6301 3784 - 08/2001 US/CA

Buderus
HYDRONIC SYSTEMS

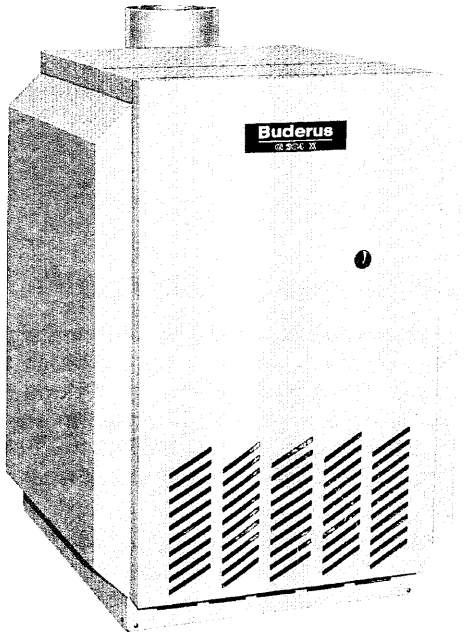
Installation, operation and maintenance manual

Gas hot water boiler G 234 X-Model Boilers

WARNING
Before putting the boiler into operation read this manual carefully.

WARNING
Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

CAUTION
The operating manual is part of the documentation that is delivered to the installation's operator. Go through the information in this manual with the owner/operator and make sure that he or she is made familiar with all the necessary operating instructions.



CERTIFIED

DESIGN CERTIFIED

Notice: This manual must be retained for future reference.

Contents page

Read this manual carefully

Correct installation and adjustment of the burner and the control panel is a precondition for safe, efficient operation of the gas boiler.

Read this manual and the specifications on the safety label carefully before attempting to put the burner into operation.

Operating limits of the boiler:

max. boiler temperature: . . . . . 220 °F

max. operating pressure:. . . . . 58 psi

Only a qualified installing contractor may carry out the installation, the initial start-up, and conversion to another type of gas.

When replacing an existing boiler, it is important to check the condition of the entire hot water distribution system to insure proper operation.

Maintenance and cleaning should be carried out at least once a year by a trained service technician. The entire installation must be tested for proper operation. Any defects detected must be fixed immeditely.

1. Regulations and guidelines

The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z 223.1. In Canada, installation must be in accordance with the requirements of CAN/CGA B 149.1 or 2 Installation Code for Gas Burning Appliances and Equipment.

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.

Install CO detectors per local regulations. Boiler requires yearly maintenance, see maintenance section page 16.

Installer détecteurs de CO survant les régulations locales. La chaudière doit être entretenue une tois par au (voir page 16 du section entretien).

2. Dimensions and supply connections

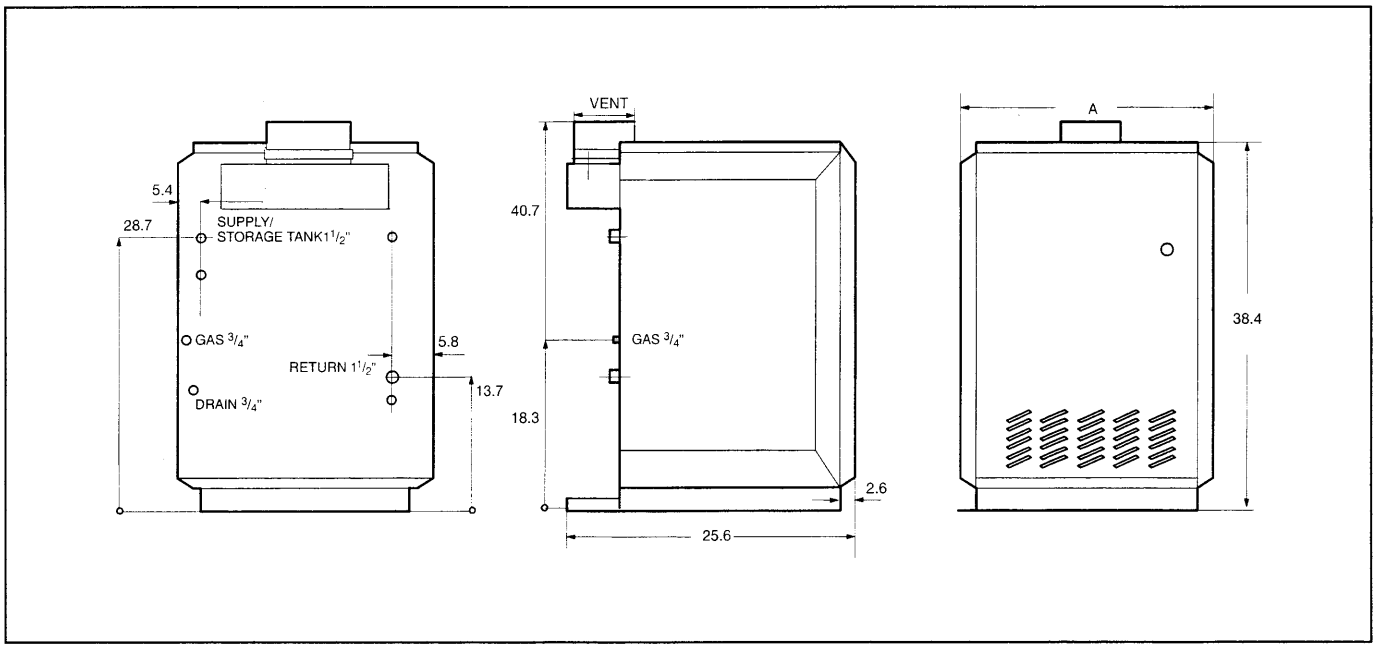


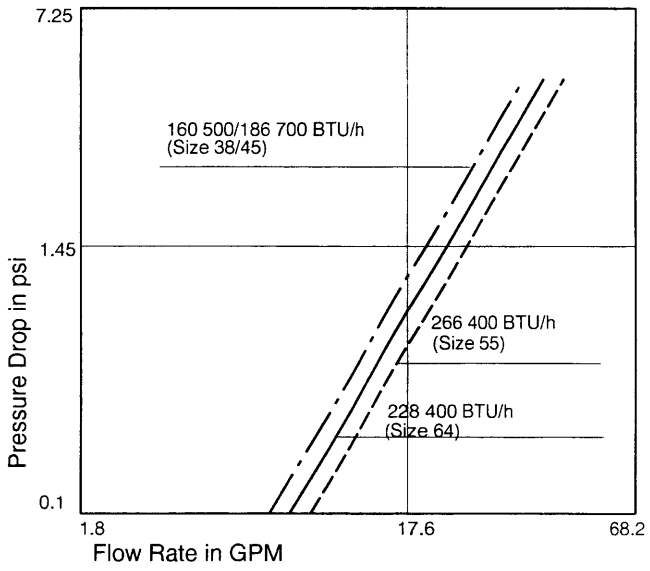
Fig. 1: Front, side and rear views, measurements in inches

Dimensions

boiler size	boiler input BTU/h	boiler output BTU/h	A inches	vent inches	minimum relief valve cap. lb/hr	number of burners	boiler water volume US Gal.	dry weight lbs
38	160 200	129 700	25.6	7	130	3	6.1	487
45	186 700	153 600	25.6	7	153	3	6.1	487
55	228 400	187 700	29.1	7	188	4	7.1	562
64	266 400	218 500	32.7	8	218	4	8.2	684

Table 1

Diagram 1: Pressure Drop



3. Boiler description

The boiler is supplied in its carton with a built in draft hood, gas burner and control, jacket, documentation packet, flame rollout safety shutoff switch and vent safety shutoff switch. The following items are shipped in an accessory cartons:

- Pressure relief valve
- 3/4" elbow
- Vent damper
- Drain valve 3/4"

The following optional items are available:

- Circulator
- Cleaning brush

4. Installation

This boiler is approved for installation in a closet. There must be allowable access of at least 33 inches in front of the boiler for servicing. Minimum clearances of 2 inches from the front, right and left sides; 6 inches from the rear of the draft hood; and 30 inches from the top must be maintained (Fig. 2). The boiler may be installed on a combustible floor. The boiler must not be installed on carpeting.

Transporting the boiler

Transport the boiler to the installation site in shipping carton.
Remove banding.
Lift off carton.
Remove bolts from under pallet.
Lift the boiler from under the side panel and slide to side of pallet. Push a pipe under the boiler as shown in fig. 3 and roll it on pipes to the installation location.
Move the boiler to its final installation position.

Important

Always protect sheet metal parts, gas pipe, burner and control panel. **Never** lift the boiler on these parts.

Installation surface

The boiler is extremely heavy when filled. Before installing, it must be determined that the floor can carry the load.

Unpacking parts before installing

Unpack all boxes and cartons and check that all parts have been delivered using the packing slips provided.

Each boiler is checked and tested carefully before leaving the factory. If there is any damage or parts are missing, inform the supplier without delay. Before throwing away packaging material, check it carefully for parts.

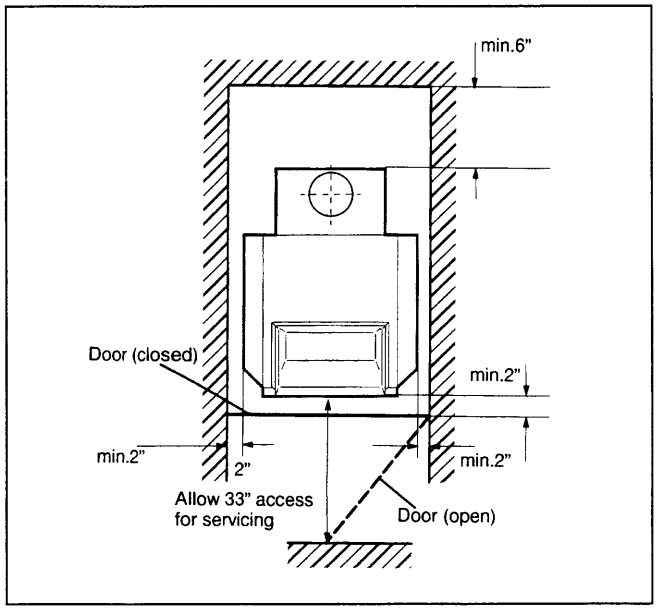


Fig. 2: Closet clearance

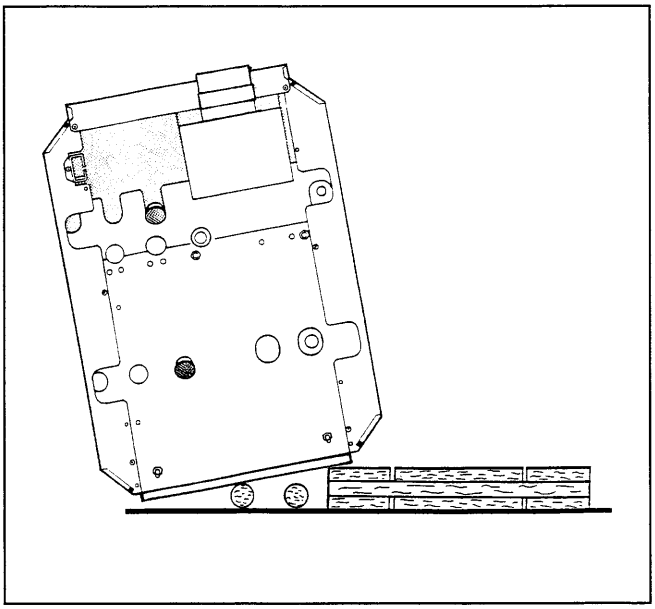


Fig. 3

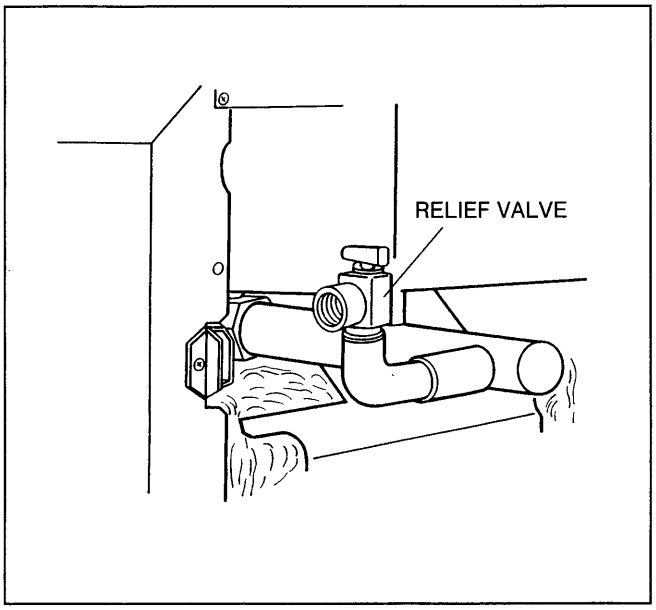


Fig. 4

5. Boiler Piping

The boiler shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, control replacement, etc.).

A hot water boiler installed above radiation level must be provided with a low water cutoff device either as a part of the boiler or at the time of boiler installation, fig. 5.

The boiler, when used in connection with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler.

The boiler piping system of a hot water boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

Install the pressure relief valve as shown in fig. 4. The relief valve must be installed per ANSI/ASME Boiler and Pressure Vessel Code, Section IV. The stem of the relief valve must be mounted vertically. Pipe the discharge full port to a floor drain. Follow good piping practices per local codes.

