ADJUSTABLE FLOW VALVES

Fig. 1. Straight Valve, Threaded and Flange

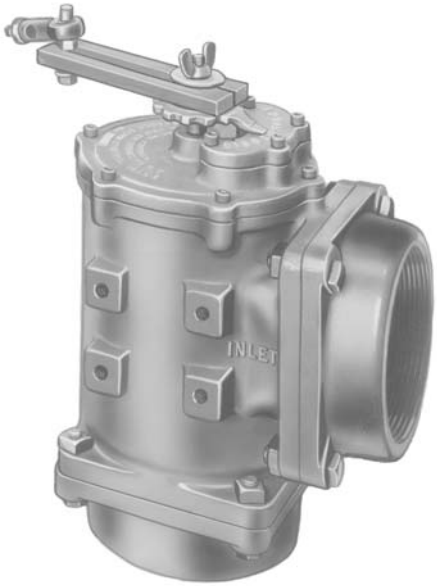

Fig. 2. Angle Valve, Threaded and Flanged

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

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.

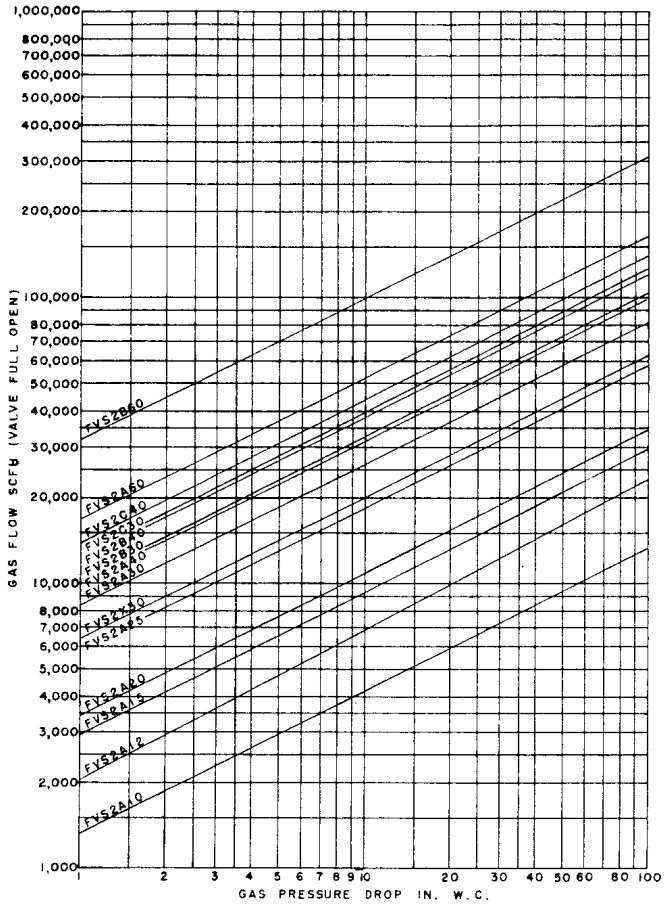
IMPORTANT

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

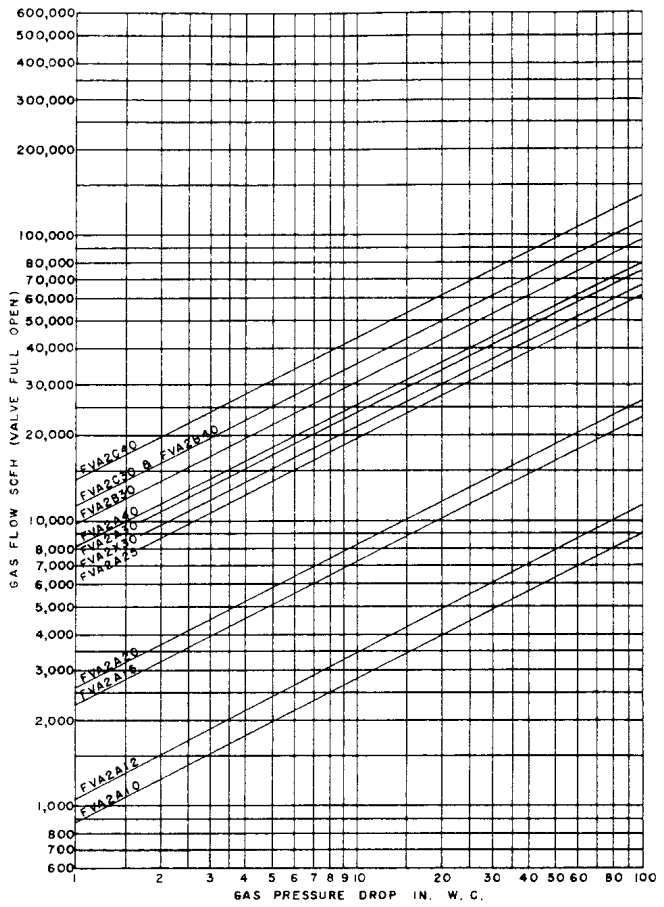
NATURAL GAS

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)

