

A. O. SMITH

COPPER BOILERS
FOR HYDRONIC HEATING
AND HOT WATER SUPPLY

- Limited Warranty
- Installation
- Operation
- Maintenance



Instruction Manual

GB/GW-200, -300, -400, -500, -650, -750

SERIES 200, 201, 202, 203



TEXT PRINTED OR OUTLINED IN RED CONTAINS INFORMATION RELATIVE TO YOUR SAFETY. PLEASE READ THOROUGHLY BEFORE INSTALLING AND USING THIS APPLIANCE.

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- **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:

- **Extinguish any open flame.**
- **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
cost efficient, high recovery
unit from A. O. Smith Water Products Co.

Please read through this informative manual
and pay special attention to the following:

"LIMITED WARRANTY" ON PAGE 2

ROUGH-IN DIMENSIONS/CAPACITIES PAGES 3 - 5

"FOREWORD" ON PAGE 6

"FEATURES" ON PAGES 7 - 8

"VENTING" ON PAGES 9 - 12

"GAS CONNECTIONS" 12 - 14

"INSTALLATION INSTRUCTIONS" ON PAGES 7 - 14

"WIRING DIAGRAM/SCHEMATIC" ON PAGES 15 - 16

"LIGHTING AND OPERATING" ON PAGES 17 - 18

"DIA-SCAN II INSTRUCTIONS" ON PAGES 19 - 22

"SYSTEMS INSTALLATION" ON PAGES 23 - 24

"SYSTEM EQUIPMENT INSTALLATION" PAGES 25 - 28

"TROUBLE SHOOTING" ON PAGES 28 - 29

"GENERAL MAINTENANCE" ON PAGES 29 - 30

"START-UP INSTRUCTIONS" ON PAGES 31 - 32

**A. O. SMITH
WATER PRODUCTS
COMPANY**

A DIVISION OF A. O. SMITH CORPORATION
EL PASO, TX MC BEE, SC RENTON, WA
STRATFORD, ONTARIO
VELDHOVEN, THE NETHERLANDS
www.hotwater.com

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

NEW BOILER LIMITED WARRANTY

A. O. Smith Corporation, the warrantor, extends the following LIMITED WARRANTY to the owner of this hydronic boiler:

1. If within TEN years after initial installation of the boiler, the heat exchanger shall prove upon examination by the warrantor to be defective in material or workmanship, the warrantor, at his option, will exchange or repair such part or portion. This term is reduced to FIVE years if this boiler is used for volume hot water supply purposes other than hydronic space heating.
 - a. This warranty is extended to the owner for all other parts or portion during the FIRST year following initial installation of this boiler.
 - b. The warranty on the repair or replacement of the part or portion will be limited to the unexpired term of the original warranty.

2. **CONDITIONS AND EXCEPTIONS**

This warranty shall apply only when the boiler is installed in accordance with local plumbing and building codes, ordinances and regulations, the printed instructions provided with it and good industry practices. In addition, an appropriately sized safety relief valve certified to the ASME Boiler and Pressure Vessel Code must have been installed and fresh water used for filling and makeup purposes;

- a. This warranty shall apply only when the boiler is used:
 - (1) at temperatures not exceeding the maximum setting of its operative and/or high limit control;
 - (2) at water pressure not exceeding the working pressure shown on the boiler;
 - (3) when filled with boiler water, free to circulate at all times and with the heat exchanger free of damaging scale deposits;
 - (4) in a noncorrosive and non-contaminated atmosphere;
 - (5) in the United States, its territories or possessions, and Canada;
 - (6) at a water velocity flow rate, not exceeding or below the Boiler's designed flow rates;
- b. Any accident to the boiler, any misuse, abuse (including freezing) or alteration of it, any operation of it in a modified form will void this warranty.

3. **SERVICE AND REPAIR EXPENSE**

Under this limited warranty the warrantor will provide only a replacement part. The owner is responsible for all other costs. Such costs may include but are not limited to:

- a. Labor charges for service removal, repair or reinstallation of the component part;
- b. Shipping, delivery, handling, and administrative charges for forwarding the replacement part from the nearest distributor and returning the claimed defective part to such distributor.
- c. All cost necessary or incidental for any material and/or permits required for installation of the replacement.

4. **LIMITATIONS ON IMPLIED WARRANTIES**

Implied warranties, including any warranty of merchantability imposed on the sale of this boiler under state law are limited to one (1) year duration for the boiler or any of its parts. Some states or provinces do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

5. **CLAIM PROCEDURE**

Any claim under the warranty should be initiated with the dealer who sold the boiler, or with any other dealer handling the warrantor's products. If this is not practical, the owner should contact:

U.S. Customers

A. O. Smith Water Products Company
5621 West 115th Street
Alsip, IL 60803
Telephone: 800 323-2636

Canadian Customers

A. O. Smith Enterprises Ltd.
P. O. Box, 310 - 768 Erie Street
Stratford, Ontario N5A 6T3
Telephone: (519) 271-5800

- a. The warrantor will only honor replacement with identical or similar parts thereof which are manufactured or distributed by the warrantor.
- b. Dealer replacements are made subject to in-warranty validation by warrantor.

6. **DISCLAIMERS**

NO OTHER EXPRESS WARRANTY HAS BEEN OR WILL BE MADE ON BEHALF OF THE WARRANTOR WITH RESPECT TO THE BOILER OR THE INSTALLATION, OPERATION, REPAIR OR REPLACEMENT OF THE BOILER. THE WARRANTOR SHALL NOT BE RESPONSIBLE FOR WATER DAMAGE, LOSS OF USE OF THE UNIT, INCONVENIENCE, LOSS OR DAMAGE TO PERSONAL PROPERTY OR OTHER CONSEQUENTIAL DAMAGE. THE WARRANTOR SHALL NOT BE LIABLE BY VIRTUE OF THIS WARRANTY OR OTHERWISE FOR DAMAGE TO ANY PERSONS OR PROPERTY, WHETHER DIRECT OR INDIRECT, AND WHETHER ARISING IN CONTRACT OR TORT.

- a. Some states or provinces do not allow the exclusion or limitation of the incidental or consequential damage, so the above limitations or exclusions may not apply to you.
- b. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state or province to province.

Fill in the following for your own reference. Keep it. Registration is not a condition of warranty. The model and serial number are found on the boiler's rating plate.

Owner _____

Installation Address _____

City and State or Province _____ Postal/Zip Code _____

Date Installed _____ Model No. _____ Serial No. _____

Dealer's Name _____

Dealer's Address _____ Phone No. _____

FILL IN WARRANTY AND KEEP FOR FUTURE REFERENCE

Metric dimensions in ().

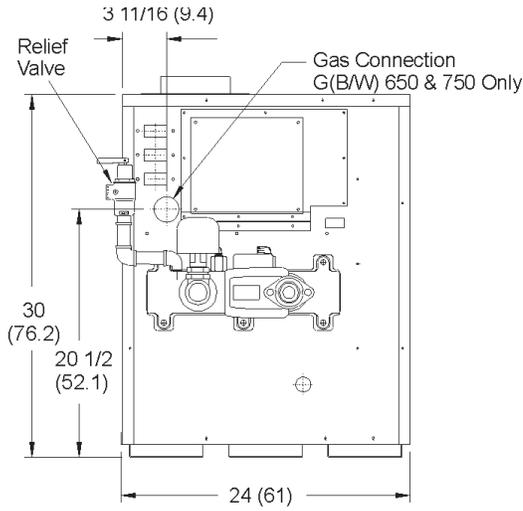


Figure 1

LEFT SIDE

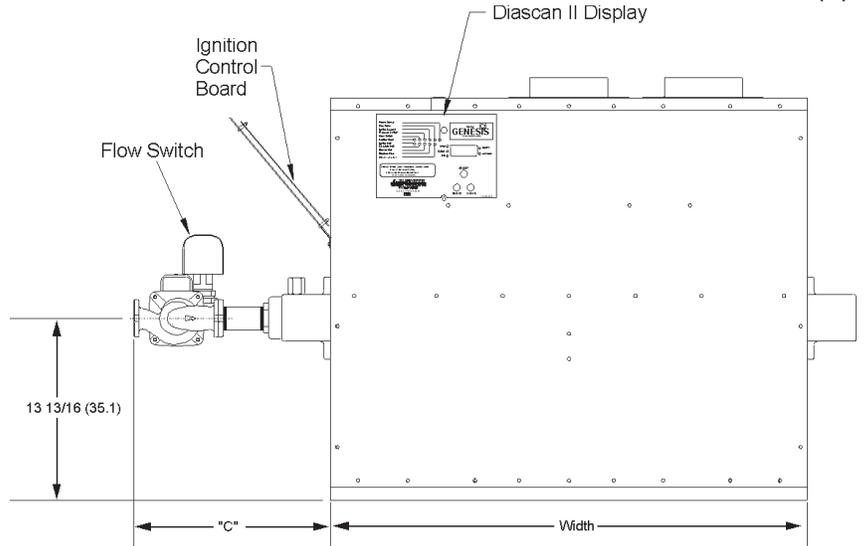


Figure 2

FRONT

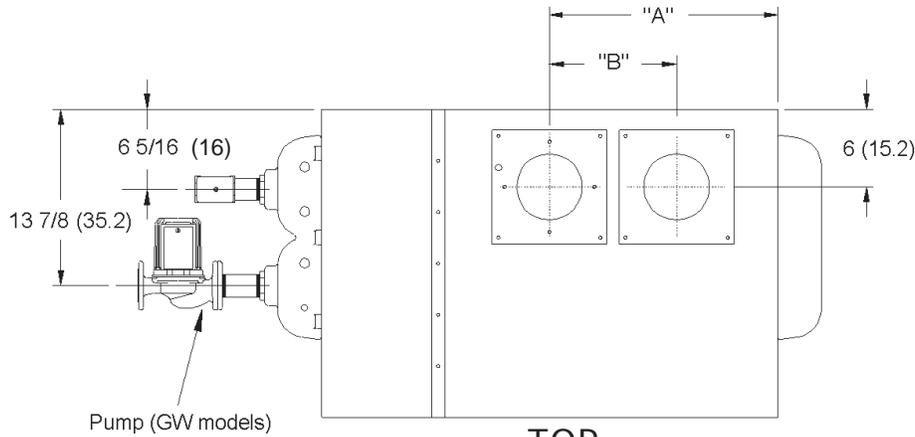


Figure 3

TOP

Table 1A: Basic Gas and Electrical Parameters

MODEL GB/GW	TYPE OF GAS	VOLTS/HZ	AMPS	MANIFOLD PRESS. Inches W.C.	MANIFOLD PRESS. kPa
200	Natural	120/60	20	3.5	0.87
300	Natural	120/60	20	3.5	0.87
400	Natural	120/60	20	3.5	0.87
500	Natural	120/60	20	3.5	0.87
650	Natural	120/60	20	3.5	0.87
750	Natural	120/60	20	3.5	0.87
200	Propane	120/60	20	10.0	2.49
300	Propane	120/60	20	10.0	2.49
400	Propane	120/60	20	10.0	2.49
500	Propane	120/60	20	10.0	2.49
650	Propane	120/60	20	10.0	2.49
750	Propane	120/60	20	10.0	2.49

All Models - Maximum Supply Pressure: 14 In. W. C. (03.49 kPa)
 Minimum Supply Pressure Natural Gas: 4.5 In. W. C. (01.22 kPa)
 Minimum Supply Pressure Propane (LP) Gas: 11.0 In. W. C. (02.74 kPa)

Table 1B: Rough-in Dimensions

Model	Btu/hr. Input Natural Gas	KW Input Natural Gas	Btu/hr. Input Propane (LP) Gas	KW Input Propane (LP) Gas	Exhaust Vent Size (Inch)	Inlet Air (Inch)	Water Connecions Size (Inch)	Gas Piping (Inch)	Width (Inch)	Width (mm)	A (inch)	A (mm)	B (Inch)	B (mm)	C (Inch)	C mm
GB/GW 200	199,900	59	199,900	59	4	4	1 1/2	3/4	23 1/4	591	11 11/16	297	7 1/2	191	12	305
GB/GW 300	300,000	88	300,000	88	5	5	1 1/2	3/4	29 1/2	749	14 13/16	376	9	229	12	305
GB/GW 400	399,900	117	399,900	117	6	6	1 1/2	1	35 3/4	908	17 15/16	456	9	229	14 3/4	375
GB/GW 500	500,000	147	500,000	147	6	6	2	1	42	1067	21 1/16	535	9	229	14 3/4	375
GB/GW 650	650,000	190	650,000	190	8	8	2	1 1/4	51 3/8	1305	25 3/4	654	9	229	14 3/4	375
GB/GW 750	750,000	220	750,000	220	8	8	2	1 1/4	57 5/8	1464	28 7/8	733	9	229	17 1/4	438

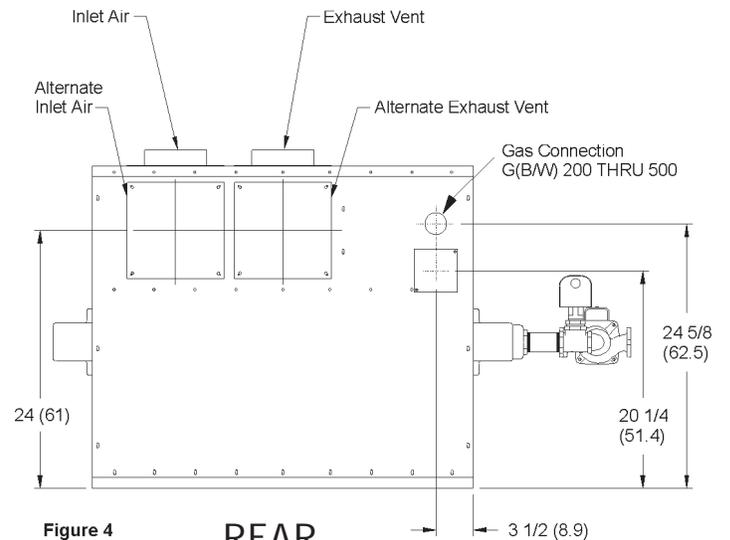
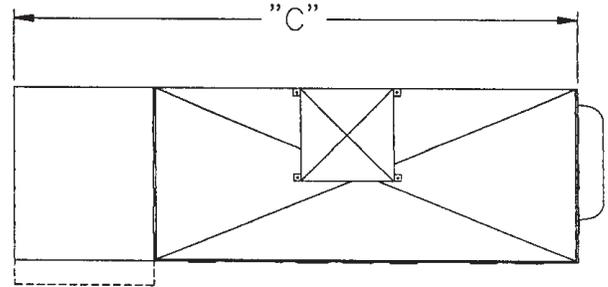
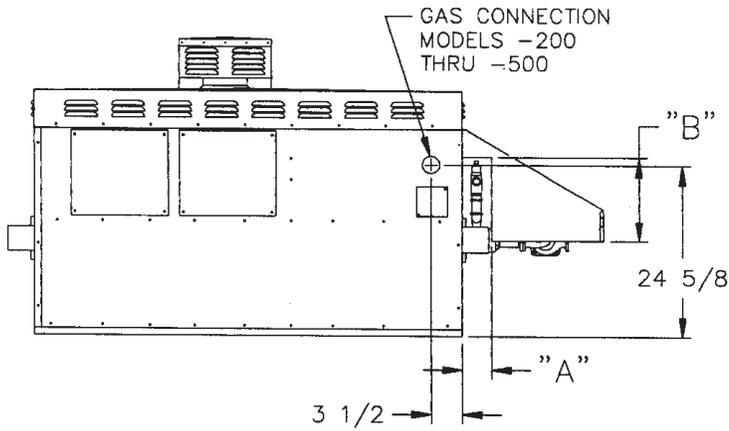


Figure 4

REAR

REAR

TOP



LEFT SIDE

FRONT

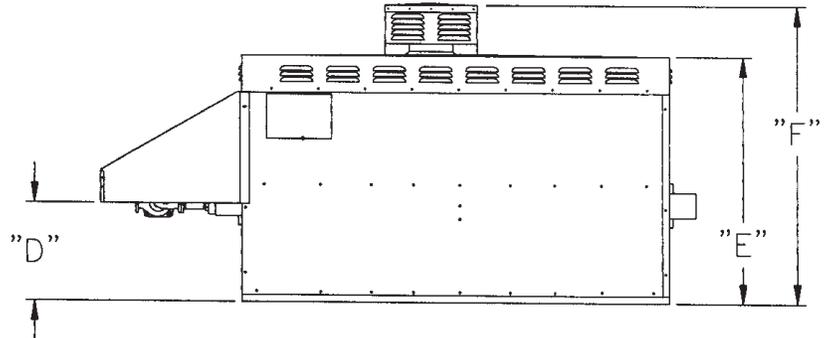
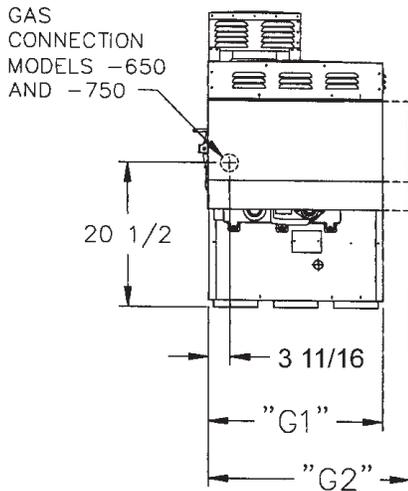


Table 1C: Outdoor Unit Dimensions

MODEL NUMBER	"A"	"B"	"C"	"D"	"E"	"F"	"G1"	"G2"
GBO/GWO-200	3	9 3/4	42 3/4	13 5/8	34 5/8	41 7/8	24 3/16	—
GBO/GWO-300	3	9 3/4	49	13 5/8	34 5/8	41 7/8	24 3/16	—
GBO/GWO-400	3	9 3/4	55 1/4	13 5/8	34 5/8	41 7/8	24 3/16	—
GBO/GWO-500	3	9 3/4	61 1/2	13 5/8	34 5/8	41 7/8	24 3/16	—
GBO/GWO-650	3	9 3/4	70 7/8	13 5/8	34 5/8	41 7/8	—	27 11/16
GBO/GWO-750	3	9 3/4	77 1/8	13 5/8	34 5/8	41 7/8	—	27 11/16

Table 2: Pump Performance

Model	Water Category	Flow Rate		Head Loss		Rise Temp.		Pipe Size (inch)	Pump Taco Models*
		GPM	LPM	Feet	Meter	F	C		
GW 200	Normal	17	64	4.4	1.3	20	2.4	1 1/2"	007
	Hard	23	87	7.7	2.3	15	4.3	1 1/2"	0012
GW 300	Normal	17	64	4.4	1.3	30	2.4	1 1/2"	007
	Hard	25	95	9.5	2.9	20	5.3	1 1/2"	0012
GW 400	Normal	23	87	8.0	2.4	30	4.4	1 1/2"	0012
	Hard	34	129	6.0	1.8	20	3.3	2"	0012
GW 500	Normal	28	106	4.6	1.4	30	2.6	2"	0012
	Hard	42	159	9.1	2.8	20	5.1	2"	1911 (1/4 HP)
GW 650	Normal	37	140	6.2	1.9	30	3.4	2"	0012
	Hard	55	208	12.2	3.7	20	6.8	2"	1911 (1/3HP)
GW 750	Normal	42	159	9.7	3.0	30	5.4	2"	1911 (1/4 HP)
	Hard	63	238	18.8	5.7	20	10.4	2"	1935 (1/3HP)

PRESSURE DROP INCLUDES THE LOSS THROUGH 50' (15.2M) OF PIPE AND NORMAL FITTINGS, WHEN INSTALLED WITH STORAGE TANK

WATER CATEGORY	GRAIN HARDNESS PER GAL.
NORMAL	1 THROUGH 15
HARD	OVER 15

*TACO PUMPS SHOWN. EQUIVALENT ARMSTRONG, BELL & GOSSETT OR GRUNDFOS ARE ACCEPTABLE AS LONG AS THE FLOW RATES ARE MAINTAINED. ALWAYS ENSURE ADEQUATE SUPPORT FOR PUMP AND PIPING.

