

## COMMERCIAL GAS-FIRED BOILERS



25589 Highway 1  
McBee, SC 29101



**MODELS: UP-FLOW MODELS  
HW 420/520/670  
SERIES 302/303**

**WITH ELECTRONIC INTERMITTENT  
PILOT IGNITION**

**SUPPLEMENT MANUAL to  
321078-000 INSTRUCTION MANUAL**

### CSD - 1 MODELS

**WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.**

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

— **WHAT TO DO IF YOU SMELL GAS:**

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

— **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**

Thank you for buying this energy efficient boiler.  
We appreciate your confidence in our products.

This supplement is to be used when the authority having jurisdiction requires that the installation must conform to the standard for Controls and Safety Devices for Automatically Fired Boilers, ASME CSD-1. The rules of the code cover the requirements for the assembly, operation and maintenance of controls and safety devices on an automatically operated boiler.

An installation that conforms with the instruction manual and the specific requirements set forth in this supplement is said to be in compliance with ASME CSD-1.

The gas control string that meets the requirements of CSD-1 is shown in Figure 1 of this supplement. The boiler is fitted with a single stage (high fire) control. This control is the same found on standard HW units with the addition of extra valving that allows for periodic leak testing.

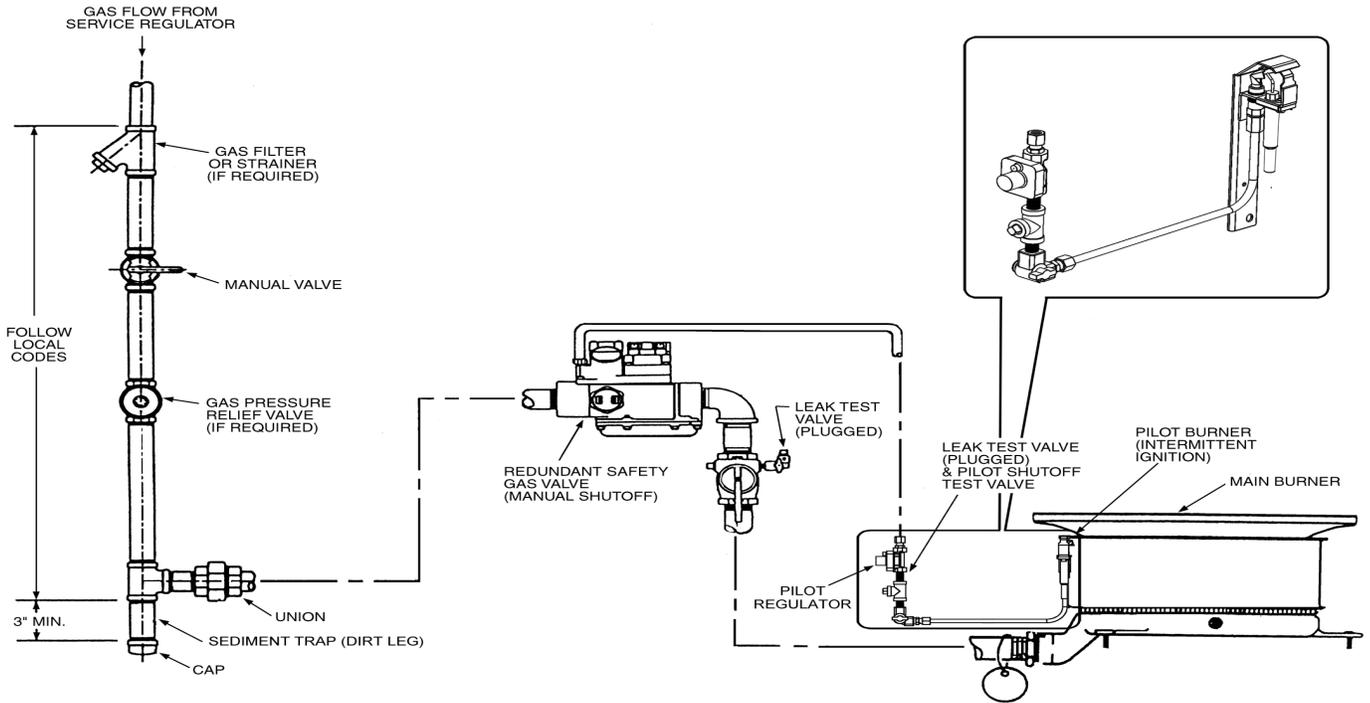
A two trial ignition module, United Technologies 1003-617A (AOS P/N 320941-000) along with United Technologies 1145-2 CSD-1 Control Lockout Module (AOS P/N 320942-000) are installed in place of Honeywell S86XX Module used on HW standard models. The two trial module's alarm output will be energized if the pilot burner does not ignite within 15 seconds of two trials, which will trigger the UT 1145-2 Control Lockout to shut down the power to the ignition module and to illuminate the red LED. If the lockout does occur, the red reset button on the control lockout module must be pressed before the ignition is again operative.

