

Series 3
Commercial Gas-Fired
Steam and Water Boilers

Boiler Manual



⚠ WARNING

Installation and service of the boiler must be performed by a qualified installer or service technician. Read all instructions, including this manual and all other information shipped with the boiler, before installation or operation. Perform steps in the order given. Failure to comply could result in severe personal injury, death or substantial property damage.

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Tools

Table 1 Common tools needed

Tools Needed	Purpose
1/16" flat blade screwdriver	Wiring on terminal blocks.
Allen wrench - small	LGB 4R, 4, & 5 gas valve adjustment.
T40 bit	LGB 6-20 gas valve adjustment.
7/16" wrench	Gas orifice installation. Collector hood j-hook installation.
1/2" wrench and socket	Collector hood j-hook installation.
5/16" socket	Burner access shield screws.
Phillips head screwdriver	Jacket screws.
Pipe wrenches	Gas train installation.
9/16" wrench and socket	Base panels.
15/16" wrench and socket	Casting draw rod nuts.
Manometer (inclined or digital)	Measuring the gas pressure coming to the boiler.
Torque wrench	Casting draw rods. Collector hood bolts.
Level	Casting block assembly. Collector hood assembly.
Scissors	Cutting fiberglass rope and tape seals.

Abbreviations

Table 2 Common abbreviations

Abbreviation	Description
AMP	Ampere or Amperage
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BTUH	British Thermal Unit per Hour
CH	Central Heat
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CP	Consumer Protection
CPVC	Chlorinated Polyvinyl Chloride
CSA	Canadian Standards Association
CSD-1	Controls and Safety Devices
DHW	Domestic Hot Water
LP	Liquefied Petroleum (Propane)
LWCO	Low Water Cut-Off
MBH	Thousands of Btuh
NFPA	National Fire and Protection Agency
NG	Natural Gas
NIOSH	National Institute for Occupational Safety and Health
NTC	Negative Temperature Coefficient
O ₂	Oxygen
P/T	Pressure and Temperature
SCFM	Standard Cubic Feet per Minute
ULC	Underwriters Laboratories of Canada
VAC	Volts Alternating Current
VDC	Volts Direct Current
W.C.	Water Column

SECTION 1

Safety

This section is intended to provide safety information.

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Safety Signals

The following defined terms are used throughout this manual to bring attention to the presence of hazards or other important information.

⚠ DANGER

Danger indicates the presence of hazards that will result in severe personal injury, death, or substantial property damage.

⚠ WARNING

Warning indicates the presence of hazards that can result in severe personal injury, death, or substantial property damage.

⚠ CAUTION

Caution indicates the presence of hazards that will or can result in minor personal injury or property damage.

NOTICE

Notice indicates additional information that may be related to property damage, but is not related to personal injury.

IMPORTANT

Important indicates additional information that is important, but is not related to personal injury or property damage.

Please Read Before Proceeding

⚠ WARNING

Adhere to all following guidelines and instructions in this section. Failure to adhere to these guidelines can result in severe personal injury, death, or substantial property damage.

Installer: Read all instructions, including this manual and all other information shipped with the boiler, before installation. Perform steps in the order given. Consider piping and installation when determining boiler location.

User: This manual is for use only by a qualified heating installer or service technician. Refer to the User Manual for your reference. A qualified service technician should inspect and service this boiler at least once per year.

Write the Consumer Protection (CP) number and serial number in the space provided on the Installation and Service Certificate on page 112. The CP number can be found on the boiler jacket.

Please include the boiler model number, CP number, and serial number when inquiring about the boiler. The model number can be found on the boiler rating label.

IMPORTANT

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Servicing a Boiler

- To avoid electric shock, disconnect all electrical supplies to the boiler before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.
- This boiler contains ceramic fiber and fiberglass materials. Refer to the warning and instructions on page 84.

Please Read Before Proceeding, continued

Boiler Operation

- Do not block flow of combustion or ventilation air to boiler.
- Should overheating occur, or gas supply fail to shut off, do not turn off or disconnect electrical supply to pump. Shut off the gas supply at a location external to the appliance.

Boiler Water

- The water chemistry for the boiler must be checked. Chemical treatment may be required. See [pages 74-76](#) for details.
- Before connecting the boiler, thoroughly flush the system to remove sediment. Install a strainer or other sediment removal equipment if necessary.
- Do not use petroleum-based cleaning or sealing compounds in the boiler system. Gaskets and seals in the system may be damaged, which can result in substantial property damage.
- Continual fresh make-up water will reduce boiler life. Mineral buildup in the heat exchanger reduces heat transfer, overheats the heat exchanger, and causes failure. Addition of oxygen carried in by make-up water can cause internal corrosion. Leaks in the boiler or piping must be repaired at once to prevent make-up water. Use this boiler **ONLY** in a closed-loop system.
- Do not add cold water to a hot boiler. Thermal shock can cause the heat exchanger to crack.

Commonwealth of Massachusetts

When the boiler is installed within the Commonwealth of Massachusetts:

- This product must be installed by a licensed plumber or gas fitter.
- If antifreeze is used, a reduced pressure back-flow preventer device shall be used.

Freeze Protection Fluids

NEVER use automotive or standard glycol antifreeze. Use only freeze-protection fluids recommended in this manual. See [page 75](#) for more information. Thoroughly clean and flush any replacement boiler system that has used glycol before installing the new LGB boiler.

Damage from Water Contact

DANGER

DO NOT attempt to operate any boiler if any part of the boiler, burner, or controls has been partially or fully sprayed with or submerged under water. The boiler must either be replaced or completely repaired and inspected. The boiler and all components must be in good condition and fully reliable before operation.

If these requirements are not met, operating the boiler will cause fire, explosion, and electrical shock hazards, leading to serious injury, death, or substantial property damage.

Saltwater damage: The immediate effects of saltwater damage are like those of freshwater, with electrical components shorting out and the removal of critical lubricants. However, salt and other contaminants left behind can lead to long term issues due to the conductive and corrosive nature of salt residue. WM Technologies equipment contaminated with saltwater or polluted water will no longer be covered under warranty and should be replaced.

Electrical damage: If any electrical component or wiring has, or is suspected to have come into contact with water, replace the boiler.

Frozen Water Damage

Power outages, unattended residences or buildings, boiler component failures, or other electrical system failures in cold weather could result in frozen plumbing and water damage in a matter of hours. Consult with a boiler contractor or a home security agent to take preventative actions, such as installing a security system that operates during power outages, senses low temperature, and initiates an effective action.

SECTION 2

Installation

This section is intended to provide installation instructions for qualified heating installers.

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Prepare Boiler Location

Installation Compliance Requirements

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1/NFPA 54 latest edition.
- National Electrical Code ANSI/NFPA 70 latest edition. For Canada, electrical installation and grounding must be in accordance with CSA C22.1, Part 1, Canadian Electrical Code and local codes.
- For Canada only: CAN/CSA B149.1, Natural Gas and Propane Installation Code and local codes.
- Where required by the authority having jurisdiction, the installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.

IMPORTANT

The LGB boiler manifold and controls met safe lighting and other performance criteria when the boiler underwent tests specified in ANSI Z21.13 latest edition.

Checks Before Boiler Installation

1. Check for nearby connections to:
 - System water piping
 - Venting connections
 - Gas supply piping
 - Electrical Power
 - Location of drain for condensate
2. Check area around boiler. Remove any combustible materials, gasoline, and other flammable liquids.

⚠ WARNING

Failure to keep boiler area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can create an explosion hazard, which can result in severe personal injury, death, or substantial property damage.

3. Check the boiler location to ensure it protects the gas control system components from dripping or spraying water and rain during operation or service.
4. If a new boiler is replacing the existing boiler, check for and correct system problems:
 - System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits.
 - Incorrect expansion tank sizing.
 - Lack of freeze protection in boiler water.

Prepare Boiler Location, continued

Flooring and Foundation

⚠ WARNING

Do not install the boiler on combustible flooring or carpeting even if a foundation is used. Failure to comply can cause a fire, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

Do not route wiring, telephone cables, or piping in the floor below the boiler. Overheating could occur, which can result in severe personal injury, death, or substantial property damage.

1. The boiler mounting surface must be level and suitable for the load.
2. Provide a solid foundation pad at least 2" (51 mm) above the floor if any of the following is true:
 - Floor can become flooded.
 - Floor is dirt, sand, gravel, or other loose material.
 - Boiler mounting area is severely uneven or sloped.
3. Foundation must be brick or concrete construction. The minimum foundation dimensions are shown in [Figure 1](#). The width (W) from [Figure 1](#) is listed in [Table 3](#) for each model.
4. If flooding is possible, elevate the boiler sufficiently to prevent water from reaching the boiler.

Openings

Openings in floors, walls, ceilings, or roofs must be designed for fire stopping as required by local codes.

Vent pipe openings through combustible materials must be 3/8" (9.5 mm) larger in diameter than the pipe.

⚠ WARNING

Pipe openings that do not have the required diameter can cause a fire, which can result in severe personal injury, death, or substantial property damage.

Air Openings: Follow all applicable codes to size and verify size of the combustion and ventilation air openings into the space. Follow the National Fuel Gas Code ANSI Z223.1/NFPA 54, latest edition for the U.S. Follow the Natural Gas and Propane Installation Code CAN/CSA B149.1 for Canada.

Figure 1 Minimum foundation and boiler placement dimensions

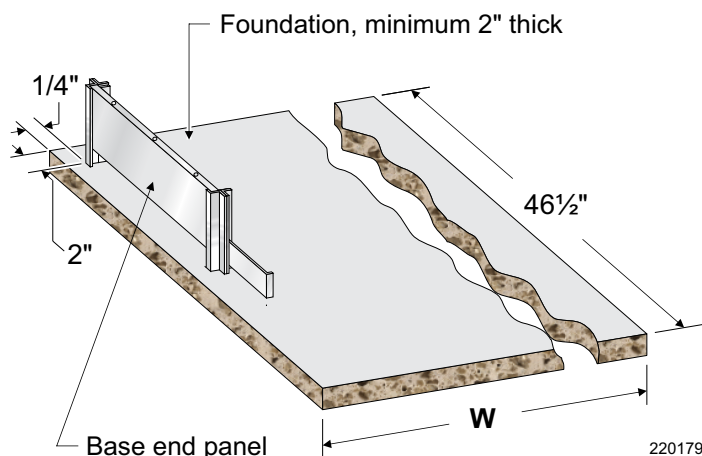


Table 3 Minimum foundation width dimensions

Boiler Model	Minimum Width (W) (inches)	Boiler Model	Minimum Width (W) (inches)
LGB-4	21	LGB-11	56
LGB-5	26	LGB-12	61
LGB-6	31	LGB-14	71
LGB-7	36	LGB-16	81
LGB-8	41	LGB-18	91
LGB-9	46	LGB-20	101
LGB-10	51		

The LGB boiler requires a special vent system. See the Venting and Combustion Air sections starting on [page 40](#) for required air openings and sizing for direct exhaust installations.

Air openings into the room must be sized to handle the LGB boiler and any other appliances. See [pages 41-42](#) for required combustion air openings.

⚠ WARNING

Provide combustion air openings correctly sized for all appliances in the room, INCLUDING the LGB boiler. Failure to comply can result in severe personal injury, death, or substantial property damage.

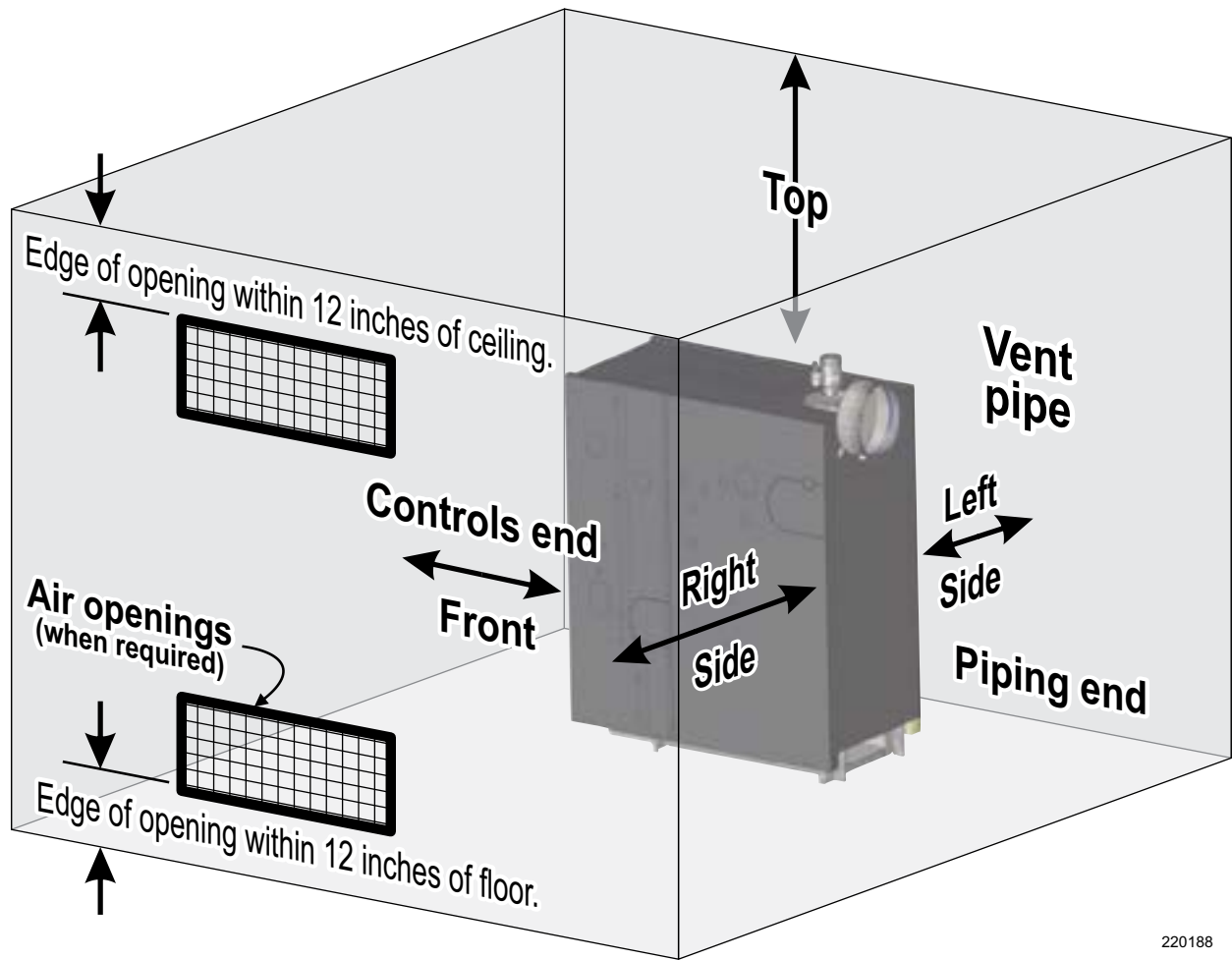
Clearances

See [Figure 2](#) for required and recommended clearances. Install the boiler in a large space in comparison with the boiler.

IMPORTANT

Without the recommended minimum clearances for service access, it may not be possible to service the boiler without removing it from the space.

Figure 2 Clearances for LGB Boilers



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Ensure that the installation complies with all state, local, and applicable codes.			
Clearance from:	Minimum clearances to combustible surfaces (inches)	Minimum allowable service clearances (inches)	Recommended minimum service access clearances (inches)
Controls end (Front)	24	24	35
Left side	24	24	24
Right side	24	24	24
Piping end	24	24	35 (Measured from jacket, not pipes)
Top	24	24	24
Floor	N/A*	—	—
Vent pipe	6	—	—
Hot water pipes	6	—	—
* Non-combustible flooring only.			



Boiler Assembly

Base Assembly

⚠ WARNING

The boiler contains ceramic fiber and fiberglass materials. Use care when handling these materials per instructions on [page 84](#). Failure to comply can result in severe personal injury or death.

IMPORTANT

Ensure the assembly and base assembly boxes are on hand before beginning this section. See the Parts section starting on [page 100](#) for more information.

Before assembling the base, relocate the access shield from the lower shipping holes to the upper mounting holes using a 5/16" nut driver. See [Figure 3](#). Remove the burner shipping bracket from the rear burner rest as shown in [Figure 4](#).

Single Base Boilers

Single base boiler bases are shipped complete and need no further modification. Proceed to Base Seal Installation on [page 12](#).

Dual Base Assembly

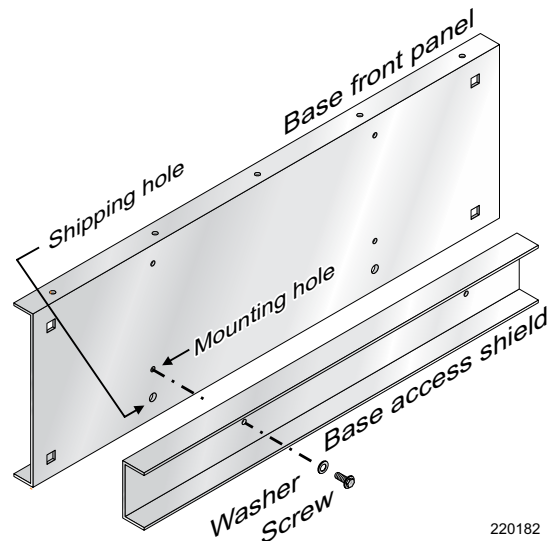
IMPORTANT

Base assembly must be installed in the order shown in [Figure 5](#) to ensure correct positioning of the components.

Dual base boiler bases are shipped individually and must be modified before section assembly.

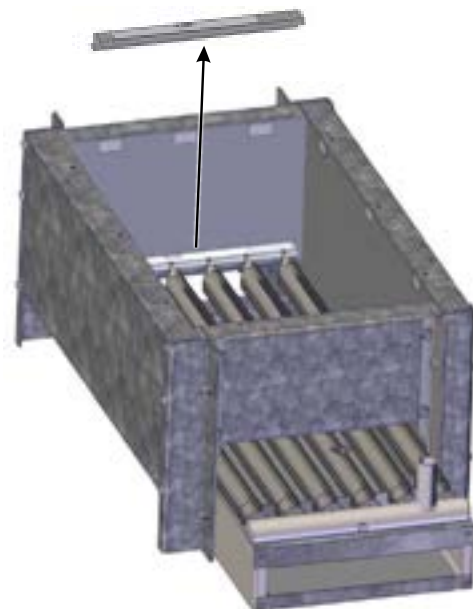
1. Remove the right end panel from the left base (Base 1) after removing the four bolts with a 9/16" wrench and ratchet. Discard the bolts and nuts.
2. Temporarily remove the two rightmost burners on Base 1.
3. Remove the two bolts and nuts securing the combustion air baffle to the cross tie on the right side of Base 1 with a 1/2" wrench and ratchet. Discard the bolts and nuts. Ensure spacers remain installed in cross ties.
4. Remove the left end panel from the right base (Base 2) after removing the four bolts with a 9/16" wrench and ratchet. Set aside the bolts and nuts

Figure 3 Access shield relocation



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Figure 4 Shipping bracket removal



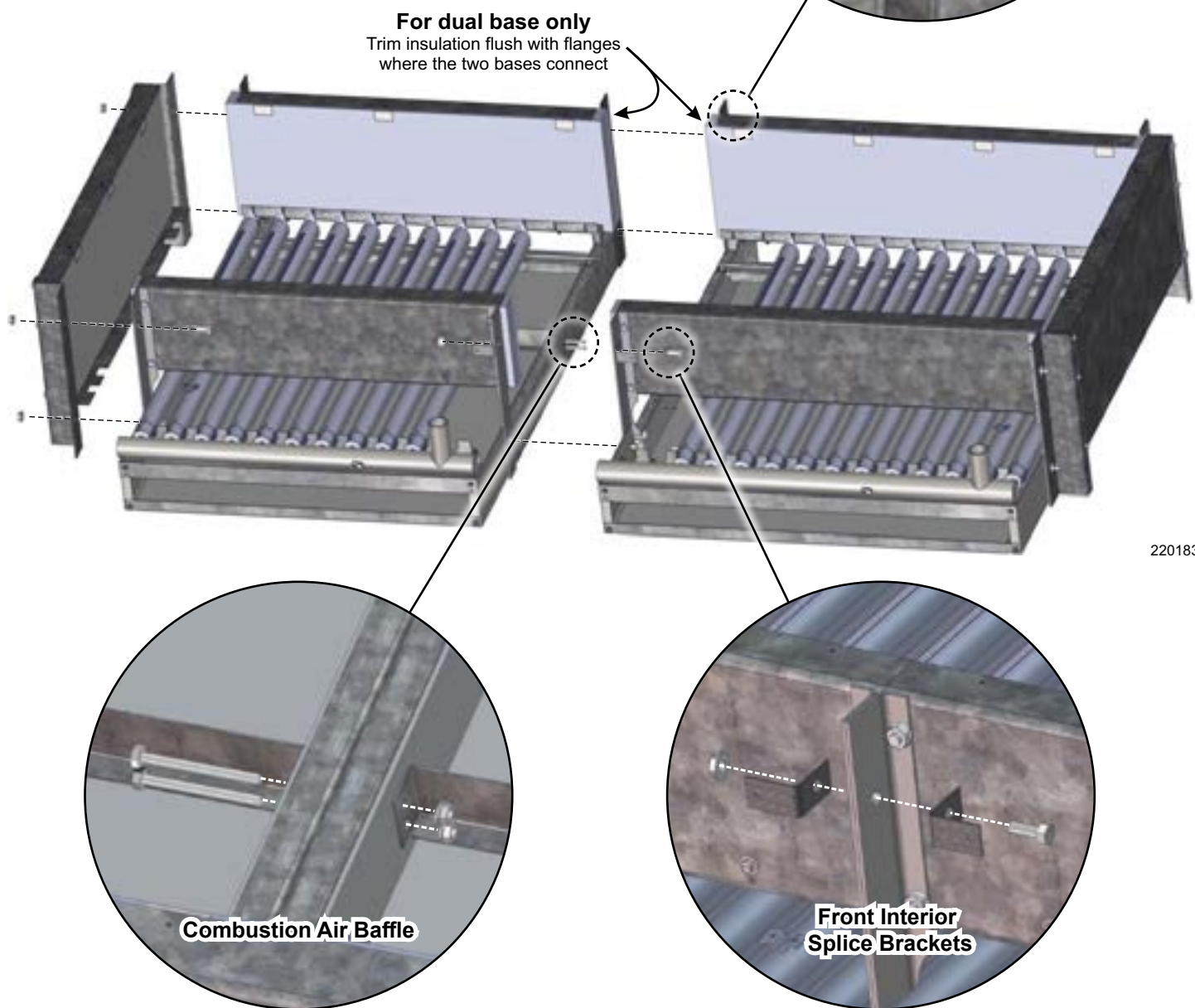
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to reuse later.

5. Temporarily remove the two leftmost burners on Base 2.
 6. Remove the two bolts and nuts securing the combustion air baffle to the cross tie on the left side of Base 2 with a 1/2" wrench and ratchet. Discard the bolts and nuts. Ensure spacers remain installed in cross ties.
- Trim refractory insulation flush with the flanges on the right side of Base 1 and the left side of Base 2.

Figure 5 Dual base assembly (LGB-14 shown)

Boiler Model Number	Base Size	Boiler Model Number	Base Size	
LGB-4	4/4R	LGB-11	F	—
LGB-5	5	LGB-12	G	—
LGB-6	A	LGB-14	B	C
LGB-7	B	LGB-16	D	C
LGB-8	C	LGB-18	D	E
LGB-9	D	LGB-20	F	E
LGB-10	E			



(continued on the next page)

Boiler Assembly, continued

Dual Base Assembly, continued

7. Align jacket brackets in the top holes of the base flanges as shown in [Figure 5, page 11](#).
8. Align Base 1 and Base 2 together; secure with the four bolts set aside in step 4 using a 9/16" wrench and ratchet.
9. Align the combustion air baffles and cross ties of Base 1 and Base 2 and secure with the provided bolts and nuts using a 1/2" wrench and ratchet. See [Figure 5, page 11](#).
10. Reinstall all removed burners.

Check the gas orifice to ensure proper sizing. See [Table 4](#) for correct orifice sizes per model and altitude.

⚠ WARNING

The orifice size marking must match the required boiler orifice size. Incorrect sizing can cause leaking gas fumes, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

Failure to properly seat and level the burners can result in severe personal injury, death, or substantial property damage.

Burners must be properly seated in the locating slots with the openings facing up. Level and straighten the burners to avoid misfiring. The front of the burners must rest fully over the main burner orifices. Gas orifices must inject down the center of the burners.

If installing a boiler in an altitude 2,000 feet or higher, follow instructions in the Gas Orifice and Pressure Switch Conversion procedure on [page 31](#).

Base Seal Installation

⚠ WARNING

Fiber glass tape seal must be installed before section installation. Failure to install seal can result in severe personal injury, death, or substantial property damage.

Retrieve base seal from the assembly box. Seal should be cut after installation.

Install seal as shown in [Figure 6](#) or [Figure 7](#), ensuring seal edges connect with no overlap or gap.

Table 4 Orifice sizes

Orifice sizes per model and altitude			
Boiler Models	Standard (below 2,000 ft.)	High Altitude (2,000-6,999 ft.)	High Altitude (7,000-10,000 ft.)
LGB 4* (see note)	3.95 mm	#27	#30
LGB 4R	#25	#27	#30
LGB 5-20	3.95 mm	#27	#30

*Note: LGB-4 bases are shipped as LGB-4R bases with #25 orifices installed. Follow steps 6-8 on [page 31](#) to install 3.95 mm orifices.

Figure 6 Single base seal

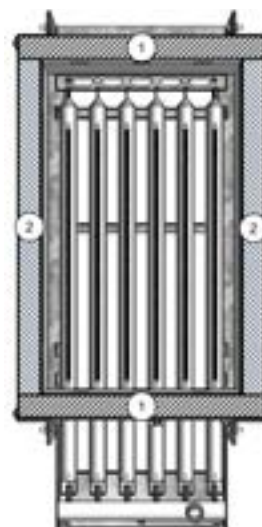
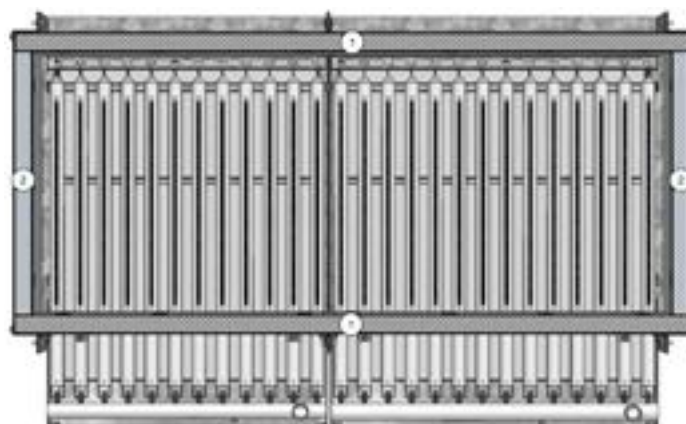


Figure 7 Dual base seal



Section Assembly

IMPORTANT

The LGB Series 3 castings are not compatible with the Series 2 castings.

Ensure all boiler sections and Assembly Boxes are on hand before beginning this section. Boiler Base must be constructed and in place. See the Parts section starting on [page 100](#) for details of components required for each boiler model.

Prepare sections:

1. With a caulking gun, apply 1/8" continuous bead of sealing rope adhesive in the sealing grooves of a section. See [Figure 8](#).
2. Place 1/2" rope in the groove. When working around curves, grasp the rope at 1" intervals and push together. Do not stretch. Rope MUST be continuous. Cut the rope as each section is completed. Do not precut rope used for sections. DO NOT use multiple pieces of rope in a single rope groove.

WARNING

Do not precut the rope for the casting sections. A gas-tight seal must be maintained to prevent flue gas spillage and carbon monoxide emissions, which can result in personal injury or death.

IMPORTANT

Before cutting the rope for section assembly, reference [Table 5, page 17](#) for the required rope length for collector hoods. Set aside the required rope length for the collector hood before proceeding to ensure sufficient remaining rope for the hood.

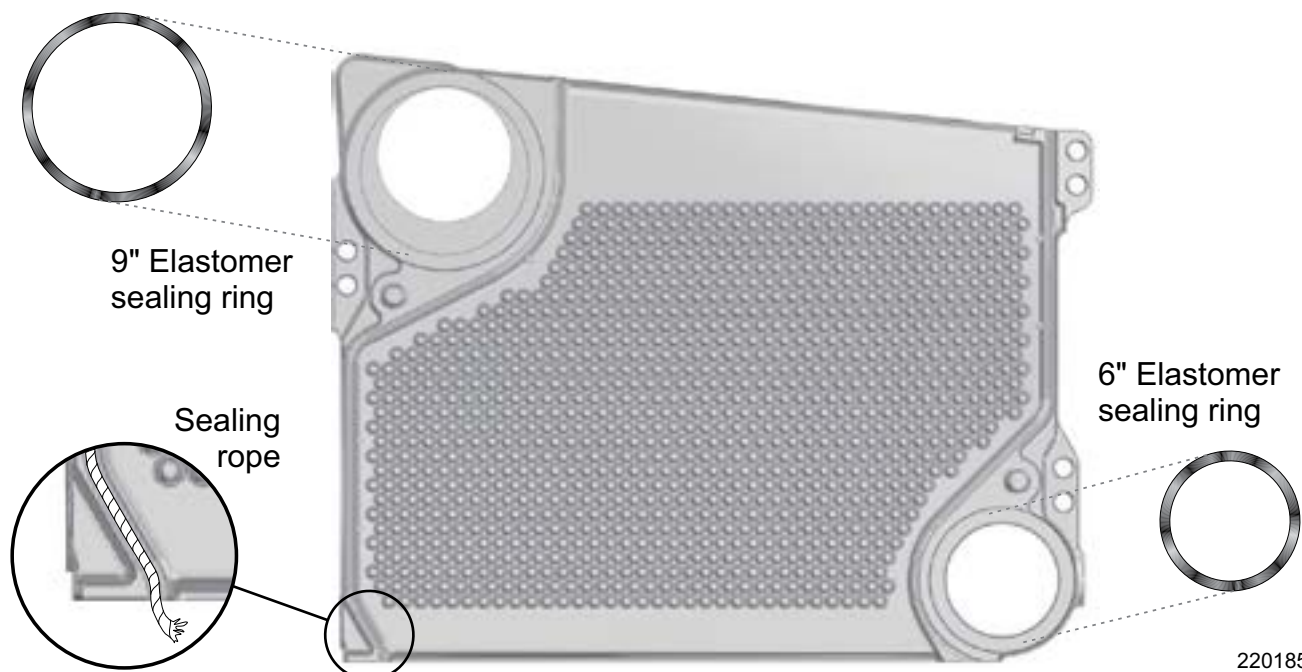
WARNING

Port opening sealing surfaces must be clear of all grit and rust. Do not use petroleum-based cleaning or sealing compounds in the boiler system. Failure to comply can cause seal failure, which can result in severe personal injury, death, or substantial property damage.

3. Remove any grit or rust from port opening sealing surfaces with a clean rag.
4. Place sealing rings into port openings ([Figure 8](#)).
5. Repeat steps 1-4 for all sections. Additionally, discard any 3/8" diameter shipping tie rods; do not use these to draw sections together.

(continued on the next page)

Figure 8 Sealing rope, seals, and draw rod tightening sequence



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Boiler Assembly, continued

Section Assembly, continued

Install the Sections:

Assembly may start with either end section. For easier assembly, these instructions start with the right end section.

IMPORTANT

Seal shown in Figures 6 & 7 must be installed before proceeding.

6. Install two retaining brackets over the base seal on the right side of the assembled base. Use three screws per bracket and a Phillips head screwdriver. See Figure 9.
7. Position the right end section up against the retaining bracket. Ensure the casting parting lines are aligned with the base brackets as shown in Figure 10. Make sure to keep the section supported.

WARNING

Sections are top-heavy and will not stand individually without support. Failure to support the sections can result in severe personal injury, death, or substantial property damage.

NOTICE

End section must be plumb. After erecting the first intermediate section, check both sections for plumb. Failure to plumb sections may cause misaligned piping and breech, resulting in property damage.

8. Position intermediate sections so the alignment lugs fit into the sockets of the placed section. Refer to Figure 12, page 15.
9. Install a section onto the base assembly. Ensure that the section is straight and properly aligned using the alignment lugs.
10. Oil threads on all draw rods. Install a washer and nut on the end being tightened. Use only a nut on the opposite end.

Figure 9 Retaining brackets

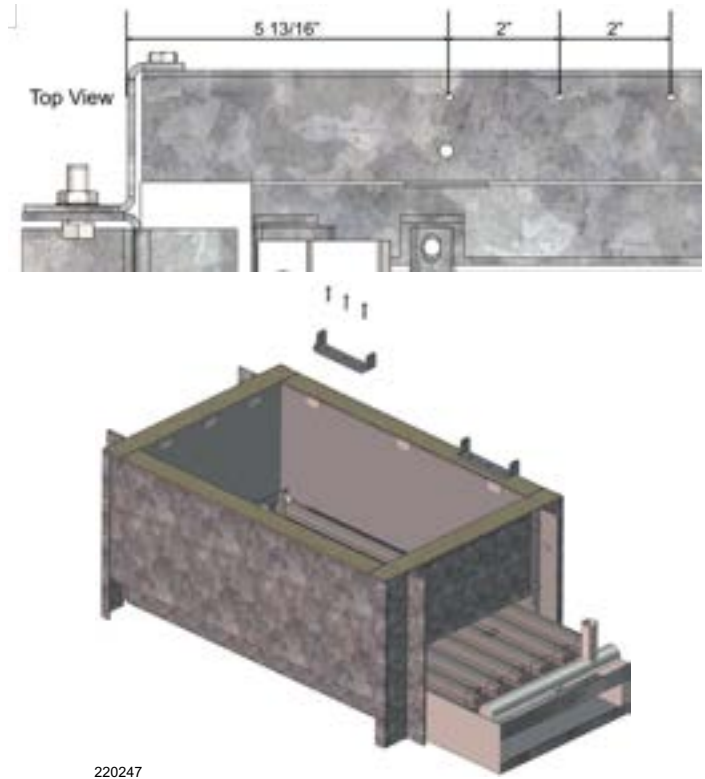
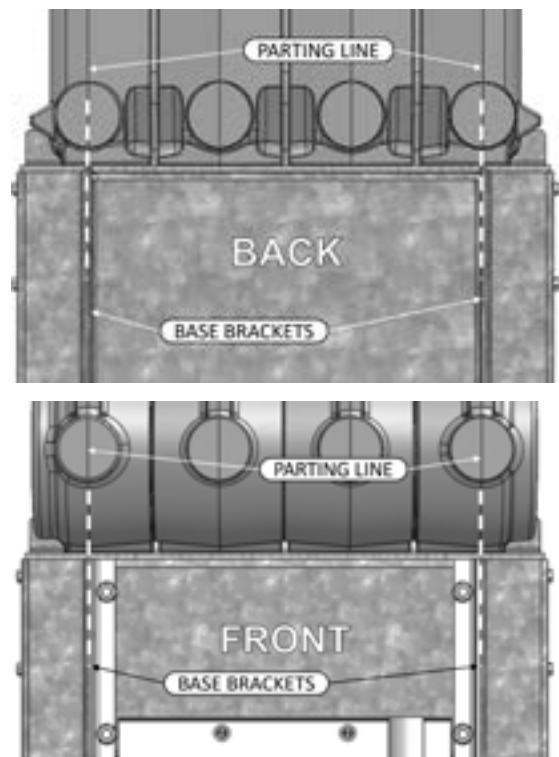


Figure 10 Section assembly



Section Assembly, continued

11. Insert the draw rods. Tighten the rear and lower front draw rods uniformly. Do not torque until all sections are installed. Do not tighten the front upper draw rods. See Figure 11.

CAUTION

The front upper draw rods must remain loose until the lower front and rear draw rods are tightened to the proper torque or misalignment may occur.

12. Repeat steps 8 to 11 for all sections.
13. Uniformly draw sections together, starting at the washer with nut end. Torque the rear then lower front draw rods to a range of 100-120 ft-lbs. Progress through every section to the end. Do not back off the draw rods once tightened.
14. Ensure that metal-to-metal contact is achieved around the port opening. See Figure 12.
- If a gap exists around the port opening, use a feeler gauge to make sure it does not exceed .032". If the gap is greater than .032", check for rope extending from rope grooves, dirt on port openings or sockets, or misaligned lugs.
 - If a gap exceeding .032" still exists after corrections are made, or nothing needs to be corrected, contact your WM Technologies distributor before continuing installation.

WARNING

Failure to correct a gap around the port opening that exceeds .032" could cause seal failure, which can result in severe personal injury, death, or substantial property damage.

15. Tighten the upper front draw rods just enough to produce good, equal compression along the length of the rope. DO NOT torque the upper front draw rods.

WARNING

Check the sealing rope of each section before proceeding to the next section. The boiler must be sealed gas-tight to prevent possible flue gas spillage and carbon monoxide emissions, which can result in severe personal injury or death.

Figure 11 Draw rods

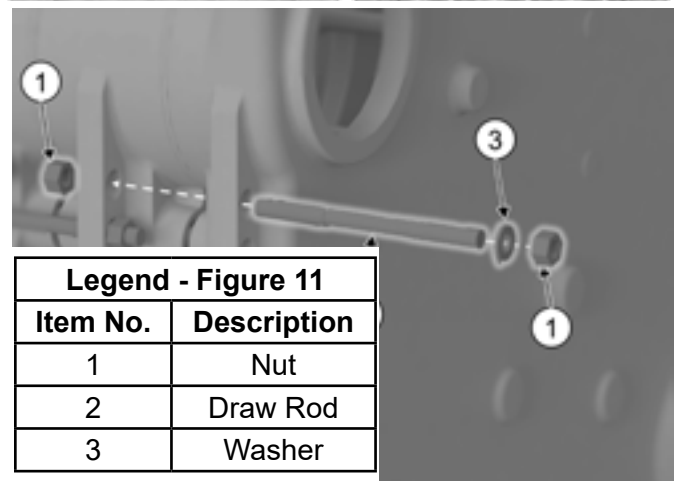
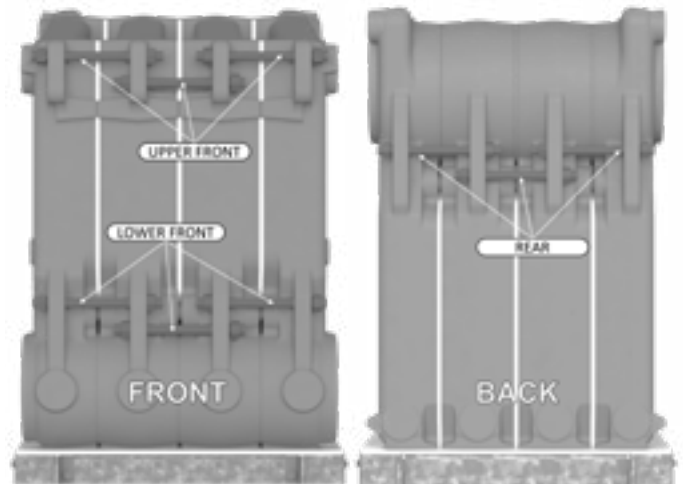
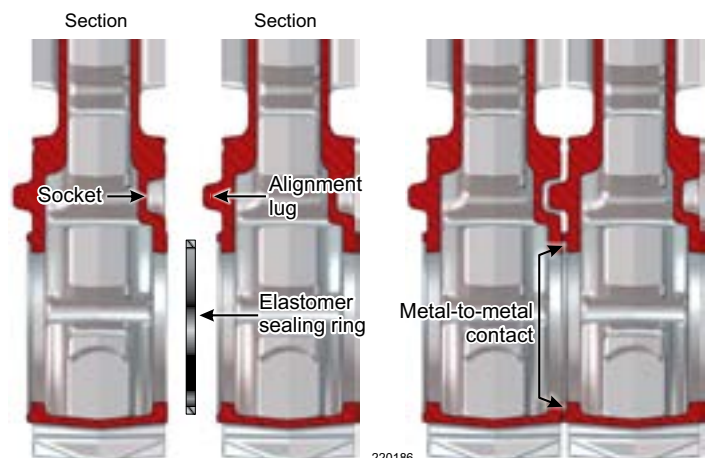


Figure 12 Sealing ring installation and port alignment



Boiler Assembly, continued

Hydrostatic Pressure Test

Perform a pressure test on the boiler before connecting gas piping and electrical supply or installing the jacket.

1. Install the following items. Refer to the figures and tables in this section for tapping locations.
 - Boiler drain (supplied by installer).
 - Water pressure gauge (for test only). Be sure the gauge can handle the test pressures stated in Step 3.
2. Plug all remaining tappings.

WARNING

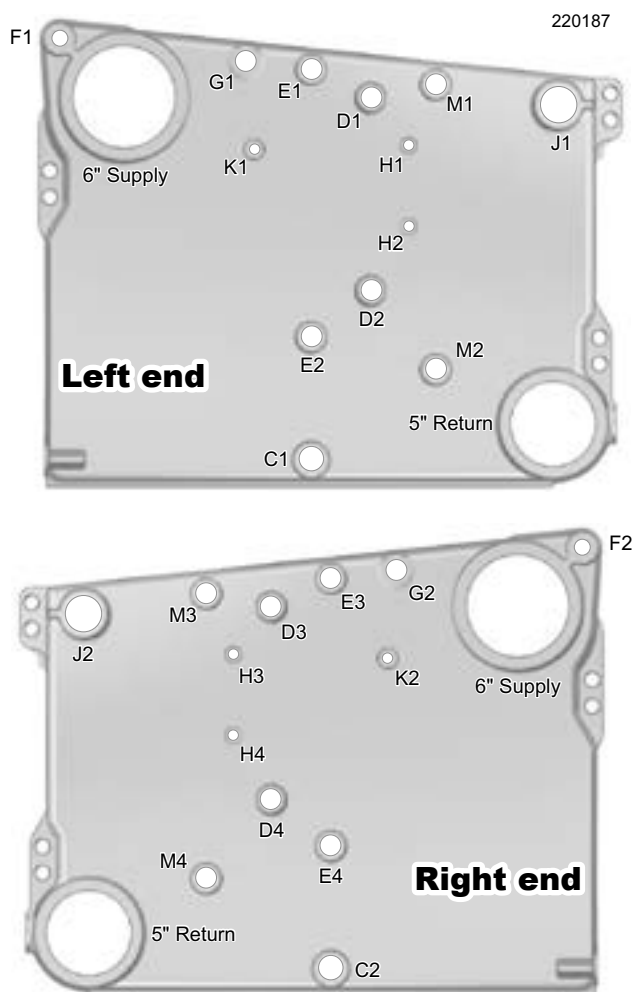
Do not leave the boiler unattended during the test. Cold water fill could expand and cause excess pressure, which can result in severe personal injury, death, or substantial property damage.

NOTICE

Do not pressure test with any controls installed or damage could occur.

