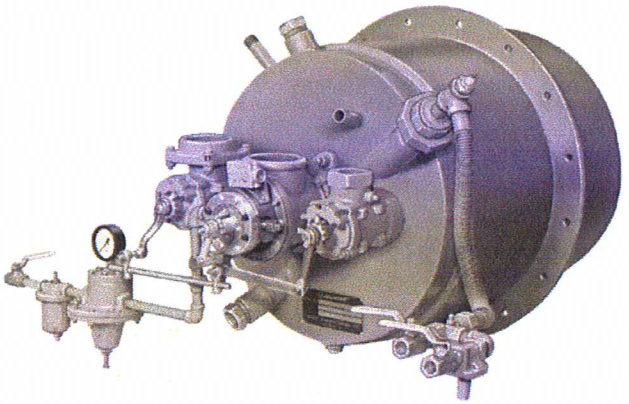
WIDE RANGE BURNER UNIT
OIL AND COMBINATION FIRED



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 basic Wide Range Burner Unit consists of an oil or combination Hauck 780 Series burner and an adjustable flow air valve mounted on a circular metal air plenum with an integrated ignition chamber. (On the larger burner units, the plenum air control valve is mounted in the plenum air supply line rather than being mounted on the chamber itself.)

The Wide Range Burner Unit is available for oil, gas, or combination oil/gas firing. Conversion of an existing unit from oil to combination firing is accomplished by installing a combination burner outer air nozzle, gas nozzle, and a flow valve. Conversion equipment is available in kit form.
The Hauck Wide Range Burner output capacity is twice that of a 780 Series burner. The turndown range is also greatly increased. Controlled combustion air is supplied through the burner and also around the burner nose. Both air flows are separately valved, but jointly controlled. Combustion ratios may be set and maintained at any constant value from high to low, with provisions for precise adjustments at all firing rates.

When burning oil, excellent atomization is assured, even with the extreme turndown available. The atomizing air is delivered at full blower pressure from high to low and throttled at the point of atomization. The oil is introduced into the atomizing air stream with zero forward velocity at the point of maximum air velocity, ensuring excellent atomization at all firing rates. On an application where there is much excess air (using 20 to 32 osig air), the unit capacities can be increased by as much as 2.5 times the sealed-in stoichiometric capacity. The Wide Range Burner Unit is suitable for both pressurized and nonpressurized applications.

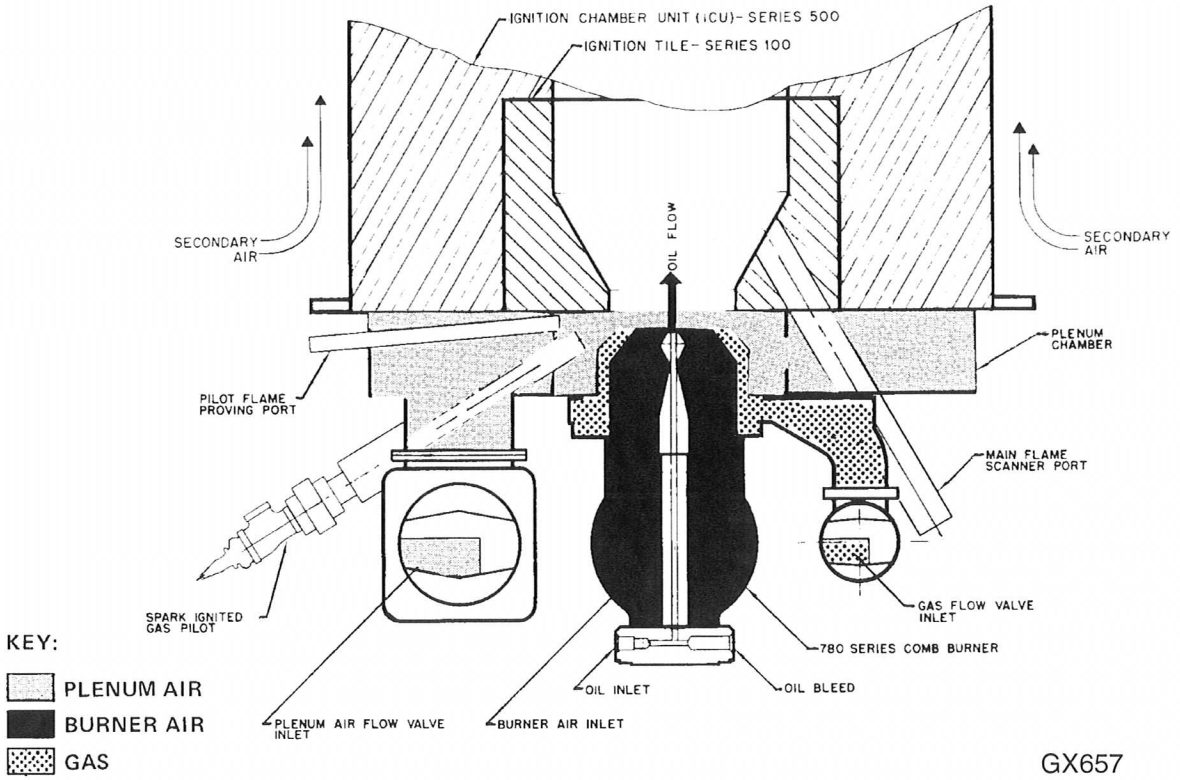


Figure 1. Flow Diagram, Wide Range Burner Unit

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. CAPACITIES

Maximum fuel capacity can be varied with the amount of secondary air available in the application. Secondary air is air supplied external to the Wide range Unit.

Based on the application, decide on the percentage of combustion air through the burner plenum unit and obtain the capacity selector from TABLE NO. 1.

Calculate the heat release required and convert into cubic feet of 1040 Btu natural gas and/or gallons of 138,000 Btu oil.

With the capacity selector chosen, use the column in TABLE NO. 2 with the same selector heading and find the line which satisfies your heat requirement.

TABLE NO. 1

TOTAL COMBUSTION AIR		CAPACITY	
% Through Burner & Plenum	% Secondary Air	Selector	Code
100%	0%	S	6
66 2/3%	33 1/3%	1.5X	7
50%	50%	2.0X	8
40%	60%	2.5X	9

TABLE NO. 2

Burner Size		CAPACITY SELECTORS								Total Burner-Plenum Air Cap. High Fire
		Sealed in Capacity		OPEN FIRING CAPACITIES (Multiples of Stoichiometric Table S)						
		S		1.5X		2.0X		2.5X		
Code No.		OIL GPH	GAS CFH	OIL GPH	GAS CFH	OIL GPH	GAS CFH	OIL GPH	GAS CFH	20 OSIG S.C.F.M.
0	(780)	6.5	908	9.7	1360	13	1815	16.2	2270	146
1	(781)	12.2	1710	18.3	2570	24.4	3420	30.5	4275	275
2	(782)	20.8	2920	31.2	4380	41.6	5840	52	7300	470
3	(783)	29.5	4140	44.2	6200	59	8280	73.7	10,350	666
4	(784)	57.8	8140	86.6	12,200	115	16,300	144	20,300	1308
5	(785)	90.3	12,700	135	19,000	180	25,400	225	31,700	2040
6	(786)	160	22,500	240	33,800	320	45,000	400	56,200	3620

The capacity figures for the percentage of secondary air introduced other than through the burner and the plenum (i.e., 1.5X, 2.0X, 2.5X) are to be used only as a guide in determining the burner range required. They are not to be interpreted as the actual limit of the burner-plenum unit. In most instances, the percentage of secondary air for open firing is difficult to determine. Unless the means are available for very accurate measuring of the secondary air, the percentage figures may vary with different applications and conditions and, thus, affect the capacity figures.

Capacities are based upon the use of 20 osig air. For other air pressures, use TABLE NO. 3 to find the multiplier factor for new air, oil, and gas capacities.

Example: You wish to use a 783 burner with 24 osig air for sealed-in capacity,. From Table No. 3, we find the factor to be 1.093. 1.093 X 29.5 = 32.2 gph oil; 1.093 X 4140 = 4525 cfh gas; 1.093 X 666 = 728 cfm air.

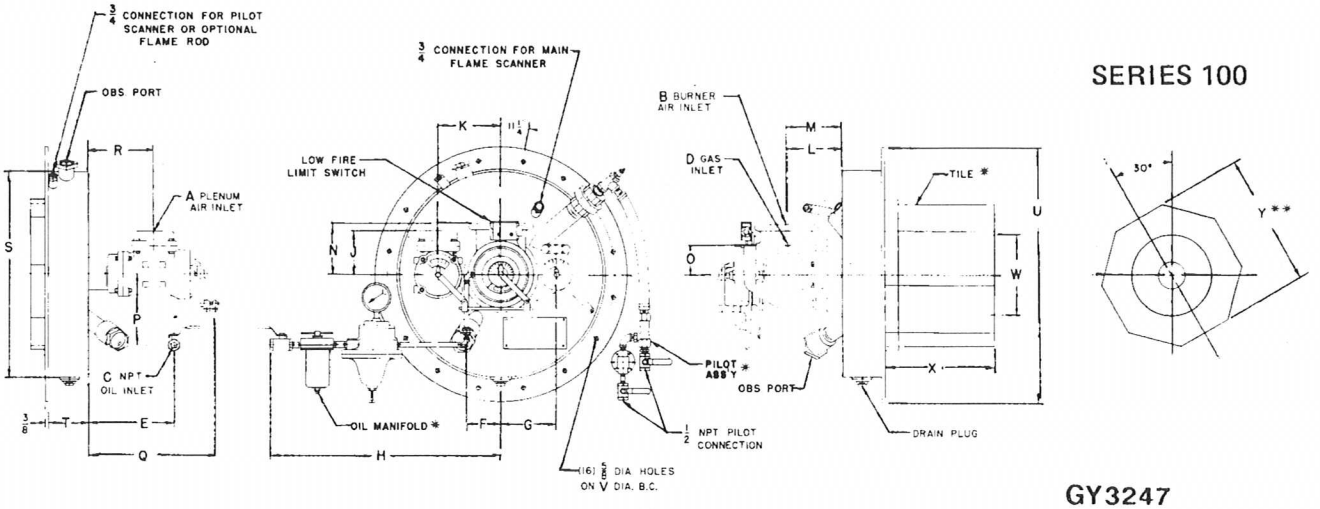
TABLE NO. 3

New Air Press.	8 OSIG	12 OSIG	16 OSIG	24 OSIG	32 OSIG
Multi. Factor	.632	.775	.895	1.093	1.265

SELECTION

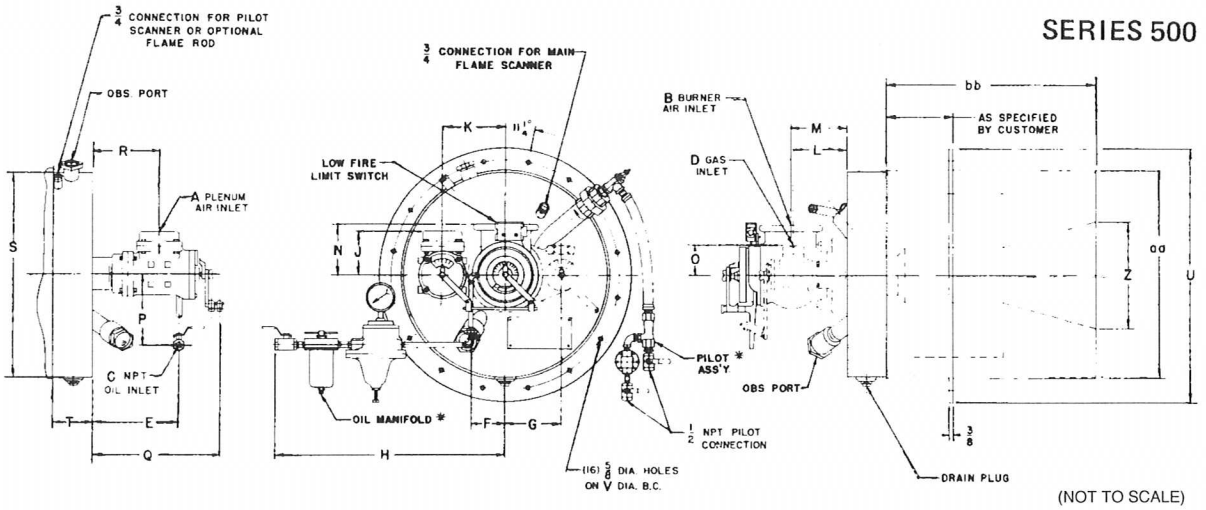
1. Select either an oil fired WRO or a combination fired WRC unit.
2. Select the Series No.
   Series 100 – For customers providing their own ignition chamber.
   Series 500 – Includes an Ignition Chamber Unit (ICU).
3. Select the capacity selector code no. from Table No. 1.
4. Select the burner size code no. from Table No. 2.

D. DIMENSIONS



NOTES

** 1) Dimension across flats for 100-103 tiles Dimension across Dia. for 104 tile.
2) Components shown in phantom are for combination firing.
3) See sheet 2 for data not shown (GW3247).
* 4) Components shipped loose.
5) Ignition chamber supplied by customer to conform to Dimensions of Hauck 500 Series.



NOTES

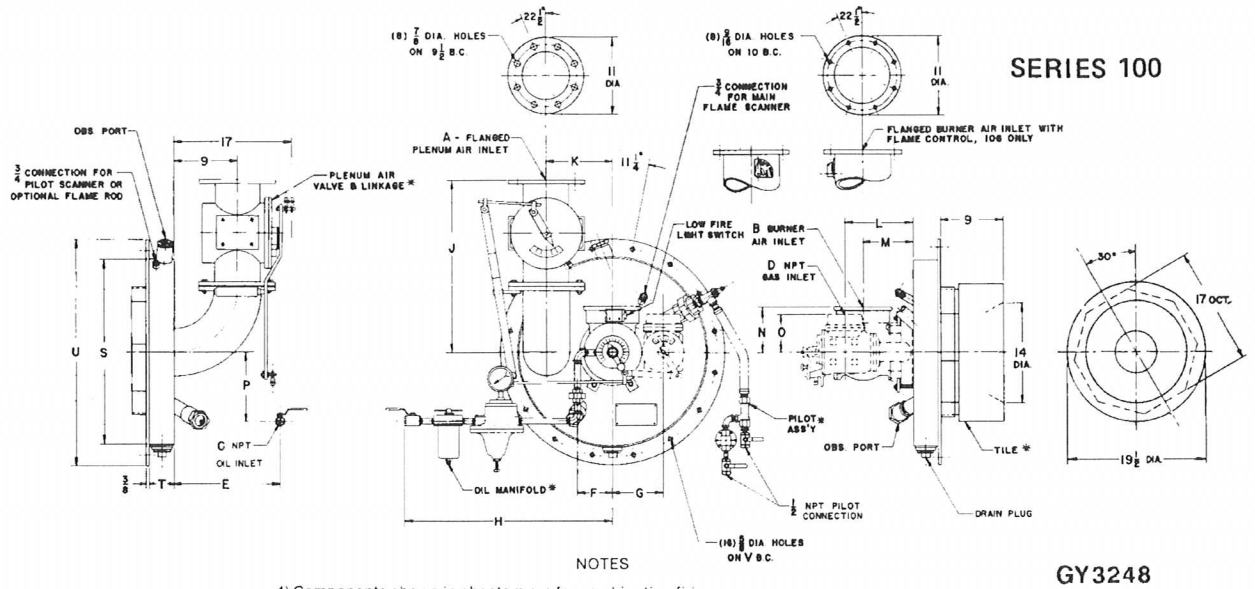
* 1) Components shipped loose.
2) Components shown in phantom are for combination firing.
3) See sheet 2 for data not shown (GW3249).