**PLACE THESE INSTRUCTIONS ADJACENT TO BOILER AND NOTIFY OWNER TO KEEP FOR FUTURE REFERENCE**

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# GAS CONTROL DIAGRAM



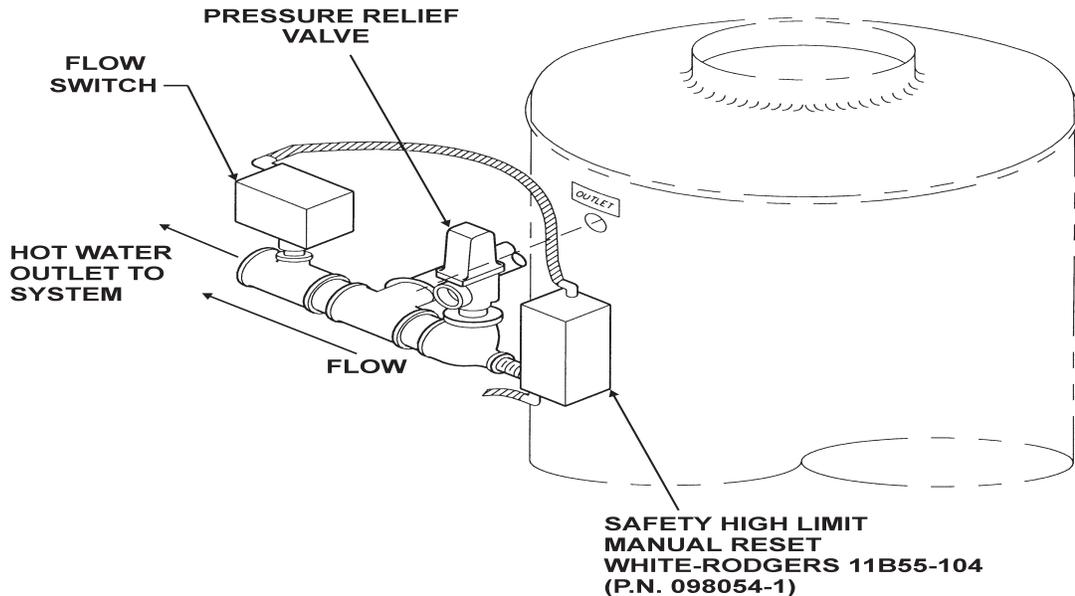
**FIGURE 1. CSD-1 GAS CONTROL DIAGRAM**

CSD-1 required components are factory installed and are shown in Figure 2. The Safety High Limit Manual Reset, White-Rodgers 11B55-104 (P.N. 98054-1) is factory set for installation as a Hydronic Heating Boiler, with maximum stop setting of 250 °F. For installation as a Hot Water Supply Boiler, the stop must be reset to a maximum of 210 °F.

For additional information on this Hot Water Boiler installation, see Instruction Manual 321078-000.

