

MRO OIL-AIR RATIO REGULATOR



WARNING

These instructions are intended for use only by experienced, qualified combustion start-up personnel. Adjustment of this equipment and its components by unqualified personnel can result in fire, explosion, severe personal injury, or even death.

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These instructions are intended to serve as guidelines covering the installation, operation, and maintenance of Hauck equipment. While every attempt has been made to ensure completeness, unforeseen or unspecified applications, details, and variations may preclude covering every possible contingency. **WARNING: TO PREVENT THE POSSIBILITY OF SERIOUS BODILY INJURY, DO NOT USE OR OPERATE ANY EQUIPMENT OR COMPONENT WITH ANY PARTS REMOVED OR ANY PARTS NOT APPROVED BY THE MANUFACTURER.** Should further information be required or desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, contact Hauck Mfg. Co.



WARNING

This equipment is potentially dangerous with the possibility of serious personal injury and property damage. Hauck Manufacturing Company recommends the use of flame supervisory equipment and fuel safety shutoff valves. Furthermore, Hauck urges rigid adherence to National Fire Protection Association (NFPA) standards and insurance underwriter's requirements. Operation and regular preventative maintenance of this equipment should be performed only by properly trained and qualified personnel. Annual review and upgrading of safety equipment is recommended.

A. GENERAL INFORMATION

The Hauck "MRO" Oil-Air Ratio Regulator is designed to accurately and consistently deliver the oil pressure which proportionally corresponds to the air pressure supplied to the burners. It is engineered to function automatically over an air impulse pressure range from 0 - 16 osig (0-6.9 kPa). This regulator is of the single seat design with a large operated diaphragm. The single seat design requires that a fairly constant oil supply line pressure be maintained to the ratio regulator. The high outlet pressure turndown (20:1 to 40:1 dependent upon the oil inlet pressure, downstream oil piping, and burner oil flow requirements) allows the highly accurate control of the oil pressure even with minute changes in the air pressure. When used with burners having impulse air pressures greater than 16 osig (6.9 kPa), an air impulse filter and bleed assembly must be installed in the air impulse line to the MRO to reduce the impulse loading pressure to the MRO to 16 osig (6.9 kPa) or less at the burner's high fire.

B. RECEIVING AND INSPECTION

Upon receipt, check each item on the bill of lading and/or invoice to determine that all equipment has been received. A careful examination of all parts should be made to ascertain if there has been any damage in shipment.

IMPORTANT

If the installation is delayed and the equipment is stored outside, provide adequate protection as dictated by climate and period of exposure. Special care should be given to all motors and bearings, if applicable, to protect them from rain or excessive moisture.