BURNER SIZE	A PLENUM AIR INLET	B BURNER AIR INLET	C OIL INLET	D GAS INLET	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	aa	bb
0 (780)	2"	1 1/2"	3/8"	1"	6 5/32	3	5	21 1/4	3 1/2	6	3 1/4	3 3/8	3	3	6 13/16	8	3 1/4	17 7/8	1 15/16	24	21 3/4	7 1/2	10 1/2	12 1/2	10	19	20
1 (781)	2"	2"	3/8"	1 1/4"	7 3/32	4	5 1/2	22 1/4	3 1/2	7	4 7/8	4 1/8	3 1/2	3	6 13/16	8	3 1/4	19 7/8	2 9/16	26	23 3/4	9	13 1/2	14	12	21	23
2 (782)	3"	3"	3/8"	1 1/2"	9 1/32	4 1/2	7	25 15/16	4 1/2	8	5 1/2	5 1/4	3 7/8	3 5/8	8 5/8	10 1/8	3 1/2	21 7/8	2 15/16	28	25 3/4	10	15	17	14	23	24 1/2
3 (783)	4"	4"	3/8	2"	10 7/32	4 1/2	7	25 15/16	5 1/2	8	7	6	4 3/8	3 5/8	8 5/8	11	4	22 7/8	3 1/16	29	26 3/4	11	15	17	15	24	24 1/2
4 (784)	4"	6"	1/2"	3"	12 5/32	4 1/2	7	29 15/16	5 3/8	9 3/4	9 3/8	7 3/8	6 3/8	4 5/8	10 13/16	14 5/8	8	25 5/8	3 5/8	31	28 3/4	14	9	19 1/2	16 3/4	26	27 1/2

Figure 2. Dimensions

D. DIMENSIONS (Continued)

SERIES 100



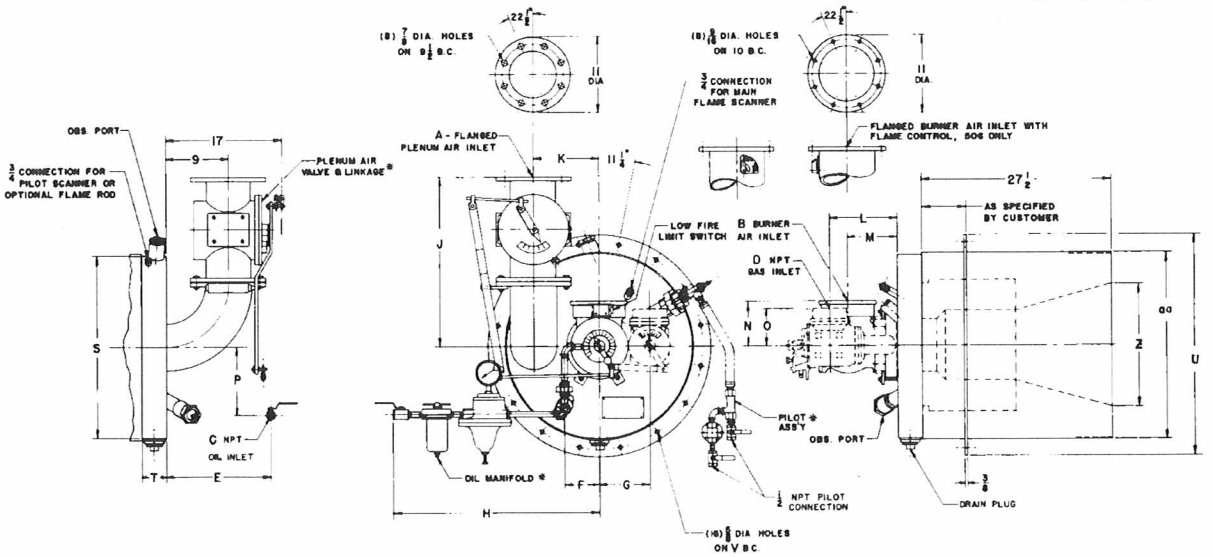
NOTES

1) Components shown in phantom are for combination firing.
2) See sheet 2 for data not shown (GW3248).
*3) Components shipped loose.
4) Ignition chamber supplied by customer to conform to Dimensions of Hauck 500 Series.

GY3248

(NOT TO SCALE)

SERIES 500



NOTES

1) Components shown in phantom are for combination firing.
2) See sheet 2 for data not shown (GW3250).
*3) Components shipped loose.

GY3250

(NOT TO SCALE)

BURNER SIZE	A PLENUM AIR INLET	B BURNER AIR INLET	C OIL INLET	D GAS INLET	E	F	G	H	J	K	L	M	N	O	P	S	T	U	V	Z	aa
5 (785)	6"	6"	1/2"	3"	12 21/32	4 29/32	7	30 11/32	24 1/2	9 1/2	10	7 3/8	6 1/2	5 1/2	10 13/16	26 3/8	3 5/8	32	29 3/4	17 3/4	27
6 (786)	6"	8"	1/2"	4"	17 1/32	4 29/32	8	30 11/32	27	10 1/8	13 1/8	10 1/4	8	5 3/8	10 13/16	27 7/8	5 7/16	34	31 3/4	19 3/4	29

Figure 3. Dimensions

E. BURNER INSTALLATION

Detailed installation instructions for the various 780 Series burners are incorporated in their respective individual Hauck instruction sheet.

F. FUEL AND AIR REQUIREMENTS

OIL

The burner must be supplied with a pressure regulated light or heavy oil supply. Wide Range Burner Units incorporating the Hauck PRO oil regulator should be supplied with a maximum pressure of **50 psig** to the regulator inlet. Units incorporating the Cashco oil regulator should be supplied with a maximum pressure of **75 psig** to the regulator inlet. When heavy fuel oil is to be used and automatic ignition or frequent starting is necessary, a circulating system must be installed so that oil at the proper viscosity will be delivered to the burner. A filter is provided in the inlet line to the pressure regulator.

GAS

A pressure regulated gas supply line must be provided to the burner. The required pressure ranges from 8 "wc to **2 psig**. The pressure required is determined by the Btu value of the gas, the burner size, the application, and the capacity required. The total pressure necessary is the sum of the pressure drops across the gas flow valve, gas nozzle, various fittings, and a pressure head allowance to overcome any combustion chamber backpressure. Assistance in determining the pressure required for gas firing may be obtained from Hauck.

GAS PILOT

A regulated pilot gas supply must be provided. This gas supply should be tapped off before the shutoff valve to the main gas line in order to be able to start the pilot without opening the main fuel valve and to ensure constant gas pressure to the pilot.
See figure 4 for details on electrode replacement.

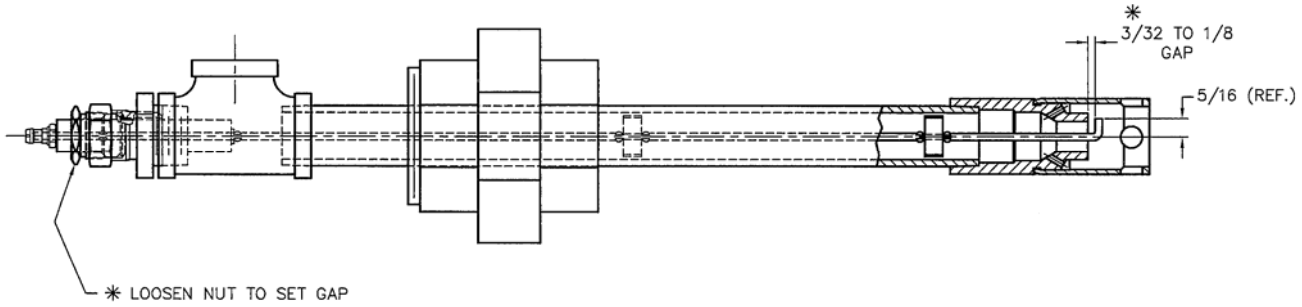


Figure 4. Replacement Electrode Bending Details

AIR

A low pressure air supply line must be provided for the burner and for the air supply to the plenum chamber valve. The line must be adequately sized in order to avoid excessive pressure drop from the turbo blower to the burner and plenum chamber. If there is any possibility of the blower pulling dirt in with the air, a filter should be provided at the blower intake. Air service must also be provided for the pilot. The pilot air may be tapped off the main burner air header.

G. PILOT ADJUSTMENT AND INSTALLATION

> **NOTE**
> To facilitate adjustment of the pilot, it is recommended that the pilot adjustments be made before installing the pilot in the burner.

1. Supply low pressure gas at approximately 6 "wc to the inlet of the pilot pressure regulator.

> **NOTE**
> A service regulator may be required to reduce the line pressure to the pilot regulator inlet. Do not supply gas in excess of 8 "wc to the pilot regulator or it will lock shut. It is recommended that a gas shutoff cock be installed at the inlet to the pilot regulator.

2. Provide a momentary-start pushbutton and 5000 volt transformer to use in pilot adjustment.
3. Be sure the gas cock at the inlet of the pilot regulator is closed.
4. Start the blower air supply, then set the pilot air cock to the full open position.
5. Push and hold in the momentary-start pushbutton to generate the pilot spark.
6. Open, fully, the pilot gas cock. This cock should be fully open at all times when the pilot is burning.
7. If the pilot does not light or burn properly, an adjustment of the mixer will be necessary. To adjust the mixer:
   a. Loosen the locknut on the mixer and turn the mixture adjustment screw *out* to make the flame *richer* or *in* to make the flame *leaner.*
   b. When the strongest and most stable flame is secured, lock the position of the adjustment screw by tightening the locknut.

> **NOTE**
> When properly adjusted, the pilot should produce a sharp, blue, high velocity blast type flame. If the pilot does not light after the full range of mixture adjustment, determine if the spark is jumping from the electrode to the nozzle properly.

8. Always close the gas cock first when the pilot is to be shut off.

H. BURNER AND PLENUM FLOW VALVE ADJUSTMENT

The burner air flow valve lever is connected to the burner operating lever by a 3/8" rod through snap connections. A setscrew is provided on the snap pin to secure the rod at its proper point.

1. Move the burner operating lever until its pointer is at position No. 1 on the burner air flow valve dialplate.
2. Loosen the wing nut on the burner micro oil valve.
3. Turn the adjusting wheel on the burner micro oil valve until its pointer is at position No. 2 on the micro oil valve dialplate.
4. Without allowing the two pointers (burner air flow valve and micro oil valve) to move, tighten the wing nut on the micro oil valve.

NOTE
The burner is now at its low fire position.

5. Move the burner operator to position No. 10.
6. Loosen the wing nut on the plenum air flow valve.
7. Set the plenum air flow valve pointer at position No. 10 on its dialplate (for plenum air flow valves up to 4" size) or position No. 12 (for 6" plenum air flow valves), as appropriate.
8. Tighten the wing nut.

NOTE
The burner is now at its high fire position. Plenum air flow valves up to 4" size should stroke from position No. 2 to position No. 10. The 6" valve should stroke from position No. 3 to position No. 12.

9. Adjust the plenum air flow valve flow rate.

NOTE
Flow valve adjustment procedure is detailed in Hauck instruction sheet AFV-9 (attached to 780C-9). Refer to that sheet to adjust the air valve flow rate. Note that some readjustment of the initial settings may be required for optimum operation after installation and initial start-up has been accomplished.

IMPORTANT
The low fire plenum air setting must maintain 0.1 "wc positive pressure differential between the plenum and the combustion chamber. UNDER NO CIRCUMSTANCES SHOULD THE PLENUM BE OPERATED UNDER NEGATIVE PRESSURE.

I. INITIAL START-UP, OIL FIRED

1. Be sure that oil shutoff valve is closed.
2. Start the blower. Check the air pressure to the burner and to the plenum air flow valve to be sure it is the proper value.
3. Ignite the pilot and make sure it is operating properly.
4. Start the oil pump.
5. Fully open the oil shutoff valve.
6. Slowly move the operating lever until the burner lights.

NOTE

On a new start-up, it is desirable that a tile cure be performed. The recommended curing cycle is to raise the refractory temperature 100^0 per hour up to the service temperature (typically, 2200°) and hold for 12 hours. Thereafter, allow 2-5 minutes at low fire for tile warmup.

NOTE

For fully automatic control systems with heavy oil, it is necessary to provide a low fire time delay in the burner system. The time delay will keep the burner on low fire for a specified period of time before the burner can go to high fire. This is necessary in order to allow the ignition tile to warm up so the flame will not blow out.

J. OIL-AIR RATIO ADJUSTMENTS

1. Adjust the oil pressure regulator to achieve a uniform oil-air ratio and consistent flame characteristics between low fire and high fire positions. At this stage of adjustment, a consistent flame characteristic is required *regardless of the flame condition* (how rich or lean the flame is). To accomplish this:
   a. Slowly rotate the burner oil-air control levers from low fire to high fire and observe the flame.
   b. If the flame changes from a **lean** flame at **low fire** to a **rich** flame at **high fire**, the oil pressure is **too high**. Correct this by adjusting the oil pressure regulator.
   c. If the flame changes from a **rich** flame at **low fire** to a **lean** flame at **high fire**, the oil pressure is **too low**. Correct this by adjusting the oil pressure regulator.

2. Once the flame characteristics is consistent, it can be made leaner or richer **over the entire operation range** from low fire to high fire by **slightly** altering the position of the oil micro valve pointer at *low fire*. To accomplish this:
   a. Drive the burner oil-air control levers to the low fire position.

CAUTION

When adjusting the oil micro valve pointer, as described in the following steps, always maintain the air control lever in the low fire position.

   b. Loosen the wing nut on the oil micro valve pointer.
   c. To make the flame **richer**, rotate the pointer **slightly** to the **right** (clockwise direction).
   d. To make the flame **leaner**, rotate the pointer **slightly** to the **left** (counterclockwise direction).
   e. Monitor the flame condition and repeat steps c and d until a flame having the desired characteristics is achieved.

NOTE

It is necessary to tighten the wing nut on the oil micro valve each time an adjustment of the pointer is made.

   f. Tighten the wing nut on the oil micro valve.

K. GAS FLOW VALVE ADJUSTMENTS

NOTE

It is recommended that the numerical settings of the burner and fuel valves be recorded to allow readjustment to the desired settings if someone should accidentally or inadvertently change the adjustments.

IMPORTANT

The adjustable air flow valve on the plenum chamber should NOT be changed while making any gas flow valve adjustments. The only difference between the oil and gas systems is that for gas operation, only the gas flow valve adjustment is altered.

The gas supplied to the burner must be in sufficient volume for the maximum capacity of the burner and maintained at a constant pressure, plus or minus 1/4 "wc.

1. With the plenum air flow valve still connected to the burner operating lever, move the levers counterclockwise to the low fire position.

2. Using the quick disconnect lever, disconnect the oil micro valve and set its pointer at the position No. 0 (zero).

3. Adjust the gas flow valve flow rate.

NOTE

Flow valve adjustment procedure is detailed in Hauck instruction sheet AFV-9 (attached to 780C-9). Refer to that sheet to adjust the gas valve flow rate. Note that some readjustment of the initial settings may be required for optimum operation after installation and initial start-up has been accomplished.

L. CONTROL SYSYEM

Although the Wide Range Burner may be operated manually, it was designed primarily for automatic modulating control. If automatic control is used, the motor operator may be directly connected to the plenum air valve by means of a bracket. The motor should be provided with an adjustable radius control lever so that adjustments can be made for the stroke of the burner and various valves and linked together from that lever to the drive lever of the plenum air valve.