The wiring changes brought about by the addition of the Figure 2 manual reset High Limit, and the Flow Switch are reflected on the wiring diagrams shown in Figure 3.

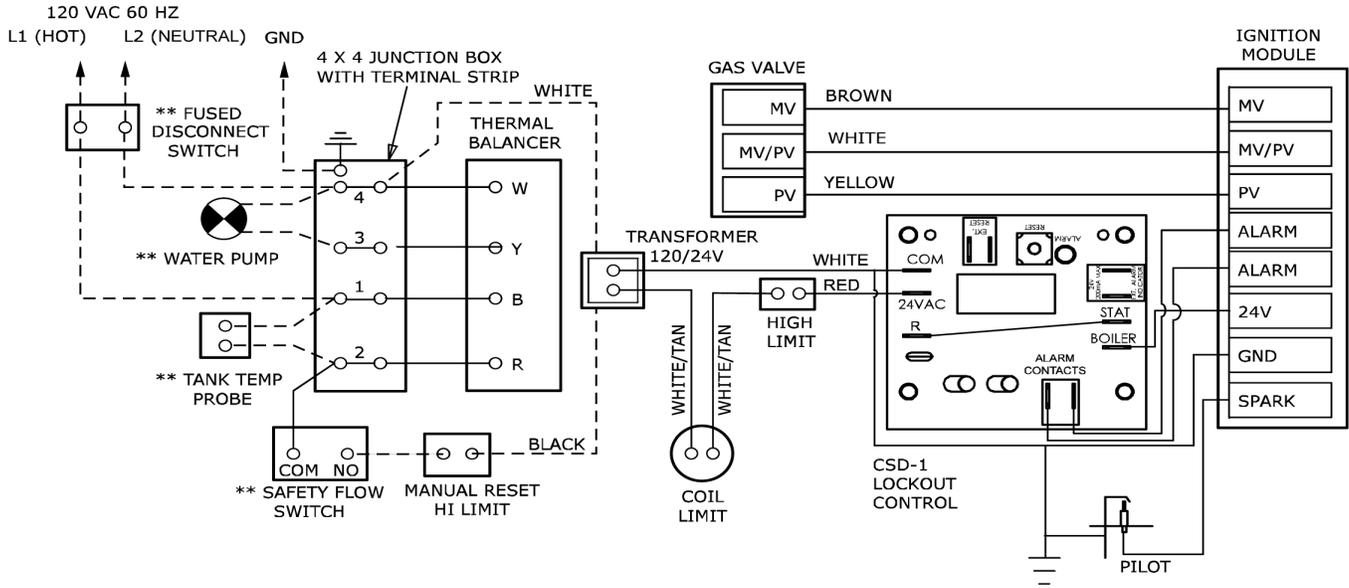
Boilers are shipped with a 50 lb. Relief Valve installed for installation as a Hot-Water Heating Boiler. For installation as a Hot-Water Supply Boiler the Relief Valve must be replaced. See Instruction Manual 321078-000 for further information on relief valve for Hot-Water Supply systems.



