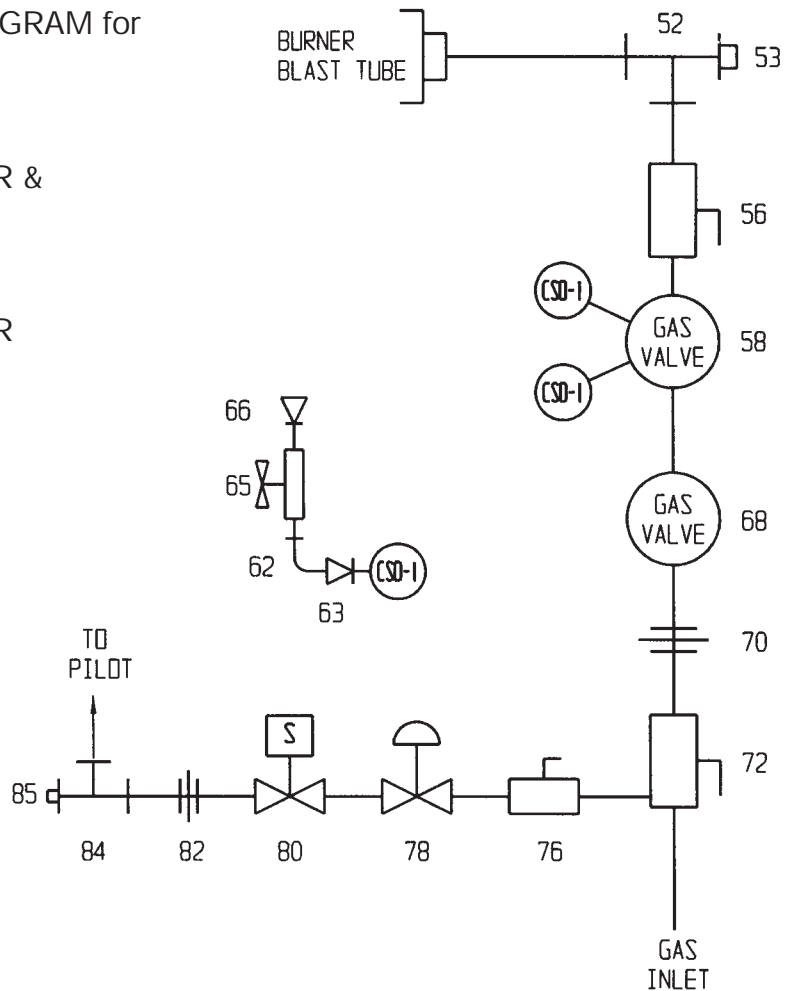
CT-6/10 BOILER  
w/POWER FLAME  
JR15A-10 (3/4") GAS BURNER



GAS TRAIN PIPING DIAGRAM for

CT-15 BOILER  
w/POWER FLAME  
JR15A-10 GAS BURNER &

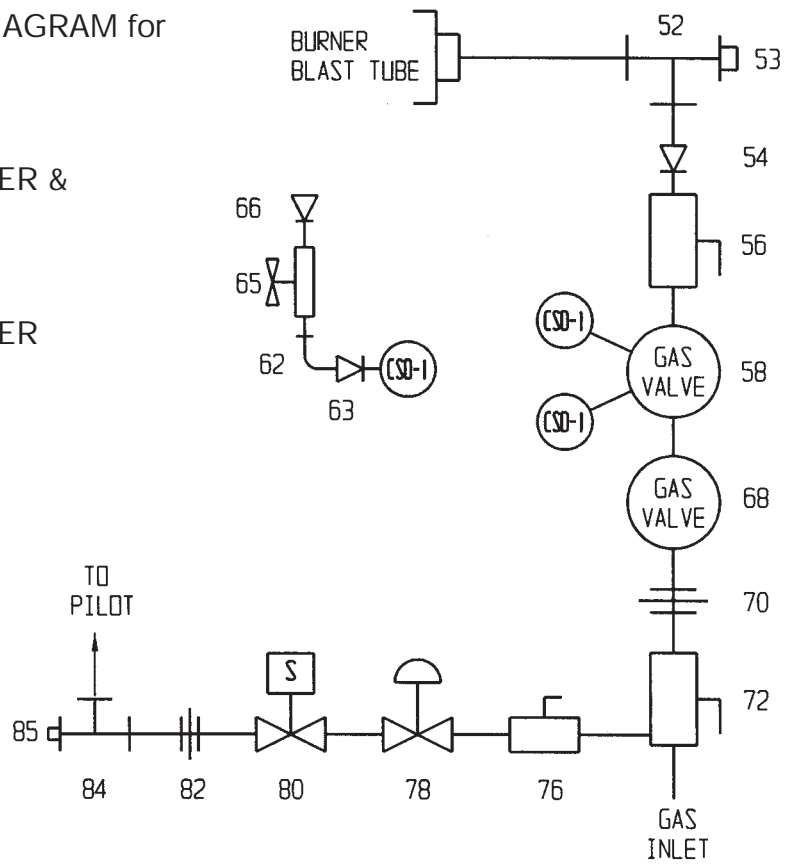
CT-20 BOILER  
w/POWER FLAME  
JR30A-12 GAS BURNER



GAS TRAIN PIPING DIAGRAM for

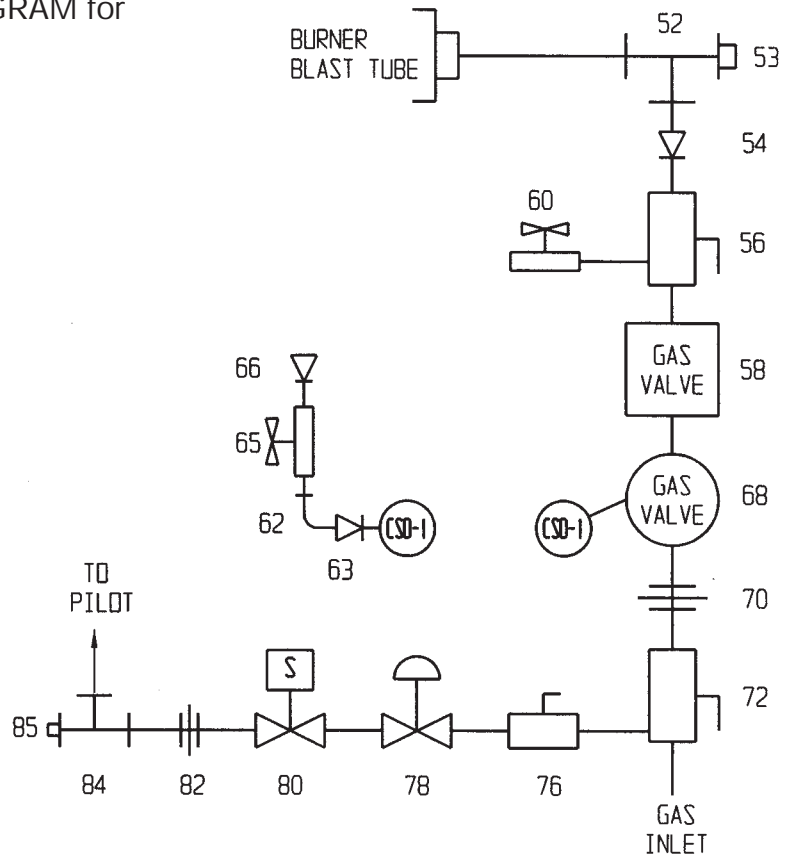
CT-25 BOILER  
w/POWER FLAME  
JR30A-12 GAS BURNER &