The drive motor is normally mounted on a rigid support adjacent to the burner. It is necessary to provide an appropriate linkage between the burner drive train and the control motor. A 90° arc control motor is recommended. The operating arm should move in a clockwise direction to open the valves over an arc of 90° at a radius of 3-1/2", which gives a maximum stroke of 5".

CAUTION

Be sure that the control motor does not move the valve arm more than 90° or 5" or, if sufficient force is applied by the motor, the valves will be damaged. The control motor used must have sufficient torque to drive the burner and the associated valves.

For fully automatic control with heavy oil, it is necessary to provide a low fire time delay for the burner system. This time delay keeps the burner on low fire for a specified period of time before the burner can go to high fire. This is necessary to allow the ignition tile to warm up so that the flame will not blow out.

M. MAINTENANCE

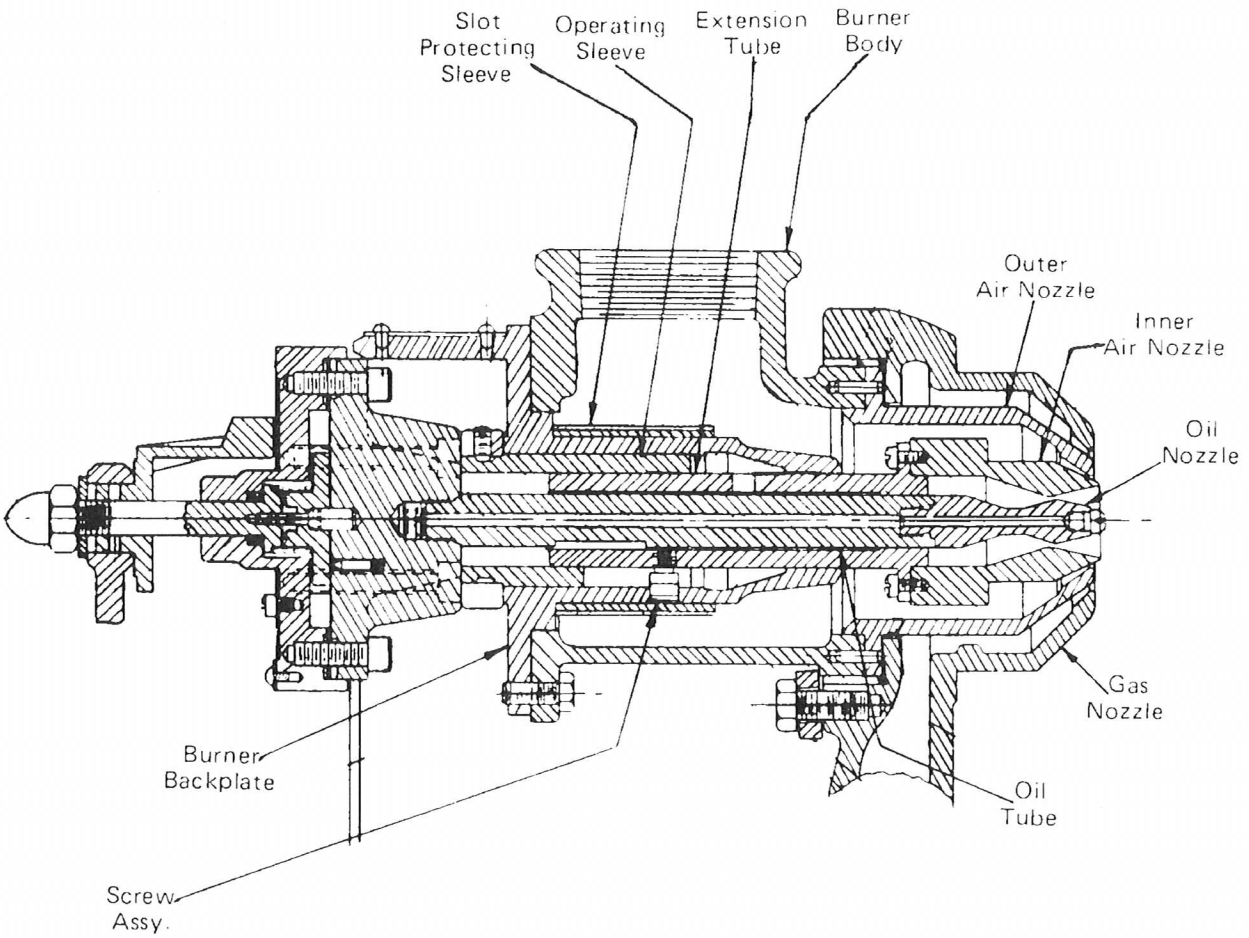


Figure 5. Cutaway Showing Burner Components

Cleaning and lubrication should be scheduled based on hours of operation and environmental conditions:

INNER AIR NOZZLE

The inner air nozzle on the burner assembly moves forward and backward on the smooth surface of the oil tube/oil nozzle. Periodically apply high temperature grease via the lubrication fitting.

OIL NOZZLE AND/OR AIR VALVE

CAUTION

Extreme care must be exercised when removing the burner parts since close tolerance, machined surfaces are utilized for proper operation. Use brass jawed or other soft metal tools for removing and holding the oil tube. Wrench flats are provided on both the oil nozzle and oil tube to facilitate disassembly and reassembly.

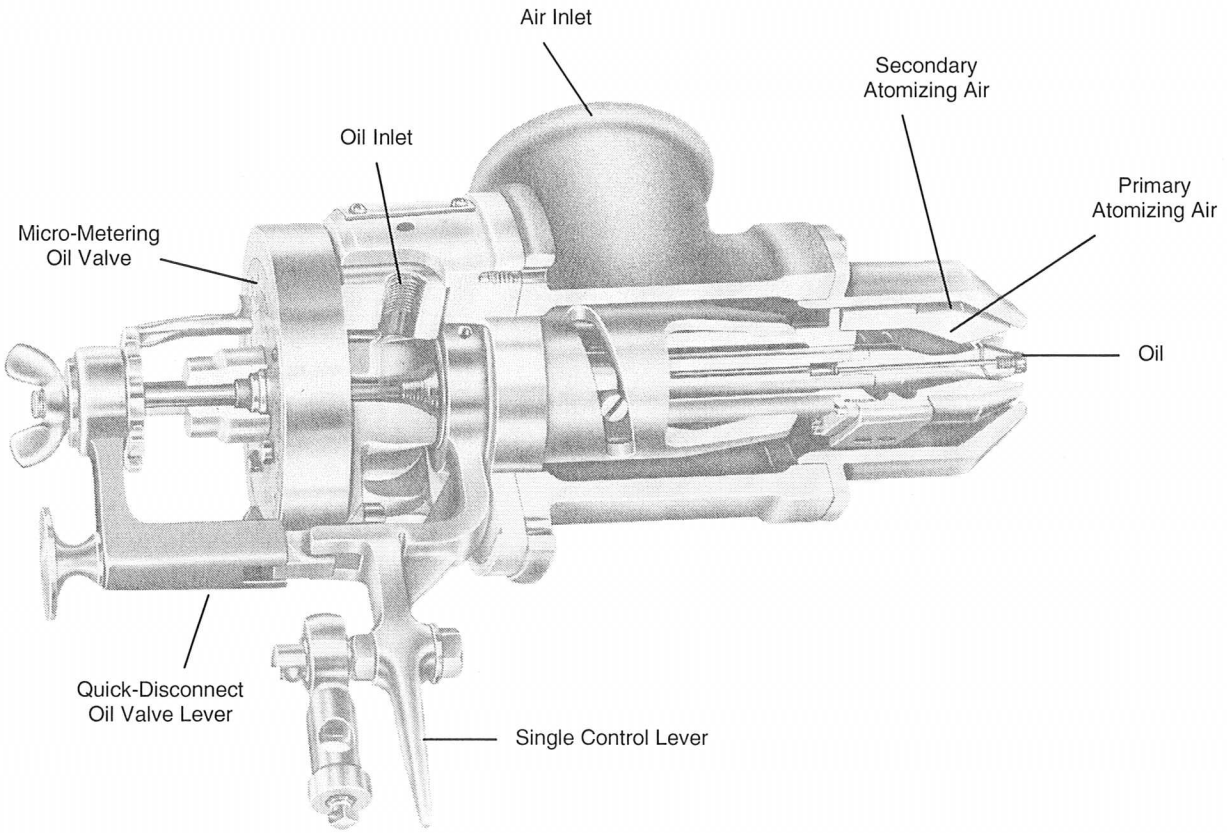


Figure 6. Sectional View Of Burner

1. Disconnect the oil supply and return lines to the oil micro valve. AT THE UNIONS PROVIDED.
2. Free the oil micro valve operating lever by disengaging the arm's quick disconnect.
3. Rotate the valve's operating lever until the micro switch (if used) actuator arm is clear of the micro switch roller and the four socket head cap screws.

4. Remove the four socket head cap screws which attach the valve to the burner backplate.
5. Remove the oil micro valve and the attached oil tube and nozzle from the burner.
6. Disconnect the oil nozzle from the oil tube.
7. Clean the oil nozzle by soaking it in a suitable cleaner. If the ports are plugged, they must be completely cleared of debris using compressed air or a wood or soft metal tool.

CAUTION
EXERCISE CARE not to change the size or shape of the port openings.

8. Reconnect the oil nozzle to the oil tube.
9. Remove the burner backplate assembly from the burner body by removing the hex head cap screws. The burner backplate assembly includes the operating lever, operating sleeve, operating screw assembly, extension tube, inner air nozzle, felt with felt sleeve, and air straightners.
10. Clean the eight tangential air inlet openings in the inner air nozzle. If the inner air nozzle air nozzle must be removed, **punch mark the pieces** for reinstallation reference. THE ORIENTATION OF THE INNER AIR NOZZLE MUST NOT BE CHANGED.
11. Remove the felt sleeve and felt which protect the operating screw and slot.
12. Remove the operating screw.
13. Pull the inner air nozzle and extension tube out of the backplate and operating sleeve assembly.
14. Inspect and clean all parts of old grease and dirt.

CAUTION
DO NOT LOOSEN OR ADJUST the socket head setscrews located where the operating lever is attached to the sleeve. The sleeve attachment to the lever determines the concentricity and minimum gap tolerances at the atomizing point of the burner. THIS ADJUSTMENT IS VERY CRITICAL.
Prior to reassembly of the parts, be sure that all mounting surfaces are clean and free of burrs.

15. Reinsert the inner air nozzle and extension tube into the backplate and operating sleeve.
16. Insert the operating screw.
17. Regrease the unit and check its operation.
18. Insert the felt and felt sleeve.
19. Insert the backplate assembly into the burner body and secure it in place with the cap screws.

20. Insert the oil micro valve with its attached oil tube. Secure the valve in position by replacing the four socket head cap screws.
21. Be sure that the micro switch contact roller (if used) and the switch actuator (located on the operating lever of the oil micro valve) are properly aligned.

> **NOTE**
> The micro switch should be **activated** when the oil micro valve is in the **full OFF** position. Reposition or replace the micro switch if it has been moved or damaged.

22. Attach the oil micro valve's quick disconnect lever.
23. Reconnect the oil supply and return lines to the oil micro valve. Be sure that the unions are tightly sealed.

ALIGNMENT OF THE INNER AND OUTER AIR NOZZLES

Whenever the burner is reassembled after either cleaning or replacing parts, the clearance between the inner and outer air nozzles should be checked. If the clearance is not within the limits listed in Table 4, Figure 7, the following instructions describe the procedure to be used for setting this clearance:

1. Remove the backplate assembly from the burner body by removing the bolts which hold it to the body.
2. Loosen the two Allen setscrews on each side of the operating lever collar. These setscrews hold the lever to the slotted sleeve.
3. Holding the operating lever in the low fire position, turn the inner nozzle so that it moves as far as away from the backplate as it will go. Then tighten lightly one setscrew in the lever, located towards the high fire position.
4. Move the operating lever to the high fire position. Replace the assembly in the burner and tighten evenly and secure the bolts which hold the lever to the burner body.
5. Hold three clearance wires (or narrow strip stock) of the proper thickness equally spaced between the inner nozzle and the outer nozzle and pull the operating lever all the way to the low fire position. The inner nozzle will then be spaced the proper distance from the outer nozzle and the lever will slip on the operating sleeve to the low fire position.
6. Without allowing the lever to move, securely tighten the Allen setscrew in the operating lever collar on the high fire side. Move the lever to the high fire position and secure the second setscrew in the collar lever on the low fire side.

BURNER	CLEARANCE
779	.007" - .010"
780	.010" - .012"
781	.010" - .012"
782	.010" - .015"
783	.010" - .015"
784	.050" - .062"
785	.050" - .062"
786	.050" - .062"

Table 4.

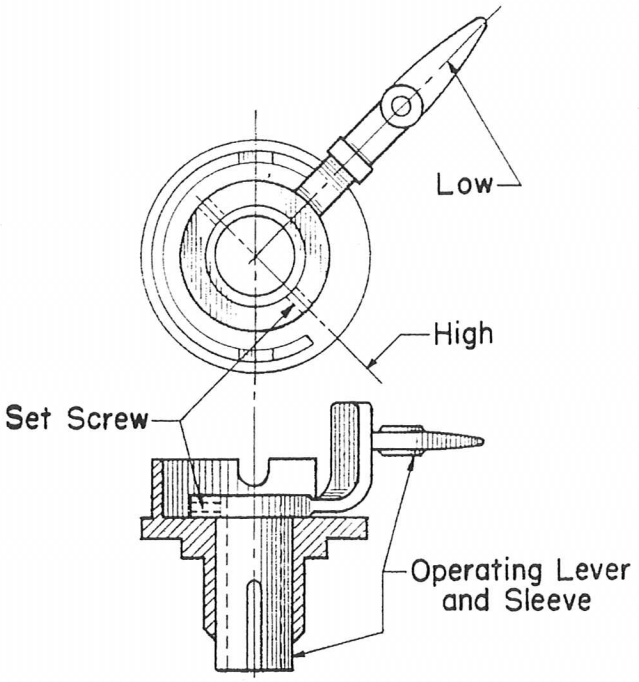


Figure 7. Drawing of the air nozzle control lever showing the set screw locations.

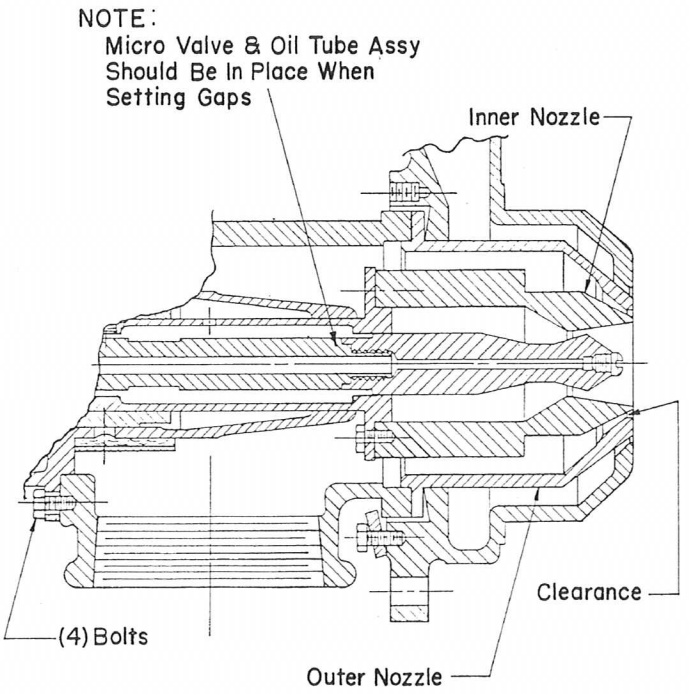


Figure 8. Schematic Representation Depicting The Inner and Outer

PLENUM

If, by some accident, fuel oil is turned on without combustion air being present, the plenum will fill with oil. If there is knowledge or suspicion that oil has flooded the plenum, open the drain plug and remove the accumulated oil before lighting the burner.