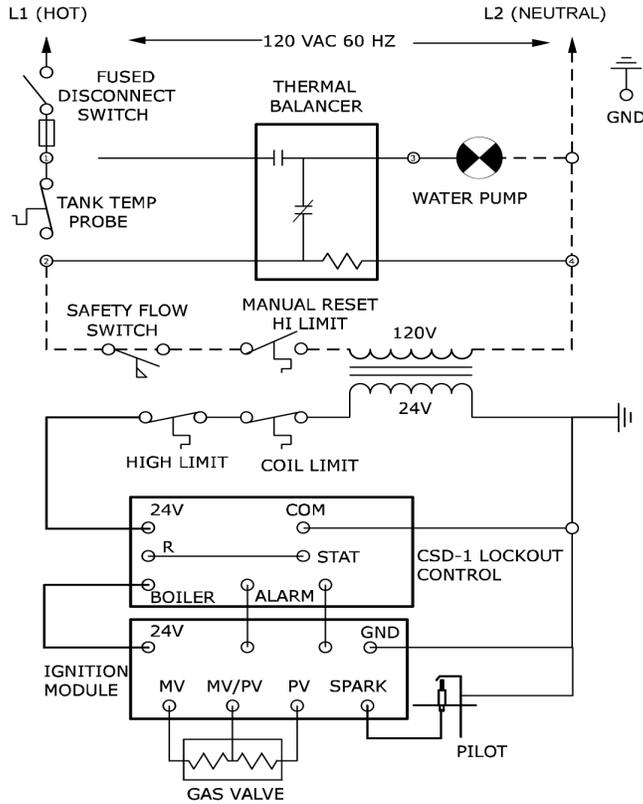
**FIGURE 2. CSD-1 OUTLET MANIFOLD**

# WIRING DIAGRAM

## HW 300 TO 670 CSD-1 CONNECTION DIAGRAM



## SCHEMATIC DIAGRAM



NOTE: IF REPLACING ANY FACTORY WIRING, USE TYPE 105°C WIRE OR EQUIVALENT, EXCEPT FOR THE IGNITION WIRE WHICH USES 250°C WIRE AND THE COIL LIMIT WHICH USES 200°C WIRE.

\*\* THESE COMPONENTS ARE NOT FACTORY INSTALLED AND MUST BE SUPPLIED BY THE INSTALLER.

WIRING

———— BY FACTORY  
- - - - BY INSTALLER

FIGURE 3. WIRING DIAGRAM

# OPERATING SEQUENCE

All units are built with an ignition control module that provides the ignition sequence, pilot flame monitoring, and safety shut off of the gas valves. The CSD-1 ignition control modules are of two 15 seconds pilot trials with 5 minutes waiting period between the two trials. If the pilot flame is not established/confirmed during the first 15 seconds ignition trial, or if the pilot flame signal is lost after main burner is ON, the United Technologies (UT) ignition module will de-energize the gas valve and wait for 5 minutes. It will start one more 15 seconds trial for ignition. If the pilot flame is still not established, the alarm contacts on the ignition module will be energized, which will cause the CSD-1 lockout module to shut down the power to the ignition module and illuminate the red LED. The ignition module will be in "Lockout" mode until the reset button on the lockout module is pressed.

## **OPERATING SEQUENCE WHEN WIRED AS SHOWN**

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1. With power supplied the unit becomes activated.
2. When the System Controller (i.e., tank temperature control, thermostat, building controller, etc.) closes "calling for heat", power will activate the circulating pump. Power is also supplied to the normally open contacts of the flow switch.
3. With the pump providing sufficient water flow, the flow switch will close contacts; allowing power to be supplied to the transformer through the manual reset high limit.
4. Power continues through the normally closed auto reset high limits to energize the ignition control module. Opening the contacts on either high limit immediately shuts down the control module.
5. Once energized, the control module tries for ignition by starting a control timer, opening the pilot gas valve (PV) and generating a high voltage pulse. Gas and ignition sparks are supplied at the pilot until the pilot lights or the control timer terminates the ignition trial.

If the pilot does not light, or the module does not recognize a stable flame, the module will de-energize the gas valve for 5 minutes, then starts the second and last 15 second trial for ignition.

6. When the pilot flame has been established and accepted by the control module sensing circuit, power is allowed to energize the main gas valve (MV). This valve opens, allowing gas to flow to the main burner which is then ignited by the pilot flame. Failure of the pilot flame at any time during operation will cause the control module to shut down the gas valve.
7. The system continues to operate until "call for heat" is satisfied. The unit then shuts down. The thermal balancer keeps the pump operating approximately one (1) extra minute for heat exchanger post-purge. The unit will continue to operate automatically as required.

# TESTING AND MAINTENANCE

Where required by the local authorities having jurisdiction, a fuel cleaning device such as a filter or strainer should be installed in the main gas supply line to the unit (see Figure 1 on Page 3).