C. CAPACITY TABLE (Standard and Metric)

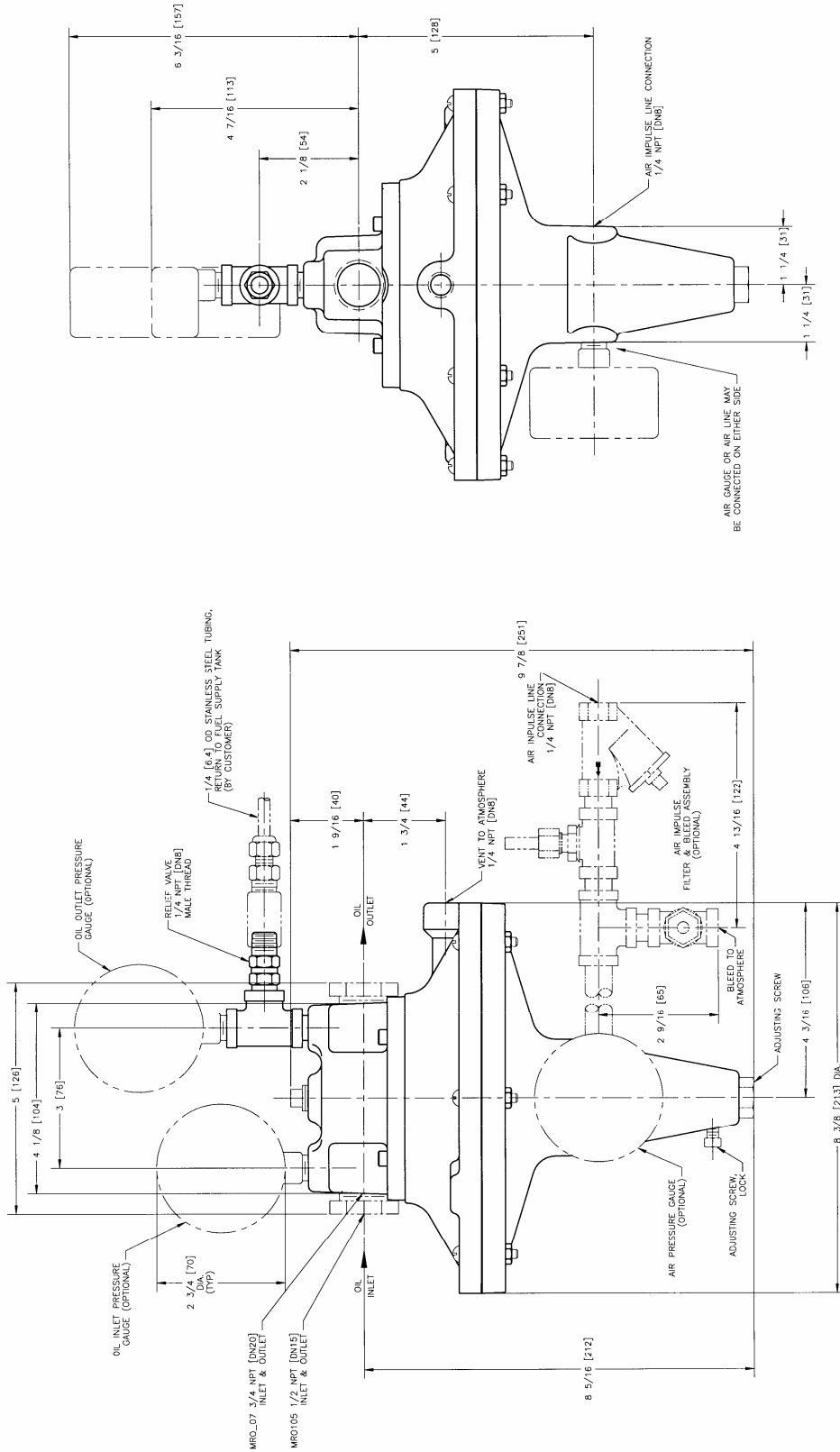
Ratio Regulator Model No.	Oil Connection		Oil Capacity			
			(gph)		(lph)	
	NPT	DN	Min.	Max.	Min.	Max.
MRO 105	1/2	15	0.75	50	2.8	189
MRO 107	3/4	20	2.0	100	7.6	379
MRO 207	3/4	20	6.0	465	23	1760

Notes:

1. Oil Capacities based on No. 2 fuel oil at 0.87 S.G. and 60°F (15.6°C).
2. Recommended inlet oil pressure for 16 osig (6.9 kPa) air impulse pressure is 45-65 psig (310-448 kPa)
3. If air impulse pressure is greater than 16 osig (6.9 kPa), an air impulse filter and bleed assembly must be installed in the air impulse line to the MRO for precise control of the air/fuel to the burner. For example, if the burner secondary air impulse pressure is 32 osig (13.8 kPa), the air impulse filter and bleed assembly is used to reduce the air impulse signal to 16 osig (6.9 kPa) at the MRO for high fire at the burner. The air/fuel ratio is maintained by adjusting high fire oil flow with the micro oil valve located at the burner, and adjusting low fire oil flow with the adjusting screw located on the bottom of the MRO.