OIL FILTER

The handle of the oil filter should be turned once or more per day, as conditions warrant. Always close the oil and air shutoff valves before cleaning. See vendor literature for details.

PRESSURE REGULATOR

If the oil pressure regulator does not maintain a uniform or constant oil pressure, it is usually caused by dirt, pipe scale, etc. See regulator literature for details.

FLOW VALVES

If there is excessive dirt in the air or gas, the valves should be cleaned periodically. See Hauck instruction sheet AFV-9 (attached to 780C-9).

IGNITION TILE AND TILE EXTENSION

The ignition or the extension may be replaced by first knocking out the existing the extension and then, if replacement is required, removing the ignition tile. A new Hauck ignition of the appropriate size should be installed in the metal jacket and a rammable refractory used to ram up the tile extension.

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779PAC TO 786PAC PROPORTIONING COMBINATION BURNERS

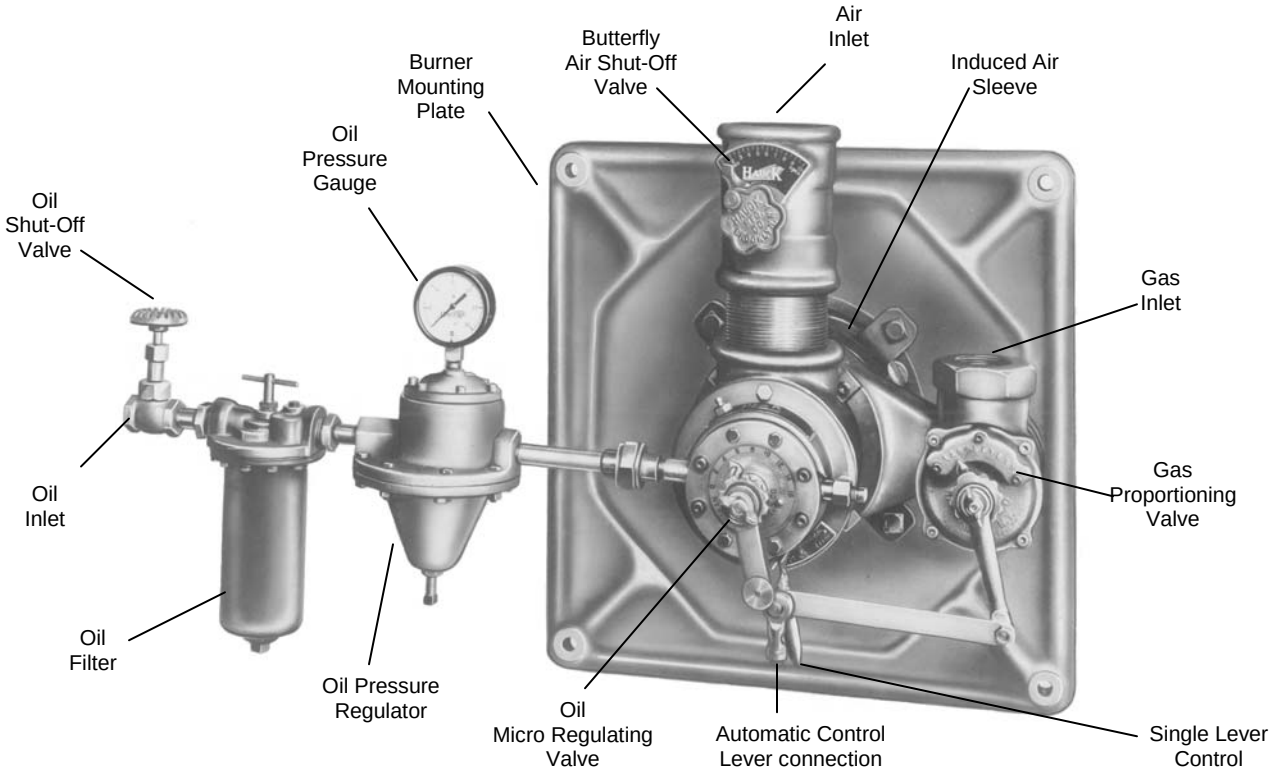


Figure 1. Typical 780 Series Burner Arrangement Showing Components. Burner Mounting Plate Is Optional.

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.

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 burners in the Hauck 780PAC series are self-proportioning (P), automatically controlled (A), combination fuel fired (C) units equipped with lubrication fittings. These burners are specifically designed to use low pressure atomizing air when operating on oil. The 780PAC efficiently burns gas, oil-even the heaviest grades-or a combination of these fuels.

Each burner is its own individual fuel-air proportioning unit. All of the required combustion and atomizing air is supplied through a single air connection on each burner. Both oil and gas can be burned simultaneously in. varying proportions after the proper adjustments are made.

This Hauck burner permits instant switching from gas to oil or oil to gas by merely closing one fuel valve and opening the other. The flow of oil and/or gas and air is accurately proportioned and controlled by the movement of one lever which can be either manually or automatically operated over the entire range of firing capacity.

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. CAPACITIES

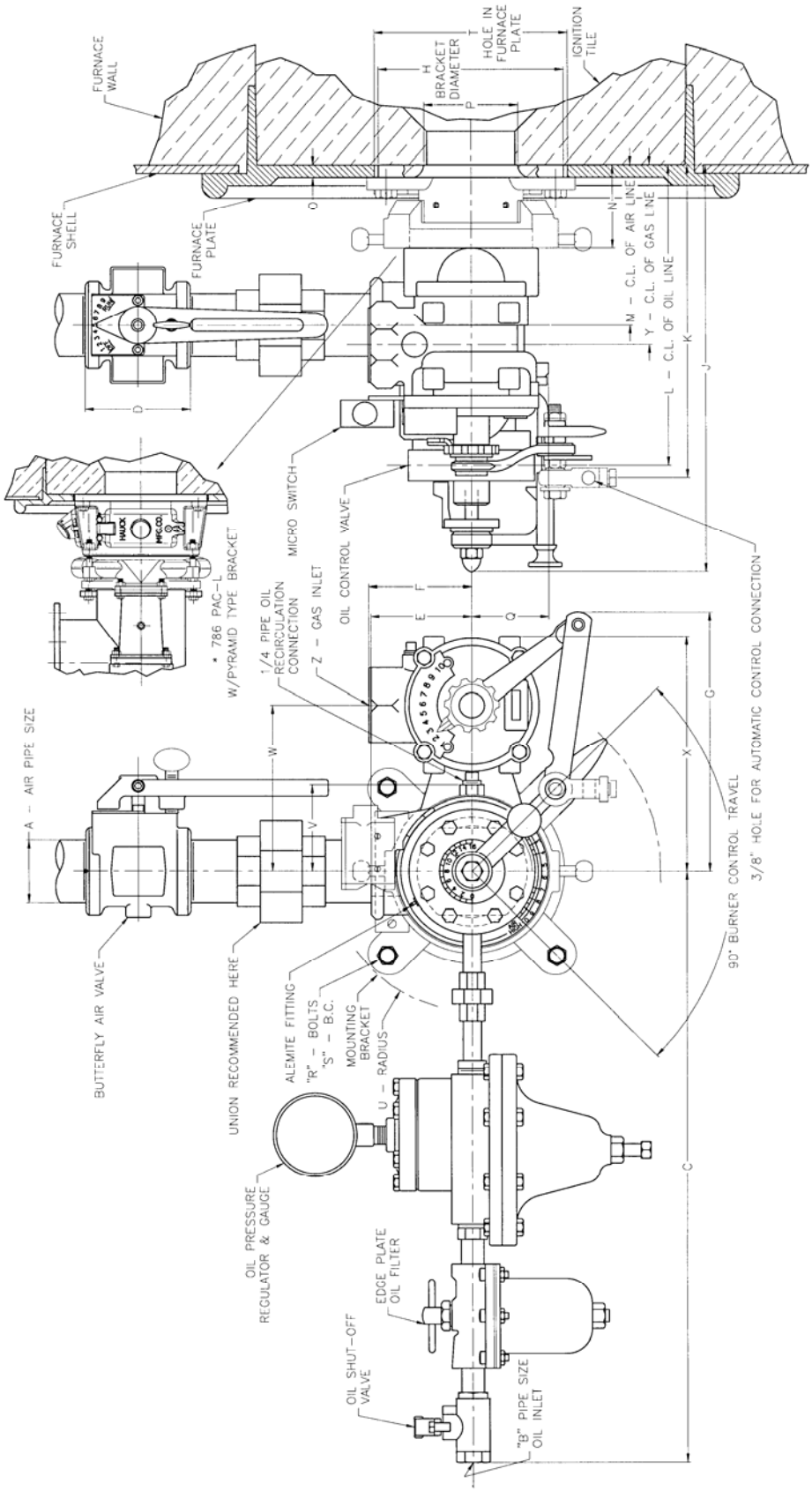
Burner Size	779	780	781	782	783	784	785	786
16 osi Air Pressure								
Air Max. (CFM)	34	66	123	210	298	660	910	1620
Oil Max. (GPH)	1.5	2.9	5.4	9.2	13.0	29.0	40.0	71.0
Oil Min. (GPH)	0.8	1.0	1.1	1.1	3.1	6.2	11.1	16.7
Gas Max. (CFH)	206	402	750	1278	1817	4024	5548	9875
Gas Min. (CFH)	102	137	151	151	427	854	1529	2298
20 osi Air Pressure								
Air Max. (CFM)	38	74	138	235	334	739	1019	1814
Oil Max. (GPH)	1.7	3.3	6.0	10.3	14.7	32.5	44.8	79.7
Oil Min. (GPH)	0.75	1.0	1.2	1.3	3.5	6.9	12.4	18.7
Gas Max. (CFH)	230	451	841	1432	2038	4505	6211	11057
Gas Min. (CFH)	103	137	165	179	483	950	1711	2577
24 osi Air Pressure								
Air Max. (CFM)	42	81	151	257	365	809	1115	1985
Oil Max. (GPH)	1.8	3.6	6.6	11.3	16	35.6	49.0	87.3
Oil Min. (GPH)	0.75	1.0	1.3	1.4	3.9	7.6	13.6	20.5
Gas Max. (CFH)	255	494	921	1567	2226	4932	6798	12096
Gas Min. (CFH)	103	137	179	192	536	1048	1875	2827

Notes:

1. Capacities for oil based on No. 2 fuel oil with HHV of 138,000 Btu/gal; for gas based on natural gas with HHV of 1,040 Btu/ft^3. Capacities for other fuel oils or gases will vary based upon their HHV; consult Hauck.
2. If using heavy oil, the burner should be operated at a minimum static air pressure of 24 osig to ensure proper atomization.
3. Air, oil, and gas flows based on 60°F @ sea level.
4. For specifics on required fuel supply requirements, see 780PAC-4 Supplemental Data Sheet.

Table 1. Capacities

D. DIMENSIONS



DIMENSIONS IN INCHES

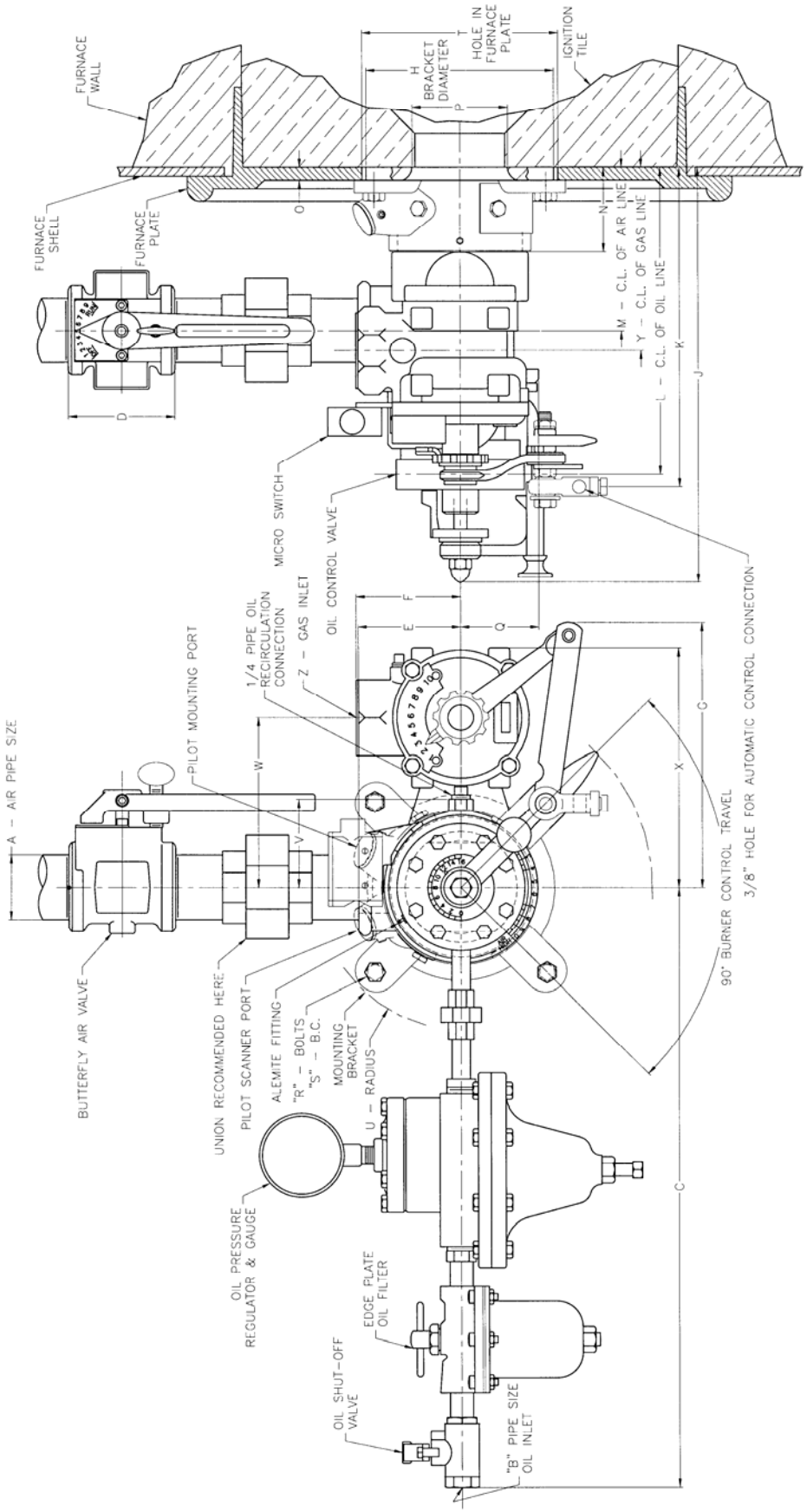
BURNER NUMBER	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
779 PAC–L	1	3/8	18 1/2	3	2 3/8	3	8	5 1/2	8 3/4	6 1/4	5 3/4	3 3/4	1 3/4	1/4	2 1/2	1 5/8	3/8	7 1/8	5 3/4	4 1/8	2 5/8	5	7	4	1
780 PAC–L	1 1/2	3/8	19	3 1/8	3	3	8	5 1/2	12	9 1/2	8 3/8	5 1/2	2 1/2	3/8	2 3/4	2 1/4	3/8	7 1/8	5 3/4	4 1/8	2 5/8	5	7	5 1/4	1
781 PAC–L	2	3/8	19	3 1/4	3 1/2	3	8	7	13 1/2	11	9 3/4	6 7/8	3	3/8	3 5/8	2 3/4	3/8	8 11/16	7 1/4	5	2 5/8	5 1/2	7 1/2	7 5/8	1 1/4
782 PAC–L	3	3/8	23	4 13/16	3 7/8	3 5/8	10	8	15 7/8	13 1/2	12	8 1/2	3 5/8	7/16	4 3/4	3 1/8	1/2	9 3/4	8 1/4	5 1/2	3	7	9	8 3/4	1 1/2
783 PAC–L	4	3/8	23	5	4 1/4	3 5/8	10	9	17 1/2	15 1/8	13 1/2	9 1/2	3 3/4	1/2	4 7/8	3 1/8	1/2	10 7/8	9 1/4	6	3	7	9	10 1/4	2
784 PAC–L	6	1/2	23	6 1/2	6 3/8	3 5/8	10	11	20 1/4	18 1/8	16 1/2	11 1/4	4 1/8	5/8	6 1/4	4	1/2	13	11 1/4	7 1/4	3	7	9	12 3/8	2
785 PAC–L	6	1/2	23	6 1/2	6 3/8	3 5/8	10	11	20 1/4	18 1/8	16 1/2	11 1/4	4 1/8	5/8	6 1/4	4	1/2	13	11 1/4	7 1/4	3	7	9	12 3/8	2
786 PAC–L*	8	1/2	27	5 1/2	7 7/8	5 3/8	10	12	27	24 1/2	22 1/2	15 3/4	5 5/8	5/8	8	4 1/8	1/2	14 3/4	12 1/4	6	3	8	11 1/8	18 1/2	3–4

* NO. 786 PAC–L BURNER HAS PYRAMID TYPE MTG. BRACKET AND FLANGED TYPE BUTTERFLY AIR VALVE.