CT-35 BOILER  
w/POWER FLAME  
JR50A-15 GAS BURNER



GAS TRAIN PIPING DIAGRAM for

CT-50 BOILER  
w/POWER FLAME  
JR50A-15 GAS BURNER



# GAS TRAIN COMPONENTS FOR CT SERIES BOILERS

## 150 PSI w/Panel Box & Warrick LWCO/Pump Control

REF. No. †	DESCRIPTION ‡	SIZE OR IDENTIFICATION					
		CT-6/10 w/ P.F. JR15A-10 (3/4")	CT-15 w/ P.F. JR15A-10 CT-20 w/ P.F. JR30A-12	CT-25 w/ P.F. JR30A-12 CT-20 w/ P.F. JR30A-12	CT-35 w/ P.F. JR50A-15	CT-50 w/ P.F. C2-G-20A CT-50 w/ P.F. JR50A-15	
52	ORIFICE TEE	1 X 1 X 3/4	1"	1"	1"	1"	1"
53	PRESSURE TAP	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
54	BUSHING (OR REDUCER)	NONE	NONE	1-1/4 X 1	1-1/2 X 1-1/4	1-1/2 X 1-1/4	1-1/2 X 1-1/4
56	BALL VALVE	3/4"	1"	1-1/4"	1-1/2"	1-1/2"	1-1/2"
58	GAS VALVE	HONEYWELL VR8305M-4009 COMBINATION	HONEYWELL V4943B-1019	HONEYWELL V4943B-1051	HONEYWELL V4943B-1035	HONEYWELL V4943B-1035	HONEYWELL V4943B-1035
60	CSD-1 LEAKAGE TEST COCK	1/4"	NONE	NONE	NONE	NONE	NONE
62	ELBOW	NONE	1/4"	1/4"	1/4"	1/4"	1/4"
63	BUSHING	NONE	1/4" X 1/8"	1/4" X 1/8"	1/4" X 1/8"	1/4" X 1/8"	1/4" X 1/8"
65	CSD-1 LEAKAGE TEST COCK	NONE	1/8"	1/8"	1/8"	1/8"	1/8"
66	PLUG	NONE	1/4"	1/4"	1/4"	1/4"	1/4"
68	SOLENOID GAS VALVE	NONE	HONEYWELL V48A-1618	HONEYWELL V48A-1626	HONEYWELL V48A-1634	HONEYWELL V48A-1634	HONEYWELL V48A-1634
70	UNION	NONE	1"	1-1/4"	1-1/2"	1-1/2"	1-1/2"
72	BALL VALVE	HONE	1"	1-1/4"	1-1/2"	1-1/2"	1-1/2"
74	COUPLING	1/8"	NONE	NONE	NONE	NONE	NONE
75	REDUCER	1/8"X1/4"	NONE	NONE	NONE	NONE	NONE
76	PILOT SHUTOFF COCK	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
78	PILOT PRESSURE REGULATOR	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
80	PILOT SOLENOID VALVE	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
82	UNION	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
84	TEE	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
85	PRESSURE TAP	1/8"	1/8"	1/8"	1/8"	1/8"	1/8"

† REFERENCE NUMBERS ABOVE REFER TO DWG. CT-549A.

‡ WHEN ORDERING PARTS, SUPPLY THE BOILER MODEL NUMBER, SERIAL NUMBER, A ND THE DESCRIPTION AND SIZE, OR MFRS' ITEM NUMBER.



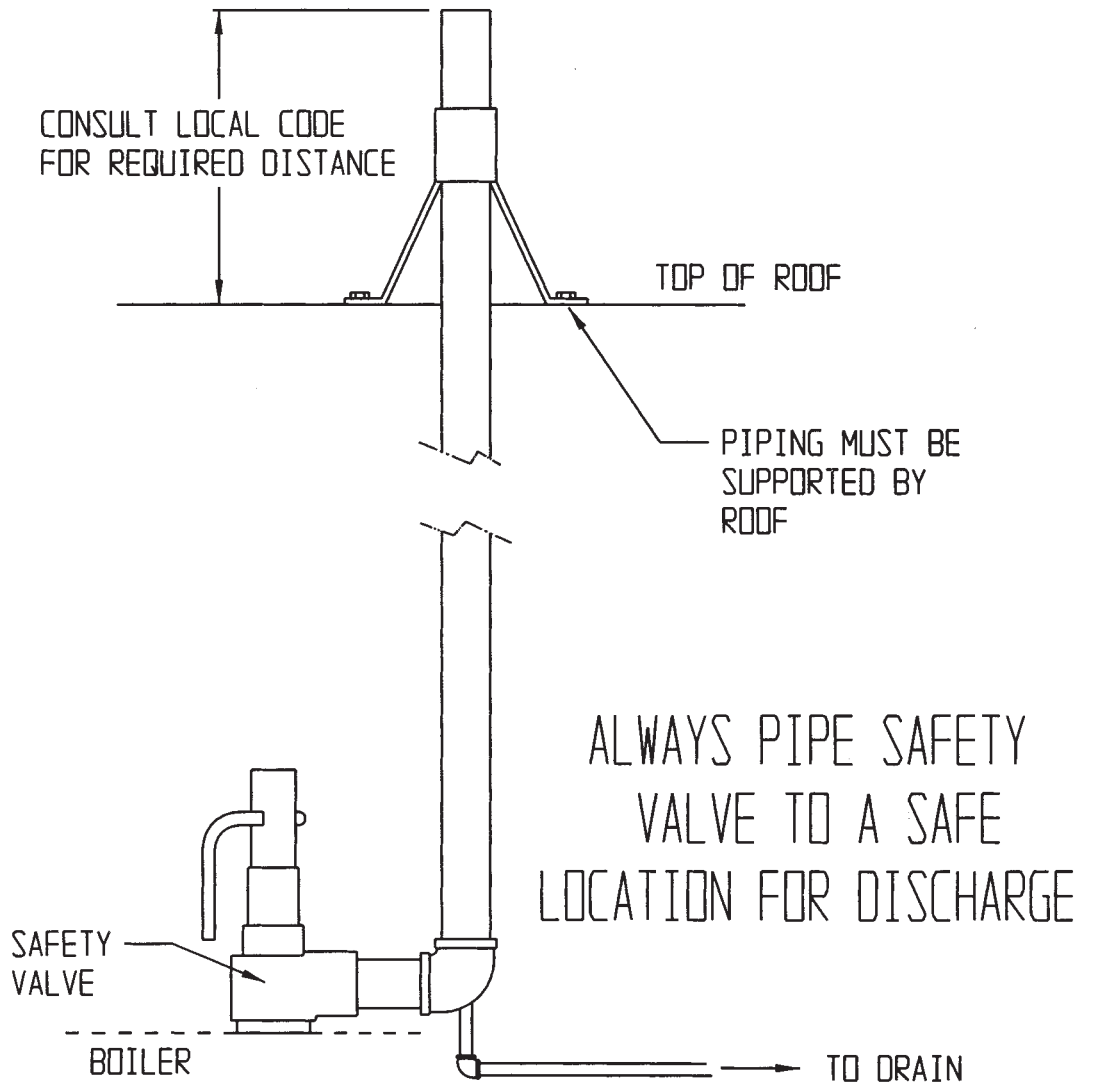
# BOILER WIRING DIAGRAM

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

# REVISIONS

REV	DESCRIPTION	BY	DATE
A	REDRAWN ON CAD	RLT	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

## COLUMBIA BOILER CO.

SAFETY VALVE PIPING  
TYPICAL

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

MATERIAL: -	DWG NO.	REV
TOLERANCE (unless spec.) PART #	PL-049	A



## INSTALLATION OF WARRICK DUAL FUNCTION CONTROLS

This bulletin should be used by experienced personnel as a guide to the installation of dual function level controls. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Warrick Controls, Inc., or its local representative if further information is required.

### SPECIFICATIONS

**CONTROL DESIGN:** Open circuit board design.  
**CONTACT DESIGN:** SPDT (1 form C): one normally open (N.O.) and one normally closed (N.C.), non-powered contacts.

**CONTACT RATINGS:** 10A @ 120, 208/240, 240 VAC resistive (120F), 1A @ 120, 208/240, 240 VAC resistive (150F), 1/3 H.P. @ 120, 208/240, 240 VAC.  
**CONTACT LIFE:** Mechanical - 5 million operations. Electrical - 100,000 operations minimum at rated load.