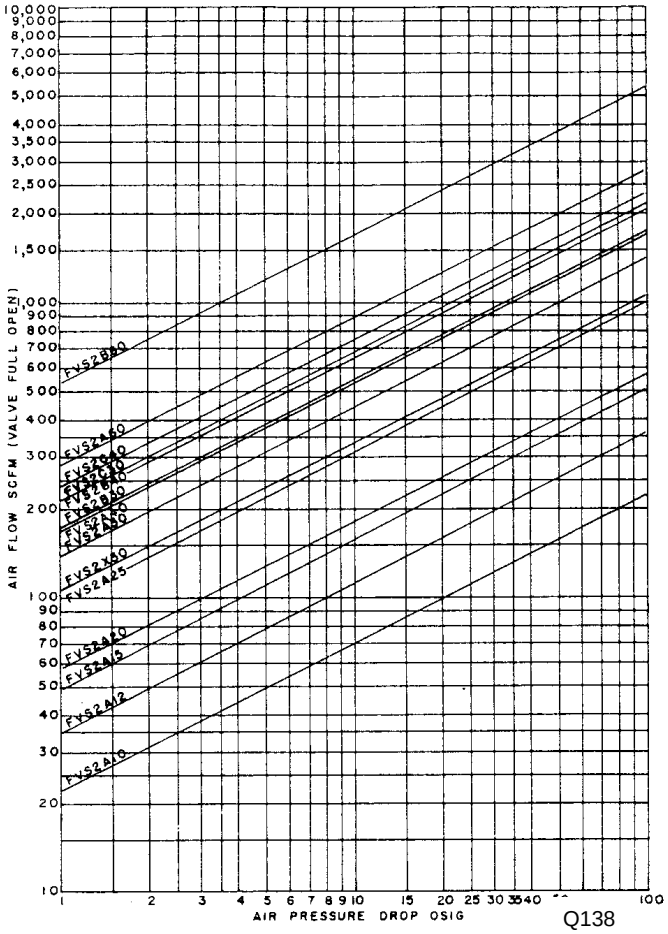
1. From the standard flow curve for Natural Gas (Q135) at 27.7 "w.c. pressure drop, determine the rated flow: ^{Q}(rated) = 16,000 scfh.
2. From the Pressure correction factor table, determine the pressure correction factor: C_1 = 3.00
3. From the Temperature correction factor table, determine the temperature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

