

PLAINTIFF'S
EXHIBIT

ARO-229

SERVICE MANUAL

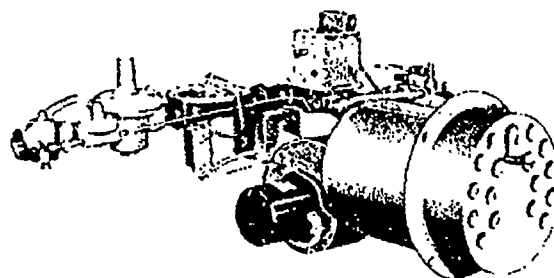


IO-BLAST Power Gas Burners

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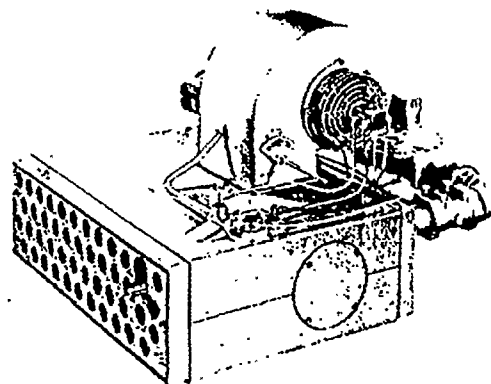
TABLE OF CONTENTS

Burner Ratings	2
Gas Pressure Regulator	4
Main Automatic Gas Valve	4
Blower and Blower Interlock ...	7
Motor	7
Burner Box	7
Flame Safe-Guard Relay	8
Pilot and Flame Sensing Element	10
Operating Cycle	12
Normal Starting Procedure	15
Permanent Shut-down	15
Trouble Chart	16



(Series K)

375,000 B.T.U. to 6,000,000 B.T.U.



(Series L)

1,000,000 B.T.U. to 20,000,000 B.T.U.

Manufactured by

MID-CONTINENT METAL PRODUCTS CO.

2717 North Greenview Avenue, Chicago, Illinois 60614

Makers of gas burning equipment since 1911



LB18-565

Printed in the U.S.A.

STANDARD SERIES BURNERS are built in two burner frame designs—the "L" Series windbox, for the usual ashpit installation, and the "K" Series round windbox, for tubular fire-box boilers and furnaces without ashpit. In addition, special burners can be furnished, including spark ignition pilot models. Burners can also be furnished for use with lead sulphite or ultra-violet scanning systems and programming safety controls.

Model numbers are arranged to designate the

burner type ("K" or "L"), size number, type of gas (N-natural, M-mixed, A-manufactured, LP-liquefied petroleum) and type of pilot (64-constant dual pilot or 63-electric ignition.) Thus, "Model L7N-64" indicates "L" Series, size 7, natural gas, constant dual pilot No. 64.

This manual covers the standard "K" and "L" Series, Custom Series, constant and spark ignition pilots with on-off control. For 2-step or modulating controls refer to supplementary Lo-Blast bulletin LB17.

BURNER RATINGS

TABLE 1

Burner Number	Max. B.T.U. Input	Min. B.T.U. Input
L1N	1,000,000	350,000
*L3N	1,750,000	560,000
L5N	2,500,000	750,000
L7N	3,000,000	1,000,000
L9N	3,500,000	1,000,000
†L11N	4,200,000	1,500,000
**L13N	5,000,000	1,500,000
**L15N	6,000,000	2,400,000

*Max. input for L3A is 1,675,000 B.T.U. per hour—5" manufactured gas.
 †Max. input for L11A is 4,000,000 B.T.U. per hour—5" manufactured gas.
 **L13 & L15 Burners not available as standard for mixed & manufactured gas.

Burner Number	Max. B.T.U. Input Natural Draft	Min. B.T.U. Input
K133-3N	375,000	200,000
K133-6N	650,000	280,000
K134-10N	1,000,000	350,000
K134-15N	1,560,000	560,000
K175-20N	2,000,000	700,000
K176-26N	2,650,000	925,000
K176-30N	3,000,000	925,000
K176-35N	3,500,000	1,200,000
K2566-42	4,200,000	1,550,000
K2566-50	5,000,000	1,550,000
K2566-60	6,000,000	1,550,000

Type of gas and pressure required:

Natural —"N"; 5 to 15" W.C.
 Manufactured —"A"; 5 to 15" W.C.
 Mixed —"M"; 4 to 15" W.C.
 Liquid Petroleum —"LP"; 11 to 15" W.C.