**SUPPLY VOLTAGE:** 120, 208/240, 240 or 24 VAC models, plus 10%, minus 15%, 50/60 Hz.

**SUPPLY CURRENT:** 120, 208/240, 240, or 24 VAC both relays energized - 4.4 VA.

**SECONDARY CIRCUIT:** 12 VAC RMS voltage on probes, 1.5 milli-amp current.

**SENSITIVITY:** Models operate from 0-26K ohm maximum specific resistance.

**TEMPERATURE:** -40 to 150 degrees F. ambient.

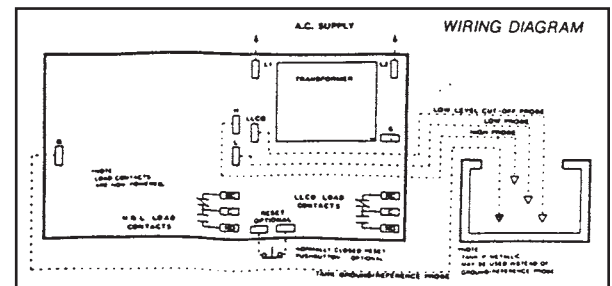
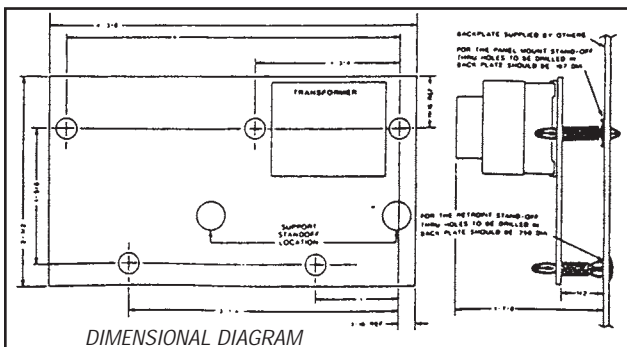
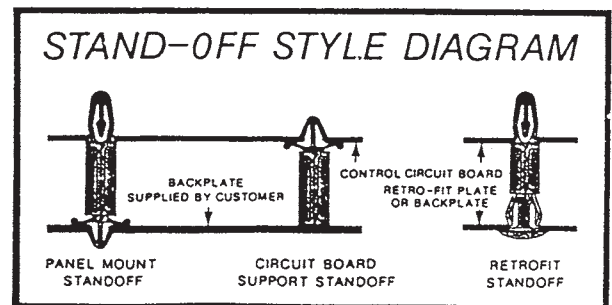
**TERMINALS:** Probe connections 3/16" male quick connects, Line and Power connections 1/4" male quick connects.

**TIME DELAYS:** Standard, .5 seconds rising level, LLCO probe, 3 seconds lowering level.

**LISTINGS:** Entire control carries U.L. motor controller recognition (508) and U.L. limit control recognition (353). (240 and 208/240 VAC models carry only motor controller recognition-508)

### INSTALLATION

- 1) Drill 5 (five) .187 dia. holes in customer supplied backplate using stick on template supplied with control. Standard standoffs are designed for back plate thickness of .062 (1/16 inch). Standoffs are available for backplates of .125 (1/8 inch) nominal thickness. If retrofit plate standoffs are used, drill 5 (five) .250 dia. holes in proper location.
- 2) Install 5 (five) standoffs into back plate. Install 2 (two) support standoffs into circuit board. Snap circuit board onto standoffs. See sketch for proper installation. Install control in appropriate enclosure.
- 3) Wire control per wiring diagram, following N.E.C. and local codes. Use appropriately sized spade terminals.



*Either "G" tab can be used for reference probe.*

# OPERATION OF WARRICK DUAL FUNCTION CONTROLS

## OPERATION

The Dual Function Control (DFXXXX) performs two independent level control functions. Terminals H and L can be used for differential service or single level service using only the H terminal. Terminal LLCO can be used for single level service only.

### Direct mode-both functions:

**LLCO FUNCTION:** When the liquid rises to the electrode on terminal LLCO, the relay associated with terminal LLCO energizes, changing state of the load contacts. (LED will be lit). The relay remains energized until the liquid level recedes below electrode on terminal LLCO. The associated relay then de-energizes, (LED will not be lit) returning load contacts to original state. Unless otherwise specified, there is a three second time delay on decreasing level. Liquid must be below probe on terminal LLCO for full three seconds before control de-energizes.

**H - L FUNCTION:** When the liquid rises to the electrode on terminal H, the associated relay energizes, changing the state of the load contacts. (LED will be lit). The relay remains energized until the liquid level recedes below electrode on terminal L. The associated relay then de-energizes, (LED will not be lit) returning load contacts to original state. Unless otherwise specified, there is a one half second time delay on increasing level. Liquid must be in contact with probe on terminal H for full half second before control energizes. This function can be wired for single level service by using only the H terminal.

**LLCO function - direct mode, H - L function inverse mode:** LLCO FUNCTION: Remains the same as listed above. H - L FUNCTION: Associated relay energizes with power, (LED will be lit) changing the state of the load contacts. When the liquid rises to the electrode on terminal H, the relay de-energizes, returning load contacts to shelf state. (LED will not be lit). The associated relay remains de-energized until the liquid level recedes below electrode on terminal L. The relay then energizes.

**Optional Manual Reset** (Normally closed pushbutton installed across reset terminals. Pushbutton ordered separately): Manual reset only applies to the function associated with terminal LLCO. When the liquid rises to the electrode on terminal LLCO, the control will remain de-energized (load contacts in original state) until the pushbutton is depressed. The control will then energize, (LED will be lit) changing the state of the contacts. The control remains energized until the liquid level recedes below electrode on terminal LLCO. The control then de-energizes, (LED will go off) returning load contacts to their original state. Unless otherwise specified, there is a three second time delay on decreasing level. Liquid must be below probe on terminal LLCO for full three seconds before control de-energizes.

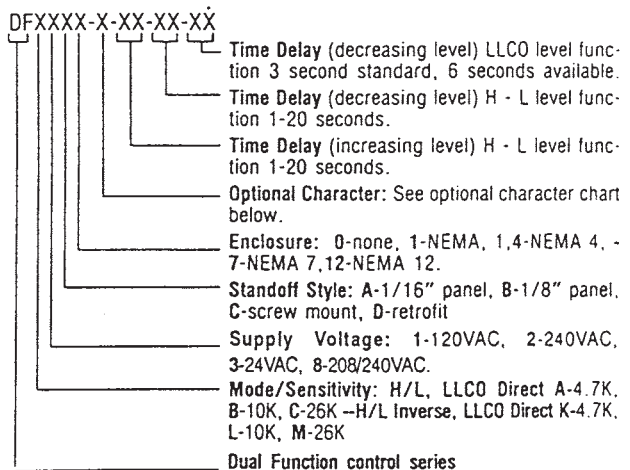
**Manual Reset with optional Power Outage Feature** (Normally closed pushbutton across reset terminals, Pushbutton ordered separately): Control will ignore power loss to control. With liquid in contact with electrode on terminal LLCO, a power outage will cause the control to de-energize, but will automatically energize upon return of power. However, loss of liquid will cause control to de-energize and remain so until liquid again rises to electrode and pushbutton is depressed.

### OPTIONAL:

Time Delays associated with terminals H and L: With time delay on increasing level, the liquid must be in contact with the short electrode for the full duration of the time delay before control will operate. With delay on decreasing level, the liquid must be below long electrode for the full duration of the time delay before control will operate. In single level service, H and L terminals must be jumpered together to achieve time delays on both increasing and decreasing levels or just decreasing level.

Time delays associated with terminal LLCO: 3 Second time delay on decreasing level is standard. A 6 second time delay can be specified and would act in the same manner as listed above.