Allow 2" clearance from hot water piping to combustible walls of closet.

Water Treatment

A water analysis should be done on the water that will be used to fill the system. Treatment may be required depending on the analysis results. For extremely hard water or pH below 7,0 consult your local water treatment company.

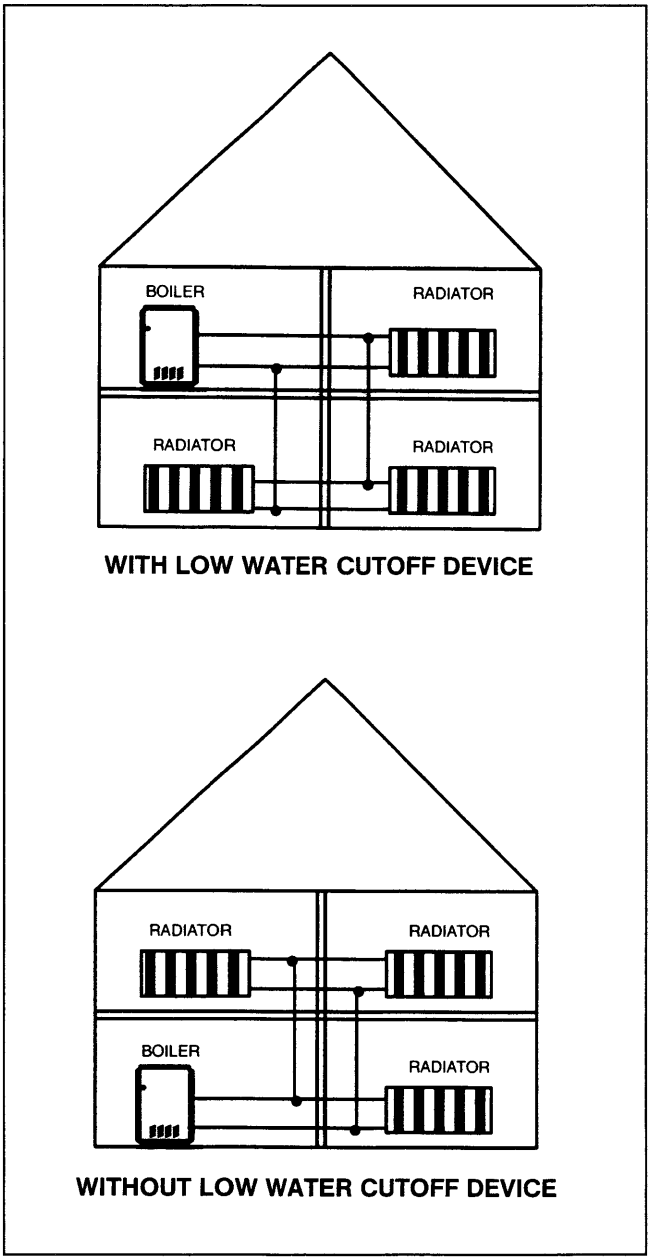


Fig. 5

6. Electrical supply

The electrical connections to this boiler must be made in accordance with all applicable local codes and the current edition of the National Electrical Code, ANSI/NFPA-70. Installation should also conform with CSA C 22.1 Canadian Electrical Code Part I if installed in Canada.

The boiler must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the current edition of the National Electrical Code, ANSI/NFPA 70.

A shutoff switch should be located at the boiler.

Caution: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Verify proper operation after servicing.

7. Gas Supply

Gas connections

Determine the proper gas pipe size needed for the installation using tables 2 and 3. Do not neglect the pipe fitting loses.

A sediment trap must be installed at the inlet of the gas supply piping to the boiler. When local codes require, a manual shutoff valve must be installed outside the boiler jacket. it is recommended that a manual shutoff valve be installed on the main gas piping to the boiler. The gas piping must be supported external to the boiler.

When installing the gas supply connection, it must comply with the local regulations or, if such regulations do not exist, with the current edition of the National Fuel Gas Code, ANSI Z223.1.

In Canada, the gas supply connection must comply with local regulations or, if such regulations do not exist, with CAN/CGA-B149. 1 or 2 Installation Guidelines.

WARNING

Do not check for gas leaks with an open flame – use soap and water solution. Failure to do so can cause severe personal injury, death or substantial property damage.

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of ½ psig.

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than ½ psig.

The boiler and its gas connection must be leak tested before placing the boiler in operation.

See "Placing the boiler in operation", page 11.

Pipe joint compound (pipe dope) must be resistant to corrosive action of liquified petroleum gases and applied sparingly only to male threads of pipe joints.

High Altitude

The boiler is factory shipped for installation below 2000 feet elevation. The boiler must be derated for installations above 2000 feet. The derate is accomplished by changing the main burner orifices. If your elevation is above 2000 feet, contact your supplier to order appropriate parts. Do not attempt to derate the appliance without Buderus certified parts and instructions.

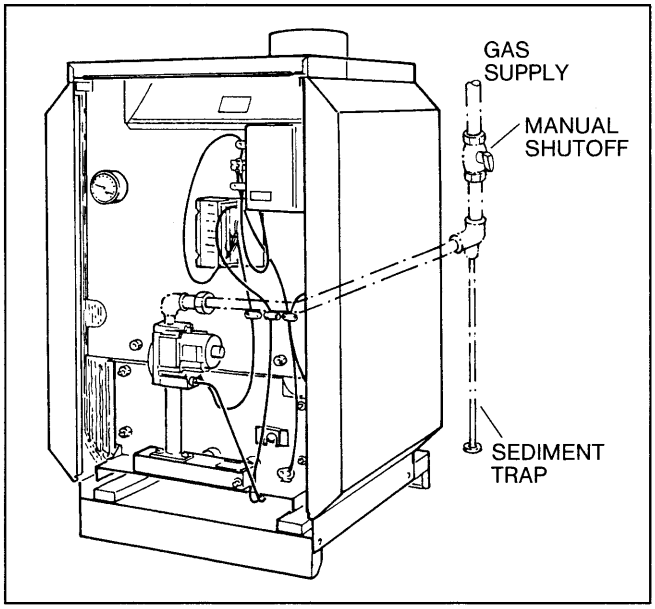


Fig. 6: Pipe connection to gas control – rear

Length of Pipe in Feet	CAPACITY OF PIPE IN CUBIC FEET OF GAS PER HOUR				
	1"	1¼"	1½"	2"	2½"
10	520	1060	1600	3050	4800
20	350	730	1100	2100	3300
30	285	590	890	1650	2700
40	245	500	760	1450	2300
50	215	440	670	1270	2000
75	175	360	545	1020	1650
100	160	305	480	870	1400
150	120	250	380	710	1130

Table 2: Gas Pipe Capacity

Maximum pipe capacity in ft/hr based on 0.60 specific gravity gas at pressure of 0.5 psig or less and a 0.3" W.C. Pressure drop.

Equivalent length of pipe fittings in feet				
Nominal Iron Pipe Size	Type of pipe fitting			
	90° Elbow	Tee (flow thru branch)	Gate Valve (full port)	Gas Cocks
(inches)	Equivalent length in feet			
1"	3	5	0.6	1.60
1¼"	4	6	0.8	2.15
1½"	5	7	1.0	2.50
2"	7	10	1.3	3.00
2½"	8	12	1.6	3.50

Table 3: Equivalent Length Chart

8. Combustion Air and Ventilation Openings

Provisions must be made for combustion and ventilation air in accordance with section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z 223.1, or applicable provisions of the local building codes.

Canadian installations must comply with CAN/CGA B 149.1 or 2. Installation Codes.

Ensure that there is no obstruction of the combustion and ventilation air flow.

Boiler area must be clear and free from combustible materials, gasoline and other flammable vapors and liquids, and corrosive liquids and vapors.

Air for combustion and ventilation

Be certain adequate facilities are available to provide air for satisfactory combustion, ventilation and draft hood dilution.

Appliances Located in Unconfined Spaces:

a. Installations in unconfined spaces with conventional construction and large areas; the supply of air for combustion and ventilation can usually be considered adequate.

Appliances Located in Confined Spaces:

a. In all air for combustion and ventilation is to come from within the building; two openings shall be provided with one opening commencing within 12 inches of the top and one opening commencing within 12 inches of the bottom of the enclosure. These openings shall not be located closer than 3 inches from either the top or bottom of the enclosure and shall be open into areas communicating freely with the outdoors. The area of each opening shall be equal to one square inch per 1000 BTU/HR of total input rating of all appliances witin the enclosure; with a minimum of 100 square inches for each opening.

b. If all air for combustion and ventilation is to come from outside the building; two openings shall be provided with one opening commencing within 12 inches of the top and one opening commencing within 12 inches of the bottom of the enclosure. These openings shall not be located closer than 3 inches from either the top or bottom of the enclosure and shall communicate directly or by ducts with the outdoors. The area of each opening shall be equal to one square inch per 4000 BTU/HR of total input rating. If ducts are used to convey the air, vertical ducts require areas of one square inch per 4000 BTU/HR; horizontal ducts require one square inch per 2000 BTU/HR. Ducts shall have the same cross sectional area as the full area of the openings to which they connect.

c. The upper opening is essential for maintenance of proper circulation of air with the boiler room and reasonable ambient temperature in order to maintain proper control temperatures.

9. Chimney or Vent Requirements

Venting must be installed according with Part 7, Venting of Equipment, of the current edition National Fuel Gas Code, ANSI Z 223.1 and applicable building codes. Canadian installations must comply with CAN/CGA B 149.1 or 2 Installation Codes.

Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

The vent size must not be reduced from sizes shown in table 1.

If this boiler will be connected to a masonry chimney, a thorough inspection of the chimney must be performed. Ensure that the chimney is clean, properly constructed and properly sized.

A lined chimney is prefered and must be used when required by federal, provincial, territorial, state, or local building codes. Vitreous tile linings with joints that prevent retention of moisture and linings made of non-corrosive materials are best. Advice for flue connections and chimney linings can be obtained from local gas utility. Vent material of single wall metal vent pipe must be used for this boiler.

Ensure the chimney is of adequate height per the tables in the National Fuel Gas Code, ANSI Z 223.1.

When removing boiler from common venting system

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it.

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

(a) Seal any unused openings in the common venting system.

(b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

(c) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

(d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

(e) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.

(f) After is has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas burning appliance to their previous condition of use.

(g) Any improper operation of the common venting system must be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z 223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 in the National Fuel Gas Code, ANSI Z 223.1.

Canadian installations must comply with CAN/CGA B 149.1 or 2 Installation Codes.

10. Vent Piping Assembly

The adapter collar provided must be installed without alteration. The draft hood must not be altered in any way. Install the adapter collar on the draft hood outlet section. Drill three (3) holes in the flue collar of the draft hood and secure the adapter collar with three (3) corrosion resistant sheet metal screws. Install the vent damper supplied with the boiler. Install plug provided into hole in damper blade.

Note: The vent damper cannot be installed in Canada on a propane gas unit.

Only the boiler may be vented through the vent damper supplied with the boiler. Ensure that the vent damper blade indicator is visible. Ensure a minimum of 6 inches of clearance to all combustible construction. Provide sufficient access for servicing of the vent damper.

Damper must be in the open position when the boiler's main burners are operating.

Secure the vent damper to the adapter collar with three (3) corrosion resistant sheet metal screws. Connect vent damper outlet to the chimney using the shortest length of vent piping possible.

Use a vent pipe of the proper diameter for the boiler. Any horizontal section of the vent system should be sloped upward toward the chimney at a minimum rate of 1/4 inch/foot. Ensure that the vent pipe is properly supported to prevent sagging. Support every 5 feet with hangers. Each connection must be securely fastened with at least 3 corrosion resistant sheet metal screws. The termination of the vent pipe should be flush with the inside of the chimney flue.

Always provide a minimum clearance of 6 inches between vent pipe and any combustible materials.

Do not reduce the size of the vent piping or add any restrictive devices to the venting system.

Ensure that all electrical power has been disconnected from the boiler.

Plug the vent damper to the Honeywell Aquastat Control on the panel in the front of the boiler, fig. 8. A cable chase is provided on the back of the boiler. Run the vent damper wiring harness through the chase, between the insulation and the jacket to the front of the boiler. Wire per the electrical diagram.