3. Fill the boiler and vent all air. Pressure-test the boiler for more than 10 minutes.
 - Steam boilers: between 45-55 psig.
 - Water boilers: 1.5 times the maximum working pressure stated on the castings and boiler nameplate.
4. Check for maintained gauge pressure and repair any leaks.
5. Drain the boiler.
6. Remove plugs from the tappings used for controls and accessories. Leave all other plugs installed.

Figure 13 Section end tappings



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Legend - Figure 13			
Tapping	Size (in.)	Steam Boilers	Water Boilers ^[3]
C1, C2	1 1/4	Boiler drain	Boiler drain
D1, D2, D3, D4	1/2	Gauge glass ^[2]	—
E1, E2, E3, E4	1	Low water cutoff ^[2]	Optional low water cutoff
E1, E3	1	Pressure operating and limit controls and pressure gauge	—
F1, F2	1	—	To expansion tank or automatic air vent ^[4]
G1, G2	1/2	—	Operating and high limit control ^[4]
H1, H2, H3, H4 ^[1]	3/8	Tri-cock	—
J1, J2	2	Steam relief valve and skim tapping	Water relief valve and skim tapping
K1, K2	1/2	—	Pressure and temperature gauge ^[4]
M1, M2, M3, M4	1	Optional low water cutoff ^[2]	Optional low water cutoff
M1, M3	1	Firing rate control (when used)	Probe low water cutoff

1. Available on special request only.
 2. Must be on the same side as steam equalizer piping.
 3. Additional controls for water boilers may be placed in supply piping.
 4. Must be on the same side as supply to the system.

Flue Collector Hood Installation

Install the collector hood only after the pressure test has been completed.

Ensure the collector hood, jacket, and assembly boxes are on hand before beginning this section. See the Parts section starting on [page 100](#) for details of components required for each boiler model.

1. Install the two alignment brackets to the upper front draw rods.
 - a. Install each bracket on the second casting from each end (Item 1).
 - b. Do not remove nuts from the draw rods; use the provided, additional nuts (Item 2).
2. Thread two screws (Item 3) into the alignment brackets. Leave 1/2" gap between the screw heads and the brackets.
3. Apply silicone bead around the top of the section assembly block as shown in [Figure 15](#).
4. Retrieve rope previously set aside. Lay rope on the sealant shown in [Figure 15](#). Refer to [Table 5](#) for rope lengths.
5. Mount the flue collector hood on the section assembly and over rope, aligning the front with the alignment brackets. The flue collector hood should be centered from left to right on the section assembly.

Figure 14 Alignment brackets

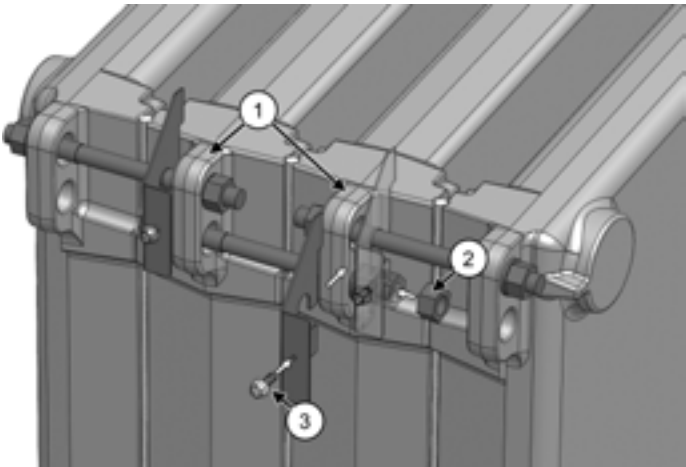


Figure 15 Silicone and fiberglass pattern

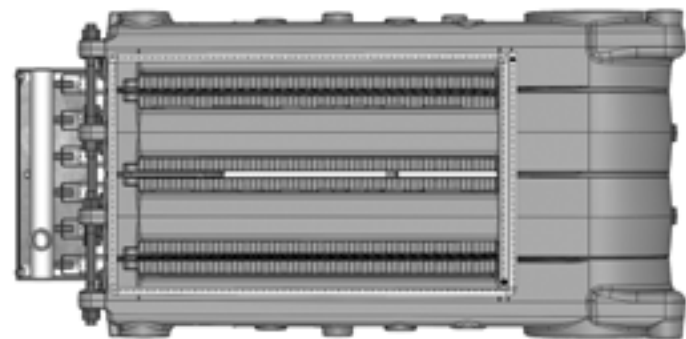


Figure 16 Flue collector hood assembly



Table 5 Rope seal lengths

Boiler Model Size	Rope Length (in)	Boiler Model Size	Rope Length (in)	
			Base 1	Base 2
LGB 4R / 4	90	LGB 11	195	—
LGB 5	105	LGB 12	210	—
LGB 6	120	LGB 14	135	150
LGB 7	135	LGB 16	165	150
LGB 8	150	LGB 18	165	180
LGB 9	165	LGB 20	195	180
LGB 10	180			

(continued on the next page)



Boiler Assembly, continued

Flue Collector Hood Installation, continued

6. Use J hooks to attach the flue hood to the draw rods at the top of the block. Refer to [Figure 17](#) and [Figure 18](#).
 - a. Secure the front brackets of the collector hood to the front top draw rods as shown in Figure 18 using items 1-3.
 - b. Secure the rear brackets of the collector hood to the rear top draws rods as shown in Figure 19 using items 4-9.
 - c. Different boiler models have collector hoods with a varying number of brackets; each bracket should be secured. Tight nuts and bolts with a 1/2" wrench or ratchet.
7. Ensure the flue collector hood is level after installation is complete.

WARNING

The hood and boiler assembly must be sealed gas-tight to prevent the possibility of flue gas spillage and carbon monoxide emissions, which can result in severe personal injury or death.

Figure 17 J hooks front installation

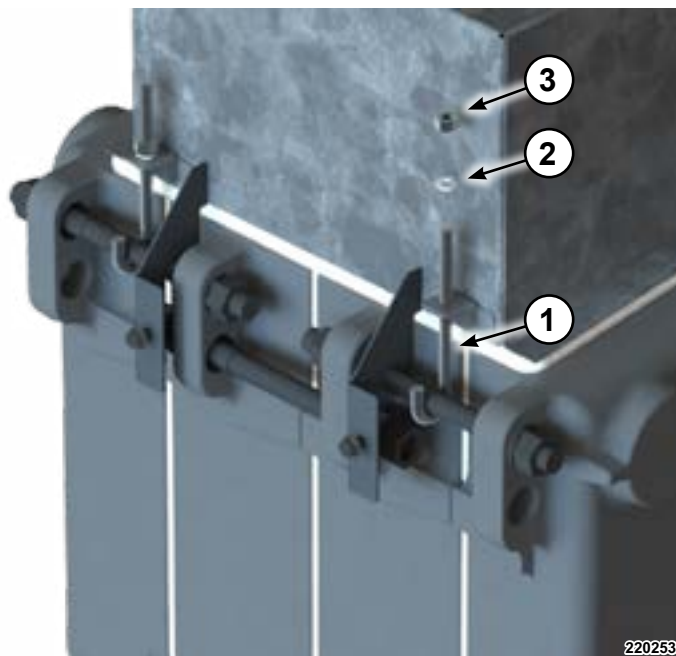
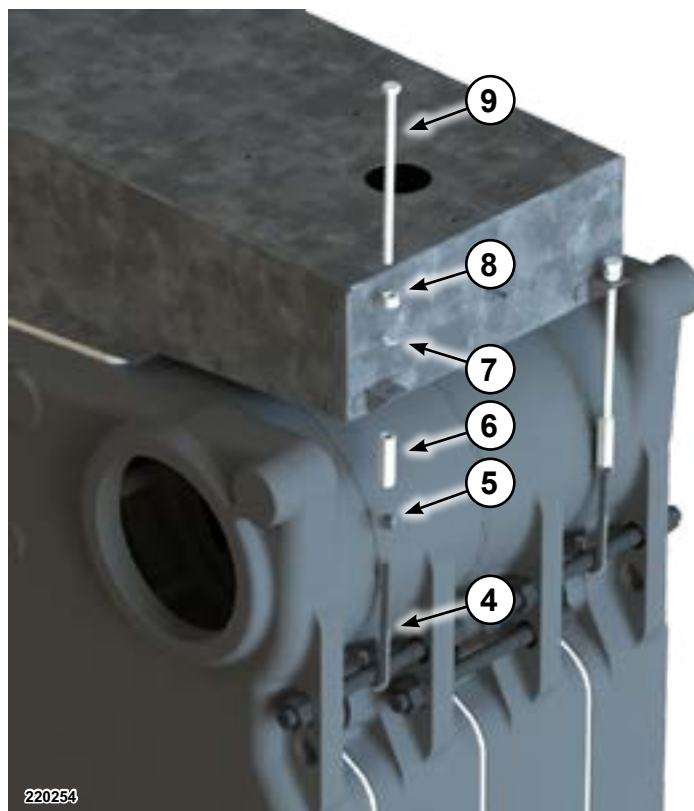


Figure 18 J hooks back installation



Legend - [Figure 17](#) & [Figure 18](#)

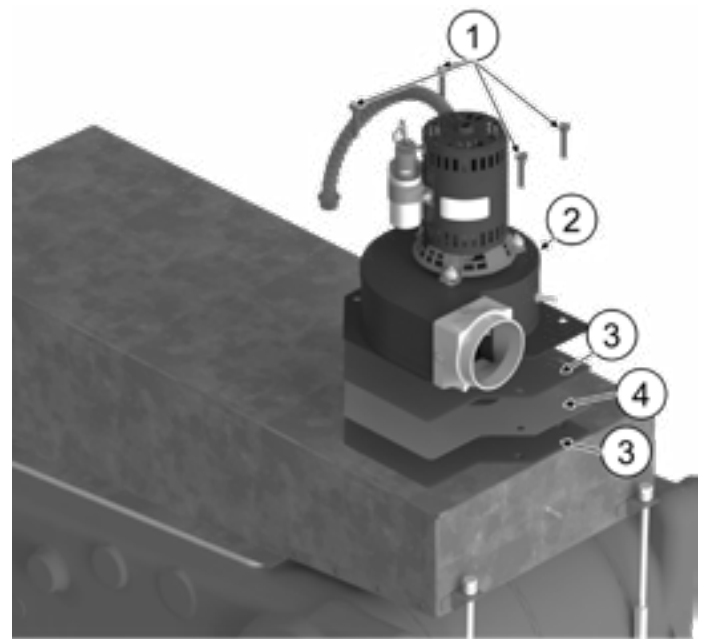
Item No.	Description
1	J-bolts
2	Lock washers
3	Nuts
4	J-bolts
5	Nuts
6	Coupling nuts
7	Lock washers
8	Leveling washers
9	Bolts

Inducer Assembly

Inducer orifice plates and bolts are shipped with the flue collector hood and must be removed before proceeding with installation. Orifice plates are marked to indicate correct boiler application. Ensure the correct orifice plate is installed for each boiler.

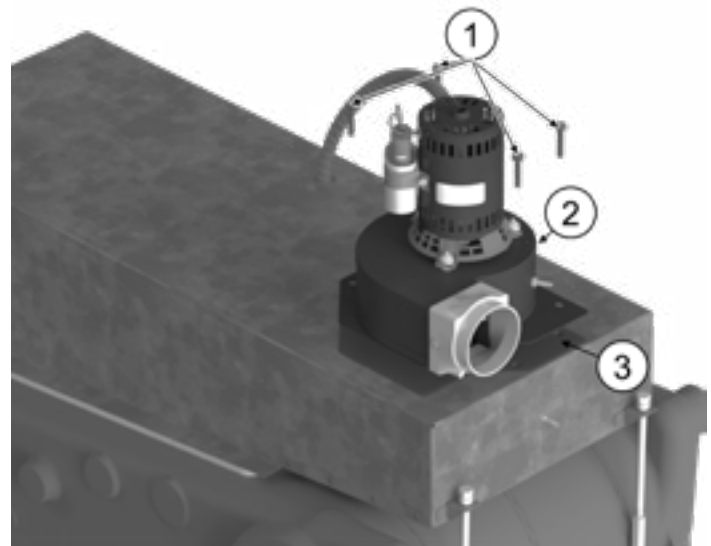
1. Align inducer with holes on the gaskets, orifices, and collector hood.
 - a. For water boilers and the LGB 4R steam, ensure a gasket (Item 3) is installed between the collector hood and the orifice plate (Item 4) as well as between the orifice plate and the inducer (Item 2).
 - b. For steam boilers (except the LGB 4R steam), ensure a gasket (Item 3) is installed between the collector hood and the inducer (Item 2).
2. Install the bolts (Item 1) securing the inducer to the collector hood:
 - a. For LGB 4 and 4R models: use a $\frac{1}{2}$ " wrench to remove four (4) $\frac{1}{4}$ -20 stainless steel bolts and set aside.
 - b. For LGB 5 thru 20 models: use a $\frac{1}{2}$ " wrench to remove six (6) $\frac{1}{4}$ -20 stainless steel bolts and set aside.
3. See [page 27](#) for instructions on pressure switch installation and hose and wire routing

Figure 19 Inducer installation – water and 4R steam



Typical LGB Water installation, LGB 4 Water Shown

Figure 20 Inducer installation – steam boilers (except 4R)



Typical LGB Steam installation, LGB 4 Steam Shown

Figure 21 Example orifice plate



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Boiler Assembly, continued

Jacket Installation Guidelines

Ensure the jacket and assembly boxes are on hand before beginning this section. See the Parts section starting on [page 100](#) for details of components required for each boiler model.

1. The following *must* be done before jacket installation:
 - Boiler must be pressure tested
 - Plugs must be installed in unused tappings
 - Flue collector hood
 - Water boilers only: temperature sensor installed
2. The following must be done *after* installing the side panels, but *before* installing the top panel:
 - Control panel
 - Routing inducer power wires, flue temperature switch wires, and flue pressure switch tubing through the wire chase.
3. The following *may* be on the boiler before jacket installation:
 - Supply and return piping
 - Gas control assembly
 - Compression tank piping
 - Pilot line tubing
4. The following must be *off* the boiler before jacket installation:
 - Relief valves
 - P/T gauge
 - Steam or water gauges
 - Limit control
 - LWCO
 - Gauge glass cocks and gauge glass
 - Siphon
 - Tri-cocks (if used)
 - Drain cock
 - Gas supply piping
 - Control tray
5. Leave jacket parts in the cartons until needed to avoid damage.
6. Remove the required jacket knockout discs.

Single Base Jacket Installation (Models 4R-12)

The recommended order of jacket installation for single bases is shown in [Figure 22, page 21](#). Jacket screws are #10 x 1/2" Type AB Phillips head screws unless otherwise noted. All installation screws are provided.

1. Attach four support brackets (item 1) to the side panels using provided 10-32 x 1/2" screws and a Phillips head screwdriver.

2. Hang the front top interior panel (Item 2) on alignment bracket screws through the slots. See [Figure 23, page 21](#).
3. Set the side panels (Items 3-6) into the support brackets.
 - a. Secure the left front panel (Item 3) to the left back panel (Item 4) (5 locations).
 - b. Secure the left front panel (Item 3) to the front top interior panel (Item 2) (3 locations).
 - c. Repeat steps a-b for the right side panels (Items 5-6).
4. To install the wire chase (Item 7), ensure insulating fiberglass tape is adhered to the bottom of the chase. See [Figure 24, page 21](#). Secure the chase to the front top interior panel (item 2) (2 locations).
5. To install the back panel (item 8), set the panel on top of the rear bracket as shown in [Figure 25, page 21](#). Secure the back panel to the left back panel and the right back panel (12 locations).

WARNING

The back panel must be installed on top of the rear bracket or air openings may be blocked. Blocked air openings can cause incomplete combustion, which can result in severe personal injury or death.

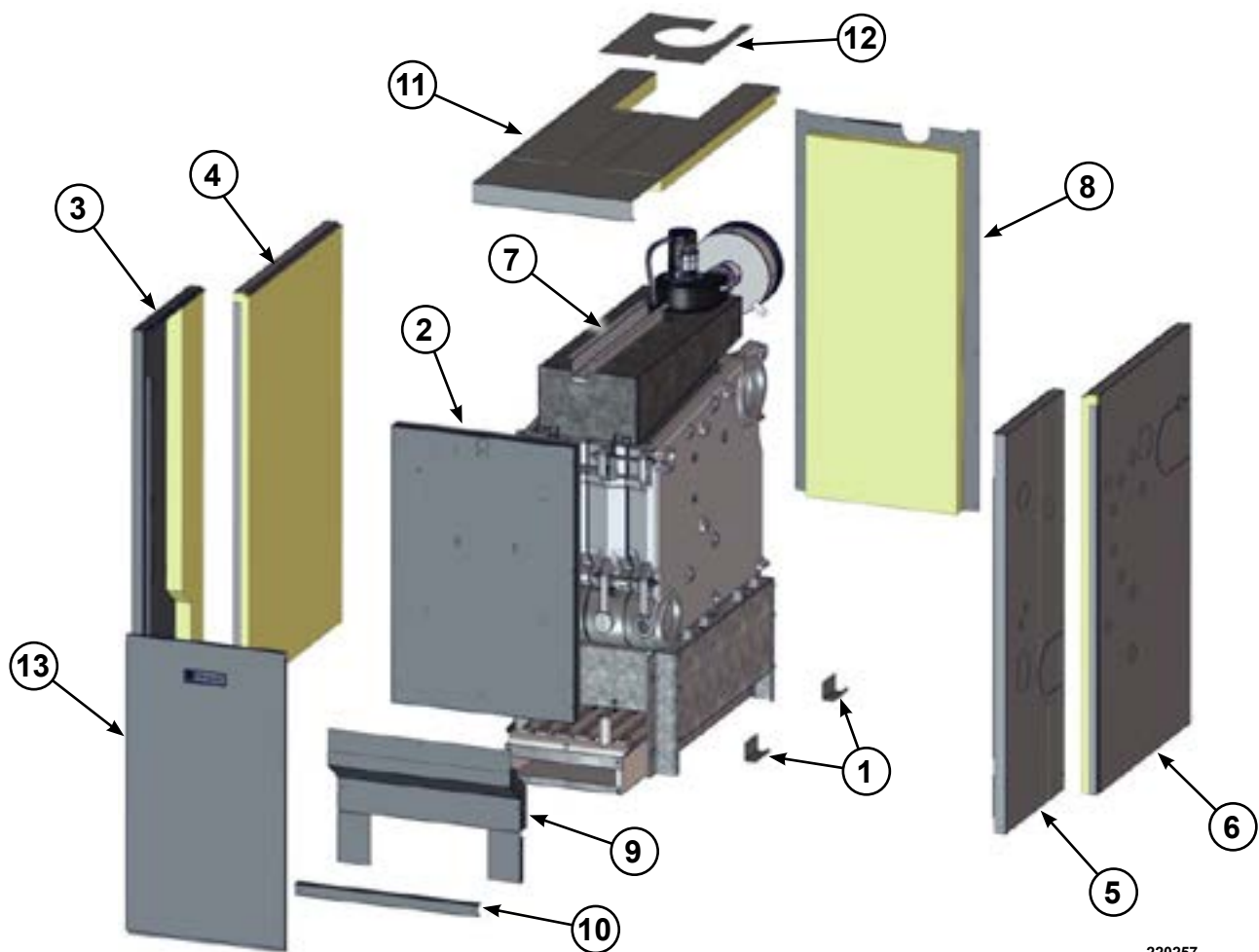
6. Install the front bottom interior panel (Item 9):
 - a. Secure to the front top interior panel (3 locations).
 - b. Secure to the front left and right panels (4 locations).
7. Secure the front cross tie (Item 10) to the front left and right panels (2 locations).

NOTICE

For ease of installation, route inducer power, pressure switch tubes and flue temp switch harness before installing top panel. See [page 28](#) for instructions.

8. Install the top panel:
 - a. Secure to the front top interior panel (3 locations).
 - b. Secure to the side panels (10 locations).
 - c. Secure to the back panel (4 locations).
 - d. Secure to the wire chase (2 locations).
9. Secure the inducer cover (Item 12) to the top panel.
10. Mark the correct model size and orifice size on the rating label.

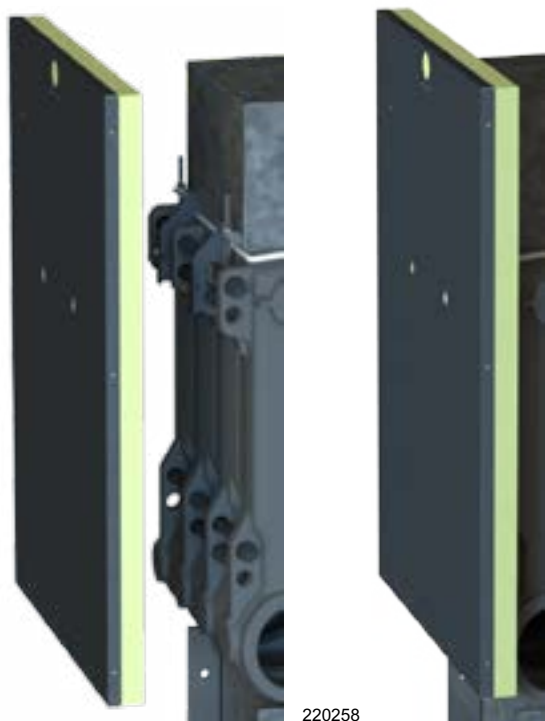
Figure 22 Recommended single base jacket installation



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Figure 23 Front top interior panel installation

Figure 24 Wire chase installation

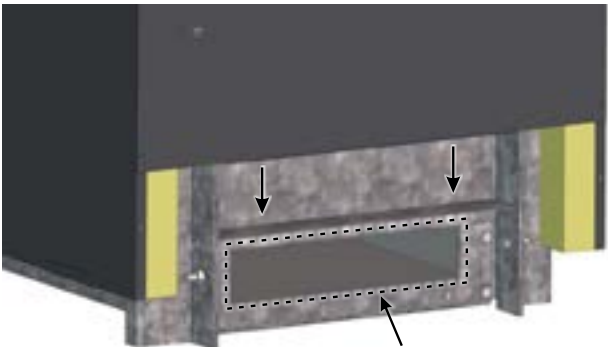


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Figure 25 Back panel installation



Note: Opening must NOT be blocked

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Boiler Assembly, continued

Dual Base Jacket Installation (Models 14-20)

The recommended order of installation for the LGB Dual Base jackets is shown in [Figure 26, page 23](#). All jacket screws are #10 x 1/2" Type AB Phillips head screws unless otherwise noted. All screws for installation are provided.

1. Attach four support brackets (item 1) to the side panels using provided 10-32 x 1/2" screws and a Phillips head screwdriver.
2. Hang the front top interior panels (Items 2-3) on alignment bracket screws through the slots. See [Figure 23, page 21](#).
3. Secure the front top interior panel splice (item 4) to the front top interior panels (6 locations).
4. Set the side panels into the support brackets (item 1).
 - a. Secure the left front panel (Item 5) to the left back panel (Item 6) (5 locations).
 - b. Secure the left front panel (Item 5) to the front top interior panel (Item 2) (3 locations).
 - c. Repeat steps a-b for the right side panels (Items 7-8).
5. To install the wire chases (Items 9-10), ensure insulating fiberglass tape is adhered to the bottom of each chase. See [Figure 24, page 21](#). Secure each chase to the front top interior panels (items 2-3) (4 locations).
6. Install the back panels (items 11-12):
 - a. Set the panels on top of the rear bracket as shown in [Figure 25, page 21](#).
 - b. Secure the back panels to the left back panel and the right back panel (12 locations).
 - c. Secure the back splice (item 13) to the back panels (12 locations).
 - d. Secure the back splice to the back splice brackets installed during base assembly (see [Figure 5, page 11](#)) (2 locations).
7. Install the front bottom interior panels (Items 14-15):
 - a. Secure to the front top interior panels (6 locations).
 - b. Secure to the front left and right panels (4 locations).
 - c. Secure the front bottom interior splice (item 16) to the front top interior panels (2 locations).
 - d. Secure the front bottom interior splice and front bottom interior panels to the front interior splice brackets installed during base assembly (see [Figure 5, page 11](#)) (2 locations).
8. Secure the top splice panel (item 17) to the back panel splice (item 13) (2 locations).
9. To install the front splice bracket, follow the instructions below and refer to [Figure 27, page 23](#).
 - a. Remove the two 10-32 screws securing the burner shields to the manifold bracket with a 5/16" ratchet or wrench.
 - b. Align the front splice bracket and burner shields. Secure to the manifold bracket with the 10-32 screws from the previous step and a 5/16" ratchet or wrench.
10. Install the Front Splice Panel (Item 18):
 - a. Secure to the top splice panel (Item 17) (2 locations).
 - b. Secure to the front splice bracket (1 location).
11. Install the front cross ties (Item 11):
 - a. Secure to the front left and right panels (2 locations).
 - b. Secure to the front splice panel (item 18) (2 locations).
12. Install the top panels (items 21-22).
 - a. Secure to the front top interior panels (6 locations).
 - b. Secure to the side panels (10 locations).
 - c. Secure to the top splice panel (item 17) (10 locations).
 - d. Secure to the back panels (8 locations).
 - e. Secure to the wire chases (4 locations).
13. Secure the inducer covers (Items 23-24) to the top panels.
14. Mark the correct model size and orifice size on the rating label.

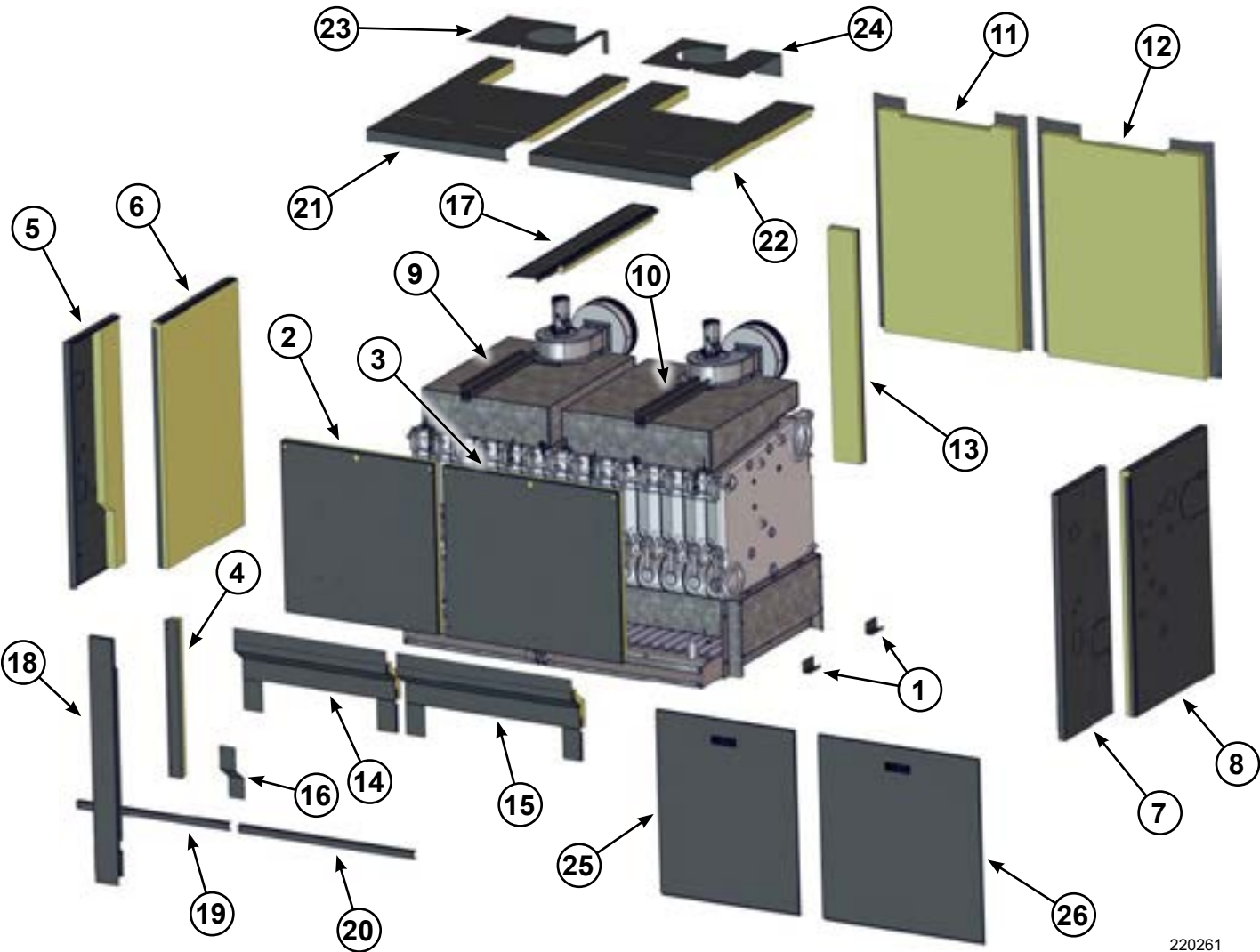
NOTICE

For ease of installation, route inducer power, pressure switch tubes and flue temp switch harness before installing top panel. See [page 28](#) for instructions.

⚠ WARNING

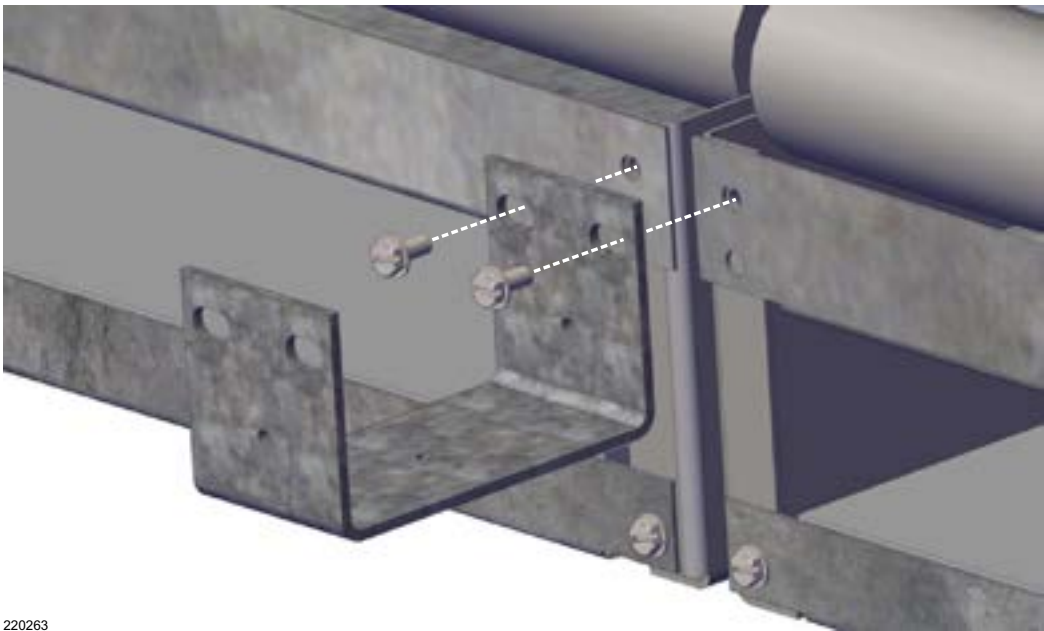
The back panel must be installed on top of the rear bracket or air openings may be blocked. Blocked air openings can cause incomplete combustion, which can result in severe personal injury or death.

Figure 26 Recommended dual base jacket installation



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Figure 27 Front splice bracket installation



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Boiler Assembly, continued

Pilot and Main Flame Sensor Installation

Pilot assemblies are installed on all LGB Boilers. Main flame sensor assemblies are installed on LGB 6 through LGB 20 boilers.

See [Figure 28](#) and the tables below for pilot and main flame sense locations. See [Figure 29](#) for proper pilot burner assembly, and [Figure 30](#) for main flame sensor assembly.

Table 6 Single base pilot and main flame sensor

Single Base Boilers		
Boiler Model	Main Flame	Pilot
4R / 4	—	4
5	—	5
6	2	9
7	2	11
8	2	13
9	2	15
10	2	17
11	2	16
12	2	16

Table 7 Dual base pilot and main flame sensor

Dual Base Boilers				
Boiler Model	Base 1		Base 2	
	Main Flame	Pilot	Main Flame	Pilot
14	2	11	14	25
16	2	15	18	29
18	2	15	18	33
20	2	16	22	37

Figure 28 Pilot and main flame sensor layout

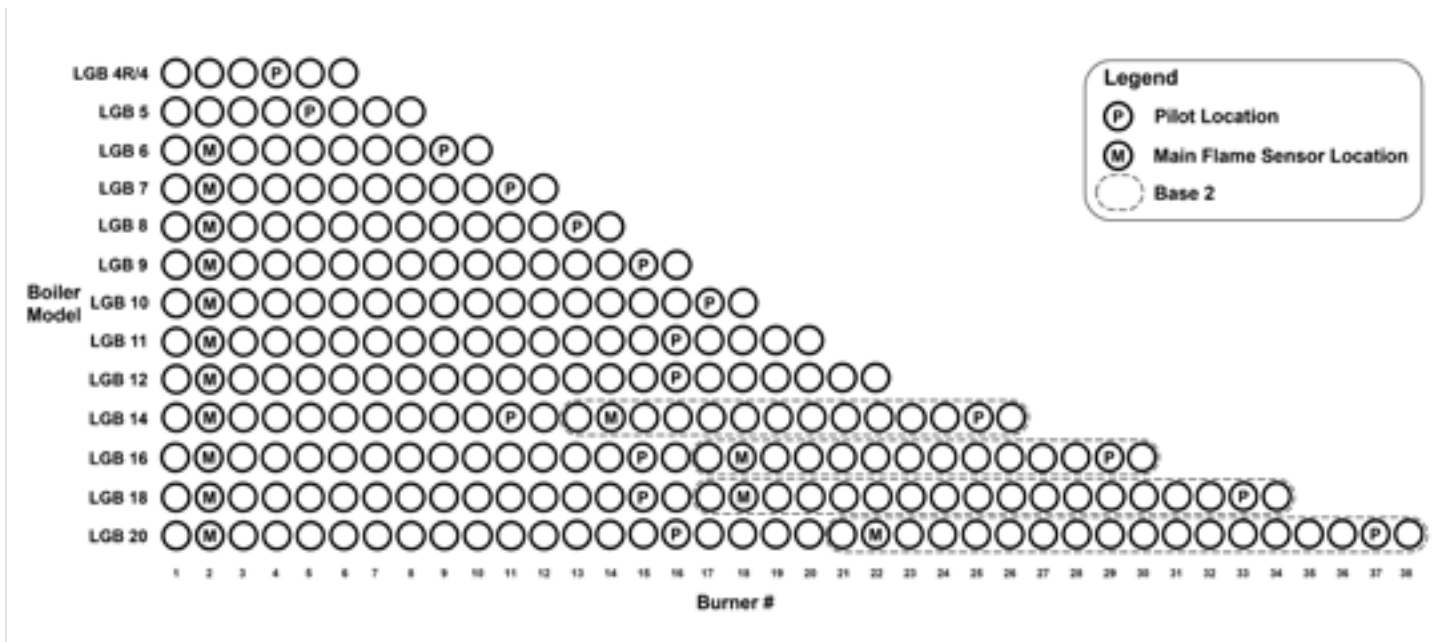
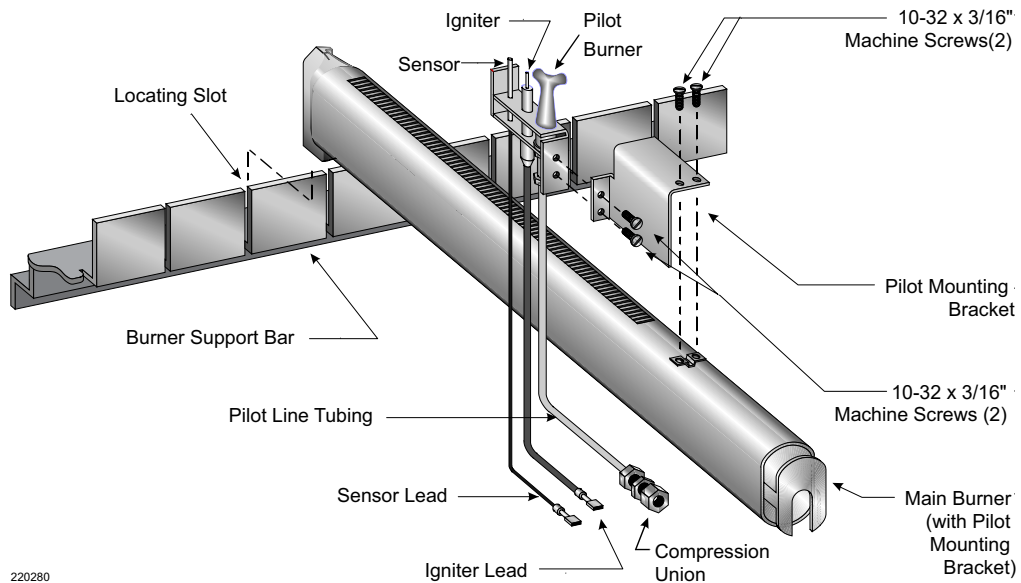
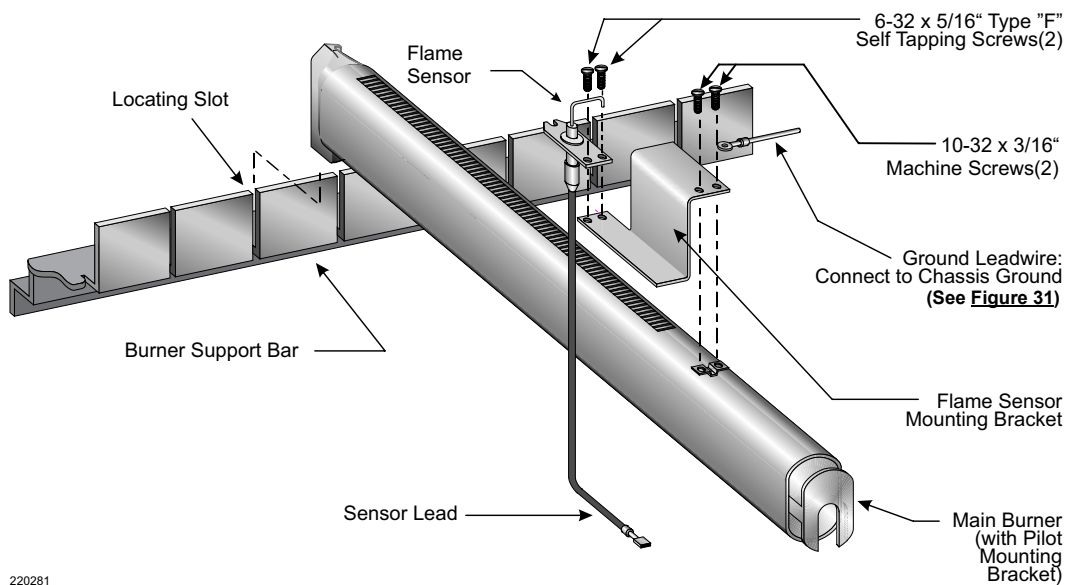
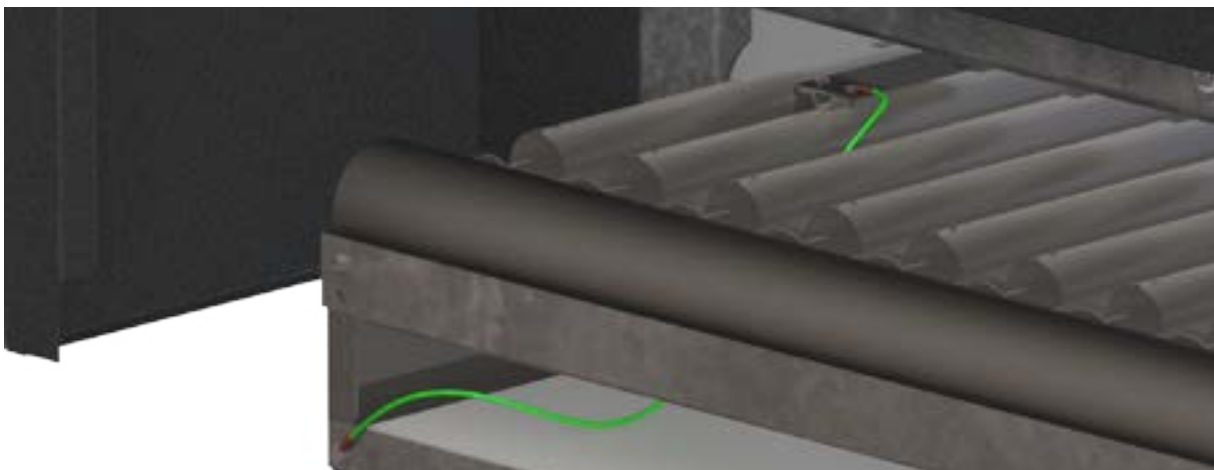


Figure 29 Pilot burner assembly, typical**Figure 30** Main flame sense assembly**Figure 31** Main flame chassis ground

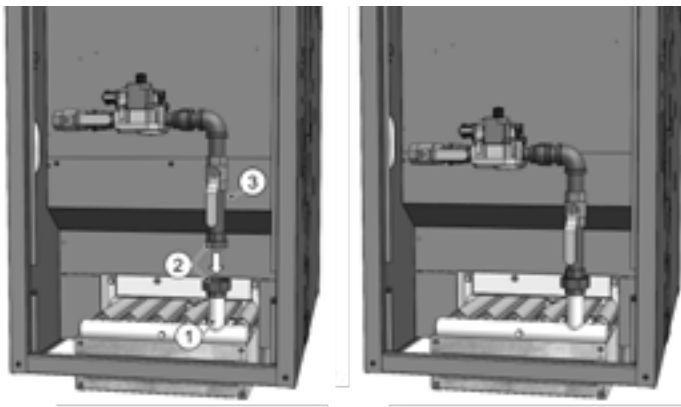
Boiler Assembly, continued

Gas Train Installation for Single Bases

LGB models 4-12:

1. Remove any covering over the burner manifold inlet pipe and apply pipe dope to the inlet pipe threads.
2. Remove the free half of the union (Figure 32, Item 2) on the gas train and thread onto the inlet pipe (Figure 32, Item 1). Use two pipe wrenches to secure the union to the inlet pipe.
3. Secure the gas train (Figure 32, Item 3) to the boiler with the remaining union half. Use two pipe wrenches to tighten the connection.

Figure 32 Single Base Gas Train Installation



4. Thread the gas supply piping into the manual shut-off valve. See [page 55](#) for appropriate pipe sizing.
5. All connections must be gas tight. Verify that all unions are tight.

NOTICE

Standard gas train installation shown. CSD-1 installations will differ. Instructions for CSD-1 installations are included in the CSD-1 kit.