## MODEL NUMBER DESIGNATION



## OPTIONAL CHARACTER CHART

	RESET FUNCTION	NORMALLY CLOSED PUSHBUTTON	POWER OUTAGE FEATURE	RETRO-FIT PLATE
D	X			
G	X	X	X	
J	X	X	X	X
K	X		X	
L	X		X	X
R				X
S	X	X		
T	X	X		X
W	X			X



## INSTALLATION OF WARRICK SERIES 3C & 3K ELECTRODE FITTINGS

### COMMON SPECIFICATIONS:

**Temperature/Pressure Limits:** 250 psig, 406 °F, saturated steam.

**Listings:** U/L Guide MBPR File MP1430 and Guide MCUR2 File MP2489. CSA Guide 184-N-13.90 File 11644.

**Terminal Housing:** Diecast aluminum with epoxy coat. 1/2"-14 NPT tapped boss for conduit.

### 3C SPECIFICATIONS

**Attachment to Vessel:** 1"-11 1/2 NPT tappings for equalizer piping.

**Blowdown:** 1"-11 1/2 NPT

**Electrodes:** Lengths not less than 1 1/2 or greater than 6 inches.

### 3K SPECIFICATIONS

**Attachment to Vessel, Gauge Glass and Tricock**

**Connections:** See ordering information.

**Blowdown:** 1"-11 1/2 NPT

**Chamber Material:** Cast Iron.

**Electrodes:** Lengths not less than 1 3/4 or greater than 13 inches.

Each Series 3C and 3K water column electrode fitting is combined with one or more on/off conductance actuated, liquid level controls to provide (a) on/off pump operation, (b) low water cutoff or alarm, (c) high level cutoff or alarm, or (d) combination of the aforementioned functions on steam boilers or other pieces of equipment where a side chamber is necessary. See literature provided with the control for information concerning the installation of that particular component.

The electrode lengths of the Series 3C and 3K are measured in inches and referenced to that surface common to the bottom of the blue terminal housing and top of the cast metal chamber. The electrode lengths are listed on the side of the blue terminal housing.

It is suggested that you check all electrode lengths before installation of the fitting on the boiler or tank to verify that the control functions will occur at the desired water levels. This is easily accomplished by working through the drain pipe tapping in the bottom of the chamber. Measure the distance from the extreme lower end of the chamber to each electrode tip. Electrode lengths, referenced as mentioned above may then be computed by subtracting each of those measurements from 7-3/8 inches for Series 3C fittings and from 16-1/8 inches for Series 3K fittings.

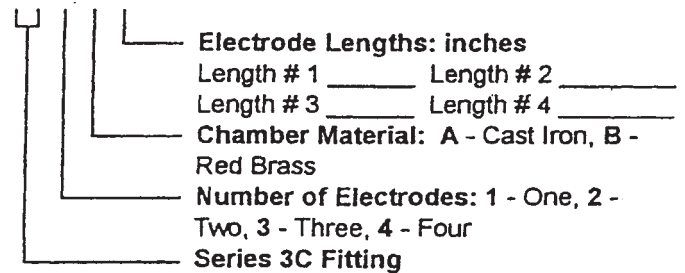
After the fitting has been installed on the boiler, the blue

terminal housing can be reoriented in the most favorable of several positions, each 90° apart, for the purpose of receiving electrical conduit from the controlbox. To reorient the housing simply remove the lid on the top of the housing, withdraw the 4 screws at the inside corners of the housing, reposition the housing, and replace the screws. For high temperature applications utilize wire with an oil resistance insulation rated at not less than 600 volts and 200° C (392° F). Teflon or silicone rubber insulated wire which possesses those ratings is common and available from electrical supply houses. **CAUTION:** Do not employ asbestos insulated wire. That material is hygroscopic (readily absorbs moisture) and unsuitable for the application.

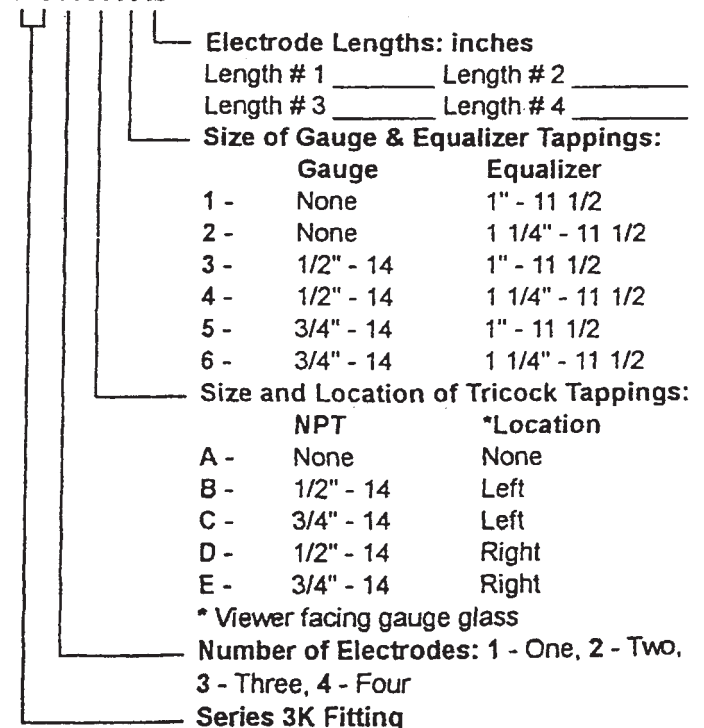
If the fitting chamber is to be used as the ground / reference, the ground / reference conductor is to be terminated in the housing by securing it beneath the head of any of the four screws which fasten the housing to the chamber.

### Ordering information:

**3C X X 0** Use "0" for 5th place symbol and list all probe lengths.



**3K X X X Z** Use "Z" for 6th place symbol and list all probe lengths.





## INSTALLATION OF WARRICK SERIES 26 CONTROLS

This bulletin should be used by experienced personnel as a guide to the installation of series 26 controls. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Warrick Controls, Inc., or its local representative if further information is required.

### SPECIFICATIONS

**CONTROL DESIGN:** Open circuit board design  
**CONTACT DESIGN:** SPDT (1 form C): One normally open (N.O.) and one normally closed (N.C.) non-powered contacts.

**CONTACT RATINGS:** 10A @ 120, 240 VAC resistive (120 F), 1A @ 120, 240 VAC resistive (150 F), 1/3 H.P. @ 120,240 VAC (120 F).

**CONTACT LIFE:** Mechanical- 5 million operations. Electrical - 100,000 operations minimum at rated load.

**SUPPLY VOLTAGE:** 120, 240 OR 24 VAC models: plus 10% minus 15% 50/60 HZ. 208/240 model: 187 Vmin. to 255 Vmax. VAC 50/60 HZ.

**SUPPLY CURRENT:** Relay energized 4.4 VA.

**SECONDARY CIRCUIT:** 12 VAC RMS Voltage on probes. 1.5 milli-amp Current.

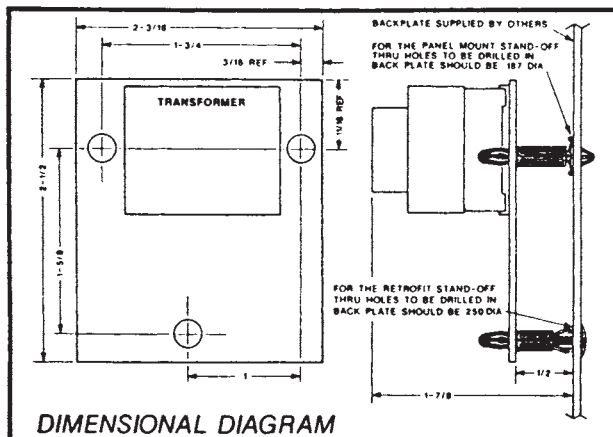
**SENSITIVITY:** Models operate from 0-26K ohm maximum specific resistance.

**TEMPERATURE:** -40 to 150 degrees F. ambient.

**TERMINALS:** Probe connections 3/16" spade: Line and Power Connections 1/4" spade.

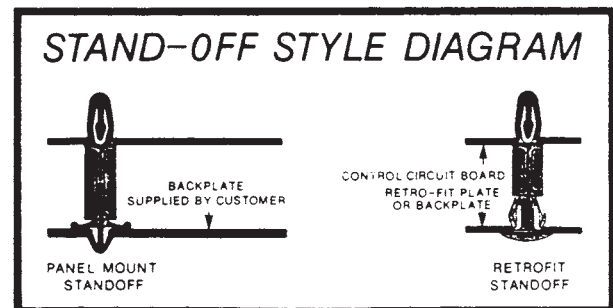
**TIME DELAYS:** Standard - LLCO probe, 3 seconds on lowering level.