Table 3: Recovery Capacities

Model	Input Rating Btu/Hr (kW)	Temp. C Rise	22 28 33 39 44 50 56 61 67 72 78										
			40	50	60	70	80	90	100	110	120	130	140
200	(59) 199,900	LPH	1919	1535	1279	1097	960	853	768	698	640	590	548
		GPH	507	406	338	290	254	225	203	184	169	156	145
300	(88) 300,000	LPH	2880	2304	1920	1646	1440	1280	1152	1047	960	886	823
		GPH	761	609	507	435	380	338	304	277	254	234	217
400	(117) 399,900	LPH	3839	3071	2559	2194	1920	1706	1536	1396	1280	1181	1097
		GPH	1014	811	676	580	507	451	406	369	338	312	290
500	(147) 500,000	LPH	4800	3840	3200	2743	2400	2133	1920	1745	1600	1477	1371
		GPH	1268	1015	845	725	634	564	507	461	423	390	362
650	(190) 650,000	LPH	6240	4992	4160	3566	3120	2773	2496	2269	2080	1920	1783
		GPH	1649	1319	1099	942	824	733	659	600	550	507	471
750	(220) 750,000	LPH	7200	5760	4800	4114	3600	3200	2880	2618	2400	2215	2057
		GPH	1902	1522	1268	1087	951	845	761	692	634	585	544

Table 4: Heat Exchanger Pressure Drop

TEMPERATURE RISE AND PRESSURE DROP												
Model GB	20 (°F) Rise		30 (°F) Rise		40 (°F) Rise		10 (°C) Rise		15 (°C) Rise		20 (°C) Rise	
	Flow GPM	PD-Ft. Head	Flow GPM	PD-Ft. Head	Flow GPM	PD-Ft. Head	Flow LPM	PD-Meters Head	Flow LPM	PD-Meters Head	Flow LPM	PD-Meters Head
200	17	0.6	11	0.4	8	0.1	64	0.19	42	0.12	30	0.02
300	25	1.3	17	0.6	13	0.4	95	0.38	64	0.19	49	0.12
400	34	2.2	23	0.9	17	0.6	129	0.67	87	0.28	64	0.20
500	42	3.4	28	1.8	21	0.9	159	1.03	106	0.54	79	0.29
650	55	3.5	37	2.0	27	1.8	208	1.07	140	0.61	102	0.56
750	63	8.3	42	4.3	32	2.1	238	2.53	159	1.31	121	0.64

FOREWORD

CAUTION

TEXT PRINTED OR OUTLINED IN RED CONTAINS INFORMATION RELATIVE TO YOUR SAFETY. PLEASE READ COMPLETELY BEFORE USING APPLIANCE.

Detailed installation diagrams are in this manual. These diagrams will provide the installer with a reference of materials needed and a suggested method of piping. IT IS NECESSARY THAT ALL WATER AND GAS PIPING, AND THE ELECTRICAL WIRING BE INSTALLED AND CONNECTED AS SHOWN IN THE DIAGRAMS.

CHECK THE DIAGRAMS THOROUGHLY BEFORE STARTING INSTALLATION TO AVOID POSSIBLE ERRORS AND TO MINIMIZE TIME AND MATERIALS COST. SEE FIGURES 1 THROUGH 4 AND TABLES 1A, 1B AND 1C.

This design complies with the latest edition of the ANSI Standard Z21.13, for Gas-Fired Low-Pressure Steam and Hot Water Boilers, or CGA 4.9/CGA 3.3 latest edition as a low-pressure boiler.

MAKE SURE THE GAS ON WHICH THE BOILER WILL OPERATE IS THE SAME AS THAT SPECIFIED ON THE BOILER RATING PLATE.

The boiler installation must conform to these instructions and the requirements of the local authority having jurisdiction.

In the absence of local code requirements, the installation must conform to the National Fuel Gas Code, ANSI Z223.1 or CAN/CGA-B149.1 or B149.2 (most recent edition).

These manuals can be purchased from the American Gas Association Laboratories, 8501 East Pleasant Valley Road, Cleveland, OH 44131 or Canadian Gas Association Laboratories, 55 Scarsdale Road, Don Mills, Ontario Canada M3B 2R3.

REPLACEMENT PARTS

Replacement parts may be ordered through A. O. Smith dealers, authorized servicers or distributors. Refer to the Yellow Pages for where to call or contact (in United States) the **A. O. Smith Water Products Company, 5621 West 115th Street, Alsip, IL 60803, 1-800-433-2545** or (in Canada) **A. O. Smith Enterprises Ltd., 768 Erie Street, Stratford, Ontario, Canada N5A 6T3, 519-271-5800**. When ordering parts be sure to state the quantity, part number and description of the item including the complete model and serial number as it appears on the product. Refer to the parts lists for more information.

For Technical Assistance call A. O. Smith Technical Information Center at 1-800-527-1953.

WARNING

THE WATER MANIFOLD IS NOT DESIGNED TO SUPPORT THE WEIGHT OF THE WATER PIPING SYSTEM. AS ON ALL BOILER INSTALLATIONS, SPECIAL CARE MUST BE TAKEN TO ENSURE PROPER SUPPORT.

WARNING

UNDER NO CIRCUMSTANCES SHOULD THE EQUIPMENT ROOM WHERE THE BOILER IS INSTALLED EVER BE UNDER NEGATIVE PRESSURE. PARTICULAR CARE MUST BE TAKEN WHEN EXHAUST FANS, COMPRESSORS, AIR HANDLING EQUIPMENT, ETC., MAY INTERFERE WITH THE COMBUSTION AND VENTILATION AIR SUPPLIES OF THIS BOILER.

CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation of the boiler.

"Verify proper operation after servicing."

INSTALLATION CLEARANCES

Sufficient area should be provided at the front (2 feet minimum) and at the water connection side (1 foot minimum) of the unit for proper servicing. Sufficient clearance should be provided at the return header side of the boiler to permit access to heat exchanger tubes for cleaning. In a utility room installation, the door shall be wide enough to allow the boiler to enter or to permit the replacement of another appliance.

These boilers are approved for installation on noncombustible flooring in an alcove with minimum clearance to combustibles of:

3 inches Sides, and Back; 3 inches top, Front Alcove, 6 inches Vent.

For installation on combustible flooring use the Combustible Floor Kit. The combustible floor kit base adds 4" to the overall height of the boiler. See figure 5.

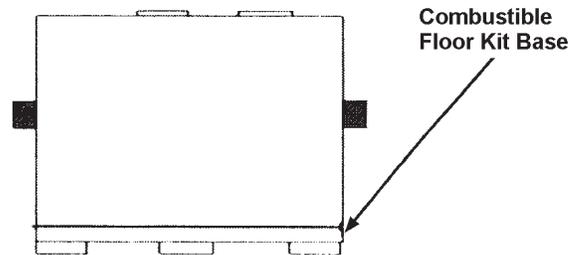


Figure 5: Boiler on Combustible Floor Base

Model	Combustible Floor Kit
(GB/GW)-200	210202-000
(GB/GW)-300	210202-001
(GB/GW)-400	210202-002
(GB/GW)-500	210202-003
(GB/GW)-650	210202-004
(GB/GW)-750	210202-005

Two inch clearance is allowable from combustible construction to hot water pipes.

LEVELLING

Each unit must be checked after installation to be certain that it is level.

CONDENSATION WARNING

Your boiler is not designed to operate with a boiler inlet water temperature of less than 120°F (38°C). Colder inlet water temperatures will result in significant condensation developing on the heat exchanger. This situation can cause a corrosive environment for the heat exchanger, burners and venting resulting in premature damage, which could result in serious personal injury or death. Damage caused by excessive condensation will not be covered under the limited warranty.

For systems that use large volumes of cold water or systems utilizing heavy water draws, condensation can be prevented by using a bypass loop. See page 27.

FEATURES

IMPORTANT

Only qualified personnel shall perform the initial firing of the heater. At this time the user should not hesitate to ask the start-up technician any questions regarding the operation and maintenance of the unit.

Lighting and Operating instructions are included with this manual. By using these instructions, the user may be able to make minor operational adjustments and save unnecessary service calls. However, the user should not attempt repairs, but should contact a service technician or gas supplier.

SAFETY RELIEF VALVES

Your local code authority may have other specific relief valve requirements not covered below.



THE PURPOSE OF A SAFETY RELIEF VALVE IS TO AVOID EXCESSIVE PRESSURE WHICH MAY CAUSE TANK EXPLOSION, SYSTEM OR BOILER DAMAGE.

TO AVOID WATER DAMAGE A DRAIN LINE MUST BE CONNECTED TO A SAFETY RELIEF VALVE TO DIRECT DISCHARGE TO A SAFE LOCATION. A DRAIN LINE MUST NOT BE REDUCED FROM THE SIZE OF THE VALVE OUTLET AND IT MUST NOT CONTAIN ANY VALVES BETWEEN THE BOILER AND THE RELIEF VALVE OR THE RELIEF VALVE AND THE DRAIN EXIT. IN ADDITION, THERE SHOULD NOT BE ANY RESTRICTIONS IN A DRAIN LINE NOR SHOULD IT BE ROUTED THROUGH AREAS WHERE FREEZING CONDITIONS MIGHT OCCUR. DO NOT THREAD OR CAP THE DRAIN LINE EXIT. RESTRICTING OR BLOCKING A DRAIN LINE WILL DEFEAT THE PURPOSE OF THE RELIEF VALVE AND MAY CREATE AN UNSAFE CONDITION. INSTALL A DRAIN LINE WITH A DOWNWARD SLOPE SUCH THAT IT NATURALLY DRAINS ITSELF.

If any safety relief valve is replaced, the replacement valve must comply with the latest version of the ASME Boiler and Pressure Vessel Code, Section IV (HEATING BOILERS). Select a relief valve with a discharge rating NOT less than the boiler input, and a set pressure NOT exceeding the working pressure of any component in the system.

The storage tank temperature and pressure relief valve must comply with the applicable construction provisions of the Standard for Relief Valves and Automatic Gas Shut-off Devices for Hot Water Supply Systems, ANSI Z21 or CAN/CGA-B149.1 or B149.2 (latest edition). The valve must be of the automatic reset type and not embody a single-use type fusible plug, cartridge or linkage.

FOR HOT WATER HEATING SYSTEMS, the boilers are shipped with a 50 psi pressure relief valve. This relief valve is factory installed in the water outlet header of the boiler, see figure 1.

FOR HOT WATER SUPPLY SYSTEMS, the boilers are shipped with a 125 psi pressure relief valve. This relief valve is factory installed in the water outlet header of the boiler, see figure 1.

This ASME-rated valve has a discharge capacity that exceeds the maximum boiler input rating and a pressure rating that does not exceed the maximum working pressure shown on the boiler rating plate.

In addition, an A.G.A. design-certified and ASME-rated temperature and pressure (T & P) relief valve must be installed on each and every water storage tank in the hot water supply system.

The T & P relief valve should have a temperature rating of 210°F, a pressure rating NOT exceeding the lowest rated working pressure of any system component, and a discharge capacity exceeding the total input of the water boilers supplying water to the storage tank.

Locate the T & P relief valve (a) in the top of the tank, or (b) in the side of the tank on a center line within the upper six (6) inches of the top of the tank. See figs. 20 and 22. The tapping shall be threaded in accordance with the latest edition of the Standard for Pipe Threads, General Purpose (inch), ANSI/ASME B1.20.1. The location of, or intended location for, the T & P relief valve shall be readily accessible for servicing or replacement.

INSTALLATION INSTRUCTIONS

REQUIRED ABILITY

INSTALLATION OR SERVICE OF THIS BOILER REQUIRES ABILITY EQUIVALENT TO THAT OF A LICENSED TRADESMAN IN THE FIELD INVOLVED. PLUMBING, AIR SUPPLY, VENTING, GAS SUPPLY AND ELECTRICAL WORK ARE REQUIRED.

LOCATION

When installing the boiler, consideration must be given to proper location. Location selected should be as close to the stack or chimney as practical with adequate air supply and as centralized with the piping system as possible. This location should also be such that the gas ignition system components are protected from water (dripping, spraying, etc.) during appliance operation and service [circulator replacement, control replacement, etc.].

- THE BOILER MUST NOT BE INSTALLED ON CARPETING.
- THE BOILER SHOULD NOT BE LOCATED IN AN AREA WHERE IT WILL BE SUBJECT TO FREEZING.
- THE BOILER SHOULD BE LOCATED NEAR A FLOOR DRAIN.
- THE BOILER SHOULD BE LOCATED IN AN AREA WHERE LEAKAGE FROM THE BOILER OR CONNECTIONS WILL NOT RESULT IN DAMAGE TO THE ADJACENT AREA OR TO LOWER FLOORS OF THE STRUCTURE.

WHEN SUCH LOCATIONS CANNOT BE AVOIDED, A SUITABLE DRAIN PAN SHOULD BE INSTALLED UNDER THE BOILER. Such pans should be fabricated with sides at least 2-1/2" deep, with length and width at least 2" greater than the dimensions of the boiler plus piping connections and must be piped to an adequate drain. The pan must not restrict combustion air flow.



THERE IS A RISK IN USING FUEL BURNING APPLIANCES IN ROOMS OR AREAS WHERE GASOLINE, OTHER FLAMMABLE LIQUIDS OR ENGINE DRIVEN EQUIPMENT OR VEHICLES ARE STORED, OPERATED OR REPAIRED. FLAMMABLE VAPORS ARE HEAVY AND TRAVEL ALONG THE FLOOR AND MAY BE IGNITED BY THE IGNITER OR MAIN BURNER FLAMES CAUSING FIRE OR EXPLOSION. SOME LOCAL CODES PERMIT OPERATION OF GAS APPLIANCES IF INSTALLED 18 INCHES OR MORE ABOVE THE FLOOR. THIS MAY REDUCE THE RISK IF LOCATION IN SUCH AN AREA CANNOT BE AVOIDED.

FLAMMABLE ITEMS, PRESSURIZED CONTAINERS OR ANY OTHER POTENTIAL FIRE HAZARDOUS ARTICLES MUST NEVER BE PLACED ON OR ADJACENT TO THE BOILER.

OPEN CONTAINERS OF FLAMMABLE MATERIAL SHOULD NOT BE STORED OR USED IN THE SAME ROOM WITH THE BOILER.

If the boiler is installed above the level of heating system terminal units, a low water cutoff device must be installed in the boiler outlet at the time of installation.

CHEMICAL VAPOR CORROSION

Heat exchanger corrosion and component failure can be caused by the heating and breakdown of airborne chemical vapors. Spray can propellants, cleaning solvents, refrigerator and air conditioning refrigerants, swimming pool chemicals, calcium and sodium chloride, waxes, and process chemicals are typical compounds which are corrosive. These materials are corrosive at very low concentration levels with little or no odor to reveal their presence.

Products of this sort should not be stored near the boiler. Also, air which is brought in contact with the water boiler should not contain any of these chemicals. If necessary, uncontaminated air should be obtained from remote or outside sources.

MANUAL RESET HIGH TEMPERATURE SAFETY OPERATING CONTROL LIMIT

This device prevents the water temperature from reaching 250°F. This device is located in the outlet water portion of the header casting.

AUTOMATIC RESET HIGH TEMPERATURE LIMIT CONTROL



CAUTION

LIMIT CONTROLS ARE NOT TO BE USED AS A THERMOSTAT.

ALL MODELS - This limit is a safety device in series with the ignition system. Set the limit control to a minimum of 40°F above the maximum designed system temperature. If the boiler outlet water temperature should exceed the high limit setting, the main gas valves will close. The limit control is factory set at 180°F and has an adjustable range from 110 to 240°F. The operating differential is also adjustable from 5 to 50°F.

TANK PROBE

FOR HOT WATER SUPPLY SYSTEMS (GW models), A tank probe is supplied with each hot water supply boiler. The inlet water temperature will default to the tank temperature on the Dia-Scan II display when the tank probe is installed.

"Pigtails" of field-supplied wires should be spliced to "pigtails" of tank probe and to "pigtails" at the junction box. See figure 21 for the tank probe installation. Follow the instructions on page 22 for the operation and temperature setting procedures for the temperature sensor.

FOR HOT WATER HEATING SYSTEMS (GB models) Due to the many various types of systems and operating conditions, no factory operating control is supplied with the GB models. GB models require a field supplied operating control be installed in the system. Such as: loop stat, indoor/outdoor reset control, sequencing panel, or energy management system. These types of controls connect to the brown thermostat wires in the junction box on the boiler. **Do not operate this boiler using the internal high limits only, you must use an operating stat as mentioned above.**

CIRCULATING PUMP

The pump flow rate should not exceed the maximum recommended flow rate, see table 2.

FOR HOT WATER SUPPLY SYSTEMS (GW models), the circulating pump is an integral part of the Boiler, see figure 3. This pump has been lubricated at the factory, and future lubrication should be in accordance with the motor manufacturer's instructions provided as supplement to this manual.

FOR HOT WATER HEATING SYSTEMS (GB models), the circulating pump is NOT provided and must be field-installed.

SAFETY FLOW SWITCH (Supplied)

The safety flow switch is a safety device which is installed at the water outlet of the unit to prevent main burner operation in the event of inadequate water flow through the boiler.

This switch is wired into the Ignition Control, and its function is displayed on the Ignition Control Display. Green light on - switch is closed, and red light on - inadequate water flow or flow switch failure.

LOW WATER CUTOFF (Not Supplied)

If low water protection is required by the authorities having jurisdiction, a low water cutoff switch should be installed next to the boiler in the outlet water line as shown in figure 23. The switch should receive periodic (every six months) inspection to assure proper operation. A low water cutoff device of the float type should be flushed every six months.