Gas Train Installation for Dual Bases

LGB models 14-20:

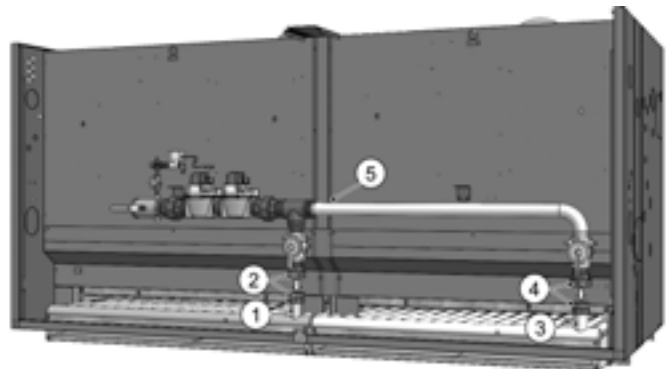
1. Apply pipe dope to the gas train extension (Figure 33, item 2).
2. Securely thread the gas train extension into the main gas train (Figure 33, item 1).

Figure 33 Dual Base Gas Train Extension Assembly



3. Remove any covering over the burner manifold inlet pipes (Figure 34, Items 1 & 3) and apply pipe dope to the inlet pipe threads.
4. Remove the free halves of the unions (Figure 34, Items 2 & 4) on the gas train and thread onto each inlet pipe. Use two pipe wrenches to secure the union to each inlet pipe.
5. Secure the gas train (Figure 34, Item 5) to the boiler with remaining union halves. Use two pipe wrenches to tighten the connections.

Figure 34 Dual Base Gas Train Installation



6. Thread the gas supply piping into the manual shut-off valve. See [page 55](#) for appropriate pipe sizing.
7. All connections must be gas tight. Verify that all unions are tight.

Control Installation

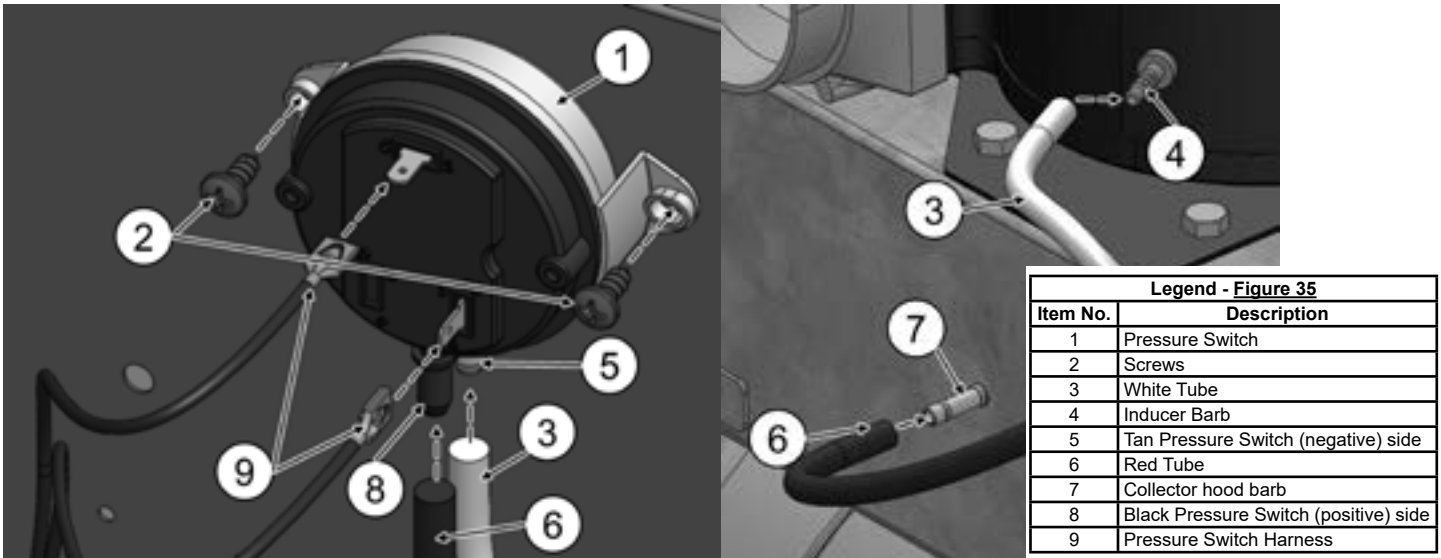
Ensure the gas control, control panel, and trim boxes are on hand before beginning this section. See the Parts section starting on [page 100](#) for details of components required for each boiler model.

1. Retrieve the common control panel from the kit.
 - For dual base boilers, also retrieve the Base 2 control panel from kit.
2. Secure the common panel to the boiler jacket with a Philips head screw driver.
 - For dual base boilers only, secure the Base 2 panel to the boiler jacket with a Philips head screw driver.
3. Retrieve pressure switch ([Figure 35](#), Item 1) from box
 - a. Ensure switch matches the following with models shown in [Table 8, page 29](#).
4. Secure switch to front interior panel as shown with two (2) screws ([Figure 35](#), Item 2) and a Phillips head screwdriver
5. Route both red and white tubes through the top chase as shown in [Figure 37, page 28](#)

6. Install the white tube ([Figure 35](#), Item 3) into:
 - a. inducer hose barb ([Figure 36](#), Item 4)
 - b. pressure switch, tan side (negative pressure side) ([Figure 35](#), Item 5)
7. Install the red tube ([Figure 35](#), Item 6) into:
 - a. Collector hood barb ([Figure 35](#), Item 7)
 - b. Pressure switch, black side (positive pressure side) ([Figure 35](#), Item 8)
8. Install harness spades ([Figure 35](#), Item 9) onto pressure switch
 - a. For dual base boilers: ensure pressure switch harness is connected so that the switches are in series.
 - b. Single base boilers have one pressure switch.
 - c. Dual base boilers have two pressure switches.
 - d. Pressure switch setpoints are shown in [Table 8, page 29](#).

(continued on the next page)

Figure 35 Pressure Switch Installation

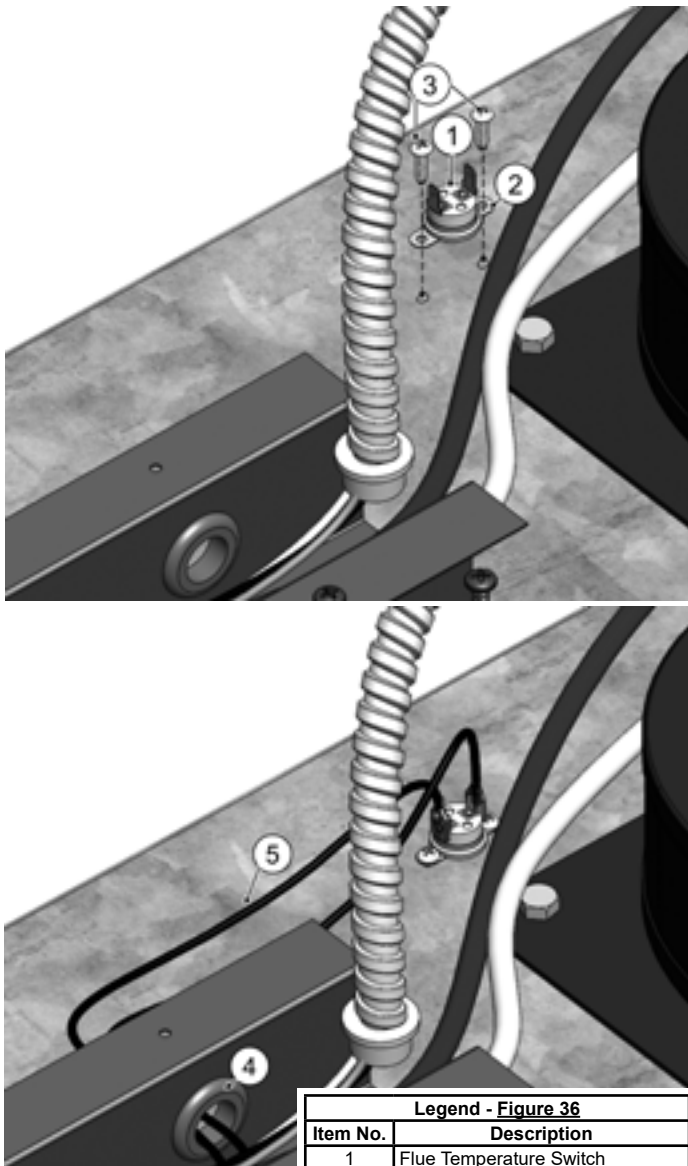


Boiler Assembly, continued

Control Installation, continued

9. Retrieve the flue temperature switch (Figure 36, Item 1) and two #6 screws from the trim kit. Steam boilers are labeled 275-20F. Water Boilers are labeled 220-20F. Ensure switch is inserted into the included bracket (Figure 36, Item 2). Secure bracket to collector hood with two (2) #6 screws (Figure 36, Item 3) and a Phillips head screwdriver. Ensure grommet (Figure 36, Item 4) is installed in wire chase hole.

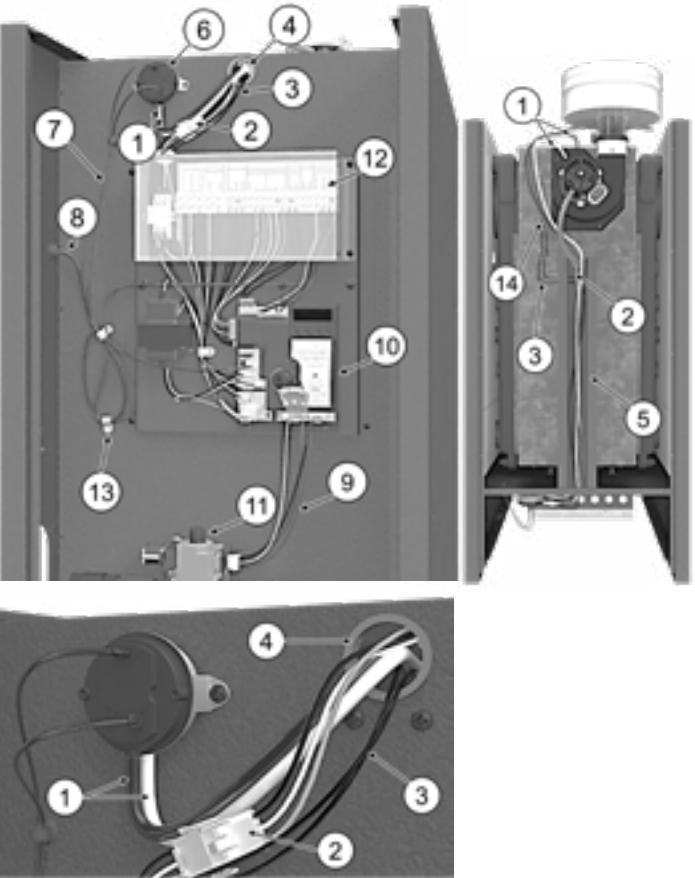
Figure 36 Flue Temperature Switch Installation



Legend - Figure 36	
Item No.	Description
1	Flue Temperature Switch
2	Flue Temperature Switch Bracket
3	#6 Screws
4	Rubber Grommet
5	Flue Temperature Switch Harness

10. Ensure both the red and white pressure switch tubes (Figure 37, Item 1), inducer wiring harness (Figure 37, Item 2), and flue temperature switch wires (Figure 37, Item 3) are routed through the plastic grommet (Figure 37, Item 4) in the front jacket panel and inside the wire chase (Figure 37, Item 5) on the top of the collector hood.
a. See Figure 37 for single base boilers.

Figure 37 Common/single base control panel



Legend - Figure 37	
Item No.	Description
1	Pressure Switch Tubes
2	Inducer Power Harness
3	Flue Temperature Switch Harness
4	Plastic Grommet
5	Wire Chase
6	Pressure Switch
7	Pressure Switch Harness
8	Water Temperature Sensor Harness (Water Boilers Only)
9	Gas Valve Harness
10	1135-400 Control Module
11	Gas Valve
12	Field Terminal Blocks (see page 58 for details)
13	Wire Clips
14	Flue Temperature Switch

Boiler Assembly, continued

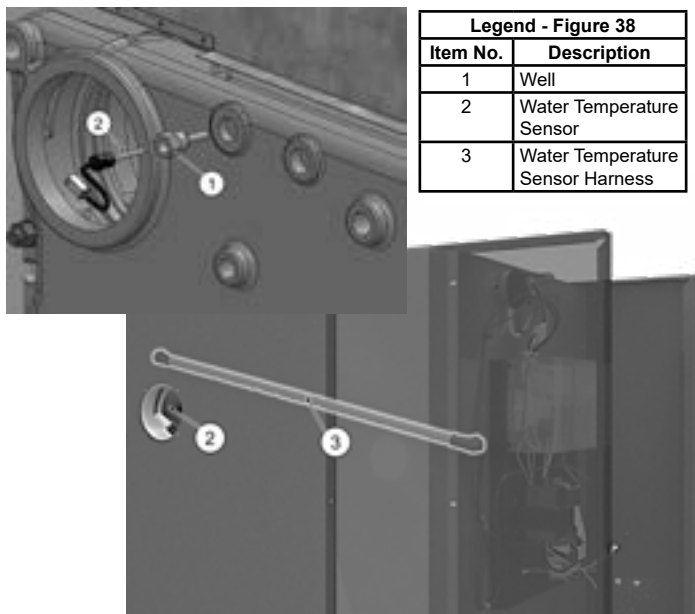
- b. See [Figure 39, page 30](#) for dual base boilers.
- c. Pressure switch wires have push-in wire clips that can be inserted into the front panel.
11. Connect gas valve and pressure switch wires.
 - a. Refer to the wiring diagrams on [pages 60-61](#) for single base boilers.
 - b. Refer to the wiring diagrams on [pages 62-63](#) for dual base boilers.

NOTICE

For LGB 5 boilers, CSD-1 installations will require the gas valve harness included in the CSD-1 kit. See instructions included in kit for details.

12. Retrieve the correct configuration plug from the trim kit. Verify that the wire color and label match the details in the schematic and wiring diagrams, starting on [page 60](#).
13. For LGB water boilers **only**:
 - a. Retrieve the water temperature sensor and thermal paste from the water trim kit.
 - b. Insert about 1/2 a tube of thermal paste into the sensor well.
 - c. Insert the temperature sensor into the well, threading securely in place.
 - d. Retrieve the water temperature sensor wire harness from the water trim kit
 - e. Route the harness as shown in [Figure 38](#); connect to the control board and sensor at both ends.

Figure 38 Water temperature harness routing



IMPORTANT

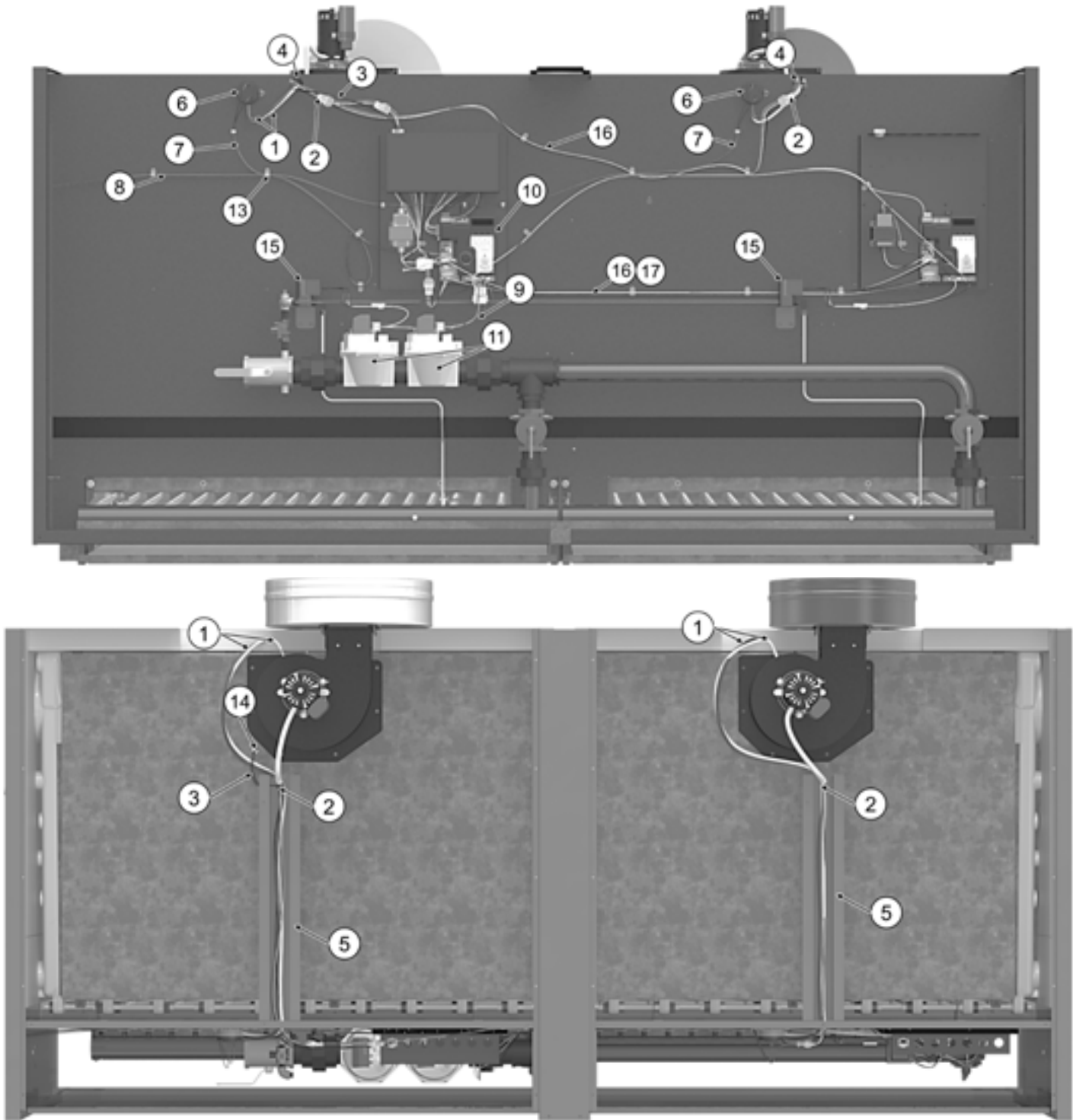
Many boiler sizes will have excess length on the harness. Before connecting to the control board, loop the excess wire and secure to the front panel with provided wire clips.

14. For dual base boilers **only**, follow the instructions below. Refer to the dual base wiring diagrams on [pages 62-63](#)
 - a. Disconnect the power harness from the Px connection on the board and connect the power Y-harness as shown in [Figure 39, page 30](#).
 - b. Disconnect the inducer relay harness from the P10 connection on the board and connect the inducer relay Y-harness as shown in [Figure 38](#).
 - c. Connect the second power Y- harness to the inducer output and each inducer harness as shown in [Figure 39, page 30](#).
15. See "Install Boiler Controls" on [page 51](#) for proper use of external limit controls.

Table 8 Pressure switches

Boiler Model	Altitude		
	0 to 1,999 ft	2,000 to 6,999 ft	7,000 to 10,000 ft
LGB 4R/4	2.45	2.20	2.10
LGB 5	1.36	1.12	1.12
LGB 6	1.65	1.45	1.36
LGB 7			
LGB 8	2.10	1.95	1.22
LGB 9			
LGB 10			
LGB 11	2.45	2.20	1.12
LGB 12			
LGB 14 Left Side	1.65	1.45	1.36
LGB 14 Right Side	2.10	1.95	1.22
LGB 16 Right Side			
LGB 16 Left Side			
LGB 18 Left Side			
LGB 18 Right Side			
LGB 20 Right Side	2.45	2.20	1.12
LGB 20 Left Side			

Figure 39 Dual base panels



Legend - Figure 39			
Item No.	Description	Item No.	Description
1	Pressure Switch Tubes	10	1135-400 Control Module
2	Inducer Power Harness	11	Gas Valve
3	Flue Temperature Switch Harness	12	Field Terminal Blocks (see page 58 for details)
4	Plastic Grommet	13	Wire Clips
5	Wire Chase	14	Flue Temperature Switch
6	Pressure Switch	15	Pilot Solenoid Valve
7	Pressure Switch Harness	16	Y-Harness – Power
8	Water Temperature Sensor Harness (Water Boilers Only)	17	Y-Harness – Inducer Relay
9	Gas Valve Harness		

Boiler Conversion

Gas Orifice and Pressure Switch Conversion

⚠ DANGER

For high altitude installations, only use the high altitude kit specified for the LGB boiler being converted. Verify the kit contents are the correct size, fuel type, and elevation for the boiler. Replace all burner orifices and pressure switches with the correct kit components. Failure to follow these limitations will result in severe personal injury, death, or substantial property damage.

All LGB boilers are shipped ready for operation at altitudes below 2,000 feet. The boilers must be fitted with high altitude burner orifices to be used at altitudes 2,000 feet and above. A conversion kit to convert the boiler for high altitude is purchased separately. See Miscellaneous Parts on [page 100](#).

⚠ WARNING

Turn off electrical supply to installed boilers before service. Close the external manual gas shut-off valve to isolate the boiler during conversion. Ensure the boiler is not hot. Failure to follow these instructions can result in severe personal injury, death, or substantial property damage.

1. For installed boilers, turn off the electrical supply and close the external manual gas shut-off valve. Allow the boiler to cool if it has been operating.
2. Remove the access panel.
3. On the gas manifold, mark the location of the pilot burner and, on models LGB 6-20 only, the main flame sense burner.
4. Remove the pilot burner with attached pilot assembly and the main flame sense burner with attached flame sense assembly from the manifold.
5. Remove all remaining burners.
6. Remove and discard all burner orifices in the gas manifold.
7. Ensure the size of the new orifice matches the correct model and altitude as specified in [Table 4, page 12](#).
8. Apply a small amount of pipe dope to each of the new orifices and install in the manifold. Make sure the orifices are aligned correctly and not cross-threaded in the manifold tapings.

9. Reinstall the main burner with attached pilot assembly at the location marked on the gas manifold.
10. Reinstall all remaining burners.
11. Check that all burners are seated firmly in the slots in the rear support. The opening in each burner must be facing up. The main burner orifice must inject down the center of the burner.

⚠ WARNING

Failure to properly seat and level the burners can result in severe personal injury, death, or substantial property damage.

12. Remove the flue pressure switch tubes from the flue pressure switch, noting ports each tube are installed in.
 - a. The white tube should be installed into the inducer hose barb and the pressure switch, tan side (negative pressure side).
 - b. The red tube should be installed into the collector hood barb and the pressure switch, black side (positive pressure side).
13. Remove the flue pressure switch wires
14. Remove the flue pressure switch.
15. Install the new flue pressure switch, ensuring the pressure switch label matches the setpoint specified in [Table 8, page 29](#).
16. Reattach the flue pressure switch tubes to the new flue pressure switch, ensuring tubes are installed in the same locations as noted. Reinstall the flue pressure switch wires.

⚠ WARNING

Failure to install flue pressure switch properly can result in severe personal injury, death, or property damage.

17. If converting to a high altitude orifice and switch, apply the high altitude conversion label above the rating label.
18. Reconnect the power to the boiler.

Test the boiler completely after conversion. Fill out the Fire Test label with the test results. Follow all instructions in this manual to start up the boiler. Check combustion levels and verify operation of the boiler and all system components after conversion.

Water Boiler Piping

Water Piping Installation

NOTICE

Use two wrenches when tightening water piping at the boiler with one at the boiler interior piping to prevent it from turning. Failure to prevent boiler piping connections from turning could cause damage to boiler components.

NOTICE

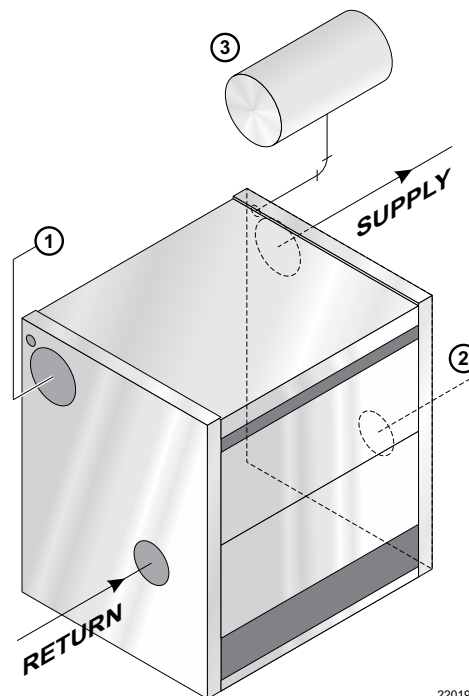
Improper piping systems or undersized piping can cause erratic boiler operation and possible boiler damage. Follow all piping instructions in this manual.

IMPORTANT

For the LGB models 4-12, the supply and return piping can be on the same end. For all other LGB models, the supply and return must be on opposite ends of the boiler.

1. The system supply and return piping can be installed before installing jacket.
2. Do not pipe in through supply and out through return, as this will create a reverse water flow.
3. Install an expansion tank.
 - a. Closed-type expansion tank: Connect the tank to the 1" tapping F. Refer to [Figure 13, page 16](#). Use 1" NPT piping. Horizontal piping must pitch upward toward the tank at least 1" for each 5 feet of piping. See [Figure 40](#).
 - b. Diaphragm-type expansion tank: Install the tank between the supply and inlet to circulator. Install an automatic air vent in tapping F.
4. Connect the supply and return piping.
 - a. Size piping according to [Table 9](#).
 - b. Install a circulator in the supply piping, with the expansion tank on the suction side.
 - c. Install a system drain valve that is sized per ASME Code.
 - **Models LGB-4 to LGB-12:** Use a 1" drain valve.
 - **Models LGB-14 to LGB-20:** Use a 1.25" drain valve.
5. When 3-way valves are used for temperature modulation, install slow-opening valves and a boiler mixing pump to minimize the potential of boiler thermal shock. See the Weil-McLain Bulletin SB-0203.
6. Piping should be sized for a 20°F rise through the boiler. For higher flow rates, use pipe sizes no smaller than those shown in [Table 9](#).

Figure 40 Water boiler piping



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Legend - Figure 40

1. **Models LGB-4 through LGB-12 only** — alternate supply tapping for supply and return on the same end.
2. **Models LGB-4 through LGB-12 only** — alternate return tapping for supply and return on the same end.
3. **Location for closed-type expansion tanks only.** Locate diaphragm-type expansion tanks between the boiler supply connection and the circulator suction connection.

Table 9 Minimum supply and return pipe sizes

By Boiler Model	Boiler Model Number	Supply & Return Pipe Size
	LGB-4R & LGB-4	2.0"
	LGB-5	2.5"
	LGB-6 to LGB-8	3.0"
	LGB-9 to LGB-16	4.0"
	LGB-18 to LGB-20	5.0"
For Specified Flow Rates	Water Flow Rate (GPM)	Supply & Return Pipe Size
	Up to 35	2.0"
	36 to 50	2.5"
	51 to 77	3.0"
	78 to 142	4.0"
	143 to 237	5.0"

NOTICE

Intermittent flow at higher velocities than shown for the pipe size in [Table 9](#) can damage the boiler, causing substantial property damage.

Water Boiler Piping, continued

General Piping Information

The control module uses temperature sensors to provide both high limit protection and operating limit control, and is UL60730 Limit Controls certified to meet ASME CSD-1 and Section IV requirements. Some codes and jurisdictions may require additional external controls.

For all boiler tappings and descriptions, see [Figure 13, page 16](#).

Additional limit controls:

Consult local requirements for other codes/standards to determine if additional limit devices are needed.

NOTICE

If the heating system includes circuits that require lower temperature water along with circuits that require higher temperature water, it is recommended to protect low-temperature circuits with limit controls that are wired to a manual or automatic reset circuit on the control.

See instructions beginning on [page 56](#) for wiring information.

- The control provides two sets of limit control contacts. One set will cause automatic reset, and the other set will cause manual reset of the control.
- The control can be reset using the manual RESET function on the control module.

Low water cutoff:

- A low-water cutoff can be installed in tappings as indicated in [Figure 13, page 16](#).
- The low-water cutoff can be wired into the limit control contacts on the control terminal block. See [page 58](#) for terminal descriptions.

Backflow preventer:

Use a backflow check valve in the water fill as required by local codes.

Pressure and temperature gauge:

The water trim carton includes a 1/2" NPT pressure and temperature (P/T) gauge which has a pressure range up to 55 psig. This gauge meets ASME requirements up to a relief valve setting of 30 psig.

Mount the P/T gauge in the 1/2-inch tapping on the side of the boiler as indicated in [Figure 13, page 16](#).

NOTICE

For higher pressure rated relief valves, a different P/T gauge with a higher pressure range is required. When installing a gauge that requires a larger tapping than the 1/2" NPT tapping in the side of the boiler, provide an additional tapping in the near boiler piping BEFORE any isolation valve. DO NOT add tappings to boilers castings.

Relief Valve Installation

⚠ WARNING

Do NOT install a relief valve with a pressure higher than 80 psig. This is the maximum allowable relief valve setting for the LGB boiler. The boiler is shipped with a 30 psig relief valve. Failure to comply can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

Improper installation of the relief valve and discharge line can cause valve operation failure, water damage, and scalding. Follow all following instructions and guidelines. Failure to comply can result in severe personal injury, death, or substantial property damage.

1. The water trim carton includes a relief valve. Install the relief valve in the tappings indicated in Figure 13, page 16.
 2. Connect discharge piping to a safe disposal location according to the guidelines below.
- Discharge line must be connected to the relief valve outlet and run to a safe place of disposal. Terminate the discharge line in a manner that will prevent the possibility of severe burns or property damage should the valve discharge.

- Discharge line must be as short as possible and be the same diameter as the valve discharge connection throughout its entire length.
- Discharge line must pitch downward from the valve and terminate at least 6" above the floor drain where any discharge will be clearly visible.
- Discharge line shall terminate plain, not threaded, with a material serviceable for temperatures of 375°F (191°C) or greater.
- Do not pipe the discharge to any place where freezing could occur.
- Do not install any shutoff valve between the relief valve and boiler, or in the discharge line. Do not plug or place any obstruction in the discharge line.
- After filling and pressurizing the system, test the operation of the valve by lifting the lever. Make sure the valve discharges freely. If the valve fails to operate correctly, replace it with a new relief valve.

See the Parts section starting on page 100 for alternative pressure setting relief valves.

Water Boiler Piping, continued

Primary/Secondary Piping

The recommended primary/secondary piping is shown in [Figure 41](#). For single boilers, pipe as shown for one unit.

1. Size secondary boiler pump GPM for 20°F to 40°F temperature rise through the boiler. The secondary boiler pump head will be very low.
2. Calculate only the secondary piping circuit resistance. Boiler resistance will not exceed 6" W.C.
3. Primary pump GPM and head calculation should not include secondary boiler circuits. The primary pump can operate continuously during the heating season.
4. Distance 12" or less.
5. Flow/check valve.
6. Hand valve.
7. Expansion tanks, relief valves, and other accessories are required but not shown.

Refrigeration System Piping

Install the boiler so that chilled medium is piped in parallel with the heating boiler, with appropriate valves to prevent the chilled medium from entering the boiler. Consult AHRI Installation and Piping Guides. See [Figure 42](#).

If the boiler system has heating coils in air handling units where exposure to refrigerated air is possible, use flow control valves to prevent gravity circulation during cooling cycles.

Figure 41 Primary/secondary piping

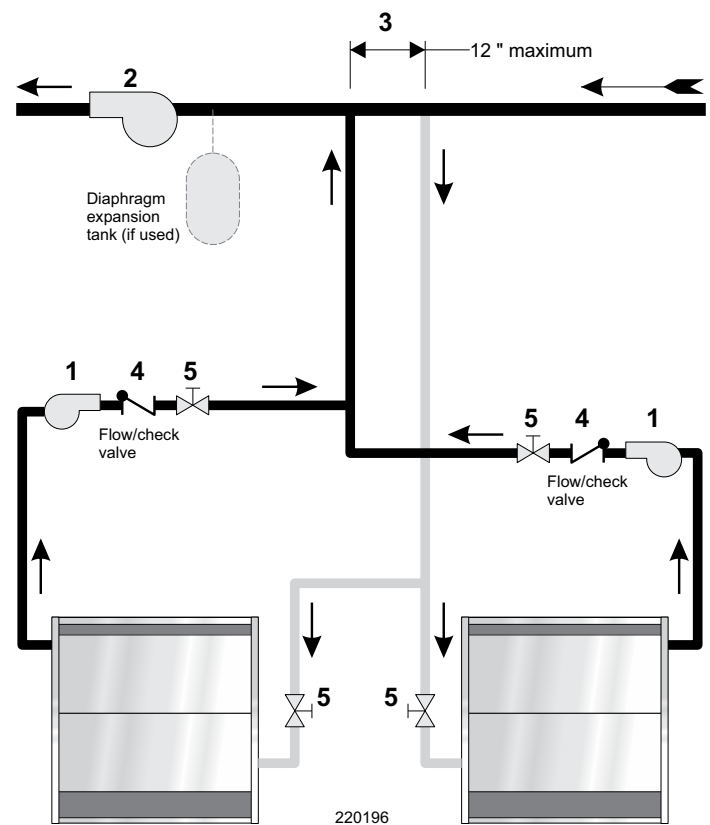
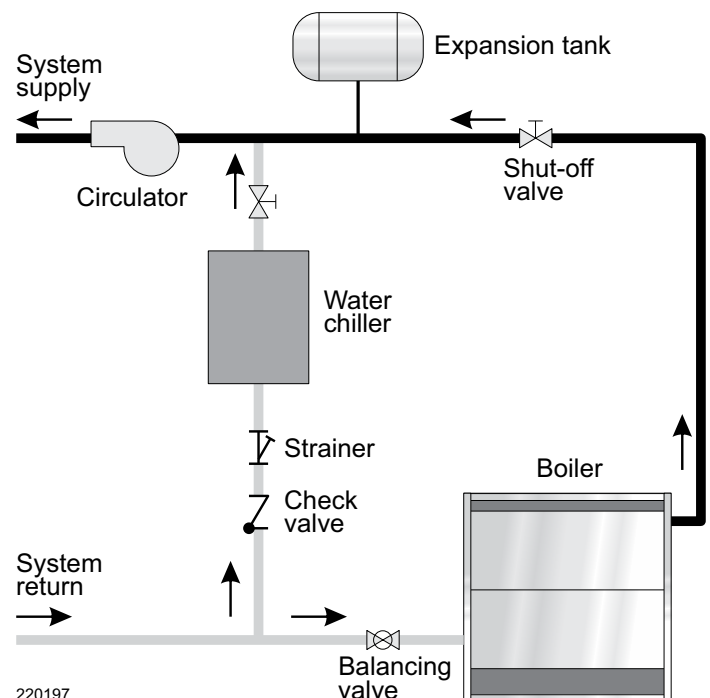


Figure 42 Refrigeration system piping



Steam Boiler Piping

Steam Piping Installation

NOTICE

Improper piping systems or undersized piping can cause erratic boiler operation and possible boiler damage. Follow all piping instructions in this manual.

A boiler feed system with a level controller on the boiler that operates the pump is recommended. It is not recommended to use a condensate return system where the pump is operated by a receiver-mounted float switch. Level controls must be mounted on the same side as the return piping and equalizer. See pages 51-52 for more information on controls.

For multiple steam boiler piping, see Figure 47, page 38.

1. Pipe the header at least 24" above the boiler water line.
2. Install a blowdown valve in tapping C1 or C2, sized per ASME Code.
 - Models LGB-4 to LGB-12: Use a 1" blowdown valve.
 - Models LGB-14 to LGB-20: Use a 1.25" blowdown valve.

Table 10 Minimum steam boiler pipe sizes

Boiler Model Number	Risers		Header	Equalizer
	A	B	H	J
LGB-4 to LGB-8	4"	-	4"	2.0"
LGB-9 to LGB-11	5"	-	5"	2.5"
LGB-12	6"	-	6"	2.5"
LGB-14	4"	4"	6"	4.0"
LGB-16 to LGB-18	5"	5"	6"	4.0"
LGB-20	6"	6"	8"	4.0"

Figure 43 Steam boiler piping for LGB 4-12 - single riser

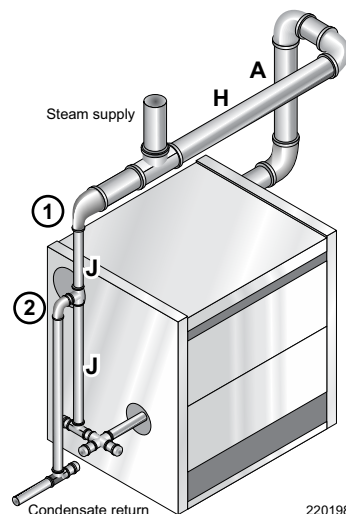


Figure 44 Steam boiler piping for LGB 14-20 - riser on each end

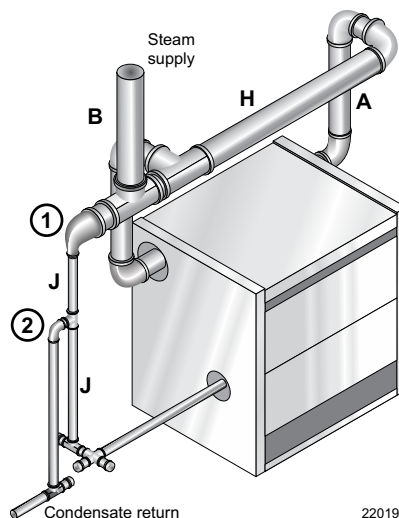
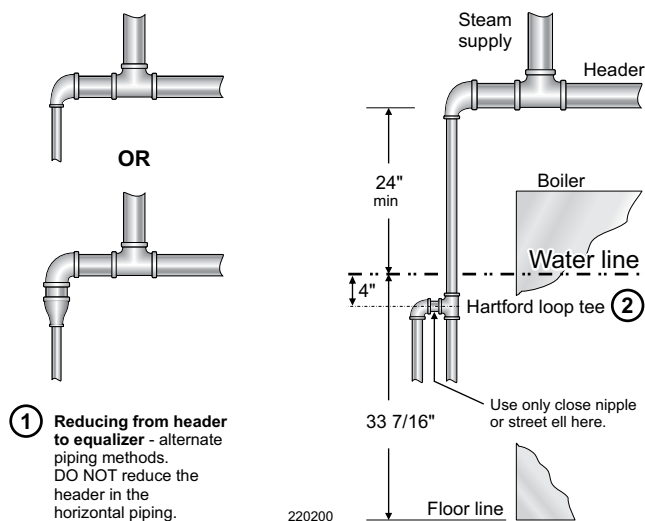


Figure 45 Steam boiler piping additional information



Steam Boiler Piping, continued

Condensate Return

There must be adequate return of condensate to maintain steady water level for satisfactory operation of the steam heating system. Avoid adding excessive makeup water.

If condensate return is not adequate, an LWCO and pump control, condensate receiver, and condensate boiler feed pump should be installed. Refer to [Figure 46](#) and [Table 11](#).

Figure 46 Boiler feed pump and condensate receiver piping

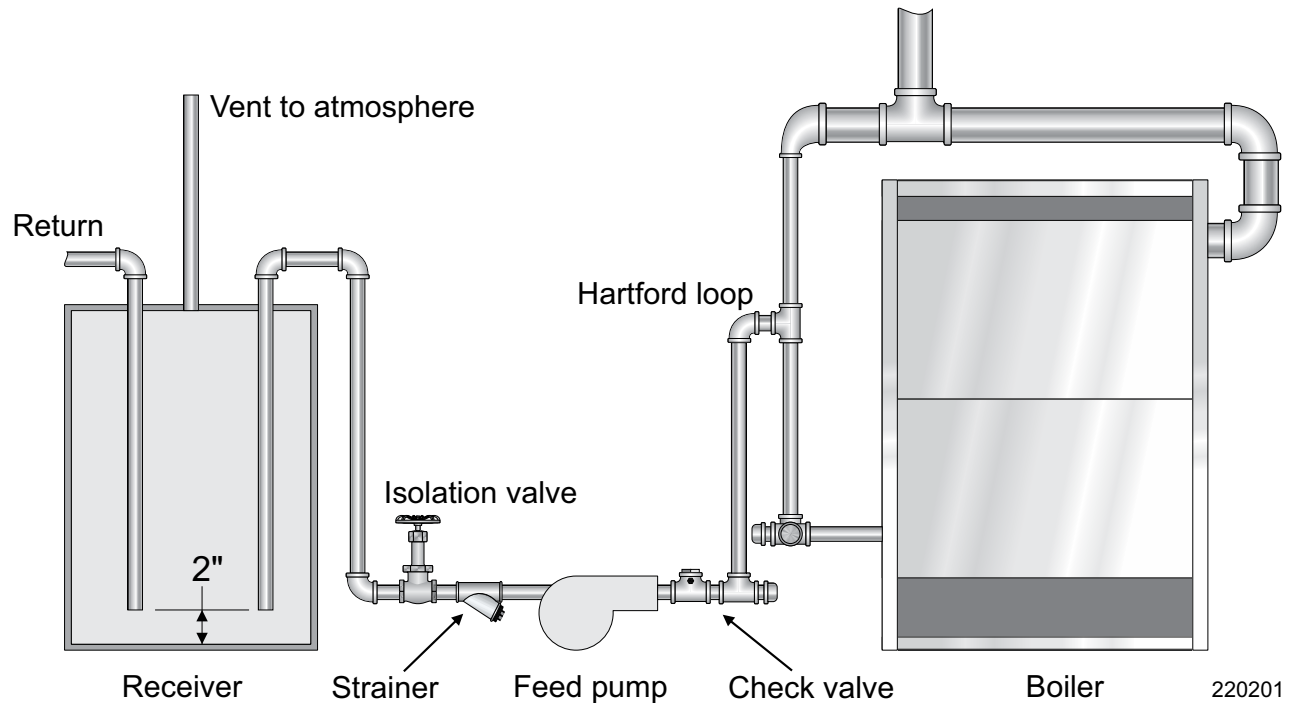


Table 11 Minimum condensate receiver capacity

Boiler Model	Gross Steam Output	Condensate gallons/hour	Minimum Condensate Receiver Capacity (gallons) (Select minimum receiver capacity base on time [minutes] required for condensate to return to the receiver)				Recommended Feed Pump Capacity GPM@15 PSI
	lbs./hour		15 minutes	30 minutes	45 minutes	60 minutes	
LGB-4R	291.8	35	11	22	33	44	1.2
LGB-4	334.0	42	13	26	39	52	1.4
LGB-5	434.0	54	17	34	51	68	1.8
LGB-6	542.3	68	21	42	64	85	2.3
LGB-7	650.5	81	25	51	76	102	2.7
LGB-8	759.8	95	30	59	89	119	3.2
LGB-9	868.0	109	34	68	102	136	3.6
LGB-10	976.3	122	38	76	114	153	4.1
LGB-11	1,085.6	136	42	85	127	170	4.5
LGB-12	1,193.8	149	47	93	140	187	5.0
LGB-14	1,410.3	176	55	110	165	220	5.9
LGB-16	1,627.8	203	64	127	191	254	6.8
LGB-18	1,845.4	231	72	144	216	288	7.7
LGB-20	2,061.9	258	81	161	242	322	8.6

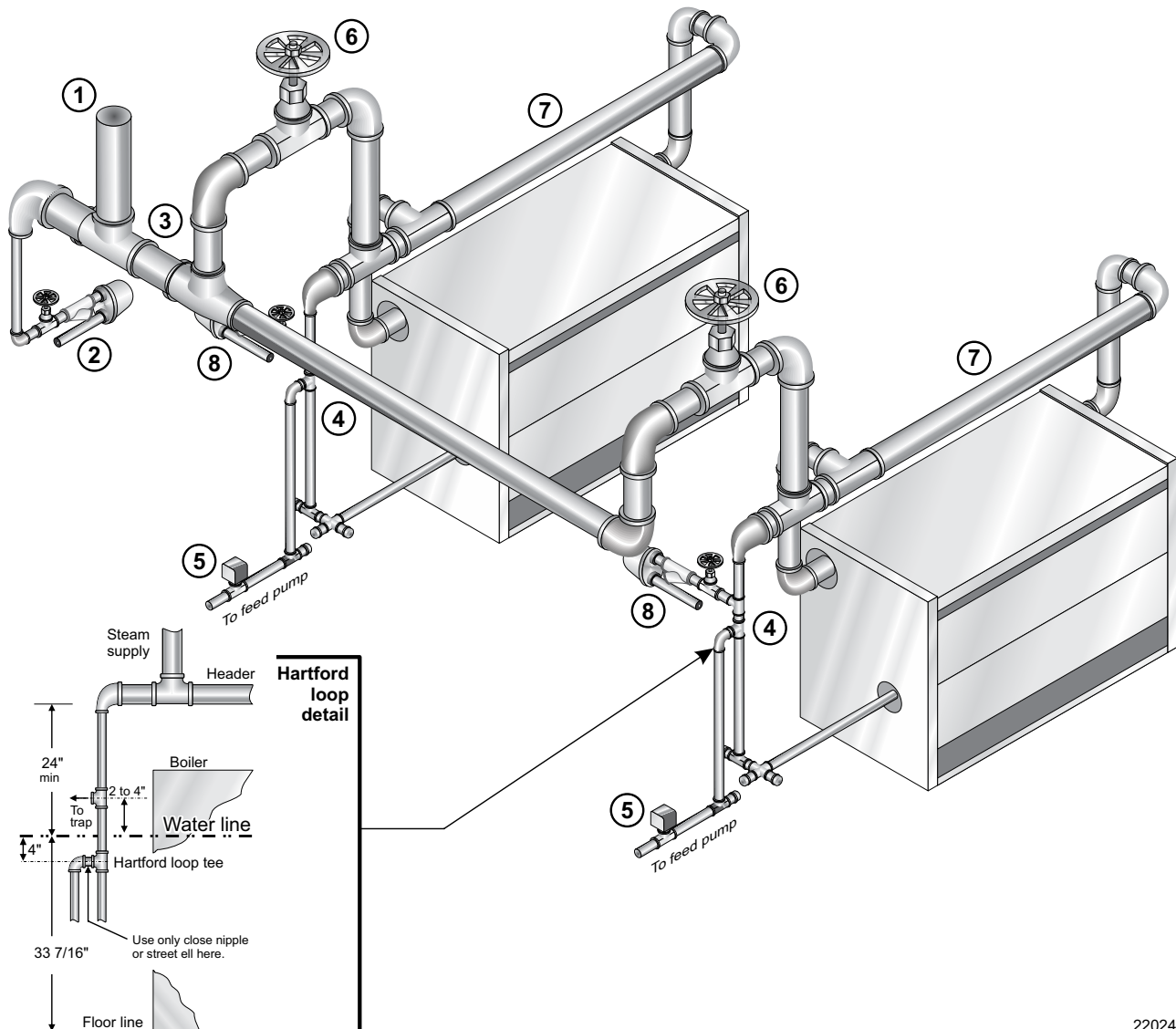
Piping Multiple Steam Boilers

Each boiler has a boiler feed pump controller. Mount each boiler feed pump controller with the body mark at the level indicated in [Figure 54](#), [page 51](#).