**LISTINGS:** U.L. limit control recognition (353). 240 and 208 volt units are not U.L. limit control recognized.



### INSTALLATION

- 1) Drill 3 (three) .187 dia. holes in customer supplied backplate using stick on template supplied with control. Standard standoffs are designed for backplate thickness of .062 (1/16"). Standoffs are available for backplates of .125 (1/8") nominal thickness. If retro-fit plate standoffs are used, drill 3 (three) .250 dia. holes in proper location.
- 2) Install 3 (three) standoffs onto backplate. Install circuit board onto standoffs by pushing down on circuit board at outer edges of all four corners. Use both hands to slide board onto standoffs until standoffs lock. **CAUTION:** Do not overflex circuit board during installation. Do not push down on transformer or relays during installation. See sketch for proper installation. Install control in appropriate enclosure.
- 3) Wire control per diagram, following N.E.C. and local codes. Use appropriately sized spade terminals.

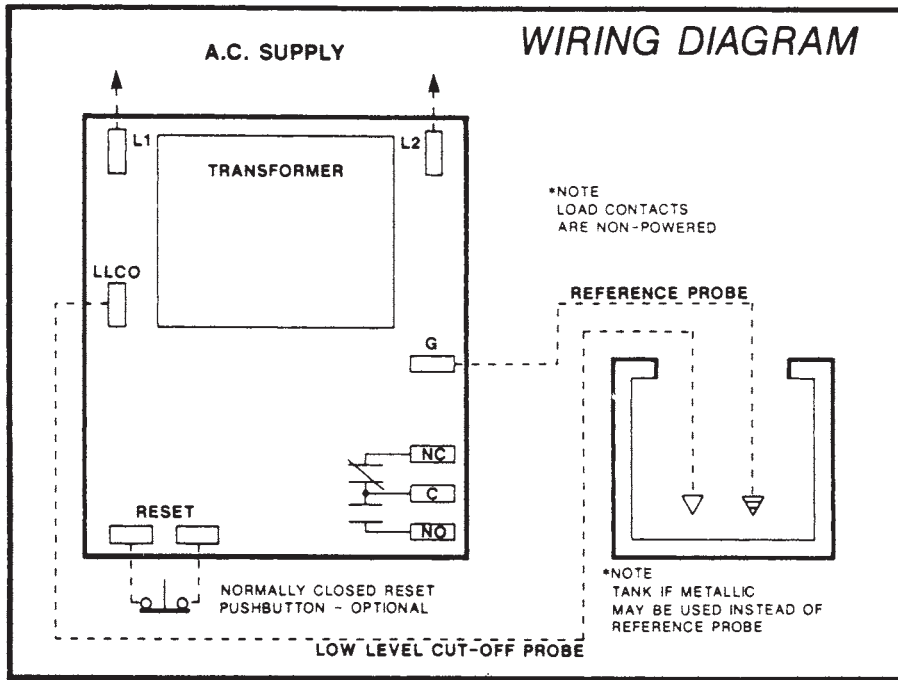


### SENSITIVITIES VS MAXIMUM PROBE WIRE DISTANCE\*

SENSITIVITY CHAR.	SENSITIVITY (KOHMS)	DISTANCE (FT)
A	4.7	900
B	10	600
C	26	250

\*Based on type MTW or THHN wire, #14 or #16 Awg.

# OPERATION OF WARRICK SERIES 26 CONTROLS



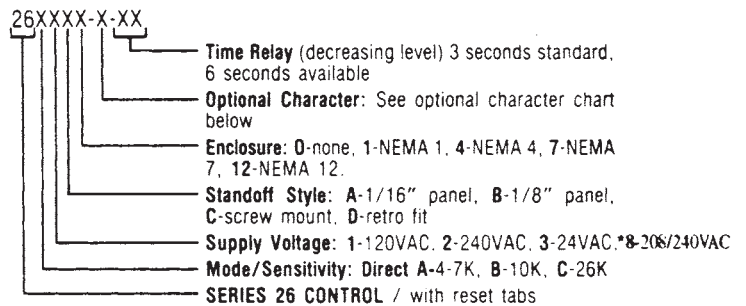
## OPERATION

**AUTOMATIC RESET** (Reset terminals not used): When the liquid rises to the electrode on terminal LLCO, the control energizes, changing state of the load contacts. (LED will be lit). The control remains energized until the liquid level recedes below electrode on terminal LLCO. The control then de-energizes, (LED will not be lit) returning load contacts to original state. Unless otherwise specified, there is a three second time delay on decreasing level. Liquid must be below probe on terminal LLCO for full three seconds before control de-energizes.

**MANUAL RESET** (Normally closed pushbutton installed across reset terminals): When the liquid rises to the electrode on terminal LLCO, the control will remain de-energized until the pushbutton is depressed. The control will then energize, (LED will be lit) changing the state of the contacts. The control remains energized until the liquid level recedes below electrode on terminal LLCO. The control then de-energizes, (LED will not be lit) returning load contacts to their original state. Unless otherwise specified, there is a three second time delay on decreasing level. Liquid must be below probe on terminal LLCO for full three seconds before control de-energizes.

**MANUAL RESET OPTIONAL POWER OUTAGE FEATURE** (Normally closed pushbutton across reset terminals): Control will ignore power loss to control. With liquid above electrode on terminal LLCO, a power outage will cause the control to de-energize, but will automatically energize upon return of power. However, loss of liquid will cause control to de-energize and remain so until liquid again rises to electrode and pushbutton is depressed.

## MODEL NUMBER DESIGNATION



\* 187 Vmin to 255 Vmax VAC

## OPTION CHARACTER CHART

	NORMALLY CLOSED PUSHBUTTON	POWER OUTAGE FEATURE	RETRO-FIT PLATE
C	X		
E		X	
F	X	X	
N		X	X
P	X	X	X
R			X

# TUBULAR GAGE GLASSES

Red Line, Standard, Heavy Wall and High Pressure

## USE AND CARE

**NOTICE:** READ THESE WARNINGS & INSTRUCTIONS BEFORE INSTALLING OR REPLACING PYREX® TUBULAR GAGE GLASS.

**Improper installation or maintenance of tubular glass can cause immediate or delayed glass breakage resulting in bodily injury. To avoid breakage observe the following Do's and Do Not's and Use and Care Instructions, as well as tubular gage manufacturer's instructions.**

**If a gage glass breaks, contained substances can be released and glass can be blown out of the unit with great force. Always wear safety glasses when looking toward a gage or working on a gage glass assembly. Guard against the possibility of fire and explosion.**

**Protect glass from impact, scratches, other surface damage and sudden temperature changes. These can weaken or stress the glass and lead to breakage.**

**FAILURE TO OBSERVE THE FOLLOWING DO's AND DO NOT's CAN RESULT IN GLASS BREAKAGE AND ITS EXPLOSIVE RELEASE OF PRESSURIZED SYSTEM CONTENTS AND FLYING GLASS PARTICLES.**

### DO NOT'S

- DO NOT work on any gage until you have carefully read these warnings & instructions.
- DO NOT reuse any tubular glass, packing, or seals.
- DO NOT use glass that is scratched, chipped, or otherwise damaged. Used glasses may contain damage and are poor safety risks.
- DO NOT exceed the glass or gage manufacturer's recommended working pressures or maximum recommended gage glass length.
- DO NOT bump, impact or scratch the glass.
- DO NOT tighten gland nut and packing beyond gage manufacturer's recommendations.
- DO NOT operate gages unless gage valve sets are equipped with drain vent and safety ball check.
- DO NOT attempt to clean glass while the unit is in operation. Cleaning should be done without removing the gage glass.
- DO NOT attempt to inspect the glass, to adjust tie rods, packing nuts or glands, to inspect or tighten other fittings without isolating the gage from the pressure vessel and opening the drain vent.
- DO NOT weld, impact, or sandblast in the gage glass area without protecting the glass.
- DO NOT have glass-to-metal contact.
- DO NOT subject gage glass to bending or twisting stresses.
- DO NOT allow the gage glass to contact the bottom of the packing gland.