DRAIN VALVE (Not Supplied)

Drain valves must be obtained and installed on each boiler and tank for draining purposes.

AIR REQUIREMENTS



WARNING

FOR SAFE OPERATION, AN AMPLE SUPPLY OF AIR MUST BE PROVIDED FOR PROPER COMBUSTION AND VENTILATION IN ACCORDANCE WITH THE NATIONAL FUEL GAS CODE, ANSI Z223.1 OR CAN/CGA-B149.1 OR B149.2 (LATEST EDITIONS) OR APPLICABLE PROVISIONS OF THE LOCAL BUILDING CODES. AN INSUFFICIENT SUPPLY OF AIR MAY RESULT IN A YELLOW, LUMINOUS BURNER FLAME, CARBONING OR SOOTING OF THE FINNED HEAT EXCHANGER, OR CREATE A RISK OF ASPHYXIATION. DO NOT OBSTRUCT THE FLOW OF COMBUSTION AND VENTILATION AIR.

UNCONFINED SPACE

In buildings of conventional frame, brick or stone construction, unconfined spaces may provide adequate air for combustion.

If the unconfined space is within a building of tight construction (buildings using the following construction: weather stripping, heavy insulation, caulking, vapor barrier, etc.), air for combustion, ventilation, must be obtained from outdoors or spaces freely communicating with the outdoors. The installation instructions for confined spaces in tightly constructed buildings must be followed to ensure adequate air supply.

CONFINED SPACE

(a) U. S. INSTALLATIONS

When drawing combustion and dilution air from inside a conventionally constructed building to a confined space, such a space shall be provided with two permanent openings, ONE WITHIN 12 INCHES OF THE ENCLOSURE TOP AND ONE WITHIN 12 INCHES OF THE ENCLOSURE BOTTOM. Each opening shall have a free area of at least one square inch per 1000 Btuh of the total input of all appliances in the enclosure, but not less than 100 square inches.

If the confined space is within a building of tight construction, air for combustion, ventilation, and draft hood dilution must be obtained from outdoors. When directly communicating with the outdoors or communicating with the outdoors through vertical ducts, two permanent openings, located in the above manner,

shall be provided. Each opening shall have a free area of not less than one square inch per 4000 Btuh of the total input of all appliances in the enclosure. If horizontal ducts are used, each opening shall have a free area of not less than one square inch per 2000 Btuh of the total input of all appliances in the enclosure.

(b) CANADIAN INSTALLATIONS

Ventilation of the space occupied by the boiler(s) shall be provided by an opening for ventilation air at the highest practical point communicating with outdoors. The total cross-sectional area shall be at least 10% of the area of the combustion air opening but in no case shall the cross-sectional area be less than 10 square inches (6500 mm²).

In addition to the above, there shall be permanent air supply opening(s) having a cross-sectional area of not less than 1 square inch per 7,000 BTUH (310 mm²/KW) up to and including 1,000,000 BTUH plus 1 square inch per 14,000 BTU in excess of 1,000,000 BTUH. This opening(s) shall be located at, or ducted to, a point neither more than 18" (450 mm) nor less than 6 inches (150 mm) above the floor level.

Where power vented equipment is used in the same room as the boiler, sufficient air openings must be supplied.

UNDERSIZED OPENINGS MAY RESULT IN INSUFFICIENT AIR FOR COMBUSTION.

Where an exhaust fan is installed in the same room with a boiler, sufficient openings for air must be provided in the walls. **UNDERSIZED OPENINGS WILL CAUSE AIR TO BE DRAWN INTO THE ROOM THROUGH THE CHIMNEY, CAUSING POOR COMBUSTION. SOOTING MAY RESULT WITH AN INCREASED RISK OF ASPHYXIATION.**

VENTING THE BOILER

This boiler is approved to be vented as a Category I, Category III (horizontal venting), or a Direct Vent appliance. The Horizontal and Direct Venting options require a special vent kit.

Horizontal or Horizontal Direct Vent

Special Vent Kit	Model Number
210320-000	G(W,B) 200
210320-001	G(W,B) 300
210320-002	G(W,B) 400
210320-002	G(W,B) 500
210320-003	G(W,B) 650
210320-003	G(W,B) 750

Vertical Direct Vent Special Vent Kit

Special Vent Kit	Model Number
210317-000	G(W,B) 200
210317-001	G(W,B) 300
210317-002	G(W,B) 400
210317-002	G(W,B) 500
210317-003	G(W,B) 650
210317-003	G(W,B) 750

CAUTION

When venting the Genesis Boiler through oversize chimney (including masonry chimneys), additional care must be exercised to assure proper draft. For proper operation, a minimum draft of -0.02" w.c. and a maximum draft of -0.04" w.c. must be maintained. In instances of excessive draft, a barometric damper may be required to assist in maintaining the proper draft. Draft should be measured 2 feet above the boiler vent collar.

WARNING

THE INSTRUCTIONS IN THIS SECTION ON VENTING THE BOILER MUST BE FOLLOWED TO AVOID CHOKED COMBUSTION OR RECIRCULATION OF FLUE GASES. SUCH CONDITIONS CAUSE SOOTING OR RISKS OF FIRE AND ASPHYXIATION.

STANDARD (VERTICAL) VENTING, CATEGORY I

THIS BOILER MAY BE VENTED ACCORDING TO TABLE 5A AND 5C (ALSO SEE FIGURE 6). AT LEAST TYPE B VENTING MUST BE USED WITH THE STANDARD VENTING OPTION (thru-the-roof) USING THE NATIONAL FUEL GAS CODE VENT TABLES.* TYPE B VENT PIPE CANNOT BE USED IF THE BOILER IS VENTED HORIZONTALLY OR AS A DIRECT VENT (SEE PAGES 10 AND 11). ALL LOCAL UTILITY, STATE/PROVINCIAL, REGULATIONS ON VENTING MUST BE FOLLOWED.

VENT SIZING, INSTALLATION AND TERMINATION SHALL BE IN ACCORDANCE WITH THE NATIONAL FUEL GAS CODE, ANSI Z223.1 OR CAN/CGA-B149.1 OR B149.2 (LATEST EDITIONS).

VENT CONNECTION

Model Number	Vent Connector
G(W,B) 200	4"
G(W,B) 300	5"
G(W,B) 400	6"
G(W,B) 500	6"
G(W,B) 650	8"
G(W,B) 750	8"

* For vent arrangements other than Table 5A and for proper boiler operation, a barometric damper is required to maintain draft between -0.02" w.c. and -0.04" w.c at 2 feet above the boiler vent collar.

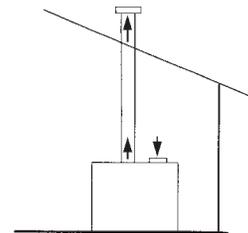


Figure 6. Single Pipe Vertical Termination

Vent connections must be made to an adequate stack or chimney and shall be in accordance with the National Fuel Gas Code, ANSI Z223.1 or CAN/CGA-B149.1 or B149.2 or applicable provisions of the local building codes. Size and install proper size vent pipe.

Horizontal runs of vent pipe shall be securely supported by adequately placed (approximately every 4 feet), noncombustible hangers suitable for the weight and design of the materials employed to prevent sagging and to maintain a minimum upward slope of 1/4" per foot from the boiler to the vent terminals. Dampers or other obstructions must not be installed in the vent. Be sure that the vent connector does not extend beyond the inside wall of the chimney.

CONNECTING BOILER TO A COMMON VENT

CAUTION

When the GENESIS boilers are commonly vented, additional care must be exercised to assure proper draft. For proper operation, a minimum draft of -0.02" w.c. and a maximum draft of -0.04" w.c. must be maintained AT EACH INDIVIDUAL BOILER. In

instances of excessive draft, a barometric damper may be required to assist in maintaining the proper draft. Draft should be measured 2 feet above EACH boiler vent collar.

Do not connect the boiler to a common vent or chimney with solid fuel burning equipment. This practice is prohibited by most local building codes as is the practice of venting gas fired equipment to the duct work of ventilation systems.

Where a separate vent connection is not available and the vent pipe from the boiler must be connected to a common vent with an oil burning furnace, the vent pipe should enter the common vent or chimney at a point ABOVE the flue pipe from the oil furnace.

UL/ULC listed double wall type B-1 gas vents, through 8" diameter, can be installed in heated and unheated areas and can pass through floors, ceilings, partitions, walls and roofs, provided the required clearance is observed.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system. Perform these steps while the other appliances remaining connected to the common venting system are not in operation.

Seal any unused openings in the common venting system.

Visually inspect the venting system for proper size and horizontal pitch and determine there is not blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

All boiler venting systems shall be installed in accordance with the National Fuel Gas Code, ANSI Z223.1 or CAN/CGA-B149.1 or B149.2 (latest version), or applicable provisions of the local building codes.

SINGLE PIPE HORIZONTAL VENTING

Vent sizing, installation and termination shall be in accordance with the NATIONAL FUEL GAS CODE, ANSI Z223.1 OR CAN/CGA-B149.1 OR B149.2 (LATEST EDITIONS). If applicable, all local, utility, state/provincial regulations on venting must be followed. This boiler may be vented according to table 5A and 5C (also, see figure 7). The exhaust vent pipe must be "Saf-T-Vent" manufactured by Heat-Fab Inc. The exhaust vent material type is AL 29-4C. This vent system must be 100% sealed with a condensate trap located as close to the boiler as possible.

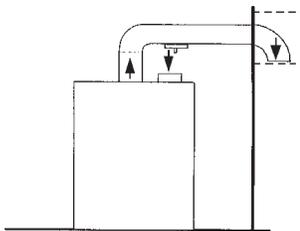


Figure 7. Single Pipe Horizontal Termination

TABLE 5A –SINGLE PIPE HORIZONTAL AND VERTICAL VENTING

MODEL	EXHAUST VENT*
GB/GW-200	110'
GB/GW-300	110'
GB/GW-400	50'
GB/GW-500	50'
GB/GW-650	50'
GB/GW-750	50'

* When sizing exhaust piping and intake air piping, 90-degree elbows are equivalent to 10 feet of straight pipe and 45-degree elbows are equal to 5 feet of straight pipe.

Intake/Exhaust Installation Requirements (See figures 6, 7 and 14):

1. The termination must be a minimum of 12 inches above anticipated snow or grade level whichever is higher.
2. Due to normal formation of water vapor in the combustion process, horizontal terminations must not be located over areas of pedestrian or vehicular traffic, (e.g., public walkways or over areas where condensate could create a nuisance or hazard. This is especially true in colder climates where ice buildup is likely to occur. A.O. Smith Corporation will not be held liable for any personal injury or property damage due to any dislodging of ice.
3. The minimum distance from the exhaust terminal to any window, gravity air inlet to a building, or from gas or electric meter(s) is 6 feet horizontally, 4 feet below and 2 feet above.
4. The minimum distance from the exhaust terminal to an inside corner formed by two exterior walls is 6 feet but 10 feet is recommended where possible.
5. Maintain a minimum distance of 4 feet from any soffit or eave vent to the exhaust terminal.
6. Maintain a minimum distance of 10 feet from any forced air inlet to a building. Any fresh air or make up air inlet such as a dryer or furnace area is considered to be a forced air inlet.
7. Avoid areas where condensate drainage may cause problems such as above planters, patios, or adjacent to windows where the steam from the flue gases may cause fogging.
8. Select the point of wall penetration where the minimum 1/4" per foot of slope up can be maintained.
9. The through the wall termination kit is suitable for zero clearance to combustible materials.
10. The mid point of the exhaust and intake air termination elbows must be a minimum of 12 inches from the exterior wall.

DIRECT VENT HORIZONTAL AND VERTICAL VENTING

Vent sizing, installation and termination shall be in accordance with the NATIONAL FUEL GAS CODE, ANSI Z223.1 OR CAN/CGA-B149.1 OR B149.2 (LATEST EDITIONS). If applicable, all local, utility, state/provincial regulations on venting must be followed. This boiler may be vented according to table 5B and 5C (also, see figures 8, 9, 10 and 11). The exhaust vent pipe must be "Saf-T-Vent" manufactured by Heat-Fab Inc. The exhaust vent material type is AL 29-4C. This vent system must be 100% sealed with a condensate trap located as close to the boiler as possible.

The intake air piping can be PVC, CPVC, ABS or any suitable intake air piping that can be sealed.

TABLE 5B -DIRECT VENT HORIZONTAL AND VERTICAL VENTING

MODEL	INTAKE*	EXHAUST*
GB/GW-200	60'	60'
GB/GW-300	60'	60'
GB/GW-400	35'	35'
GB/GW-500	35'	35'
GB/GW-650	35'	35'
GB/GW-750	35'	35'

* When sizing exhaust piping and intake air piping, 90-degree elbows are equivalent to 10 feet of straight pipe and 45-degree elbows are equal to 5 feet of straight pipe.

Intake/Exhaust Installation Requirements (See Figures 8, 9, 10, 11 & 14):

1. The exhaust and intake air termination must be a minimum of 12 inches above anticipated snow or grade level which ever is higher, see figure 14.
2. Due to normal formation of water vapor in the combustion process, horizontal terminations must not be located over areas of pedestrian or vehicular traffic, (e.g. public walkways

or over areas where condensate could create a nuisance or hazard). This is especially true in colder climates where ice buildup is likely to occur. A.O. Smith Corporation will not be held liable for any personal injury or property damage due to any dislodging of ice.

3. The minimum distance from the exhaust terminal to any window, gravity air inlet to a building, or from gas or electric meter(s) is 6 feet horizontally, 4 feet below and 2 feet above.
4. The minimum distance from the exhaust terminal to an inside corner formed by two exterior walls is 6 feet but 10 feet is recommended where possible.
5. Maintain a minimum distance of 4 feet from any soffit or eave vent to the exhaust terminal.
6. Maintain a minimum distance of 10 feet from any forced air inlet to a building. Any fresh air or make up air inlet such as a dryer or furnace area is considered to be a forced air inlet.
7. Avoid areas where condensate drainage may cause problems such as above planters, patios, or adjacent to windows where the steam from the flue gases may cause fogging.
8. Select the point of wall penetration where the minimum 1/4" per foot of slope up can be maintained.
9. The through the wall termination kit is suitable for zero clearance to combustible materials.
10. The mid point of the exhaust and intake air termination elbows must be a minimum of 12 inches from the exterior wall.

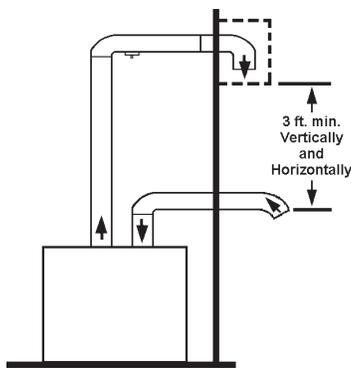


Figure 8. Direct Vent Horizontal Termination and Minimum Clearances

CAUTION
 Direct venting into dead air spaces such as alleys, atriums and inside corners can cause recirculation of flue gases. Recirculation of flue gases will cause sooting, premature failure of the heat exchanger and icing of the combustion air intake during severe cold weather. To prevent the recirculation of flue gases, maintain as much distance as possible between the combustion air intake and the exhaust vent terminal.

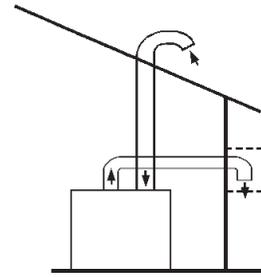


Figure 9. Direct Vent Horizontal/Vertical Termination

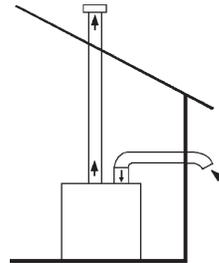


Figure 10. Direct Vent Vertical/Horizontal Termination

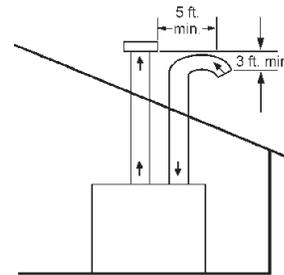


Figure 11. Direct Vent Vertical Termination and minimum clearances

FLIP VENT INSTALLATION

This boiler can be vented and/or bring in fresh air through the rear of the cabinet with the use of the FLIP VENT and vent adaptor. Any of the previous venting configurations can be installed with rear connections.

Table 5C - Intake/Venting Configurations, Categories and Materials

Source for Combustion Air Supply	Exhaust Venting Configuration	Venting Category	Approved Venting Material Required	Combustion Air Intake Material
Boiler Room Air (Using combustion air from within the building.)	Vertical Natural Draft	Category I	Type B Vent Pipe* (Requires a single-acting, listed barometric damper if vent length exceeds Table 5A.)	None Required
	Horizontal/Sidewall Venting	Category III	AL29-4C Stainless Steel Vent Pipe**	None Required
Direct Venting (Outside combustion air thru sealed pipe to boiler intake.)	Vertical Direct Venting	Category I	AL29-4C Stainless Steel Vent Pipe**	PVC, ABS, CPVC**
	Horizontal Direct Venting	Category III	AL29-4C Stainless Steel Vent Pipe**	PVC, ABS, CPVC**
Ducted Air*** (Using combustion air from outside the building ducted to boiler intake.)	Vertical Natural Draft	Category I	Type B Vent Pipe* (Requires a single-acting, listed barometric damper if vent length exceeds Table 5A.)	PVC, ABS, CPVC, Galvanized Metal Duct Pipe**

Notes:

* A standard list type B vent terminal as supplied by the vent pipe manufacturer may be used.

** Vent cap/vent terminations and combustion air intake terminations must be furnished by the boiler manufacturer in accordance with AGA/CGA requirements. No substitutions; unapproved substitutions may/will result in dangerous conditions, nuisance lockouts during windy conditions and premature boiler failure.

*** Cannot be used in rooms with negative pressure.

Table 7. Suggested Pipe Size For Multiple Gas Appliances

Nominal Iron Pipe Size in Inches	Maximum Capacity of Pipe in Cubic Feet of Gas per Hour for Gas Pressures of 14 in. W.C. (0.5 psi) or Less and a Pressure Drop of 0.5 in W.C. based on a 0.60 Specific Gravity Gas													
	Length of Pipe (Feet)													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1 1/4	1,400	950	770	660	580	530	490	460	430	400	360	325	300	280
1 1/2	2,100	1,460	1,180	990	900	810	750	690	650	620	550	500	460	430
2	3,950	2,750	2,200	1,900	1,680	1,520	1,400	1,300	1,220	1,150	1,020	950	850	800
2 1/2	6,300	4,350	3,520	3,000	2,650	2,400	2,250	2,050	1,950	1,850	1,650	1,500	1,370	1,280
3	11,000	7,700	6,250	5,300	4,750	4,300	3,900	3,700	3,450	3,250	2,950	2,650	2,450	2,280
4	23,000	15,800	12,800	10,900	9,700	8,800	8,100	7,500	7,200	6,700	6,000	5,500	5,000	4,600

GAS CONNECTIONS

⚠ WARNING

THIS BOILER IS NOT INTENDED TO OPERATE AT GAS SUPPLY PRESSURE OTHER THAN SHOWN ON THE RATING PLATE. EXPOSURE TO HIGHER GAS SUPPLY PRESSURE MAY CAUSE DAMAGE TO GAS VALVES WHICH CAN RESULT IN FIRE OR EXPLOSION. IF OVERPRESSURE HAS OCCURRED SUCH AS THROUGH IMPROPER TESTING OF GAS LINES OR EMERGENCY MALFUNCTION OF THE SUPPLY SYSTEM, THE GAS VALVES MUST BE CHECKED FOR SAFE OPERATION. MAKE SURE THAT THE OUTSIDE VENTS ON THE SUPPLY REGULATORS AND THE SAFETY VENT VALVES ARE PROTECTED AGAINST BLOCKAGE. THESE ARE PARTS OF THE GAS SUPPLY SYSTEM, NOT THE BOILER. VENT BLOCKAGE MAY OCCUR DURING ICE BUILD-UP OR SNOW STORMS.