Level controls must be mounted on the same side as the return piping.

Boiler controls and trim (such as valves, LWCO, pump controllers, and burners) are omitted in [Figure 47](#) for piping clarity.

Figure 47 Piping multiple steam boilers



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1. Locate the steam supply takeoff outboard from the connecting piping to ensure liquid in the line will flow to the trap.
2. Locate combined header drain as shown. Install a strainer and float and a thermostatic trap in the drain line as shown. Pipe the trap outlet to the condensate receiver.
3. Size the common header piping per ASHRAE recommendations, but not smaller than the individual boiler headers.
4. Pipe the Hartford Loop tee 4" below the boiler waterline.
5. Provide a separate feed pump for each boiler. Alternatively, provide a separate automatic valve with end switch and a single feed pump. If using a valve, activate it with the boiler pump controller. Activate the feed pump with the valve end switch.
6. Manual steam valve or slow opening automatic steam valve, sized to the boiler output capacity.
7. Boiler steam header for single boiler. See [page 36](#).
8. Install a float and thermostatic trap and strainer off the equalizer of each boiler from 2" to 4" above the waterline. Connect the trap outlet to the condensate receiver. The trap will prevent an idle boiler from flooding due to condensed steam from the system.

Commonwealth of Massachusetts Installations

Commonwealth of Massachusetts — When the boiler is installed within the Commonwealth of Massachusetts, the boiler must be installed by a licensed plumber or gas fitter. Read and comply with the instructions below.

1. **REQUIREMENTS:** For all sidewall horizontally-vented gas-fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than 7 feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:
 - a. **INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gas fitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gas fitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.
 - In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
 - In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.
 - b. **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
 - c. **SIGNAGE.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of 8 feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS."
 - d. **INSPECTION.** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a) 1 through 4.
2. **EXEMPTIONS:** The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:
 - a. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
 - b. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.
3. **MANUFACTURER REQUIREMENTS — GAS EQUIPMENT VENTING SYSTEM PROVIDED.** When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:
 - a. Detailed instructions for the installation of the venting system design or the venting system components; and
 - b. A complete parts list for the venting system design or venting system.
4. **MANUFACTURER REQUIREMENTS — GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.** When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:
 - a. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
 - b. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.
5. **PLASTIC VENTING SYSTEMS.** The only plastic piping which may be used for venting appliances shall be:
 - a. Allowed by the appliance manufacturer.
 - b. Listed to a national/international standard for plastic venting systems.
 - c. Product-accepted for that purpose by the board.
6. **INSTALLATION INSTRUCTIONS.** A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

Venting and Combustion Air - General

Code Compliance

Venting and combustion air piping installations must provide provisions in accordance with the section, "Air for Combustion and Ventilation," of the National Fuel Gas Code - ANSI Z223.1/NFPA 54, latest edition, or Sections 8.2, 8.3, or 8.4 of the Natural Gas and Propane Installation Code - CAN/CSA B149.1, and applicable provisions of the local building codes.

⚠ DANGER

Inspect finished vent system thoroughly to ensure it is airtight and complies with instructions in this manual and applicable codes. Verify all air openings are correctly sized, unobstructed, and free of airborne contaminants. Failure to provide a properly installed vent system will result in severe personal injury or death.

⚠ WARNING

Provide a vent manufacturer's bird screen at each termination. Bird screens must be purchased from the vent piping supplier. Failure to comply can result in severe personal injury, death, or substantial property damage.

Venting System Category

The LGB water and steam boilers have two different venting categories with very different venting requirements. However, both have the same combustion air provision and contamination requirements found in the following sections on this page. The venting system categories used are below.

LGB Steam Boilers:

Category I: Negative pressure, unlikely to condense within the venting system. For specific vent system requirements, see the Steam Boiler Venting - Category I section on [page 45](#).

LGB Water Boilers:

Category II: Negative pressure, likely to condense within the venting system (corrosion resistant & water tight). For specific vent system requirements, see the Water Boiler Venting - Category II section on [page 47](#).

Table 12 Corrosive contaminants and sources

Products to avoid
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes and cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid and muriatic acid
Cements and glues
Anti-static fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents
Adhesives used to fasten building products and other similar products
Excessive dust and dirt
Areas likely to have contaminants
Laundry and dry cleaning areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

Combustion Air Provision

The LGB commercial boiler can use inside air if no contaminants are present in the boiler space. If contaminants are likely to be present, install the boiler as a direct vent appliance. Use the appropriate vent instructions in this manual.

The boiler room must be fitted with combustion air openings large enough to provide air for all appliances in the room. Use the following information to size the openings. Ensure the installation complies with all applicable codes and standards.

Combustion Air Contamination

Provide combustion air openings as described in this manual. See [Table 12](#) for products and areas that may cause contaminated combustion air.

Venting and Combustion Air - General, continued

Sizing Combustion Air Openings

Air openings provide the air required by the LGB boiler to complete the combustion process. Air is also needed for other appliances located in the same space. Use the information in [Figure 48, page 42](#) for air openings.

⚠ WARNING

Air openings must be sized to handle all appliances and air movers, such as exhaust fans, using the air supply. Failure to comply can result in severe personal injury, death, or substantial property damage.

The sizing given in [Figure 48, page 42](#) is based on the National Fuel Gas Code - ANSI Z223.1/ NFPA 54, latest edition. The sizing allows adequate air openings for gravity-vented gas appliances (Category I), in addition to the needs for the LGB boiler. The air openings specified by NFPA 54 and [Figure 48, page 42](#) will allow adequate ventilation and combustion air, provided the boiler room is not subjected to negative pressure due to exhaust fans or other mechanical ventilation devices. Refer to the National Fuel Gas Code when working with other conditions.

Free area and louvers

The free area of openings means the area after reduction for any installed louvers or grilles. Be sure to consider this reduction when sizing the air opening.

Special Considerations

Tight construction

The National Fuel Gas Code - ANSI Z223.1/NFPA 54, latest edition defines unusually tight construction where all of the following is true:

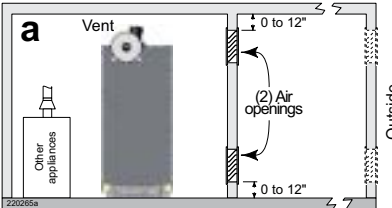
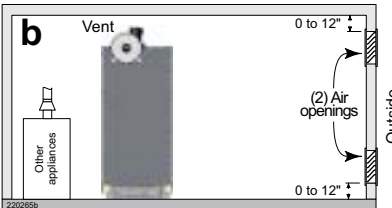
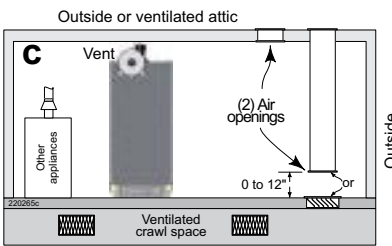
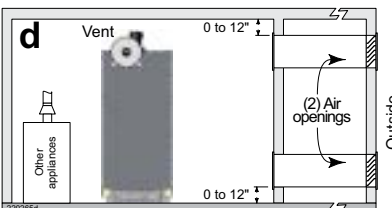
1. Walls and ceilings exposed to the outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings fitted with gaskets.
2. Weather-stripping has been added on windows and doors that are capable of being opened.
3. Caulking or sealants are applied to areas such as joints around windows and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and in other openings.

For buildings with such construction, provide air openings into the building from outside. Size the openings per the appropriate condition in [Figure 48, page 42](#) if appliances are to use inside air for combustion and ventilation.

Exhaust fans and movers

The appliance space must never be under a negative pressure. Always provide air openings sized to the dimensions required for the firing rate of all appliances, with the ability to handle the air movement rate of the exhaust fans or air movers using air from the building or space.

Figure 48 Minimum combustion air openings

<p>Air openings</p> <p>The required air opening sizes below are FREE AREA, after reduction for louver obstruction. See the important below for large spaces.</p>	<p>LGB boiler WITH other appliances in the same room</p>	<p>LGB boiler WITHOUT other appliances in the same room</p>
	<p>Two openings, each at least: 1 square inch per 1,000 Btuh of all appliances in the room, but not less than 100 in².</p>	<p>Two openings, each at least: 1 square inch per 1,000 Btuh of all appliances in the room, but not less than 100 in².</p>
	<p>Two openings, each at least: 1 square inch per 2,000 Btuh of all appliances in the room -OR- One opening* at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>	<p>Two openings, each at least: 1 square inch per 2,000 Btuh of all appliances in the room -OR- One opening* at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>
	<p>Two openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room -OR- One opening* at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>	<p>Two openings, each at least: 1 square inch per 4,000 Btuh of all appliances in the room -OR- One opening* at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>
	<p>Two openings, each at least: 1 square inch per 2,000 Btuh of all appliances in the room -OR- One opening* at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>	<p>Two openings, each at least: 1 square inch per 2,000 Btuh of all appliances in the room -OR- One opening* at least: 1 square inch per 3,000 Btuh of all appliances in the room</p>
<p>* Requirements for using the single air opening option</p>	<p>A single combustion air opening can be used for cases b, c, or d above, sized as listed, provided that the following are met:</p> <ul style="list-style-type: none"> • The single opening must communicate directly to open air outside of the building or to a space that communicates directly to the outside of the building. • The top of the opening must be within 12" of the ceiling. • The free area of the opening must be at least equal to the sum of the areas of all equipment vent connectors in the space. 	
<p>IMPORTANT</p> <p>A special exception exists for large spaces. See the information to the right.</p>	<p>No combustion air openings are needed when the boiler and other appliances are installed in a space with a volume no less than 50 cubic feet per 1,000 Btuh of all appliances in the space. The building must NOT be of tight construction.</p> <p>Calculation: Take the total inputs of all appliances in MBH (1,000s Btuh) and multiply by 50. The space volume must be equal to or greater than the total of this calculation.</p> <p>[Total appliances input in MBH x 50] ≥ space volume</p> <p>Example: For a total input of 1500 MBH (1,500,000 Btuh), the minimum space volume necessary would be 1500 x 50 = 75,000 cubic feet.</p>	

Venting and Combustion Air - General, continued

Existing Vent System

⚠WARNING

Follow all venting and piping instructions. Failure to follow all instructions can cause flue gas spillage and carbon monoxide emissions, which can result in severe personal injury or death.

Removal of the previous boiler may cause an issue for the appliances that remain on the old common vent as the vent may be too large. The following test is intended to check for proper operation of the appliances remaining on the old common vent system.

Existing Vent System Test Procedure

Perform this test when removing a boiler from the common venting system. The following steps shall be followed with each appliance remaining connected to the common venting system. Test each appliance separately while in operation. Ensure all other appliances connected to the common vent are not in operation. Seal any unused openings in the common venting system before proceeding with the test.

1. Visually inspect the venting system for proper size and horizontal pitch. Ensure there is no blockage, restriction, leakage, corrosion, or other deficiency that could cause an unsafe condition.
2. Close all building doors and windows as practical. Close all doors between the location of the appliances connected to the common venting system and other spaces of the building.

3. Turn on the clothes dryer and any other appliance not connected to the common venting system. Turn on all exhaust fans, except for a summer exhaust fan, and operate at maximum speed. Exhaust fans include range hoods and bathroom fans. Close fireplace dampers.
4. Place the appliance being inspected into operation. Follow the lighting instructions. Adjust the thermostat so the appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after five minutes of main burner operation. Use the flame of a match or candle, or smoke from a smoke stick.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined here, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

Correct any improper operation of the common venting system so the installation conforms with the National Fuel Gas Code - ANSI Z223.1/NFPA 54, latest edition. Adhere to the National Gas and Propane Installation Code - CAN/CSA B149.1 for Canada. When resizing any portion of the common venting system, approach the minimum size as determined using the appropriate tables in part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and CAN/CSA B149.1 Natural Gas and Propane Installation Code.

Steam Boiler Venting - Category I

Chimney Draft Venting

⚠ DANGER

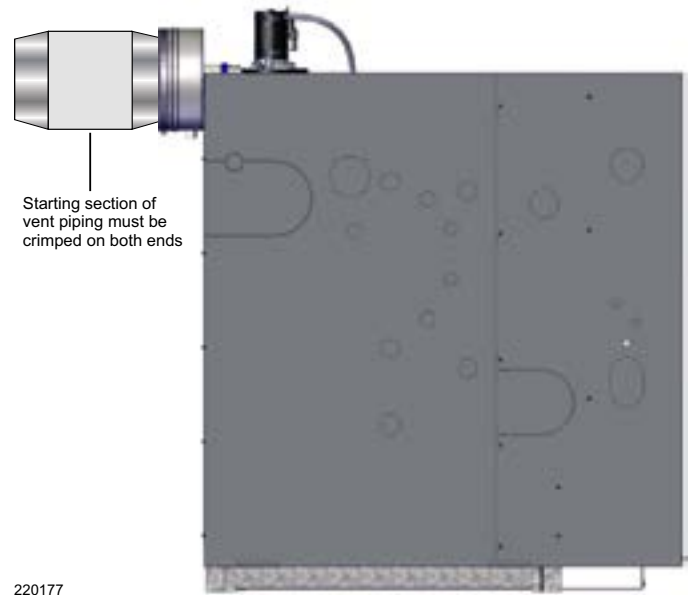
Inspect existing chimney before installing boiler. Failure to clean or replace perforated pipe or lining will result in severe personal injury or death.

⚠ WARNING

The vent connector and chimney must be designed, sized and constructed in compliance with all applicable codes. Technical data to support the proper sizing of the vent and chimney can be found in [Table 13, page 45](#). Failure to comply can result in severe personal injury, death, or substantial property damage.

1. Use single wall metal pipe, double wall Type B gas vent, or chimney as required by the National Fuel Gas Code, ANSI Z223.1/NFPA 54 –latest edition, or in Canada, B149.1 or B149.2 Natural Gas and Propane Installation Code.
2. To prevent downdrafts, chimney should extend at least 3 feet above the highest point where it passes through a roof or snow line, and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet, and in accordance with local codes that have jurisdiction.
3. To vent with another appliance, see National Fuel Gas Code, ANSI Z223.1/NFPA 54 –latest edition or in Canada B149.2 or B149.2 Natural Gas and Propane Installation Code.
4. Do not connect breeching to any portion of a mechanical draft system that can operate under positive pressure.
5. Maintain a minimum 2" clearance from combustible materials to vent pipe.
6. Do not use a chimney with an open fireplace.
7. Make horizontal runs as short as possible; long runs can cause condensation.
8. When longer runs are used, support pipe with appropriate hangers sloping the vent upward towards the chimney at 1/4" per foot.
9. To prevent blockage, do not vent into the bottom of the chimney.
10. Vent pipe must not go beyond the inside wall of the chimney.
11. Vent passing through floors or ceilings must be firestopped.
12. See [Figure 49](#) and [Table 13, page 45](#) to connect the boiler to the venting system.

Figure 49 Vent piping to boiler



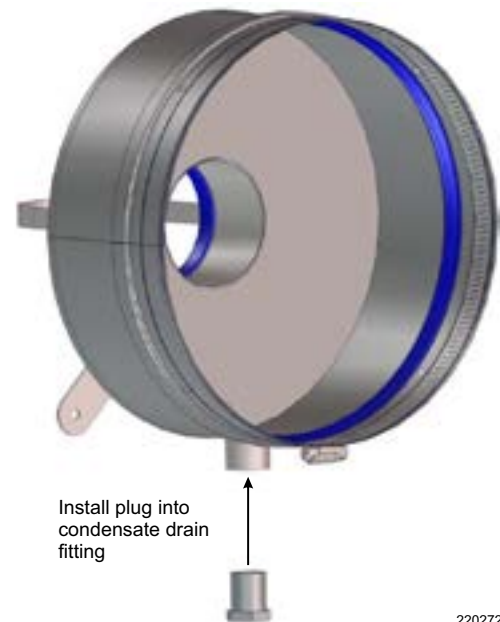
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Steam Boiler Venting - Category I, continued

Condensate Drain Plug Installation

A condensate trap is not needed with Category I venting. Install the provided 1/2" NPT drain plug into the condensate drain fitting on the vent connector. Use Teflon tape on the threads of the plug to provide a tight seal. See [Figure 50](#).

Figure 50 Plug condensate drain fitting



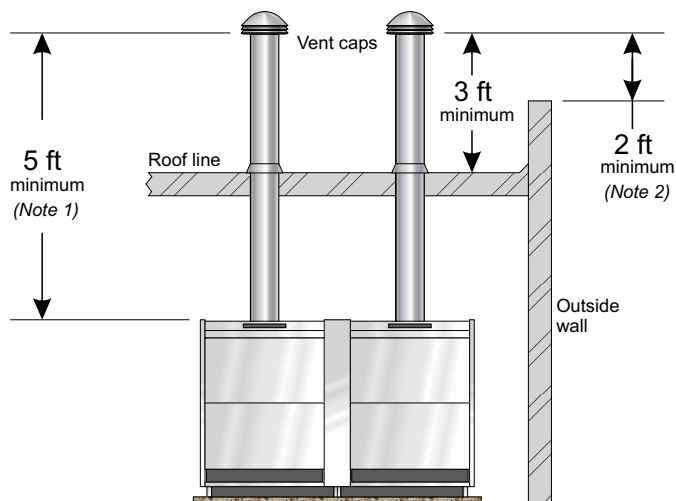
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Table 13 Category I vent system technical data

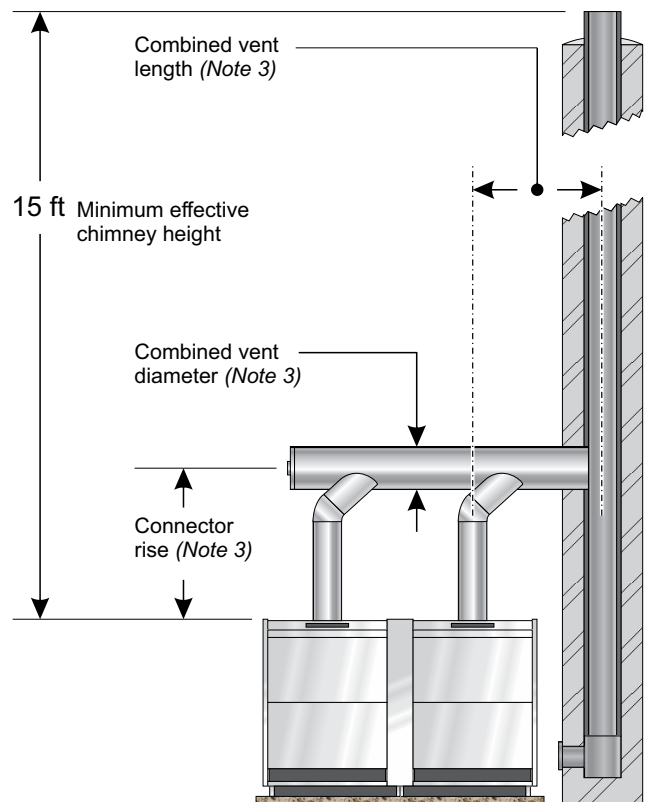
LGB Series 3 Steam - Category I Venting Information							
Boiler Size	Maximum Input	Max. Stack/Vent Flow Rate*	Minimum Input	Min. Stack/Vent Flow Rate*	Typical Flue Temperature	Negative Pressure to be maintained @ Vent Connection	Vent Connection and Minimum Vent Diameter
	BTU/hr	CFM	BTU/hr	CFM	°F	Inches W.C.	Inches (Qty)
LGB-4R	350,000	125	175,000	63	280 - 300	-0.001 to -0.1	10 (1)
LGB-4	400,000	143	200,000	72	280 - 300	-0.001 to -0.1	10 (1)
LGB-5	520,000	186	260,000	93	280 - 300	-0.001 to -0.1	12 (1)
LGB-6	650,000	233	325,000	116	280 - 300	-0.001 to -0.1	12 (1)
LGB-7	780,000	279	390,000	140	280 - 300	-0.001 to -0.1	12 (1)
LGB-8	910,000	326	455,000	163	280 - 300	-0.001 to -0.1	14 (1)
LGB-9	1,040,000	373	520,000	186	280 - 300	-0.001 to -0.1	14 (1)
LGB-10	1,170,000	419	585,000	210	280 - 300	-0.001 to -0.1	16 (1)
LGB-11	1,300,000	466	650,000	233	280 - 300	-0.001 to -0.1	16 (1)
LGB-12	1,430,000	512	715,000	256	280 - 300	-0.001 to -0.1	16 (1)
LGB-14	1,690,000	605	845,000	303	280 - 300	-0.001 to -0.1	12 (1) 14 (1)
LGB-16	1,950,000	699	975,000	349	280 - 300	-0.001 to -0.1	14 (2)
LGB-18	2,210,000	792	1,105,000	396	280 - 300	-0.001 to -0.1	14 (1) 16 (1)
LGB-20	2,470,000	885	1,235,000	442	280 - 300	-0.001 to -0.1	16 (2)

*Stack / flow rate is based on the unit operating at 7.6% CO₂. This value can vary based on the location of the installation and operating conditions.

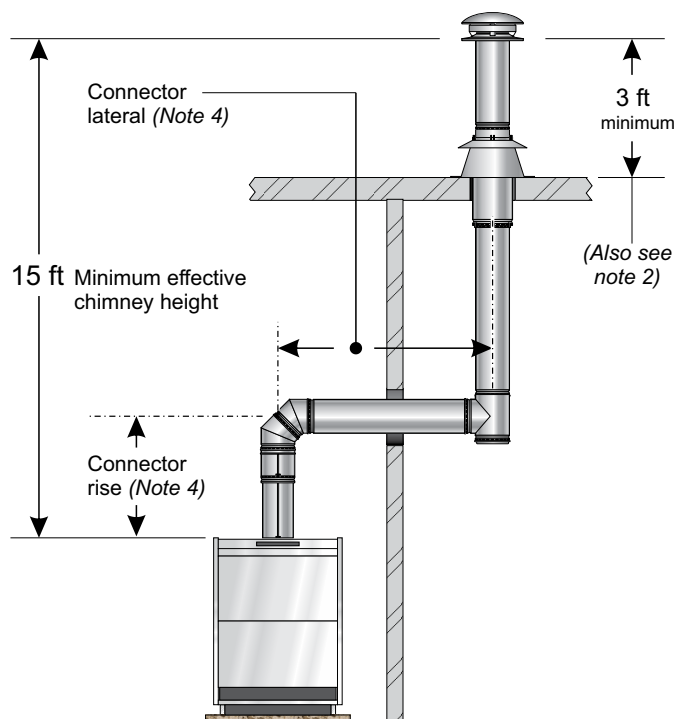
Figure 51 LGB series 3 steam — typical Category I venting



Individual Stub Vents



Combined Vents



Offset Vents

Notes

1. Minimum vent height using full size connector.
2. Minimum 2 feet above any structure within 10 feet.
3. Vent and combined vent materials, length and diameter must be determined using the combined venting tables of the National Fuel Gas Code, ANSI Z223.1—latest edition, or other accepted engineering design method. Use a connector rise as high as possible to improve vent connector capacity.
4. Vent and vent connector material and design must be determined using the individual venting tables of the National Fuel Gas Code, ANSI Z223.1—latest edition, or other accepted engineering design method. Use a connector rise as high as possible to improve vent connector capacity.

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Water Boiler Venting - Category II

Category II Requirements

⚠WARNING

Install a Category II vent system per all instructions in this manual. Improper Installation of a Category II vent system that results in positive pressure in the vent system can cause flue gas spillage and carbon monoxide, which can result in severe personal injury or death.

⚠WARNING

Follow all applicable national and local codes for installations. Failure to comply with the codes can result in severe personal injury, death, or substantial property damage.

The vent system for a Category II LGB water boiler is considered a designed and engineered vent system. This system should be designed by a professional using accepted engineering practices in accordance to all local codes and the authority having jurisdiction.

Use only the materials listed in [Table 14, page 48](#) for vent pipe and fittings. Vent connections are sized for DuraVent Fas-N-Seal and crimped, galvanized venting. A list of approved vent suppliers and systems is provided in [Table 15, page 48](#).

Using a Chimney

⚠WARNING

DO NOT install Category II boilers into existing Category I venting systems as this can cause vent pipe corrosion, condensate leakage, and flue gas leakage. Failure to comply can result in severe personal injury, death, or substantial property damage.

⚠WARNING

A chimney must be completely lined with a suitable Category II rated, corrosion-resistant and water-tight lining, with a way to drain away condensate that is formed in the vent or chimney. Failure to comply can result in severe personal injury, death, or substantial property damage.

A chimney must be completely lined with a Category II rated lining in accordance with UL 1738 Venting Systems for Gas-Burning Appliances.

The lining must be corrosion-resistant and water-tight, with means to drain away condensate. Only other Category II rated appliances can be common vented with the boiler in an engineered vent system designed for such an application.

- The Category II rated vent material must be installed per the vent manufacturer's instructions.
- The chimney must be fitted with a sealed access opening for inspection of the chimney interior.
- The chimney and liner must be inspected annually.

Additional Category II venting requirements:

- Contact your preferred vent supplier for vent sizing support. Follow the vent supplier's installation instructions to ensure safe and proper operation of the venting system.
- Category II venting is natural draft; terminations must be vertical with required bird screen and rain caps.
- The required information to calculate and design the engineered vent system is provided in [Table 16, page 48](#).
- The Category II vent system should be designed to ensure that the pressure at the vent connector is between the ranges provided in [Table 16, page 48](#).
- In applications where the vent system will not produce enough draft, a vent inducer may be required to ensure the vent is kept within the pressure range provided in [Table 16, page 48](#).
- In applications where the vent system provides excessive draft, a draft control device may need to be added to ensure the vent is kept within the pressure range provided in [Table 16, page 48](#).
- The vent connector supplied with the boiler provides for a 1/2" female NPT connection to drain away condensate. A condensate trap can be constructed out of CPVC or purchased from the preferred vent supplier. Failure to drain away condensate can cause condensate to build up, resulting in potential shut down and lockout.
- Any lateral or horizontal vent runs should be sloped per the venting manufacturer's instructions to ensure proper draining of condensate.
- It is recommended that carbon monoxide detectors be installed in the boiler room. The carbon monoxide detector must be wired on the same electrical circuit as the boiler.
- Check your local codes for any additional requirements for carbon monoxide detectors.

Table 14 Vent piping materials

Items	Material	Supplier / Manufacturer	United States	Canada
Vent pipe fittings	AL29-4C or 316 stainless steel	M&G Simpson-DuraVent - Fas-N-Seal or Fas-N-Seal Flex -No adapter needed-	Certified for Category II appliance venting. UL1738 - Venting Systems for Gas Burning Appliances	Certified for Category II appliance venting.
		Heat Fab, Inc. - Saf-T-Vent™ -Requires adapter by others-		
		Metal-Fab, Inc. - CORR/GUARD -Requires adapter by others-		
		Z-Flex, Inc. - Z-Vent II -Requires adapter by others-		

Table 15 Vent adapters - approved vent suppliers

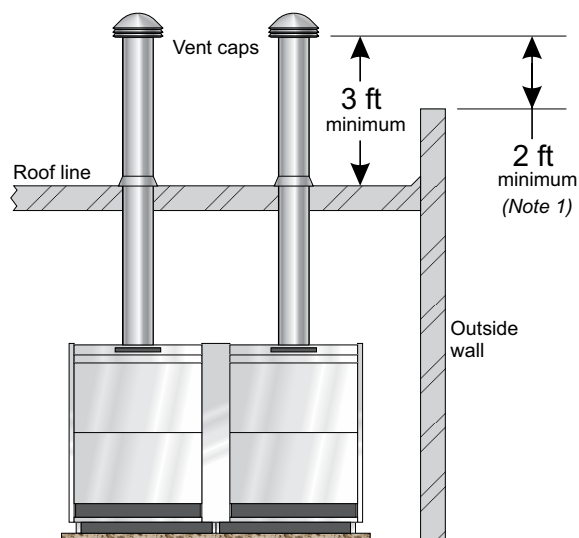
Supplier	Vent Model	Supplier vent adapter required to connect to boiler			
		LGB 4R-4	LGB 5-7*	LGB 8-9*	LGB 10-12*
		10"	12"	14"	16"
M&G Simpson-DuraVent	Fas-N-Seal**	Not required	Not required	Not required	Not required
MetalFab, Inc.	CORR/Guard	10FCSLCA	12FCSLCA	14FCSLCA	16FCSLCA
HeatFab, Inc.	Saf-T-Vent	91001MAD	91201MAD	91401MAD	91601MAD
Z-Flex, Inc.	Z-Vent II	2SVSAFNS10	2SVSAFNS12	2SVSAFNS14	2SVSAFNS16
*LGB 14-20 are dual-base vent units, requiring two adapters. Verify vent connectors on dual base units for specific sizes needed.					

Table 16 Category II vent system technical data

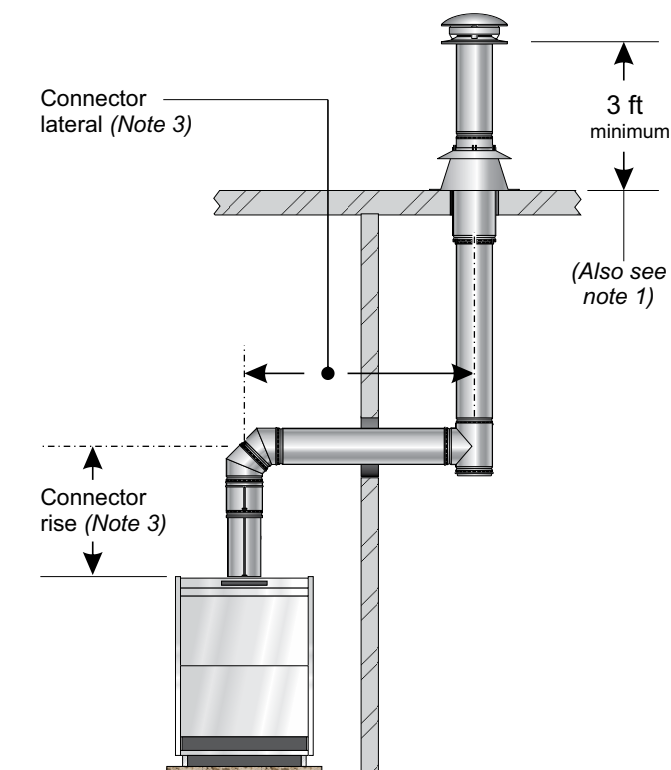
LGB Series 3 Water – Technical Data for Designing a Category II Vent System							
Boiler Size	Input	Stack / Vent Flow Rate*	Minimum Input	Min. Stack/ Vent Flow Rate*	Typical Flue Temperature	Negative Pressure to be maintained @ Vent Connection	Vent Connection and Minimum Vent Diameter
	BTU/hr.	CFM	BTU/hr.	CFM	°F	Inches W.C.	Inches (Qty.)
LGB-4R	350,000	114	175,000	57	255 - 275	-0.001 to -0.1	10 (1)
LGB-4	400,000	131	200,000	65	255 - 275	-0.001 to -0.1	10 (1)
LGB-5	520,000	170	260,000	85	255 - 275	-0.001 to -0.1	12 (1)
LGB-6	650,000	212	325,000	106	255 - 275	-0.001 to -0.1	12 (1)
LGB-7	780,000	255	390,000	127	255 - 275	-0.001 to -0.1	12 (1)
LGB-8	910,000	297	455,000	149	255 - 275	-0.001 to -0.1	14 (1)
LGB-9	1,040,000	340	520,000	170	255 - 275	-0.001 to -0.1	14 (1)
LGB-10	1,170,000	382	585,000	191	255 - 275	-0.001 to -0.1	16 (1)
LGB-11	1,300,000	425	650,000	212	255 - 275	-0.001 to -0.1	16 (1)
LGB-12	1,430,000	467	715,000	234	255 - 275	-0.001 to -0.1	16 (1)
LGB-14	1,690,000	552	845,000	276	255 - 275	-0.001 to -0.1	12 (1) 14 (1)
LGB-16	1,950,000	637	975,000	318	255 - 275	-0.001 to -0.1	14 (2)
LGB-18	2,210,000	722	1,105,000	361	255 - 275	-0.001 to -0.1	14 (1) 16 (1)
LGB-20	2,470,000	807	1,235,000	403	255 - 275	-0.001 to -0.1	16 (2)
*Stack / vent flow rate is based on the unit operating at 8.4% CO ₂ . This value can vary based on the location of the installation and operating conditions.							

Water Boiler Venting - Category II, continued

Figure 52 LGB series 3 water — typical Category II venting

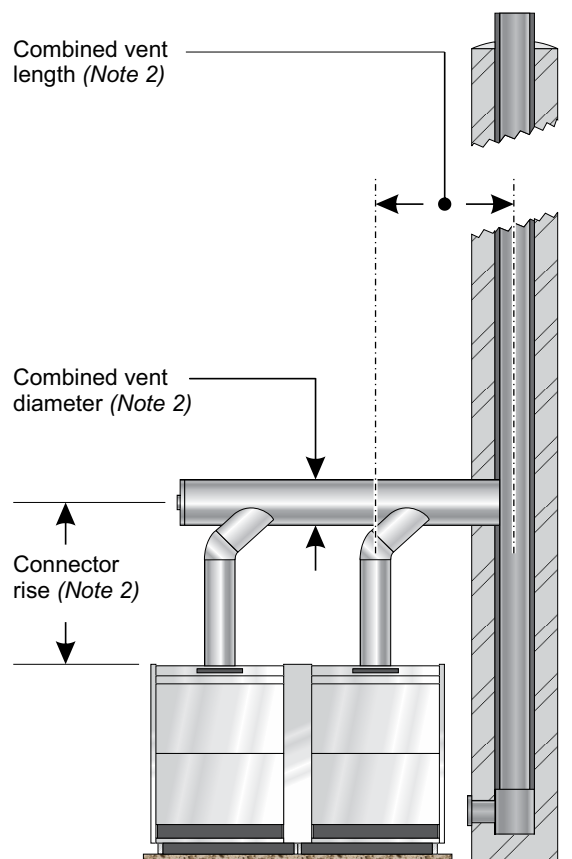


Individual Stub Vents



Offset Vents

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Combined Vents

Notes

1. Minimum 2 feet above any structure within 10 feet.
2. Vent and combined vent materials, length and diameter must be determined using the combined venting tables of the National Fuel Gas Code, ANSI Z223.1—latest edition, or other accepted engineering design method. Use a connector rise as high as possible to improve vent connector capacity.
3. Vent and vent connector material and design must be determined using the individual venting tables of the National Fuel Gas Code, ANSI Z223.1—latest edition, or other accepted engineering design method. Use a connector rise as high as possible to improve vent connector capacity.

Condensate Drain Trap Construction

⚠ WARNING

A condensate drain trap *MUST* be in place to prevent possible flue gas leakage through the condensate drain system. Failure to comply can result in severe personal injury, death, or substantial property damage.

Install a condensate trap onto the boiler. Trap components are not included with the boiler. The damper connector includes a 1/2" female threaded boss for condensate drainage of the vent system.

1. Verify that the threaded boss on the damper connector is pointed directly downwards toward the floor.
2. Install a 1/2" NPT male threaded CPVC connector into the female threaded boss on the damper connector.
3. A standard drain trap design for boilers is shown in [Figure 53](#). Typical trap component sizes are approximately one 1/2" threaded connector, two 1/2" elbows fitting connectors, one 1/2" "T"-fitting connector, and 1/2" pipe – cut to provide at least the minimum trap height, and fit installation needs.
4. Create a minimum trap height of 3.0".
5. Use appropriate connection methods (cement and primer) between CPVC joints to create water-tight connections.
6. Condensate trap must be filled with condensate (or water) before starting the boiler to prevent possible flue gas leakage through the condensate drain system.

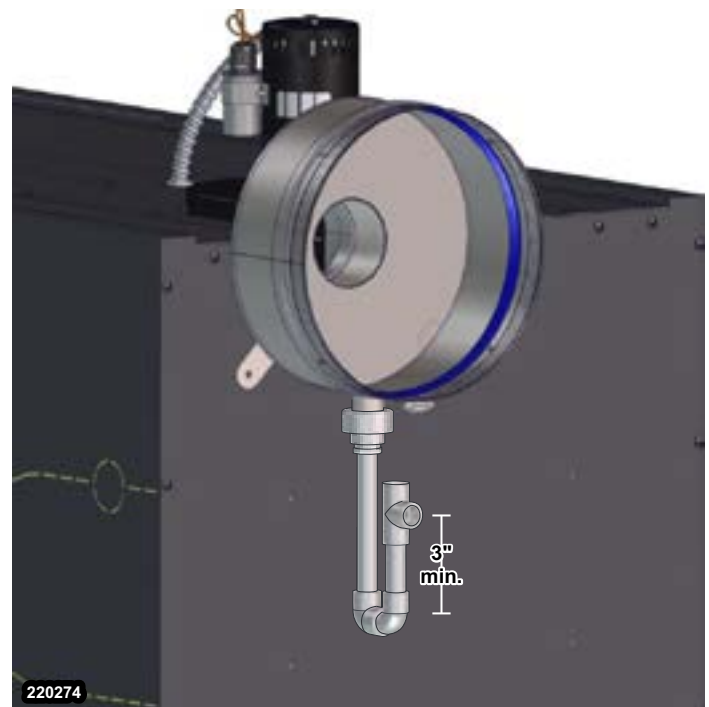
⚠ WARNING

Ensure the condensate trap has condensate or water before starting the boiler. Failure to comply could cause flue gas leakage, which can result in personal injury, death, or substantial property damage.

Condensate drain trap notes:

- Route condensate from the trap to a drain or condensate pump.
- Use materials approved by the authority having jurisdiction.
- In the absence of other authority, CPVC pipe must comply with ASTM D1785, F441 or D2665.

Figure 53 Condensate trap, installed



- Cement and primer must comply with ASTM D2564 or F493.
- For Canada, use CSA or ULC certified CPVC pipe, fittings and cement.
- The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manor, condensate can back up into the boiler, eventually leading to boiler lockout.
- Condensate from the boiler will be slightly acidic (typically with a pH from 3.2 to 4.5). Use a condensate neutralizer if required by local codes.
- If installing a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. Provide an external power source for the condensate pump.

Install Boiler Controls

General Boiler Controls

See [pages 26-28](#) for details on gas train and control board installation.

Water Boiler Controls

1. Install controls in the tappings given in [Figure 13, page 16](#).
2. A LWCO must be installed on any water boiler that is located above radiation level. Other boilers may need a LWCO according to state, local, or territorial codes, or by insurance requirements.
3. If a LWCO is used on a water boiler, use a control designed for water installation. See control tappings in [Figure 13, page 16](#), or install the LWCO in piping above the boiler.
4. Install optional controls per control manufacturer's instructions.

Steam Boiler Controls

1. Install pressure operating and limit controls, gauge glass, and pressure gauge as shown in [Figure 54](#).
2. Install water level controls as shown in [Figure 54](#) and [Table 17](#). If the water level control is not shown in [Table 17](#), install it according to the manufacturer's instructions.
3. Install a 1" blowdown valve at the bottom of each cross.
4. Install relief valves and other items in tappings as specified in [Figure 55, page 52](#).
5. The primary level control piping components are furnished with the boiler.
6. The piping for backup control is provided by the installer.
7. Level controls must be mounted on the same side of the boiler as the equalizer and return piping.