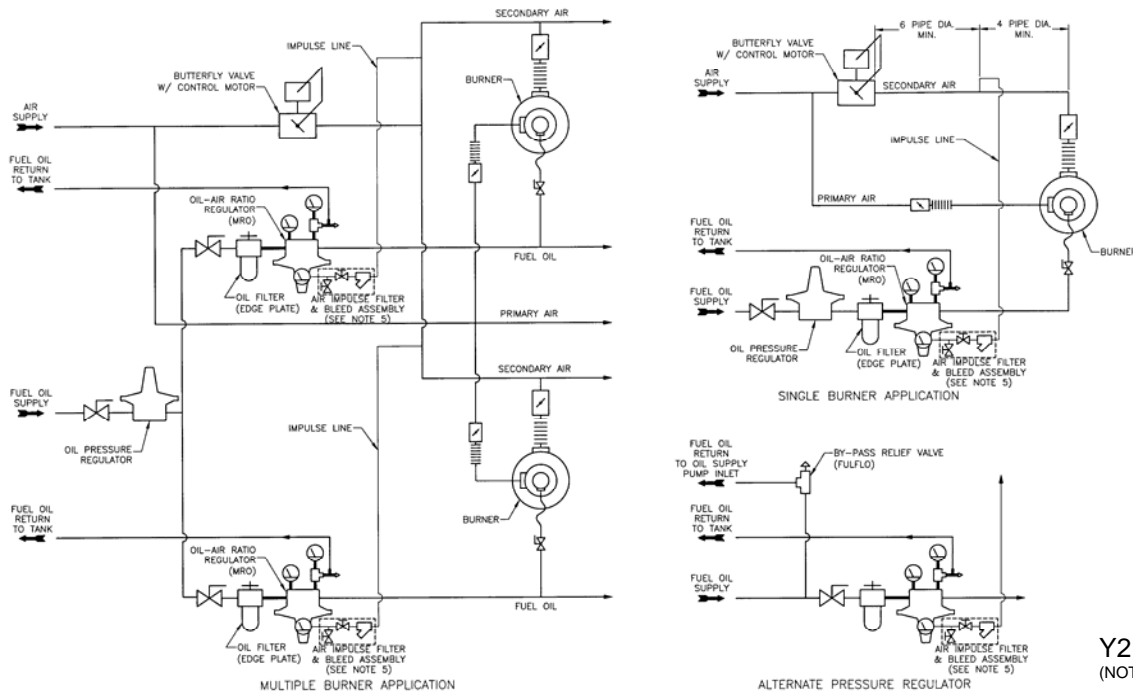
Table 1. Standard and Metric Capacities

D. DIMENSIONS



- NOTES:
1. ALL DIMENSIONS ARE IN INCHES [MM]; PIPE CONNECTIONS ARE IN NPT [DN].
 2. ALL PRESSURE GAUGE CONNECTIONS ARE 1/4 NPT [DN8].
 3. AIR IMPULSE FILTER & BLEED ASSEMBLY REQUIRED IF IMPULSE AIR PRESSURE IS GREATER THAN 16 OSIG [6.9 KPA].

Y2182
(NOT TO SCALE)



Y2179
(NOT TO SCALE)

- NOTE: 1. RELIEF VALVE ON OIL-AIR RATIO REGULATOR IS PRE-SET AT 75 PSIG (517 KPA).
 2. OIL-AIR RATIO REGULATOR OUTLET CAN NOT BE LOCATED MORE THAN 6" (152MM) LOWER AND NEVER HIGHER THAN THE CENTER LINE OF THE BURNER OIL VALVE FOR HORIZONTALLY MOUNTED BURNERS, OR THE BURNER NOZZLE DISCHARGE FOR VERTICALLY MOUNTED DOWN-FIRED BURNERS. OIL-AIR RATIO REGULATOR MUST BE MOUNTED WITHIN 20' (6M) OR LESS OF THE OIL VALVE AT THE BURNER.
 3. HEAVY OIL SUPPLY SYSTEM (NOT SHOWN) IS AN INTEGRAL PART OF ANY HEAVY OIL BURNER SYSTEM. TYPICAL COMPONENTS INCLUDE SUCTION HEATER, SUPPLY PUMPING UNIT, AND LINE HEATER. HOWEVER, REQUIREMENTS ARE DEPENDENT UPON THE SPECIFIC BURNER SYSTEM (CONSULT HAUCK).
 4. ALL HEAVY FUEL OIL PIPING MUST BE TRACED (ELECTRIC OR STEAM) AND INSULATED. SELF-REGULATING HEAT TRACING IS RECOMMENDED TO MAINTAIN THE DESIRED TEMPERATURE OF A GIVEN FUEL OIL; NO. 4 FUEL OIL @ 160°F (71°C), NO. 6 OIL @ 250°F (121°C). ELECTRICAL HEAT TRACING WITH A NOMINAL RATING OF 12 W/FT (39W/M) COVERED WITH A NOMINAL 2" (51MM) FIBERGLASS TYPE INSULATION IS SUFFICIENT FOR MOST APPLICATIONS.
 5. AIR IMPULSE FILTER & BLEED ASSEMBLY MUST BE INSTALLED IN THE AIR IMPULSE LINE TO THE MRO IF THE SECONDARY AIR PRESSURE IS GREATER THAN 16 OSIG (6.9 KPA).