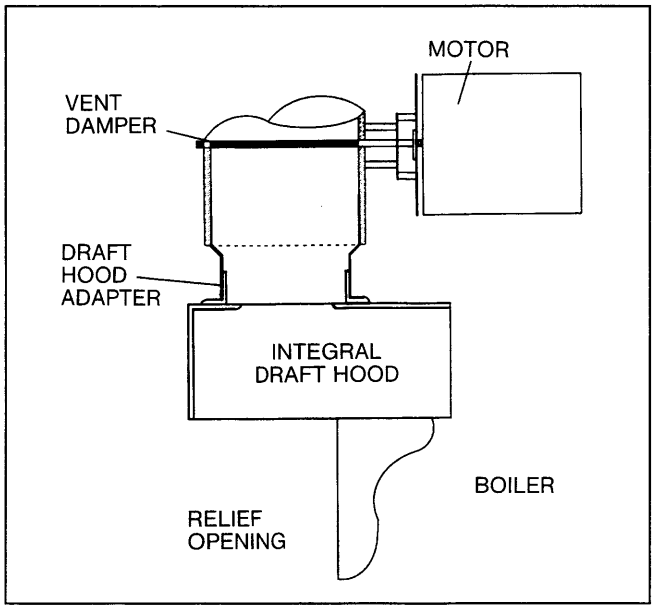


Fig. 7: Vent Damper Assembly

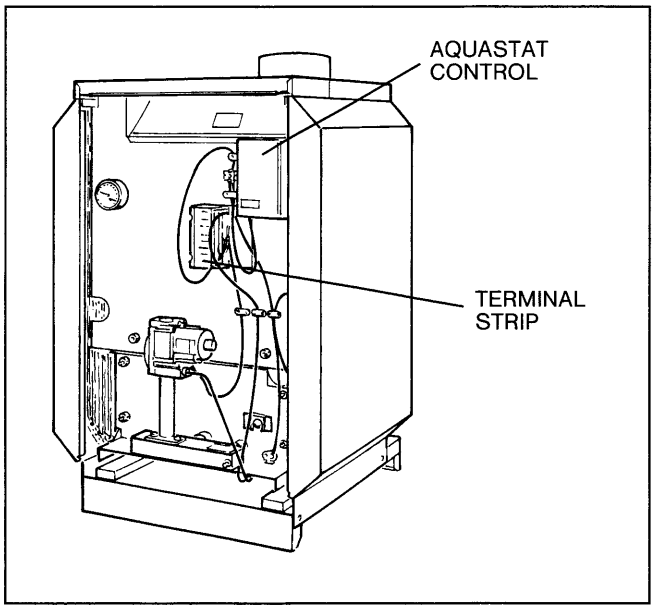


Fig. 8

11. Placing the boiler in operation

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler when the boiler underwent tests specified in ANSI Z 21.13 and CGA 4.9.

1. Turn off all electric power to the boiler and set thermostat to lowest setting.
2. Check the combustion air and ventilation openings.
3. Fill the boiler system with water and purge the air from the piping and radiation.
4. Remove the control access panel.
5. Open the main gas piping shutoff valve.
6. Test the gas piping on the side of gas control for leaks by applying a soap and water solution. If no leaks are found go to step 8. If any leaks are found, shut off the main gas piping shutoff valve.
7. Repair leaks and repeat step 6.
8. Shut off the main gas supply shutoff valve. Remove the line pressure tapping plug from gas control, fig. 9; install a test fitting and hook up a manometer so that line pressure can be checked.
9. Remove the manifold pressure tapping plug from the gas control, install a test fitting and hook up a manometer so that manifold pressure can be checked, fig. 9.
10. Open the main gas piping shutoff valve and measure the supply pressure to the boiler. The supply pressure must be between 7 and 10.5 inches water column for natural gas or 11 and 13 inches water column for propane gas. If pressure is not between 7" and 10.5" for natural gas or 11 and 13 inches for propane, call your service technician or gas supplier.
11. Follow the lighting instructions below.

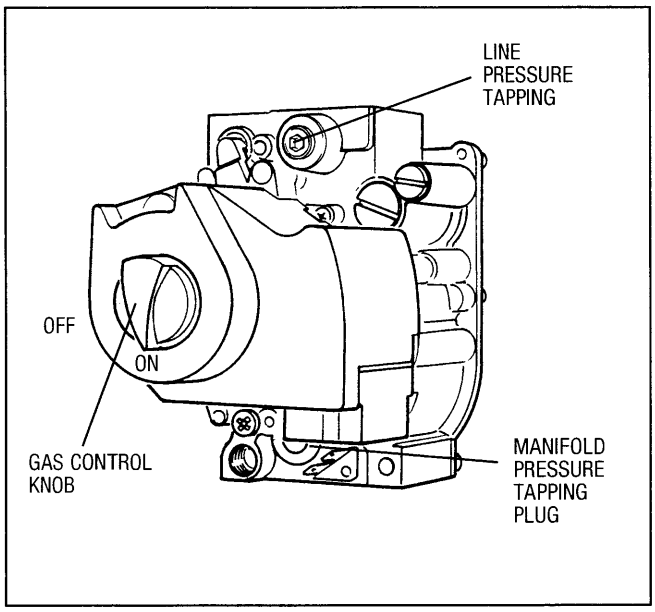


Fig. 9

Lighting Instructions

FOR YOUR SAFETY, READ BEFORE LIGHTING

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

A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the 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.

WHAT TO DO IF YOU SMELL GAS

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

C. Use only your hand to turn the gas control knob. Never use tools. If the knob 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.

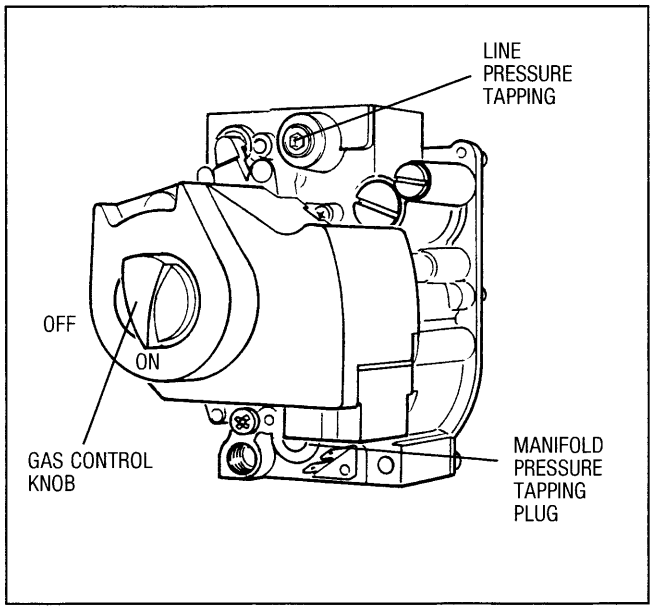


Fig. 10

OPERATING INSTRUCTIONS

STOP! Read the safety information printed on page 11 in these instructions.

1. 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 printed on page 11. If you do not smell gas, go to the next step.
2. Locate the pilot assembly by looking through the access hole in the burner assembly plate, fig. 11.
3. Turn gas control knob counterclockwise ↶ to **"ON"**.
4. Turn on all electric power to the appliance.
5. Set the thermostat to the desired setting.
6. The ignition control should initiate sparking at the pilot. The pilot should light and then the main burners should light. If the main burners do not light, shut off the main gas piping shutoff valve. Shut off all electric power to the appliance and call your service technician or gas supplier.
7. If the main burners light, then the gas fittings, union and orifices must be tested for leaks with a soap and water solution. If no leaks are found then go to step 9. If any leaks are found, turn gas control knob clockwise ↷ to **"OFF"**. Turn off all electrical power to the appliance, and set the thermostat to lowest setting.
8. Repair leaks. Repeat steps 1. through 7.
9. Check the supply pressure while the boiler is running. Pressure must be between 7 and 10.5 inches water column for natural gas or 11 and 13 inches water column for propane gas. Record supply pressure on page 14.
10. Check the manifold pressure. The manifold pressure must be adjusted to the values shown in the table 4. To adjust the manifold pressure, remove the capscrew from the gas control. Turn the pressure regulating adjusting screw clockwise ↷ to increase, or counterclockwise ↶ to decrease the manifold pressure. This adjustment must be made while the boiler is in operation.
11. After adjustment, record pressure on the form on page 14, and install the capscrew on the gas control, fig. 12.
12. Observe the pilot flame through hole in the burner assembly plate. The flame should envelop the flame sensor ½ – 1½ inch, fig. 13. If the pilot flame is satisfactory then go to step 13. If the pilot flame is too small or too large, adjust the pilot using the **pilot adjustment,** fig. 12. Turn the inner adjustment screw clockwise ↷ to decrease, or counterclockwise ↷ to increase the pilot flame. After adjustment, replace the cover screw and tighten firmly.
13. Observe the main burner flame through hole in the burner assembly plate. The flame should have a smooth, firm contour and be mostly blue in color, **fig. 14.** If the main burner flame is satisfactory, go to step 14. If main burner flame is lazy, yellow, or lifting off the burners, turn the gas control knob clockwise ↷ to **"OFF"**. Shut off the main gas piping shutoff valve. Disconnect all electric power to the appliance and call your service technician or gas supplier.

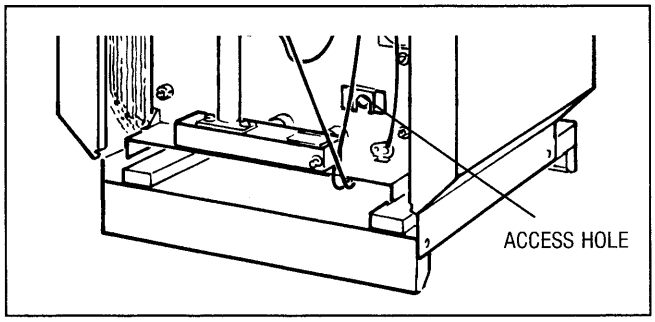


Fig. 11

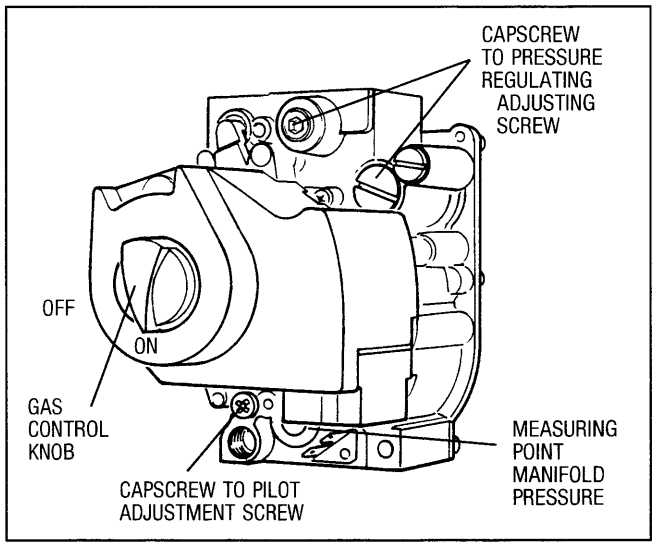


Fig. 12

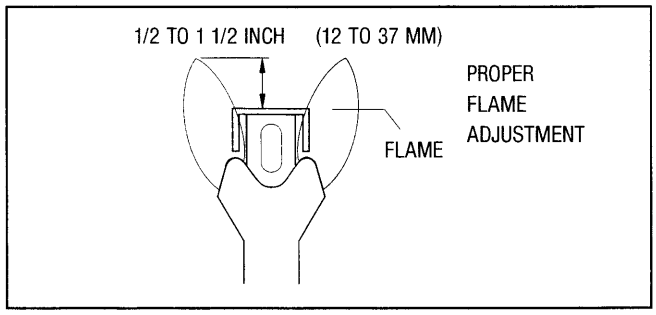


Fig. 13

Model G 234 X	**Natural gas**	**Propane gas**
38	3.0 Inches Water Column	10.6 Inches Water Column
45	4.1 Inches Water Column	10.5 Inches Water Column
55	4.6 Inches Water Column	10.3 Inches Water Column
64	4.4 Inches Water Column	10.3 Inches Water Column

Table 4

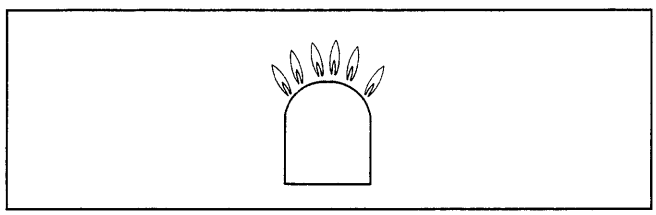


Fig. 14

14. The ignition safety shutoff means must be tested. Test the safety shutoff by shutting off the main gas piping shutoff valve.

    The main burner and the pilot flame will extinguish. Within six (6) seconds the gas control main gas solenoid should close and make an audible sound. The ignition will spark.

    After 90 seconds, the module should go into lock out mode and spark should stop. Turn off the electric power to the appliance. Open the main gas shutoff valve. Turn on the electric power to the unit. A normal operating sequence should occur. If the gas control functions satisfactorily then go to step 15. If the gas control does not function satisfactorily, immediately turn the gas control knob clockwise ↷ to **"OFF"**. Shut off the main gas piping shutoff valve. Turn off all electrical power to the appliance and call your service technician or gas supplier.

15. Turn the gas control knob clockwise ↷ to **"OFF"**.
16. Shut off the main gas piping shutoff valve.
17. Turn off electric power to the appliance, and set the thermostat to the lowest setting.
18. Remove the pressure test fittings from the line pressure and manifold pressure taps in the gas control and replace the plugs.
19. Repeat steps 1 through 6, and 13 to place the appliance back on operation. Check the plugs in the gas control with a soap and water solution. If no leaks are found go to step 21. If any leaks are found, shut off the main gas piping shutoff valve and turn off all electrical power to the appliance and turn the gas knob clockwise ↷ to **"OFF"**.
20. Repair leaks. Open the main gas shutoff valve and repeat step 19.
21. Wash off the soap and water solution used to test for leaks to ensure no corrosive effects from the soap.
22. Check the high limit aquastat operation to ensure that it shuts off the boiler when the boiler water temperature reaches the set point of the aquastat. Record on form on page 14.
23. Replace the control access panel.