Figure 54 Steam boiler level control locations

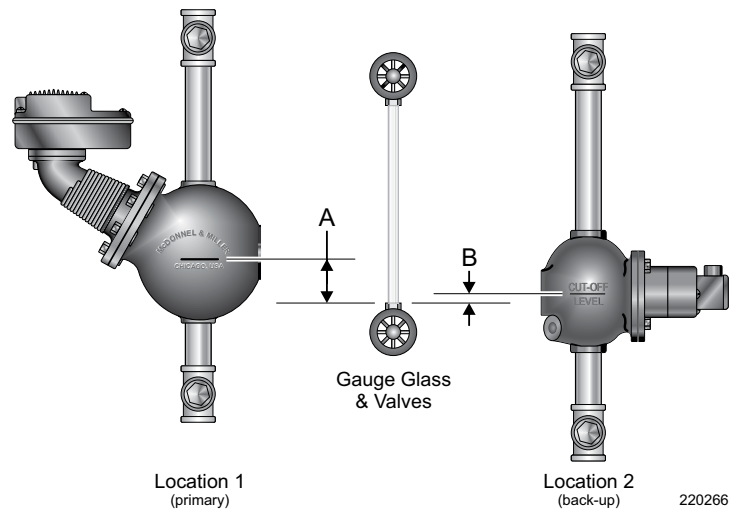
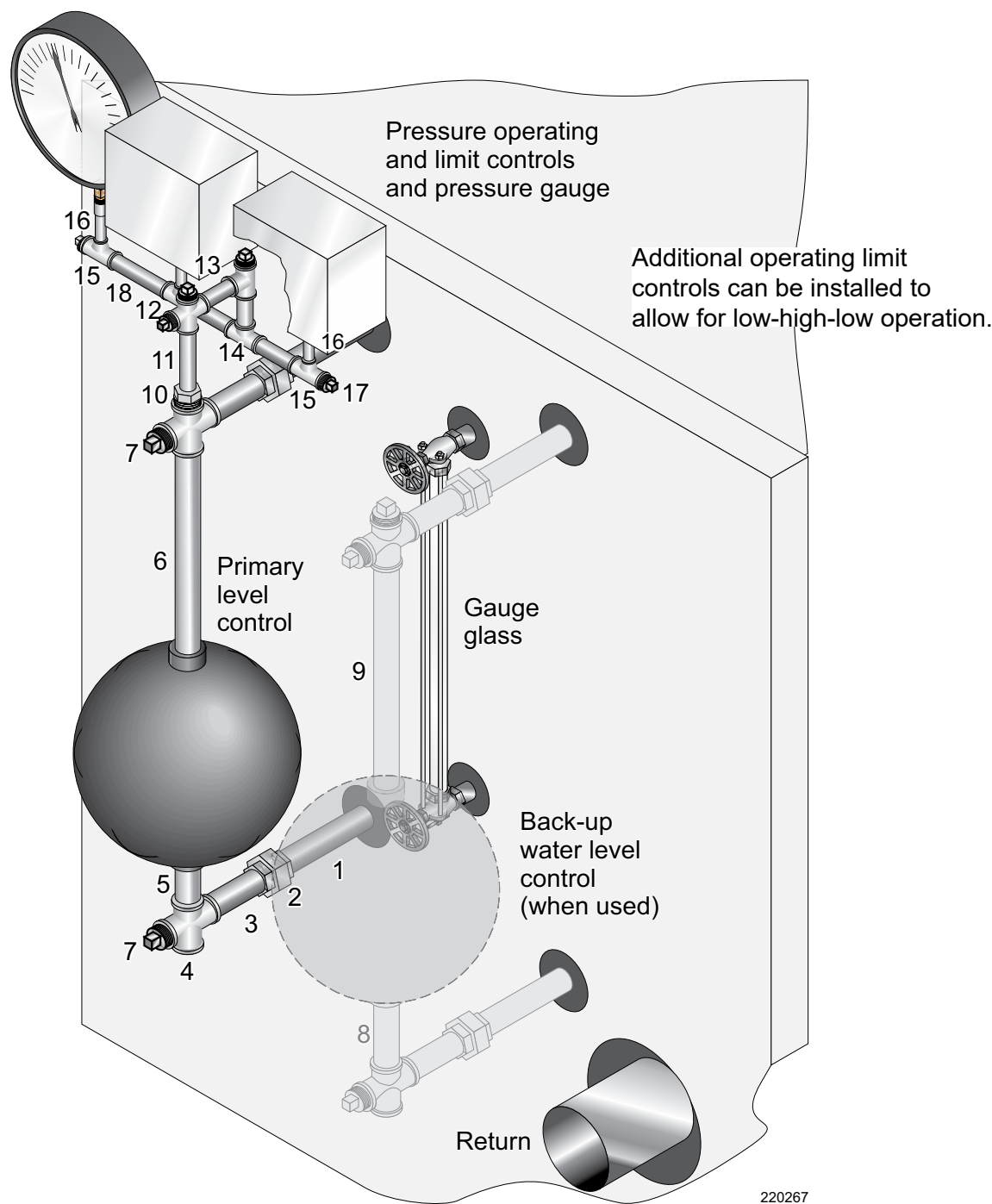


Table 17 Recommended steam boiler water level controls and locations

Location 1	A	Location 2	B
Primary water level control ^[1]	Casting line height above bottom of gauge glass	Primary water level control ^[1]	Casting line height above bottom of gauge glass
61 and 63	1"	—	—
150S-MD, 93 ^{[2] [3]}	2 3/8"	—	—
51-2 and 51-S-2 ^[2]	3 5/8"	—	—
61 and 63	1 1/2"	61 and 63	1/2"
150S-MD, 93 ^{[2] [3]}	2 3/8"	61 and 63	1/2"
51-2 and 51-S-2 ^[2]	3 5/8"	61 and 63	1/2"
<ol style="list-style-type: none"> 1. Other manufacturers' controls providing similar function may be used, if properly located and selected to handle boiler evaporative capacity. Weil-McLain does not recommend using McDonnell & Miller Model 157 or 193. 2. These controls cannot be used as backup water level controls. 3. When a pump control is used with a feed water tank, install a pump control on the boiler and a makeup water feeder on tank. Use a separate low water cutoff on the boiler when backup is needed. Do not install a combination low water cutoff and feeder as backup control on boiler. Feeder will operate before pump control operates. 			

Figure 55 Steam boiler control installation



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Legend - Figure 55

Qty	Item	Qty	Item	Qty	Item
2	1. Nipple, 1" x 4"	2	7. Plug, 1"	4	13. Nipple, .75" x 2"
2	2. Union, 1"	**	8. Nipple, 1" x 3.5"	2	14. Tee, .75"
2	3. Nipple, 1" x 2.5"	**	9. Nipple, 1" x cut to fit	3	15. Tee, .75" x .25"
2	4. Cross, 1"	1	10. Bushing, 1" x .75"	3	16. Nipple, .25" x 1.5"
1	5. Nipple, 1" x 2"	1	11. Nipple, .75" x 4.5"	5	17. Plug, .75"
1*	6. Nipple, 1" x 7"	1	12. Cross, .75"	1	18. Nipple, .75" x 3.5"

* Used only with Model 61 LWCO; cut to fit for other controls.
** Not included



Gas Piping

Gas Supply Piping Connection

⚠WARNING

Use two wrenches when tightening gas piping at the boiler. Use one wrench to prevent the boiler gas line connection from turning. Failure to prevent the boiler gas connection pipe from turning could damage gas line components, which can result in severe personal injury, death, or substantial property damage.

1. Connect the gas supply piping to the boiler. See [Figure 56](#).
 - a. Install a union for servicing when required.
 - b. Install a manual shutoff valve in the gas supply piping within 6' of the boiler.
 - c. In Canada, the manual gas valve must be identified by the installer.
2. Support gas piping with hangers or other devices. Do not support the piping by the boiler or boiler accessories.
3. Use pipe dope compatible with propane gases as natural gas may contain some propane. Apply pipe dope sparingly only to male threads of pipe joints so that it does not block gas flow.

⚠WARNING

Apply pipe dope as detailed in this section. Failure to apply pipe dope properly can result in severe personal injury, death, or substantial property damage.

⚠WARNING

LGB boilers are shipped ready to fire natural gas ONLY and cannot be converted to propane. Failure to comply can result in severe personal injury, death, or substantial property damage.

4. If inlet pressure can exceed 14" W.C. at any time:
 - a. Install a 100% lock up gas pressure regulator as defined by ANSI Z21.80 in the gas supply line. Lock up regulators can have pressure spikes of 5" W.C. or 150% of setting, whichever is greater.
 - b. Adjust the lock up regulator for inlet pressure below 10" W.C. with boiler at minimum input rate.
 - c. Gas pressure can be adjusted higher or lower as needed.

Figure 56 Gas supply piping connection (fittings and gas valve supplied by installer)



⚠WARNING

A lock up regulator must be installed as detailed if inlet pressure can exceed 14" W.C. Failure to comply can result in severe personal injury, death, or substantial property damage.

Check Natural Gas Supply Pressure

1. Purge all air from the gas supply piping.
2. Check the boiler and its gas connection for leaks before placing the boiler in operation.
 - a. Close manual main shutoff valve during any pressure testing at less than 14" W.C.
 - b. Disconnect the boiler gas connection from the gas supply piping during any pressure testing greater than 14" W.C.

⚠WARNING

DO NOT check for gas leaks with an open flame; Gas leaks can result in an explosive atmosphere. Use a soapy water bubble test to check for gas leaks. Failure to eliminate gas leaks can result in severe personal injury, death, or substantial property damage.

Check Natural Gas Supply Pressure, continued

3. Connect a manometer or pressure gauge to the tapping on the gas line elbow by the gas valve.
4. Verify minimum gas pressure when all gas appliances are in operation. The pressure at the gas valve test port is as follows:
 - a. Minimum gas pressure required with gas flowing = 4" W.C.
 - b. DO NOT operate the boiler below 4" gas inlet pressure. Verify during boiler startup while boiler is at high fire.
 - c. Maximum gas pressure is certified to 14" W.C. See [page 53](#) for installation of a 100% lock up regulator as necessary
5. The boiler will derate below 5.75" inlet pressure. See [page 108](#) for the derate table.

Gas Train Diagram

Figure 57 LGB models 4R-5 – gas train diagram

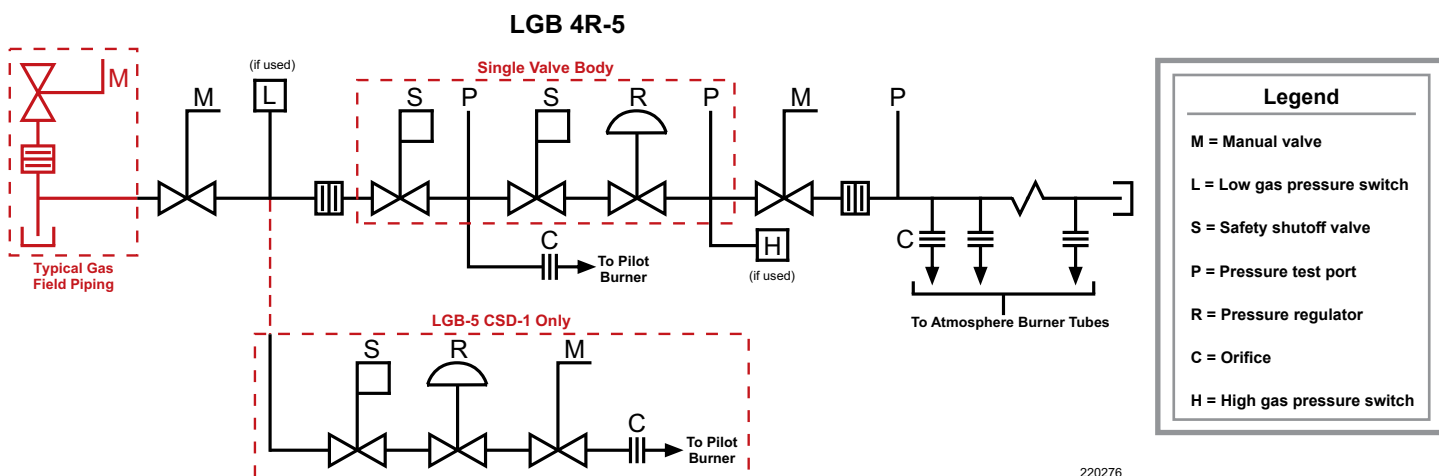
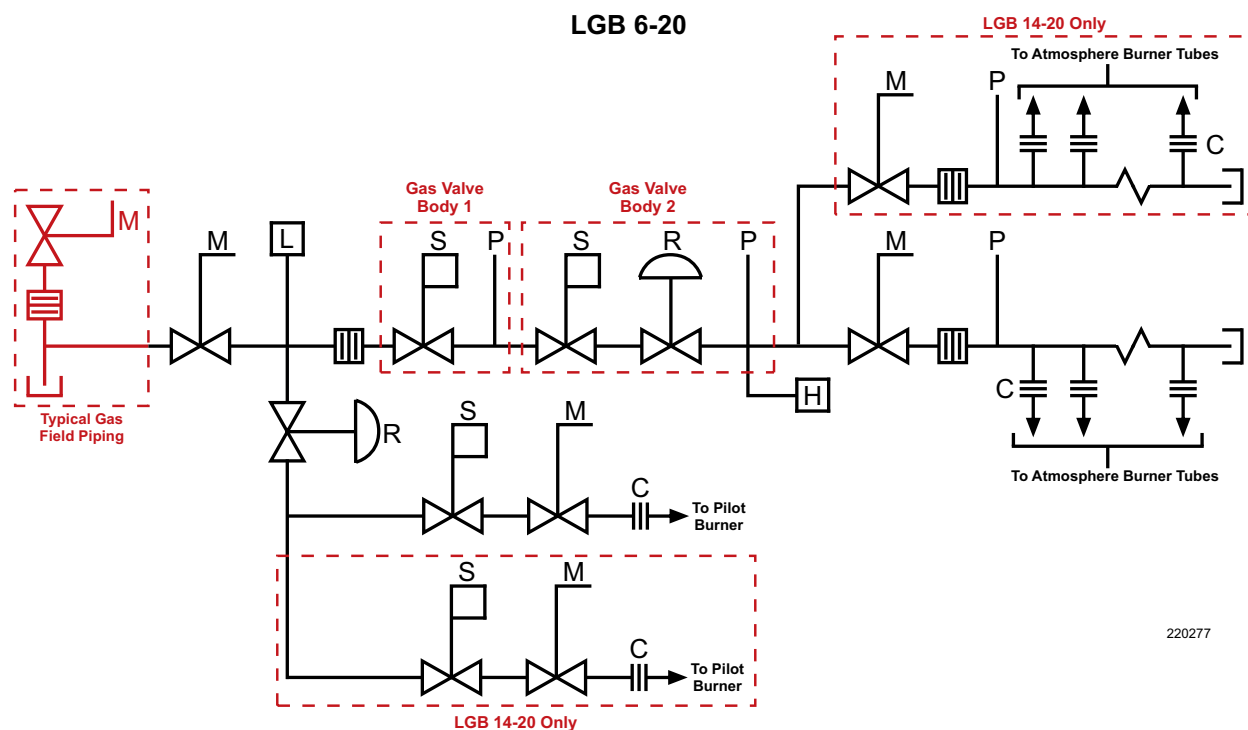


Figure 58 LGB models 6-20 – gas train diagram



Gas Piping, continued

Pipe Sizing for Natural Gas

1. Size gas supply piping from meter outlet to the entrance of the boiler in accordance with [Table 18](#) and [Table 19](#).
2. Divide the total input in Btuh of all connected appliances by 1,000 to obtain approximate cubic feet per hour of natural gas.
 - a. Pipe lengths in [Table 18](#) are equivalent lengths of straight pipe. Use [Table 19](#) to determine equivalent length of fittings. Add the total straight pipe with the equivalent lengths of the fittings to determine the gas pipe total length.
 - b. [Table 18](#) is only for natural gas with specific gravity 0.60, with a pressure drop through the gas piping of 0.30" W.C.
 - c. For additional gas pipe sizing information, refer to ANSI Z223.1/NFPA 54, latest edition. In Canada, refer to the National Gas and Propane Installation Code - CAN/CSA B149.1.

Multiple Boiler Applications - Manifolded Gas Supply Lines

1. Size the gas supply piping as instructed above.
2. Provide a manual shutoff gas valve, union, and sediment trap (minimum 3" below tee) at each boiler as shown in [Figure 56](#), [page 53](#).
3. Ensure the piping is large enough to meet the minimum pressure requirement at each boiler as specified on [page 54](#).

Gas Pressure Switches (CSD-1 only)

There is an optional kit for LGB boilers that includes manual reset high and low gas pressure switches. These switches are factory set and should remain at the following settings.

High gas pressure switch: 5" W.C.

Low gas pressure switch: 2" W.C.

Table 18 Pipe capacity for natural gas

Pipe Size	Pipe Length,* in feet (natural gas capacities listed in MBH)							
	Specific gravity 0.60 @ pressure loss of 0.30" W.C.							
	10	20	30	40	50	75	100	150
1.25"	1,050	730	590	500	440	360	305	250
1.50"	1,600	1,100	890	760	670	545	460	380
2.00"	3,050	2,100	1,650	1,450	1,270	1,020	870	710
2.50"	4,800	3,300	2,700	2,300	2,000	1,650	1,400	1,130
3.00"	8,500	5,900	4,700	4,100	3,600	2,900	2,500	2,000
4.00"	17,500	12,000	9,700	8,300	7,400	6,000	5,100	4,100
*Include measured length of gas supply piping and allowance in feet for number and size of fittings.								

Table 19 Equivalent lengths for gas line fittings

Pipe Size	Equivalent Length (feet)	
	90° Elbow	Tee
1.25"	3.45	6.90
1.50"	4.02	8.04
2.00"	5.17	10.30
2.50"	6.16	12.30
3.00"	7.67	15.30
4.00"	10.10	20.20

SECTION 3

Electrical

This section is intended to provide wiring and zoning instructions for qualified installers and service contractors.

Section Contents

Electrical - General	56
Field Wiring	58

Electrical - General

⚠ WARNING

Turn off electrical power supply at the service entrance panel before making any electrical connections. Failure to turn off the electrical power can cause electric shock, which can result in severe personal injury or death.

NOTICE

Do not use 24V from a transformer to power any external devices that are not listed in this manual.

⚠ WARNING

Wiring errors can cause improper and dangerous operation. Label all wires to ensure proper connection. Never jumper (bypass) any device except for momentary testing. Failure to comply can result in severe personal injury, death, or substantial property damage.

The installation must comply with the National Electrical Code and any other national, state, provincial, or local codes and regulations. In Canada, comply with Canadian Electrical Code Part 1 - CSA C22.1, and any other local codes.

Wiring must be N.E.C. Class 1. If original wiring supplied with the boiler must be replaced, only equivalently rated wire shall be used. The boiler must be electrically grounded as required by the National Electrical Code - ANSI/NFPA 70, latest edition, or the Canadian Electrical Code Part 1 - CSA C22.1.

The boiler must be electrically bonded to ground when installed in accordance with the requirements of the authority having jurisdiction. In the absence of such requirements, comply with the requirements in the National Electrical Code - ANSI/NFPA 70, latest edition, or the Canadian Electrical Code Part 1 - CSA C22.1.

Electrical - General, continued

Power Requirements

- The LGB boilers are manufactured for 120 VAC, 60 Hz electrical service.
- The total operating amperage indicated on the nameplate requires:
 - LGB 4R, 4-12: Less than 12 amps at full load.
 - LGB 14-20: 23 amps at full load.
- Before starting the boiler, ensure the proper electrical service is connected to the boiler.
- An external electrical disconnect and overload protection (not supplied with the boiler) **are required**.

The electrical service to the boiler must be installed and grounded in accordance with local codes. In the absence of such requirements, comply with National Electrical Codes, ANSI/NFPA No. 70, latest edition in the U.S. In Canada, comply with the Canadian Electrical Code, Part 1, CSA C22.1, latest edition. The installed conduit must not block any of the boiler's openings and must allow space to open the front door.

Power Supply Connections

The LGB boilers feature three dedicated power terminals on the High Voltage terminal block for the 120 VAC, 60 Hz electrical supply. See [Figure 59](#) for the location of the Low Voltage and High Voltage terminal blocks.

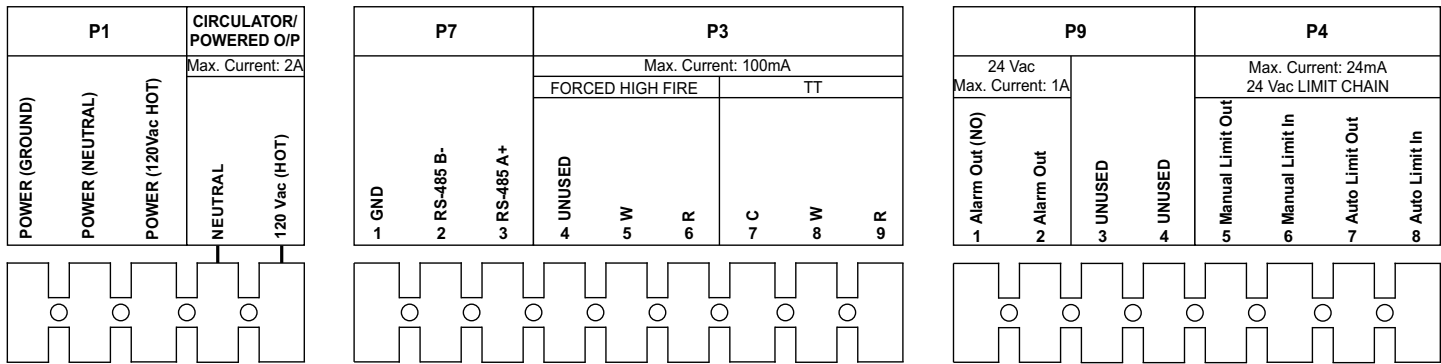
Figure 59 Terminal block locations



Field Wiring

The figure below shows the terminal block wiring used in this section. Also refer to the schematic and ladder diagrams in [Figure 61, page 60](#) and [Figure 62, page 62](#).

Figure 60 Terminal block wiring section



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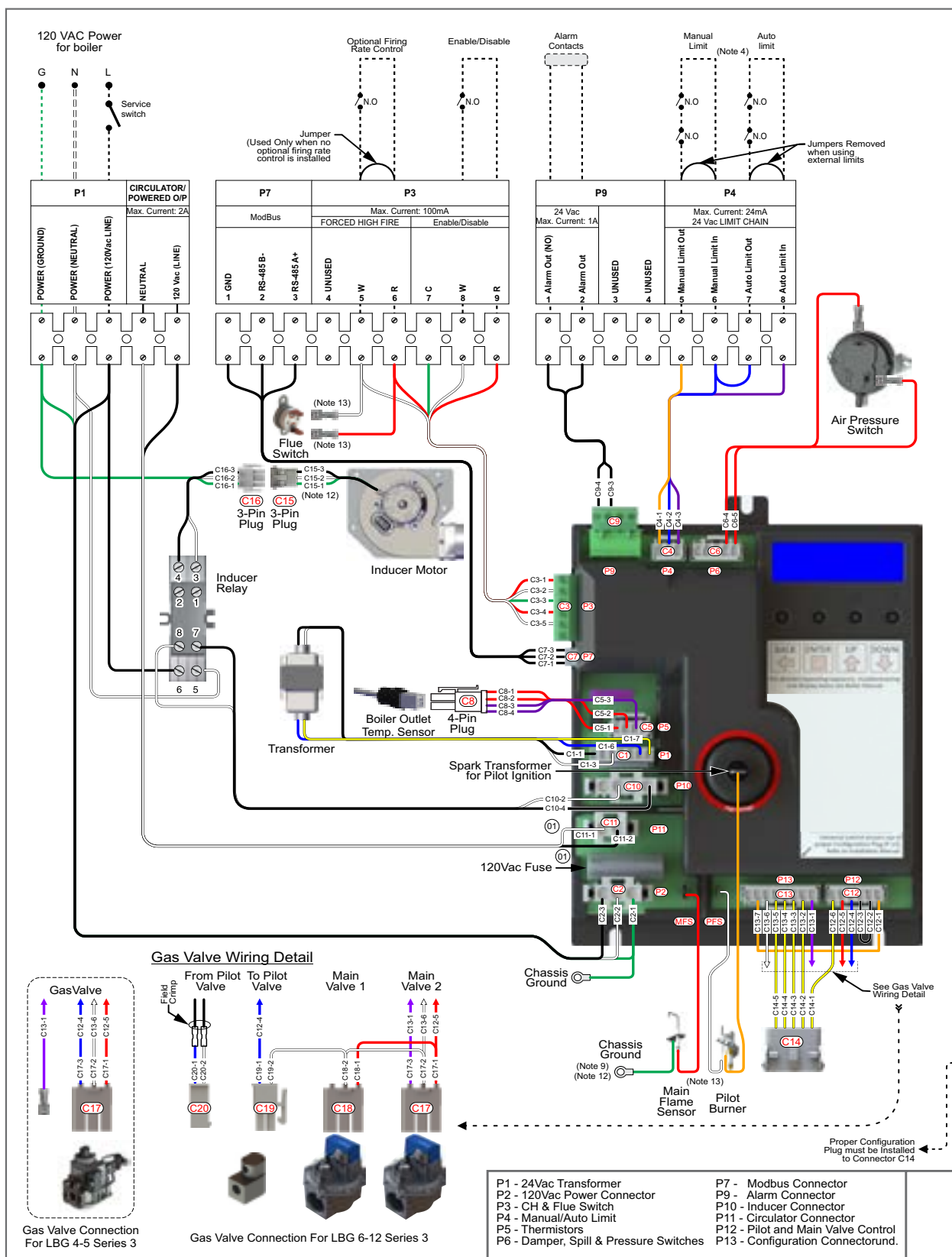
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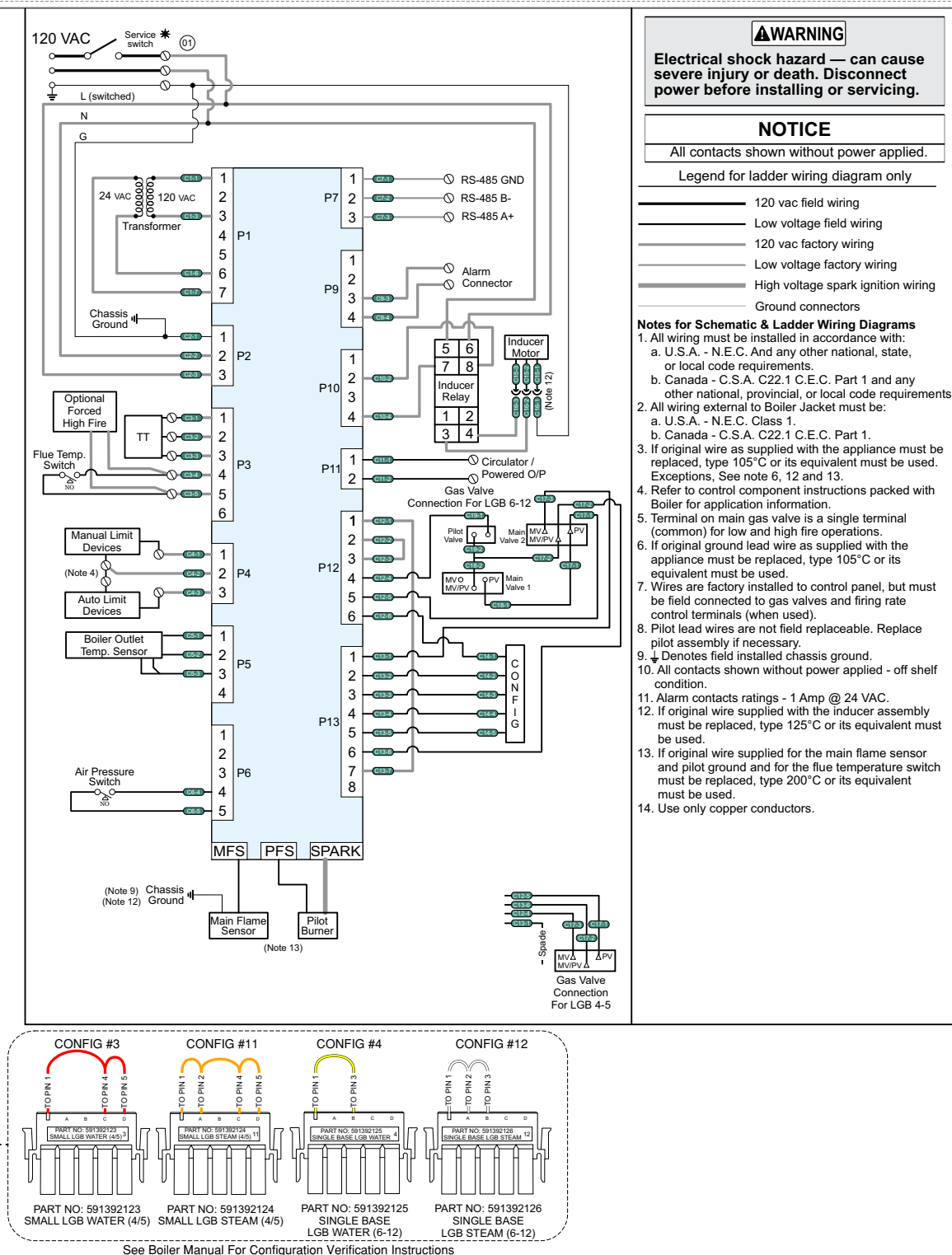
Field Wiring, continued

LGB 4R, 4-12 - Single Base Schematic and Ladder Diagrams

Figure 61 Schematic and ladder wiring diagrams for LGB single base boilers (continued on next page)



LGB 4R, 4-12 - Single Base Schematic and Ladder Diagrams, continued



LGB Commercial Boiler
Single Base Series 3

Schematic Wiring & Ladder Diagram

Field wiring Factory wiring See ladder wiring diagram for notes



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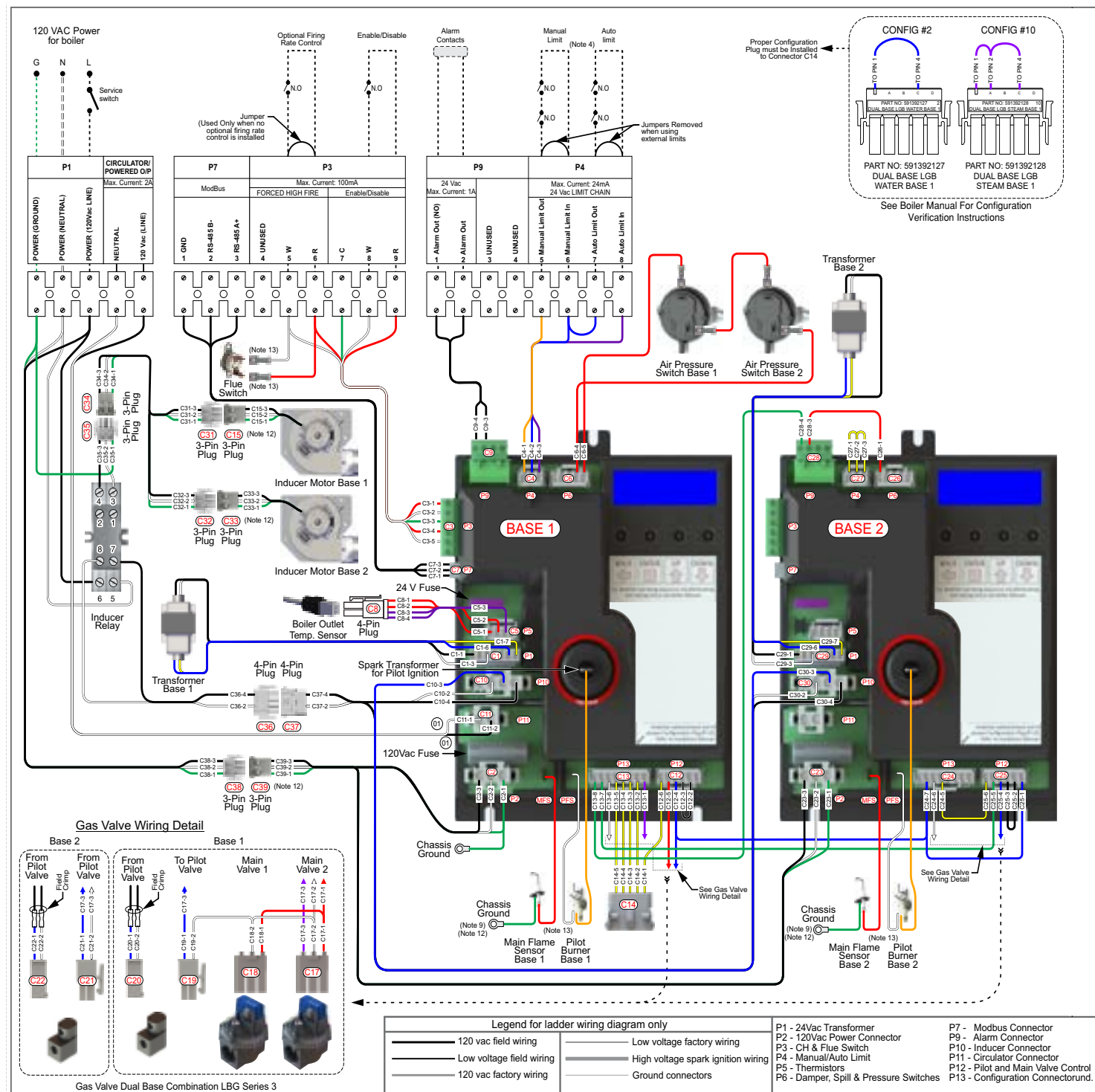
Part Number 550-141-198/1222



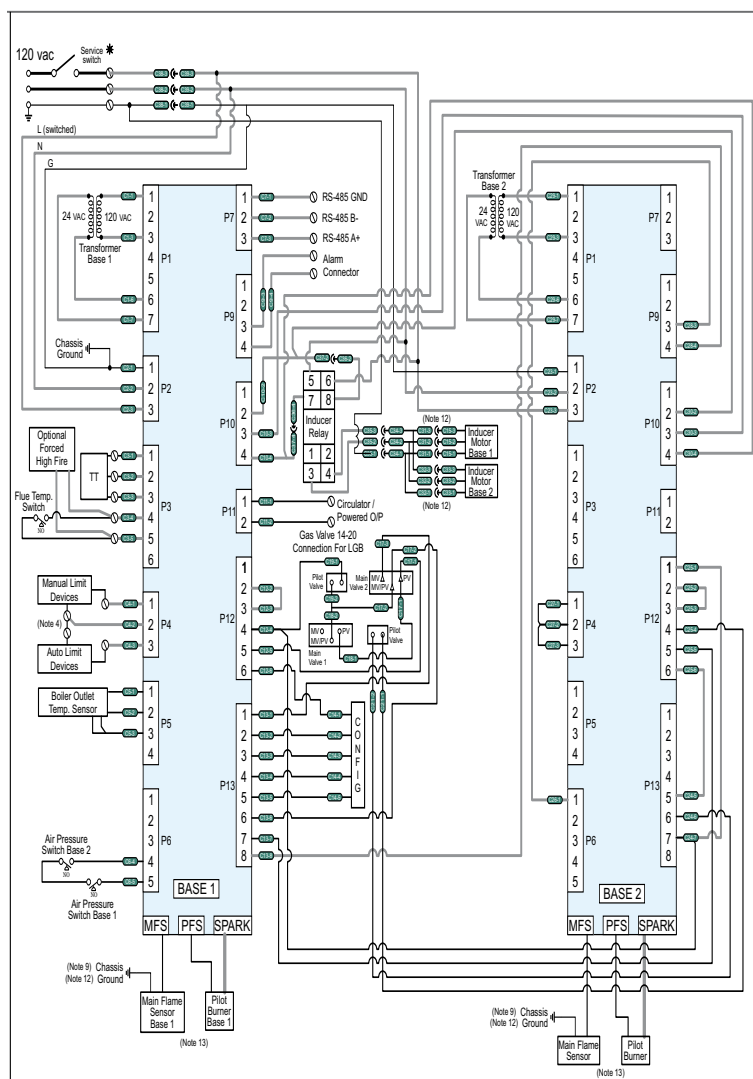
Field Wiring, continued

LGB 14-20 - Dual Base Schematic and Ladder Diagrams

Figure 62 Schematic and ladder wiring diagrams for LGB dual base boilers (continued on next page)



LGB 14-20 - Dual Base Schematic and Ladder Diagrams, continued

**WARNING**

Electrical shock hazard — can cause severe injury or death. Disconnect power before installing or servicing.

NOTICE

All contacts shown without power applied.

Notes for Schematic & Ladder Wiring Diagrams
 1. All wiring must be installed in accordance with:
 a. U.S.A. - N.E.C. And any other national, state, or local code requirements.
 b. Canada - C.S.A. C22.1 C.E.C. Part 1 and any other national, provincial, or local code requirements.

2. All wiring external to Boiler Jacket must be:

- U.S.A. - N.E.C. Class 1.
 - Canada - C.S.A. C22.1 C.E.C. Part 1.
3. If original wire as supplied with the appliance must be replaced, type 105°C or its equivalent must be used. Exceptions, See Note 6, 12 and 13.

4. Refer to control component instructions packed with Boiler for application information.

5. Terminal on main gas valve is a single terminal (common) for low and high fire operations.

6. If original ground lead wire as supplied with the appliance must be replaced, type 105°C or its equivalent must be used.

7. Wires are factory installed to control panel, but must be field connected to gas valves and firing rate control terminals (when used).

8. Pilot lead wires are not field replaceable. Replace pilot assembly if necessary.

9. ⚡ Denotes field installed chassis ground.

10. All contacts shown without power applied - off shelf condition.

11. Alarm contacts ratings - 1 Amp @ 24 VAC.

12. If original wire supplied with the inducer assembly must be replaced, type 125°C or its equivalent must be used.

13. If original wire supplied for the main flame sensor and pilot and for the flue temperature switch must be replaced, type 200°C or its equivalent must be used.

14. Use only copper conductors.

LGB Commercial Boiler
Dual Base Series 3

Schematic Wiring & Ladder Diagram

Field wiring Factory wiring See ladder wiring diagram for notes

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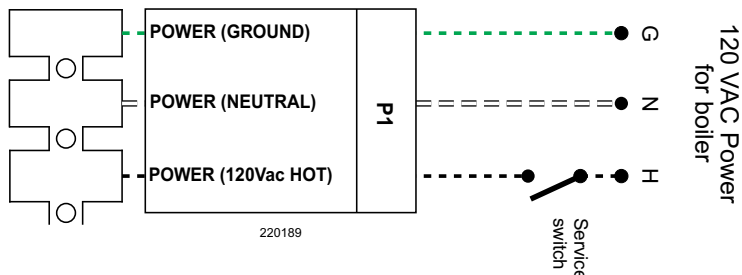
Weil-McLain • 500 Boline St. • Madison City, TN 37050-2288

Part Number 550-141-199/1222

Field Wiring, continued

A. Power Supply — *REQUIRED*

- **POWER (GROUND)** – Connect the ground lead of the 120 Vac, 60HZ electrical service to the POWER (GROUND) terminal.
- **POWER (NEUTRAL)** – Connect the neutral lead of the 120 Vac, 60HZ electrical service to the POWER (NEUTRAL) terminal.
- **POWER (120 Vac HOT)** – Connect the 120 Vac Hot lead of the 120 Vac 60HZ electrical service to the POWER (120 Vac HOT) terminal.

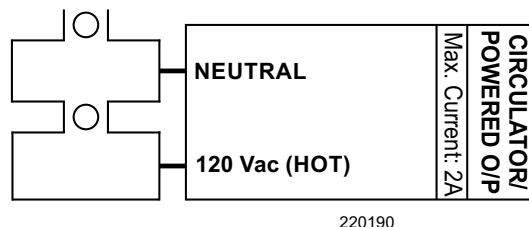


B. Circulator / Powered Outlet— *As needed for systems*

- Circulator / Powered Outlet can be used to provide 120 Vac to a circulator or an auxiliary item that may be energized during a call for heat.

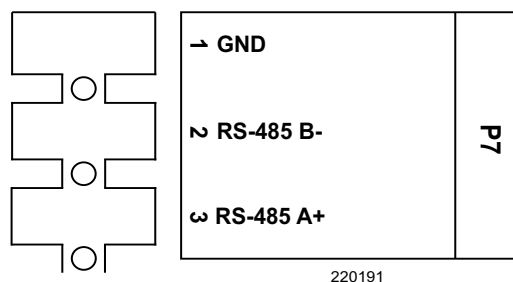
NOTICE

Powered output is limited to 2 Amps.



C. MODBUS and Shield – *As needed for systems*

- P7 can be used to integrate the boiler with a Building Management System, Protocol Converter, or other device capable of RS-485 2 wire MODBUS® communication.
- The GND, RS-485 B-, and RS-485 A+ terminals are reserved for MODBUS, GND providing the connection for shield or ground.

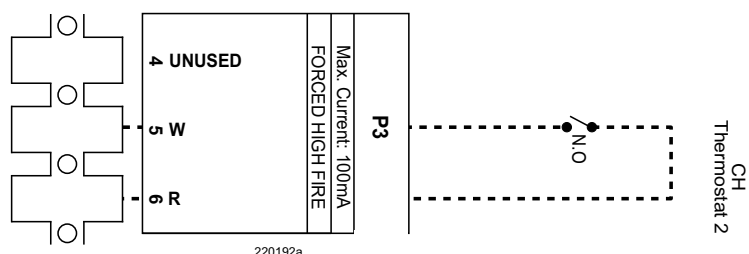


D. Forced High Fire – *As needed for systems*

- P3 Forced High Fire is used to connect the leads to control forced high fire operation.
- Water Boilers: Boiler control has an integrated firing rate control.
- Steam Boilers: Use an additional Steam Pressure Limit (not provided) as a firing rate control. When contact is closed, the boiler will fire at maximum rate. When contact opens, the boiler will fire at reduced rate.

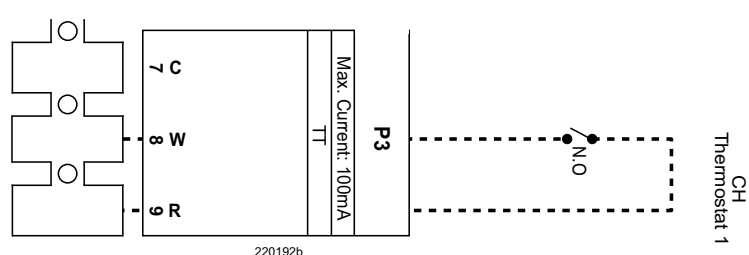
NOTICE

24 Vac, maximum current of 100 mA.

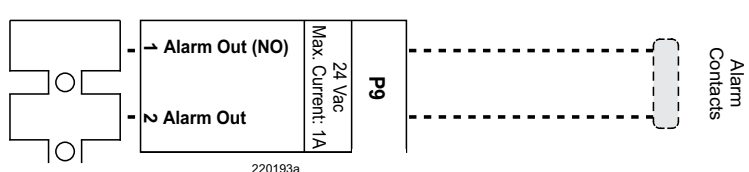


E. Enable/Disable (CH TT Input) – As needed for systems

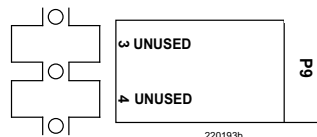
- P3 TT is used to control the central heat operation. Contact closure between W and R enables central heat operation. An open circuit disables central heat operation.