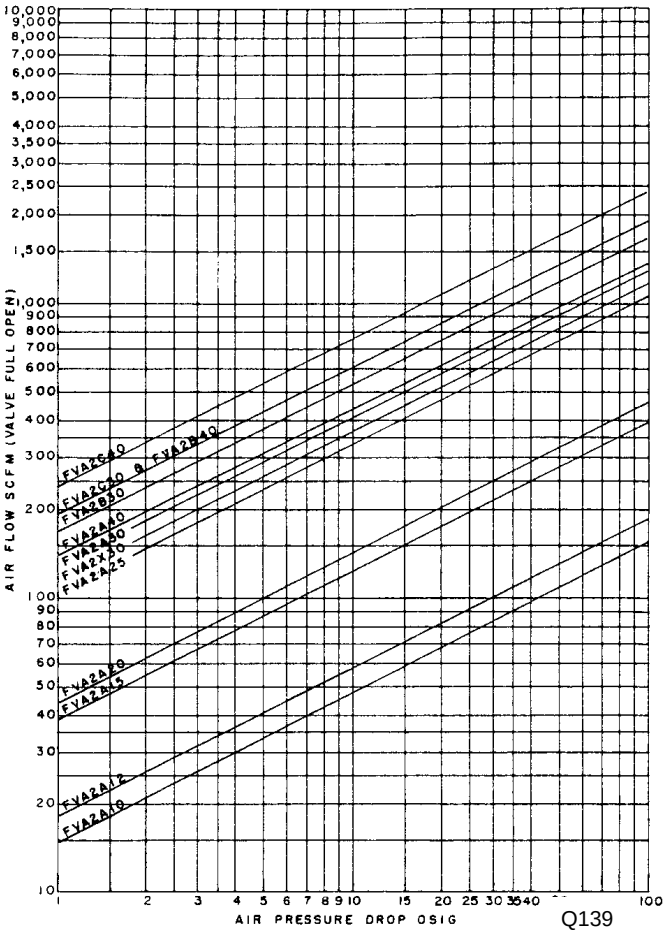
AIR

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

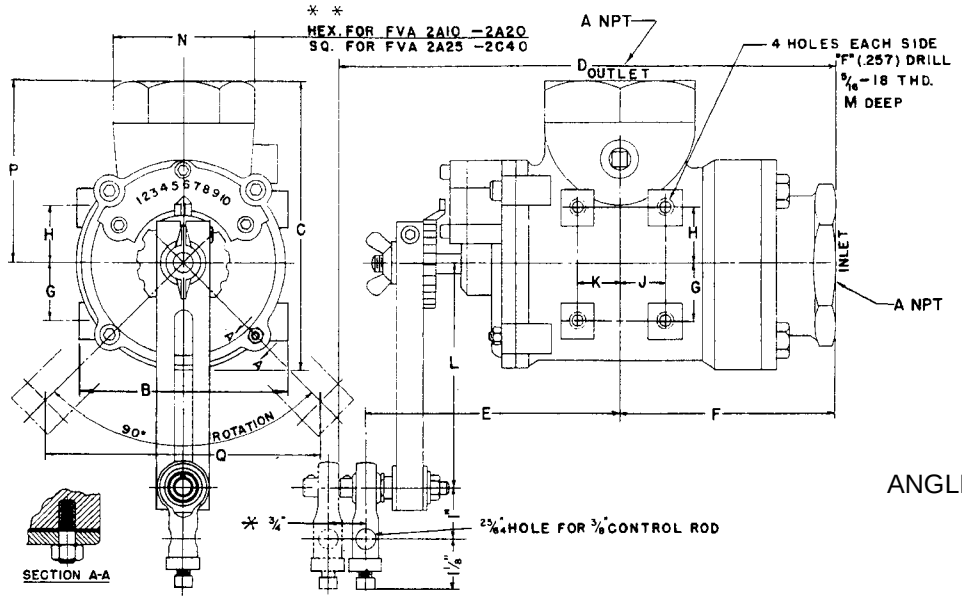
Then, ^{Q}(corrected) = (3.00) x (1.07) x (12,000)
= 38,520 scfh of air