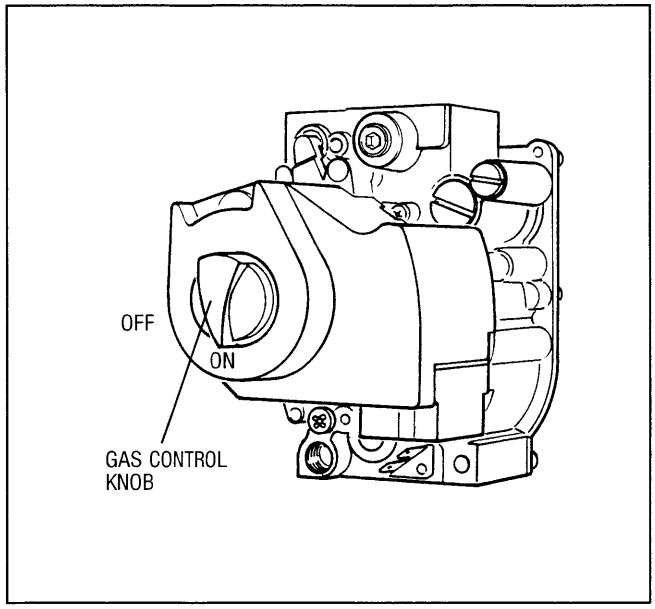


Fig. 15

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Turn gas control knob clockwise ↷ to "OFF". Do not force.
5. Replace control access panel.

Record of initial inspection and start up

Record the following information during initial start up of the boiler. This record will serve as a reference for yearly inspections.

Putting into operation	Remarks or measurement
1. Note type of gas	☐
2. Check combustion air and ventilation openings and flue connection	☐
3. Check boiler for correct orifices, see table 5 below	☐
4. Fill boiler with water and purge air from the system	☐
5. Measure gas inlet pressure in inches water column	_____
6. Check manifold pressure and adjust if necessary	_____
7. Leakage test during operation Check pilot and main burner flames and vent system operation	☐
8. Take stack measurements; see instructions page 15	☐
8.1 Gross stack gas temperature t_S in °F Record room temperature t_A in °F	t_S = _____ t_A = _____
8.2 Net stack gas temperature $t_S - t_A$ in °F	_____
8.3 Carbon dioxide content (CO_2) in %	_____
8.4 Carbon monoxide content stack (CO), airfree in ppm	_____
8.5 Chimney draft min. in inches water column. Ensure that no flue gas is spilling from the relief opening	_____
9. Check high limit aquastat operation	☐
10. Inform owner/sign and hand over the technical documents	☐
11. Installing Contractor Signature _____ Owner Signature _____	☐ ☐

	Orifice Size (0 – 2000 ft)			
Boiler Sizes	38	45	55	64
Natural Gas	3.70 mm	3.70 mm	3.50 mm	3.80 mm
Propane Gas	2.20 mm	2.40 mm	2.30 mm	2.45 mm

Table 5

Taking vent gas measurements

Record all measurements on form on page 18.

- Drill a hole in the vent pipe 2 feet downstream of the collector vent hood.

Carbon dioxide content

If the carbon dioxide content is less than 3 % or more than 7 % for natural gas or less than 4 % or more than 8 % for propane, the chimney draft must be checked.

Vent gas loss

Vent gas loss can be calculated with the following formula:

$$q_A = (t_S - t_A) \cdot \left(\frac{A}{CO_2} + B \right) \text{ where}$$

q_A = vent gas loss
t_S = gross vent gas temperature
t_A = ambient air temperature
$t_S - t_A$ = net vent gas temperature
A, B see Table 6

Carbon monoxide content

The measured carbon monoxide content must be converted according to the following formula to an air free state and entered in the record. CO_2 max. for natural gas is approx. 12 % (propane, approx. 14 %).

$$\text{CO airless} = \frac{CO_2 \text{ max.}}{CO_2 \text{ measured}} \cdot \text{CO measured}$$

In an airless state, CO measurements must be lower than 400 ppm or 0.04 % volume. Measurements around or greater than 200 ppm indicate an erroneous burner setting, dirt in the gas burner or heat exchanger, or defects in the burner.

The problem must be corrected immediately.

Chimney draft

Values recommended between 0.012" wc and 0.12" wc.

Higher chimney drafts cause preventable vent losses which result in higher heating costs.

For values above 0.12" wc it is recommended that you consult the National Fuel Gas Code, ANSI Z 223.1 or applicable local codes. In Canada consult CAN CGA B 149.1 or 2 Installation Codes.

Inform the owner/operator and hand over the technical documents

Make the owner/operator familiar with the entire installation and the operation of the boiler. Sign the form with the owner on page 14 and turn over the documents to the owner.

If the heating installation is not operated in the winter months, the heating water must be drained from the installation to prevent freezing.

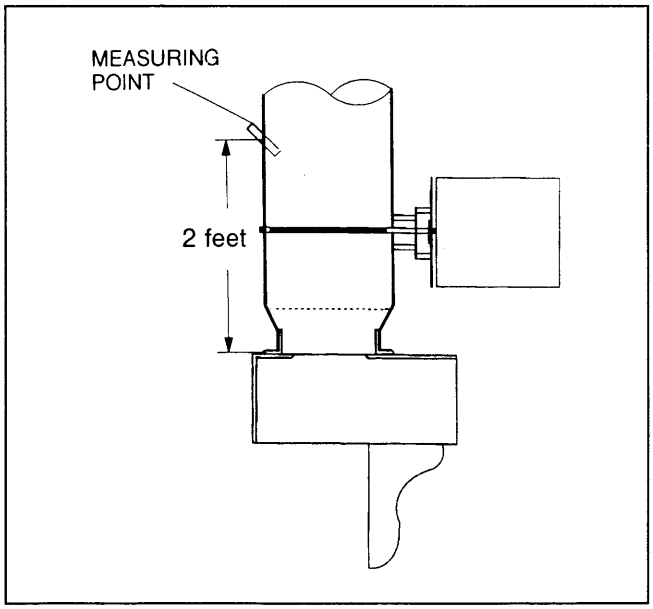


Fig. 16: Measuring point in flue pipe – schematic diagram for model II

	A	B
natural gas	0.206	0.0050
propane	0.233	0.0044

Table 6

12. Maintenance

Maintenance record –

Maintenance should only be carried out by a qualified service technician on a yearly basis.

Check off the maintenance items once they are completed and enter the measurements where indicated. Read and follow the maintenance instructions on the following pages.

Maintenance items	(date)		
1. Examine ventings system including combustion and ventilation air	☐	☐	☐
2. Cleaning of boiler flue	☐	☐	☐
3. Cleaning of gas burner	☐	☐	☐
4. Measure gas inlet pressure in inches water column	_____	_____	_____
5. Measure manifold pressure	_____	_____	_____
6. Leakage test during operation	☐	☐	☐
7. Check main burner and pilot flames	_____	_____	_____
8. Check damper	_____	_____	_____
9. Take measurements	☐	☐	☐
9.1 Gross stack gas temperature t_S in °F	_____	_____	_____
9.2 Air temperature t_A in °F	_____	_____	_____
9.3 Net flue gas temperature $t_S - t_A$ in °F	_____	_____	_____
9.4 Carbon dioxide content (CO_2) in %	_____	_____	_____
9.5 Vent gas losse q_A, see p. 15 in %	_____	_____	_____
9.6 Carbon monoxide content (CO), airfree in ppm	_____	_____	_____
9.7 Chimney draft in inches water column	_____	_____	_____
10. Check high limit aquastat operation	☐	☐	☐
11. Check boiler area for combustible materials, gasoline and other flammable or corrosive liquids	☐	☐	☐
12. Confirm maintenance	☐	☐	☐
Signed			

☐	☐	☐	☐	☐
☐	☐	☐	☐	☐
☐	☐	☐	☐	☐
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
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_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
☐	☐	☐	☐	☐
☐	☐	☐	☐	☐
☐	☐	☐	☐	☐

Maintenance Procedure

Maintenance should only be carried out by a qualified service technician. When replacing parts, use only Buderus authorized components. Maintenance should be done on a yearly basis. Results of the inspection must be recorded on the form provided on page 16.

1. Inspect the venting system including the combustion and ventilation air openings. Any repairs identified must be corrected immediately.

   Ensure that there is no obstruction of combustion and ventilation air flow.

2. Inspect the boiler flueway. The boiler must be placed out of service prior to inspection of flueway. See instruction to turn off gas appliance page 13.
3. Remove the control access panel.
4. Disconnect the ignition lead from the control box and remove it from the strain relief.
5. Secure the gas line piping to the slot in the top jacket panel with wire or rope.
6. Disconnect the union from the gas supply. Place the gasket from the union in a safe place.

> **Caution:** Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.
> Verify proper operation after servicing.

7. Label the flame roll-out switch wires and disconnect the wires from the flame roll-out switch, fig. 17.
8. Label the wires connected to the gas control and disconnect them from the gas control.
9. Remove the nuts that secure the burner assembly to the boiler and remove the burner assembly from the boiler, fig. 17.
10. Remove the top rear jacket panel. Inspect for damage, fig. 18.
11. Remove the flueway access panel under the insulation. Visually inspect the flueway with a flashlight; if there is no deposit or scale, replace the access panel and jacket panel. If the flueway has deposits, they must be cleaned. If a liquid agent is used the floor plate must be covered with a cloth to protect base from moisture.

    After the flueway has been cleaned, clean all debris from the combustion chamber, floor plate and the floor around the base of the boiler.

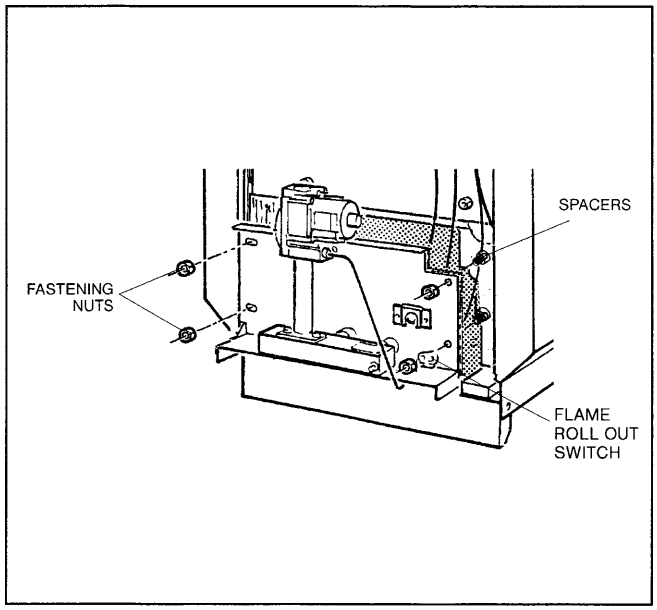


Fig. 17

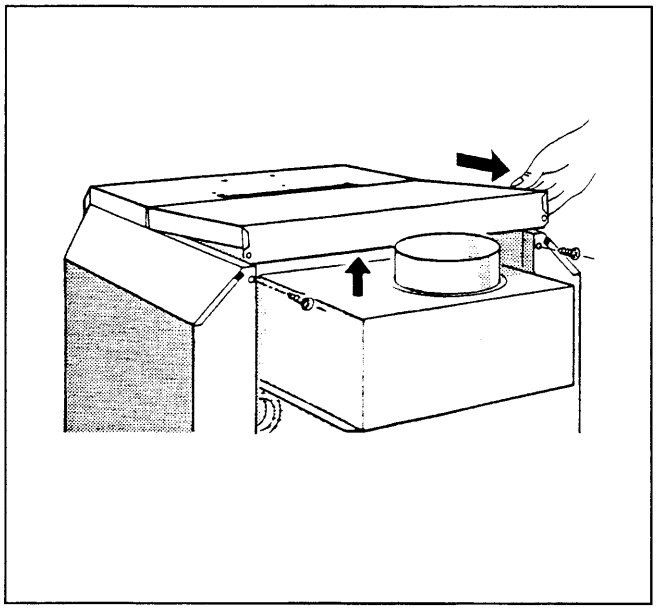


Fig. 18

Cleaning the gas burner

- Remove pilot burner assembly from burner assembly.
- Loosen the pilot gas line on the pilot burner (Fig. 19).
- Remove pilot gas orifice and blow out to clean.
- Dip burner tubes into water with diswashing cleaning agent and brush off. Ensure that insulation does not get wet.
- Rinse the burner with a stream of water; when doing so, hold the gas burner in such a way that the water penetrates into all the burner slits and can run out again through the Venturi tubes.
- Remove the rest of the water by shaking the burner tubes.

  Dirt remaining in the burner tube can be removed with a vacuum cleaner.
- Check the burner slits for free passage; remove any water from in the slits. if any slits are damaged the burner must be replaced.
- When assembling and installing the gas burner, proceed in the opposite sequence as described for removal and disassembly.
- Ensure spacers shown in fig. 17 are in place when installing burner assembly.
- Ensure that the gasket is installed in the gas piping union.

Place the boiler into operation per instructions on page 10 thru 15.

- **Take vent gas measurements per the procedure on page 16.**

- **Check high limit aquastat operation.**

- **Check low water cutoff if installed.**

- **Check boiler area for hazards**

  The boiler area must be clear and free from combustible materials, gasoline and other flammable or corrosive vapors and liquids.