Figure 1. Typical MRO Piping Schematics

E. INSTALLATION

1. Ensure that all of the components required upstream of the MRO have been properly positioned and installed. For proper installation, refer to the instruction sheets which accompany each component. As depicted in Figure 1, the following items should be present:
 - A. A separate oil pressure regulator is recommended to maintain precise control of the furnace atmosphere is necessary. Without a regulator, a 5 psig (34.5 kPa) variation in the oil pressure upstream of the ratio regulator will cause a 2% change in the flow rate at a flow turndown of 3:1, and a 5% change at a turndown of 5:1. For precise flow control, an oil pressure regulator should be used. As an alternate, but less precise method, use a by-pass relief valve. This valve can be sized to allow a 2-5 psig (13.8 – 34.5 kPa) increase in oil pressure at the MRO inlet with maximum turndown. Oil supply line pressure should range from 45-65 psig (310 – 448 kPa) at the MRO inlet for 16 osig (6.9 kPa) combustion air loading pressure.
 - B. An air impulse filter and bleed assembly is required if the air impulse pressure to the MRO is greater than 16 osig (6.9 kPa). The air impulse filter and bleed assembly must be installed in the air impulse line to the MRO and allows the air impulse pressure to be reduced to 16 osig at the MRO for high fire at the burner.
 - C. A shutoff valve is required in the piping system since the MRO is not designed to provide a tight shutoff of the oil.
 - D. A 0.0035" (0.09mm) edge plate oil filter (which can be supplied as a regulator-filter assembly) should be installed immediately upstream of each regulator. A 0.001" (0.025mm) filter cartridge is available for use when precise low volume flow pressure control is required with the MRO.

2. Install the MRO in a horizontal oil line as close to the burner(s) as possible without exposing the regulator to direct heat. The outlet of the MRO must not be more than 6" (152mm) lower and never higher than the center-line of the burner oil valve for horizontally mounted burners, or the burner nozzle discharge for vertically mounted down-fired burners. If the burners in a zone are located with variations in elevation which make it impossible to meet this requirement with one regulator, additional regulators are required. For recommendations on MRO placement in complex applications, consult Hauck. **Mount the MRO with the arrow on the body pointing in the direction of the oil flow and pressure gauges on the top.**
3. Connect the secondary air supply line, through an adequate size (1/4 NPT or DN8 minimum) air impulse line, to the lower diaphragm casing of the MRO. Note: Utilize an air impulse filter and bleed assembly between the secondary air impulse line and MRO if the air impulse pressure is greater than 16 osig (6.9 kPa). **Never obstruct the air vent to atmosphere on the upper diaphragm casing.** Locate the connection between the air impulse line and the secondary air line at a minimum of 6 pipe diameters downstream of the control butterfly valve and a minimum of 4 pipe diameters upstream of any pipe fittings for simple runs of piping with few elbows (see Figure 1). When more complex runs of piping are involved, consult Hauck for recommended control line placement to avoid loss of ratio control with turndown.
4. Pipe the pressure relief valve (supplied on the MRO) from the regulator back to the fuel supply tank using 1/4" (6.4mm) OD stainless steel tubing. **Do not install a shutoff valve in this relief line.** This relief valve is pre-set at 75 psig (517 kPa) to protect the MRO internals from excessive oil pressures.
5. If an air impulse filter and bleed assembly is used, preset the impulse pressure to the MRO as listed below.
 - A. Set the main air control valve at the fully open or high fire position.
 - B. Fully close the in-line and bleed needle valves by turning valve stems clockwise.
 - C. Open the bleed to atmosphere needle valve by turning valve stem one turn counter-clockwise.
 - D. Slowly open the in-line bleed needle valve by turning valve stem counter-clockwise until the pressure gauge on air side (bottom) of the MRO reads 16 osig (6.9 kPa).
6. Complete the initial adjustment of the MRO by completing the steps listed below. Prior to attempting this adjustment, ignite the burners and ensure that each burner has been properly adjusted for high fire conditions.
 - A. Set the main air control valve at the fully closed or low fire position.
 - B. Adjust the spring adjustment screw on the regulator base until the desired low fire flame is achieved. If the flame is too lean, turn the screw counterclockwise to increase the oil flow. If the flame is rich, turn the screw clockwise to decrease the oil flow. **When at the low fire position, always maintain a minimum discharge pressure of 0.5 psig (3.4 kPa).**

- C. Return the main air control valve to its full open position.
- D. Recheck the high firing rate with all burners in operation. If required, adjust the burner micro valves for the desired high fire.