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	_

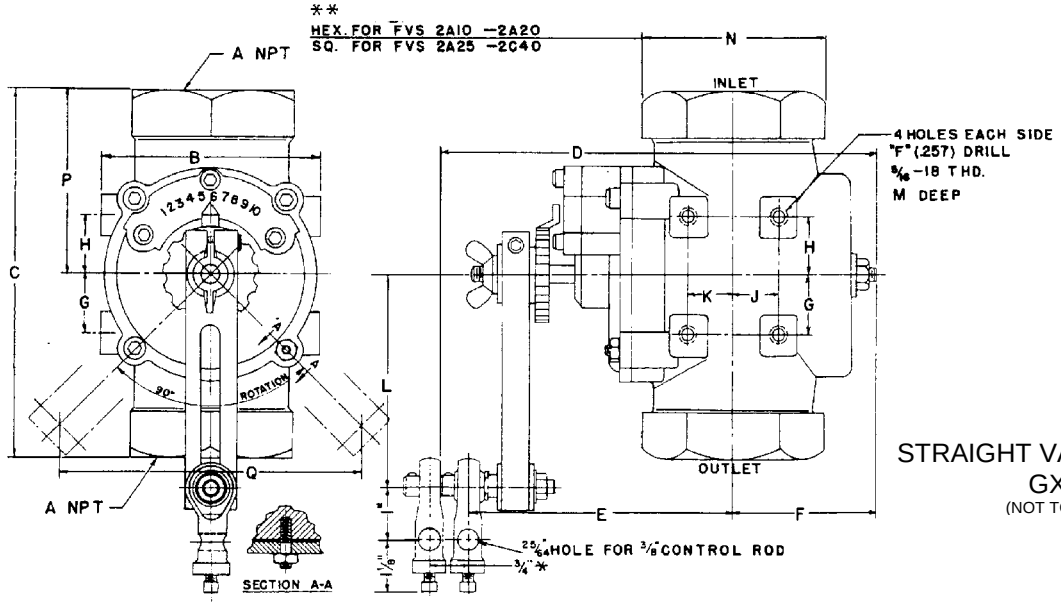
DIMENSIONS



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 5/8	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 5/8	7/16	3 1/2	3 5/8	6 3/16
FVA 2A25 -2X30	2 1/2 OR 3	5	6 31/32	10 29/32	5 9/16	4 25/32	1 1/8	1 1/8	1	1	1 1/8	4 5/8	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 5/8	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)

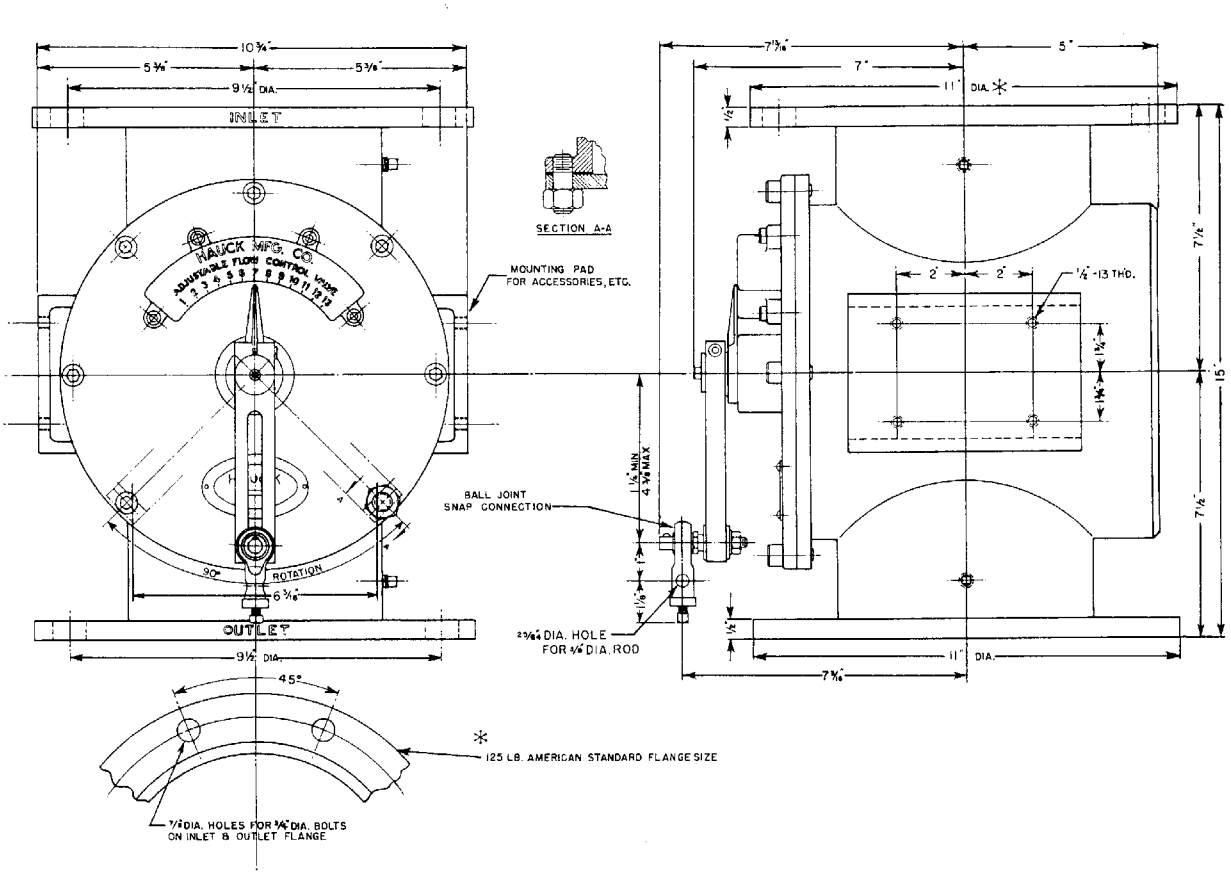
VALVE MODEL NO.	A NPT	DIMENSIONS — INCHES B	C	D	E	F	G	H	J	K	L MIN	L MAX	M	N	P	Q
FVS 2A10 -2A12	1 OR 1 1/4	4 1/8	6 3/8	8 1/8	4 11/16	2 7/8	1 1/8	1 1/8	1 1/8	7/8	1 1/8	4 3/8	5/16	2 3/8	3 5/16	6 3/16
FVS 2A15 -2A20	1 1/2 OR 2	4 1/8	7 1/4	8 1/8	4 7/16	2 11/16	1 1/8	1 1/8	7/8	1 1/8	1 1/8	4 3/8	7/16	3 1/2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