Y26
(NOT TO SCALE)

Figure 2. Dimensions - Burner With Combination Sleeve Bracket

D. DIMENSIONS (Continued)



DIMENSIONS IN INCHES

BURNER NUMBER	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
780 PAC–L	1 1/2	3/8	19	3 1/8	3	3	8	5 1/2	12	9 1/2	8 3/8	5 1/2	2 1/2	3/8	2 3/4	2 1/4	3/8	7 1/8	5 3/4	4 1/8	2 5/8	5	7	5 1/4	1
781 PAC–L	2	3/8	19	3 1/4	3 1/2	3	8	7	13 1/2	11	9 3/4	6 7/8	3	3/8	3 5/8	2 3/4	3/8	8 11/16	7 1/4	5	2 5/8	5 1/2	7 1/2	7 5/8	1 1/4
782 PAC–L	3	3/8	23	4 13/16	3 7/8	3 5/8	10	8	15 7/8	13 1/2	12	8 1/2	3 5/8	7/16	4 3/4	3 1/8	1/2	9 3/4	8 1/4	5 1/2	3	7	9	8 3/4	1 1/2
783 PAC–L	4	3/8	23	5	4 1/4	3 5/8	10	9	17 1/2	15 1/8	13 1/2	9 1/2	3 3/4	1/2	4 7/8	3 1/8	1/2	10 7/8	9 1/4	6	3	7	9	10 1/4	2
784 PAC–L	6	1/2	23	6 1/2	6 3/8	3 5/8	10	11	20 1/4	18 1/8	16 1/2	11 1/4	4 1/8	5/8	6 1/4	4	1/2	13	11 1/4	7 1/4	3	7	9	12 3/8	2
785 PAC–L	6	1/2	23	6 1/2	6 3/8	3 5/8	10	11	20 1/4	18 1/8	16 1/2	11 1/4	4 1/8	5/8	6 1/4	4	1/2	13	11 1/4	7 1/4	3	7	9	12 3/8	2
786 PAC–L*	8	1/2	27	5 1/2	7 7/8	5 3/8	10	12	27	24 1/2	22 1/2	15 3/4	5 5/8	5/8	8	4 1/8	1/2	14 3/4	12 1/4	6	3	8	11 1/8	18 1/2	3–4

* NO. 786 PAC–L BURNER HAS FLANGED TYPE BUTTERFLY AIR VALVE.

Y8004
(NOT TO SCALE)

Figure 3. Dimensions - Burner With Combination Access Bracket

E. INSTALLATION

1. Install the ignition tile. When the furnace mounting plate is used, securely seat the tile in the flange provided for it on the inside of the furnace mounting plate. Where this plate is not used, cut a hole in the furnace shell 1/4" larger in diameter than the burner mounting bracket opening. Place the tile in the furnace wall and secure it firmly in place.

2. Bolt the burner mounting bracket to the furnace mounting plate or the furnace shell. If the latter method is used, make sure that the centerline of the bracket is aligned with the centerline of the tile and apply a 1/8" layer of air setting refractory cement to the face of the tile so that when the bolts are tightened, an air tight seal will exist between the tile and the bracket.

> **CAUTION**
> If a pyramid mounting bracket is used, make sure that it is positioned so that the bracket ports do not interfere with the operation of the burner or it accessories.

3. Unscrew the Allen setscrews in the mounting bracket.

4. Insert the burner nozzle into the mounting bracket as far as it will go.

5. Lock the burner in position by tightening the Allen setscrews.

6. Install a Butterfly Air Valve as shown in Figure 1. A union and flexible air connection between the butterfly air valve and the burner is recommended. The union will allow the burner to be easily removed for cleaning. The flexible connection helps to isolate the burner from movements of the piping caused by heat expansion.

> **NOTE**
> Air piping should enter the burner from the top or, when necessary, from either side. If air enters from the bottom, the air piping could be flooded with oil if an air failure should occur.

7. Supply a low pressure air supply line to the burner. This line must be adequately sized and piped to avoid excessive pressure drops. The combustion air should be clean. If there is any possibility that the blower will pull dirt in with the air, a filter should be provided at the blower intake.

8. Pipe the oil set-up assembly to the burner. The oil pressure regulator and filter must be in a horizontal position and, if possible, about 8 to 12 inches below the burner. This will prevent oil from draining into the burner after the shutoff valve is closed. Use galvanized iron piping for any extension between the micro oil valve and filter to prevent clogging from iron pipe scale.

9. Supply a fuel line to the inlet of the oil set-up assembly. When heavy fuel oil is used with automatic ignition, or when frequent starting is necessary, install a circulating system so that hot oil of the proper viscosity (80 to 90 SSU) will be available to the burner at the time of burner start-up. When heated oil is being used, it is advisable to trace and insulate the oil supply lines.

CAUTION
All piping must be properly supported and aligned to avoid strain on the burner and associated equipment.

10. Pipe a gas supply line to the adjustable flow valve on the burner. The gas supplied to the burner must be in sufficient volume for the maximum capacity of the burner.

11. Complete the preliminary adjustment of the adjustable flow valve as described in the instruction sheet which accompanied the burner (see AFV-9).

12. IF APPLICABLE, install the pilot ignition system in accordance with the instructions which accompanied the unit.

13. Start fuel and air flow to the pilot.

14. Ignite the pilot by energizing the ignition transformer (automatic system) or by placing a lighted torch at the end of the pilot nozzle (manual system). Adjust the pilot as described in the instructions which accompanied the unit. When properly adjusted, the pilot should produce a sharp, blue, high velocity, blast type flame.

15. IF OPERATING ON OIL, start the oil supply pump. It is recommended that oil at **50 psig** be supplied to the inlet of the pressure regulator.

NOTE
When firing on heavy oils requiring heating, a Hauck Viscometer or other suitable device should be used to determine the oil temperature required to produce the needed viscosity of 80 to 90 SSU.

Adjust the oil pressure regulator for the appropriate, initial discharge pressure: **5 to 10 psig** for light oil, **7 to 15 psig** for heavy oil.

16. IF OPERATING ON GAS, adjust the gas supply system to supply the gas at a constant pressure of 2" wc for high Btu gases and 6" wc for lower Btu gases. Where the burners are operated at ratings higher than the sealed in capacities, the pressure may have to be increased to get sufficient gas flow.

17. Make sure that the burner control valve is in the low fire position.

18. Open all restrictions in the air supply line to the burner.

19. Open the main shutoff valve in the fuel line to the burner.

20. Ignite the burner by slowly moving the operating lever forward until the burner lights.

CAUTION
Remain in the low fire position 2 to 10 minutes to allow for the ignition tile to warm up sufficiently to insure good burning.

21. Complete the final adjustment of the burner:
    Gas Operation – See AFV-9
    Oil Operation – Steps 22 and 23 Below.

22. Adjust the oil pressure regulator to achieve a uniform oil-air ratio and consistent flame characteristics between low fire and high fire positions. At this stage of adjustment a **consistent flame characteristic is required regardless of the flame condition** (how rich or lean the flame is). To accomplish this adjustment, complete the following.
    A. Slowly rotate the burner oil-air control levers from low fire to high fire and observe the flame.
    B. If the flame changes from a lean flame at low fire to a rich flame at high fire, the oil pressure is too high. Correct this by adjusting the oil pressure regulator.
    C. If the flame changes from a rich flame at low fire to a lean flame at high fire, the oil pressure is too low. Correct this by adjusting the oil pressure regulator.

23. Once the flame character is consistent, it can be made richer or leaner, **over the entire range from low fire to high fire,** by SLIGHTLY altering the position of the micro oil valve pointer at low fire. To accomplish this adjustment, complete the following.

A. Drive the burner oil-air control levers to the low fire position.

B. Loosen the wing-nut on the burner micro oil valve pointer.

C. To make the flame richer, rotate the pointer SLIGHTLY to the right (clockwise direction).

D. To make the flame leaner, rotate the pointer SLIGHTLY to the left (counterclockwise direction).

E. Monitor the flame condition and repeat steps C and D until a flame having the desired conditions is observed.

F. Tighten the wing-nut on the burner micro oil valve pointer.

CAUTION

When adjusting the micro oil valve pointer, always maintain the air control lever in the low fire position.

WARNING

Adjustment of this equipment, by unqualified personnel, can result in fire, explosion, severe personal injury, or even death.

F. OPERATION

During the normal operations, the air, and oil valves are operated simultaneously. The oil valve linkage can be quickly disconnected to allow only the gas and air to operate together. The valves are designed to operate together and the linkages are not engineered for an adjustable radius or length of arc.

With the three valves properly linked, the air valve supplies a fixed air volume per position on the fuel control valves. For proper combustion, the gas and oil flows are set to be "on ratio" with the air volume throughout the burner's operational range. The initial adjustment of the gas and oil valves is critical and should be done with care. **Once the valves are adjusted, no changes should be made in their settings.**

CAUTION

Linkage adjustments, pressure adjustments, or any other changes which affect the burner's operation should be accomplished as described in this Instruction Manual. If problems are encountered, contact Hauck Manufacturing Company.

G. MAINTENANCE

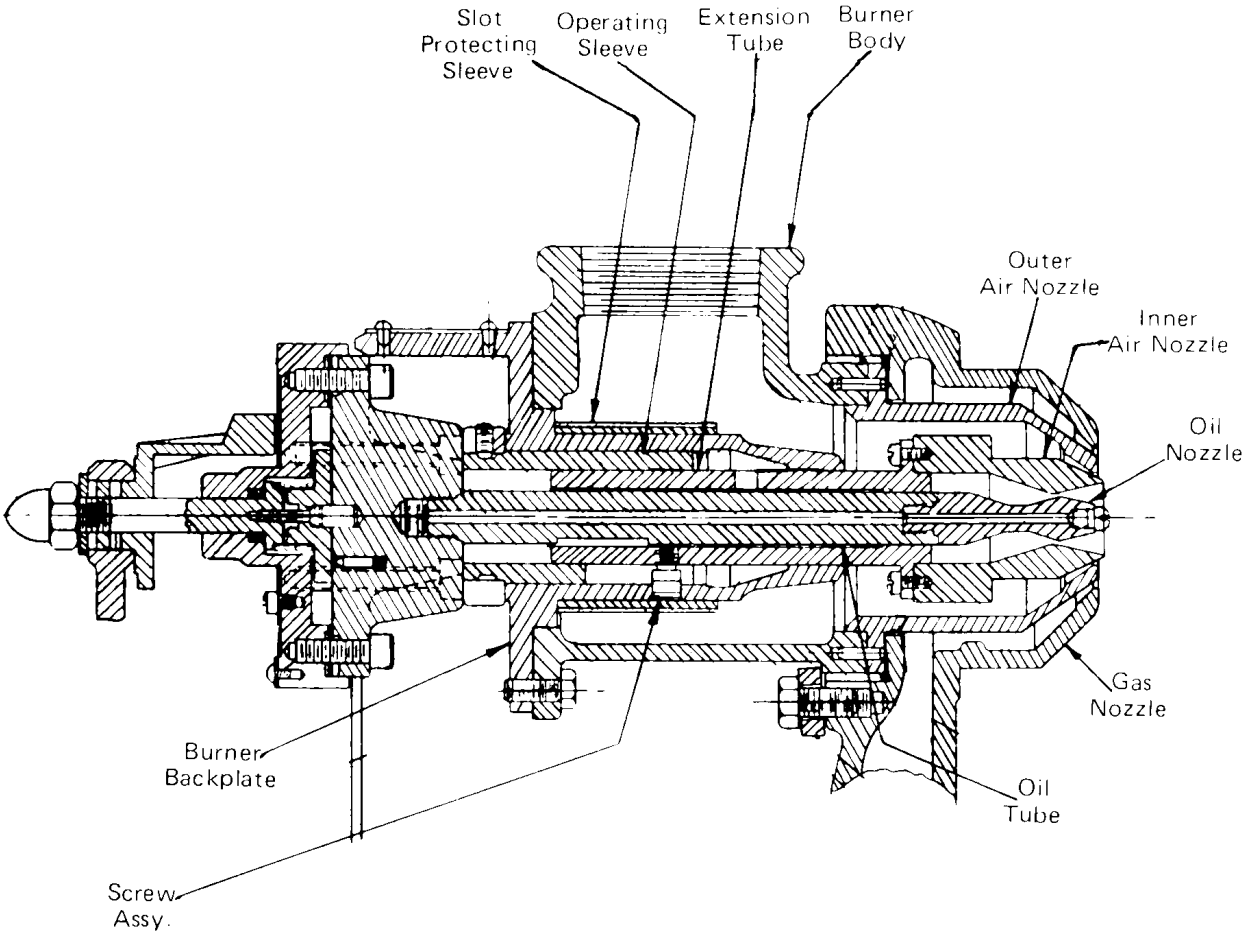


Figure 4. Cutaway View Of The 780 Seires Burner Assembly Showing The Individual Components.

The inner air nozzle on the burner assembly moves forward and backward on the smooth surface of the oil tube/oil nozzle assembly. Periodic applications of a high temperature grease (via the lubrication fitting) will help trouble free service.