### DO's

- DO inspect the gage glass daily, keep maintenance records, and conduct routine replacements.
- DO install protective guards where necessary to protect personnel.
- DO protect the outside of the gage glass from sudden temperature changes, such as drafts, water spray, etc.
- DO remove all deposits from the seal areas, the gland nuts, glands (where used) and use new packing before installing a tubular gage glass.
- DO examine gage glass for damage and seals for hard deposits and tears.
- DO verify that the tubular gage glass, gland, nuts, packing, etc. are the correct size and type before installing.
- DO ensure that system is protected by safety shut-off system (e.g. safety ball check).

### MAINTENANCE

Examine the gage glass regularly for any signs of clouding, scratching, erosion, or corrosion. In new processes, the glass should be inspected daily until the need for replacement becomes apparent. This will help establish the routine inspection and routine replacement cycles.

### CLEANING

Keep gage glass clean using non-abrasive commercial glass cleaners. Where regular cleaners do not seem to work, use dilute acids such as Hydrochloric (muriatic) acid. Always observe safety rules when handling hazardous cleaning solutions. Never use wire brushes, metal scrapers, or harsh abrasives which could scratch the glass.

### INSPECTION

Scratches, corrosion, chips, surface flaws, or nicks on the surface or edges weaken the gage glass. To examine for these, shine a very bright concentrated light ("Burton Lite" or powerful flashlight) at about 45° angle. Anything which glistens and catches the fingernail or any star-shaped or crescent-shaped mark which glistens, is cause for replacement. Any gage glass which appears cloudy or roughened and will not respond to cleaning procedures, should be replaced.

### STORING

Keep gage glasses in original packaging until ready to install.

### HANDLING

Avoid bumping, chipping, or scratching glass. Any glass-to-glass contact can cause scratches and must be avoided.

Corning Glass Works  
Industrial Supplies  
MP-21-1-4  
Corning, New York 14831  
607-974-4231

PYREX is a registered trademark of Corning Glass Works

**CORNING**





## KP / KPI



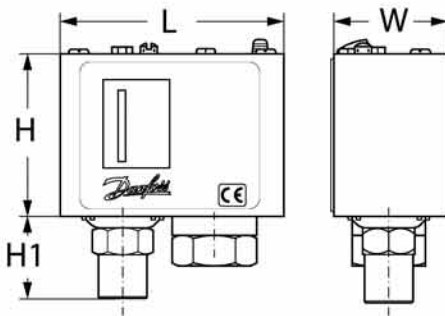
### Pressure switches

- Wide regulation range
- Small dimensions
- Ultra-short bounce times
- Easy electrical connection
- Long operation life
- High contact load
- High pulsation protection



### Technical data

Process connection	G 1/4" A (BSP; ISO 228/1)		
Enclosure	IP 30 / NEMA 2 (see accessories for higher enclosure covers)		
Media temperature	-40° to 100°C (-40° to 212°F)		
Ambient temperature	-40° to 65°C (-40 to 149°F)		
Electrical connection	Cable entry for 6 to 14 mm (0.24 to 0.55 in) diameter cable Rubber boot or 1/2 -14 NPT conduit nut		
Contact system	SPDT		
Contact rating	Non-inductive Amperes	16A @ 400Vac	
	FLA	16A @ 120Vac	
	Pilot duty DC	12W @ 240Vdc	



### Dimensions and weight

H		W		L	
mm	in	mm	in	mm	in
60.96	2.4	43.18	1.7	838.2	33.0

H1		Weight	
mm	in	kg	lbs
33.02	1.3	0.30	0.66



## Ordering - KP / KPI

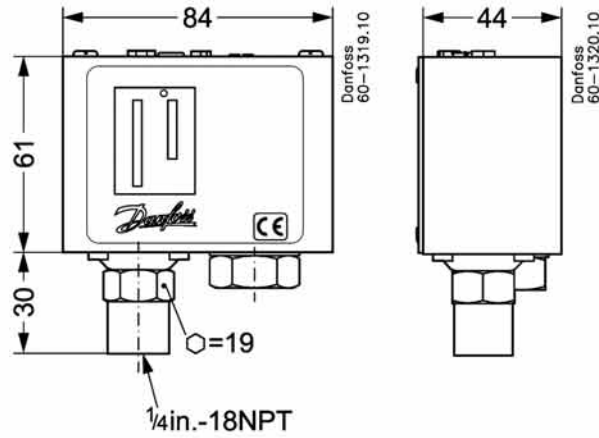
Type	Process connection	Pressure range		Differential		Operating pressure		Reset	Code no.	Code no.
		<i>bar</i>	<i>psi</i>	<i>bar</i>	<i>psi</i>	<i>max. bar</i>	<i>max. psi</i>		<i>Silver contacts</i>	<i>Gold contacts</i>
KP 34	1/4 - 18 NPT (female)	0.13 to 1	2 to 15	0.20	3	4	58	Max.	<b>060-214866</b>	-
KP 34	1/4 - 18 NPT (female)	0.13 to 1	2 to 15	0.13 to 0.41	2 to 6	4	58	Automatic	<b>060-214966</b>	-
KP 35	1/4 - 18 NPT (female)	0.41 to 3.44	6 to 50	0.48	7	10	145	Max.	<b>060-215066</b>	-
KP 35	1/4 - 18 NPT (female)	0.41 to 3.44	6 to 50	0.41 to 2.2	6 to 32	10	145	Automatic	<b>060-215166</b>	-
KP 36	1/4 - 18 NPT (female)	1 to 10.3	15 to 150	0.69 to 4	10 to 58	16.9	245	Automatic	<b>060-214466</b>	-
KP 36	1/4 - 18 NPT (female)	1 to 10.3	15 to 150	0.69	10	16.9	245	Max.	<b>060-214566</b>	-
KP 37	1/4 - 18 NPT (female)	4 to 20.7	58 to 300	1.8 to 2.9	26 to 43	27.9	405	Automatic	<b>060-214666</b>	-
KP 37	1/4 - 18 NPT (female)	4 to 20.7	58 to 300	2.9	43	27.9	405	Max.	<b>060-214766</b>	-
KP35	G1/4A (BSPP)	-0.2 to 7.5	-2.9 to 109	0.7 to 4	10 to 58	17	246.5	Automatic	<b>060-113366</b>	<b>060-504766</b>
KP36	G1/4A (BSPP)	2 to 14	29 to 203	0.7 to 4	10 to 58	17	246.5	Automatic	<b>060-110866</b>	<b>060-113766</b>
KP36	G1/4A (BSPP)	4 to 12	58 to 203	0.5 to 1.6	7.25 to 23.2	17	246.5	Automatic	<b>060-122166</b>	-
KPI35	G1/4A (BSPP)	-0.2 to 8	-2.9 to 116	0.4 to 1.5	5.8 to 21.75	18	261	Automatic	<b>060-121766</b>	<b>060-316466</b>
KPI35	G1/4A (BSPP)	-0.2 to 8	-2.9 to 116	0.5 to 2	7.25 to 29	18	261	Automatic	<b>060-121966</b>	-
KPI36	G1/4A (BSPP)	2 to 12	29 to 174	0.5 to 1.6	7.5 to 23.2	18	261	Automatic	<b>060-316966</b>	-
KPI36	G1/4A (BSPP)	4 to 12	58 to 174	0.5 to 1.6	7.5 to 23.2	18	261	Automatic	<b>060-118966</b>	<b>060-113866</b>
KPI38	G1/4A (BSPP)	8 to 28	116 to 406	1.8 to 6	26 to 87	30	435	Automatic	<b>060-508166</b>	-