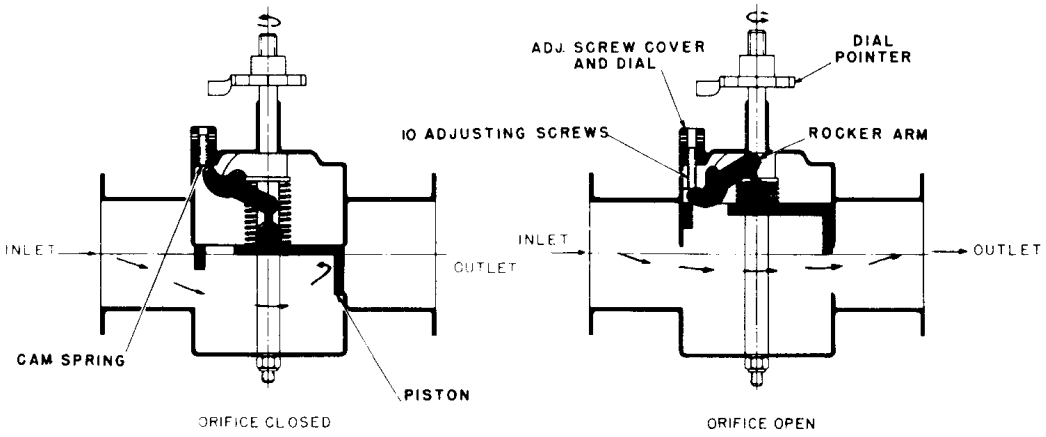


Figure 3. Theory of Operation

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.

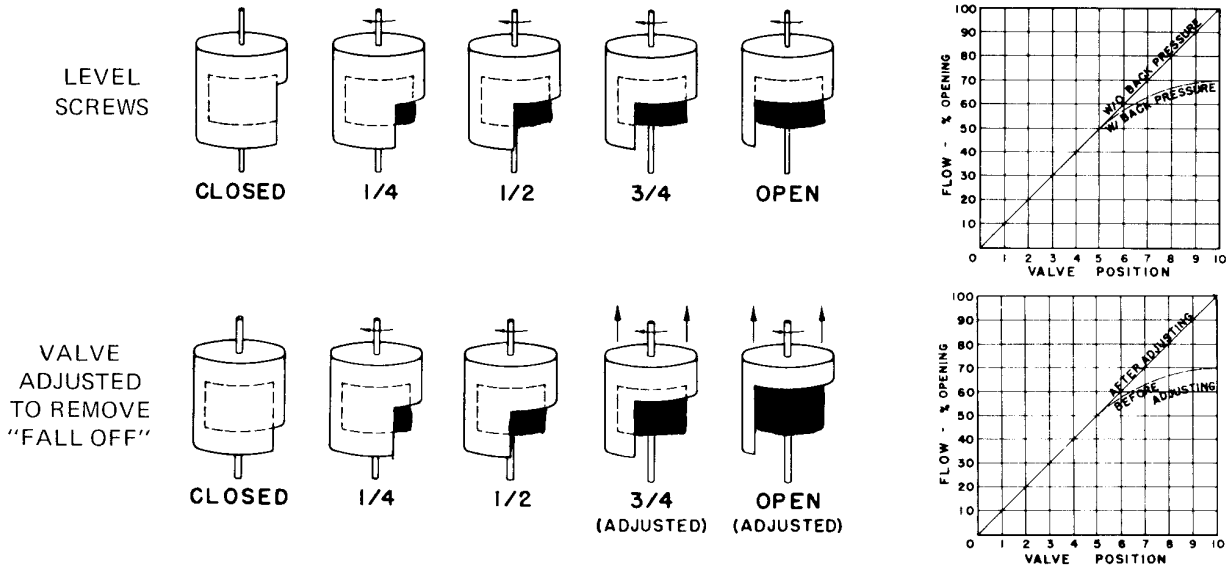


Figure 4.

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).