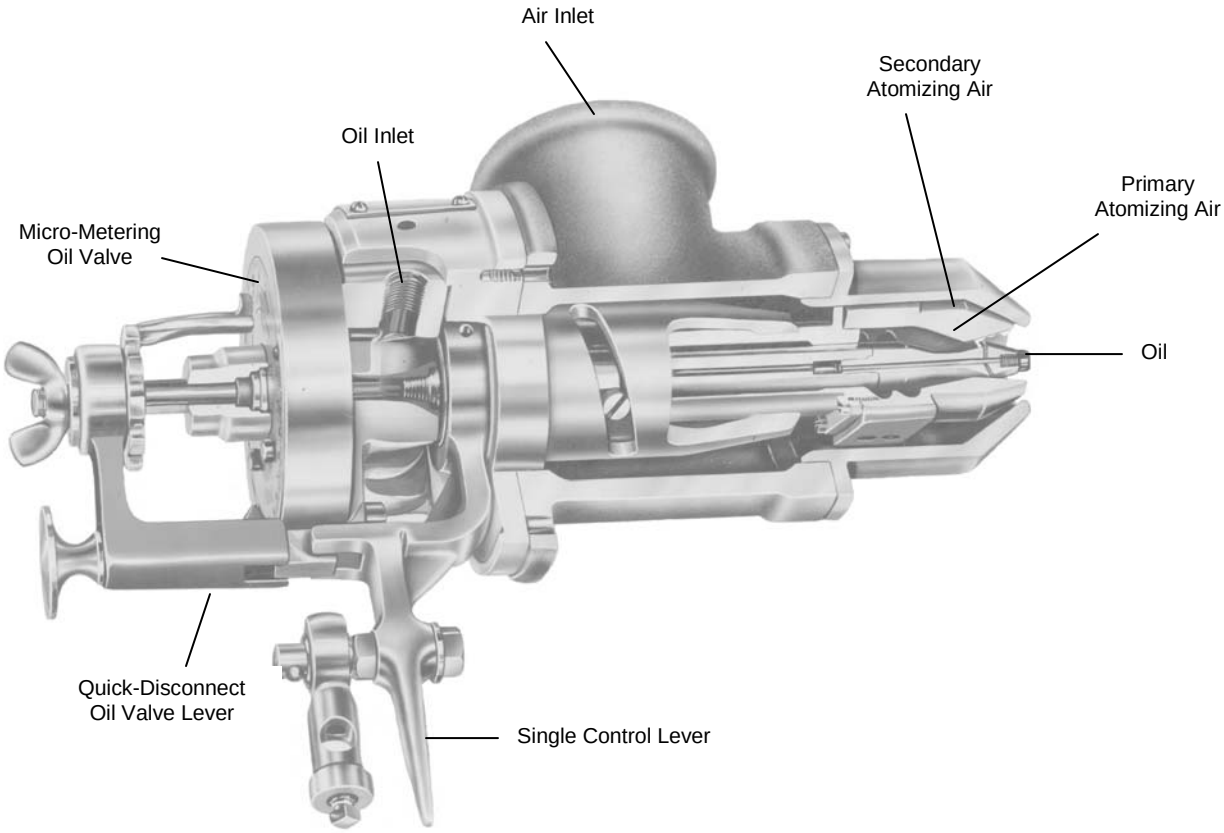


Figure 5. Sectional View Of Hauck Self Proportioning Oil Burner

To clean the oil nozzle and/or the air valve, complete the following.

CAUTION
Extreme care must be exercised when removing the burner parts since close tolerance, machined surfaces are required for proper operation. Use brass jawed or other soft metal tools for removing and holding the oil tube. Wrench flats are provided on both the oil nozzle and the oil tube to facilitate disassembly.

1. Disconnect the oil supply and return lines to the oil micro valve AT THE UNIONS PROVIDED.

2. Free the oil micro valve operating lever by disengaging the arm's quick disconnect.

3. Rotate the valve's operating lever until the micro switch (if used) actuator arm is clear of the micro switch roller and the four socket head cap screws.

4. Remove the four socket head cap screws which attach the valve to the burner backplate.

5. Remove the micro valve and the attached oil tube and nozzle from the burner.

6. Disconnect the oil nozzle from the oil tube.

7. Clean the oil nozzle by soaking it in a solvent. If the ports are plugged, they must be completely cleared of debris using compressed air or a wooden or soft metal instrument. EXERCISE CARE NOT TO CHANGE THE SIZE OR THE SHAPE OF THE PORT OPENINGS.

8. Reconnect the oil nozzle to the oil tube.

9. Remove the burner backplate assembly from the burner body by removing the hex head cap screws. THE BURNER BACKPLATE ASSEMBLY INCLUDES THE OPERATING LEVER, OPERATING SLEEVE, OPERATING SCREW ASSEMBLY, EXTENSION TUBE, INNER AIR NOZZLE, AND FELT WITH FELT SLEEVE.

10. Clean the eight tangential air inlet openings in the inner air nozzle. If the inner air nozzle must be removed, PUNCH MARK THE PIECES FOR REINSTALLATION REFERENCE. THE ORIENTATION OF THE INNER AIR NOZZLE MUST NOT BE CHANGED.

11. Remove the felt sleeve and felt which protect the operating screw and slot.

12. Remove the operating screw.

13. Pull the inner air nozzle and extension tube out of the backplate and operating sleeve assembly.

14. Inspect and clean all parts of old grease and dirt.

CAUTION

Do not loosen or adjust the socket head set screws located where the operating lever is attached to the operating sleeve. The sleeve attachment to the lever determines the concentricity and minimum gap tolerances at the atomizing point of the burner. THIS ADJUSTMENT IS VERY CRITICAL.

CAUTION

Prior to reassembly of the parts, ensure that all mounting surfaces are clean and free of burrs.

15. Reinsert the inner air nozzle and extension tube into the backplate and operating sleeve.

16. Replace the operating screw.

17. Regrease the unit and check its operation.

18. Replace the felt and felt sleeve.

19. Insert the backplate assembly into the burner body and secure it in place with the cap screws.

20. Replace the oil micro valve with its attached oil tube. Secure the valve in position by replacing the four socket head cap screws.

21. Ensure that the micro switch contact roller (if used) and the switch actuator (located on the operating lever of the oil micro valve) are properly aligned. The micro switch should be activated when the oil micro switch is in the full off position. Reposition the micro switch if it has been moved or damaged.

22. Engage the oil micro valve's quick disconnect lever.

23. Reconnect the oil supply and return lines to the oil micro valve. Ensure that the unions are tightly sealed.

If the gas flow valve becomes stiff or sluggish, inspect and clean the unit by accomplishing the following:

1. Disconnect the linkages.

2. Remove the three screws and guide stud nuts which secure the cover to the valve body.

3. Remove the complete internal assembly.

4. Wash all of the parts thoroughly with solvent or kerosene.

5. Clean thoroughly the valve body housing.

6. Inspect the cylinder. If scarring has occurred, use an emery cloth to restore a smooth surface.

7. Apply cup grease or graphite grease to the cam springs and lubricate all of the other parts with a light grade oil or Molykote.

8. Replace the gasket.

9. Reinsert the complete internal assembly. Use the position of the guide stud to ensure proper alignment. ENSURE THAT THE VALVE STEM IS PROPERLY SEATED IN THE BUSHING AT THE BACK OF THE VALVE BODY.

10. Secure the valve cover to the valve body.

11. Reconnect the linkages.

ADJUSTABLE FLOW VALVES

Fig. 1. Straight Valve, Threaded and Flange

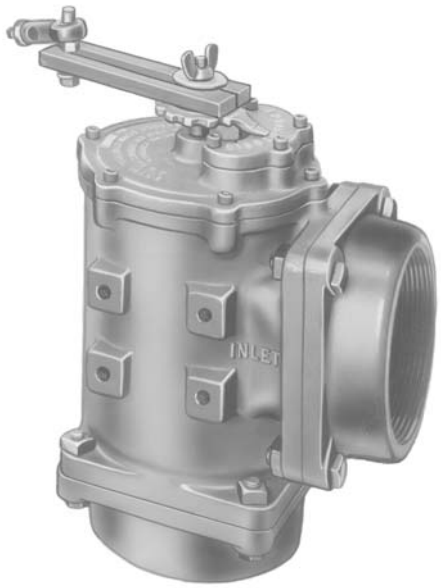


Fig. 2. Angle Valve, Threaded and Flanged

WARNING

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Adjustment of this equipment and its components, by unqualified personnel, can result in fire, explosion, severe personal injury, or even death.

Table Of Contents

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.

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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

Hauck Adjustable Flow Valves allow the flow rate to be changed at any of the 10 or more adjusting points. In this way the valve flow curve can be characterized to suit different constants in pressure, flow suction, or discharge pressure. Flow control may be either manual or automatic. Each side of the valve is equipped with four drilled and tapped mounting pads. This facilitates the installation of multiple valve units or an automatic control system. These valves are designed to be used as efficient control systems, not as shutoff valves.

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.

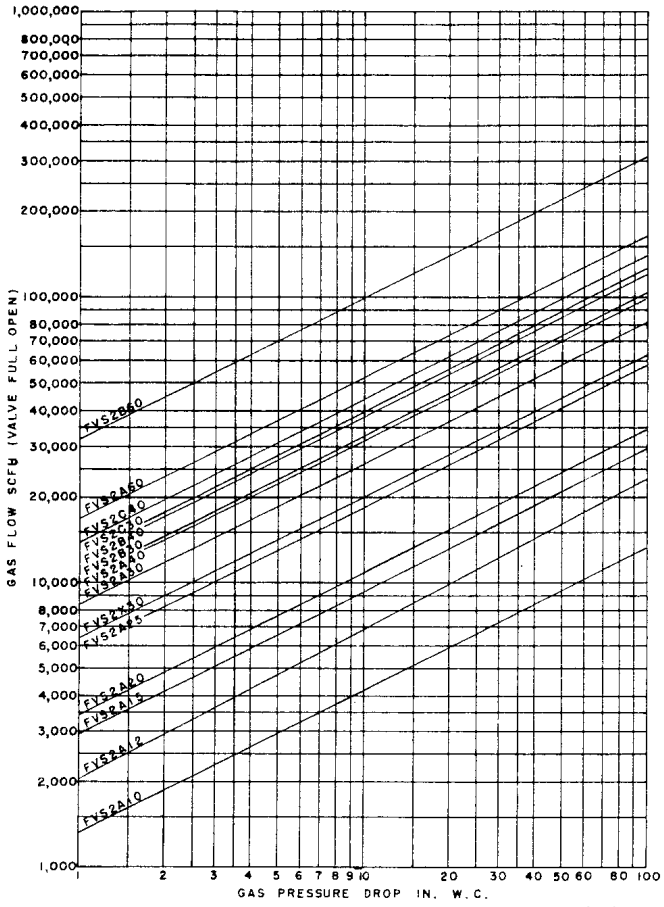
IMPORTANT

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.

CAPACITIES

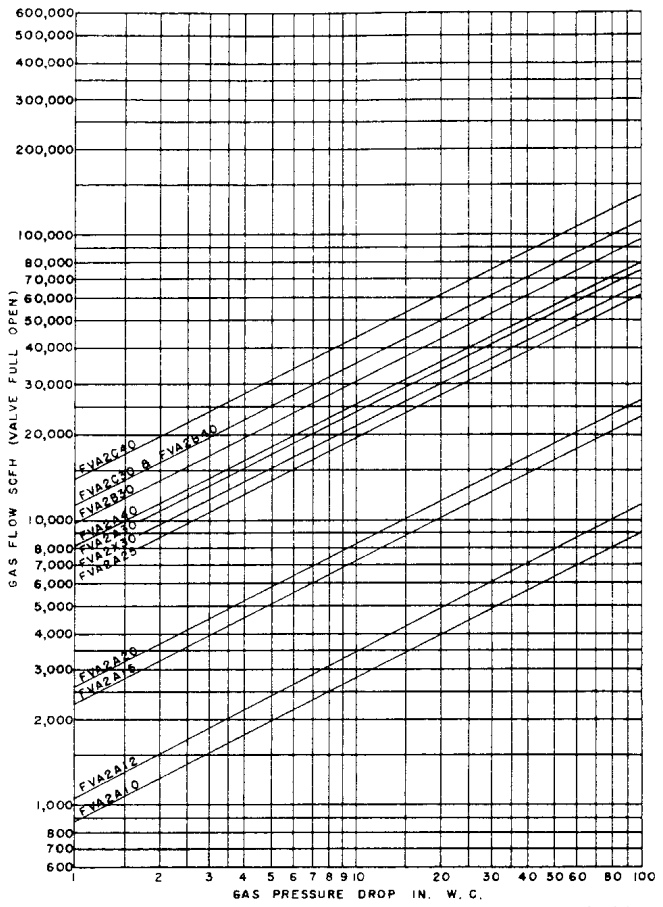
NATURAL GAS

STRAIGHT VALVE-GAS



Q135

ANGLE VALVE-GAS



Q136

NOTES:

1. Capacities based on gas @ 0.60 s.g. and 68°F temperature.
2. Static pressure drop measured across full open valve with pointer at position 10 and valve piston in full open position.
3. Maximum inlet pressure is **15 psig** up to 4" valve size and **3 psig** for 6" valve size.
4. Maximum temperature is **200°F**.

CORRECTION FACTORS

PRESSURE (Correction Factor C_1)

Pressure Drop (psig)	Inlet Pressure (psig) 5	10	15
1	1.15	1.29	1.42
2	1.63	1.80	1.95
3	1.95	2.25	2.45
4	2.20	2.50	2.85
5	2.45	2.75	3.00
10		3.70	4.05
15			4.70

TEMPERATURE (Correction Factor C_2)

Temperature (°F)	68	100	150	200
Multiplier	1.00	1.03	1.07	1.12

SPECIFIC GRAVITY (Correction Factor C_3)

Gas	Coke Oven	Natural Gas			Blast Furnace	Propane	Butane
Specific Gravity	.40	.59	.60	.61	1.02	1.52	2.01
Multiplier	1.224	1.007	1.000	.992	.767	.628	.547

EXAMPLE:

Determine the corrected volumetric flow rate in standard cubic feet per hour for a FVS2A15 (1½") adjustable flow valve for propane gas at 100°F having an inlet pressure of 15 psig and a pressure drop of 5 psig.