- **Confirm that all maintenance items are completed by filling out the Maintenance Record (page 16), signing at the bottom, and reviewing with the owner.**

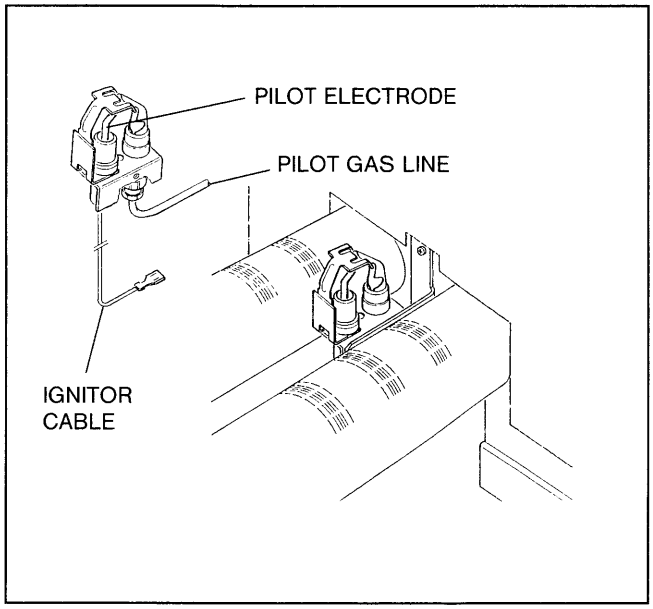


Fig. 19

S 8600 H – Intermittent pilot system troubleshooting table

Note: Before troubleshooting, familarize yourself with the startup and checkout procedure.

START

Turn gas supply off. Turn thermostat. (Controller) to call for heat. (damper opens, Inducer on)
Power to module (24V Nominal)

no → – Check line voltage power, low voltage transformer controller, thermostat (controller) and wiring, and that vent damper (if used) is open and end switch is made.

yes

Spark across igniter/sensor gap (look thru sight glass)

no → – Make sure vent damper operates and end switch is made. Replace vent damper if necessary.
– Check ignition cable, ground wiring, igniter sensor ceramic insulator and gap, and correct.
– Check boot of the ignition cable for signs of melting or buckling..
– Replace module.

yes

Turn gas supply on
Pilot burners lights.

no → – Check that all manual gas valves are open, supply tubing and pressures are good and pilot burner orifice is not blocked.
– Checks electrical connections between module and pilot operator on gas control.
– Check for 24 V ac across PV– MV /PV terminals on module. If voltage is okay, replace gas control. If not, replace module .

yes

Spark stops when pilot is lit.

no → – Check continuity of ignition cable and ground wire.
– Check flame rod.
– Check electrical connections between flame rod and module.
– Check for cracked ceramic flame rod insulator.
– Check that pilot flame covers flame rod and is steady and blue.
– Adjust pilot flame.
– If problem persists, replace module.

yes

Main burner lights.

no → – Check for 24 V ac across MV– MV/PV terminals, closed circuit on module. If no voltage, replace module.
– Check electrical connections between module and gas control. If okay, replace gas control.

yes

System runs until call for heat ends

no → – Check continuity of ignition cable and ground wire. Note: If ground is poor or erratic, shutdowns may occur occasionally even though operation is normal at the time of checkout.
– Check that pilot flame covers flame rod and is steady and blue.
– If checks are okay, replace module .

yes

Call for heat ends, system shuts off. Damper closes.

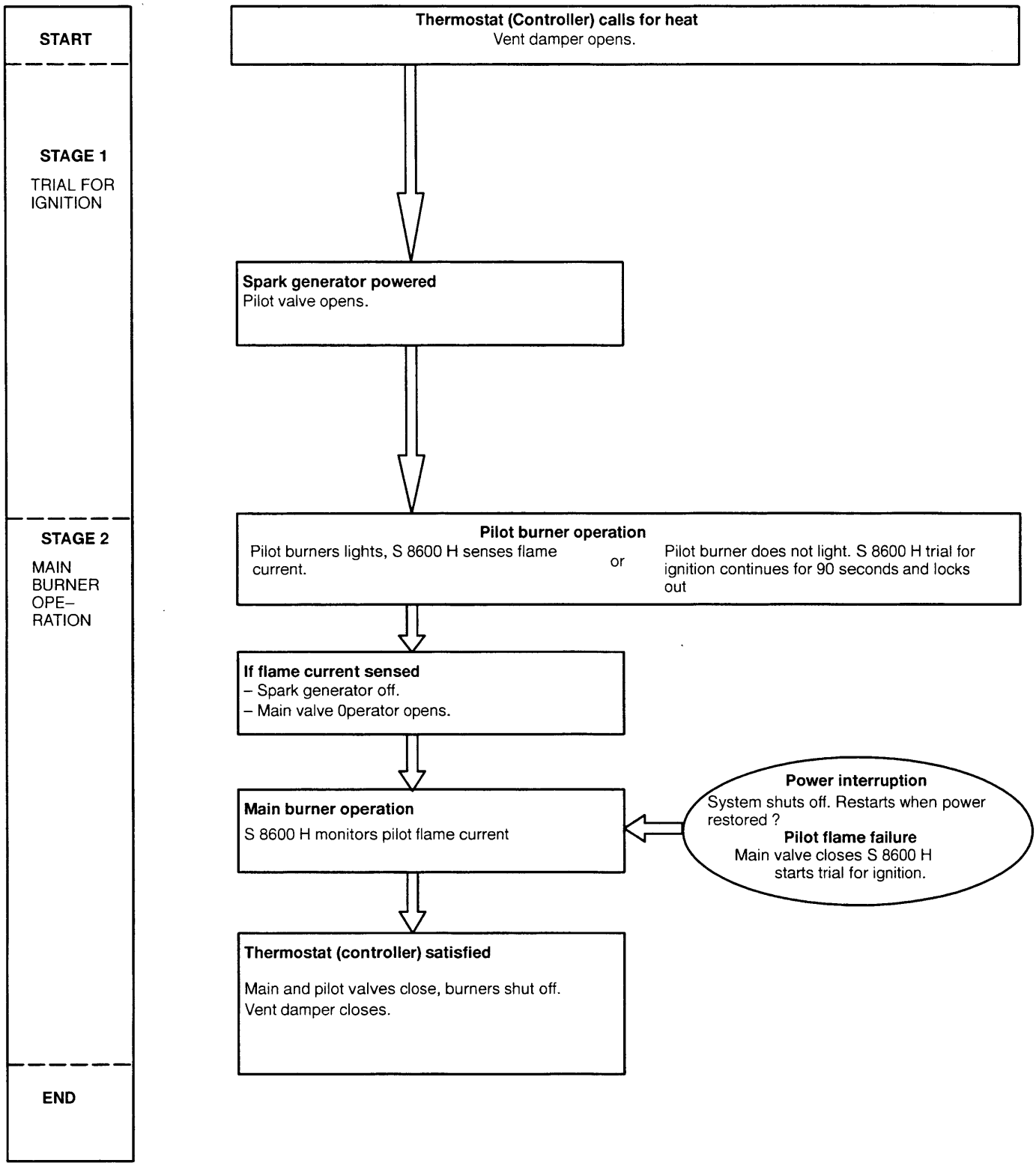
→ – Check for proper thermostat (controller) operation.
– Remove MV lead at module.
– If valve closes, recheck temperature controller and wiring, replace module.
– If valve does not close, replace gas control.

yes

Troubleshooting ends

Repeat procedure until troublefree operation is obtained..

Sequence of normal operation

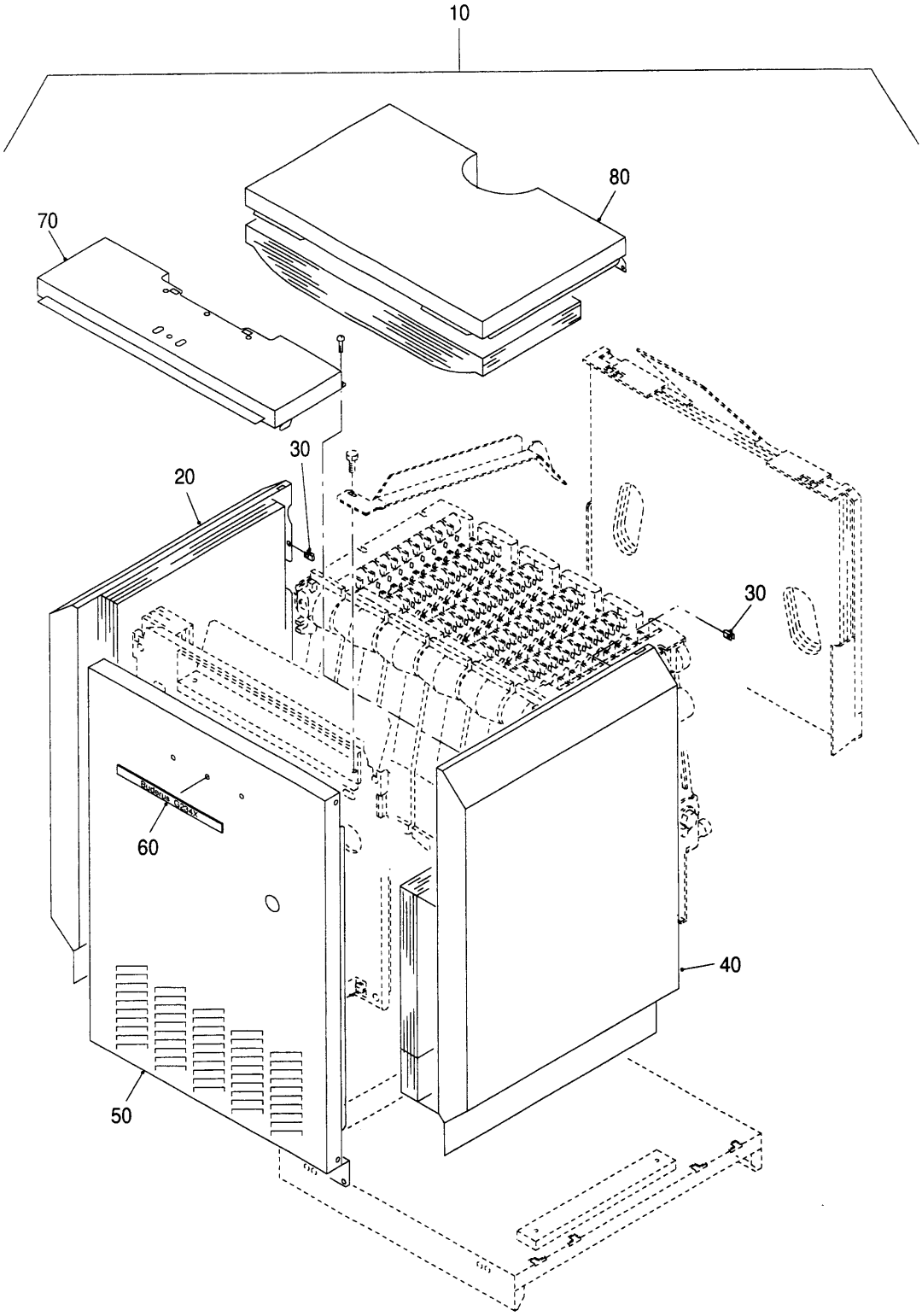


13. Parts List

The following parts are available from Buderus Hydronic Systems.