A gas service pressure regulator is required to maintain the gas supply pressure below the maximum allowable pressure indicated on the appliance rating plate. A gas pressure relief valve, if required by the local code authority, should be installed upstream of all operating and safety controls in the gas train and downstream of the gas pressure regulator in the gas supply line (see Figure 1 on Page 3).

Pertinent operating, cleaning and testing procedures are outlined in this supplement in the TESTING AND MAINTENANCE section.

A Manufacturer's/Installing Contractor's Report for ASME CSD - 1 Certification and Reporting (CG-500) requirements is provided with the instructions. This report shall be made available to the authorized inspection agency or the inspector for action as required by the local jurisdiction. Installing contractors shall maintain a data report for each installation completed. It is the responsibility of the installing contractor to deliver the pertinent operating, cleaning and testing procedures together with the complete wiring and piping diagrams, to the owner/user and to obtain a receipt for the instructions. The receipt shall be filed with the installation report.

## TESTING AND MAINTENANCE

Periodic testing of all boiler controls and safety devices is required to verify correct operation. Precautions shall be taken to protect against bodily injury or property damage while tests are being conducted. Cover plates that require removal in order to gain access to items requiring maintenance or testing shall be replaced before the boiler is put back in service. Since it is essential to have all control and safety devices operating as intended at all times, a periodic testing and maintenance schedule should be set up and followed with results being logged on a regular basis. Operators or maintenance technicians should follow the recommended procedures set forth in the instructions and allow for any additional circumstances that arise based on the particular installation when preparing a maintenance program. The operator or technician should thoroughly understand the operating procedures and be able to recognize an equipment malfunction. Obtain a receipt for the instructions. The receipt shall be filed with the installation report.

Table 1, provided herein is a recommended guideline to follow for periodic testing of the boiler's safety devices and controls. Detailed maintenance procedures are included here as well.

**TABLE 1. PERIODIC TESTING PROCEDURES**

ITEMS	FREQUENCY	ACCOMPLISHED BY	REMARKS
1. Gauges and Indicators	Daily	Operator	Visually inspect, log observations.
2. Burner Flame	Daily	Operator	Visually inspect for uniform blue flames.
3. Pilot Burner	Daily	Operator	Visually inspect for uniform flame envelope.
4. Flame Failure Detection	Weekly	Operator	Close Pilot Manual Shutoff Valve, check safety shutdown time, log results.
5. Gas Valves	Weekly	Operator	Open Operating Control, listen for valve closure, check for voltage.
6. Flow Switch	Weekly	Operator	See detailed instructions.
7. Vent System	Monthly	Operator	See detailed instructions.
8. Optional Power Vent	Monthly	Operator	See detailed instructions.
9. Burner Components	Monthly	Service Technician	See Owner's Manual
10. Heat Exchanger Assembly	Semi-Annually	Service Technician	See detailed instructions.
11. Transformer	Semi-Annually	Service Technician	Check primary and secondary voltage, log results.
12. Manual Reset High Limit and Auto Reset High Limit	Annually	Service Technician	See detailed instructions.
13. Safety Valves	As Required	Operator	See detailed instructions.
14. Drip Leg and Gas Strainer	As Required	Operator	See detailed instructions.

# INSTRUCTIONS FOR TESTING AND MAINTENANCE

## DAILY CHECKS

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1. Thermometers and temperature gauges should be visibly inspected on a daily basis for normal operation. These items should be noted and the differential temperatures recorded during operation. If the temperature differential increases by five (5) degrees Fahrenheit (3 degrees C) over the original installation, a general delimiting of the heat exchanger may be required.
2. Visually inspect main burner flame by viewing upwards between the burners from the front bottom of the boiler. Inspect for well-defined blue flames. Check for smooth light-off.
3. Visually inspect pilot burner for a well-defined flame pattern. Pilot flame should envelop 3/8 to 1/2 inch (9 to 12 mm) of the top of the insulated rod on the pilot burner.