WHEN LOCAL CODES REQUIRE A MAIN MANUAL SHUT-OFF VALVE OUTSIDE THE BOILER JACKET, A SUITABLE MAIN MANUAL SHUT-OFF VALVE MUST BE INSTALLED IN A LOCATION COMPLYING WITH THOSE CODES.

IT IS IMPORTANT TO GUARD AGAINST GAS VALVE FOULING FROM CONTAMINANTS IN THE GAS WAYS. SUCH FOULING MAY CAUSE IMPROPER OPERATION, FIRE OR EXPLOSION. IF COPPER SUPPLY LINES ARE USED THEY MUST BE APPROVED FOR GAS SERVICE.

BEFORE ATTACHING THE GAS LINE BE SURE THAT ALL GAS PIPE IS CLEAN ON THE INSIDE.

TO TRAP ANY DIRT OR FOREIGN MATERIAL IN THE GAS SUPPLY LINE, A DIRT LEG (SOMETIMES CALLED DRIP LEG) MUST BE INCORPORATED IN THE PIPING. The dirt leg must be readily accessible and not subject to freezing conditions. INSTALL IN ACCORDANCE WITH RECOMMENDATIONS OF SERVING GAS SUPPLIERS. REFER TO NATIONAL FUEL GAS CODE, ANSI Z223.1 OR CAN/CGA-B149.1 OR B149.2 (MOST RECENT EDITION).

To prevent damage, care must be taken not to apply too much torque when attaching gas supply pipe to gas valve gas inlet.

Fittings and unions in the gas line must be metal to metal type.

Apply joint compounds (pipe dope) sparingly and only to the male threads of pipe joints. Do not apply compound to the first two threads. Use compounds resistant to the action of liquefied petroleum gases.

THE BOILER MUST BE ISOLATED FROM THE GAS SUPPLY PIPING SYSTEM BY CLOSING ITS MAIN MANUAL GAS SHUT-OFF VALVE DURING ANY PRESSURE TESTING OF THE GAS SUPPLY PIPING SYSTEM AT TEST PRESSURES EQUAL TO OR MORE THAN 1/2 PSIG.

PURGING

Gas line purging is required with new piping or systems in which air has entered.

⚠ CAUTION

PURGING SHOULD BE PERFORMED BY PERSONS EXPERIENCED IN THIS TYPE OF GAS SERVICE TO AVOID RISK OF FIRE OR EXPLOSION. PURGE DISCHARGE MUST NOT ENTER CONFINED AREAS OR SPACES WHERE IGNITION CAN OCCUR. THE AREA MUST BE WELL VENTILATED AND ALL SOURCES OF IGNITION MUST BE DEACTIVATED OR REMOVED.

BEFORE PLACING THE BOILER IN OPERATION, CHECK FOR GAS LEAKAGE. Use soap and water solution or other material acceptable for the purpose in locating gas leaks. DO NOT USE MATCHES, CANDLES, FLAME OR OTHER SOURCES OF IGNITION FOR THIS PURPOSE.

1. CORRECT GAS

Make sure the gas on which the boiler will operate is the same as that specified on the boiler rating plate. Do not install the boiler if equipped for a different type gas, consult your gas supplier.

2A. SIZING GAS SUPPLY LINE (For single boiler installations.)
See table 6.

2B. SIZING GAS SUPPLY LINE (For multiple installations of two or more boilers.) See table 7.

Use table 7, which is taken from ANSI booklet Z223.1, NATIONAL FUEL GAS CODE, or CAN/CGA-B149.1 or B149.2 (most recent edition) to size iron pipe or equivalent gas supply line. Table 7 is based on a pressure drop of 0.5 inches of water and a specific gravity of 0.60 approximately that of natural gas. (LP gas has an S.G. of about 1.53).

TABLE 8. Multiplier Table

Specific Gravity	Multiplier	Specific Gravity	Multiplier
0.55	1.04	1.00	0.78
0.60 (natural)	1.00	1.10	0.74
0.65	0.96	1.20	0.71
0.70	0.93	1.30	0.68
0.75	0.90	1.40	0.66
0.80	0.87	1.50 (Propane)	0.63
0.85	0.84	1.60	0.61
0.90	0.82	1.70	0.59

Capacities in cubic feet per hour of 0.60 specific gravity gas for different sizes and lengths of pipe are shown in table 7. No additional allowance is necessary for an ordinary number of fittings.

Where it is necessary to use more than the average number of pipe fittings (e.g., elbows, tees, and valves in gas supply line), use a pipe size larger than specified to compensate for increased pressure drop.

Applications of the gravity factor converts the figures given in table 7 to capacities with another gas of different specific gravity. Such application is accomplished by multiplying the capacities given in table 7 by the multipliers shown in table 8.

HIGH ALTITUDE INSTALLATIONS



WARNING
INSTALLATIONS ABOVE 5,000 FEET REQUIRE REPLACEMENT OF THE BURNER ORIFICES IN ACCORDANCE WITH THE NATIONAL FUEL GAS CODE (ANSI/NFPA 54). FAILURE TO REPLACE THE ORIFICES WILL RESULT IN IMPROPER AND INEFFICIENT OPERATION OF THE APPLIANCE, PRODUCING CARBON MONOXIDE GAS IN EXCESS OF SAFE LIMITS, WHICH COULD RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

These Genesis Series 200 boilers are equipped with prejet orifices which are self-regulating. This makes it unnecessary to replace these prejet orifices for high altitude installations (up to 5,000 feet only. Consult the factory for higher altitudes). These prejet orifices will automatically compensate for higher elevations and adjust the appliance's input rate accordingly. See Table 9.

Some utility companies derate their gas for altitude. You should contact your gas supplier for any specific changes which may be required in your area. Call the local gas utility to verify BTU content of the gas supplied.

Ratings specified by manufacturers for most boilers apply for elevations up to 2000 feet (600 m). For elevations above 2000 feet (600 m) ratings must be reduced by a rate of 4% for each 1000 feet (300 m) above sea level.

Example: A Genesis boiler is rated at 750,000 Btu/hr. input at sea level. At an altitude of 5,000 (1500m), the prejet orifices will decrease the input rate by 20% (= 4% x 5) to a new rating of 600,000 Btu/hr. (= 80% x 750,000 Btu/hr.) The input reduction is achieved by the prejet orifices through self-regulation.

WIRING CONNECTIONS

ALL ELECTRICAL WORK MUST BE INSTALLED IN ACCORDANCE WITH THE MOST RECENT VERSION OF THE NATIONAL ELECTRICAL CODE/CANADIAN ELECTRICAL CODE AND MUST CONFORM TO LOCAL REGULATIONS.

AN ELECTRICAL GROUND IS REQUIRED TO REDUCE RISK OF ELECTRIC SHOCK OR POSSIBLE ELECTROCUTION. Make the ground connection to the wire provided in the electrical supply junction box on the boiler.

Grounding and all wiring connected to this boiler must conform to the local code authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA 70 or CSA-C22.1 most recent edition.

IF ANY OF THE ORIGINAL WIRE, AS SUPPLIED WITH THE APPLIANCE, MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE 105°C WIRE OR ITS EQUIVALENT.

The Genesis Hot Water Supply Boiler must be connected to a single phase line source that is:

120 volts, 60 Hertz, and 20 Amps.

The system controller, other than the factory-supplied tank probe, (e.g. Honeywell Aquastat) must be wired on the low voltage side (24VAC).

Refer to the Connection Diagram (Figure 15) and to the Schematic Diagram (Figure 16).

Table 9: Orifice Size for Natural and Propane (LP) Gases (U.S. and Canadian Installations) (Drill size unless otherwise indicated.)

Model	Rating Input BTUH	Number of Burners	Natural	Propane
GB/GW 200	199,900	4	0.091"	0.048"
GB/GW 300	300,000	6	0.091"	0.048"
GB/GW 400	399,900	8	0.091"	0.048"
GB/GW 500	500,000	10	0.091"	0.048"
GB/GW 650	650,000	13	0.091"	0.048"
GB/GW 750	750,000	15	0.091"	0.048"

NOTES:

1. Use either the tank probe or an external control (24 VAC) for system control, but not both.
2. If any of the original wire as supplied with the appliance must be replaced, it must be replaced with 18 GAUGE, 105°C wire or equivalent.

BURKAY GENESIS CONNECTION DIAGRAM

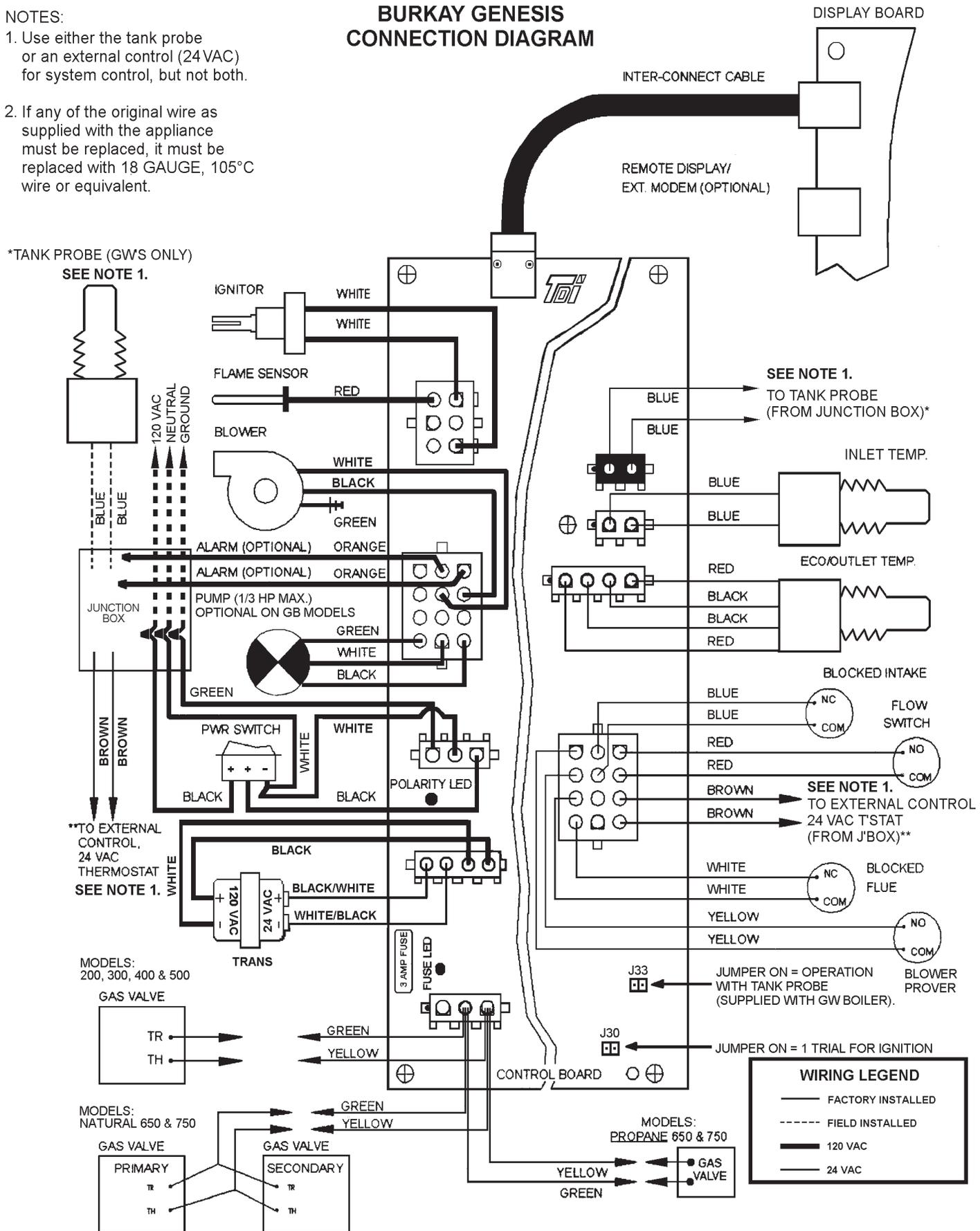


FIGURE 15. POINT TO POINT WIRING DIAGRAM

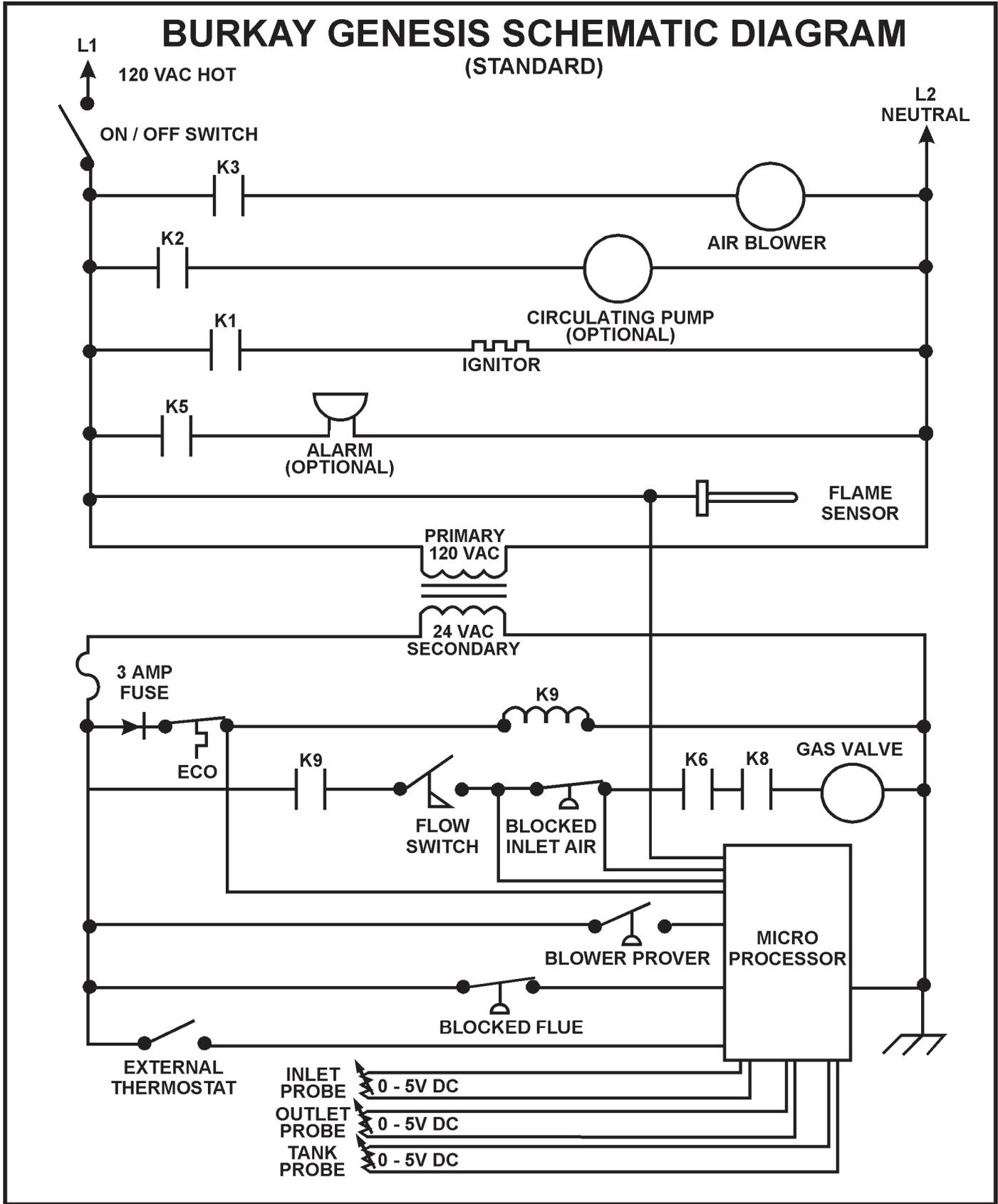


FIGURE 16. SCHEMATIC DIAGRAM

Lighting Instructions for the G(B/W) 200 through 500 models

FOR YOUR SAFETY READ BEFORE OPERATING



WARNING : IF YOU DO NOT FOLLOW THESE INSTRUCTIONS EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.



A. THIS APPLIANCE DOES NOT HAVE A PILOT. IT IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE BURNER. DO NOT TRY TO LIGHT THE BURNER BY HAND.

B. BEFORE LIGHTING: SMELL ALL AROUND THE APPLIANCE AREA FOR GAS. BE SURE TO SMELL NEXT TO THE FLOOR BECAUSE SOME GAS IS HEAVIER THAN AIR AND WILL SETTLE ON THE FLOOR.

WHAT TO DO IF YOU SMELL GAS

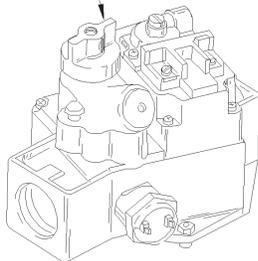
- DO NOT TRY TO LIGHT ANY APPLIANCE.
- DO NOT TOUCH ANY ELECTRIC SWITCH; DO NOT USE ANY PHONE IN YOUR BUILDING.
- IMMEDIATELY CALL YOUR GAS SUPPLIER FROM A NEIGHBOR'S PHONE. FOLLOW THE GAS SUPPLIER'S INSTRUCTIONS.
- IF YOU CANNOT REACH YOUR GAS SUPPLIER, CALL THE FIRE DEPARTMENT.

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

D. DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. IMMEDIATELY CALL A QUALIFIED SERVICE TECHNICIAN TO INSPECT THE APPLIANCE AND TO REPLACE ANY PART OF THE CONTROL SYSTEM AND ANY GAS CONTROL WHICH HAS BEEN UNDER WATER.