Standard current required:

115 volt, 60 cycle A. C.
 Control system: Low voltage 2 wire.

GAS PRESSURE REGULATOR

The gas pressure regulator is used first, to automatically reduce and maintain a constant gas pressure at the burner and, second, to provide means for final adjustment of gas rate of the burner. No regulator is furnished with 1.1" gas models since the low pressure tank regulator is satisfactory for maintaining the proper pressure.

The gas pressure regulator is simply an automatic pressure reducing valve. The outlet pressure being controlled is transmitted to the diaphragm chamber via the sensing hole and exerts an upward force under the flexible diaphragm. This upward force is opposed by a spring. If the outlet pressure would tend to increase, the additional force would raise the diaphragm. Since the valve is connected directly to the diaphragm, the upward movement raises and restricts the valve opening, restoring the original pressure. A lowered outlet pressure has the reverse effect, opening the valve to restore the original pressure.

To vary the outlet pressure, adjustment is accomplished by removing the seal cap for access to the adjusting screw. Turning the screw clockwise will increase outlet pressure; counter-clockwise will decrease outlet pressure.

The regulator illustrated in Figure 2 is the Maxitrol RV-series. Any of several makes of regulators may be furnished. However, all operate on the same general principles.

Maximum allowable gas inlet pressures as well as minimum pressures required for full burner capacity ratings are shown in Tables 1 and 2. Standard and custom series burners designed for low pressure gas (15" W.C. maximum) can be operated at partial capacity with lower pressures than indicated on the chart—but not less than 3" W.C. for dependable pilot operation. Because these regulators are of the low pressure type with metal seats, leakage through the seat will cause outlet pressure to rise equal to inlet pressure during burner shut down. Therefore do not subject the burner to inlet pressures above 15" W.C.

Custom series burners for high pressure are equipped with suitable soft seated, tight shut-off regulators.

If a burner originally built for low pressure gas is to

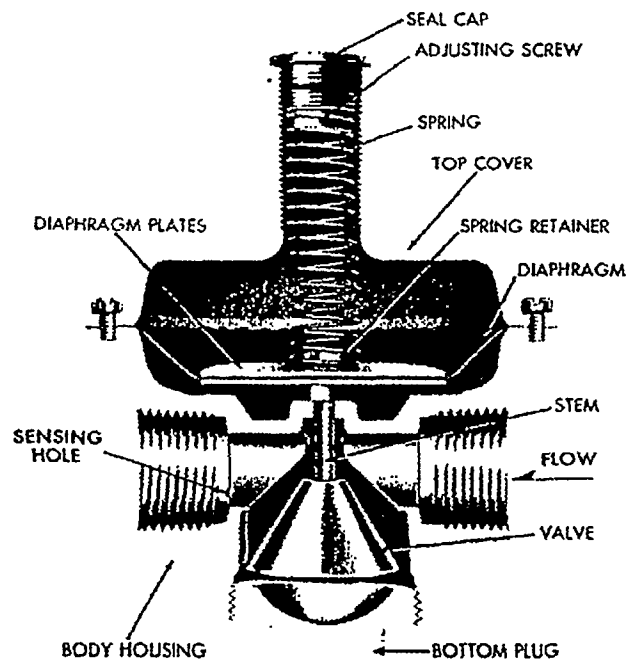


FIGURE 2. GAS PRESSURE REGULATOR

be operated on high pressure, the correct regulator must be substituted, or an intermediate tight shut-off regulator must be added which will reduce gas pressure to a maximum of 15" W.C. Pilot gas must be taken from the high pressure side of the line and separately regulated.

The vent in the upper diaphragm case normally breathes only air, and may be left open. To meet local requirements it can be connected to the outdoors, the chimney or to the pilot, to prevent escape of gas into the boiler room in the event of a punctured diaphragm. The vent line must be of sufficient diameter, otherwise the restriction may cause sluggish opening of the main valve. The effect can be checked by comparing start up time with vent connected and unconnected.