Using the equation: ^{Q}(corrected) = C_1 x C_2 x C_3 x ^{Q}(rated)

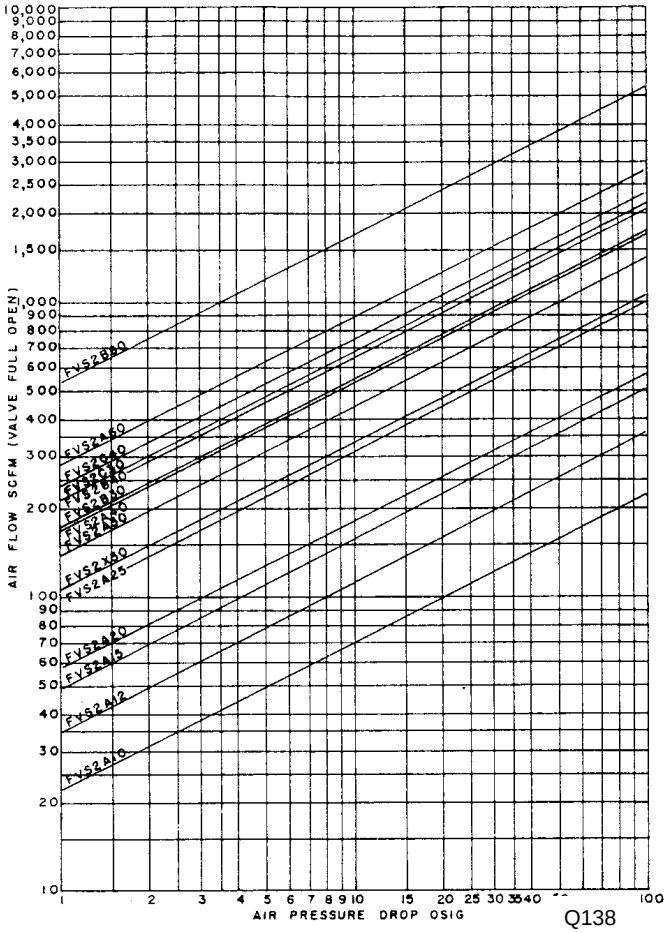
1. From the standard flow curve for Natural Gas (Q135) at 27.7 "w.c. pressure drop, determine the rated flow: ^{Q}(rated) = 16,000 scfh.
2. From the Pressure correction factor table, determine the pressure correction factor: C_1 = 3.00
3. From the Temperature correction factor table, determine the temperature correction factor: C_2 = 1.03
4. From the Specific Gravity correction factor table, determine the specific gravity correction factor for Propane: C_3 = 0.628

Then, ^{Q}(corrected) = (3.00) x (1.03) x (0.628) x (16,000)
= 31,050 scfh of propane gas

CAPACITIES (Continued)

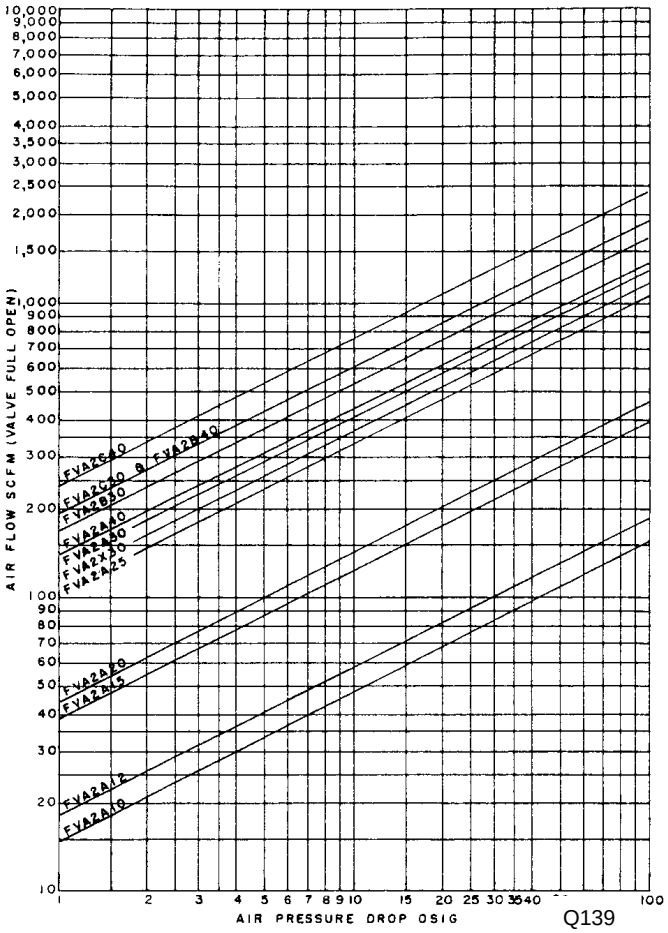
AIR

STRAIGHT VALVE – AIR



Q138

ANGLE VALVE - AIR



Q139

NOTES:

1. Capacities based on air @ 1.0 s.g. and 68°F temperature.
2. Static pressure drop measured across full open valve with pointer at position 10 and valve piston in full open position.
3. Maximum inlet pressure is **15 psig** up to 4" valve size and **3 psig** for 6" valve size.
4. Maximum temperature is **200°F**.

CORRECTION FACTORS

PRESSURE (Correction Factor C_1)

Pressure Drop (psig)	Inlet Pressure (psig) 5	10	15
1	1.15	1.29	1.42
2	1.63	1.80	1.95
3	1.95	2.25	2.45
4	2.20	2.50	2.85
5	2.45	2.75	3.00
10		3.70	4.05
15			4.70

TEMPERATURE (Correction Factor C_2)

Temperature (°F)	68	100	150	200
Multiplier	1.00	1.03	1.07	1.12

EXAMPLE:

Determine the corrected volumetric flow rate in standard cubic feet per hour for a FVS2A15 (1½") adjustable flow valve for air at 150°F having an inlet pressure of 15 psig and a pressure drop of 5 psig.

Using the equation: ^{Q}(corrected) = C_1 x C_2 x ^{Q}(rated)

1. From the standard flow curve for Air (Q138) at 16 osig pressure drop, determine the rated flow: ^{Q}(rated) = 12,000 scfh.
2. From the Pressure correction factor table, determine the pressure correction factor: C_1 = 3.00
3. From the Temperature correction factor table, determine the temperature correction factor: C_2 = 1.07

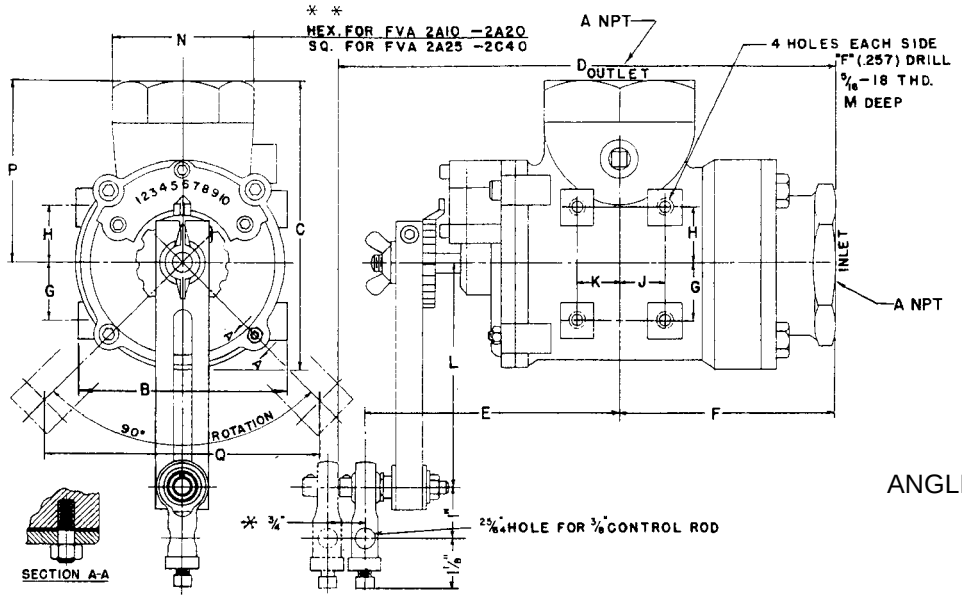
Then, ^{Q}(corrected) = (3.00) x (1.07) x (12,000)
= 38,520 scfh of air

CAPACITIES (Continued)

SELECTION TABLE

VALVE SIZE	PORT SIZE	STRAIGHT MODEL NO.	ANGLE MODEL NO.
1"	A	FVS2A10D	FVA2A10B
1-¼"	A	FVS2A12D	FVA2A12B
1-½"	A	FVS2A15D	FVA2A15B
2"	A	FVS2A20D	FVA2A20B
2-½"	A	FVS2A25F	FVA2A25A
3"	X	FVS2X30F	FVA2X30A
3"	A	FVS2A30F	FVA2A30B
3"	B	FVS2B30F	FVA2B30B
3"	C	FVS2C30F	FVA2C30B
4"	A	FVS2A40F	FVA2A40B
4"	B	FVS2B40F	FVA2B40B
4"	C	FVS2C40F	FVA2C40B
6"	A	FVS2A60F	_
6"	B	FVS2B60F	_

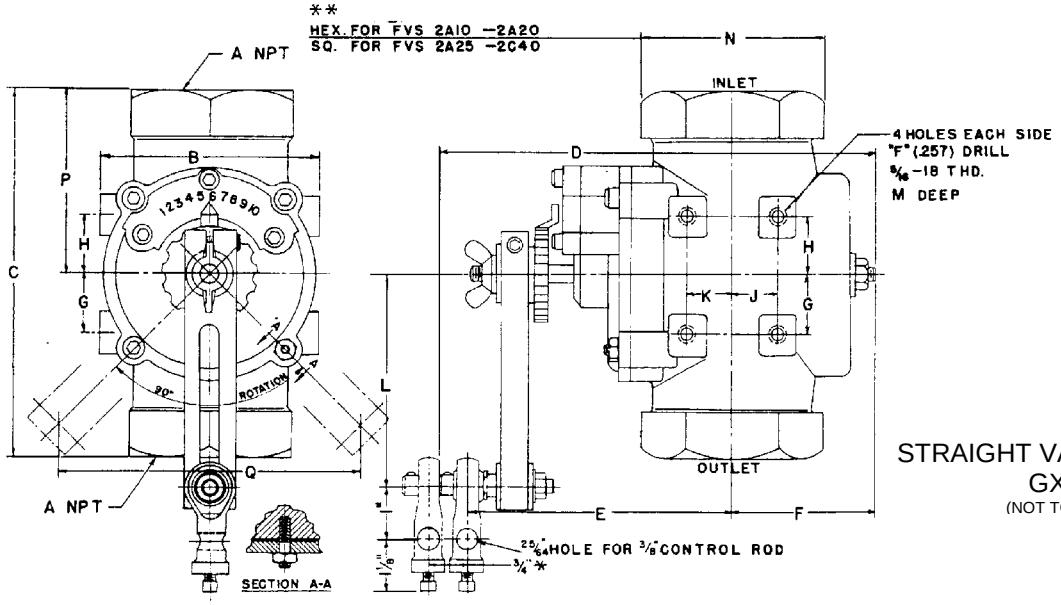
DIMENSIONS



ANGLE VALVES (1-4")
GX428
(NOT TO SCALE)

VALVE MODEL NO.	A NPT	DIMENSIONS — INCHES B	C	D	E	F	G	H	J	K	L MIN	L MAX	M	N	P	Q
FVA 2A10 -2A12	1 OR 1 1/4	4 1/8	5	7 15/16	4 11/32	3 1/32	1 1/8	1 1/8	1	1	1 1/8	4 3/8	5/16	2 3/8	3	6 3/16
FVA 2A15 -2A20	1 1/2 OR 2	4 1/8	5 23/32	9 15/16	5 1/32	4 9/32	1 1/8	1 1/8	7/8	1 1/8	1 1/8	4 3/8	7/16	3 1/2	3 5/8	6 3/16
FVA 2A25 -2X30	2 1/2 OR 3	5	6 3/32	10 29/32	5 9/16	4 25/32	1 1/8	1 1/8	1	1	1 1/8	4 3/8	9/16	4 7/8	4 1/2	6 3/16
FVA 2A30 -2C40	3 OR 4	6 1/4	8 11/16	12 9/16	6 3/32	5 29/32	1 1/8	1 1/8	1	1	1 1/8	4 3/8	1/2	5 1/2	5 7/16	6 3/16

NOTE: 1. TORQUE REQUIREMENT, 20 IN-LB
* WHEN ORDERING SPECIFY DOUBLE BALL SNAP IF DESIRED
** FVA 2A10-2A20 HAVE ONE PIECE CAST BODYS
FVA 2A25-2C40 HAVE REMOVABLE COMPANION FLANGES



STRAIGHT VALVES (1-4")
GX427
(NOT TO SCALE)

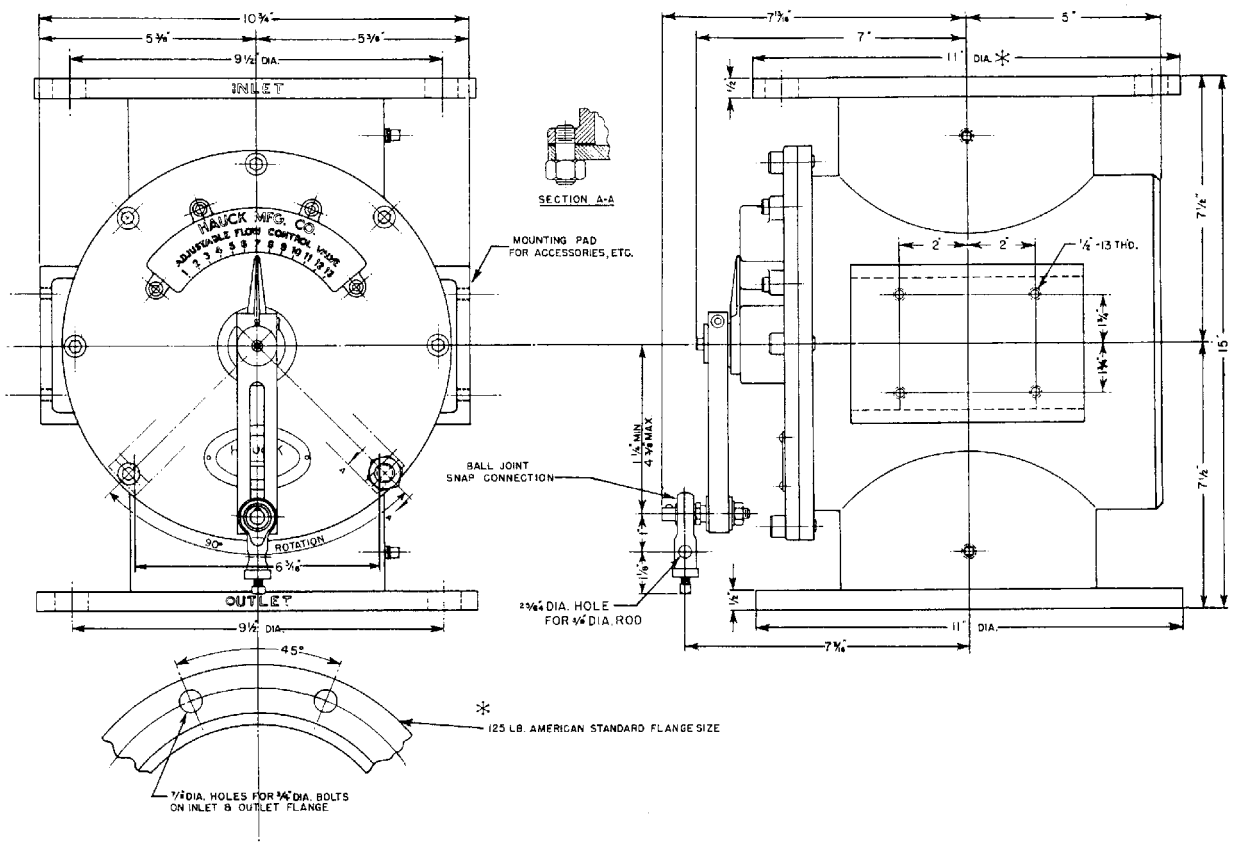
VALVE MODEL NO.	A NPT	DIMENSIONS — INCHES B	C	D	E	F	G	H	J	K	L MIN	L MAX	M	N	P	Q
FVS 2A10 -2A12	1 OR 1 1/4	4 1/8	6 3/8	8 1/8	4 11/16	2 7/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	4 3/8	5/16	2 3/8	3 5/16	6 3/16
FVS 2A15 -2A20	1 1/2 OR 2	4 1/8	7 1/4	8 1/8	4 7/8	2 11/16	1 1/8	1 1/8	7/8	1 1/8	1 1/8	4 3/8	7/16	3 1/2	3 5/8	6 3/16
FVS 2A25 -2X30	2 1/2 OR 3	5	9 1/16	9 1/16	5 9/16	2 15/16	1 1/8	1 1/8	1	1	1 1/8	4 3/8	1/2	4 7/8	4 1/2	6 3/16
FVS 2A30 -2C40	3 OR 4	6 1/4	11	9 15/16	6	3 3/8	1 1/8	1 1/8	1	1	1 1/8	4 3/8	1/2	5 1/2	5 1/2	6 3/16

NOTE:
1. TORQUE REQUIREMENT, 20 IN-LB
2. FOR 6" VALVE, WRITE FOR PRINT OF DRAWING GY226F
* WHEN ORDERING SPECIFY DOUBLE BALL SNAP IF DESIRED

** FVS 2A10 -2A20 HAVE ONE PIECE CAST BODYS
FVS 2A25 -2C40 HAVE REMOVABLE COMPANION FLANGES

DIMENSIONS (Continued)

STRAIGHT VALVES (6")
GY226
(NOT TO SCALE)



INSTALLATION

1. The flow valve can be installed in any position (except with the dial cover facing down), at any convenient location in the air or gas line. When installing this valve, it is recommended that a means be provided for measuring the line pressure downstream of the valve. These valves are designed to operate with pressures up to **15 psig** for the 1 to 4" valves and up to **3 psig** for the 6" valve. The 1 to 4" valves are designed with female connections threaded for standard pipe. The 6" valve is flanged for 125lb. ASA flanges. These valves should not be used when the temperature exceeds 250°F. Ensure that all piping both to and from the valve is properly aligned and supported to prevent undue strain on the valve.