E. DO NOT OPERATE APPLIANCE UNLESS UNIT IS FILLED WITH WATER AND WATER LINES ARE FULLY OPEN.

TOP KNOB



ROBERTSHAW

FIGURE "A"

FIGURE "B"



"OFF" POSITION

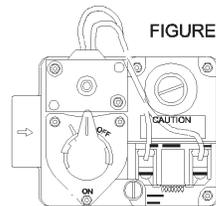


"ON" POSITION

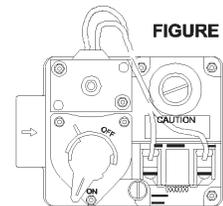
WHITE - RODGERS

FIGURE "A"

FIGURE "B"



"OFF" POSITION



"ON" POSITION

OPERATING INSTRUCTIONS

1. STOP ! READ THE SAFETY INFORMATION ABOVE ON THIS LABEL.
2. SET THE SYSTEM CONTROLLER TO THE LOWEST SETTING.
3. TURN OFF ALL ELECTRIC POWER TO APPLIANCE.
4. THIS APPLIANCE IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE BURNER. DO NOT TRY TO LIGHT THE BURNER BY HAND.
5. REMOVE CONTROL ACCESS PANEL.
6. REFER TO DIAGRAMS ABOVE. TURN TOP KNOB OF GAS CONTROL CLOCKWISE TO "OFF" POSITION, (FIG. A).
7. WAIT FIVE (5) MINUTES TO CLEAR OUT ANY GAS. THEN SMELL FOR GAS, INCLUDING NEAR THE FLOOR. IF YOU SMELL GAS,

8. TURN TOP KNOB OF GAS CONTROL COUNTER-CLOCKWISE TO "ON" POSITION, (FIG. B).
9. REPLACE CONTROL ACCESS PANEL.
10. TURN POWER SWITCH TO "ON" POSITION (SWITCH LIGHT COMES ON).
11. SET THE SYSTEM CONTROLLER TO DESIRED SETTING.
12. IF THE APPLIANCE WILL NOT OPERATE, FOLLOW THE INSTRUCTIONS "TO TURN OFF GAS TO THE APPLIANCE" AND CALL YOUR SERVICE TECHNICIAN OR GAS SUPPLIER.

TO TURN OFF GAS TO APPLIANCE

1. SET THE SYSTEM CONTROLLER TO THE LOWEST SETTING.
2. TURN POWER SWITCH ON APPLIANCE TO "OFF" POSITION (SWITCH LIGHT GOES OUT).
3. REMOVE ACCESS PANEL TO EXPOSE GAS CONTROL.

4. REFER TO DIAGRAMS ABOVE. TURN TOP KNOB OF GAS CONTROL CLOCKWISE TO "OFF" POSITION, (FIG. A).
5. REPLACE CONTROL ACCESS PANEL.

Lighting Instructions for the G(B/W) 650 and 750 models

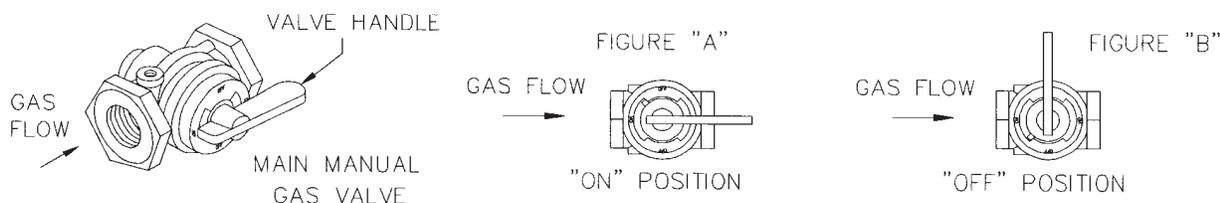
FOR YOUR SAFETY READ BEFORE OPERATING



WARNING: IF YOU DO NOT FOLLOW THESE INSTRUCTIONS EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.



- A. THIS APPLIANCE DOES NOT HAVE A PILOT. IT IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE BURNER. DO NOT TRY TO LIGHT THE BURNER BY HAND.
- B. BEFORE LIGHTING: SMELL ALL AROUND THE APPLIANCE AREA FOR GAS. BE SURE TO SMELL NEXT TO THE FLOOR BECAUSE SOME GAS IS HEAVIER THAN AIR AND WILL SETTLE ON THE FLOOR.
- WHAT TO DO IF YOU SMELL GAS
- DO NOT TRY TO LIGHT ANY APPLIANCE.
 - DO NOT TOUCH ANY ELECTRIC 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.
- C. USE ONLY YOUR HAND TO TURN THE MAIN MANUAL GAS VALVE HANDLE. NEVER USE TOOLS. IF THE HANDLE WILL NOT TURN BY HAND, DON'T TRY TO REPAIR IT, CALL A QUALIFIED SERVICE TECHNICIAN. FORCE OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.
- D. DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. IMMEDIATELY CALL A QUALIFIED SERVICE TECHNICIAN TO INSPECT THE APPLIANCE AND TO REPLACE ANY PART OF THE CONTROL SYSTEM AND ANY GAS CONTROL WHICH HAS BEEN UNDER WATER.
- E. DO NOT OPERATE APPLIANCE UNLESS UNIT IS FILLED WITH WATER AND WATER LINES ARE FULLY OPEN.

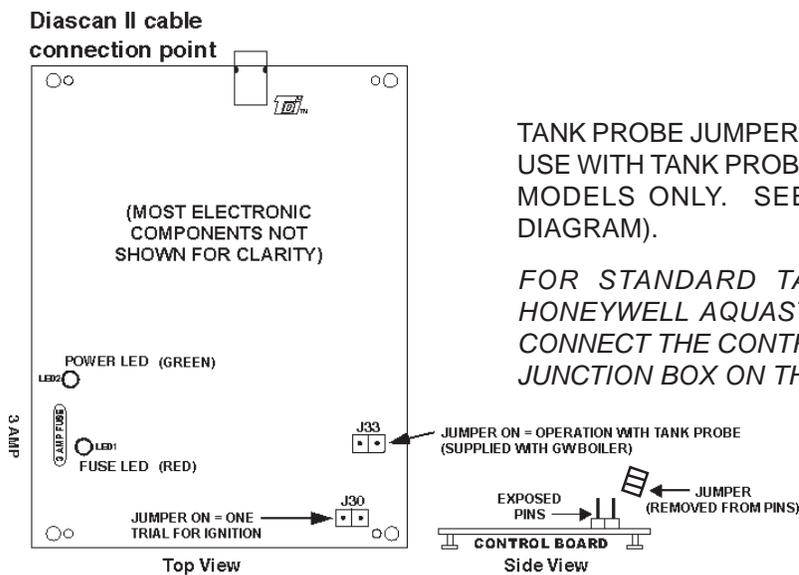


OPERATING INSTRUCTIONS

1. STOP! READ THE SAFETY INFORMATION ABOVE ON THIS LABEL.
2. SET THE SYSTEM CONTROLLER TO THE LOWEST SETTING.
3. TURN POWER SWITCH ON APPLIANCE TO "OFF" POSITION (SWITCH LIGHT GOES OUT).
4. TURN MAIN MANUAL GAS VALVE TO "OFF" POSITION, (FIGURE "B"). THE VALVE IS "OFF" WHEN THE HANDLE IS PERPENDICULAR TO THE GAS FLOW DIRECTION.
5. THIS APPLIANCE IS EQUIPPED WITH AN IGNITION DEVICE WHICH AUTOMATICALLY LIGHTS THE BURNER. DO NOT TRY TO LIGHT THE BURNER BY HAND.
6. WAIT FIVE (5) MINUTES TO CLEAR OUT ANY GAS. THEN SMELL FOR GAS, INCLUDING NEAR THE FLOOR. IF YOU SMELL GAS,
7. STOP! FOLLOW "B" IN THE SAFETY INFORMATION ABOVE ON THIS LABEL. IF YOU DON'T SMELL GAS, GO TO THE NEXT STEP.
7. TURN MAIN MANUAL GAS VALVE TO "ON" POSITION, (FIGURE "A"). THE VALVE IS "ON" WHEN THE HANDLE IS PARALLEL TO THE GAS FLOW DIRECTION.
8. TURN POWER SWITCH TO "ON" POSITION (SWITCH LIGHT COMES ON).
9. SET THE SYSTEM CONTROLLER TO DESIRED SETTING.
10. IF THE APPLIANCE WILL NOT OPERATE, FOLLOW THE INSTRUCTIONS "TO TURN OFF GAS TO THE APPLIANCE" AND CALL YOUR SERVICE TECHNICIAN OR GAS SUPPLIER.

TO TURN OFF GAS TO APPLIANCE

1. SET THE SYSTEM CONTROLLER TO THE LOWEST SETTING.
2. TURN POWER SWITCH ON APPLIANCE TO "OFF" POSITION (SWITCH LIGHT GOES OUT).
3. TURN MAIN MANUAL GAS VALVE TO "OFF" POSITION, (FIGURE "B"). THE VALVE IS "OFF" WHEN THE HANDLE IS PERPENDICULAR TO THE GAS FLOW DIRECTION.



TANK PROBE JUMPER J33 IS ON AS DEFAULT, READY FOR USE WITH TANK PROBE SUPPLIED WITH THE BOILER (GW MODELS ONLY. SEE FIGURE 15 FOR CONNECTION DIAGRAM).

FOR STANDARD TANK CONTROLS (e.g., 24 VAC HONEYWELL AQUASTAT) REMOVE THIS JUMPER AND CONNECT THE CONTROL TO THE BROWN WIRES IN THE JUNCTION BOX ON THE BACK OF THE BOILER.

Figure 17. WHC 1502 Ignition Control Board.

There are five (5) electrical connections that must be made for the boiler to operate correctly.

1. Black 120 VAC hot.
2. White 120 VAC neutral.
3. Green ground.
4. (2) Brown 24 VAC thermostat wires or (2) blue tank probe wires.

These connections shall be made at the rear of the unit where a junction box is provided. **An electrical ground is required to reduce the risk of electrical shock or possible electrocution. A ground wire grounded to the boiler cabinet is provided in the rear junction box.**

ELECTRONIC HOT SURFACE IGNITION CONTROL

ALL MODELS - The WHC1502 ignition control is a fully integrated, state of the art electronic control system. The ignition control includes a microprocessor, which governs all temperature and ignition control functions for the appliance. Inherent in the design are the normal operating sequences and safety features associated with a gas ignition control system. The ignition control continuously performs various diagnostic tests to verify proper appliance and control operation. Should an unsafe condition occur, the control will shut down the burner and illuminate the appropriate diagnostic indicators on the Display Board, indicating a need for service. All operating programs are stored in permanent memory on the ignition control and a second programmable memory is used for retaining user-specific operating parameters in the event main power is ever interrupted.

Line Polarity Indicator

A green LED is mounted on the ignition control board to indicate line voltage polarity is properly connected (see figure 17). When 120 VAC input power is properly connected to the Ignition Control Board, the green LED will illuminate. If an error is made when connecting 120 VAC input power, this LED will not light. Improperly connecting the input power may result in a false flame sensor failure.

Fuse Protection

The 24 VAC circuitry is protected with a 3 amp auto fuse. If the fuse opens, a red LED located near the fuse will light (see figure 17). If the red LED is illuminated, replace the fuse (recommended replacement part is Little fuse p/n 257003 automotive fuse). **Repeated failure of the fuse is an indication of possible damage to the ignition control board.**

Note: One extra fuse is supplied with the boiler.

Appliance Operating Sequence

1. When power is applied to the WHC1502 ignition control, the Display board will initially run through a self-diagnostic routine, and then go into its operating mode, displaying the temperature sensed at temperature probe #1 (Outlet).
2. If the ignition control determines the actual outlet water temperature at the temperature sensing probe (probe #1) is below the programmed temperature set-point less the switching differential, and the thermostat circuit or tank probe circuit is closed, a call for heat is activated.
3. The control then performs selected system diagnostic checks. This includes confirming the proper state of the ECO/High Limit device, flow switch, and pressure switches.
4. If all checks are successfully passed, the circulating pump circuit is energized, then the combustion blower circuit is energized for the 20 second pre-purge cycle.
5. When the pre-purge cycle is complete, power is applied to the ignitor element for the ignitor warm-up period (pump and blower should continue to run).
6. The control will verify ignitor current. After the verification, the gas valve will open, allowing gas to enter the burner.
7. After an additional 1 second, the control will monitor the flame sense probe to confirm a flame is present. If a flame is not verified within 4 seconds, the gas valve is immediately closed. The control will return to step 2, unless jumper J30 is in place (on), see fig. 17.
8. If a flame is confirmed, the control will enter the heating mode where it will continue heating until the set-point temperature is reached, and the thermostat circuit is open. At that point, the gas valve is closed and the control enters the post-purge and post-circulate cycles.

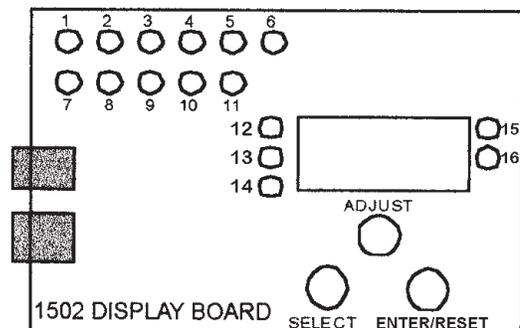


Figure 18. Dia-Scan II Display Board (Simplified).

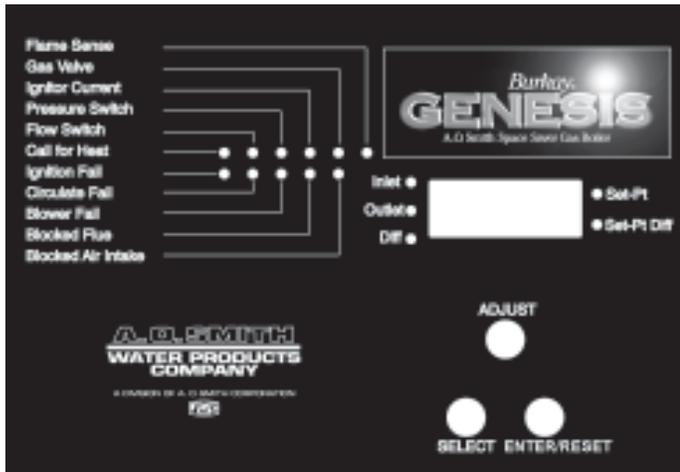


Figure 19. Dia-Scan II Display Board Label.

9. The combustion blower will run for a 25 second post purge cycle. When the post purge cycle is complete, the blower is de-energized and will coast to a stop. The circulating pump will continue with the post-circulate cycle for the programmed amount of time (factory default 45 seconds). See circulating pump adjustment procedure on page 21 of the manual.
10. The control now enters the idle state while continuing to monitor temperature and the state of other system devices. If the outlet water temperature drops below the set-point value minus the switching differential, and the thermostat circuit or tank probe circuit closes, the control will return to step 2 and repeat the entire operating cycle. During this idle state, if the control detects an improper operating state for external devices such as the ECO switch, air pressure switch, gas pressure switch, etc., the appropriate LED(s) on the Display Board will illuminate indicating the nature of the fault.

DIA-SCAN II DISPLAY BOARD OPERATING PROCEDURES

The Display Board provides a user-friendly interface to the WHC1502 Ignition Control Board. With the Display Board, the user can control appliance functions and view the overall operating status of the appliance. If an error condition occurs, the Display Board will scroll a diagnostic message across the LED display. Under normal operating conditions, the four digit LED display on the Display Board will continuously illustrate the water temperature sensed at temperature probe #1 (Outlet). The push buttons on the Display Board allow the user to program and view the desired water temperature set point. The Display Board is connected to the Ignition Control Board through a 6 conductor cable assembly with modular plug terminations. In addition, an 8 conductor modular jack on the Display Board allows for connecting a remote display board.

When power is applied to the WHC1502 System, the Display Board will initially run through a self-diagnostic test, and then display the Outlet temperature. To display a specific setting or temperature, press the SELECT push-button until the appropriate LED is illuminated (see figure 19). After 5 seconds, the Display Board will automatically revert to displaying the Outlet temperature. Pressing the ENTER/RESET push-button will hold the display in the indicated mode until the SELECT push-button is pressed.

With the display board, the user can make adjustments to many of the appliance's control features. This includes the following:

Options/Features Setting Procedures

- Set Appliance Temperature Set-point Value
- Set Appliance Switching Differential Value
- Select Appliance Post-Circulate Time
- Set Appliance Circulating Pump to Continuous ON Mode
- Check Appliance Cycle Count
- Control the water temperature in a storage tank

Green Status Lights

- LED 1: Call for Heat
- LED 2: Flow Switch
- LED 3: Pressure Switch
- LED 4: Ignitor Current
- LED 5: Gas Valve
- LED 6: Flame Sense

Red Fault Lights

- LED 7: Ignition Fail
- LED 8: Circulate Failure
- LED 9: Blower Failure
- LED 10: Blocked Inlet
- LED 11: Blocked Flue

Water Temperature Set Lights

- LED 12: Inlet Water Temperature*
 - LED 13: Outlet Water Temperature
 - LED 14: Inlet/Outlet Differential Temperature
 - LED 15: Set-Point Temperature
 - LED 16: Outlet/Set-Point Differential Temperature
- * Defaults to tank probe temperature when tank probe is used.

Temperature Set-point Adjustment Procedure

The control board has a standard programmable temperature set-point range of 110°F to 240°F. The user can easily change the temperature set-point at any time by using the following procedure. In all cases, you must apply input power to the controller to perform any programming operations. The factory default setting is 180°F.

To change or view the current programmed temperature set-point value:

1. Press the SELECT push-button on the display board until both the Set-Pt LED (LED 15, see figure 18) and Outlet Water Temperature LED (LED 13, see figure 18) are illuminated.
2. The LED display will show the current set-point temperature.
3. Press and hold the ADJUST push-button. The displayed temperature will either increase or decrease. To alternate between increasing or decreasing the temperature, release then press and hold the ADJUST push-button.
4. When the desired set-point temperature is reached, release the ADJUST push-button.
5. Press the ENTER/RESET push-button once, this enters the selected set-point temperature into controller memory.
6. The appliance will now control the temperature to the desired set-point value.

NOTE: The boiler must complete a full cycle in order for the new setting to take effect. If the unit is turned off prior to a complete cycle the setting will be lost and the previous setting will remain in effect.

If the ADJUST push-button is held down long enough, the set-point will reach 110°F, the minimum value (or 240°F, the maximum value) and stop. At this point, if the desired set-point is not obtained, release the ADJUST push-button and depress it again. The set-point value will now restart at 110°F (240°F) and once again increase (decrease) in value for as long as the ADJUST push-button is pressed.

Switching Differential Adjustment Procedure

To facilitate proper operation and maximize appliance performance, the control has a programmable operating switching differential or “hysteresis” about the set point. This means a call for heat will become active when the water temperature measured at the outlet temperature sensing probe (Probe #1) drops to the set-point value minus the switching differential value. The burner will remain on until the water temperature measured at probe #1 reaches the set-point value. The switching differential value is fully programmable from 5°F to 50°F using the push-button(s) located on the Display Board. The default is set at 20°F.