## WEEKLY CHECKS

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4. When satisfied, or on lockout, the main gas valves should shut off within five(5) seconds. With the system operating, momentarily turn the system controller down to shut down the boiler. Listen for valve closure, noting timing. Verify that there is no voltage present at the valves. Return the system controller to its normal setting.
5. When a pilot flame failure is detected the boiler should shut off within four (4) seconds. With the boiler operating, close the manual pilot shut-off valve, which is located in the pilot gas supply line.  
Note gas valve closure time. Verify that there is no voltage present at the valves.
6. Flow switch operation is checked by verifying the switch position during operation. With the cover removed, and water flowing through the system, observe that the switch closes the circuit between terminal #1 (common) and terminal #2 (flow closes circuit). When flow stops, this switch will open the circuit, shutting down the boiler. Note your observations.

## MONTHLY CHECKS

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7. The flue collector and draft hood are to be visually inspected internally for any signs of deterioration. Significant corrosion can signal high moisture content or chemical reactions in the flue gases. The use of a mirror and light source allows for easy inspection through the draft hood opening.
8. On optional power vent system, the blower prover switch may be checked by disconnecting the pressure switch tube. The boiler will shut down if already operating, or not start if it is not. Reconnecting the tube will allow the boiler to fire. Note your observations.

## SEMI-ANNUAL CHECKS

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9. Burners shall be maintained per the operating instructions of the Instruction Manual.
10. The heat exchanger is to be visually inspected for build up of deposits or tube distortion. This is best accomplished when the burners are removed for their inspection. Light deposits are to be brushed clear. Heavy deposits or tube repairs may require removal of the heat exchanger. As well, heavy deposits may indicate the need for more frequent inspections and changes in operating parameters. Refer to the Instruction Manual regarding air supply and corrosion.

11. The transformer's primary and secondary voltages can be checked with a voltmeter and the voltages recorded.

## ANNUAL CHECKS

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12. The Manual Reset High Limit may be checked by recording the temperature settings, changing the auto reset limit (auto reset limit may require temporarily jumping the 2 terminals to bypass the control for higher temperature) and system controller to a higher set point than the limit itself and running the boiler. Allow the boiler to shut down on Manual High Limit. After shut down, the boiler should not fire up until the manual reset button is depressed and power to the unit is reset. The auto reset limit and the system controller may be tested in similar fashion but a shut down on either will not require the power to the boiler to be reset. Note: If jumper wire was used be sure to remove it. Return all temperature settings to the original positions upon completion of test.

13. Redundant Safety Gas Valves may be checked for proper closure upon shutdown and should stop the flow of gas to the burner within five (5) seconds of being de-energized.

Downstream of each valve is a smaller leak test valve. Removal of the plug will allow the connection of a gas pressure gauge for the purpose of testing - see Figure 1 on Page 3.

The Redundant Safety Gas Valve first valve seat may be checked with the boiler off. Close the manual valve located ahead of the redundant valve. Open the first leak test valve, note the gauge pressure and verify it is stable. Open the manual valve allowing gas to flow against the first valve seal. A steady increase in gas pressure indicates gas is leaking past the valve seat and the redundant valve should be replaced.

To check the second redundant valve seat, first disconnect the electrical supply wire (brown) from TH terminal on redundant valve. With the firing valve closed, open the leak test valve downstream of the redundant safety valve, note the gauge pressure and verify it is stable.

Operate the boiler to call for heat allowing the pilot burner to light. The first valve seat will open allowing gas against the second valve seat. A steady increase in gas pressure indicates fuel is leaking past the second valve seat and the redundant valve should be replaced.

14. The sediment trap (dirt leg) and gas strainer (if required) should be inspected periodically for accumulation of foreign debris that could cause blockage. Gas should be shut off ahead of the particular device to be cleaned or inspected to prevent gas leakage.



25589 Highway 1, McBee, SC 29101  
Technical Support: 800-527-1953 • Parts: 800-433-2545 • Fax: 800-644-9306  
[www.hotwater.com](http://www.hotwater.com)