**F. Alarm Contacts – As needed for systems**

- P9 Alarm Contacts is used to connect an alarm to the boiler. 24 Vac power with a maximum current load of 1 Amp.

**G. Spare Analog Input**

- Not used. Reserved for future use.

**H. Manual and Auto Limits – As needed for systems**

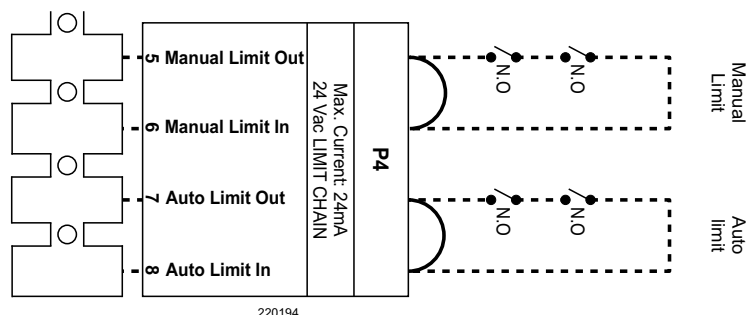
- P4 is used to connect external limit devices.
- Manual Limit In/Out: These connections are for safety devices that are required to have a manual reset before the unit will be allowed to operate following a lockout condition.
- Auto Limit In/Out: These connections are for operational devices that would cause the unit to shut down and automatically restart once the condition passed. Examples of operational devices include a Water Temperature Operating Control or a Steam Pressure Limit.

⚠ WARNING

When wiring devices, remove the jumper from the terminals that the device is being wired into. Failure to comply can result in severe personal injury, death, or substantial property damage.

NOTICE

All devices should be 24 Vac rated with a combined current load not to exceed 24 mA.



SECTION 4

Operation

This section is intended to provide instructions for control operation and boiler startup procedures.

Section Contents

Control Operation.	66
Startup - Fill the System	74
Startup - Final Checks	77
Startup Procedure	80

Control Operation

User Interface

The user interface is comprised of a two-line by sixteen-character display and four pushbuttons. See [Figure 63](#). The buttons are immediately below the display. These buttons allow the user to navigate a list of menu items and edit the associated parameter.

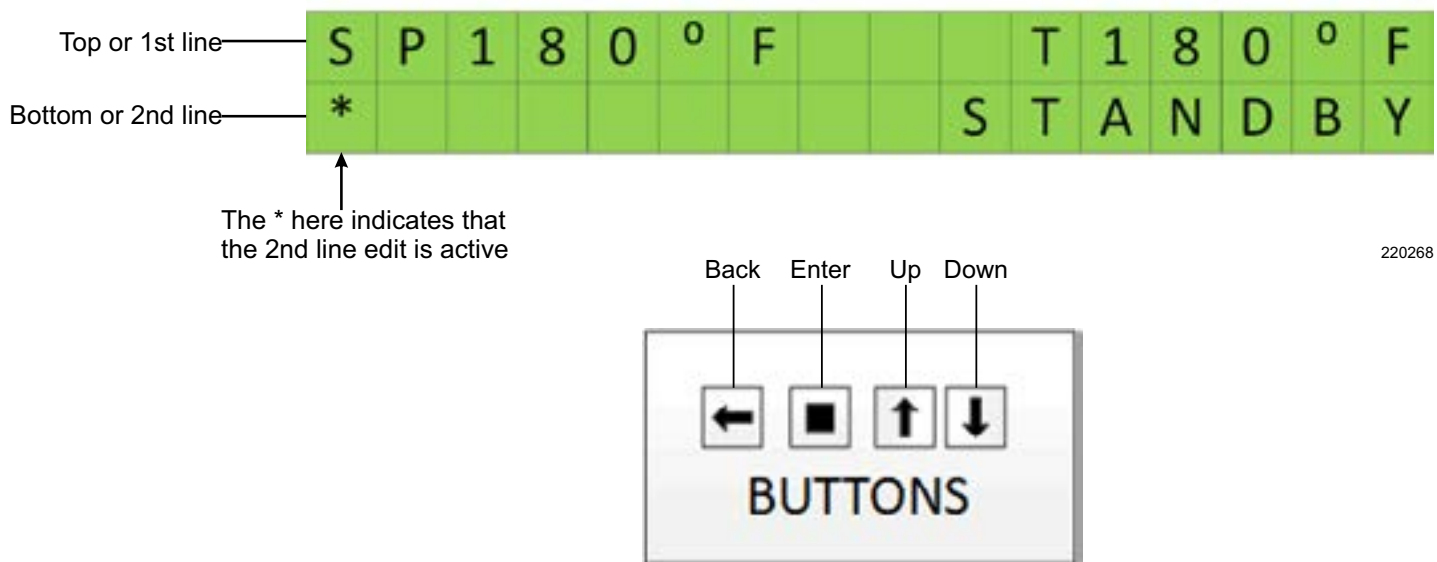
Display and Keypad

The display shown in [Figure 63](#) is the default display. It is shown unless a user has pressed a button, or a fault occurs. After 20 minutes of no button activity, the display will revert back to this default screen regardless of the last menu item displayed.

The control display indicates Initialization/Fault/Operational status through its use of backlight colors.

1. A persistent blue backlight indicates that initialization is taking place and some user input may be necessary to allow initialization to complete.
2. A green backlight, like what's shown in [Figure 63](#), means the control is running without any faults.
3. A red backlight indicates a fault has occurred. Although a fault must be cleared before normal operation can proceed, the Advanced Menu can be used while in fault to identify the current state of parameters which may be involved in this fault condition.

Figure 63 User interface



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Control Operation, continued

Menu Structure

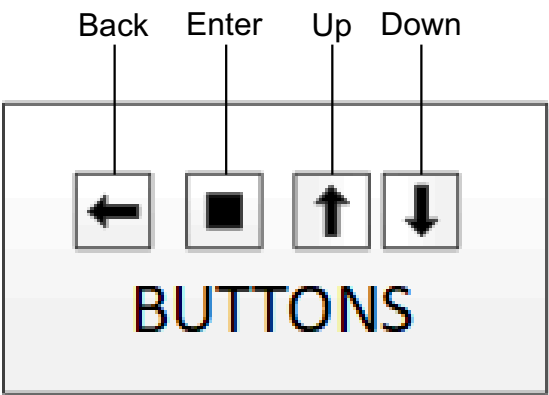
Figure 64 depicts the functional flow and operation of the 1135-400 menu structure. The default User Menu is shown on the left, and the Advanced Menu is on the right.

The default menu is the always accessible user menu which allows display and modification of the CH and Backlight Intensity settings. Figure 64 shows the sequence of operation while transitioning the menu structure.

Installers use the Advanced Menu to set parameters that are necessary for installing a new boiler. The Advanced Menu also contains the DIAGNOSTICS menu, allowing near real-time display of important system parameters; this feature is useful when attempting to quickly diagnose system problems.

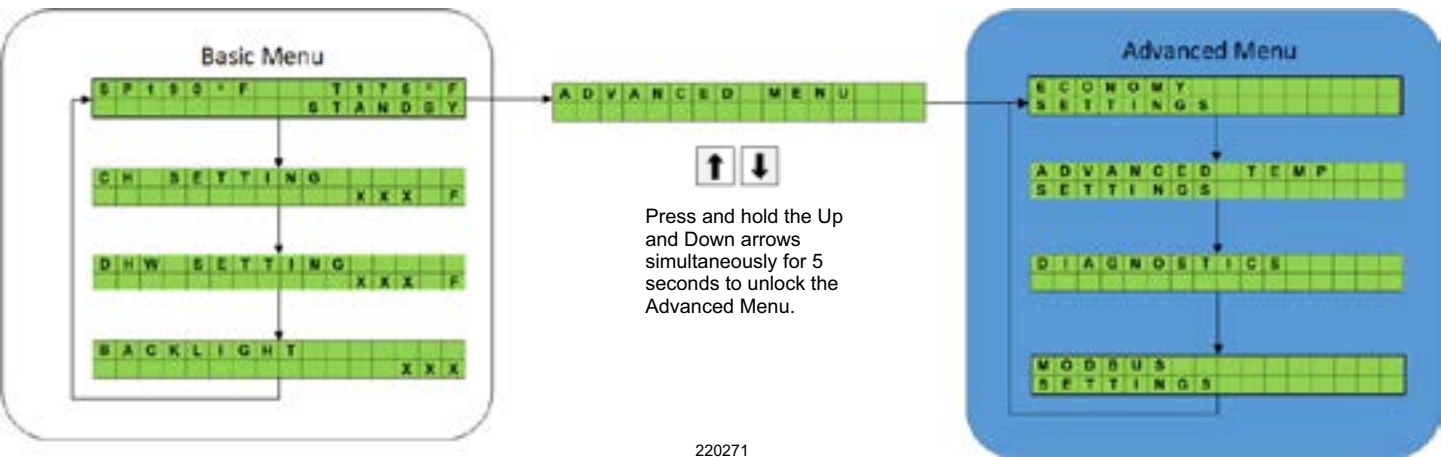
The default display will be active after control initialization. See Figure 63, page 66. As shown by default, the top, left line of the display shows the Central Heat target setting. The current outlet temperature of the boiler is displayed in the top, right line. The second line of the control displays the current state of operation, which is Standby in the image.

Figure 65 User interface buttons



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Figure 64 Boiler control menu structure



User Menu

By default, the control will start in the User Menu displaying the default temperature/status display.

1. Pressing any button will turn on the backlight, which will turn off again after 20 minutes of no button activity.
2. The next press will advance you to a parameter item. For example, pressing the Down button twice will take you to the Central Heat setting item. The top line will say CH TEMP SETTING while the second row will display a temperature.
3. Pressing the Enter button will edit the parameter. The control will indicate edit mode by placing an asterisk (*) on the left of the second line as shown in [Figure 63, page 66](#).
4. The Up and Down buttons will now affect the parameter value displayed to the right on the second line. Pressing and releasing these buttons will increment or decrement the value shown.
5. Press the Enter button to save the new value you have chosen. The asterisk will disappear from the bottom line, and the new value will be saved.
6. If the Left button is pressed before the Enter button, the edit function ends, the asterisk will disappear, and the display will return to showing the original parameter value and return you to the parameter selection mode.

When in a parameter display, pressing the Down button will move the display to the next parameter in the menu. Pressing the UP button will move the display back to the previous parameter item. Editing and saving parameter values will operate the same as before.

When displaying the last item in a menu, the Down button will wrap around to the top of the menu and display the Default Temperature/Status screen item. User Menu operation will continue as before.

Advanced Menu

The Advanced Menu can be accessed when the User Menu is not in edit mode.

To access the Advanced Menu, press and hold the Up and Down buttons simultaneously for 5 seconds. The display will change to read "Advanced Menu." After a few seconds, the display will proceed to the first menu item, "Advanced Temperature Settings."


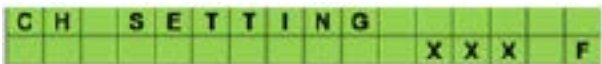

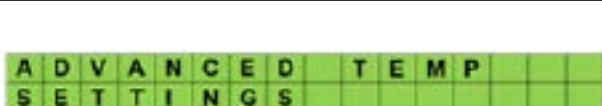
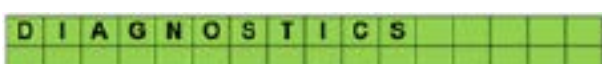

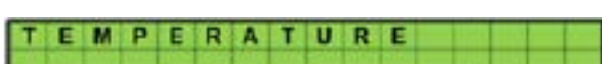
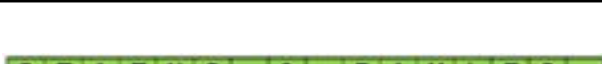

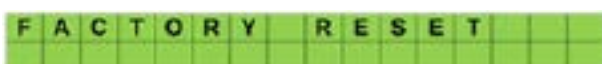
The Advanced Menu provides access to submenus, which allow for setup, control, and diagnosis of advanced boiler functions: Advanced Temperature, Diagnostics and Modbus settings as well as Factory Reset.

1. Advanced Temperature – This menu allows an operator to change the value of specific parameters, such as limits and differentials.
2. Diagnostic – This submenu provides access to further submenus, which show the states and values of sensors and various operating parameters.
 - a. Inputs and Outputs
 - b. Temperature
 - c. LWCO
 - d. Status & Faults
3. The Modbus submenu allows you to set communications parameters for Modbus communications such as:
 - a. Baud Rate – Default "38400"
 - b. Parity – Defaults "NONE"
 - c. Stop Bits – Defaults "2"
 - d. Communications status (Active/Inactive)

All of these Advanced Menus are navigated in exactly the same manner as is done in the default User menu. To go back to the Default User Menus, repeatedly press the Back arrow until you see the Default Temperature/Status screen item.

Control Operation, continued

Display Screens

	<p>This is the main screen on the control which display. This shows the setpoint temperature, the current temperature, and the current status of the boiler</p>
	<p>This setting is on 'basic' menu of the control. This setting allows the setpoint temperature to be changed</p>
	<p>This is a screen which is displayed momentarily after the control enters the advanced menu.</p>
	<p>This is a sub menu of the advanced menu section the following items are available under this sub-menu:</p> <ul style="list-style-type: none"> • Start-Up On Diff • HF On Diff • HF Off Diff • High Temp Limit
	<p>This is a sub menu of the advanced menu section the following items are available under this sub-menu:</p> <ul style="list-style-type: none"> • Inputs & Outputs • Temperature
	<p>This is a sub menu of the diagnostics section the following items are available under this sub-menu:</p> <ul style="list-style-type: none"> • Alarm Status • Circulator Status • Flame Sense Values • Inducer Status • Pilot Valve status • Main Valve status • High-Fire Status • Air Pressure Switch Status • Auto Limit Status • Manual Limit Status
	<p>This is a sub menu of the diagnostics section the following items are available under this sub-menu:</p> <ul style="list-style-type: none"> • Boiler Out 1 • Boiler Out 2
	<p>This is a sub menu of the advanced menu section the following items are available under this sub-menu:</p> <ul style="list-style-type: none"> • Boiler status • CH input Status • Lockout/ Fault • Model information
	<p>This is a sub menu of the advanced menu section the following items are available under this sub-menu:</p> <ul style="list-style-type: none"> • Modbus Status • Modbus Address • Modbus Baud Rate • Modbus Parity • Modbus Stop Bits • Modbus Activity
	<p>This is a setting under the advanced menu, which allows the control to be reset to factory settings.</p>

Control Settings

Table 20 Control menus and settings information

Basic menu			
Menu / Item	Description	Default	Setting Range
Setpoint & Boiler Out Temp –Water Boiler Only–	This shows the current CH Setpoint (SP), current Boiler Out Temperature (T), and current boiler status.	NA	NA
Boiler Status –Steam Boiler Only–	Displays the current boiler status.	NA	NA
Ch Setting –Water Boiler Only–	CH setting is the Operating Limit for the control. The boiler will shut down when reaching this temperature.	180°F	140 - 220°F
Backlight	This will change the brightness of the backlight on the LCD display.	5	1 - 10
Advanced Menu			
Advanced Temp Settings –Water Boiler Only–	Description	Default	Setting Range
Start-Up On Diff	This differential controls when the burner will be turned back on after cycling off after achieving the CH Setpoint.	30°F	1 - 50°F
HF On-Diff	When used, this differential controls when the burner will transition back from reduced rate to High Fire.	15°F	0 - 50°F
HF Off-Diff	Controls timing for reducing the burner firing rate before achieving the CH Setpoint.	10°F	0 - 15°F
High Temp Limit	This is the setting for the Manual Reset High Temperature Limit on water boilers.	240°F	50 - 240°F
Diagnostics			
Inputs & Outputs	Description	Default	Range
Alarm Status	Shows the status of the alarm	—	ACTIVE / INACTIVE
Circulator	Shows the status of the circulator output	—	ON / OFF
Flame Sense	This shows the value of the flame sense, Pilot for LGB 4R, 4, and 5, Pilot and Main for LGB 6 - 12, and Pilot and Main for Base 1 on LGB 14 - 20	—	0 - 60
Inducer Status	Shows the status of the Inducer output	—	ON / OFF
Pilot Valve	Shows the status of the Pilot Valve output	—	ON / OFF
Main Valve	Shows the status of the Main Valve output	—	ON / OFF
High-Fire	Shows the status of the High-Fire Valve output	—	ON / OFF
Air Pressure SW	Shows the status of the Air Pressure Switch input	—	OPEN / CLOSED
Auto Limit	Shows the status of the Auto Limit Switch	—	OPEN / CLOSED
Manual Limit	Shows the status of the Manual Limit Switch	—	OPEN / CLOSED
Temperature –Water Boiler Only–	Description	Default	Range
Boiler Out 1	Shows the value of temperature sensor 1 at the boiler out sensor	—	—
Boiler Out 2	Shows the value of temperature sensor 2 at the boiler out sensor	—	—
Status & Faults	Description	Default	Range
Boiler Status	This shows the status of the boiler.	—	—
CH Input Status	This shows the status of the call for heat input.	—	—
Lockout/Fault	Two menu items showing current and previous fault.	—	—
Model	Shows the control board model and firmware version	—	—
Modbus Settings	Description	Default	Setting Range
Modbus Status	Shows the status of modbus system	Enable	Enable / Disable
Modbus Address	Change the modbus address of this control	249	0 - 255
Modbus Baud Rate	Speed of communication channel.	38400	4800 / 9600 / 19200 / 38400
Modbus Parity	Change the modbus parity setting of this control	none	—
Modbus Stop Bits	Allow time for the reception and processing of current byte and preparation for next byte.	2	1 / 2
Modbus Activity	Shows whether a modbus signal is sent or received	—	—
Factory Reset	Reset the firmware on the control to factory condition.	—	—

Control Operation, continued

Sequence of Operations

The 1135-400 control can be used in single base LGB configurations, where only one control is required, and in dual base LGB configurations where two controls are required. One control is used to control and monitor the ignition process for each half of the boiler. Ignition is initiated with a call for heat applied to the TT1 input of Base 1 by applying the 24 Vac from P3-1 "C" to P3-2 "W".

In a dual base configuration, each 1135-400 has control over operation of its own pilot valve, pilot ignition, pilot flame sense, and main flame sense. Base 1 alone has control over the main gas valve and must receive a signal from Base 2 that the Base 2 pilot is properly proven before it can enable the main gas valve to turn on.

⚠ WARNING

If any manual reset limit device trips, DO NOT reset without determining and correcting the cause. Never attempt to bypass a safety limit device. Attempting to operate a boiler without diagnosing the cause of failure can cause unsafe operation, which can result in personal injury, death, or substantial property damage.

Ignition Process for Single Bases

LGB models 4R, 4, and 5

1. After a call for heat, the control will immediately start the Inducer and run it for 45 seconds and display "Pre Purge"
2. When the control completes the Pre Purge, it energizes the Pilot Valve. The control begins the spark Ignition sequence and starts a 15-second Pilot Flame-Sense timer.
3. As the ignition sequence proceeds, and the pilot flame lights, the control monitors Flame sense inputs to verify the Pilot is properly lit.
 - a. In the Advanced Menu under Diagnostics > Inputs & Outputs > Flame Sense, one can read the flame sense status of the Pilot burner as measured by the control.
 - b. A value of 60 is considered to be 'No Flame'.
 - c. A good quality flame is expected to show a value of less than 60, with higher quality flames showing lower values.
4. If the control's Pilot Flame Sense timer expires before the control sees an acceptable pilot flame sense value, it will remove power from the Pilot valve, start an Inter-Purge, and determine whether a restart is possible.
5. If the control successfully completes its pilot ignition process, it will energize the Main Gas Valve.
6. If flame sense is not proven within the Control's verification interval, the control will turn off both the main and pilot gas valves.
7. Only one attempt to relight is allowed. The control will attempt to follow the procedure listed above. If burners fail to successfully light on the first retry, the control will display Ignition Fault and go into a manual lockout. Removing a manual lockout condition requires User Input through the Display menu.
8. Once the burners are operating in steady heat, high fire can be achieved through the activation of the secondary thermostat control input on connector P3 P3-4 & P3-5 are the "R" and "W" inputs of a thermostat control input where P3-4 is a 24 Vac source and P3-5 the "call for heat" input. Any method of shorting these two pins together will cause the control to activate High Fire
 - a. This can be done, as is factory standard for Steam applications, with a shorting wire in cases where High Fire is always the required operating mode
 - b. In cases where Flue stack condensation is of a concern a normally open Flue temperature switch is placed into the exhaust flue to maintain flue temperatures which will not be conducive to condensation.

Ignition Process for Single Bases, continued

LGB models 6-12

1. After a call for heat, the control will immediately start the Inducer and run it for 45 seconds and display "Pre Purge"
2. When the control completes the Pre Purge, it energizes the Pilot Valve. The control begins the spark Ignition sequence and starts a 15-second Pilot Flame-Sense timer.
3. As the ignition sequence proceeds, and the pilot flame lights, the control monitors Flame sense inputs to verify the Pilot is properly lit.
 - a. In the Advanced Menu under Diagnostics > Inputs & Outputs > Flame Sense, one can read the flame sense status for both the Pilot and Main burner as measured by the control.
 - b. A good quality flame is expected to show a value of less than 60, with higher quality flames showing lower values.
 - c. A value of 60 is considered to be 'No Flame'.
4. If the control's Pilot Flame Sense timer expires before the control sees an acceptable pilot flame sense value, it will remove power from the Pilot valve, start an Inter-Purge, and determine whether a restart is possible.
5. If the control successfully completes its pilot ignition process, it will energize the Main Gas Valve and the main burner will begin to light. Once the flames propagate across to the main flame sense rods, the control will identify flame sense on its advanced display menu identified previously.
6. If main flame sense is not proven within the Control's verification interval, the control will turn off both the main and pilot gas valves.
7. Only one attempt to relight is allowed. The control will attempt to follow the procedure listed above.
8. If pilot and main burners fail to successfully light on the first retry, the control will display Ignition Fault and go into a manual lockout. Removing a manual lockout condition requires User Input through the Display menu.
9. Once the Main burners are operating in steady heat, high fire can be achieved through the activation of the secondary thermostat control input on connector P3.

P3-4 & P3-5 are the "R" and "W" inputs of a thermostat control input where P3-4 is a 24 Vac source and P3-5 the "call for heat" input. Any method of shorting these two pins together will cause the control to activate High Fire

- a. This can be done, as is factory standard for Steam applications, with a shorting wire in cases where High Fire is always the required operating mode
- b. In cases where Flue stack condensation is of a concern a normally open Flue temperature switch is placed into the exhaust flue to maintain flue temperatures which will not be conducive to condensation.

Ignition Process for Dual Bases (LGB 14-20)

1. After a call for heat, the Base 1 control will immediately start the Inducer and run it for 45 seconds. The Base 1 control will display "Pre Purge." Base 2 will continue displaying Standby Mode until Base 1 energizes its Pilot Valve.
2. Once Base 1 completes the Pre Purge, the Base 1 Pilot Valve will energize. Base 1 begins the spark sequence Ignition sequence and starts its 15-second Pilot Flame-Sense timer. Energizing this valve will also apply 24 Vac to Base 2 P13-7 & P12-1.
3. P13-7 is the wake-up call for heat to the Base 2 control. This causes Base 2 to apply power to its pilot valve. Starting the pilot ignition process for Base 2 includes starting the 15-second Pilot Flame Sense timer on Base 2.
4. The 24 Vac applied to Base 2 P12-1 is required to enable Base 2, upon approving its Base 2 pilot to output a confirmation signal of 24 Vac to Base 1 once Base 2 proves its pilot. This is only an enable for the Base 2 output so the pilot proven signal to Base 1 will not go active until pilot proof-of-flame is verified.
5. Base 1 will be a little over a second ahead of Base 2 in starting this ignition sequence. To keep the two bases synchronized Base 1, will wait for its full 15 second timeout before looking for the Flame Sense Proven signal from Base 2.

(continued on the next page)

Control Operation, continued

Ignition Process for Dual Bases (LGB 14-20) (continued)

6. Both bases monitor their flame sense inputs to verify the pilots are properly lit. The flame sense status for the Base 1 pilot and main burners is in the Base 1 Advanced Menu under Diagnostics > Inputs & Outputs > Flame Sense. The Base 2 display shows the Base 2 information. Ignition Process for Dual Bases (LGB 14-20)
7. A value of 60 is the flame sense threshold. The lower the value the stronger the flame is determined to be. A value of less than 60 is required with 60 meaning that no flame is detected. At this point in an ignition sequence, the Main Flame sense status will show as 60 since the Main Gas Valve is not enabled yet.
 - a. If the Base 1 Flame Sense timer expires before the control sees a pilot flame sense value below 60, it will remove power from the Base 1 Pilot valve, start an Inter-Purge, and determine whether a restart is possible. Removing power from the Base 1 Pilot Valve will also cause Base 2 to exit its pilot ignition mode and return to its Standby state.
 - b. If the Base 2 Flame Sense timer expires before it sees a pilot flame sense value below 60, it will remove power from the Base 2 pilot gas valve and return to the Base 2 Standby state. This will cause Base 1 to time out. Base 1 will remove power from the Base 1 Pilot valve, start an Inter-Purge, and determine whether a restart is possible.
8. The Base 2 pilot proven signal is sourced from Base 2 P12-5 to be received at Base 1 on P13-7 once Base 2 has proven its pilot flame and its 15 sec. pilot flame sense timer has expired. The Base 2 pilot proven signal is a 24 Vac signal which is required to enable the Base 1 output control of the Main Gas Valve.
9. Immediately upon reception of the Base 2 pilot proven signal, Base 1 will energize the Main Gas Valve. The main burner for each half of the boiler will begin to light. Each base control will identify flame sense on its advanced display menu once the flames propagate across to the main flame sense rods at opposite end of each burner.
10. If main flame sense is not proven within the Base 1 Control's verification interval, Base 1 will turn off both its main and pilot gas valves. This will also remove the Base 1 pilot gas valve signal from Base 2, causing Base 2 to disable the Base 2 pilot gas valve and return to the Base 2 Standby state.
11. Only one attempt to relight is allowed. If the LGB controls, following the above listed procedure, cannot successfully light pilots and main burners on the first retry the Base 1 control will display Ignition Fault and go into a manual lockout. Removal of a manual lockout condition requires User Input through the Display menu.
12. Once the Main burners are operating in steady heat, high fire can be achieved through the activation of the secondary thermostat control input on connector P3.

P3-4 & P3-5 are the "R" and "W" inputs of a thermostat control input where P3-4 is a 24 Vac source and P3-5 the "call for heat" input. Any method of shorting these two pins together will cause the control to activate the Second Stage Main Gas Valve.

 - a. This can be done, as is factory standard for Steam applications, with a shorting wire in cases where High Fire is always the required operating mode
 - b. In cases where Flue stack condensation is of a concern a normally open Flue temperature switch is placed into the exhaust flue to maintain flue temperatures which will not be conducive to condensation.

Startup - Fill the System

Freeze Protection

⚠ WARNING

Failure to follow the guidelines in this section can result in severe personal injury, death, or substantial property damage.

Never use automotive or standard glycol antifreeze. Use only freeze-prevention fluids recommended by WM Technologies for applications in LGB boiler systems. Thoroughly flush any system that has used glycol before installing the new LGB boiler.

Always drain and flush the system thoroughly before filling with antifreeze. Sludge, iron, oxide deposits, and other sediment in the system inhibit flow and can cause rapid breakdown of inhibitors.

Install a water meter or monitor water make-up when using freeze protection fluid with automatic fill. Antifreeze may leak before the

water begins to leak, causing concentration to drop and reducing the freeze protection level.

Do not exceed 50% antifreeze by volume. Antifreeze is more sluggish than water, and can interfere with heat transfer. Sludge can develop in the boiler with antifreeze concentrations higher than 50%, potentially causing damage to the heat exchanger.

Test antifreeze concentration at least annually. If concentration is low, either add antifreeze to the current mixture, or drain the system and refill with the correct mixture. Running the system with low antifreeze concentration can result in substantial property damage.

Review the material safety data sheet (MSDS) for the fluid used with the boiler owner and leave a copy for reference. The MSDS contains information on potential hazards and first aid procedures for exposure or ingestion.

Clean the System

NOTICE

The system must be thoroughly flushed, without the boiler connected, to remove sediment. The high-efficiency heat exchanger can be damaged by buildup or corrosion due to sediment, resulting in substantial property damage.

1. If necessary, use an approved chemical cleaning agent. Follow the manufacturer's guidelines for cleaning procedures.
 - a. A list of approved cleaning products is available at www.weil-mclain.com.
 - b. See the Parts section starting on page 100 for Weil-McLain part numbers to obtain cleaning agents through a WM Technologies distributor.
2. For zoned systems, flush each zone separately through a purge valve.
 - a. If purge valves and isolation valves are not already installed, install them to properly clean the system.

3. Flush the system until water runs clean. Ensure that all piping is free of sediment.

NOTICE

DO NOT use petroleum-based cleaning or sealing compounds in the boiler system. Damage to elastomer seals and gaskets could occur, resulting in substantial property damage.

NOTICE

Install a strainer or other mechanical separator device if necessary to ensure sediment will not enter the boiler.

Startup - Fill the System, continued

Antifreeze — Water Boilers

Read all warnings in "Freeze Protection" on [page 74](#) before using any freeze protection in the boiler system.

1. Use antifreeze especially made for hydronic systems. Inhibited propylene glycol is recommended.
2. 50% solution provides protection to about -30°F.
3. Local codes may require a back-flow preventer or actual disconnect from city water supply.
4. Determine quantity according to system water content. Boiler water content is listed on back cover. Remember to add in expansion tank water content.
5. Follow antifreeze manufacturer's instructions.

Use the correct amount of antifreeze:

6. Determine the freezing temperature needed to protect against the lowest likely temperature the system water will encounter.
7. Find the antifreeze percentage (concentration by volume) needed for the freezing temperature from the antifreeze manufacturer's data on the antifreeze container.
8. Calculate the total volume (gallons) of all system piping and components, including the expansion tank and boiler. Boiler water content is listed in [Table 29, page 109](#).
9. The gallons of antifreeze required equals the total water volume multiplied by the antifreeze percentage required.
10. Verify that the water flow rate is within the values given in [Table 9, page 32](#), and the temperature rise with antifreeze is in line with the requirements on [page 35](#).

Water Chemistry

Water pH:

1. Maintain boiler water pH between 7.0 and 8.5. Test the water with litmus paper, or have it chemically analyzed by a water treatment company.
2. If pH differs from above, consult a local water treatment company for treatment needed.

Hardness must be less than 7 grains:

Consult local water treatment companies for unusually hard water areas above 7 grains hardness.

NOTICE

Before filling the boiler and system with water, verify the water chemistry complies with these instructions. Verify that the water chemistry meets the limitations and requirements of all other equipment in the system. Failure to comply could result in boiler failure or unreliable operation.

Fill and Test Water Boilers

1. Fill the system only after ensuring the water meets the requirements of this manual.
2. Close the manual and automatic air vents and boiler drain valve.
3. Fill to correct system pressure. Correct pressure will vary with each application.
 - a. Pressure will rise when the boiler is turned on and system water temperature increases.
 - b. Operating pressure should be no higher than 80% of the relief valve setting for most systems.
4. At initial fill and during boiler startup and testing, thoroughly check the system and repair all leaks.

NOTICE

Eliminate all system leaks. Continual fresh make-up water will reduce boiler life. Minerals can build up, reducing heat transfer, overheating the heat exchanger, and causing heat exchanger failure.

5. After the system has been filled and leak tested, verify that the water chemistry is acceptable.
6. Verify antifreeze concentration, when used.

Check Concentrations Annually

1. Test the pH of a sample of system water at least annually. The pH of the water mixture must be between 7.0 and 8.5. Alternately, use the Sentinel inhibitor test kit to check concentration.
 - a. If pH is outside this range, or the inhibitor test kit indicates low level, the inhibitor level may not be sufficient to prevent corrosion.
2. Test antifreeze concentration. Follow instructions on [page 75](#) to determine the amount of antifreeze.
3. Check the inhibitor level after adjustments are made.

Recommended Inhibitor

Adding Sentinel X100 to the boiler system will prevent damage to the heat exchanger. See [page 100](#) for ordering information.

1. After filling the system as directed in these instructions, use a caulking gun to inject the X100 inhibitor concentrate into the system. Alternatively, fill the system with X100 in its liquid form, following the instructions on the tube or container.
2. After adding the inhibitor to the system, allow time for the water to circulate and mix. Check the inhibitor level. Add additional inhibitor if necessary.
3. See manufacturer instructions or www.weil-mclain.com to determine how much inhibitor to use.

IMPORTANT

Check inhibitor level at least annually as inhibitor levels may change over time. Add an inhibitor as needed to bring to an acceptable level. Use an inhibitor test kit to verify.

Purge Air from Water Boilers

1. Connect a hose to the purge valve. Route the hose to an area where water can drain and be seen.
2. Close the boiler or system isolation valve between the purge valve and fill connection to the system.
3. Close the zone isolation valves.
4. Open the quick-fill valve on the cold water make-up line.
5. Open the purge valve.
6. Open the isolation valves one zone at a time. Allow water to run through, pushing out air until no air flow is present. Close the isolation valves and proceed to the next zone. Repeat until all zones are purged.
7. Close the quick-fill water valve and purge valve. Remove the hose. Open all isolation valves. Watch that the system pressure rises to correct cold-fill pressure.
8. Operate and purge the system to eliminate trapped air.

System without purge valves:

1. If purge valves are not installed, open manual air vents in the system one at a time, beginning with the lowest floor. Close the vent when water comes out.
2. Repeat with the remaining vents.
3. Refill the system to the correct pressure.

System with a diaphragm-type or bladder-type expansion tank:

1. Open the automatic air vent one turn. These vents are used on diaphragm-type or bladder-type expansion tanks only.
2. Refill the system to the correct pressure.

Fill and Test Steam Boilers

1. Only fill steam boilers if doing leakage testing or when the boiler is ready to be fired.
2. Fill to the normal waterline, halfway up the gauge glass.
3. Follow the skimming procedure below.

Skimming Procedure for Steam Boilers

NOTICE

Clean all newly installed steam boilers to remove oil and grease. Do not use petroleum-based cleaning or sealing compounds. Failure to properly clean can result in fluctuations of the water level, water passing into steam mains, seal degradation, or high maintenance costs on strainers, traps, and vents, resulting in substantial boiler damage.

1. Provide 2" piping from the boiler skim tapping to a floor drain. See [Figure 13, page 16](#).
2. Adjust the waterline to the midpoint of the skim piping.
3. Fire the boiler to maintain a temperature below steaming rate during the skimming process.
4. Feed in water to maintain water level. Cycle burners to prevent a rise in steam pressure.
5. Continue skimming until the discharge is clear; this may take several hours.
6. Drain the boiler. Let the boiler cool until warm and flush all interior surfaces under full pressure until the drain water runs clear.
7. Remove the skim piping and plug the tapping.
8. Close the drain cock.
9. Fill the boiler with fresh water to the waterline.
10. Start burners and steam for 15 minutes to remove dissolved gases, then stop the burners.
11. Check traps and air vents for proper operation.

Startup - Final Checks

Check for Gas Leaks

Before starting the boiler, and during initial operation, use a leak detector or smell around the boiler and floor for gas odorant or any unusual odor. Remove the boiler jacket door and smell the interior of the boiler jacket.

⚠WARNING

DO NOT proceed with startup if there is any indication of a gas leak. Repair any leak at once. Starting the boiler up when there is a gas leak could cause an explosion, which can result in severe personal injury, death, or substantial property damage.

Check Thermostat Circuits

1. Disconnect the two external wires connected to the boiler thermostat terminals. See Sections D and E on pages [64-65](#) for terminal locations.
2. Connect a voltmeter across these two incoming wires. Close each thermostat and relay in the external circuit one at a time. Check the voltmeter reading across the incoming wires.

NOTICE

There should NEVER be a voltage reading across the thermostat circuit wiring. If a voltage does occur under any condition, check and correct the external wiring. Applying voltage across the thermostat terminals will damage the control.

3. Once the external thermostats circuit wiring is checked, and corrected if necessary, reconnect the external thermostat circuit wires. Allow the boiler to cycle.

Inspect the Condensate System — Category II Vent Systems

Inspect the condensate drain line, PVC fittings, and trap. See [page 50](#) for component locations. Ensure the trap is filled with water.

⚠WARNING

The condensate trap must be filled with water during boiler operation at all times to avoid flue gas emission from the condensate drain line. Failure to fill the trap could result in severe person injury or death.

Figure 66 Operating instructions, warning

FOR YOUR SAFETY READ BEFORE OPERATING



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

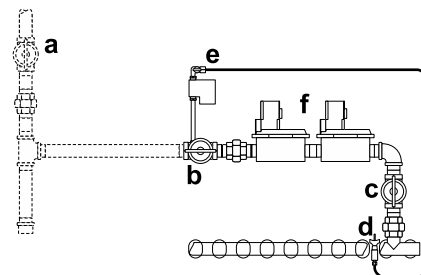
- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the automatic pilot by hand.
- B. Before OPERATING, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor. See below.
- C. Use only your hand to depress or turn gas valve handles. Never use tools. If a 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.

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.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above this label.
2. Set the thermostat/operating control to the lowest setting.
3. Turn off all electrical power to the appliance.
4. Remove jacket front panel.
5. Close gas hand valve, **b**. Close manual test firing valve, **c**. Close all pilot shutoff valve(s), **e**.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow **B** in the safety information above. If you do not smell gas, go to step 7.
7. Open pilot shutoff valve(s), **e**.
8. Open manual test firing valve, **c**, and gas hand valve, **b**. Follow sequence below.
9. Turn on electric power to the appliance.
10. Set the thermostat/operating control to desired setting.
11. If boiler does not operate correctly, follow instructions under, "TO TURN OFF GAS TO APPLIANCE," below. Call your service technician or gas supplier.
12. Replace jacket front panel.



Typical gas piping only — See Boiler Manual for details

- a service valve
- b gas hand valve
- c manual test firing valve
- d automatic pilot
- e pilot shutoff valve(s)
- f automatic gas valves, typical

TO TURN OFF GAS TO THE APPLIANCE

1. Set thermostat or operating control to lowest setting.
2. Turn off all electrical power to the appliance if service is to be performed.
3. Close manual test firing valve (**c**), all pilot shutoff valve(s) (**e**) and gas hand valve (**b**).
4. Replace jacket front panel.

550-224-000(1022)

Startup - Final Checks, continued

Inspect the Pressure Switch Hoses

Inspect all pressure switch sense hoses and verify correct installation. See [Figure 67](#). Replace the hoses if necessary.

NOTICE

The pressure switch sense lines must be in good condition and firmly attached to the correct locations. Incorrect placement or disconnected sense lines can result in unreliable boiler operation.

Final Checks Before Starting the Boiler

- ☐ Read the instructions to adjust and set up the control module. Verify that all settings have been made correctly.
- ☐ Verify that the boiler and system are full of water and all system components are correctly set for operation.
- ☐ Vent any remaining air from the system using manual vents. Air in the system will interfere with circulation and cause heat distribution issues and noise.
- ☐ Check system piping for leaks. If any leaks are found, shut down the boiler and repair immediately.
- ☐ Fill condensate trap with water. See [page 77](#) for the procedure.
- ☐ Verify electrical connections are correct and securely attached.
- ☐ Inspect vent and air piping in direct vent systems for signs of deterioration from corrosion, physical damage, or sagging. Verify vent and air piping is intact and correctly installed per this manual.

⚠ WARNING

Venting system must be sealed gas-tight to prevent flue gas spillage and carbon monoxide emissions, which can result in severe personal injury or death.

Figure 67 Pressure switch hose locations

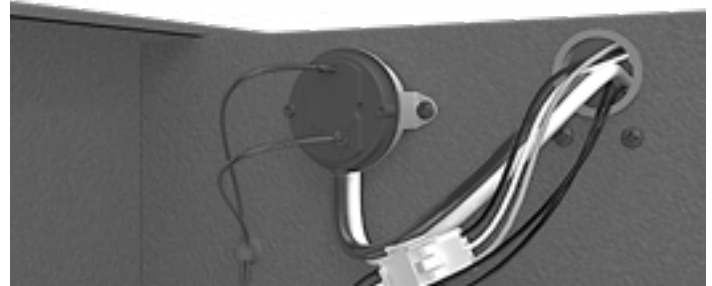
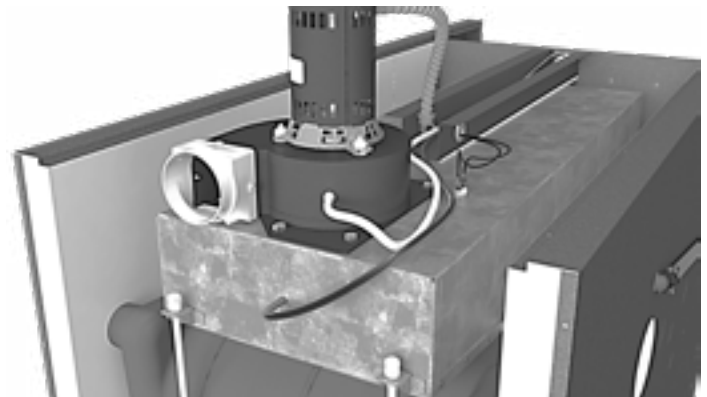


Figure 68 Rear control routing



Startup Procedure

Starting the Boiler

1. Apply power to the boiler via the service switch.
2. Follow the operating instructions in [Figure 66, page 78](#).
3. If this is the first time powering the boiler, the control may ask for configuration confirmation. Check the boiler label and verify that the configuration on the screen, the configuration plug, and the type of boiler all match.

IMPORTANT

Boilers that do not match their configurations will not operate as intended.

4. Ensure all connected sensors are detected and the correct boiler model is identified. If not, determine the cause and correct before proceeding.
5. Check water, vent, air and gas piping again for leaks. If any leaks are found, shut down the boiler and repair immediately.

Troubleshooting Startup Issues

1. Check for loose connections, a blown fuse, or if the service switch is in the off position.
2. Is gas turned on at the meter and at the boiler?
3. Are control settings correct for the application?
4. Are thermostats set below room temperature?
5. Are external limit controls open (if used)? Is the boiler water temperature above 200°F?
6. Are the closure switch contacts open?
7. Is incoming gas pressure within the limits of the minimum and maximum values given on [pages 53-55](#)?
8. If none of the above corrects the issue, refer to the Troubleshooting section starting on [page 94](#).