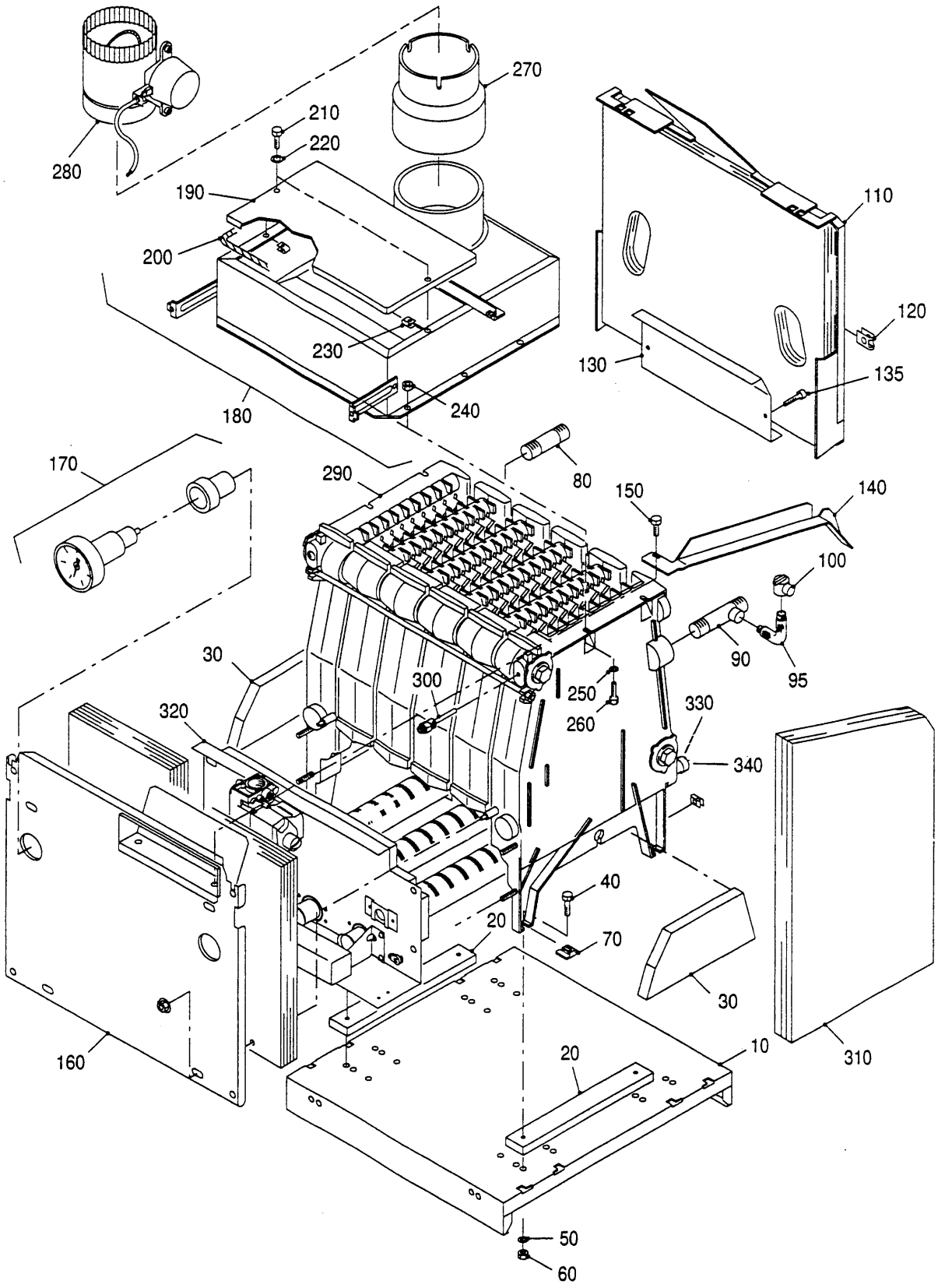
Pos. Nr.	Description	BHG Article Number	Model 38 Qty./Model	Model 45 Qty./Model	Model 55 Qty./Model	Model 64 Qty./Model
	Illustr. 1 Jacket Assembly					
10	Jacket Assembly (complete)	5024-	240	240	242	244
20	Left Side Jacket Panel	5024 050	1	1	1	1
30	Clip Nut SNU-5743	5834 364	2	2	2	2
40	Right Side Jacket Panel	5024 052	1	1	1	1
50	Front Jacket Panel	5024-	030	030	032	034
60	"Buderus" Plate	5340 600	1	1	1	1
70	Top Front Jacket Panel	5024-	060	060	062	064
80	Top Back Jacket Panel	5024-	080	080	082	084
	Mounting Kit No. 1	5015 950	1	1	1	1

Illustr. 1 Jacket Assembly



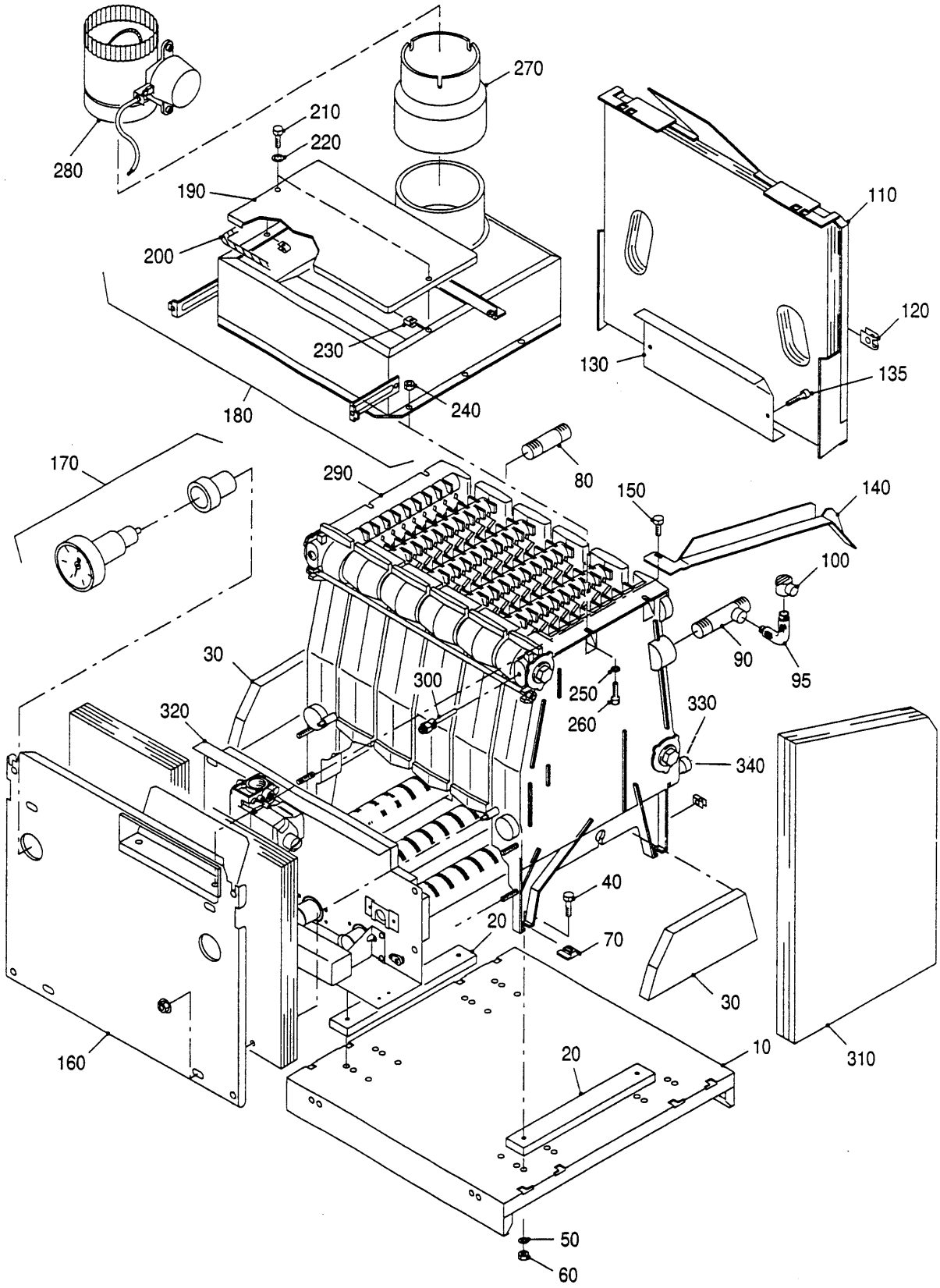
Pos. Nr.	Description	BHG Article Number	Model 38 Qty./Model	Model 45 Qty./Model	Model 55 Qty./Model	Model 64 Qty./Model
	Illustr. 2 Block Assembly – Component Parts					
10	Noncombustible Base	5024-	140	140	142	144
20	Mounting Plate	5015257	2	2	2	2
30	Insulation Plate	5015272	2	2	2	2
40	Bolt M 8 x 50	s. M. Kit No. 2	4	4	4	4
50	Spring Ring	s. M. Kit No. 2	4	4	4	4
60	Nut M 8 - 8 - A3K	s. M. Kit No. 2	4	4	4	4
70	Block Clamp	s. M. Kit No. 2	4	4	4	4
80	Return Pipe	5584754	1	1	1	1
90	Supply Pipe	5584752	1	1	1	1
95	3/4" Ellbow	99908401	1	1	1	1
100	Safety Relief Valve	5947650	1	1	1	1
110	Back Jacket Panel	5024-	181	181	183	185
120	Clip Nut SNU-5743	s. M. Kit No. 2	2	2	2	2
130	Back Insulation Panel	5512-	526	526	528	530
135	Screw C-ST 4,8 x 22	s. M. Kit No. 2	2	2	2	2
140	Cableway	5495470	1	1	1	1
150	Screw 3,5 x 9,5 - A3T	s. M. Kit No. 2	1	1	1	1
160	Middle Panel	5024-	121	121	123	125
170	Tridicator Set	5900076	1	1	1	1
180	Draft Hood	5624-	529	529	533	535
190	Flueway Access Panel	5371-	923	923	924	925
200	Gasket Cord GP 6 x 1285	5830634	1	1	–	–
200	Gasket Cord GP 6 x 1465	5830635	–	–	1	–
200	Gasket Cord GP 8 x 1645	5830636	–	–	–	1
200	Gasket Cord GP 6 x 10000	5822706				
	Sealing Material Buderus - 3055	5522052	1	1	1	1
210	Bolt M 6 x 16-MS	s. M. Kit No. 3	2	2	2	2
220	Washer A 6,4	s. M. Kit No. 3	2	2	2	2
230	Cage Nut M6-A3F-MCU5315	s. M. Kit No. 3	2	2	2	2
	Cement PK-W11	2037038	1	1	1	1

Illustr. 2 Block Assembly – Component Parts



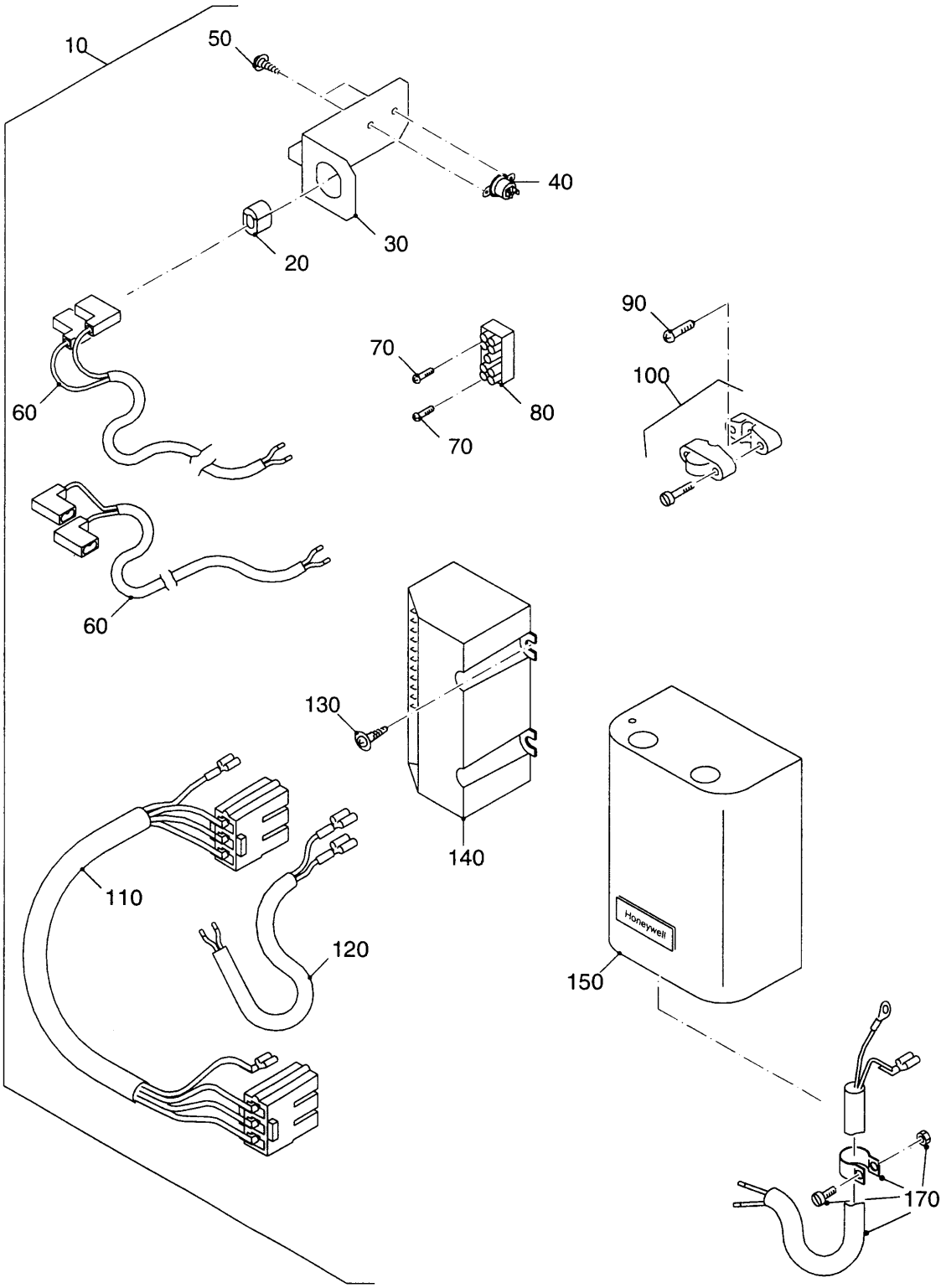
Pos. Nr.	Description	BHG Article Number	Model 38 Qty./Model	Model 45 Qty./Model	Model 55 Qty./Model	Model 64 Qty./Model
	Illustr. 2 Block Assembly – Component Parts					
240	M 8 Nut	s. M. Kit No. 3	4	4	4	4
250	Washer	s. M. Kit No. 3	4	4	4	4
260	Bolt M 8 - 25	s. M. Kit No. 3	4	4	4	4
270	Exhaust Gas Adaptor 7" D 182,5 M	5384 516	1	1	1	–
270	Exhaust Gas Adaptor 8" D 202,5 M	5384 508	–	–	–	1
280	Vent Damper RVGP-KS 7 INCH BKF	9990 8399	1	1	1	–
280	Vent Damper RVGP-KS 8 INCH BKF	9990 8400	–	–	–	1
290	Block Assembly	67900-	358	358	359	360
300	Sensor Well	5446 190	1	1	1	1
310	Insulation	7 0003 538	1	1	1	1
320	Manifold including	5181-	736	736	738	740
	Mounting Kit No. 2	5621 818	1	1	1	1
	Mounting Kit No. 3	5621 819	1	1	1	1
330	Reducing Bushing DIN 2950 241 1" x 3/4"	3869 828	1	1	1	1
340	Extension Tube DIN 2950 526 3/4" x 80	320 840	1	1	1	1