F. OPERATION

The oil supply line pressure can range from 45 - 65 psig (310 – 448 kPa) at the inlet connection of the MRO. The inlet oil pressure must be regulated.

Once properly adjusted in accordance with Step 5 under INSTALLATION, this regulator should require no additional adjustments.

CAUTION

The MRO operating temperature range is 0 to 270°F (-18 to 132°C).

G. MAINTENANCE

All MRO regulators are designed for maintenance free operation. Under normal usage no service or adjustment should be necessary. However, if service should become necessary, it is recommended that the regulator be returned to Hauck for repair since the unit is highly sensitive and an improper alignment could cause operating difficulties.

Periodically clean and/or replace the oil filter element.

IMPORTANT

Failure to use the recommended oil filter may result in premature failure.

It is recommended that a filter be installed in the air impulse line if the air is not expected to be clean.

To replace the cartridge assembly, perform the following steps:

IMPORTANT

The valve cartridge diaphragm is NOT field replaceable.

- A. To replace the existing cartridge refer to Figure 2 (see page 8):
 1. Remove the four valve body screws (Item 8) and separate the air diaphragm assembly from the oil diaphragm assembly.
 2. There are a total of eight cartridge-related attachment screws. **Remove only the four recessed cartridge attachment screws** (Item 9).
 3. Remove the center pipe plug (Item 7) located on the top of the oil diaphragm assembly between the two oil pressure gauges.

NOTE
DO NOT REMOVE THE FOUR NON-RECESSED CARTRIDGE SCREWS (see Figure 2). These screws hold cartridge components together. It is not necessary or desirable to disassemble the cartridge itself to remove and replace the cartridge assembly.

4. Insert a short section of 1/8" schedule 40 (DN6) section of pipe through this opening. Place the pipe over the protruding valve stem and seat it firmly on the cartridge body.
5. Ensure that the pipe end is resting on the cartridge body and not on the valve stem (Item 4A). Gently tap out the existing cartridge unit. Exercise care to avoid damage to the valve pin or seat.
6. Insert the replacement cartridge. Ensure that it is properly seated.
7. Insert and securely tighten the four recessed cartridge attachment screws (Item 9) removed in step A.2.
8. Reseat the oil diaphragm assembly on the air diaphragm assembly.
9. Insert and securely tighten the four valve body screws (Item 8).
10. Replace the center pipe plug (Item 7).