060R9365

060R9365

## Pressure Controls

KP 34, KP 35, KP 36 and KP 37

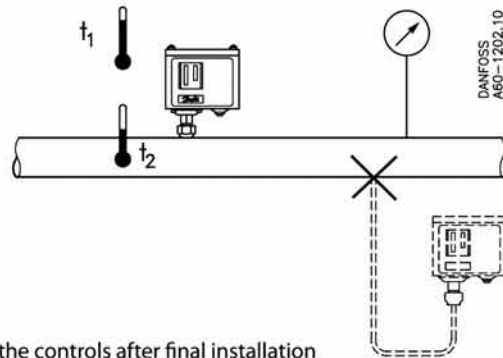


### KP 34, KP 35, KP 36 and KP 37

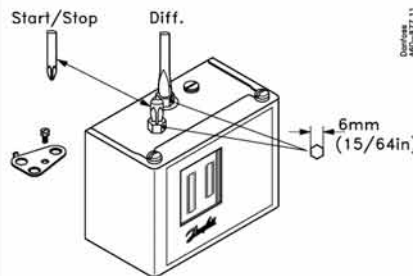
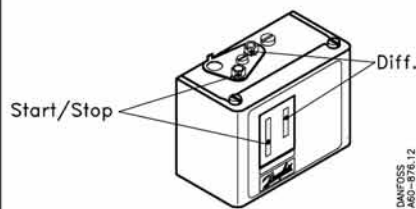
$t_1$  min. -40°F  
 $t_1$  max. 149°F

$t_2$  min. -40°F  
 $t_2$  max. 212°F

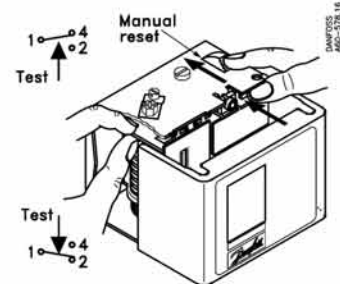
$P_{test}$  max.  
 KP 34: 87 psi  
 KP 35: 145 psi  
 KP 36: 290 psi  
 KP 37: 465 psi

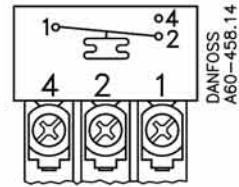
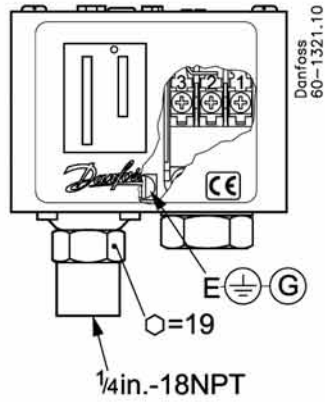


No maintenance is required for the controls after final installation



Please note: scale in KP units is indicative only. For accurate setting or when using according to FM approval use additional pressure gauge to set the unit.

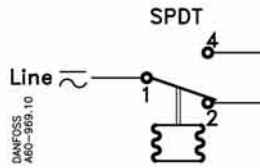




Contact system with standard AG contacts  
Single pole changeover switch (SPDT)

**Alternating current:**  
AC-1: 16A, 400 V  
AC-3: 16A, 400 V  
AC-15: 10A, 400 V

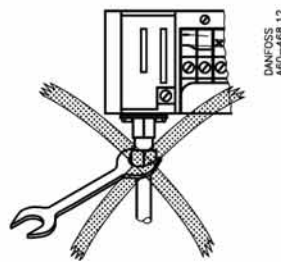
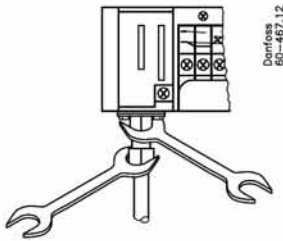
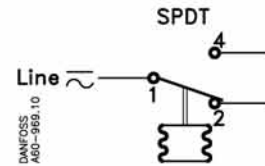
**Direct current:**  
DC-13: 12 W, 220 V



Contact system with gold contacts  
Single pole changeover switch (SPDT)

**Alternating current:**  
AC-1: 10A, 400 V  
AC-3: 6A, 400 V  
AC-15: 4A, 400 V

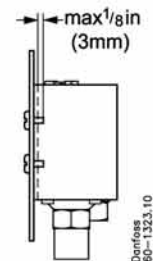
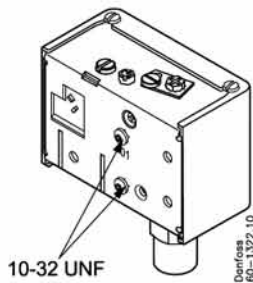
**Direct current:**  
DC-13: 12 W, 220 V



When used acc. to UL or FM regulations

UL Listed refrigeration controller 61B5				
Voltage	FL	LR	Resist.	Pilot
AC	A	A	load	duty
240	8	48	8A	3A
120	16	96	16A	
240				12W

Use copper wire only  
Tightening torque 10 lb. in.



**REVISIONS**

REV.	DESCRIPTION	BY	DATE
A	CONTRLS. REMOVED IN BOX) GAGE MOVED	RLH	10/31/07

GALVANIZED "8" TYPE VENT OR AS PER LOCAL CODE REQUIREMENTS

DOWNWARD PITCH

STEAM TO PROCESS  
CONDENSATE RETURN FROM PROCESS

VENT TO ATMOSPHERE MUST BE FULL SIZE

PIPE SAFETY VALVE TO A SAFE PLACE OF DISCHARGE PER LOCAL CODES

RETURN TANK VENT MUST BE VENTED TO ATMOSPHERE AT A SAFE PLACE OF DISCHARGE

VERTICAL RETURN TANK

ENSURE THAT ADEQUATE AIR IS PROVIDED FOR PROPER COMBUSTION AND VENTING.

PROVIDE PIPE SUPPORT (TYP.)

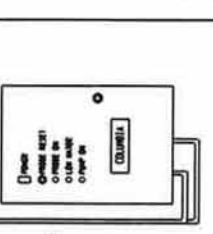
CHECK VALVE

MAKE-UP WATER INLET

SWING TYPE

SPRING TYPE

CHECK VALVES



"Y" TYPE BLOWDOWN VALVE

BOILER DRAIN (CLOSED DURING BLOWDOWN)

COLD WATER SUPPLY

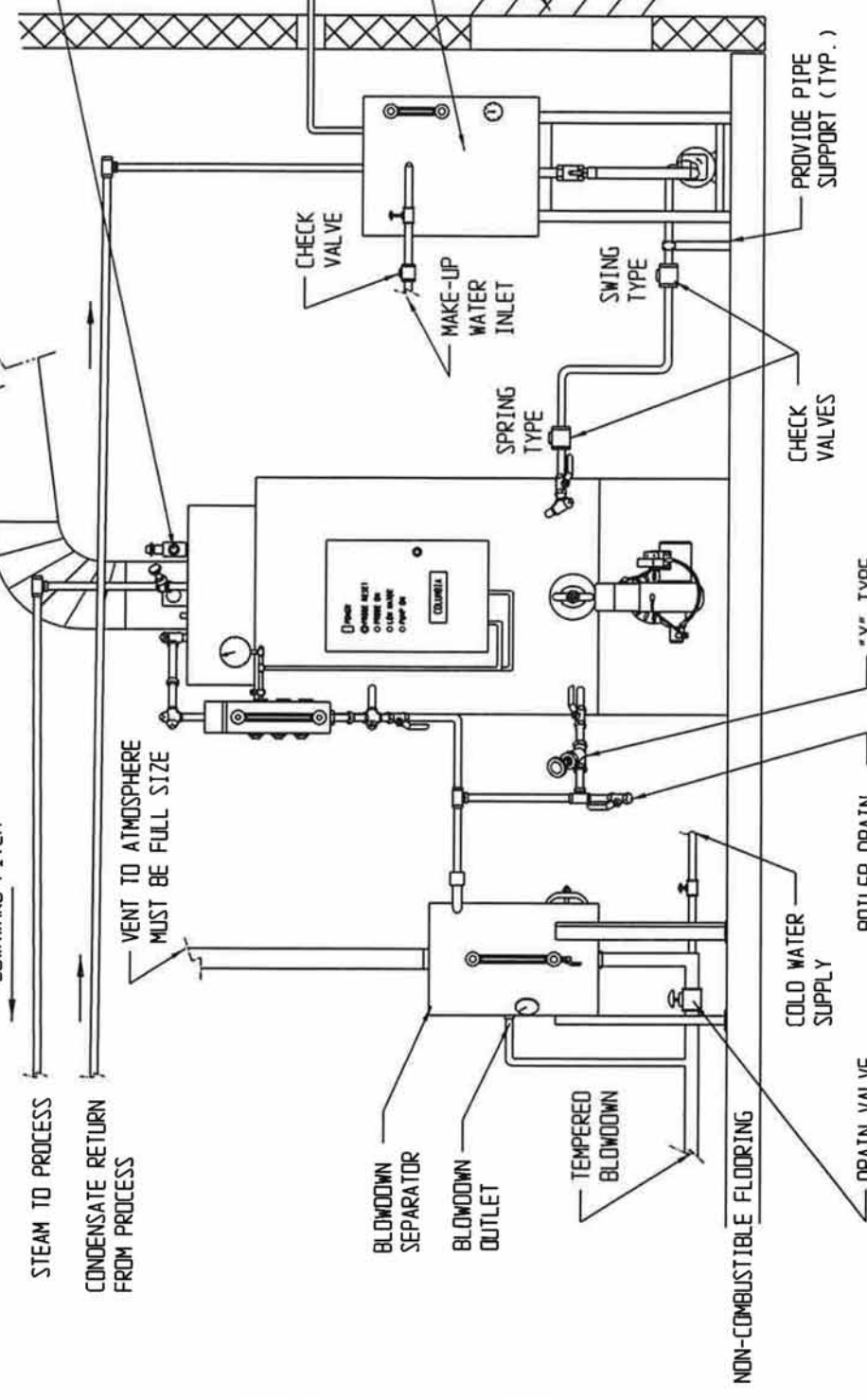
DRAIN VALVE (CLOSED DURING NORMAL OPERATION)