Illustr. 2 Block Assembly – Component Parts



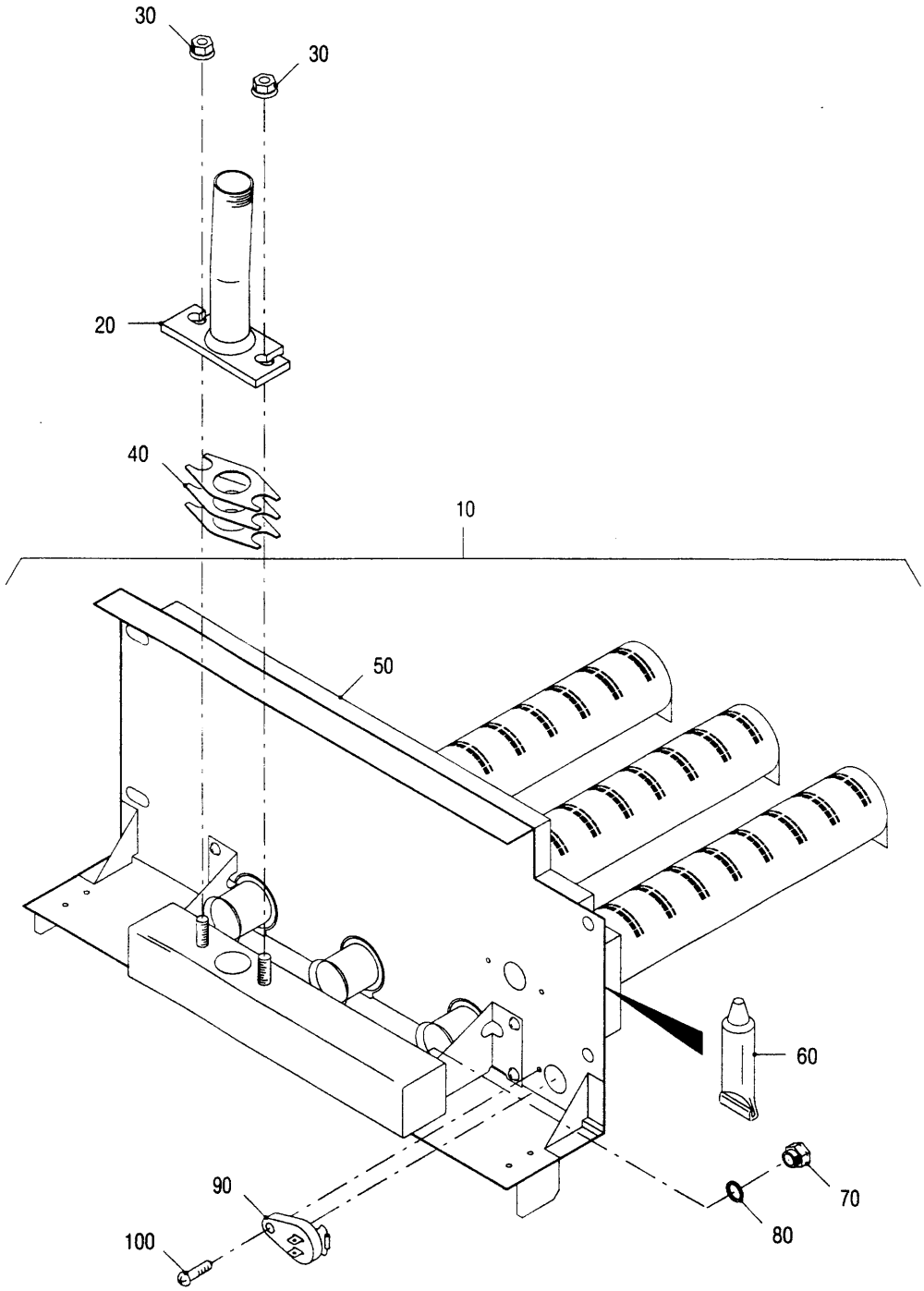
Pos. Nr.	Description	BHG Article Number	Model 38 Qty./Model	Model 45 Qty./Model	Model 55 Qty./Model	Model 64 Qty./Model
	Illustr. 3 Control Panel Assembly					
10	Control Panel Assembly	5557 946	1	1	1	1
20	Strain Relief	s. M. Kit No. 4	1	1	1	1
30	Strain Relief Bracket for blocked vent switch	s. M. Kit No. 4	1	1	1	1
40	Blocked Vent Switch	7079 498	1	1	1	1
50	Screw F ST 3,5 x 6,5 A3K	s. M. Kit No. 4	2	2	2	2
60	Wiring Harness	70000 725	2	2	2	2
70	Screw KA 3,5 x 16	s. M. Kit No. 4	2	2	2	2
80	Terminal Strip	s. M. Kit No. 4	1	1	1	1
90	Screw C ST 2,9 x 16 A3K	s. M. Kit No. 4	2	2	2	2
100	Strain Relief	s. M. Kit No. 4	2	2	2	2
110	Wiring Harness	920 137	1	1	1	1
120	Cable orange / black	7079 632	1	1	1	1
130	Screw (Flathead) 3,9 x 9,5 A3K	s. M. Kit No. 4	4	4	4	4
140	Ignition Control	5493 087	1	1	1	1
150	Aquastat	5996 360	1	1	1	1
170	Wiring Harness	7079 532	1	1	1	1
	Mounting Kit No. 4	7079 764	1	1	1	1

Illustr. 3 Control Panel Assembly



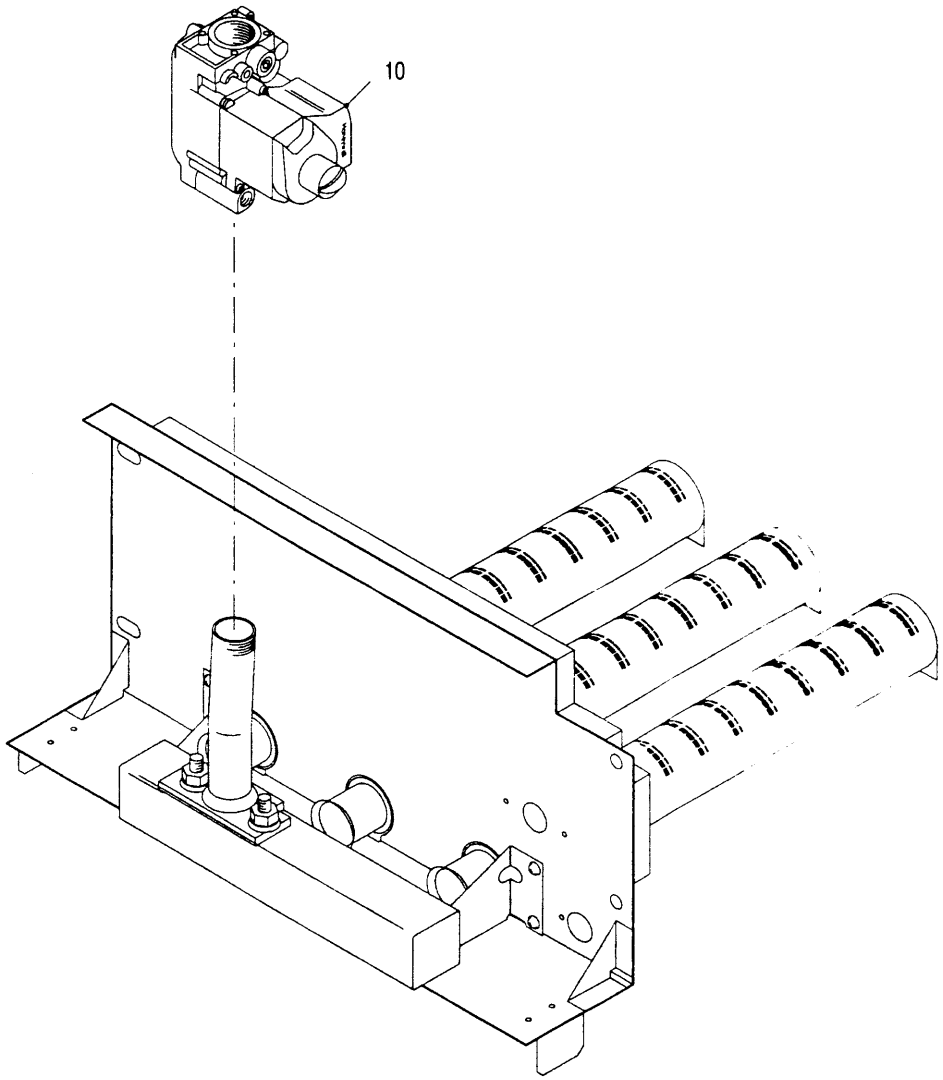
Pos. Nr.	Description	BHG Article Number	Model 38 Qty./Model	Model 45 Qty./Model	Model 55 Qty./Model	Model 64 Qty./Model
	Illustr. 4 Manifold – Component Parts					
10	Burner Tray	5181-	742	742	744	746
20	Manifold Pipe	5181 872	1	1	1	1
30	M 8 Nut	s. M. Kit No. 5	2	2	2	2
40	Gasket	5489 280	3	3	3	3
50	Insulation including Adhesive	5181-	730	730	732	734
60	Adhesive for Insulation	2037 312	1	1	1	1
	ALL ORIFICES ARE FOR 0–2000 FEET ELEVATION: CONTACT BUDERUS HYDRONIC SYSTEMS FOR HIGH ALTITUDE CONVERSIONS.					
70	Orifice Kits NG-0-2000FT	5484-	176	176	168	184
80	Gasket	5883 094	3	3	4	4
90	Roll Out Switch	5176 272	1	1	1	1
100	Screw M 4 x 16 ST	s. M. Kit No. 5	1	1	1	1
	Mounting Kit No. 5	5181 883	1	1	1	1

Illustr. 4 Manifold – Component Parts



Pos. Nr.	Description	BHG Article Number	Model 38 Qty./Model	Model 45 Qty./Model	Model 55 Qty./Model	Model 64 Qty./Model
	Illustr. 5 Gas Union					
10	Gas Control	5181 870	1	1	1	1
	WARNING:					
	DO NOT USE THE MOUNTING (FOR PILOT LINE) WHICH IS DELIVERED WITH THE GAS CONTROL!					