Never connect the regulator vent to the diaphragm valve vent. If it is to be connected to the pilot, the line must run to the separate connection on the pilot. The vent must never be connected to a spark ignition pilot.

SERVICE

Although regulators seldom require servicing the most vulnerable part is the diaphragm. Periodic service should be limited to a diaphragm inspection, which should be checked for punctures or stiffness.

When the diaphragm is replaced the valve stem should be checked for free movement and full travel.

If the entire regulator is removed from the piping, take care not to crush the body casting. Apply wrench only on the heavy body section immediately adjacent to the pipe thread.

MAIN AUTOMATIC GAS VALVE

The main automatic gas valve serves to control the flow of gas to the burner. It is subject to the action of the various safety devices incorporated in the burner which serve to prevent valve opening unless safe conditions exist.

For safe and dependable service, the time proven diaphragm type valves with magnetic operators are furnished. These valves are designed to fail safe and close automatically when electric current is cut-off.

Figure 3 illustrates the valve and magnetic operator in the closed position. When the coil in the valve operator is energized by the burner relay, magnetic force draws the armature to the coil core. This pulls up the valve stem of the three-way valve seat, closing off gas pressure from the inlet side of the diaphragm valve and opening the normally closed seat. As indicated by the solid line arrows, gas on top of the diaphragm is then allowed to escape through the bleed line to the centrifugal vent valve, and on to the pilot, providing a momentary flare to assist in main burner ignition. As the pressure above the diaphragm decreases due to the escape of gas, the valve disc starts to lift due to pressure of gas under it. Lifting of the valve disc allows gas pressure to be applied under the entire lower surface of the diaphragm, causing it to snap upward and allowing a full flow of gas through the valve.

A small amount of gas is passed through the by-pass orifice in the center stud of the diaphragm which also escapes through the bleed line. It serves to maintain a reduced flare throughout the burner run after the starting flare has been dissipated. Gas flowing through the by-pass orifice, being limited in volume, is readily passed off through the bleed line, avoiding pressure build-up on top of the diaphragm.

When the burner relay opens in response to a satisfied thermostat, the coil is de-energized and the armature returns to its closed position by spring action. The valve stem then returns to its normal position, closing off the bleed line and allowing gas from the valve inlet to pass through the normally open seat to the top of the diaphragm, as indicated