Check Flame and Combustion

1. Ensure that all load devices, such as control valves, radiators, and air handling units, are in operation to prevent the boiler from cycling off during adjustment. The load devices must be able to shed or dump the heat created by the boiler.
2. Initiate a call for heat on a thermostat input.

High Fire Check:

3. Check the flame. The high fire flame should be blue and stable.
4. Measure the manifold pressure with a manometer. The manifold pressure should be within 10% of 3.5. If results are acceptable, proceed to the next step. If not, follow the instructions under the Gas Valve Adjustment section starting on [page 81](#) to set the positions of the regulating screws.
5. To check the natural gas input (as needed):
 - a. Turn off other appliances.
 - b. Operate the boiler for 10 minutes.
 - c. At the natural gas meter, measure time in seconds required to use one cubic foot of gas.
 - d. Calculate the gas input:

$$\frac{3600 \times 1000}{\text{number of seconds from step c}} = \text{Btuh}$$
 - e. Btuh calculated should approximate input rating on boiler rating label.

Low Fire Check:

6. Check the flame. The low fire flame should be stable.
7. Repeat the combustion test as instructed in the previous steps.

Startup Procedure, continued

Gas Valve Adjustment

⚠ WARNING

DO NOT attempt to adjust the high or low fire regulator screws unless done by a qualified technician with calibrated combustion test instruments. Failure to comply can result in severe personal injury, death, or substantial property damage.

IMPORTANT

Adjust the high or low fire regulator screw only as needed to meet the manifold pressure specified in [Table 21](#).

1. High fire regulator screw adjustment is only necessary if specified elsewhere in this manual, or if combustion tests indicate the need. See Check Flame and Combustion on [page 80](#) for testing.
2. Boiler behavior could indicate a need to check combustion values at high fire, such as:
 - Difficulty igniting
 - Poor flame stability at low fire
 - Combustion noise
 - Low or high manifold pressure
 - High carbon monoxide values
3. Manifold pressure must be measured at both high fire and low fire. See [Figure 69](#) and [Figure 70](#) for screw locations.
4. If gas valve adjustment does not correct the issue, shut down the boiler and contact your local WM Technologies representative.

⚠ CAUTION

Adjust the high or low fire regulator screws in small increments.

High fire adjustment

IMPORTANT

Adjust only the high fire regulator screw for high fire.

5. If the manifold pressure is high or low, remove the top cover of the gas valve and adjust the input.
 - a. If the manifold pressure is high, turn the high fire regulator screw **CLOCKWISE** in small increments to *decrease* the input.
 - b. If the manifold pressure is low, turn the high fire regulator screw **COUNTERCLOCKWISE** in small increments to *increase* the input.
6. Allow the boiler to stabilize before taking another reading.
7. Continue until the desired manifold pressure value is achieved.
8. Reinstall the top cover on the gas valve.

Figure 69 LGB 4R, 4, & 5 - high and low fire regulator screws

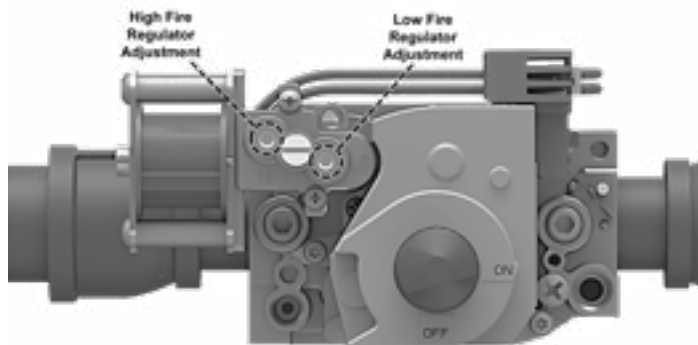


Figure 70 LGB 6-20 - high and low fire regulator screws

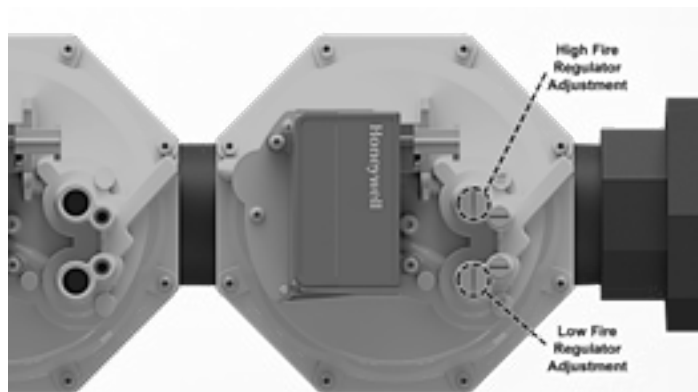


Table 21 Manifold pressures

Boiler Model	Low Fire Manifold Pressure	High Fire Manifold Pressure
LGB 4R, 4, 5	0.85	3.5
LGB 6-7	0.65	
LGB 8-20	0.85	

Gas Valve Adjustment, continued

Low fire adjustment

IMPORTANT

Adjust only the low fire regulator screw for low fire.

1. Remove the cap for low fire regulator screw adjustment. See [Figure 69](#) & [Figure 70](#) on [page 81](#).
 - a. If the manifold pressure is high, turn the low fire regulator screw COUNTERCLOCKWISE in *very small* increments to lower the input.
 - b. If the manifold pressure is low, turn the low fire regulator screw CLOCKWISE to increase the input.
2. Allow the boiler to stabilize before taking another reading.
3. Continue until the desired manifold pressure is achieved.
4. Reinstall the cap when adjustment is complete.

Maximum and Minimum Final Check

1. Turn the boiler off, then restart it. Ensure the manifold pressure setting level has remained unchanged.
2. Reduce to low fire and check the minimum rate output. Ensure the manifold pressure setting level has remained unchanged.
3. Repeat the steps under high fire adjustment or low fire adjustment if necessary.

If any assistance is needed during the set up procedure, contact WM Technologies Technical Services.

Check Ignition System Safety Shutoff Device

1. After the boiler has been installed, turn off the boiler.
2. Shut off the manual gas valve, located downstream of the gas valve, to stop flow of fuel to the boiler.
3. Turn on the boiler. The ignition sequence will start, but the burner will not light.

4. The boiler will lockout after some time. The display screen will turn red and the control will be a solid red alarm; this means the boiler tried to ignite without success. There is one retry before lockout, which is in accordance with ASME CSD-1, latest edition. The ignition system safety device is working properly when the lockout performs as indicated in this step.
5. Clear the lockout condition by selecting Reset on the control.
6. Open the manual gas valve to resume fuel supply to the boiler.

Check the System for Leaks

⚠ WARNING

The system must be sealed gas-tight to prevent flue gas spillage and carbon monoxide emissions. Gas spillage and emissions can result in severe personal injury or death.

1. Operate the boiler on high fire.
2. Inspect the joints between the vent adapter and vent pipe.
3. Check for gas-tight seals at every connection and seam of the vent piping.
4. A leak would appear as vapor on the surface of the mirror. In addition to the mirror, look for signs of weepage or other indications that there may be leakage.
5. If there is any indication of a leak at any joint, shut down the boiler immediately.
6. When disassembling components, inspect gaskets to see if there is any damage. Replace damaged gaskets.

Startup Procedure, continued

Gas Valve Leakage Testing

Refer to the gas valve manufacturer's instructions for the procedure to test the valve.

LGB 6-20:

Each valve can be operated individually by removing the harness connector from the desired valve.

1. Remove the harness from the desired valve and provide a call for heat.
2. Verify there is no gas flow through the unplugged valve.
3. Repeat steps 1-2 for each valve as needed.
4. Reconnect the gas valve electrical harness.

IMPORTANT

The gas valve electrical harness must be reconnected to return the boiler to normal function.

5. Turn on power to the boiler.
6. Operate the boiler through an ignition cycle to ensure proper operation.

Verification Check List

- ☐ Verified that the control is programmed correctly?
- ☐ Verified that the boiler and heat distribution units are filled with water?
- ☐ Verified water chemistry per page 75?
- ☐ Automatic vents opened one full turn (if used)?
- ☐ Air purged from the system?
- ☐ Filled the condensate trap with water?
- ☐ Thermostat circuit wiring checked to ensure there are no stray voltages?
- ☐ Followed the operating instructions on page 78?
- ☐ Verified burner flame and combustion (page 80)?
- ☐ Verified control operation for space heating and DHW (if used) per this manual?
- ☐ Tested additional field-installed controls? Verified these controls cause automatic reset or manual lockout as desired?
- ☐ Set additional field-installed limit controls to system temperature requirements?
- ☐ Adjusted balancing valves and controls to provide the correct temperature to the system per system design?
- ☐ For multiple zones, adjusted for correct flow in each zone?
- ☐ Cycled boiler with thermostat and DHW aquastat (if installed)? Set to highest setting and verified normal startup cycle? Set to lowest setting and verified the boiler turns off?
- ☐ Measured natural gas input?
- ☐ Checked incoming gas pressure as specified on pages 53-54?
- ☐ Observed several operating cycles for proper operation?
- ☐ Set room thermostat to desired temperature?
- ☐ If installed, set DHW aquastat to desired DHW storage temperature?
- ☐ Reviewed all instructions shipped with this boiler with the owner or maintenance person?
- ☐ Filled in the Installation and Service Certificate on page 112?
- ☐ Filled out the warranty registration card and sent it to WM Technologies?
- ☐ Return all instructions to the envelope and place inside the boiler housing. Instructions must be available for all service and adjustment of the boiler.

SECTION 5

Maintenance

This section is intended to provide maintenance instructions and timing for the boiler.

Section Contents

Maintenance - General	84
Annual Inspection	85
Annual Startup	87

Maintenance - General

⚠WARNING

Turn off power to the boiler before any service operation except as noted otherwise in this manual to avoid electrical shock, which can result in severe personal injury or death.

Handling Ceramic Fiber Materials

⚠WARNING

The cover plate components, refractory insulation, and gaskets contain ceramic fiber materials that have been identified as carcinogenic, or possibly carcinogenic, to humans. Avoid breathing in dust. Avoid contact with skin and eyes. Wear long-sleeve, loose-fitting clothing, gloves, and eye protection when working on the boiler. Use a NIOSH certified dust respirator (N95). Failure to comply can result in severe personal injury or death.

Ceramic fibers can be converted to cristobalite in very high temperature applications. The international Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)."

Use of an N95 respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions.

Preventative measures include the following:

- Avoid breathing in dust.
- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Use an N95 respirator
- Handle cover plate components, refractory insulation, and gaskets carefully.
- If replacement is necessary, remove the parts and insulation from the boiler and place into a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse the clothes washer thoroughly afterwards.

Current NIOSH recommendations can be found on the NIOSH website at www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.

NIOSH stated First Aid for contact or irritation:

- Eyes: Irrigate immediately
- Breathing: Fresh air

Perform Startup and Checkout

After any maintenance procedure, verify operation of the boiler. Removing and reinstalling components can change boiler behavior. Follow the complete procedure for boiler and system startup, beginning on [page 75](#).

⚠WARNING

Wiring errors can cause improper and dangerous operation. Label all wires to ensure proper connection. Never jumper (bypass) any device except for momentary testing. Failure to comply can result in severe personal injury, death, or substantial property damage.

Annual Inspection

First-Year Special Inspection

⚠WARNING

Eliminate all system or boiler leaks. Piping leaks can result in severe personal injury, death, or substantial property damage.

1. No later than 12 months after the boiler is installed, perform a first-year inspection of the boiler. The inspection should include the following specific instructions, in addition to routine annual start-up procedures.
 - a. Inspect the heat exchanger and clean if necessary. See [page 90](#) for access and cleaning procedures.
 - b. Remove and clean the burners thoroughly using a vacuum cleaner and compressed air if necessary.
 - c. Make sure there is no blockage or accumulation of debris in the burner or burner ports. Replace the burner if necessary.
 - d. Inspect all water and gas piping. Look for signs of leaking lines. Correct any issues found. See the procedures on [page 77](#) and [page 82](#).
 - e. Disconnect the condensate trap and drain lines; inspect, then flush thoroughly. Reinstall and refill the trap per [pages 50](#) and [77](#).
2. Determine any follow-up maintenances and service needs based on the condition of the heat exchanger and condensate lines.
 - a. If the heat exchanger shows substantial fouling, or if the condensate lines show accumulation of sediment, schedule a follow-up service call to perform the first-year inspection again. This service call should be sooner than the normal 12 months between inspections.
 - b. Heavy fouling of the exchanger or condensate lines indicates possible combustion air contamination. Inspect the air intake area carefully. Remove all possible contaminants. See [Table 12, page 40](#) for products to avoid.

3. Verify the boiler area is free of any combustible materials, gasoline, and other flammable vapors and liquids.

NOTICE

Corrosion and contamination causes must be eliminated to ensure reliable operation of the boiler and system. Failure to eliminate these causes can result in substantial property damage.

General Information

The boiler should be inspected and started at the beginning of the heating season annually, only by a qualified service technician.

The maintenance and care of the boiler designated in this section must be performed to assure maximum boiler efficiency and reliability. Inspect any issues reported by the owner and correct before proceeding.

NOTICE

Failure to service and maintain the boiler and system could result in equipment failure.

⚠WARNING

Do not use solvents to clean any of the boiler components. The components could be damaged, causing unreliable or unsafe operation, which can result in personal injury, death, or substantial property damage.

⚠WARNING

Turn off power to the boiler before any service operation except as noted otherwise in this manual. Failure to turn off electrical power could cause electrical shock, which can result in severe personal injury or death.

Inspect the Base Insulation

Make sure the base insulation is secure against all four base panels. If the base insulation material is damaged or displaced, call a service technician immediately and do not operate the boiler.

Service and Maintenance Schedules

Service Technician <i>(use this manual for instructions)</i>	
Annual Start-up <i>(also see the first-year inspection instructions)</i>	General: <ul style="list-style-type: none"> <input type="checkbox"/> Investigate reported issues. <input type="checkbox"/> Clean the condensate trap and fill with fresh water. <input type="checkbox"/> Check for leaks (water, gas, flue, and condensate). <input type="checkbox"/> Check system water chemistry, inhibitor level, and antifreeze concentration, if used. <input type="checkbox"/> Check boiler relief valve. <input type="checkbox"/> Verify flue and air lines are in good condition and sealed tight. <input type="checkbox"/> Verify operation of the combustion air damper, if used. <input type="checkbox"/> Check system water pressure, system piping, and expansion tank. <input type="checkbox"/> Check ignition electrode and flame sense rods. Inspect, clean, and check spacings. <input type="checkbox"/> Check ignition and ground wiring. <input type="checkbox"/> Check control function and settings: <ul style="list-style-type: none"> • High gas pressure switch • Low gas pressure switch • Low water cut-off • Operating and high limits <input type="checkbox"/> Check wiring and connections. <input type="checkbox"/> Perform startup checkout and performance verification beginning with Startup, Fill the System, page 75. <input type="checkbox"/> Inspect flame for stability and uniformity. <input type="checkbox"/> Check the flame signal.
	Additional actions if combustion or performance indicate the need: <ul style="list-style-type: none"> <input type="checkbox"/> Clean heat exchanger <input type="checkbox"/> Remove the burners and clean with a vacuum or compressed air only. Refer to instructions and warnings on page 89.
	Review: <ul style="list-style-type: none"> <input type="checkbox"/> Review with the owner

⚠ WARNING

Operating a boiler with damaged or displaced base insulation can result in severe personal injury, death, or substantial property damage.

Owner Maintenance <i>(see the User Manual)</i>	
Daily	<ul style="list-style-type: none"> <input type="checkbox"/> Check the boiler area. <input type="checkbox"/> Check air openings. <input type="checkbox"/> Check pressure/temperature gauge. <input type="checkbox"/> Verify the boiler panels are securely in place.
Monthly	<ul style="list-style-type: none"> <input type="checkbox"/> Check the vent piping. <input type="checkbox"/> Check the relief valve. <input type="checkbox"/> Check the condensate drain system. <input type="checkbox"/> Check the air vents.
Periodically	<ul style="list-style-type: none"> <input type="checkbox"/> Test low water cutoff.
Every 6 Months	<ul style="list-style-type: none"> <input type="checkbox"/> Check the boiler gas and water piping. <input type="checkbox"/> Operate the relief valve.
End of Season	<ul style="list-style-type: none"> <input type="checkbox"/> Shut down the boiler (unless the boiler is used for domestic water).

⚠ WARNING

Follow the service and maintenance procedures given throughout this manual and other literature shipped with the boiler. Failure to perform service and maintenance could cause damage to the boiler or system. Failure to follow the directions in this manual and component literature can result in severe personal injury, death, or substantial property damage.

Annual Startup

Check Air Openings

1. Verify that combustion and ventilation air openings to the boiler room and building are open and unobstructed.
2. Check operation and wiring of automatic combustion air dampers, if used.
3. Verify the boiler vent discharge and air intake are clean and free of obstructions.

NOTICE

Failure to reinstall or repair a combustion air damper could result in nuisance shut downs or substantial property damage.

Flue Vent System

1. Visually inspect the entire flue gas venting system for blockage, deterioration, or leakage.
2. Repair any joints that show signs of leakage in accordance with vent manufacturer's instructions.

⚠WARNING

Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check the Water System

1. Verify all system components are correctly installed and operational.
2. Check the cold fill pressure for the system, and verify it is correct.
3. Watch the system pressure as the boiler heats up during testing to ensure the pressure does not rise too high. Excessive pressure rise indicates an issue with the expansion tank, such as incorrect sizing or other performance issues.
4. Inspect automatic air vents and air separators.
 - a. Remove the air vent caps and briefly press the push valve to flush the vent. Reinstall the caps.
 - b. Make sure the vents do not leak.
 - c. Replace any leaking vents.
5. Check the system water chemistry. See [page 75](#).

Check the Boiler Relief Valve

The safety relief valves must be inspected at least once every three years. This inspection must only be done by a plumbing contractor or authorized inspection agency, not by the owner.

However, the safety relief valve *lever* must be operated at least once per year to ensure waterways are clear. This can be done by a contractor, maintenance personnel, or owner.

Before operating any relief valve, ensure it is piped with its discharge in a safe area to avoid severe scald potential. See Relief Valve Installation on [page 34](#) before proceeding further.

1. Remove and inspect the valve and its components.
 - a. Ensure the valve has no corrosion, and make sure the valve and discharge line have not been tampered with or altered.
 - b. Water conditions or some natural occurring conditions may corrode the valve or its components over time, making the valve inoperative.
 - c. If the relief valve weeps or will not seat properly, replace the valve. Ensure the reason for the valve weeping is the valve itself, and not the over-pressurization of the system due to a waterlogging or under-sized expansion tank.
2. Operate the safety relief valve lever.
 - a. If no water flows when operating the lever, the valve is inoperative and must be replaced.
3. If relief valve replacement is necessary, shut down the boiler until a new relief valve has been installed by a licensed contractor or inspection agency.

⚠WARNING

Failure to reinspect the boiler relief valve and its components as directed could cause unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

Check the Expansion Tank

Expansion tanks provide space for water to move in and out as the heating system water expands or contracts due to temperature increases or decreases. Tanks may be open, closed, diaphragm, or bladder type.

Open-type: Located above the highest radiator or baseboard unit, usually in the attic or a closet. This type has a gauge glass and overflow pipe to a drain.

Closed-type: Welded gas tight and located above the boiler. This tank is partially filled with water, leaving an air cushion for expansion.

- Make sure a closed-type tank is fitted with a tank fitting, such as the B&G Airtrol. This fitting reduces gravity circulation of air-saturated tank water back to the system. It also prevents the air from bubbling up through the water as it returns from the system.
- Do not use automatic air vents in systems with closed-type tanks. The air will escape from the system instead of returning to the tank. Eventually, the tank will waterlog and no longer control pressurization. The boiler relief valve will weep frequently.

Diaphragm- or bladder-type: Welded gas tight with a rubber membrane to separate the tank pressurizing air and the water. This tank may be located at any point in the system, but it is most often found near the boiler.

- Systems with a diaphragm- or bladder-type expansion tank require at least one automatic air vent, preferably located on top of an air eliminator, as shown in this manual.

If the relief valve tends to weep frequently, the expansion tank may be waterlogged or undersized.

- Closed-type: The tank is most likely waterlogged. Install a tank fitting if not already installed. Check the fill level per the fitting manufacturer's instructions. If the fill level is correct, check the tank size against the manufacturer's instructions. Replace with a larger tank if necessary.
- Diaphragm- or bladder-type: Check that the tank size is large enough for the system. If the tank is too small, add one or more additional tanks as necessary to provide sufficient expansion. If the

tank size is large enough, remove the tank from the system and check charge pressure. If the tank will not hold pressure, the membrane has been damaged, and the tank needs to be replaced.

Inspect the Pilot and Main Flame Sensor Assemblies

- Shut off power to the boiler before inspection.
- Close the external manual gas valve to ensure there is no gas flow to the unit.
- Allow time for the boiler to cool to room temperature is it has been firing.
- If replacement parts are needed, see the parts section starting on [page 100](#) for ordering information.

Pilot assembly:

1. Disconnect the ignition wire and flame sense wire from the control board.
2. Use a 5/16" nut driver to remove the two screws securing the burner access shield to the front base. Carefully remove the burner access shield and set aside.
3. Use a Phillips head screwdriver to remove the two screws securing the pilot assembly to the burner bracket. Carefully remove the pilot assembly.
4. Inspect the ignition and flame sense electrodes and ceramic insulators.
 - a. Remove any white oxides that have accumulated on the electrodes using steel wool.
 - b. If the electrodes are cracked or damaged, or if they cannot be satisfactorily cleaned, replace the pilot assembly.
5. Inspect the ignition and flame sense wires.
 - a. Check that the resistance is 0 Ohms.
 - b. Replace the pilot assembly if results are not satisfactory, or if there is any damage to either wire.

(continued on the next page)

Annual Startup, continued

Inspect the Pilot and Main Flame Sensor Assemblies, continued

Main flame sensor assembly:

1. Disconnect the flame sense wire from the main flame sensor assembly.
2. Use a Phillips head screwdriver to remove the two screws securing the main flame sensor assembly to the burner bracket. Carefully remove the main flame sensor assembly.
3. Disconnect the ground wire from boiler chassis and burner bracket.
4. Inspect the flame sense electrode and ceramic insulator.
 - a. Remove any white oxides that have accumulated on the electrode using steel wool.
 - b. If the electrode is cracked or damaged, or if it cannot be satisfactorily cleaned, replace the main flame sensor assembly.
5. Inspect the flame sense and ground wires.
 - a. Check that the resistance is 0 Ohms.
 - b. Replace the pilot assembly if results are not satisfactory, or if there is any damage to either wire.

Inspect and Clean the Burner and Combustion Chamber

⚠WARNING

The boiler contains ceramic fiber materials. Use care when handling these materials per instructions on [page 84](#). Failure to comply can result in severe personal injury or death.

Burners:

1. Follow the steps in the previous section to remove the pilot and main flame sensor assemblies.
2. Carefully remove all burners. Lift each burner over each gas orifice and slide out of the combustion chamber. Be careful not to drag burners on the base refractory.
3. Vacuum or brush burners to remove dust or lint.

Combustion chamber:

4. Use a light to inspect the combustion chamber while burners are removed.
5. Make sure the inside of the combustion chamber is free of debris. Remove any debris with a vacuum.
6. Make sure there are no signs of overheating, flue gas leakage, or damage to chamber refractory lining. Ensure all refractory is secured to all base panels.

⚠WARNING

If the base refractory is damaged or displaced, call a service technician immediately. Do not operate the boiler. Operating the boiler with damaged or displaced base refractory can result in severe personal injury, death, or substantial property damage.

7. Replace any parts that may be damaged or show signs of leaking.

⚠WARNING

Damaged or leaking components must be replaced. Failure to comply can result in severe personal injury, death, or substantial property damage.

Cleaning the Heat Exchanger Block

Water side:

1. Use one pound of trisodium phosphate for every 50 gallons of water content in the boiler.
 - a. Alternative #1: Use one pound of sodium carbonate for every 30 gallons of water.
 - b. Alternative #2: Use one pound of sodium hydroxide (lye) for every 50 gallons of water.
2. Fill, vent, and circulate the system with the above mixture, allowing it to reach the design or operating temperature, if possible.
3. Circulate the mixture in the boiler for 2-3 hours.
4. Drain the system completely and refill with fresh makeup water.
5. Check the pH level of the boiler water after cleaning. It should be between 7.0 and 8.5. A small amount of cleaner may be added to adjust the pH up to the proper range of 7.0 to 8.5

Flue side:

Excessive sooting at the heat exchanger indicates improper gas combustion. Check for proper combustion and make any necessary adjustments.

6. Shut down the boiler.
 - a. Follow the instructions under To Turn Off Gas to the Appliance in [Figure 66, page 78](#).
 - b. Do not drain the boiler unless it will be exposed to freezing temperatures. If using freeze prevention fluid in the system, do not drain.
7. Close the external manual gas valve to ensure there is no gas flow to the unit.
8. Allow time for the boiler to cool to room temperature if it has been in operation.
9. Remove the inducer cover and top jacket panels.
10. Remove the inducer from the vent adapter and collector hood (see [page 19](#)).
11. Remove the collector hood (see [pages 17-18](#)).
12. With burners removed, place a drop cloth or paper down into the combustion chamber to collect soot.
13. Use a wire brush to clean the flueways between sections.
14. Remove cloth or paper and soot.

Reinstall All Components

1. Ensure all components are inspected and cleaned as instructed in this section.
2. Replace any damaged or stretched gaskets or seals. See the Parts section starting on [page 100](#) for replacement parts.
3. Reinstall all removed parts. Make sure the parts are installed correctly. Detailed assembly instructions for all components are located in the Installation section, which starts on [page 7](#).

Inspect the Flue Pressure Switch

When inspecting the flue pressure switch, ensure the wire connects are properly connected and the tubes are secured to the pressure ports. Inspect the tubes for any signs of damage or debris. Replace if necessary.

1. After navigating to the control settings, disconnect the tube connection with the inducer.
2. Apply a small suction on the tube until the flue pressure switch closes and the control display shows "Closed" in the diagnostics section.
3. Ensure that the flue pressure switch opens when the suction is removed. When the boiler is not running, the control display should show "Open" in the diagnostics section.
4. Securely reconnect the tube connection with the inducer.

Check Boiler Wiring

1. Inspect all boiler wiring. Make sure the wires are in good condition and securely attached.
2. Verify that all connectors are securely inserted.
3. Verify that the chassis ground wire is secured to the control panel.

Check Control Settings

Use the control display to navigate through all settings. Adjust the settings if necessary. Check the settings of the external limit controls (if any). Adjust as needed to accommodate the system design.

Annual Startup, continued

Perform Startup and Checks

1. Start the boiler and perform checks and tests specified in this manual.
2. Verify the cold fill pressure is correct and the operating pressure does not go too high. Adjust the water pressure and expansion tank charge pressure as necessary.
3. Complete the Verification Check List on [page 83](#).

WARNING

Failure to follow the provided procedures could cause gas, air, or exhaust gas leakage, which can result in severe personal injury, death, or substantial property damage.

Check Main Burner and Pilot Burner Flame

1. Inspect the main burner flame and the pilot flame by looking into the combustion chamber.
2. Pilot: refer to [Figure 71](#).
 - a. Proper pilot flame should be blue, and the inner flame cone will engulf the sensor.
 - b. An overfired pilot will have large flames with lifting and blowing past the sensor.
 - c. An underfired pilot will have small flames, and the sensor will not be engulfed by the inner flame cone.
3. Main burner: refer to [Figure 72](#).
 - a. Proper main burner flame is blue with occasional yellow-orange streaks caused by dust.
 - b. An overfired main burner will have large flames.
 - c. An underfired main burner has small flames.
 - d. A main burner lacking primary air will have yellow tipping on flames; sooting will occur.

Figure 71 Typical pilot burner flame

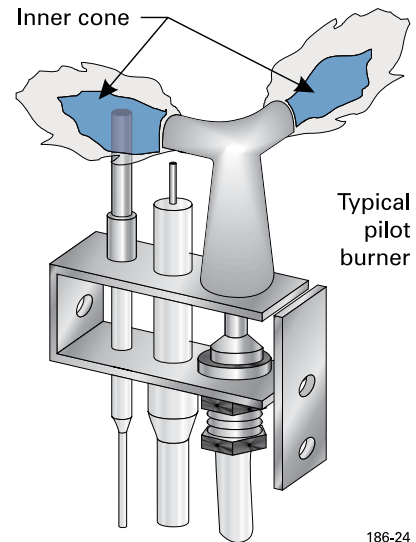
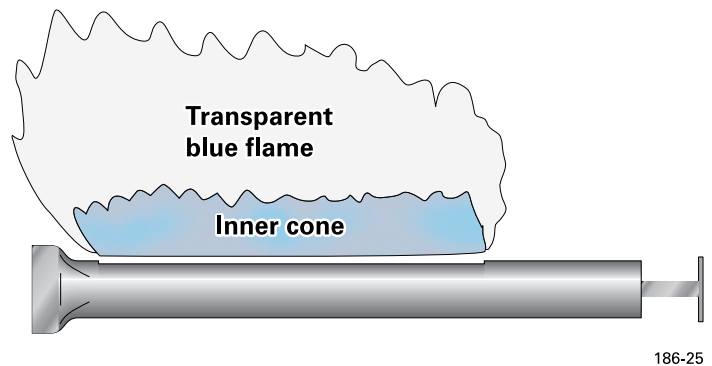


Figure 72 Typical main burner flame



Check the Flame Signal

1. Check the flame signal at both high and low fire.
 - a. Navigate to Diagnostics section in Control.
 - b. Scroll to find Flame Sense Value.
2. If the flame sense value rises to 60, the control will shut down the boiler operation.
3. A high flame sense value may indicate a fouled flame sense rod.
 - a. See Inspect the Pilot and Main Flame Sensor Assemblies, pages 88-89, to remove and inspect the pilot flame sense electrode or main flame sensor electrode.
 - b. If required, clean the flame sense electrodes.
 - c. Check the combustion values.
 - d. If cleaning the flame sense rod does not improve low flame sense, but the flame sense wiring is in good condition and ground continuity is satisfactory, replace the main flame sensor or pilot assemblies.
4. If flame sense remains high after replacement:
 - a. Inspect the vent and air piping.
 - b. Inspect the heat exchanger.
 - c. Clean the heat exchanger block as described on page 90 as necessary.

High Altitude

See page 31 for high altitude conversion, page 29 for pressure switches, and Table 4, page 12 for gas orifice sizes. Boiler input rate will derate 4% for each 1,000 feet above sea level after 2,000 feet. This is in accordance with the National Fuel Gas Code - ANSI Z223.1/NFPA 54, latest edition.

IMPORTANT

For elevations above 11,000 feet in the USA, please contact WM Technologies Technical Support for details.

Reinstall the Jacket Door After Servicing

Reinstall the boiler jacket door after startup or servicing. Ensure door screws are secure to the boiler jacket at the bottom of the door.

Review with the Owner

1. Review the User Manual with the owner.
2. Emphasize the need to follow the maintenance schedule.
3. Remind the owner of the need to call a licensed contractor should the boiler or system exhibit any unusual behavior.
4. Remind the owner to follow the proper shutdown procedure, and to schedule an annual startup at the beginning of the next heating season.

Table 22 Flame sense values

Flame Sense Value	State	Notes
0-20	Steady Heat	Indicates nominal flame sense value under typical conditions.
21-40*	Steady Heat	Indicates potentially fouled flame sense rods, incorrect manifold pressure, or damaged sense rods/wires.
>40	Steady Heat	Indicates likely fouled flame sense rods, incorrect manifold pressure, or damaged sense rods/wires.
60	Standby	Indicates no flame, normal for standby state.

*All values are typical and may vary based on location and environment. If higher flame sense values are present, and there is no history of ignition or gas pressure issues, these high values may be due to boiler installation and environment variations.

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SECTION 6

Troubleshooting

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Errors and Lockouts	94

Troubleshooting - General

⚠WARNING

Turn off all power to the boiler when servicing. Failure to comply can cause electrical surges or electrical shock, which can result in severe personal injury, death, or substantial property damage.

⚠WARNING

Wiring errors can cause improper and dangerous operation. Label all wires to ensure proper connection. Never jumper (bypass) any device except for momentary testing. Failure to comply can result in severe personal injury, death, or substantial property damage.

Always turn power off to the boiler before servicing and making connections. If assistance is required, please complete the Installation and Service Certificate on [page 112](#) before calling Tech Services. The CP number can be found on the boiler jacket.

Checking Boiler Out Sensor

1. The boiler out temperature sensor is a resistance –type device.
2. The correct value for the sensor at various temperatures is shown in [Table 23](#).
3. Use the resistance values at 32°F, 60°F, 70°F, and 212°F to measure the sensor resistance at known temperatures (freezing point, room temperature, and sea level boiling point). For freezing and boiling point, insert the sensor in water at that temperature. Use an ohmmeter to read the resistance value.
4. To check whether the control module is correctly sensing temperature, use a resistance decade box. Temporarily connect the decade box in place of a sensor and read the corresponding temperature on the control display.

Table 23 Sensor resistance values

Water Temperature		Expected Range	
Temp(°C)	Temp(°F)	Min R(Ω)	Max R(Ω)
0	32	293920	374080
5	41	227480	289520
10	50	177461	225859
15	59	139480	177520
20	68	110414	140526
25	77	88000	112000
30	86	70605	89861
35	95	56988	72530
40	104	46278	58900
45	113	37797	48105
50	122	31039	39505
60	140	21262	27060
70	158	14849	18899
80	176	10558	13438
90	194	7633	9715
100	212	5605	7133
110	230	4175	5313
120	248	3151	4011

The temperature should be close to the value corresponding to the input resistance.

Errors and Lockouts

Control Display

There are two types of lockouts.

1. Manual reset lockouts. The operator must physically press the on-screen or device's reset button.
2. Automatic reset lockouts. This lockout resolves with a self-reset when the error condition clears.

Loss of Power

In the event of a power failure, the entire boiler will de-energize. The signal relays used to command auxiliary devices connected to the boiler will also lose power and deactivate. The sequence of operation will resume when power is restored as shown in Sequence of Operations, starting on [page 71](#). The control will retain any present errors when power is restored.

Errors and Lockouts, continued

Fault and Action Items

Table 24 Control fault information and troubleshooting

Fault Name	Fault Description	Troubleshooting	Action
CONFIRM CONFIGURATION	Board not configured.	Does the control display a non-zero number on line 2?	If No, verify a configuration connector is installed on the gas valve harness and that the P13 connector on the control is fully seated. - If this doesn't correct the display, verify the continuity from the gas valve harness configuration connector to the P12 and P13 connectors of the control. - If neither of the above displays a valid configuration number, replace the control.
		Does the configuration number displayed match the boiler model?	If No, install the correct configuration plug on the valve harness. If Yes, press enter to configure the control. ⚠ WARNING Ensure boiler control is configured correctly per the boiler manual before operation. Failure to comply can result in severe personal injury, death, or substantial property damage.
CONFIG MISMATCH	Configuration number stored in the board does not match the configuration number the control reads from the harness.	Is the Configuration number shown for the board, on line 2 correct for the boiler model? (Configuration Table 19.3)	If No, but the number shown for the boiler is correct, press enter. If No, and the number shown for the boiler is also incorrect, install the correct configuration plug on the valve harness. Press enter when the boiler number is correct. If Yes, install the correct configuration plug on the valve harness. Press enter when the boiler number is correct. ⚠ WARNING Ensure boiler control is configured correctly per the boiler manual before operation. Failure to comply can result in severe personal injury, death, or substantial property damage.
AUTO LIMIT	Auto Limit chain / electrical circuit is open.	Is the Factory Jumper installed in the Auto Limit terminal block?	If Yes, verify continuity of jumper and factory wiring back to the control. If No, replace the jumper, unless there are devices that are intended to be wired to the Auto Limit chain.
		Are there devices installed / wired to the Auto Limit terminal?	If Yes, verify continuity of the Auto Limit chain at the field wiring terminal blocks. - If there is continuity, verify factory wiring back to the control.
			If Yes, and there is no continuity on the Auto Limit chain, verify all devices are in an operational state with closed contacts: Ensure there is electrical continuity with a multi-meter at the Auto Limit wiring connections on the device. - If a device will not close its electrical contact when normal operating conditions would indicate it should be closed, replace that device.
MANUAL LIMIT	Manual Limit chain / electrical circuit is open.	Is the Factory Jumper installed in the Manual Limit terminal block?	If Yes, verify continuity of jumper and factory wiring back to the control. If No, replace the jumper, unless there are devices that are intended to be wired to the Manual Limit chain.
		Are there devices installed / wired to the Manual Limit terminal?	If Yes, verify continuity of the Manual Limit chain at the field wiring terminal blocks. - If there is continuity, verify factory wiring back to the control.
			If Yes, and there is no continuity on the Manual Limit chain, verify all devices are in an operational state with closed contacts: Ensure there is electrical continuity with a multi-meter at the Manual Limit wiring connections on the device. - If a device will not close its electrical contact when normal operating conditions would indicate it should be closed, replace that device.
FALSE FLAME	Flame detected when the gas valve is not powered.	Verify flame is present at Pilot or Main Burners.	If Yes, close manual ball valves and verify flame has been extinguished.
		Verify wiring of Pilot valve and both Main gas valves are per the boiler manual.	If incorrect wiring is found, correct wiring and follow boiler manual for startup procedure to verify normal operation.
			If wiring is correct, verify that the pilot valve and both main gas valves are actually closing and stopping gas flow. If not, replace the valve that is faulty.

Fault Name	Fault Description	Troubleshooting	Action
PS CLOSED	Flue Pressure Switch is closed when it is supposed to be open.	Is the Inducer running?	If Yes, verify operation of the Inducer ice cube relay by disconnecting P10 on the control board; this should cause the inducer to stop. If it continues to run, then the ice cube relays contacts are most likely welded shut, and the relay needs replaced.
		Verify Flue Pressure Switch.	Check continuity with a multi-meter of the spade connections on the Flue Pressure Switch: If there is continuity, check wiring and pressures. Remove the pressure hose from the pressure switch and measure the pressure differential with a manometer. - If no pressure differential exists, check wiring. - If a pressure differential exists and is higher than the pressure switch setting (found in boiler manual or on switch), check chimney and vent system for excessive draft.
		Verify wiring of Flue Pressure Switch.	Inspect Flue Pressure Switch wiring to ensure it is connected properly, and that wiring is not damaged and creating a short.
PS OPEN	Flue Pressure Switch is open when it is supposed to be closed.	Is the Inducer running?	If Yes, verify the Flue Pressure Switch below. If No, verify the 120 Vac power is present at the Inducer relay: - Incoming Pins 5 & 6 should have 120 Vac between them. - Control Signal on Pins 7 & 8 should have 120 Vac between them. - Output Pins 3 & 4 should have 120 Vac between them. If 120 Vac power exists on the outlet of the inducer relay, verify 120 Vac power is present at the inducer connection, C-16. If 120 Vac is present at C-16, check the wiring and connector to the inducer for damage. If no damage is found, replace the inducer.
		Verify Flue Pressure Switch with Inducer running.	Check continuity with a multi-meter of the spade connections on the Flue Pressure Switch with inducer running: - If there is continuity, check wiring from pressure switch to control. - If there is not continuity, check the pressure switch operation below. Inspect pressure switch hoses and connections on the pressure switch, collector hood, and inducer; ensure they are clear of moisture, cuts, or other damage. Verify the hoses are connected as shown in the boiler manual. If the above are all correct, remove the pressure hoses from the pressure switch and measure the pressure differential with a manometer. - If the pressure differential is below pressure switch setpoint, inspect for blockages in the boiler heat exchanger, collector hood, or vent system. - If the pressure differential is above the pressure switch setpoint, the wiring is in good condition, and the switch still fails to close, replace the Flue Pressure Switch.
PS NOT PROVEN	Flue Pressure Switch did not close when Inducer was turned on.	Is the Inducer running?	If Yes, verify the Flue Pressure Switch below. If No, verify the 120 Vac power is present at the Inducer relay: - Incoming Pins 5 & 6 should have 120 Vac between them. - Control Signal on Pins 7 & 8 should have 120 Vac between them. - Output Pins 3 & 4 should have 120 Vac between them. If 120 Vac power exists on the outlet of the inducer relay, verify 120 Vac power is present at the inducer connection, C-16. If 120 Vac is present at C-16, then check the wiring and connector to the inducer for damage; if none is found, replace the inducer.
		Verify Flue Pressure Switch with Inducer running.	Check continuity with a multi-meter of the spade connections on the Flue Pressure Switch with inducer running: - If there is continuity, check wiring from pressure switch to control. - If there is no continuity, check the pressure switch operation below. Inspect pressure switch hoses and connections on the pressure switch, collector hood, and inducer; ensure they are clear of moisture, cuts, or other damage. Verify the hoses are connected as shown in the boiler manual. If the above are all correct, remove the pressure hoses from the pressure switch and measure the pressure differential with a manometer. - If the pressure differential is below pressure switch setpoint, inspect for blockages in the boiler heat exchanger, collector hood, or vent system. - If the pressure differential is above the pressure switch setpoint, the wiring is in good condition, and the switch still fails to close, replace the Flue Pressure Switch.

Errors and Lockouts, continued

Fault and Action Items, continued

Fault Name	Fault Description	Troubleshooting	Action
IGNITION FAULT	Maximum number of failed ignitions has been reached.	Is the Pilot sparking?	If not, verify wiring from control to pilot assembly. If in question, remove spark wire from control and check the continuity from the spade connection to the spark rod. If there is no continuity, replace pilot assembly. If pilot has continuity and there is still no spark, replace control.
		Is Gas present?	Check to verify that gas is present and all air has been safely bled from the gas piping. As the boiler goes through an ignition attempt proving pilot and main flame, verify gas pressures remain within the stated operating pressures of the boiler manual.
		Pilot is sparking but no pilot flame.	- Verify that the Pilot valve is being energized with 24 Vac. - Is the Pilot gas line piped and routed properly per this boiler manual with no kinks or loose connections? - Verify gas is flowing to the pilot. If not, replace the Pilot valve.
		Pilot is lighting, but not energizing the Main Gas Valve(s).	- Check Pilot Flame Signal in the Control Diagnostics: a flame signal < 60 is required for proven flame. If the flame signal does not register, check the Pilot Flame Sense wiring and Flame Rod for continuity and corrosion on the rod. Replace if necessary. - Verify incoming power is wired correctly and polarity is not reversed (line wired to neutral and neutral wired to line). See pg. 62 for field terminal block details. - If a pilot gas pressure regulator is used with lower gas inlet pressures, increase the pilot gas pressure regulator to provide additional gas to the pilot.
		Pilot is lighting, but Main Flame is not.	- Verify that the Main Gas valve(s) are being energized with 24 Vac. - Verify all Manual gas valves are in the open position. - Verify Manifold pressure during Main Flame ignition.
		Main Flame is lighting, but not staying lit.	- Check Main Flame Signal in Control Diagnostics: a flame signal < 60 is required for proven flame. If the flame signal does not register, check Main Flame Sense wiring and Flame Rod for continuity and corrosion on the rod. Replace if necessary. - Verify inlet gas pressure is within range specified in the boiler manual. - Verify the Manifold pressure is set per the boiler manual.
FLAME LOST	Flame has been lost during operation.	LGB 4R, 4, & 5	- Check Pilot Flame Signal in the Control Diagnostics: a flame signal < 60 is required for proven flame. If the flame signal does not register, check the Pilot Flame Sense wiring and Flame Rod for continuity and corrosion on the rod. Replace if necessary.
		LGB 6-12	- Check Pilot & Main Flame signal in Control Diagnostics: a flame signal < 60 is required for proven flame. If the flame signal does not register, check the Pilot and Main Flame Sense wiring and Flame Rods for continuity and corrosion on the rods. Replace if necessary.
		LGB 14-20	- Check Pilot & Main Flame signal in Control Diagnostics for both base controls: a flame signal < 60 is required for proven flame. If the flame signal does not register, check the Pilot and Main Flame Sense wiring and Flame Rods of the base registering the issue for continuity and corrosion on the rods. Replace if necessary.
		All LGB boilers	Verify Inlet Gas pressure and Manifold pressure through both high fire and reduced firing rates: Ensure pressures are within ranges specified in the boiler manual.
HIGH TEMPERATURE LIMIT	Boiler Temperature above High Limit Setpoint. –Water-only models–	Does the boiler have water flow?	Verify that the circulator pump that provides water flow to the boiler is operating.
		Is the Boiler Control operating the circulator pump starter?	Verify the control is providing the 120 Vac to the circulator pump starter. If not, replace control. Note: The Boiler Control is only capable of providing up to 2 amps.
		CH Setting vs High Temp Limit	Verify there is adequate separation between CH Setpoint and the High Temp Limit. High mass boilers can have a temperature rise at shut down depending on pump control and system flow rates. If the boiler continues to cycle off on CH setpoint, but also reach the High Temp Limit, the CH setpoint or High Fire Off Differential can be adjusted to prevent this occurrence.