Illustr. 5 Gas Union

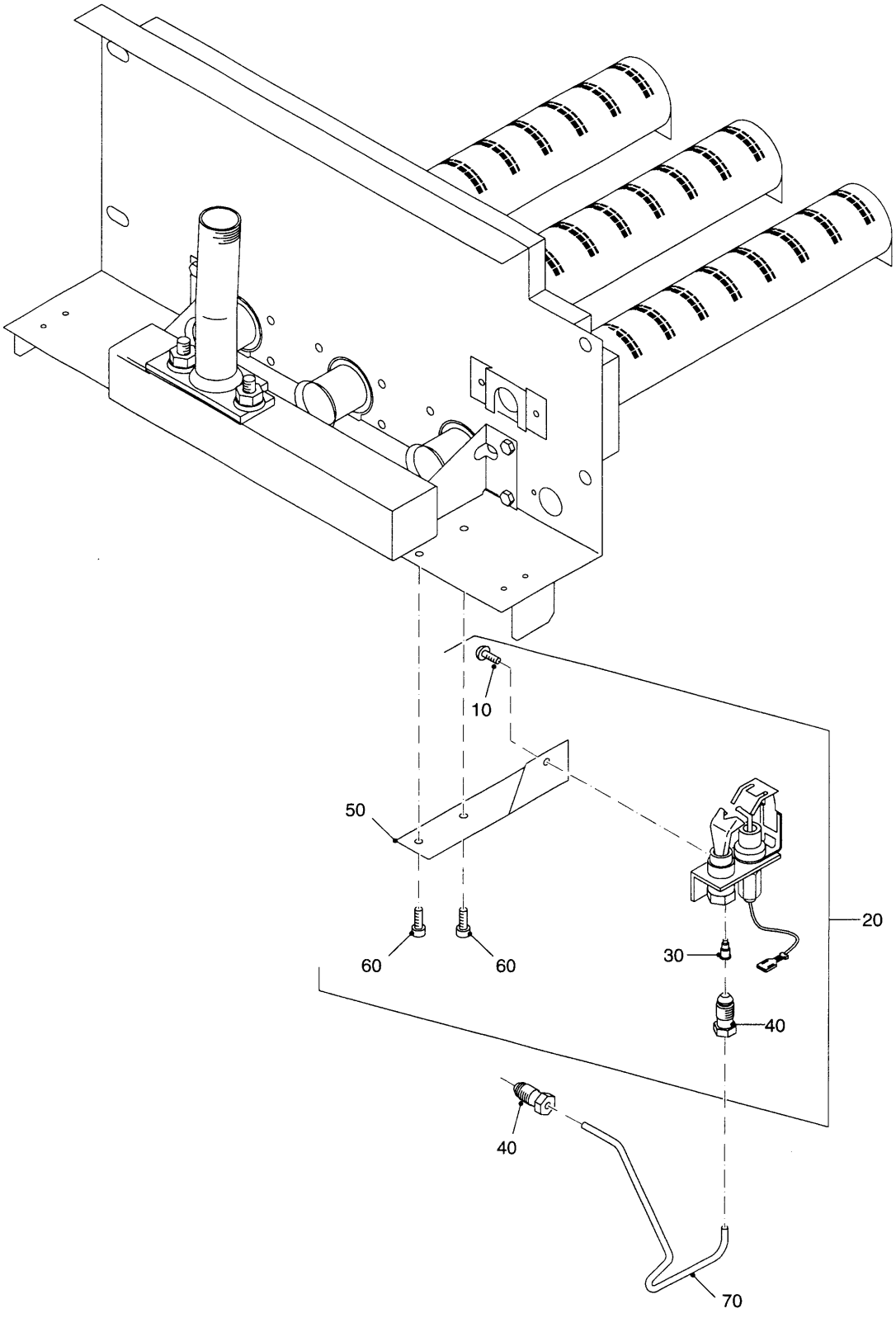


Pos. Nr.	Description	BHG Article Number	Model 38 Qty./Model	Model 45 Qty./Model	Model 55 Qty./Model	Model 64 Qty./Model
	Illustr. 6 Pilot Burner					
10	Hex Screw, 8 x 32 x 3/16	s. M. Kit No. 5	1	1	1	1
20	Pilot Burner Q 345 1 E	5181 443	1	1	1	1
30	Pilot Orifice, Natural Gas, BCR 20	5181 648	1	1	1	1
30	Pilot Orifice, Propane Gas, BCR 12	5176 998	1	1	1	1
40	Mounting for Pilot Line	5181 672	1	1	1	1
50	Pilot Bracket	s. M. Kit No. 5	1	1	1	1
60	Screw, M 5 x 12 A3K	s. M. Kit No. 5	2	2	2	2
70	Pilot Line	5181 670	1	1	1	1

These parts are available from:

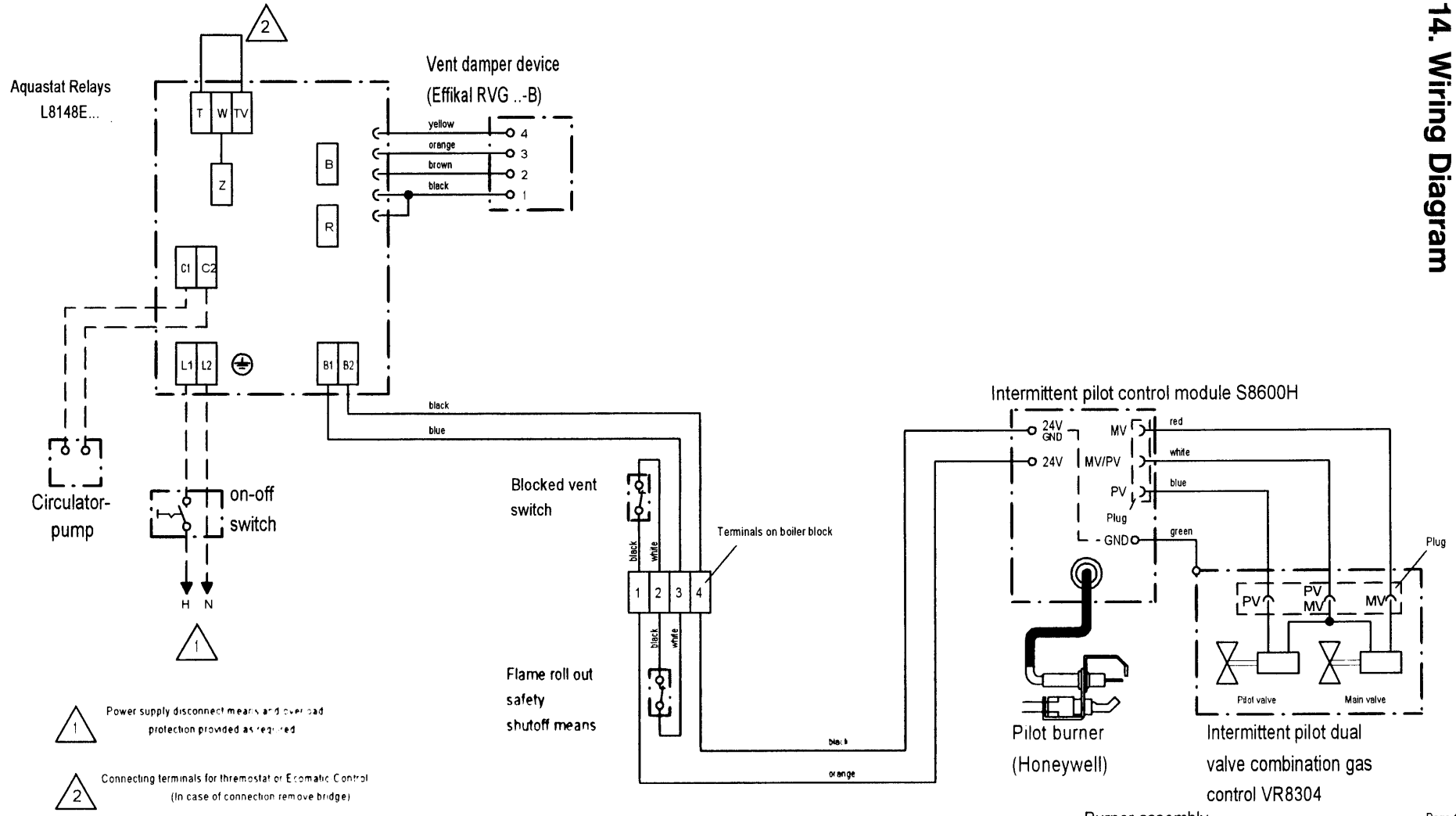
BUDERUS HYDRONIC SYSTEMS,
Salem N.H.
Phone: (603) 898 - 0505
Fax: (603) 898 - 1055

Illustr. 6 Pilot Burner



US

14. Wiring Diagram



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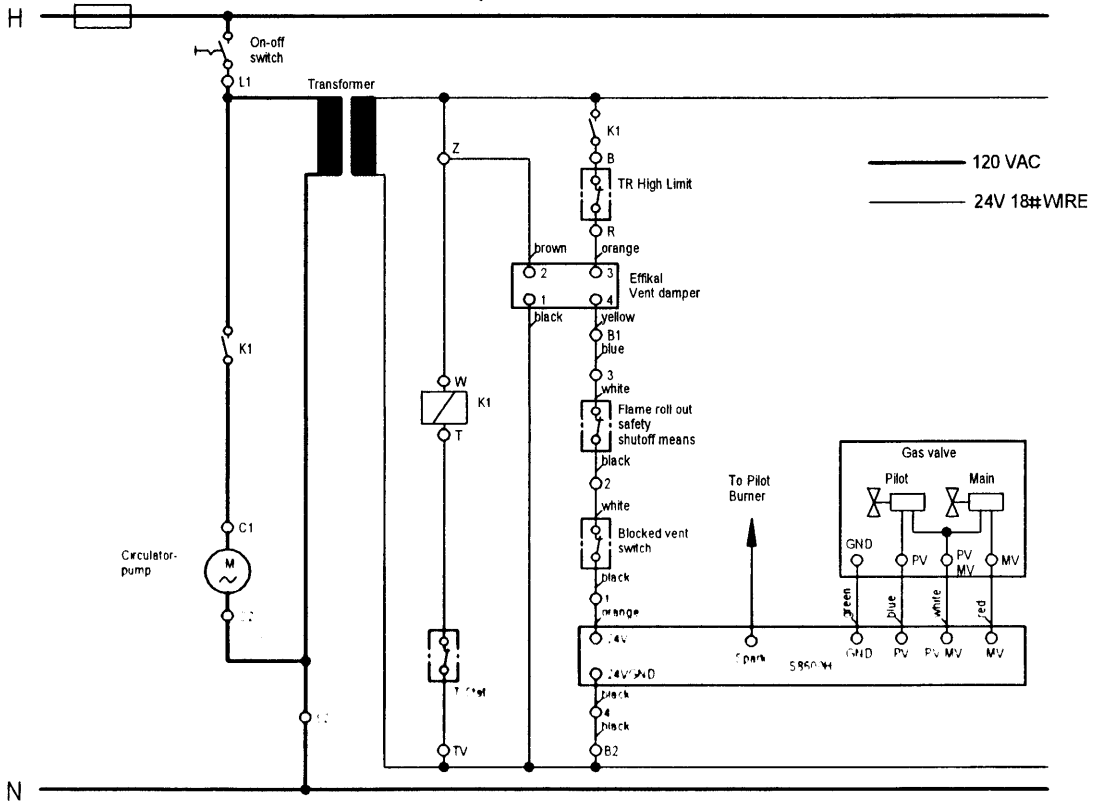
Buderus	Wiring diagram gas-boiler G234X USA-CDN Intermittent pilot	Drwg. no.: 63001271	Wiring diagram : GAW 025 USA	
		Ref. no.:	Reviewed : 6340	Edition : 02/99

US

Wiring Schematic G234X
with vent damper



Buderus	Wiring diagram gas-boiler G234X USA-CDN Intermittent pilot	Drwg. no.: 63001271	Wiring diagram :	GAW 025 USA
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NATURAL OR PROPANE BOILER
INSTALLATION AND OPERATING INSTRUCTIONS

DANGER

ONLY THE BOILER MAY BE SERVED BY THE VENT DAMPER. DO NOT USE IT TO VENT AN ADDITIONAL APPLIANCE: THIS WILL CAUSE A FIRE OR CARBON MONOXIDE POISONING.

DANGER

LE VOLET DE VENTILATION DOIT SERVIR SEULEMENT A LA CHAUDIERE. NE PAS L'UTILISER POUR VENTILER D'AUTRES APPAREILS: SINON CELA POURRAIT PROVOQUER UN INCENDIE OU CAUSER UN EMPOISONNEMENT PAR LE MONOXYDE DE CARBONE.

METHOD OF INSTALLATION FOR MOTORIZED VENT DAMPER
METHODE D'INSTALLATION POUR LE VOLET MOTORISE DE VENTILATION

The damper must be mounted to the draft hood adapter without modifying the draft hood and draft hood adapter or damper device.

Attach the lower portion of the vent damper to the draft hood adapter with 1/2" screws or pop rivets.

Do not install within 6 inches of combustible materials. Make sure the motor actuator and position indicator are readly visible and accessible.

Wire the damper per wiring diagram figure.

Determine the amperage draw of the gas control circuit and damper device. Check heat anticipator in comfort thermostat to determine that it's properly adjusted.

To manually open the damper, follow instructions inside the damper cover.

Le volet d'obturation doit être joint à l'adapteur du coupe-tirage sans modifier le coupe-tirage il-même, l'adapteur du coupe-tirage ou le volet d'obturation.

Attacher la partie inférieure du volet a l'adapteur du coupe-tirage à l'aide de vis de 12 mm ou plus courtes, ou de rivets.

Ne pas installer le registre à moins de 152 mm de distance de matériaux combustibles. S'assurer que le dispositif de commande du moteur soit visible et facilement accessible.

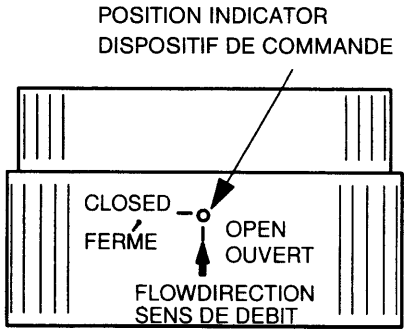
Faire la connection électrique entre le volet et le bornier à l'intérieur du couvercle d'accés du contrôle suivant le schema electrique correspondant.

Determiner l'amperage du circuit de contrôle gaz et du volet. Vérifier la résistance anticipatrice de chaleur du thermostat d'ambiance afin de determiner si elle est correctement réglée.

Pour ouvrir manuellement le registre, suivre les instructions qui se trouvent à l'intérieur du couvercle du volet.

DAMPER MUST BE IN OPEN POSITION WHEN APPLIANCE MAIN BURNERS ARE OPERATING.

LE REGISTRE DOIT ETRE EN POSITION OUVERTE LORSQUE LE BRULEUR PRINCIPAL EST EN MARCHE.



15. Installation and service certificate

Type _____

Operator _____

Manufacturer's no. _____

Location _____

Installing contractor
(specialist company) _____

The system described above has been installed and put into operation according to all applicable codes and regulations.

_____

Date, signature of installing contractor

The technical documents have been delivered to the operator who has also been made familiar with the safety instructions and the maintenance of the installation described above.

_____

Date, signature of operator

For the installing contractor

Type _____

Operator _____

Manufacturer's no. _____

Location _____

The technical documents have been delivered to the operator who has also been made familiar with the safety instructions and the maintenance of the installation described above.

_____

Date, signature of operator

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