2. Loosen and remove the three screws which secure the valve dial plate to the gas valve body.

3. Remove the valve dial plate. This will expose ten socket head set screws (one for each position, number, on the dial plate). These screws adjust the flow of gas through the valve at the various positions of the valve.

4. Loosen and remove all of the screws, and the nut on the guide bolt, holding the valve cover to the valve body.

5. Extract the entire valve assembly.

6. Adjust the rectangular port so that it will be fully opened when the valve is in the high fire position (10 on the dial plate). Accomplish this by inserting an Allen wrench in the last socket head setscrew and slowly turning it in until the port is in the proper position. Repeat this process for the next-to-last setscrew. Refer to Figure 3 and the section on Theory of Operation.

> **CAUTION**
> Do not apply excessive force on the wrench when screws are all the way in as they will bind and should not be forced beyond this point.

7. Adjust the remaining setscrews so that there is a **gradual** slope from the first setscrew to the last setscrew.

> **IMPORTANT**
> When all adjustments are complete, the 10 socket head setscrews should be slightly sloped BUT NO SINGLE SCREW SHOULD BE EXTENDED APPRECIABLY FARTHER OUT THAN THE OTHERS.

8. Reinsert the valve assembly. Use the location of the guide bolt to ensure proper alignment. Ensure that the stem is properly seated in the bushing at the back of the valve body.

9. Replace and properly seat the valve cover gaskets.

10. Replace and tighten all of the screws in the valve cover.

11. When an automatic operation is to be used, a control motor should be mounted to the valve or some other nearby rigid support. The valve's operating arm moves in a clockwise direction to open the valve over an arc of about 90° at an adjustable radius from 2-5/8" to 4-3/8".
    A. Connect the valve lever to the control motor arm by a 3/8" rod through the snap connection pin on the valve lever. A setscrew is provided on the snap pin to secure the rod at the proper point.

    B. Adjust the length of the control motor arm so that the valve pointer moves through the desired range on the valve dial. Be sure that the control motor does not move the valve lever beyond the stops on the dial as this can damage the valve if sufficient force is applied.

OPERATION

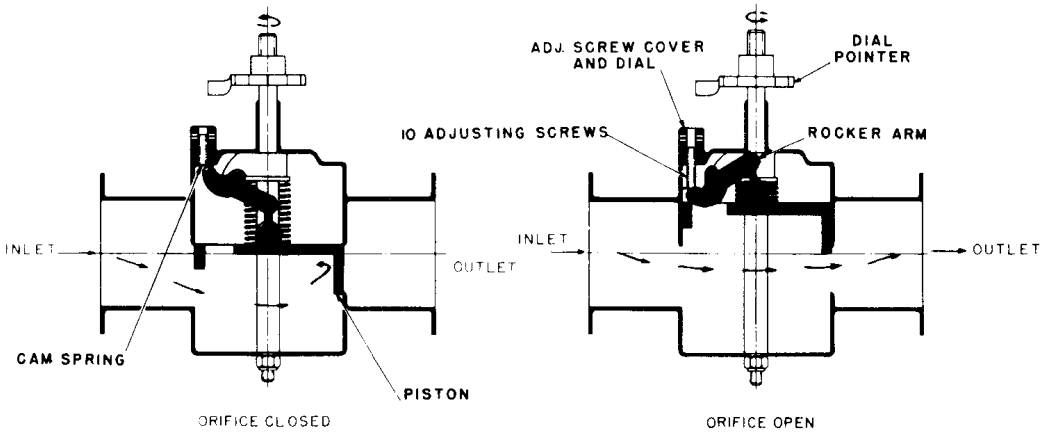


Figure 3. Theory of Operation

The valve consists of a cylindrical piston with a rectangular port. The rectangular port both rotates and reciprocates within the valve body, which also has a rectangular opening. When the valve lever is moved from low (1) to high (10) position, the rectangular opening in the body is uncovered for flow. The height of the rectangular port is adjustable. The position of the cam spring affects the position of the rocker arm, which in turn controls the height of the port. The cam spring can be adjusted at 10 or more independent points (the number of points is dependent on the valve size) by rotating the adjusting screws located under the valve dial.

If more or less flow is desired at any position, the adjusting screw under the pointer is turned in to increase, or out to decrease, the height of the port opening and thus change the overall port area at that point. Great flexibility of flow characteristics is provided by the adjusting screws which can be set for either uniform or varying increments of change in capacity at the 10 valve dial position.

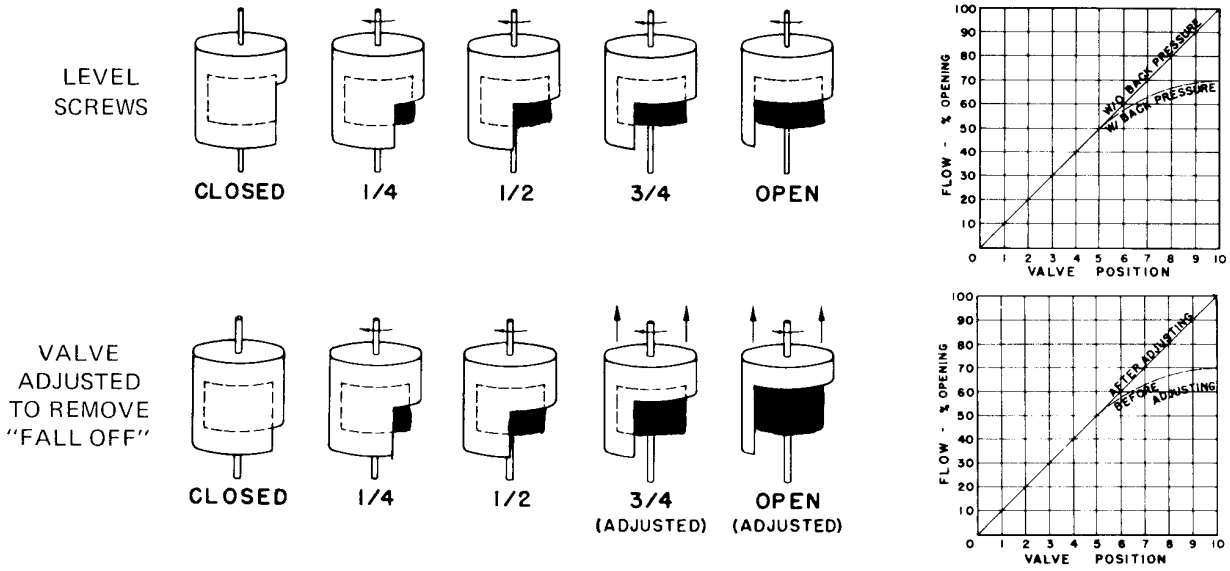


Figure 4.

When adjusting screws are LEVEL (as shipped and as shown in Figure 4), the flow curve **without any back pressure** on the valve is a straight line, as shown. When valves are installed in a combustion system, as the burner flow rate increases the back pressure in the downstream side of the valve increases causing the flow through the valve to "fall off" from a straight line curve, as shown.

By turning the adjusting screws in, flow can be increased separately at each of ten valve positions to produce a straight line flow curve for the combustion system.

Final Setscrew Adjustment

Adjust the flow valve to achieve uniform and consistent flame conditions between low fire and high fire by accomplishing the following:

A. Start flow through the valve and ignite the burner.
B. While monitoring the downstream pressure using a manometer or other suitable device, insert an Allen wrench in the socket head setscrew nearest the valve pointer and turn the screw slowly until the appropriate differential pressure is achieved.
C. Insert the Allen wrench in the next screw toward the high side of the one just adjusted and turn it in or out so that it is in about the same position as the preceding screw.
D. Drive the air and gas control levers to the next position, i.e. from position 1 to position 2.
E. Repeats steps B, C, and D until all socket head setscrews have been adjusted.

CAUTION

Do not apply excessive force on the wrench when screws are all the way in as they will bind and should not be forced beyond this point.

IMPORTANT

When all adjustments are complete, the 10 socket head setscrews should be slightly sloped BUT NO SINGLE SCREW SHOULD BE EXTENDED APPRECIABLY FARTHER OUT THAN THE OTHERS

F. Replace the valve dial plate and securely fasten it in place with the three screws provided.

MAINTENANCE

All port valves are designed and constructed for maintenance free operation. Under normal usage no service should be necessary.

If it should become necessary to clean the valve, the entire valve assembly can be easily removed, in one piece, by accomplishing the following:

A. Disconnect the automatic linkage (if present).
B. Loosen and remove all of the screws, and the nut on the guide bolt, holding the valve cover to the valve body.
C. Extract the entire valve assembly.
D. Wipe the piston clean of any particles of residue. If scarring has occurred, use an emery cloth to restore a smooth surface.
E. Lubricate the piston with Molykote or some other suitable high temperature, non gumming lubricant.
F. Check all internal parts for wear or damage.
G. Reinsert the valve assembly. Use the location of the guide bolt to ensure proper alignment. Ensure that the stem is properly seated in the bushing at the back of the valve body.
H. Replace and properly seat the valve cover gaskets.
I. Replace and tighten all of the screws in the valve cover.
J. Move the radius control lever through its full range of movement. If the movement is either binding or too free moving, adjust the setscrew on the valve back by accomplishing the following:

    a. Loosen the lock nut which secures the setscrew.
    b. Slowly tighten the setscrew (clockwise rotation) until there is resistance to the movement of the lever.
    c. Rotate the setscrew 1/8 to 1/4 turn in a **counterclockwise** direction.
    d. Tighten the lock nut.

K. Reconnect the automatic linkage (if used).

ALIGNMENT OF THE INNER AND OUTER AIR NOZZLES ON A HAUCK PROPORTIONING OIL BURNER

Whenever a Hauck Proportioning Oil Burner is reassembled after either cleaning the burner or replacing parts, the clearance between the Inner and Outer Air Nozzles should be checked. If the clearance is not within the limits listed on Table1, the following instructions describe the correct procedure to be used for setting this clearance:

1. Remove backplate assembly from burner body by removing bolts which hold it to the body

2. Loosen the two Allen setscrews on each side of the operating lever collar which holds it to the slotted sleeve.

3. Holding the operating lever in low position turn the inner nozzle so that it moves away from the backplate as far as it will go. Then tighten lightly the one Allen set-screw in lever which will be located toward the high side of the burner.

4. Move operating lever to high position. Replace the assembly in the burner and tighten bolts which hold it to the body evenly and securely.

5. Hold three clearance wires (or narrow strip stock) of the proper thickness equally spaced between the inner nozzle and outer nozzle and pull the operating lever to low position all the way. The inner nozzle will then be spaced the proper distance from the outer nozzle and the lever will slip on the operating sleeve to the low position.

6. Without moving lever, tighten securely the Allen setscrew in operating lever collar on the high side. Move the lever to the high position and tighten securely the second Allen setscrew in the collar lever at the low side.

BURNER	CLEARANCE
779	.007" - .010"
780	.010" - .012"
781	.010" - .012"
782	.010" - .015"
783	.010" - .015"
784	.050" - .062"
785	.050" - .062"
786	.050" - .062"

Table 1.

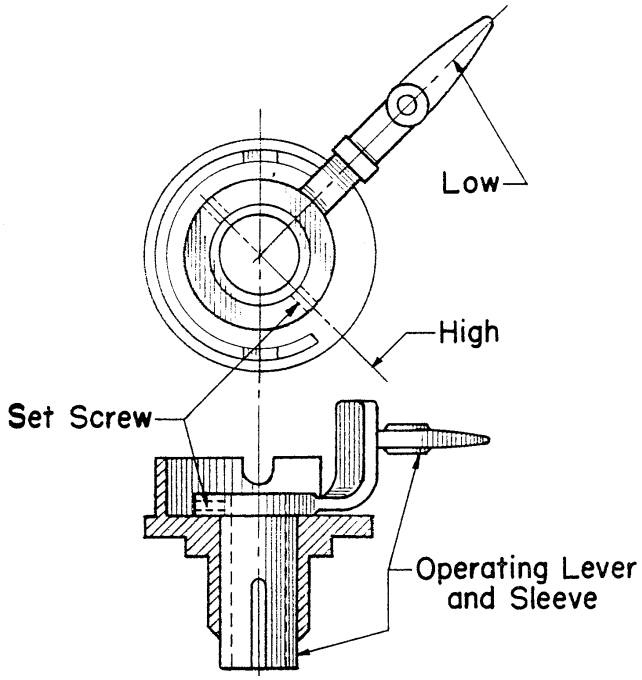


Figure 1. Drawing of the air nozzle control lever showing the set screw locations.

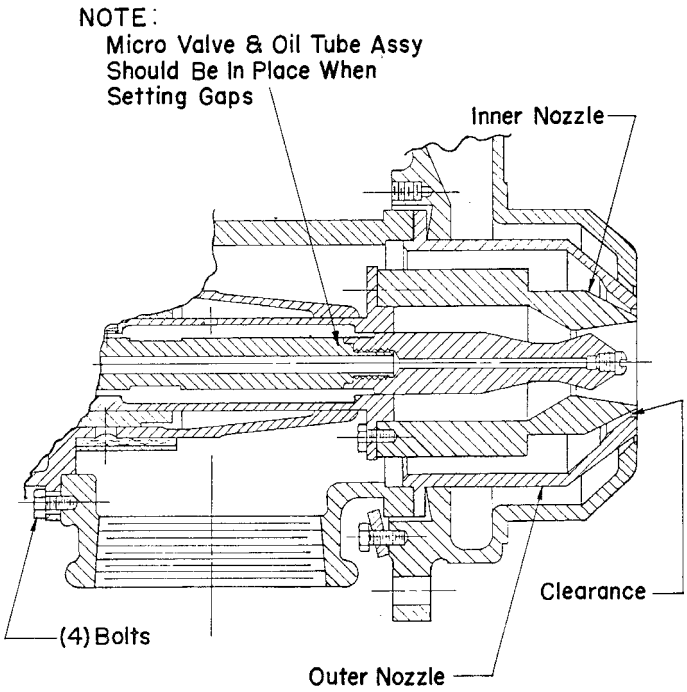


Figure 2. Schematic representation depicting the inner and outer nozzles.