To change or view the current programmed switching differential:

1. Press the SELECT push-button on the display board until the Set-Pt differential LED (LED 16, see figure 18) is illuminated.
2. The LED display will show the current switching differential.
3. Press and hold the ADJUST push-button. The displayed value will either increase or decrease. To alternate between increasing or decreasing the switching differential, release then press and hold the ADJUST push-button.
4. When the desired switching differential is reached, release the ADJUST push-button.
5. Press the ENTER/RESET push-button once, this enters the selected switching differential value into controller memory.
6. The appliance will now control temperature utilizing the desired switching differential value.

If the ADJUST push-button is held down long enough, the switching differential setting will reach 5, the minimum value (or 50, the maximum value) and stop. At this point, if the desired switching differential is not obtained, release the ADJUST push-button and depress it again. The switching differential value will now restart at 5 (50) and once again increase (decrease) in value for as long as the ADJUST push-button is pressed.

Circulating Pump Adjustment Procedure

The Controller is factory set with a 45 second post circulate function. With the Display Board, the user has the capability to choose between a 45, 90, or 180 second post circulate time period, or turn the pump on continuously. This provides flexibility in selecting the post circulate time to meet specific installation requirements, and improves the efficiency of the circulating pump operation.

To change or view the current programmed post-circulating time:

1. Press the SELECT push-button on the display board until the LED display reads OPt (Options).
2. To enter into the options mode, press the ENTER/RESET push-button.
3. The display will illustrate Circ. Enter this mode by pressing the ENTER/RESET push-button.

4. The display will now illustrate the current post circulate time. Press the ADJUST push-button to select the desired post circulate time (45, 90, 180, On).
5. When you have selected the desired post circulate time mode, press the ENTER/RESET push-button once, this enters the selected post circulate time into controller memory.
6. The display will automatically return to illustrating the outlet temperature.

Display Current Mode

In this mode, the Display Board will illustrate the current functional step in the appliance operational sequence. For example, if the appliance is performing Ignitor Warm-up, the display will illustrate IGnt. To enter into this mode, perform the following steps:

1. Press the SELECT push-button on the display board until the LED display reads OPt (Options).
2. To enter into the options mode, press the ENTER/RESET push-button.
3. The display will illustrate Circ. Press the SELECT push-button until the display illustrates StEP. Enter this mode by pressing the ENTER/RESET push-button.
4. The display will illustrate the current appliance operating step.
5. The display will automatically resort to illustrating the outlet temperature, after five (5) seconds. To keep the display in the Display Step Mode, press ENTER/RESET twice in step 3.

Display Message	Appliance Mode
IdLe	Idle state
NoSn	Wait for No Sensor Inputs
CrSn	Wait for Circulate Sense
Circ	Circulate Pump is ON
PrSn	Wait for Blower Pressure Sense
PreP	Pre-Purge state
IGnt	Ignitor Warm-up
rEdn	Turn ON redundant Gas Valve relay
IAct	Turn ON Gas Valves
StAb	Turn OFF Ignitor and wait for Flame Sense Stabilization
HEAt	Heat Mode
PoPC	Post Purge and Post Circulate
Po C	Post Circulate

Display Total Cycle Count

The Main Control Board counts the number of cycles the appliance has operated. In the Main Control Board, a cycle is counted every time the gas valve is energized. To access this number, perform the following procedure:

1. Press the SELECT push-button on the display board until the LED display reads OPt (Options).
2. To enter into the options mode, press the ENTER/RESET push-button.
3. The display will illustrate Circ. Press the SELECT push-button until the display illustrates Count. Enter this mode by pressing the ENTER/RESET push-button.
4. The display will now illustrate the current number of cycles the appliance has cycled through.
5. The display will automatically resort to illustrating the outlet temperature.

TANK PROBE INSTALLATION PROCEDURE

A tank probe is supplied with each hot water supply boiler (GW). When installed on a tank, the inlet water temperature on the Dia-Scan II will default to the tank temperature. **See figures 15 and 17 to add the tank jumper to the control board so that the tank probe is active.**

Refer to figure 21 for connecting the tank probe to the boiler.

A tank probe is NOT supplied with the hydronic heating boilers (GB's). Therefore, a loop or operating thermostat must be provided. This field-supplied operating thermostat should be wired to the BROWN wires at the junction box. The jumper at location J33 on the control board must NOT be on. Refer to figures 15 and 17 for the location of this jumper.

Tank Probe Set-Point Adjustment

When the tank probe is installed in a water tank, and the tank probe is used with the WHC1502 system, the controller will monitor and control the temperature of the water at the tank probe location. Setting the temperature is accomplished through the Dia-Scan control display. The programmable temperature range is 110°F to 190°F. The switching differential of the probe is fixed at 5°F.

Tank Probe Temperature Set-point Adjustment Procedure

The user can easily change the tank probe temperature set-point at any time by using the following procedure:

1. Press the SELECT push-button on the display board until both the Set-Pt LED (LED 15, see figure 18) and Inlet Water Temperature LED (LED 12, see figure 18) are illuminated.

NOTE: When a tank probe is connected to the board at location CN10, the Inlet Water Temperature LED defaults to Tank Water Temperature.

2. The LED display will show the current set-point temperature.
3. Press and hold the ADJUST push-button. The displayed temperature will either increase or decrease. To alternate between increasing or decreasing the temperature, release then press and hold the ADJUST push-button.
4. When the desired set-point temperature is reached, release the ADJUST push-button.
5. Press the ENTER/RESET push-button once, this enters the selected tank set-point temperature into controller memory.
6. The appliance will now control the water temperature to the desired set-point value.

If the ADJUST push-button is held down long enough, the set-point will reach 110°F, the minimum value (or 190°F, the maximum value) and stop. At this point, if the desired set-point is not obtained, release the ADJUST push-button and depress it again. The set-point value will now restart at 110°F (190°F) and once again increase (decrease) in value for as long as the ADJUST push-button is pressed.

⚠ DANGER

HOT WATER TEMPERATURES REQUIRED FOR AUTOMATIC DISHWASHER AND LAUNDRY USE CAN CAUSE SCALD BURNS RESULTING IN SERIOUS PERSONAL INJURY AND/OR DEATH. THE TEMPERATURE AT WHICH INJURY OCCURS VARIES WITH THE PERSON'S AGE AND TIME OF EXPOSURE. THE SLOWER RESPONSE TIME OF DISABLED PERSONS INCREASES THE HAZARDS TO THEM. NEVER ALLOW SMALL CHILDREN TO USE A HOT WATER TAP, OR TO DRAW THEIR OWN BATH WATER. NEVER LEAVE A CHILD OR DISABLED PERSON UNATTENDED IN A BATHTUB OR SHOWER.



THE WATER HEATER SHOULD BE LOCATED IN AN AREA WHERE THE GENERAL PUBLIC DOES NOT HAVE ACCESS TO SET TEMPERATURES.

It is recommended in storage tank applications that lower water temperatures be used to avoid the risk of scalding. It is further recommended, in all cases, that the water temperature be set for the lowest temperature which satisfies the user's hot water needs. This will also provide the most energy efficient operation of the boiler and minimize scale formation in the heat exchanger, thus prolonging the life of the boiler.

SETTING THE WATER HEATER TEMPERATURE AT 120°F WILL REDUCE THE RISK OF SCALDS. Some states require settings at specific lower temperatures. Table 10 below shows the approximate time-to-burn relationship for normal adult skin.

TABLE 10. Risk of Scalds

Temperature Setting	Time to Produce 2nd & 3rd Degree Burns on Adult Skin
Over 170°F	Nearly instantaneous
160°F	About 1/2 second
150°F	About 1-1/2 seconds
140°F	Less than 5 seconds
130°F	About 30 seconds
120°F or less	More than 5 minutes

USE ANTI-SCALD VALVE(S) in the hot water system to reduce the risks of scalding at points of use such as lavatories, sinks and bathing facilities.

A change in water temperature in the storage tank lower than the Tank Probe setting (minus 5°F differential) will cause the boiler to start.

ONE GENESIS (MODEL GW) HOT WATER SUPPLY BOILER WITH HORIZONTAL TANK

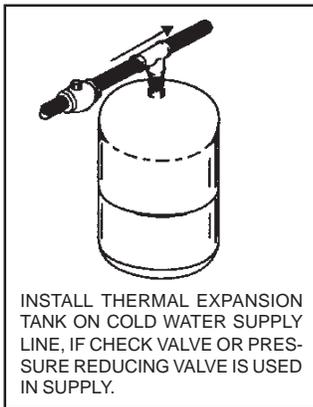
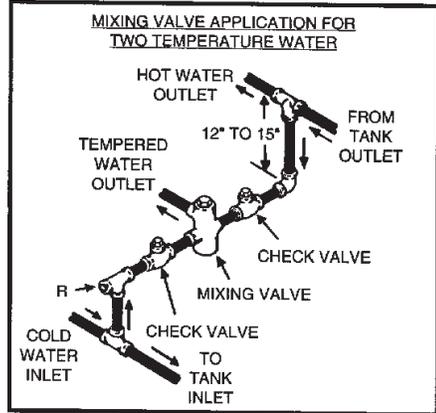
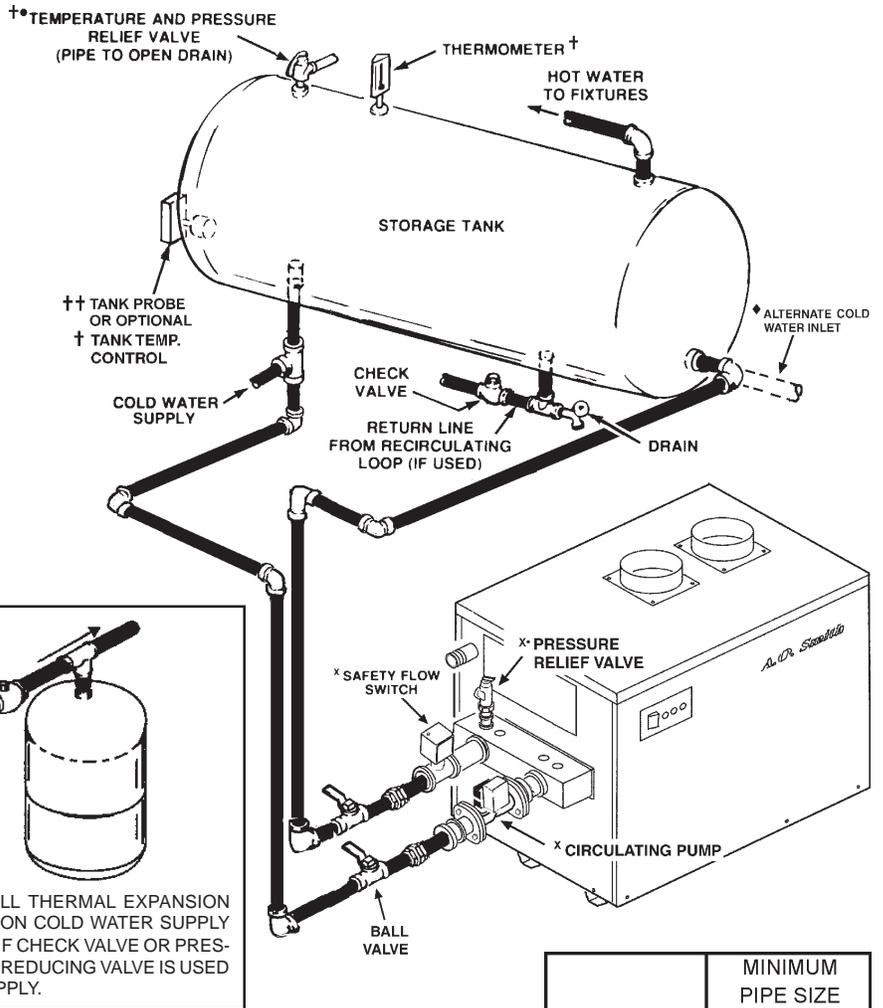
PRESSURE RELIEF VALVE RATING SHOULD NOT EXCEED PRESSURE CAPACITY OF ANY COMPONENT IN THE SYSTEM.

PIPING SHOULD CONFORM TO LOCAL CODES.

BALL VALVES ARE SHOWN FOR SERVICING BOILER. HOWEVER, LOCAL CODES SHALL GOVERN THEIR USAGE.

IMPORTANT
SAFETY FLOW SWITCH PROTECTS THE BOILER IN CASE OF WATER SERVICE INTERRUPTION OR CIRCULATOR FAILURE.

- PIPE TO OPEN DRAIN
- X FACTORY-INSTALLED ON UNIT
- ➔ SUPPLIED WITH UNIT
- $\frac{1}{12}$ FOR SYSTEMS WITH LARGE PEAK DEMANDS OR SEVERE COLD WATER CONDITIONS.
- † FIELD-INSTALLED

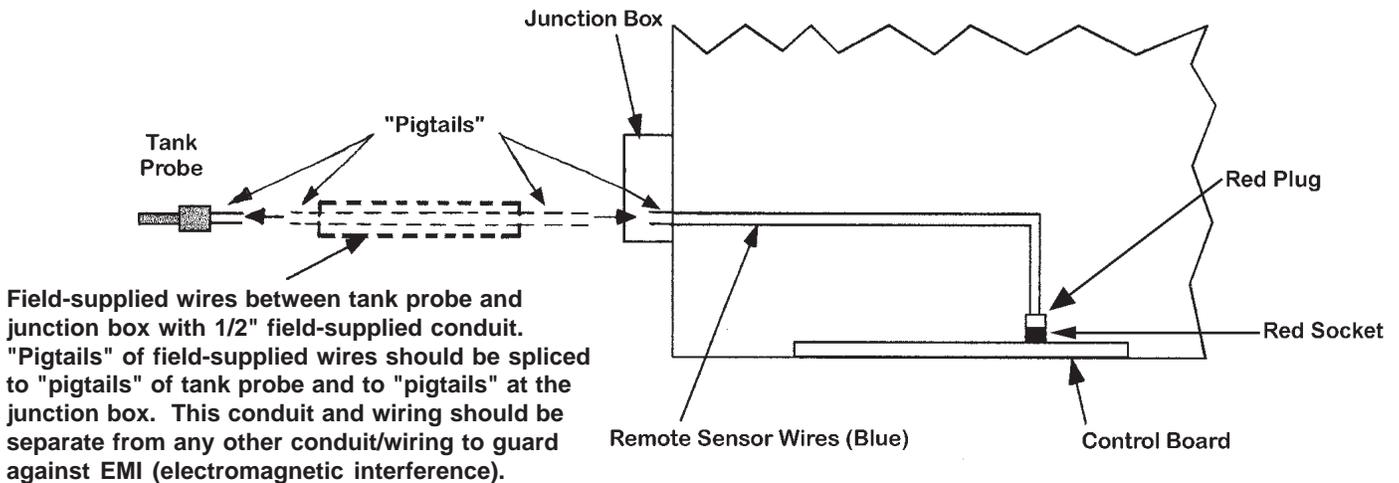


MODELS	MINIMUM PIPE SIZE INCHES
GW-200 THRU 400	1 1/2"
GW-500 THRU 750	2"

⚠ DANGER
TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE WARNING ON PAGE 22. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.

FACTORY PUMP SIZING BASED ON 50 EQUIVALENT FEET OF PIPE.

Figure 20. Single boiler with horizontal tank.



Field-supplied wires between tank probe and junction box with 1/2" field-supplied conduit. "Pigtails" of field-supplied wires should be spliced to "pigtailed" of tank probe and to "pigtailed" at the junction box. This conduit and wiring should be separate from any other conduit/wiring to guard against EMI (electromagnetic interference).

Figure 21. Tank probe installation.

ONE GENESIS (MODEL GW) HOT WATER SUPPLY BOILER WITH VERTICAL TANK

PRESSURE RELIEF VALVE RATING SHOULD NOT EXCEED PRESSURE CAPACITY OF ANY COMPONENT IN THE SYSTEM.

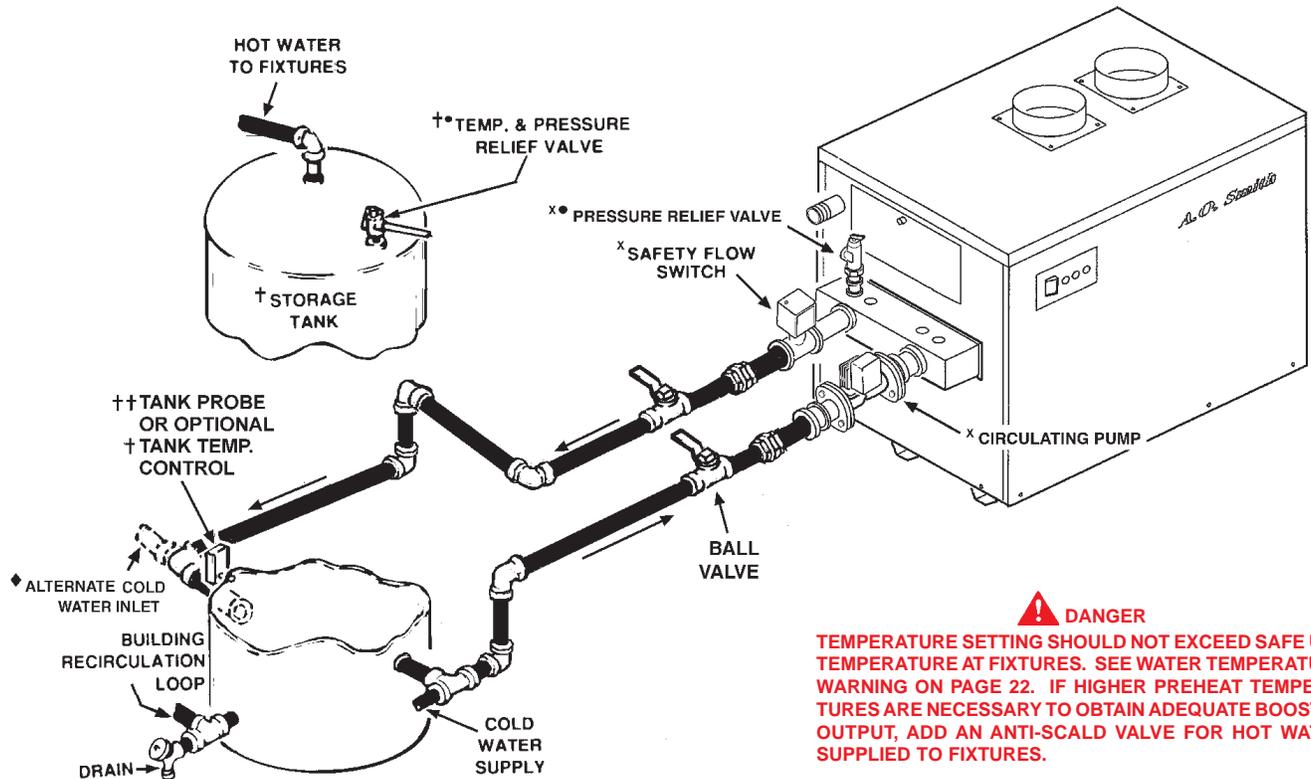
PIPING SHOULD CONFORM TO LOCAL CODES.