Fault Name	Fault Description	Troubleshooting	Action
BOILER OUT > 10F	Thermistor 1 and Thermistor 2 differ by more than 10°F. –Water-only models–	How different are the Boiler Out temperatures?	- Navigate the Control to the Diagnostics > Temperature, where Boiler Out 1 and Boiler Out 2 can be read.
			- Measure the individual resistance values of Boiler Out 1 and 2 and compare to Table 23, page 94 .
			- Replace Boiler Out Sensor if the thermistors do not come back with 10°F, or they repeatedly diverge.
BOILER OUT 1 OPEN	Boiler Control measures an open circuit.	Inspect Boiler Out Sensor and wiring.	- Verify that wiring has no breaks, cuts, or damage that could short or provide an open circuit for the sensor reading back to the control. - Measure the individual resistance values of Boiler Out 1 and 2 and compare to Table 23, page 94 . - Replace Boiler Out Sensor if values are outside the range of the table for the given temperature.
BOILER OUT 1 SHORT	Boiler Control measures a closed circuit with no resistance.		
BOILER OUT 2 OPEN	Boiler Control measures an open circuit.		
BOILER OUT 2 SHORT	Boiler Control measures a closed circuit with no resistance.		
TEMP SENSOR CONFIG	Boiler Out Sensor present when it shouldn't be per control configuration.	Is the control configured correctly?	Verify the control is configured correctly for type of boiler being operated. Boiler Out Sensors are not used on steam boilers or on the Base 2 control. ⚠WARNING <i>Ensure boiler control is configured correctly per the boiler manual before operation. Failure to comply can result in severe personal injury, death, or substantial property damage.</i>
HARDWARE FAULT 1	Control Board Hardware faults – A/D converter fault, flame circuit fault, RAM fault, ROM fault, sequence fault, RAM disagrees fault.	Possible Control Board failure.	Cycle power on control. If fault reoccurs when transitioning from Steady Heat to Standby, replace the control.
HARDWARE FAULT 2	Control Board K3 Relay Open Fault.	Possible Control Board failure.	Cycle power on control. If fault reoccurs when transitioning from Steady Heat to Standby, replace the control.
HARDWARE FAULT 3	Control Board K3 Relay Closed Fault.	Possible Control Board failure.	Cycle power on control. If fault reoccurs when ending the next heat cycle, replace the control.
HARDWARE FAULT 4	Control Board K4 Relay Open Fault.	Possible Control Board failure.	Cycle power on control. If fault reoccurs when ending the next heat cycle, replace the control.
HARDWARE FAULT 5	Possible Control board failure or Pilot valve harness short to 24 Vac.	LGB 4R & 4-12	Disconnect Pilot valve harness at control P12. Check for voltage on the harness C12 pin 4. If voltage is detected, inspect harness for short.
		LGB 14-20	- If Control Fault is shown on Base 1 control: Disconnect harness from Base1 control P12 and Base 2 control P12 & P13. Check for voltage on the harness Base 1 C12 pin 4. If voltage is detected, inspect harness for short. - If Control Fault is shown on Base 2 control: Disconnect harness from Base 2 control P12 only. Check for voltage on the harness Base 2 C12 pin 4. If voltage is detected, inspect harness for short.
		All LGB boilers	If no voltage is detected at C12 pin 4, reconnect all harness connectors and cycle power on the control displaying the Control Fault. If fault reoccurs when ending the next heat cycle, replace the control displaying the Control Fault.
HARDWARE FAULT 6	Control Board K5 Relay Open Fault.	Possible Control Board failure.	Cycle power on control. If fault reoccurs when ending the next heat cycle, replace the control.

Errors and Lockouts, continued

Fault and Action Items, continued

Fault Name	Fault Description	Troubleshooting	Action
HARDWARE FAULT 7	Possible Control board failure or Main valve harness short to 24 Vac.	LGB 4R & 4-12	Disconnect Main Gas valve harness at control P12. Check for voltage on the harness C12 pin 5. If voltage detected inspect harness for short.
		LGB 14-20	<ul style="list-style-type: none"> - If Control Fault is shown on Base 1 control, disconnect harness from Base 1 Control P12. Check for voltage on the harness Base 1 C12 pin 5. If voltage is detected, inspect harness for short. If fault reoccurs when ending the next heat cycle, replace the control displaying the Control Fault. - If Control Fault is shown on Base 2 control, disconnect harness from Base 2 Control P12. Check for voltage on the harness Base 2 C12 pin 5. If voltage is detected, inspect harness for short. If fault reoccurs when ending the next heat cycle, replace the control displaying the Control Fault.
HARDWARE FAULT 8	Control Board K6 Relay Open Fault.	Possible Control Board failure.	Cycle power on control. If fault reoccurs when ending the next heat cycle, replace the control.
HARDWARE FAULT 9	Possible Control Board failure, or Second Stage Gas valve harness short to 24 Vac.	LGB 4R & 4-12	Disconnect Second Stage Gas valve harness at control P13. Check for voltage on the harness connector pin 1. If voltage is detected, inspect harness for short.
		LGB 14-20	<ul style="list-style-type: none"> - If Control Fault is shown on Base 1 control: Disconnect harness from Base 1 Control P13. Check for voltage on the harness Base 1 connector pin 1. If voltage is detected, inspect harness for short. If fault reoccurs when ending the next heat cycle, replace the control displaying the Control Fault. - If Control Fault is shown on Base 2 control: Disconnect harness from Base 2 Control P13. Check for voltage on the harness Base 2 connector pin 1. If voltage is detected, inspect harness for short. If fault reoccurs when ending the next heat cycle, replace the control displaying the Control Fault.
CH VOLTAGE HIGH	Ch / Thermostat1 input excessive voltage.	Measure Ch / Thermostat1 supply voltage.	<p>Unplug the control P3 connector. Measure the voltage between the control connector's Pins 1 & 3. Is the measured voltage in excess of 24 Vac nominal?</p> <ul style="list-style-type: none"> - If No, inspect the harness for a short. - If Yes, measure the voltage of the 24 Vac transformer output connector P1, between P1 pins 6 & 7, without unplugging it from the control. Is the measured voltage in excess of 24 Vac nominal? - If Yes, replace the transformer. - If No, inspect 120 Vac supply power.
DHW VOLTAGE HIGH	DHW / Thermostat2 input excessive voltage.	Measure HDW / Thermostat 2 supply voltage.	<p>Unplug the control P3 connector. Measure the voltage between the control connector's Pins 4 & 6. Is the measured voltage in excess of 24 Vac nominal?</p> <ul style="list-style-type: none"> - If No, inspect the harness for a short. - If Yes, measure the voltage of the 24 Vac transformer output connector P1, between P1 pins 6 & 7, without unplugging it from the control. Is the measured voltage in excess of 24 Vac nominal? - If Yes, replace the transformer. - If No, inspect 120 Vac supply power.
BASE ALARM	Alarm Input from Base 2 Control.	Is Base 2 Control in Lockout?	If Yes, use the above troubleshooting information to resolve Base 2 fault. If No, verify wiring from Base 1 to Base 2 controls to ensure no damaged wiring.

SECTION 7

Parts

This section includes replacement parts and ordering information.

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Miscellaneous Parts	100
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Replacement Parts	103
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Miscellaneous Parts

See Table 25 for miscellaneous part numbers and descriptions for ordering purposes.

Ordering

Replacement parts must be purchased through a WM Technologies distributor. Specify the boiler model and size when ordering. Include the description and part number of the replacement part. Part numbers are found on www.weil-mclain.com and the following pages.

⚠ CAUTION

Results from using modified, other manufactured parts, and parts not purchased through an authorized distributor will not be covered by warranty. These parts may damage the boiler or impair operation.

Table 25 Miscellaneous parts and kits

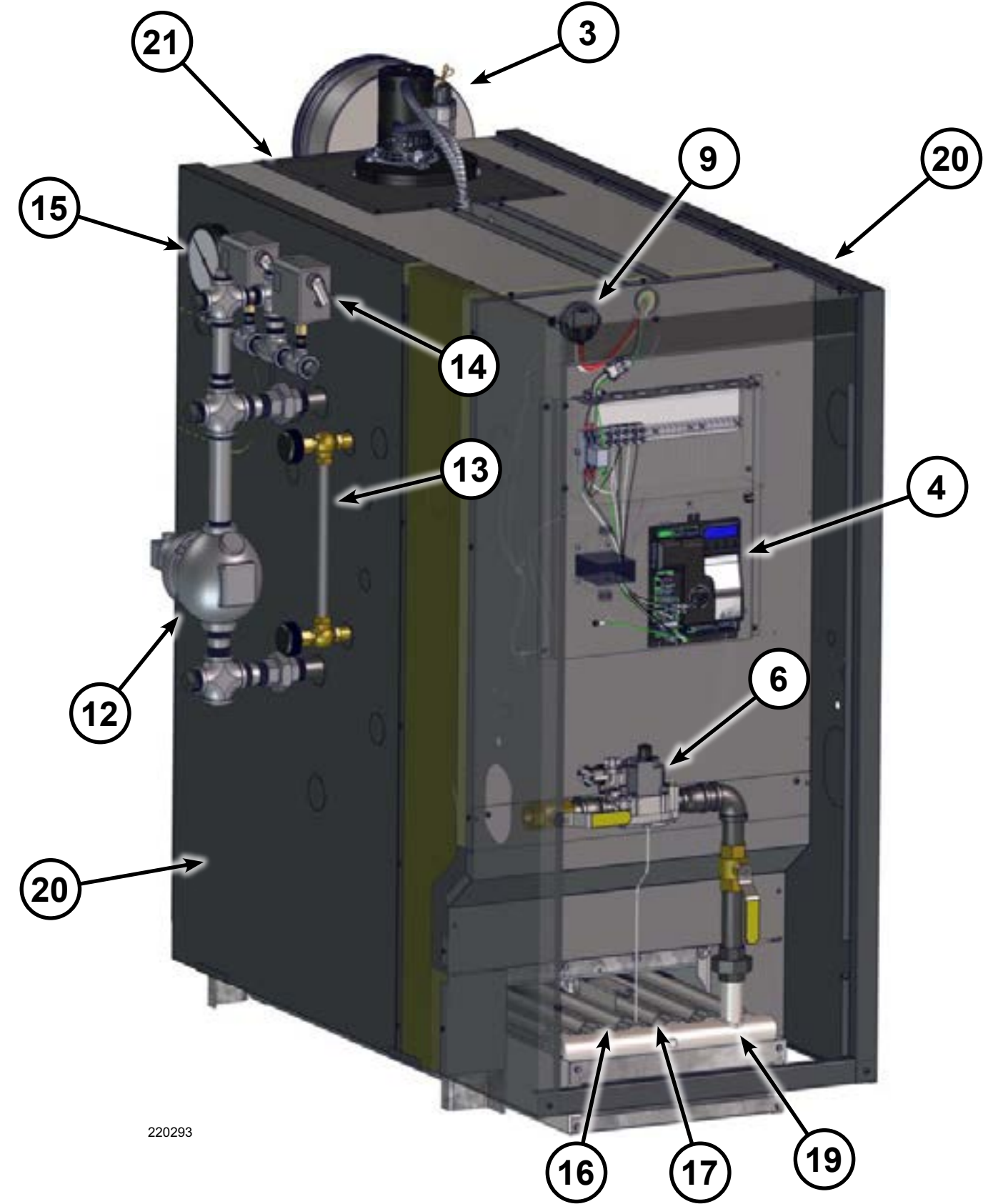
Description	Part Number
Pressure Relief Valve – Water: Watts 740 3/4" x 1" 925,000 Btu/hr. 30 PSI Watts 740 3/4" x 1" 1,352,000 Btu/hr. 50 PSI	383600063 383600064
Watts 740 1" x 1-1/4" 1,300,000 Btu/hr. 30 PSI Watts 740 1" x 1-1/4" 1,899,000 Btu/hr. 50 PSI	383600092 383600098
Watts 740 1-1/4" x 1-1/2" 2,105,000 Btu/hr. 30 PSI Watts 740 1-1/4" x 1-1/2" 3,075,000 Btu/hr. 50 PSI	383600093 383600101
Watts 740 1-1/2" x 2" 2,900,000 Btu/hr. 30 PSI Watts 740 1-1/2" x 2" 4,237,000 Btu/hr. 50 PSI	383600094 383600102
Watts 174A 3/4" x 3/4" 1,400,000 Btu/hr. 80 PSI	383600521
Antifreeze, Sentinel X500 (5 gallons)	592900006
Corrosion Inhibitor, Sentinel X100 (5 gallons)	592900016
Corrosion Inhibitor, Sentinel X100 (50 gallons)	592900017
Inhibitor Quick-Test Kit	592900005
Cleaner, Sentinel X400 (one tube, 275 ml)	592900003
High Altitude Conversion Kit 2,000 to 6,999 ft	383301201
High Altitude Conversion Kit 7,000 to 10,000 ft	383301202
CSD-1 Conversion Kit – LGB-5	383301203
CSD-1 Conversion Kit – LGB 6 thru 20	383301204
Safety Valve - Steam 1" x 1" 643,000 Lb/hr 15 PSI 1-1/4" x 1-1/2" 1,200,000 Lb/hr 15 PSI 1-1/2" x 2" 1,900,000 Lb/hr 15 PSI 2" x 2" 2,500,000 Lb/hr 15 PSI	383600107 383600108 383600109 383600110

The LGB Commercial Boiler

Legend for Figure 73, page 102

- | | |
|---|---|
| 1. Cast iron heat exchanger assembly (not shown)
Cast iron sections assembled using drawing rods. | 12. Low water cutoff (steam shown) |
| 2. Collector hood (not shown) | 13. Gauge glass (steam only) |
| 3. Inducer / Vent adapter
Inducer overcomes heat exchanger pressure drop to ensure adequate flow through flue ways. | 14. Pressure controls/limits (steam only) |
| 4. Control module
The control module is used to configure boiler settings and monitor boiler operation. | 15. Gauge
Pressure or pressure/temperature |
| 5. Transformer | 16. Main burners
409 stainless steel burners. |
| 6. Gas valve | 17. Pilot assembly
Includes pilot burner, ignition electrode, and flame sense rod. |
| 7. High pressure switch (not shown)
CSD-1 only. | 18. Main flame sense (not shown)
Measures flame signal on LGB-6 - 20 models. |
| 8. Low pressure switch (not shown)
CSD-1 only. | 19. Gas manifold / Orifices |
| 9. Air pressure switch
Detects inducer operation and vent blockage. | 20. Jacket panels
The front door panel is removable to access controls and gas train. |
| 10. Flue temperature switch (not shown) | 21. Inducer cover plate |
| 11. Temperature sensor (water only, not shown) | 22. ASME rating plate (not shown) |
| | 23. Boiler tappings (not shown)
See <u>page 16</u> for tapping details. |

Figure 73 The LGB commercial boiler



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Replacement Parts

Table 26 Kits and part numbers for [Figure 74, page 104](#)

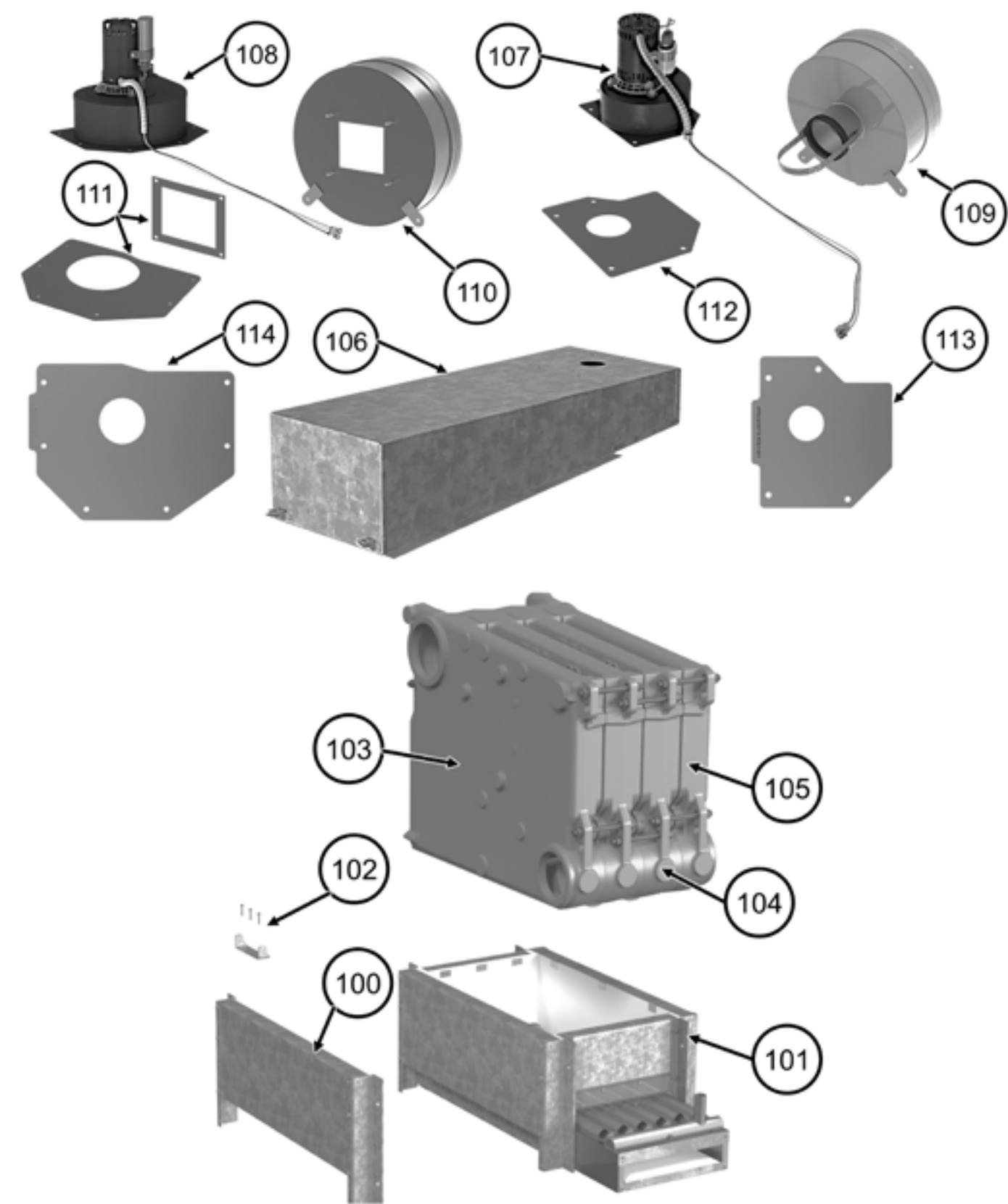
ASSEMBLY BOXES			
Item	Description	Part Number	Required for assembly of
Not Shown	Assembly Box (includes draw rods, gaskets, seals, and add'l hardware)		
	Size 4R/4	383301020	Base Assembly, Section Assembly, Collector Hood Assembly, Jacket Assembly
	Size 5	383301021	
	Size A	383301022	
	Size B	383301023	
	Size C	383301024	
	Size D	383301025	
	Size E	383301026	
	Size F	383301027	
	Size G	383301028	

BASE			
Item	Description	Part Number	Required for assembly of
100	Base End Panel	383301000	Replacement only
101	Base Assembly		Base Assembly
	Size 4R/4	383301001	
	Size 5	383301002	
	Size A	383301003	
	Size B	383301004	
	Size C	383301005	
	Size D	383301006	
	Size E	383301007	
	Size F	383301008	
	Size G	383301009	
102	Casting Retention Bracket Kit	383301210	Replacement only
Not Shown	Fiberglass Tape Seal Kit	383301321	Replacement only

CASTINGS			
Item	Description	Part Number	Required for assembly of
103	Left End Section	313300200	Section Assembly
104	Intermediate Section	313300208	
105	Right End Section	313300212	
Not Shown	Section Replacement Kit	383300405	Replacement only

COLLECTOR HOODS AND INDUCERS			
Item	Description	Part Number	Required for assembly of
106	Collector Hoods (includes collector hood, orifice plate)		Collector Hood Assembly
	Size 4R/4	383301080	
	Size 5	383301081	
	Size A	383301082	
	Size B	383301083	
	Size C	383301084	
	Size D	383301085	
	Size E	383301086	
	Size F	383301087	
	Size G	383301088	
107	Inducers		Inducer Assembly, Vent Adapter Assembly
	Small (LGB 4R & 4)	510312193	
108	Large (LGB 5 thru 20)	510312194	Vent Adapter Assembly
109	Vent Adapters		
	10" (LGB 4R & 4)	560907833	
110	12" (LGB 5 thru 7, LGB 14 Left Side)	560907837	
	14" (LGB 8 thru 9, LGB 16, LGB 14 Right Side, LGB 18 Left Side)	560907835	
	16" (LGB 10 thru 12, LGB 20, LGB 18 Right Side)	560907836	
111	Inducer Gasket Kit (includes gaskets, hardware)		Replacement only
	Size 5-20	383301207	
112	Size 4/4R	383301208	
Not Shown	Collector Hood Hardware Kit (includes j-bolts, bolts, washers, nuts, QTY for 1 boiler)	383301209	
Not Shown	Fiberglass Rope Seal Kit (includes rope, silicone sealant)	383301322	
113	Inducer Orifice Kits (includes orifice plate, gaskets, hardware)		
	LGB 4R Water	383301212	
114	LGB 4 Water & 4R Steam	383301213	
	LGB 5 Water	383301214	
	LGB 6 Water	383301215	
	LGB 7 Water & LGB 14 Left Water	383301216	
	LGB 8, LGB 14 Right, & LGB 16 Right Water	383301217	
	LGB 9, LGB 16 Left, & LGB 18 Left Water	383301218	
	LGB 10, LGB 18 Right, & LGB 20 Right Water	383301219	
	LGB 11 & LGB 20 Left Water	383301220	
	LGB 12 Water	383301221	

Figure 74 Boiler assembly



Replacement Parts, continued

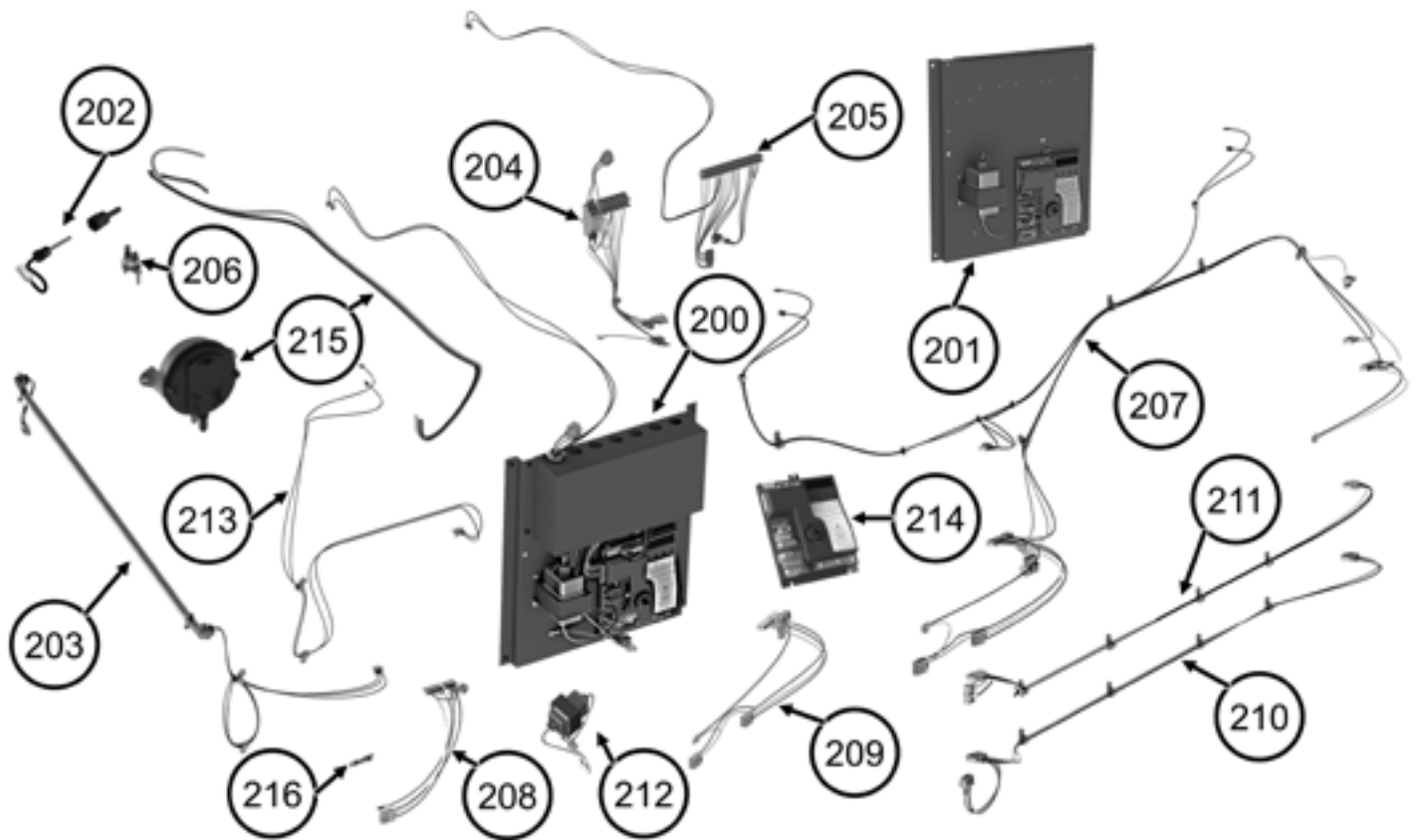
Table 27 Kits and part numbers for Figure 75, page 106

TRIM BOXES			
Item	Description	Part Number	Required for assembly of
Not Shown	Water Trims (includes high limit control, operating control, relief valve, pressure/temperature gauge, wiring harness)		Section Assembly, Control Assembly
	LGB 4R thru 5	383301040	
	LGB 6 thru 9	383301041	
	LGB 10 thru 12	383301042	
	LGB 14 thru 20	383301043	
Not Shown	Steam Trims (includes high limit control, operating control, relief valve, pressure gauge, water gauge glass & cocks, wiring harness)		Section Assembly, Control Assembly
	LGB 4R thru 5	383301050	
	LGB 6 thru 10	383301051	
	LGB 11 thru 12	383301052	
	LGB 14 thru 20	383301053	

CONTROL ITEMS			
Item	Description	Part Number	Required for assembly of
Not Shown	#61 LWCO (Steam Only)	511114474	Control Assembly (Steam)
200	Control Panels (includes control module, panel, wiring harnesses)		Control Assembly
	Common (LGB 4R thru 20)	383300588	
	Base 2 (LGB 14 thru 20)	383300589	
202	Water Outlet Temperature Sensor Kit (includes sensor, well, thermal paste)	383301295	Replacement only
203	Water Outlet Temperature Sensor Wiring Harness Kit	383301296	
204	High Voltage Inducer/Circulator Common Wiring Harness Kit	383301297	
205	Low Voltage Common Wiring Harness Kit	383301298	
206	Flue Temperature Switch Kit (includes switch, hardware)		
	Steam	383301299	
	Water	383301300	
207	Gas Valve Dual Base Combination Wiring Harness Kit	383301301	
208	Gas Valve LGB 4-5 Wiring Harness Kit	383301302	
209	Gas Valve LGB 6-12 Wiring Harness Kit	383301303	
210	High Voltage Y-Harness Dual Base Wiring Harness Kit	383301304	
211	High Voltage Inducer Y-Harness Dual Base Wiring Harness Kit	383301305	
212	Transformer Kit (includes transformer, hardware)	383301306	
213	Pressure Switch Single Base Wiring Harness Kit	383301307	
214	Kit Service Module Ignition 1135-400	383301200	
215	Pressure Switch Kit (includes pressure switch, tubes x2, hardware)		Replacement only
	Setpoint 2.45 LGB 4/4R, 11/12, 20 Left Side	383301309	
	Setpoint 1.36 LGB 5	383301310	
	Setpoint 1.65 LGB 6/7, 14 Left Side	383301311	
216	Setpoint 2.10 LGB 8/9/10, 14 Right Side, 16/18, 20 Right Side	383301312	
	Configuration Plug Kit (includes configuration plug only)		
	4-5 Water	383301313	
	4-5 Steam	383301314	
	6-12 Water	383301315	
	6-12 Steam	383301316	
Not Shown	14-20 Water	383301317	
	14-20 Steam	383301318	
	Blower Relay	570350231	
	Gas Valve LGB 5 CSD-1 Wiring Harness Kit	383301320	
	1135-401 Upgrade Wiring Harness Kit	383301319	

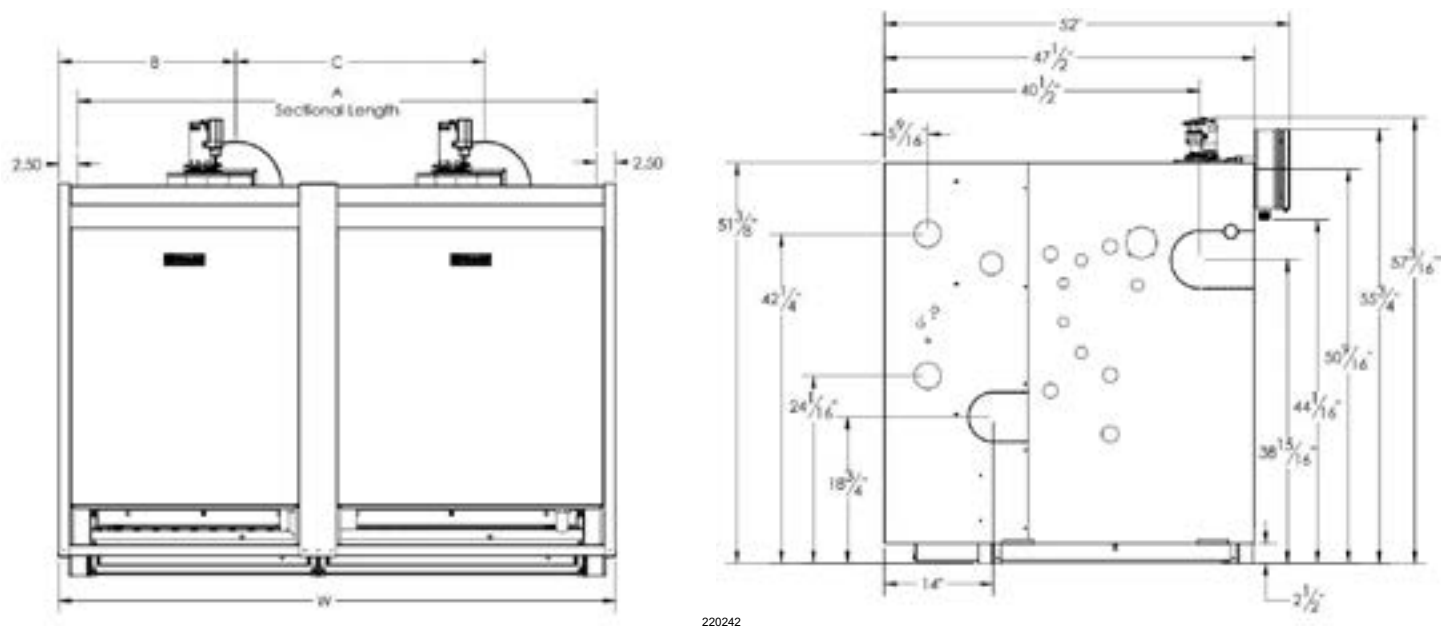
Not Shown	Water Trim Wiring Harness	591319804	Replacement only
	Combination Operating and High Limit Control	510312065	
	Electrode Type Low Water Cut-Off	511114528	
	Well, 3/4 NPT	592300006	
	Steam Trim Wiring Harness	591319800	
	Water Gauge Glass Kit, 5/8" x 10 5/8" with gaskets and brass washers	383600002	
	Water Gauge Glass Guard, 3/16" Dia. X 12 1/2" Long	563334595	
	Water Gauge Glass Cocks, Set 1/2" NPT Male Inlet	510218145	
	Combination Pressure-Vacuum Gauge	510218100	
	High Limit Steam Pressure Control	510312135	
	High Limit Steam Pressure Control	510312106	

GAS TRAIN ITEMS			
Item	Description	Part Number	Required for assembly of
300	Gas Controls (includes complete gas train and wire harnesses)		Gas Train Assembly
	Size 4R/4/5	383301061	
301	Size A/B	383301062	
	Size C/D	383301063	
	Size E	383301064	
302	Size F/G	383301065	
	Size 14/16	383301066	
	Size 18/20	383301067	
Not Shown	LGB 5 CSD-1 Kit (includes pilot solenoid, fittings, high/low gas pressure switches, pilot tubing, pilot regulator, harness)	383301203	CSD-1 Boilers (LGB 5 Only)
Not Shown	LGB 6-20 CSD-1 Kit (includes fittings, high/low gas pressure switches, pilot regulator)	383301204	CSD-1 Boilers (LGB 6-20 Only)
303	Burner Regular	512200126	Replacement only
304	Burner With Pilot Bracket	512200127	
Not Shown	Pilot Kit (includes pilot, screws)	383301205	
	Main Flame Sensor Kit (includes sensor, harnesses)	383301206	
	Pilot Burner Mounting Bracket	460005624	
	Main Flame Sensor Mounting Bracket	423300420	
	Main Flame Sensor	511724274	
	Pilot Line Aluminum Tubing, 1/4" Dia. X 20" Long	560742880	
	Pilot Line Union, 1/4" CC	561643450	
	Valve Gas without Regulator 1-1/4 NPT Normally Closed 1/2 Maximum PSI	511044192	
	Valve Gas without Regulator 1-1/2 NPT Normally Closed 1/2 Maximum PSI	511044193	
	Valve Natural Gas 2 x 2 NPT 24V Without Regulator	511044513	
	Valve Natural Gas 3/4 x 3/4 NPT 2-Stage Intermittent Pilot	511044515	
	Valve Gas Two Stage Pressure Regulator 1-1/4 NPT 24 Volt Natural Gas	511044215	
	Valve Gas Two Stage Pressure Regulator 1-1/2 NPT 24 Volt Natural Gas	511044216	
	Valve Natural Gas 2 x 2 NPT 24V 2-Stage With Regulator	511044514	
	Solenoid Valve 24 Volt 1/4 NPT 20CFH 10 PSI Maximum Pressure	511044039	
	Valve Gas Manual 1/8 Male NPT x 1/4 Compression	511246340	
	Valve Hand 1 NPT with (2) 1/8 NPT Taps	511246325	
	Valve Manual 1-1/4 NPT	511246330	
	Valve Manual Control 1-1/2 NPT	511624300	
	Valve Manual Control 2 NPT	511246305	
	Orifice Gas 3.95mm (LGB 4-20)	560528979	
	Orifice Gas Size 25 (LGB 4R)	560529142	

Figure 75 Control panel and gas train examples

Dimensions

Figure 76 Dimensional data



LGB Series 3 (Natural Gas Only)												
Boiler Model Number	Supply Tappings		Return Tappings		Dimensions in Inches				5.75" Gas Train		Vent Adapter Outlets	
	No.	Size	No.	Size	A	B	C	W	No. Gas Trains	Gas connect size	No.	Size
LGB-4R	2	6	2	5	18	15	—	23	1	1"	1	10
LGB-4	2	6	2	5	18	15	—	23	1	1"	1	10
LGB-5	2	6	2	5	23	18-3/16	—	28	1	1"	1	12
LGB-6	2	6	2	5	28	20-11/16	—	33	1	1-1/4"	1	12
LGB-7	2	6	2	5	33	23-3/16	—	38	1	1-1/4"	1	12
LGB-8	2	6	2	5	38	25-11/16	—	43	1	1-1/4"	1	14
LGB-9	2	6	2	5	43	28-3/16	—	48	1	1-1/4"	1	14
LGB-10	2	6	2	5	48	30-11/16	—	53	1	1-1/2"	1	16
LGB-11	2	6	2	5	53	33-3/16	—	58	1	2"	1	16
LGB-12	2	6	2	5	58	35-11/16	—	63	1	2"	1	16
LGB-14	2	6	2	5	68	23-3/16	32-11/16	73	1	2"	2	12
												14
LGB-16	2	6	2	5	78	28-3/16	37-11/16	83	1	2"	2	14
												14
LGB-18	2	6	2	5	88	28-3/16	42-11/16	93	1	2"	2	14
												16
LGB-20	2	6	2	5	98	33-3/16	47-11/16	103	1	2"	2	16
												16



SECTION 8

Service Information

This section includes ratings information, maintenance log, and the installation and service certificate.

Section Contents

Ratings	108
Maintenance Log	110
Notes	111
Installation and Service Certificate	112

Ratings

Derate Information

Table 28 Derate per inlet pressure

Derate per 0.25" below 5.75" inlet pressure				
Actual Inlet Natural Gas Pressure	LGB-4R		LGB 4-20	
	Derate Multiplier	Resulting Manifold Gas Pressure	Derate Multiplier	Resulting Manifold Gas Pressure
5.50	—	—	0.95	3.20
5.25	—	—	0.93	3.10
5.00	—	—	0.90	2.80
4.75	0.98	3.43	0.88	2.70
4.50	0.95	3.23	0.82	2.30
4.25	0.91	2.99	0.79	2.20
4.00	0.90	2.88	0.77	2.05
Note: DO NOT operate below 4.00" gas inlet pressure while flowing.				

Ratings, continued

Boiler Ratings

Table 29 Ratings and engineering data for LGB boilers

DOE



To determine the boiler size, count the number of sections or measure the jacket length.* Check the box next to the boiler size installed.				Input Btuh	Minimum Input Btuh	STEAM Gross Output Btuh	WATER Gross Output Btuh	Net AHRI Output		
Boiler Model Number	Number of Sections	Jacket Length (inches)	Min. Relief Valve Cap. MBH					STEAM Sq. Ft.	STEAM MBH	WATER MBH
<input type="checkbox"/> LGB-4R*	4	23	350	350,000	175,000	283,000	294,000	885	212	256
<input type="checkbox"/> LGB 4	4	23	400	400,000	200,000	324,000	336,000	1013	243	292
<input type="checkbox"/> LGB 5	5	28	520	520,000	260,000	421,000	436,000	1316	316	379
<input type="checkbox"/> LGB 6	6	33	650	650,000	325,000	526,000	546,000	1644	395	475
<input type="checkbox"/> LGB 7	7	38	780	780,000	390,000	631,000	655,000	1972	473	570
<input type="checkbox"/> LGB 8	8	43	910	910,000	455,000	737,000	764,000	2304	553	664
<input type="checkbox"/> LGB 9	9	48	1040	1,040,000	520,000	842,000	873,000	2632	632	759
<input type="checkbox"/> LGB 10	10	53	1170	1,170,000	585,000	947,000	982,000	2960	710	854
<input type="checkbox"/> LGB 11	11	58	1300	1,300,000	650,000	1,053,000	1,092,000	3303	793	950
<input type="checkbox"/> LGB 12	12	63	1430	1,430,000	715,000	1,158,000	1,201,000	3666	880	1044
<input type="checkbox"/> LGB 14	14	73	1690	1,690,000	845,000	1,368,000	1,419,000	4394	1054	1234
<input type="checkbox"/> LGB 16	16	83	1950	1,950,000	975,000	1,579,000	1,638,000	5108	1226	1424
<input type="checkbox"/> LGB 18	18	93	2210	2,210,000	1,105,000	1,790,000	1,856,000	5791	1390	1614
<input type="checkbox"/> LGB 20	20	103	2470	2,470,000	1,235,000	2,000,000	2,074,000	6470	1553	1803

* The LGB-4R has the same dimensions and section count as the LGB-4. Verify that the Inducer Orifice and Gas Orifices are from LGB-4R.

IMPORTANT

Gas information labels must be attached to the gas train in the gas control carton. Installation is not complete until the labels are attached to the gas train.

- For installation on noncombustible flooring only.
- Provide service clearances and a minimum 24" between jacket and any combustible walls and ceiling.
- Install boiler in a space large in comparison to the size of the boiler.
- Install the boiler system according to the category for which it is rated:
 - Steam Boilers: Vent Category I
 - Water Boilers: Vent Category II
- Net AHRI Ratings are based on net installed radiation of sufficient quantity for building requirements. Do not add on for normal piping and pickup. Water boilers are rated at 80 psig maximum working pressure. Water ratings are based on piping and pickup allowance of 1.15. Steam ratings are based on piping and pickup allowances as follows: LGB-4R thru LGB-10 = 1.333, LGB-11 = 1.328, LGB-12 = 1.316, LGB-14 = 1.297, LGB-16 thru LGB-20 = 1.288. Additional allowance should be made for gravity hot water systems or unusual piping and pickup loads. Ratings shown are for elevations up to 2,000 feet. For ratings above 2,000 feet, reduce at a rate of 4 percent per 1000 feet above sea level.

Maintenance Log

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Notes

Lined area for notes.



Boiler Model:_____ Series:___ Consumer Protection Number (CP):_____

- ☐ Installation instructions have been followed.
- ☐ Checkout sequence has been performed.
- ☐ Above information is certified to be correct.
- ☐ Information has been received and left with the owner or maintenance person.

Installer: _____

(Company) (Phone)

(Address) (Installer's Signature)

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Manual Part Number 550-100-206/0124

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