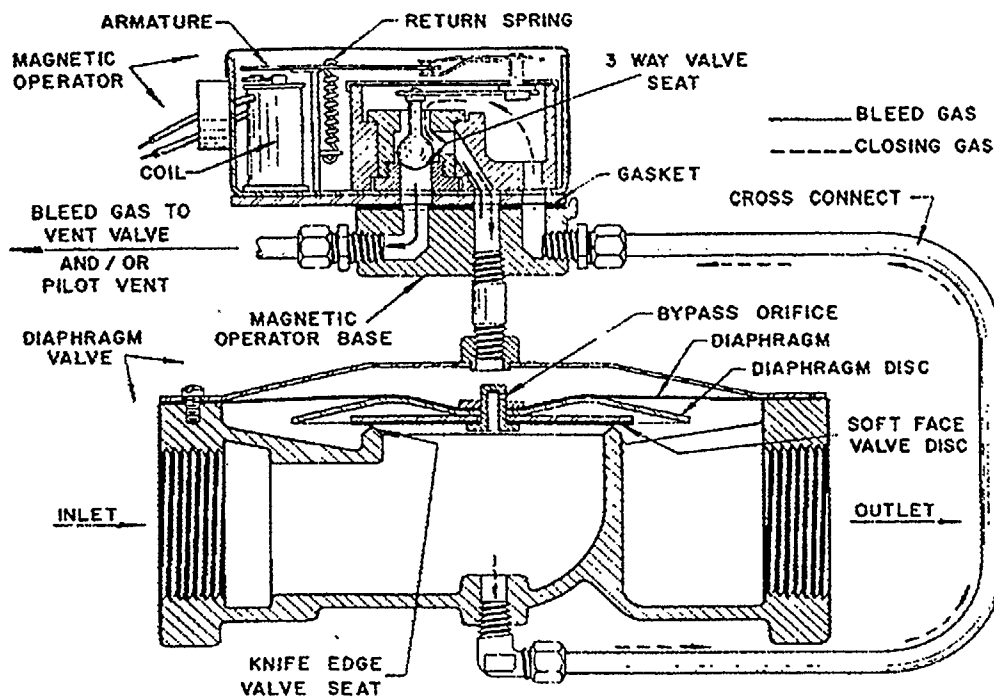


FIGURE 3. DIAPHRAGM VALVE AND MAGNETIC OPERATOR

by the broken line arrows. Supplementary gas also flows to the top of the diaphragm through the by-pass orifice. As soon as the pressure on both sides of the diaphragm is equalized, which occurs almost instantly, the diaphragm and valve disc falls of its own weight onto the valve seat. The main flow of gas is now cut off and as pressure under the diaphragm dissipates, pressure on top of the diaphragm forces the soft faced valve disc onto the knife edge seat, effectively stopping all gas flow. Gas flow through the by-pass orifice ceases when gas pressure on top of the diaphragm equals inlet gas pressure under the valve disc.

In the event that the blower motor fails to start on a call for heat, valve opening is prevented by electrical action of the flame safety relay, since no intermittent pilot will be established. Simultaneously, even if the valve operator assumed its running position, a second action preventing opening takes place by virtue of the venting system. Release of gas on top of the diaphragm is prevented by the centrifugal vent valve in the bleed line; thus pressure on the diaphragm is maintained by the by-pass orifice to hold the valve closed. In like manner, if blower failure occurs during a burner run the valve will close, due to pressure build-up on top of the diaphragm.

When diaphragm valves other than those built by Midco are used on Lo-BLAST burners they are modified to incorporate the by-pass orifice. **REPLACEMENT OPERATORS MUST BE OBTAINED FROM MID-CONTINENT TO BE SURE THAT THE CORRECT MODEL IS FURNISHED.**

SERVICE

No periodic service is necessary with a diaphragm valve. However, when service work is performed on the burner a check should be made to make sure that valve action is satisfactory, i.e. it closes off quickly and tightly when the burner shuts down and opens promptly when the burner starts. When the diaphragm valve fails to open, trouble can usually be attributed to a closed-off bleed line due to action of the centrifugal valve. For proper operation, gas pressure must be great enough to lift the diaphragm from the seat.

Hence failure of the valve to open can occasionally be traced to extremely low gas pressure.

If the diaphragm valve is disassembled for any reason, the following checks should be made: (1) The diaphragm must be soft and pliable, it must be free of holes and it must have sufficient slack when set in position. (2) The valve disc leather and valve seat must be free of gum, tar, or other dirt, and must be free of cuts, nicks and worn spots. (3) The by-pass orifice must be clean. (4) The valve operator must respond instantly to the relay with no sticking or binding.

A treatment of neat's-foot oil will help preserve the valve disc leather in a soft and pliable state. When reassembling valve operator to the base, be sure that the gasket is properly positioned to avoid blocking the gas passages.

When reassembling the valve, the cover screws should be started but left loose and tightened only while the diaphragm has been stretched upward by insertion of a small diameter rod through the lower tubing tapping under the center of the seat. It should then be checked for prompt action and tight closing. A check must also be made to make sure that the valve will close if the bleed line is restricted. Make this check by manually closing the bleed side of the centrifugal pilot-vent valve while the burner is running. The valve should close in one to two minutes depending on the size of the valve. If the valve fails to close under these conditions, check for leaks in the bleed line.

CAUTION

Accidental release of pressure on top of the diaphragm will allow the valve to open even though the relay and/or burner switch is off. Therefore, **BE SURE TO ALWAYS CLOSE THE MANUAL MAIN GAS COCK BEFORE LOOSENING OR REMOVING ANY PARTS OF THE VALVE OR CONNECTING TUBES. BE SURE ALL JOINTS AND FITTINGS ARE TIGHT BEFORE RE-OPENING THE GAS COCK.**

In the event that the entire diaphragm valve is replaced or relocated, be sure to mount upright (diaphragm case horizontal).