BALL VALVES ARE SHOWN FOR SERVICING BOILER. HOWEVER, LOCAL CODES SHALL GOVERN THEIR USAGE.

IMPORTANT

SAFETY FLOW SWITCH PROTECTS THE BOILER IN CASE OF WATER SERVICE INTERRUPTION OR CIRCULATOR FAILURE.

- PIPE TO OPEN DRAIN
- X FACTORY INSTALLED ON UNIT
- SUPPLIED WITH UNIT
- $\frac{1}{12}$ FOR SYSTEMS WITH LARGE PEAK DEMANDS OR SEVERE COLD WATER CONDITIONS.
- ↔ FIELD-INSTALLED

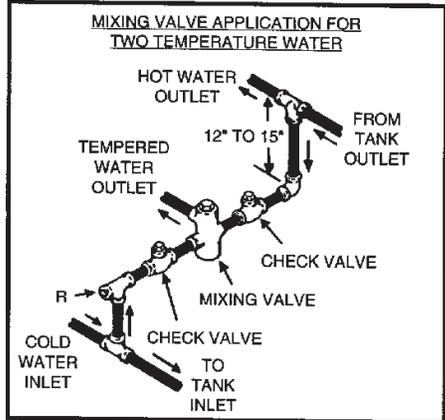


⚠ DANGER
 TEMPERATURE SETTING SHOULD NOT EXCEED SAFE USE TEMPERATURE AT FIXTURES. SEE WATER TEMPERATURE WARNING ON PAGE 22. IF HIGHER PREHEAT TEMPERATURES ARE NECESSARY TO OBTAIN ADEQUATE BOOSTER OUTPUT, ADD AN ANTI-SCALD VALVE FOR HOT WATER SUPPLIED TO FIXTURES.



MODELS	MINIMUM PIPE SIZE INCHES
GW-200 THRU 400	1 1/2"
GW-500 THRU 750	2"

FACTORY PUMP SIZING BASED ON 50 EQUIVALENT FEET OF PIPE.



CIRCULATING RETURN LINE CONNECTIONS

- TEMPERED WATER LOOP, IF USED, CONNECT TO POINT R.
- STORED TEMPERATURE WATER LOOP, IF USED, CONNECT TO ANY OPENING NEAR BOTTOM OF TANK.

Figure 22. Single boiler with vertical tank.

AUXILIARY EQUIPMENT INSTALLATION

The following is a brief description of the equipment required for installations noted in this manual. All installations must comply with local codes.

The boilers described in this manual may be used for space heating or for the heating of potable water. If the heater is to be used for hydronic space heating, follow the instructions on pages 25 and 26 given for equipment required for installation on page 27. However, if units are to be used for heating potable water, the information describing specific systems is found starting on page 27. Installations must comply with all local codes.

WATER SUPPLY LINE

These boilers can be used ONLY in a forced circulation hot water heating system. Since most forced circulation systems will be of the closed type, install the water supply line as shown on piping diagrams, figures 20 and 22.

Fast filling of large pipe, old radiator installations (where high pressures are not available) requires bypassing of the pressure reducing valve. Generally, pressure purging is not possible with a well pump system. High point air venting is essential.

If the system is of the open type, a pressure reducing valve will not be required as the water supply to the system will be controlled by a manually operated valve. An overhead surge tank is required. A MINIMUM PRESSURE OF 15 PSI MUST BE MAINTAINED ON THE BOILER AT ALL TIMES to avoid potential damage to the boiler that may not be covered by the warranty.

EXPANSION TANK

If the system is of the closed type, install an expansion tank as shown in fig. 23. The sizing of the expansion tank for a closed system is very important and is directly related to the total water volume of the system. Refer to ASME or other reliable specifications for sizing.

An air separator as shown in the piping diagrams is recommended especially for modern commercial hydronic systems.

VENT VALVES

It is recommended that automatic, loose key or screwdriver type vent valves be installed at each convector or radiator.

SYSTEM HEADERS

Split systems with individual supply and return lines from the boiler room should normally have this piping connected to supply and return manifold headers near the boiler. To achieve good water distribution with minimum pressure drop for several circuits, manifolds should be larger than system loops.

The circuits should be spaced on the header at a minimum of 3" center to center. Install a balancing cock in each return line.

Manifold headers are recommended for split systems with or without zone valves and also those installations with zone circulators. If the system is to be split at remote points, good practice requires special attention be given to main pipe sizing to allow balancing of water flow.

COOLING PIPING

When the boiler is used in conjunction with a refrigeration system it must be installed so that the chilled medium is piped in parallel with the boiler. Appropriate valves, manual or motorized, must be provided to prevent the chilled medium from entering the boiler.

Water temperature in the heating system must be reduced to less than 100°F before cooling system is started, or damage to the chiller unit may occur.

If the boiler is connected to chilled water piping or heating coils exposed to refrigerated air, the boiler piping system must be equipped with flow control valves or other automatic means to prevent gravity circulation through the boiler during the cooling cycle.

Primary/secondary pumping of both the chiller(s) and the boiler(s) is an excellent winter-summer change-over method, because cooling flow rates are much more than heating flow rates. In this way each system (heating or cooling) is circulated independently.

SYSTEM INSTALLATION

GENERAL

If the system is to be filled with water for testing or other purposes during cold weather and before actual operation, care must be taken to prevent a down draft entering the boiler or freezing air from contacting the system. Failure to do so may cause the water in the system to freeze with resulting damage to the system. Damage due to freezing is not covered by the warranty.

Good practice requires that all piping, etc., be properly supported.

CONVENTIONAL SPACE HEATING INSTALLATION

Modern fin type boilers are exceptionally fast heating units. The low water volumes in relation to firing rates require special attention to water flow rates for smooth, efficient operation. These considerations for the A. O. Smith copper heat exchanger boilers are covered below.

Refer to table 4 showing flow rate vs. pressure drop and temperature rise.

Figure 23 shows a typical installation of the boiler.

A system with several flow controlled zones, or with a 3-way mixing valve system could present a flow rate to the boiler of less than required for a maximum of 50°F temperature rise. Such a system should be designed with compensating bypasses to the boiler.

A system bypass should be installed as shown in figure 23 to prevent boiler circulation starvation when the system zones call for reduced flow.

This bypass may also be used with multiple boilers manifolded for reverse-return flow. The system bypass would be installed from boiler outlet to suction side of pump.

INSTALLATION AS BOILER REPLACEMENT

Installation as boiler replacement on an old system with large water volume may result in condensation within the boiler on cold starts. This condensing of water vapor in the combustion area can be prevented if a portion of the system water flow is diverted past the boiler to cause an increase in boiler temperature rise.

BYPASS BALANCING

With systems where water temperature can be expected to drop appreciably due to long standby periods, or heavy draw down, a bypass pipe of at least 1" size with a balancing cock should be installed between the boiler inlet and outlet (see figure 23). When the system first starts, the valve should be slowly opened until the condensing ceases. This adjustment remains at a permanent setting to establish required temperature rise across the boiler.

SPACE HEATING APPLICATIONS

Controlling of these systems is decided mainly by the type of building system controlling that is desired. A single boiler installation might be controlled directly from space temperature thermostat(s). Multiple boiler installations are more effective when the boilers are sequenced in and out of operation by some form of main water temperature controller. With one or two boilers, individual control set at progressive temperature may be used. For more than two boilers, electronic sequencing controlling is recommended.

Individual controls, or the separate stages of a step controller, should fire a boiler and also start the boiler loop circulator whenever that boiler is fired. Some large installations may require the firing of more than one boiler per stage.

The system or primary circulator may or may not be controlled by the boiler sequencer. When this pump is operated through the first switch of any type of step controller, care should be taken to determine if a motor starter is needed due to insufficient switch capacity.

If the primary pump is controlled by a manual switch or any other controllers, the electric current supply to the boiler group should be through the primary pump controller. The fast response of A.O. Smith boilers eliminates any need to maintain boiler temperature when the system is satisfied. Wiring should always prevent firing of boiler(s) when there is no water flow in the mains.

Installation diagrams show safety flow switches in the outlet piping from each boiler as good protection against any boiler being fired when the boiler loop circulator is not in operation. These safety flow switches will also provide some protection if there is a loss of water.

Multiple boiler installations are especially adapted to the use of outdoor reset for main water temperatures. This feature is not mandatory but offers smooth, efficient operation of a modern system.

Outdoor reset systems should utilize an automatic shutdown control if there is a continuous recirculating main and/or if the entire building is not under control of space temperature thermostats. A single bulb outdoor sensing control will serve this requirement. This precaution will prevent overheating of halls, stairways or other uncontrolled areas. There are occasions when outdoor temperatures are temporarily too warm for even a moderate amount of heating in these areas.

Space temperature controlling can be varied to meet the building requirements. Either the single thermostat, or multiple zone thermostats should control a common relay. This relay controls electric power to the system primary circulator and to the main water temperature controller. This provides for water movement in the system before the main temperature controller can start the secondary circulating pump or fire the boiler.

SPACE HEATING INSTALLATIONS

A. New Installation

Figure 23 shows piping and accessory arrangement for 1 or more boilers pumped independently of the primary system mains. Pipe sizing and boiler loop pump selection data, are shown in table 2 for several different temperature rises across various boiler sizes. Total heating requirements for the building can be supplied by a series of boiler loops all connecting to a common pipe joining the system supply and return mains. The supply and return branches of each boiler loop must join the common pipe only a short nipple

length apart. The different sets of branches should be installed reasonably close together, but not necessarily to the short nipple length as required for the supply and return of each set. These branches may be made with tees or with welded connections.

The installer is reminded that the total boiler flow rates do not have to match the system flow rate. Flow rates through heat generator type boilers establish temperature rises. The deciding factor in choice of boiler temperature rise relates to the boiler inlet temperature. Boiler outlet, minus system temperature drop, is boiler inlet temperature. **THE BOILER TEMPERATURE RISE SHOULD NOT RAISE THE OUTLET TEMPERATURE UP TO THE MAXIMUM 240°F (115°C) SETTING OF THE AUTOMATIC RESET LIMIT CONTROL.**

If inlet temperature (plus temperature rise) of any boiler on the group exceeds 240°F (115°C), that boiler and all downstream boilers will shut down.

B. Commercial Boiler Replacements

Application of Genesis to a commercial boiler replacement with an old multiple pump installation is an excellent way to modernize the system. The A. O. Smith boiler(s) should be installed on a pipe loop with a separate circulating pump. Use table 2 to determine pipe sizes and operating ranges.

The following illustration shows how the system headers should be connected to pipe loop that is installed with the replacement boiler(s). Make-up water connections, and accessories are not shown.

Supply and return headers of the old system should be connected to the boiler loop with a pair of tees set close together. The boiler loop pump and the boiler(s) should be wired to operate only when any of the system pumps are in operation. The number of zone pumps that may be in operation at any particular time will take their required flow rate out from the first tee in the boiler piping. This water will be circulated through the proper branches from the supply header to the zones calling for heat. The water will be brought back to the return header and then into the second tee in the boiler pipe loop. There will be no conflict between the boiler pump and the zone pumps when the two tees in the boiler loop are placed close together.

Normal use of flow control valves is required to prevent cross circulation of zones as with any multiple pump system.

Large systems with multiple boilers should include main water temperature controls (with or without outdoor reset) to sequence the boiler on and off, in relation to the load on the system.

LEGEND FOR FIGURE 23

1. PAIR OF SHORT PIPE NIPPLES, PAIR OF BOILER LOOP TEES AND BALL VALVE BETWEEN SYSTEM SUPPLY AND RETURN - ONE SET PER EACH BOILER
2. BOILER PIPE LOOP (See Pipe Sizing Data Table 2.)
3. BOILER CIRCULATING PUMP (See Pipe Sizing Data Table 2.)
4. THERMOMETER
5. PRESSURE GAUGE
6. LOW WATER CUTOFF (If Required By Local Code.)
7. SAFETY FLOW SWITCH (Factory-Installed)
8. PRESSURE RELIEF VALVE [PRV] (Factory-Installed)
9. BOILER INLET - OUTLET
10. SYSTEM SUPPLY TEMPERATURE THERMOMETER
11. DRAIN or BLOW-DOWN VALVE

HOT WATER SUPPLY APPLICATIONS

WATER LINE CONNECTIONS

Where excessive heat exchanger condensation exists due to continued low inlet water temperatures (below 120°F), a bypass balance loop must be installed (see figure 23).

HARD WATER CONDITIONS

Where hard water conditions exist, water softening or the threshold type of water treatment is recommended. This will protect the dishwashers, coffee urns, water heaters, water piping and other equipment. When water softening or water treatment is not practical, a comparatively easy method of periodic lime removal from the unit must be employed.

⚠ WARNING

Lime accumulation can reduce the life of the equipment, reduce efficiency and waste fuel. Boiler failure due to lime or scale buildup voids the warranty.

INTERNAL CONTAMINANTS

The system must be internally cleaned and flushed after a new or replacement unit has been installed to remove contaminants that may have accumulated during installation. This is doubly important when a replacement unit is installed into an existing system where Stop Leak or other boiler additives have been used.

All systems should be completely flushed with a grease removing solution to assure trouble-free operation. Pipe joint compounds, soldering paste, grease on tubing and pipe all tend to contaminate a system.

Failure to clean and flush the system can cause solids to form on the inside of the heat exchanger, can produce acid concentrations that become corrosive, can allow excessive amounts of air or other gases to form which could block circulation, foul system accessories and damage circulator seals and impellers.

It is recommended that after installation, the boiler and system when filled should include the proper percentage of cleaning solution related to approximate water volume of the system. Fire and circulate for about one hour and then flush clean with fresh water. Commercial grease removing solutions are available.

Before operating the boiler, the entire system must be filled with water, purged of air and checked for leaks. Do not use Stop Leak or other boiler compounds. The gas piping must also be leak tested.

PRECAUTIONS

If the unit is exposed to the following, do not operate boiler until all corrective steps have been made by a qualified serviceman:

1. Exposure to fire.
2. If damaged.
3. Firing without water.
4. Sooting.

If the heater has been exposed to flooding it must be replaced.

IMPORTANT

ONLY QUALIFIED PERSONNEL SHALL PERFORM THE INITIAL FIRING OF THE HEATER. AT THIS TIME THE USER SHOULD NOT HESITATE TO ASK THE INDIVIDUAL ANY QUESTIONS REGARDING THE OPERATION AND MAINTENANCE OF THE UNIT.

FILLING AND VENTING

1. Fast fill system through bypass until pressure approaches desired system pressure. Close bypass valve and permit pressure to be established by the pressure reducing valve.
2. Vent all high points in system to purge system of air.

Provisions should be made to permit manual venting of radiators or convectors.

IMPORTANT

UNDER NO CIRCUMSTANCES SHALL THE GAS PRESSURE MEASURED AT THE BURNER MANIFOLD EXCEED THAT STATED ON THE BOILER RATING PLATE. OVERFIRING WILL RESULT IN DAMAGE TO THE BOILER, AS WELL AS INCREASED RISK OF FIRE, SOOTING AND ASPHYXIATION.

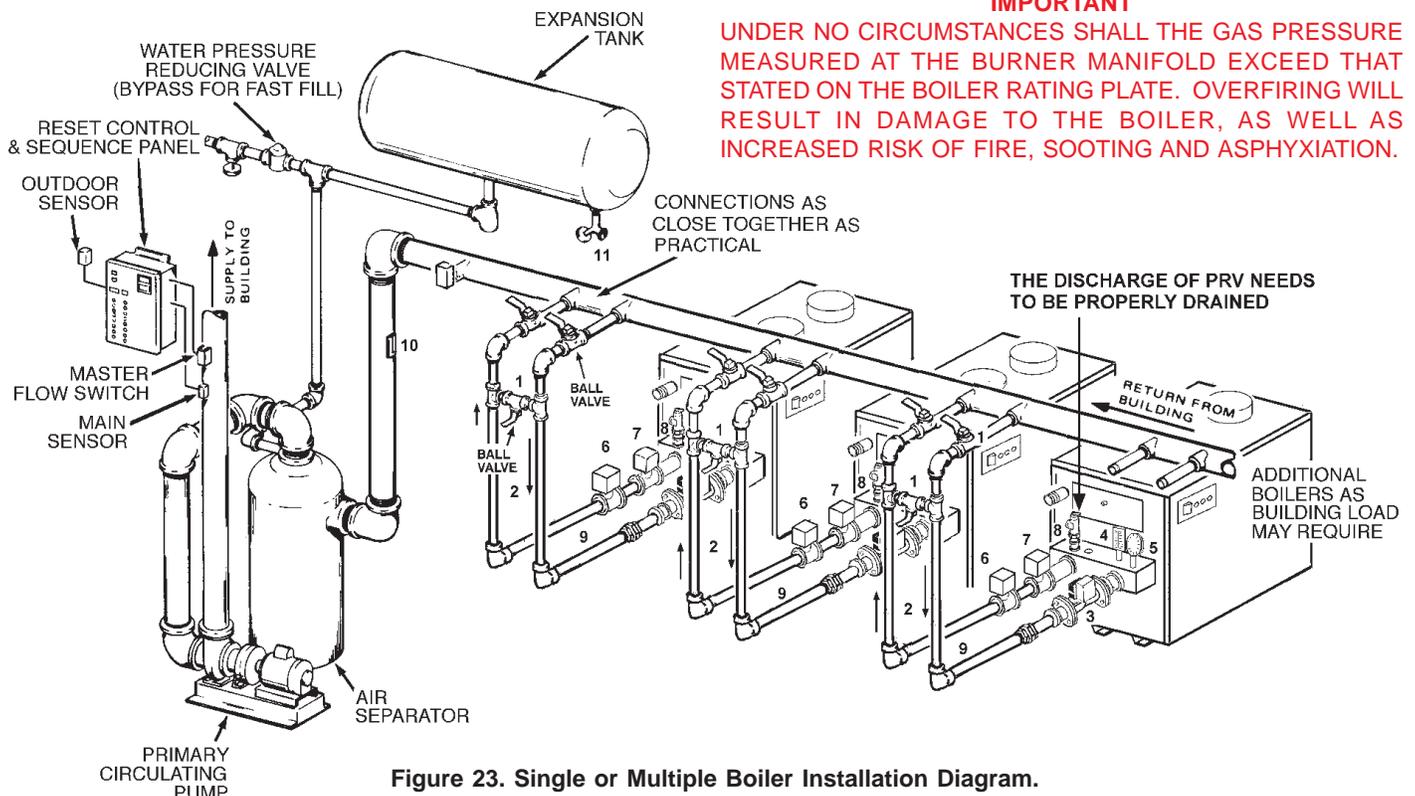


Figure 23. Single or Multiple Boiler Installation Diagram.