BLOWDOWN SEPARATOR

BLOWDOWN OUTLET

TEMPERED BLOWDOWN

NON-COMBUSTIBLE FLOORING



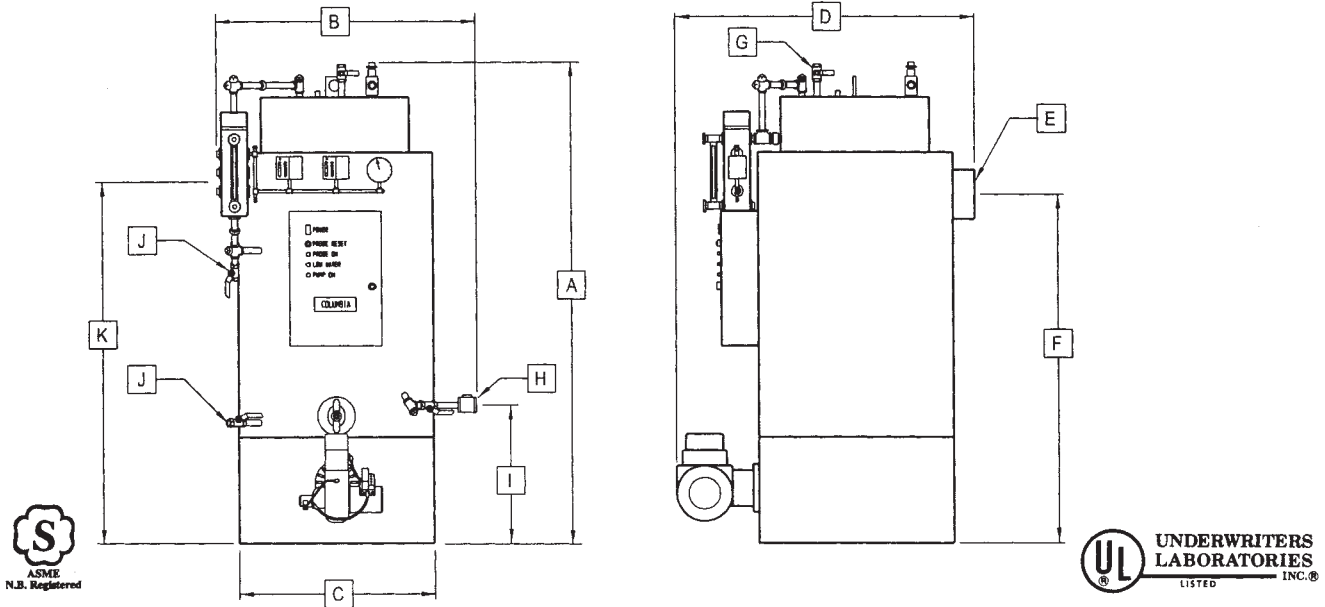
**COLUMBIA BOILER CO.**

TYPICAL CT BOILER PIPING LAYOUT

DRW BY	J.M.	DATE	14 JUL 99
SCALE	NONE	CHK'D BY	

MATERIAL: -	DWG NO.	REV
TOLERANCE (unless spec.)	PL-098	A

# CT SPECIFICATIONS AND DATA



MODEL NO.	CT-6	CT-10	CT-15	CT-20	CT-25	CT-35	CT-50
<b>RATINGS:</b>							
Horsepower	6	9.5	15	20	25	35	50
Gas Input (BTU per hour)	252,000	399,000	630,000	840,000	1,050,000	1,470,000	2,100,000
Oil Input (Gals. per hour)	2.00	2.85	4.50	6.00	7.50	10.50	15.00
Output (BTU per hour)	201,600	320,000	504,000	672,000	840,000	1,176,000	1,680,000
Output (Lbs. steam per hour)	207	320	517	690	862	1207	1725
Maximum Allowable Working Pressure	150	150	150	150	150	150	150
Water Capacity (Gals.)	16	27	37	43	59	90	240
Steam Release Surface Area	183 sq. in.	262 sq. in.	389 sq. in.	501 sq. in.	627 sq. in.	817 sq. in.	1,402 sq. in.
Hand Hole Sizes	(3) 3 x 4	(3) 3 x 3-3/4	(3) 3 x 3-3/4	(4) 3 x 3-3/4	(4) 3 x 3-3/4	(4) 3 x 3-3/4	(4) 3 x 3-3/4
<b>BOILER DIMENSIONS:</b>							
A Boiler Height (includes piping)	70"	78"	84"	88"	92"	96"	103"
B Boiler Diameter (left to right, packaged including M & M)	34"	36"	40"	41"	42"	43"	56"
C Boiler Diameter (left to right, less trim & piping)	27"	30"	34"	37"	40"	43"	56"
D Burner to Flue Outlet (approx.)	47"	48"	54"	58"	62"	71"	94"
E Flue Outlet (diameter)	6"	6"	8"	8"	10"	12"	12"
F Flue Outlet to Floor (centerline)	48-1/4"	55"	60"	63-1/2"	65-1/2"	69"	76-1/4"
G Steam Outlet (IPS)	3/4"	3/4"	1"	1"	1-1/4"	1-1/4"	2"
H Feedwater Inlet	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	1"
I Feedwater Inlet to Floor (centerline)	22-3/8"	24-3/8"	24-3/8"	27-3/8"	28-3/8"	13-1/2"	15-1/2"
J Blowdown Outlet (IPS)	1"	1"	1"	1"	1"	1"	1-1.4"
K Normal Water Line to Floor	46-3/4"	54-1/2"	60-1/2"	65"	69"	71-1/2"	81-1/2"
Approx. Floor space	3' x 5'	3' x 5'	3-1/4' x 5'	3-1/2' x 5-1/2'	4' x 6'	5' x 8'	6' x 10'
<b>CRATED DIMENSIONS:</b>							
Left to Right	38"	41"	43"	44"	44"	45-1/2"	56"
Front to Rear	53"	56"	62"	66"	66"	77"	96"
Height	73"	81"	86"	95"	95"	95"	104"
Approx. Shipping Wt. (skidded & crated)	1580 lb	1900 lb	2450 lb	3075 lb	3400 lb	4650 lb	6200 lb



*America's Most Trusted Name in Industrial, Commercial and Residential Boilers*

**COLUMBIA<sup>®</sup> BOILER COMPANY**

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