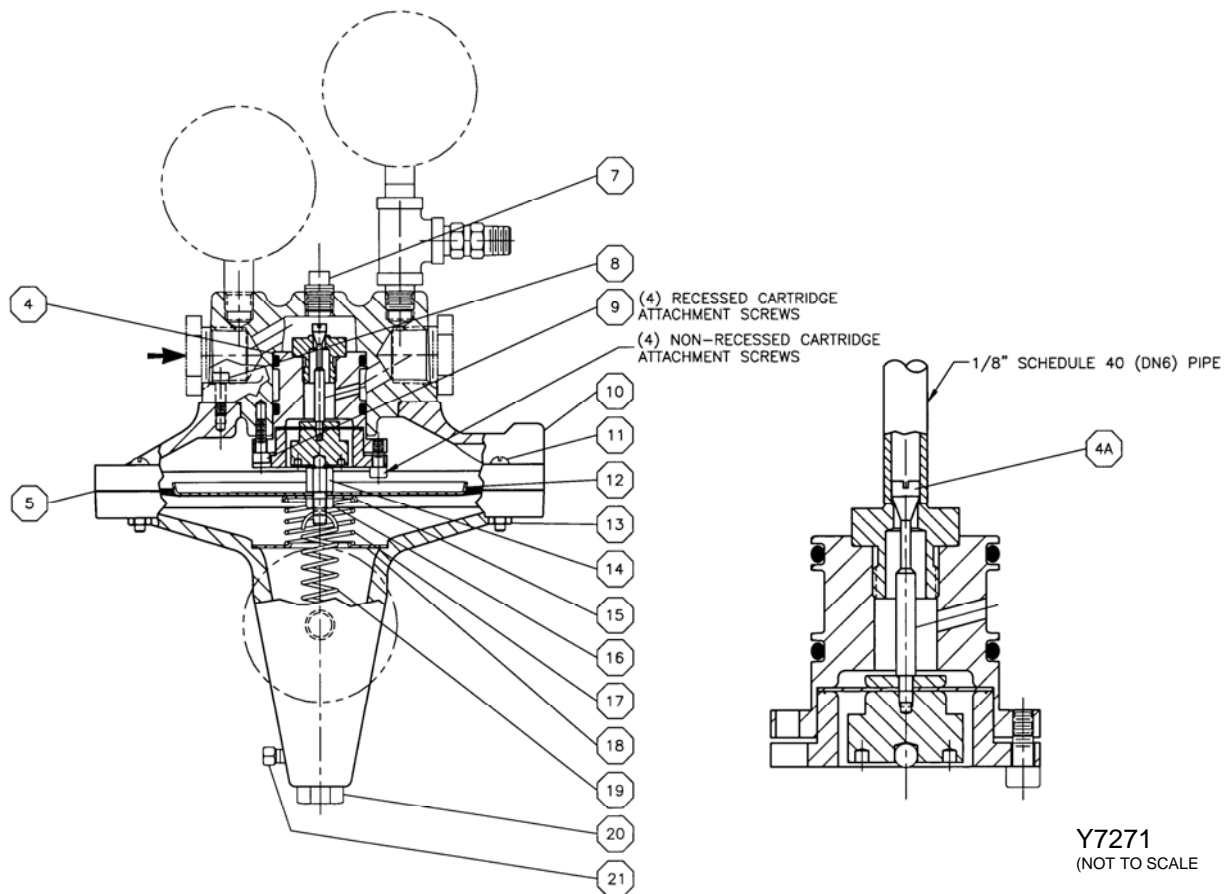


Figure 2. Cartridge Assembly and Air Diaphragm Replacement

B. To replace the air diaphragm, perform the following steps:

1. Remove the four valve body screws (Item 8) and separate the air body assembly from the oil diaphragm assembly.
2. Remove the six air body screws (11) and nuts (13).
3. Remove air diaphragm cover (10) by tapping with rubber mallet.
4. Peel off existing air diaphragm (5).
5. Loosen screw (21) and turn spring adjusting nut (20) counter-clockwise to release tension on the adjusting spring (19).
6. Grab the hook end of the adjusting spring (19) closest to the air diaphragm with a needle nose pliers and unhook the spring from the hole in the diaphragm retaining screw (14).
6. Remove nut (16) from the diaphragm retaining screw (14).
7. Remove the air diaphragm plate (12) and washer (15) from the existing air diaphragm (5) and discard the air diaphragm.
8. Place air diaphragm plate (12) and washer (5) on opposite sides of the replacement air diaphragm (5), and secure with diaphragm retaining nut (16) and screw (14).
9. Center and compress the compression push spring (17) on spring push washer (18).

IMPORTANT

Flat surface on air diaphragm plate (12) and washer (15) must face the air diaphragm (5).

10. Grab the hook end of the adjusting spring (19) closest to the air diaphragm with a needle nose pliers and hook the spring through the hole in the diaphragm retaining screw (14).
11. Put tension on the adjusting spring (19) by turning the spring adjusting nut (20) clockwise.
12. Align holes in air diaphragm (5) with holes on air diaphragm body, place cover diaphragm (10) over air diaphragm and secure with six air body screws (11) and nuts (13). Trim off excess air diaphragm with sharp knife.
13. Install air body assembly to the oil diaphragm assembly with four valve body screws (8).
14. Readjust spring adjusting nut (20) as necessary and secure screw (21).

H. RECOMMENDED SPARE PARTS LIST

Item	Qty.	Part Number	Description
1	1	See Parts List	Cartridge Assembly
2	*	4500	Air Diaphragm
3	*	10878	Pressure Gauge (0-100 psig)
4	*	10798	Pressure Gauge (0-32 osig)

* - Quantity dependent upon number of regulators installed; contact Hauck.

Table 2. Recommended Spare Parts