MAIN BURNERS

Check main burners every three months for proper flame characteristics.

The main burner should display the following characteristics:

- Provide complete combustion of gas.
- Cause rapid ignition and carry over of flame across entire burner.
- Give reasonably quiet operation during initial ignition, operation and extinction.
- Cause no excessive lifting of flame from burner ports (see fig. 24).

If the preceding burner characteristics are not evident, check for accumulation of lint or other foreign material that restricts or blocks the air openings to the burner or boiler.

NOTE: Cleaning of main burners.

Shut off all gas and electricity to unit.

1. Remove main burners from unit.
2. Check that burner venturi and ports are free of foreign matter.
3. Clean burners with bristle brush and/or vacuum cleaner. DO NOT distort burner ports.
4. Reinstall burners in unit. Ensure that all the screws on the burner flange are tightened securely so that the gasket will provide a good seal. Also, ensure that each orifice is centered with the venturi opening of every burner. Refer to the illustration and Note 1 of the PSD Parts List, Part No. 210312-000.

Also check for good flow of combustion and ventilating air to the unit.

After placing the boiler in operation, check the ignition system safety shut-off devices for proper operation. To accomplish this with the main burners operating, close the valve on the manifold. Within four seconds the main burners should extinguish. If this does not occur, discontinue gas supply by closing main manual shut-off and call a qualified serviceman to correct the situation. If the burners extinguish, then light boiler in accordance with lighting and operating instructions.

For installations above 2000 feet (600 m), refer to HIGH ALTITUDE INSTALLATIONS in the installation section.

PRE-TROUBLESHOOTING

Before any extensive troubleshooting, ensure that:

- Power (120 VAC) is supplied to the appliance.
- System control (tank probe, thermostat, etc.) is calling for appliance operation (call for heat).
- Other contacts (switches) are closed (low water cutoff, flow switch, limit controls, pressure switches, etc.)
- Gas supply pressure is within the maximum and minimum operating ranges listed on the appliance rating plate/label.
- Appliance is wired according to wiring diagram.

NOTE: Shorting the thermostat wiring to ground in the 24 volt circuit will blow the 3 amp fuse.

- All wire terminals/connectors are firmly attached to valves, modules, switches, limit controls, etc.
- There has been no damage caused by freezing, inoperative pumps, etc.

TROUBLESHOOTING IGNITION SYSTEM

Display Board LED Indicators

The Display Board contains eleven (11) solid state LED indicators for viewing various states of appliance operation and for troubleshooting if problems occur. Under normal operating conditions, the appropriate LEDs will sequence with steady illumination according to the particular appliance operating state. In cases where problems or a lockout occurs, the appropriate LEDs will illuminate indicating the general area where the problem exists.

A description of the LEDs and their corresponding functions are as follows.

<u>LED</u>	<u>Controller Function</u>
Call for Heat	Monitors Outlet water temperature minus Switching Differential and thermostat circuit or tank probe circuit. LED is ON when the temperature at Outlet water Probe is less than the set-point minus the switching differential and the thermostat circuit or tank probe circuit is closed.
Flow Switch	Monitors the condition of the flow switch. LED is ON when the flow switch closes, indicating water flow through the system.
Pressure Switch	Monitors the condition of the pressure switches. LED is ON when the pressure switches are in their correct state.
Ignitor Current	Monitors current flow through the ignitor element. LED is ON when current flow through the ignitor is sensed.
Gas Valve	Monitors Gas Valve output. LED is ON when the output relay supplying power to the gas valve(s) is closed.
Flame Sense	Monitors the Flame Sense Rod. LED is ON when a signal from the flame rod is sufficient to indicate flame.
Blocked Air Intake	Indicates a blockage or interference at the appliance air inlet.
Blocked Flue	Indicates a blockage or interference at the appliance flue.
Blower Fail	Indicates an error/malfunction in the blower motor circuit.
Circulate Fail	Indicates an error/malfunction in the circulating pump circuit.
Ignition Fail	Indicates a malfunction in the ignition system circuit.

TROUBLESHOOTING

The WHC1502 Series Control System has many inherent diagnostic and fault detection routines built into its operating hardware and software. These routines, in conjunction with the four (4) digit LED display and eleven (11) LED status indicators on

the Display Board, can greatly assist any service person in quickly pinpointing the source of a problem which may occur within the appliance. In certain circumstances, multiple LEDs will illuminate to better pinpoint the target area(s).

The following list defines the error code messages that scroll across the LED display:

<u>ERROR MESSAGE</u>	<u>REPORTED ERROR</u>
OPEn InLEt ProbE	No probe detected at connector CN1 on Control Board.
OPEn OutLEt ProbE	No probe detected at connector CN2 on Control Board.
Circulation FAIL	No flow detected at flow switch.
Inducer FAIL	No pressure detected at pressure switch.
FLAmE SenSE FAIL	Flame sense detected before gas valve is turned on.
SenSor FAIL	One of the sensors, Flow, Pressure, Hi Gas, or Lo Gas was not in the correct state.
Ignitor FAIL	No Ignitor current sensed.
No Ignition	Flame not detected after 3 (or 1) tries.
ECO FAIL	ECO/High Limit switch opened.
Control FAIL	Relay did not open or close properly.

Upon lockout, manually push either the ADJUST, SELECT or ENTER/RESET button on the burner access panel to restart the boiler. If the boiler has an ECO lockout, the boiler's power must be reset and the Enter/Reset button must be pushed to restart the boiler.

DESCRIPTION OF COMPONENTS

BLOWER PROVER PRESSURE SWITCH

The blower prover pressure switch ensures that the combustion blower is operating and creating sufficient air pressure. This air pressure is measured in the pre-mix chamber behind the front jacket panel. It is important that this panel remain sealed at all times while the boiler is operating.

This pressure switch is normally open and closes when the combustion blower starts. The 20 second pre-purge timing starts after this switch closes.

BLOCKED FLUE PRESSURE SWITCH

The blocked flue pressure switch ensures that the flue gas vent is clear. This pressure switch is normally closed and only opens on the fault conditions.

BLOCKED AIR INTAKE PRESSURE SWITCH

The blocked air intake pressure switch ensures that the intake air system is clear. This pressure switch is normally closed and only opens on the fault conditions.

FLAME SENSOR

The flame sensor acts to prove the flame has carried over from the ignitor to the right-most burner. If no flame is sensed, the gas valve(s) will close automatically. If no flame is sensed on three (or one) ignition trials the boiler will lock out. Upon lockout, manually push either the ADJUST, SELECT OR ENTER/RESET button on the front jacket panel to restart the boiler.

WATER FLOW SWITCH

The Water Flow Switch is installed at the boiler outlet to prevent burner operation in the event of inadequate water flow through the boiler. The Water Flow Switch is a single pole, normally open switch that will close its contacts when increasing water flow rate is encountered. This switch is factory-set, but may require field adjustment. The contacts will open when the flow rate drops below the adjusted setting and the gas valve(s) will close turning off the gas to the burners.

LIMIT CONTROLS

This boiler contains two limit controls built into the outlet water probe. The automatic reset limit is adjustable from 110°F to 240°F.

The manual reset limit is factory-set at 250°F. Once the manually reset limit opens, the gas valve(s) will close and the boiler will lockout. Upon lockout, manually push either the ADJUST, SELECT OR ENTER/RESET push-button on the front jacket panel and turn the power off and on to the boiler to restart the boiler.

ON/OFF SWITCH

The ON/OFF switch is a single-pole, single-throw rocker switch. The switch provides 120VAC from the line source to the boiler.

COMBUSTION AIR BLOWER

The bearings in the motor are pre-lubricated and sealed at the factory. No further oiling of the bearings is required for the life of the motor.

GENERAL MAINTENANCE

These boilers are designed to give many years of efficient and satisfactory service when properly operated and maintained. To assure continued good performance, the following recommendations are made.

The area around the unit should be kept clean and free from lint and debris. Sweeping the floor around the boiler should be done carefully. This will reduce the dust and dirt which may enter the burner and heat exchanger, causing improper combustion and sooting.

THE FLOW OF COMBUSTION AIR TO THE BOILER MUST NOT BE OBSTRUCTED.

THE BOILER AREA MUST BE KEPT CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS.

Any safety devices including low water cutoffs used in conjunction with this boiler should receive periodic (every six months) inspection to assure proper operation. A low water cutoff device of the float type should be flushed every six months.

Periodic checks, at least twice a year, should be made for water and/or gas leaks.

More frequent inspections may be necessary depending on water conditions.

The boiler-mounted gas and electrical controls have been designed to give both dependable service and long life. However, malfunction can occur, as with any piece of equipment. It is therefore recommended that all components be checked periodically by a qualified serviceman for proper operation.

RELIEF VALVE

The safety relief valve should be opened at least twice a year to check its working condition. This will aid in assuring proper pressure relief protection. Lift the lever at the top of the valve several times until the valve seats properly and operates freely.

DANGER

THE WATER PASSING OUT OF THE VALVE DURING CHECKING OPERATION MAY BE EXTREMELY HOT. BEFORE OPERATING RELIEF VALVE, MAKE SURE DRAIN LINE IS INSTALLED TO DIRECT DISCHARGE TO A SAFE LOCATION SUCH AS AN OPEN DRAIN, TO AVOID SCALDING OR WATER DAMAGE.

WARNING

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, TURN OFF THE MANUAL GAS CONTROL VALVE TO THE APPLIANCE.

COMBUSTION AIR FILTER

If the combustion air supply to the boiler contains dust, dirt, drywall dust etc. a filter must be installed. Air filter is not supplied with the boiler as shipped from the factory. The installer must provide a filtering system in the air inlet to the boiler if dust, dirt or construction dirt can be pulled into the boiler through the inlet air piping.

BLOWER COMPARTMENT

The blower compartment should be cleaned annually to remove any dirt and lint that may have accumulated in the compartment or on the blower and motor. Buildups of dirt and lint on the blower and motor can create excessive loads on the motor resulting in higher than normal operating temperatures and possible shortened service life.

VENTING MAINTENANCE

It is recommended that the intake and exhaust piping of the appliance be checked every 3 months for dust, condensate leakage, deterioration and carbon deposits.

Qualified serviceman should follow this procedure when the boiler's intake and exhaust piping need cleaning.

WARNING

DO NOT USE A NYLON BRUSH OR OTHER STATIC CREATING MATERIAL TO CLEAN DUST AND CARBON DEPOSITS FROM HEATING SURFACES AND VENT.

SUCH DEPOSITS ARE FLAMMABLE AND MAY BE IGNITED BY STATIC ELECTRICITY. USE A METAL BRUSH TO MINIMIZE THE DANGER OF EXPLOSION

1. Turn off the electrical power, and manual gas shut-off.
 - Allow boiler parts to cool before disassembly.
2. Remove the vent pipe.
 - Check parts and chimney for obstructions and clean as necessary.
3. Remove burners from boiler and other metal parts as required to clean as necessary.
 - Refer to parts list supplied with this manual for disassembly aid.
4. Clean and reinstall the parts removed in steps 2 and 3.
 - Be sure the vent pipe has a minimum upward pitch of one quarter inch per foot of length and is sealed as necessary.

5. Restore electrical power and gas supply to boiler.
 - Check for gas leaks and proper boiler and vent operation.

HEAT EXCHANGER PREVENTIVE MAINTENANCE

In most water supply systems some solids exist. As the water is heated, these tend to drop out depositing as scale or lime. This scale must be removed before the heat exchanger tubes become blocked.

CAUTION

Lime accumulation can reduce the life of the equipment, reduce efficiency and waste fuel. Boiler failure due to lime or scale buildup voids the warranty.

See section on CIRCULATING PUMP to ensure you have selected the proper size pump for your situation.

DELIMING

The amount of calcium carbonate (lime) released from water is in direct proportion to water temperature and usage. The higher the water temperature or water usage, the more lime deposits are dropped out of the water. This is the lime scale which forms in pipes, boilers and on cooking utensils.

The usage of water softening equipment greatly reduces the hardness of water. However, this equipment does not always remove all of the hardness (lime). For this reason it is recommended that a regular schedule for deliming be maintained.

The time between cleaning will vary from two to six months depending upon water conditions and usage. A change of approximately 5°F in the normal temperature rise through the boiler is usually an indication that scale should be removed. For long life, copper or brass is recommended for all valves, pipe and fittings, see figure 23.

TUBE CLEANING PROCEDURE MECHANICAL REMOVAL OF DEPOSITS

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

To service heat exchanger tubes remove return header casting, side opposite the water connections. Use a standard 9/16" deep socket ratchet to remove the nuts, exposing the tube ends. Inspect to ensure tubes are free of scale and deposits. If scaled, remove deposits with a stiff wire brush or mechanical tube cleaner to bare metal. Install new O rings and reinstall return header casting. Flush system.

Note: Removal of the heat exchanger is not required.

CAUTION

If heat exchanger maintenance requires tubing replacement, special provisions shall be taken to ensure that the damaged tubes are carefully removed.

Replacement tubes must be properly installed and expanded into the tube plate.

Over rolling, misalignment of tubes or improper tightening of the assembly may result in leaks or damage to the heat exchanger. Contact your A. O. Smith dealer for detailed instructions.

Start-up Instructions

COPPER BOILERS FOR HYDRONIC HEATING AND HOT WATER SUPPLY SERIES 200, 201, 202, 203

Before starting the boiler please review the Boiler's Instruction Manual (AOS Part Number 210889-000) supplied with the boiler. This is a powered combustion copper tube boiler. If you are not familiar with a powered combustion boiler please contact an authorized A.O. Smith representative before starting the unit.

This boiler is equipped with a WHC 1502 control board and a Diascan II integrated display system. The Dia-Scan II displays the system status and errors that may occur during normal operation. For full details on the controls please refer to the Instruction Manual supplied with the boiler. The boiler must be installed according to the Installation Instructions provided with the unit. Failure to do so will void the warranty.

Prior to starting the boiler for the first time check the following:

Gas Supply Lines are sized in accordance with ANSI Z223.1 National Fuel Gas Code or CAN/CGA-B149.1 or B 149.2 (most recent edition).

Minimum Inlet Gas Supply Pressure of 5.5" W.C. for Natural Gas or 11.0" W.C. for Propane.

Check all gas supply lines for leaks.

Check that all venting is properly sealed in accordance with the Instruction Manual.

Main power is 120 VAC, 60Hz, single phase, rated for 20 Amps or above.

Turn "**ON**" gas and water supply to the boiler (DO NOT DRY FIRE THE BOILER).

Purge air from the gas and water lines.

Make sure the boiler is not damaged and all jacket panels are tightly sealed with all the screws in place. If the unit is damaged contact an A.O. Smith representative for service or replacement parts prior to starting the boiler.

Starting the boiler for the first time.

The boiler is tested at the factory and should start properly if installed in accordance with the Boiler's Instruction Manual. The boiler may have a slight rumble on a cold start. This is normal and will not harm the unit nor is it a safety issue. The rumble is caused by cold water in the heat exchanger creating a cold combustion chamber. Thus, the rumble occurs. Once the boiler has been started from a cold start the rumble will disappear on subsequent starts.

Should the boiler not start, a minor air shutter adjustment may be required by the installer, as atmospheric conditions may change the amount of air supplied to the unit at the given installation site (see figure 24 for final flame appearance).

When adjusting the air shutter, 1/2 turns on the air shutter adjustment screw (located at the top of the unit) are recommended. If the boiler continues to start hard or rough after the initial cold start, adjust the air shutter until the boiler starts smoothly.

DO NOT try to adjust the gas air mixture to make the flame sit on the burner (see figure 24 for final flame appearance).

This is a powered burner and the flame is not supposed to be on the burner. The flame should be just above the burner deck approximately 1/8" and blue in color (see figure 24).

Visually check flame characteristics through the view port located under the left-hand header on the boiler. Figure 24 below shows the normal flame condition. Also, refer to the flame label on the unit (adjacent to the view port).

A. **Normal Flame:** A normal flame is blue without yellow tips. No adjustments required.

B. **Yellow Tips:** Yellow tips are caused by a lack of air to the burner.

- | | |
|---------------------------------|-----------------------------------------------------------------|
| Possible cause: Blocked intake. | Solution: Remove blockage. |
| Possible cause: Air shutter. | Solution: Open Air Shutter until normal flame occurs. |
| Possible cause: Gas pressure | Solution: Check manifold pressure and adjust to proper setting. |

C. **Yellow Flames:** Yellow flames are caused by a lack of air to the burner.

- | | |
|---------------------------------|-----------------------------------------------------------------|
| Possible cause: Blocked intake. | Solution: Remove blockage. |
| Possible cause: Blocked burner. | Solution: Remove blockage. |
| Possible cause: Air shutter. | Solution: Open air shutter until normal flame occurs. |
| Possible cause: Gas pressure. | Solution: Check manifold pressure and adjust to proper setting. |

D. **Lifting Flames:** Lifting flames are caused by over firing the burners or excess air.

- | | |
|-------------------------------|-----------------------------------------------------------------|
| Possible cause: Gas pressure. | Solution: Check manifold pressure and adjust to proper setting. |
| Possible cause: Air shutter. | Solution: Close the air shutter until normal flame occurs. |

Gas Manifold Pressure Settings:

- GB & GW-200 thru 750: 3.5" W.C (Natural Gas)
- GB & GW-200 thru 750: 10.0" W.C. (Propane Gas).

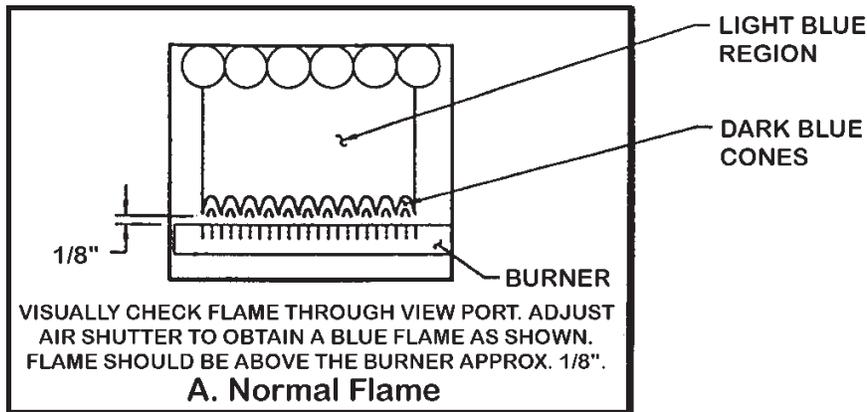


Figure 24. Burner Flame Characteristics

For additional information please refer to the User’s Manual supplied with the boiler or contact:

A.O. Smith Technical Services at

1-800-527-1953

7 a.m. to 7 p.m. Central Time.

Our Internet Site is another source of information 24 hours a day.

<http://www.hotwater.com>