Type 1808 & 1808A Pilot-Operated Backpressure Regulators or Relief Valves

Fisher Controls *November 1982* *Bulletin 71.4:1808*

The Type 1808 globe-style and 1808A angle-style pilot-operated backpressure regulators or relief valves* (figure 1) are economical, compact devices used in gas or liquid service to maintain pressure on oil and gas separators, and in pressure relief applications in gas distribution systems.

Two pilots are available with these units. The Type 6358 pilot is used in backpressure and pressure relief applications throughout the oil production industry, and it is used in either gas or liquid service. Pressure relief and liquid service applications in the oil and gas industry are typically handled by the Type 6356 pilot.

With either pilot, these units control pressure from 5 to 125 psig (0.3 to 8.6 bar), and the set pressure is varied to individual requirements by the adjusting screw on the pilot. Pilot exhaust can be piped into the downstream line or vented into the atmosphere on gas service, but must always be piped downstream on liquid service.

Features

- **Simple, Reliable Design—**Units have few parts for reliable service and minimum spare parts inventory.

- **Compact and Lightweight—**Less than 12 inches (305 mm) tall and weighing 25 pounds (11 kilograms) or less, these units are easily transported and installed where space is limited.

- **Simplified, Convenient Installation in Any Position—**Pressure connection in diaphragm casings and factory-piped pilot tubing mean no upstream control line is required on standard installations. There are no mounting restrictions to limit service.

- **Versatility in Both Liquid and Gas Service—**Pilot exhaust port and standard tapped pilot spring case (figure 2) each come with removable vent for remote piping when necessary. The standard tapped pilot spring case comes complete with a gasketed closing cap that permits pressure loading for remote pneumatic adjustment of the set pressure.

- **Quick Disassembly—**With the removal of just two nuts, the upper and lower casings lift away, exposing the trim and leaving the main valve body in line.

- **Optional Upstream Registration for Reduced Buildup—**For gas service with the Type 6356 pilot, upstream control line construction is available to provide wide-open relief flow capacity with 3 psig (0.2 bar) or less buildup regardless of set pressure.

*These terms are defined in ANSI B95.1–1972.

Figure 1. *Type 1808 and 1808A Pilot-Operated Back-Pressure Regulators or Relief Valves*

- **Self-Draining Body—**Increased capacity Type 1808A angle-body design provides complete process fluid drainage from body cavity during shutdown period or before disassembly of the main valve.

Specifications

BODY SIZE AND END CONNECTION STYLE[1]	2 in. NPT screwed
MAXIMUM RELIEF (INLET) PRESSURE[2]	150 psig (10.3 bar) including buildup
RELIEF SET PRESSURE RANGE	5 to 125 psig (0.3 to 8.6 bar); red spring—part number 1K7485 27202
DIFFERENTIAL PRESSURES	**Maximum:** 125 psig (8.6 bar) **Minimum:** 5 psig (0.3 bar)
MAIN VALVE SHUTOFF CLASSIFICATION	ANSI Class VI (B16.04-1976): Leakage is less than 3 bubbles (0.45 mL) per minute using air at service pressure drop or 50 psi (3.4 bar), whichever is lower
TYPE 6358 PILOT BLEED RATE	Bleeds only when repositioning the main valve
WIDE-OPEN GAS SIZING COEFFICIENTS[3] **WITH 3 PSIG (0.21 BAR) BUILDUP**	**Type 1808:** C_g =1410; C_1 = 35.2 **Type 1808A:** C_g = 1800; C_1 = 35
WIDE-OPEN LIQUID COEFFICIENTS[4] **WITH 3 PSIG (0.21 BAR) BUILDUP**	**Type 1808:** C_v = 40.1; K_m = 0.79 **Type 1808A:** C_v = 52.9; K_m =0.76
TYPICAL MAIN VALVE FLOW CAPACITIES	See figure 3, table 1, and Capacity Information section
MAIN VALVE FLOW DIRECTION	Flow up
MAIN VALVE FLOW CHARACTERISTIC	Quick-opening
INLET PRESSURE INDICATION	0 to 160 psig[5]
CONSTRUCTION MATERIALS	**Main Valve** *Type 1808 Body:* ■ Cast iron or ■ steel *Type 1808A Body:* Cast iron *Diaphragm Plates and Diaphragm Casings:* Steel *Diaphragm:* Neoprene *O-Rings:* Nitrile *Gaskets:* Asbestos *Backup Rings:* TFE *Spring:* ■ Plated steel (standard) or ■ Inconel[6] (sour gas service) *Valve Plug Guide:* ■ 416 heat-treated stainless steel (standard) or ■ 17-4PH/H1150 heat-treated stainless steel (sour gas service) **Pilot and Pilot Mounting Parts** *Body, Body Plug, Spring Case, and Closing Cap:* ■ Aluminum (standard) or ■ stainless steel *Control Spring:* Plated steel *Vents:* Zinc/Monel[6] *Metal Trim Parts:* ■ Steel and stainless steel, except ■ Inconel X750 valve plug spring for sour gas service *O-Rings and Soft Seating Parts:* ■ Nitrile (standard) or ■ fluoroelastomer (high-temperature), except asbestos for gaskets *Tubing:* Steel or copper *Fittings:* Steel or brass *Pipe Tees and Nipples:* Malleable iron and galvanized steel
MATERIAL TEMPERATURE CAPABILITIES[1]	–20 to 150°F (–29 to 66°C)
PILOT TUBING AND CONNECTIONS	1/4 in. NPT ■ with or ■ without P590 Series Filter
APPROXIMATE WEIGHT	**Type 1808:** 22 lb (10 kg) **Type 1808A:** 25 lb (11 kg)
OPTION	Upstream control line construction

1. End connections threaded to various national or international thread standards can usually be supplied. Consult the Fisher sales office or sales representative.
2. The pressure or temperature limits in this bulletin and any applicable standard or code limitations should not be exceeded.
3. With the Type 6356 pilot, gas service requires standard or high-gain restriction depending on proportional band requirements.
4. With the Type 6356 pilot, liquid service requires low-gain restriction.
5. Consult your Fisher sales office or sales representative for gauges in other units.
6. Trademark of International Nickel Co.

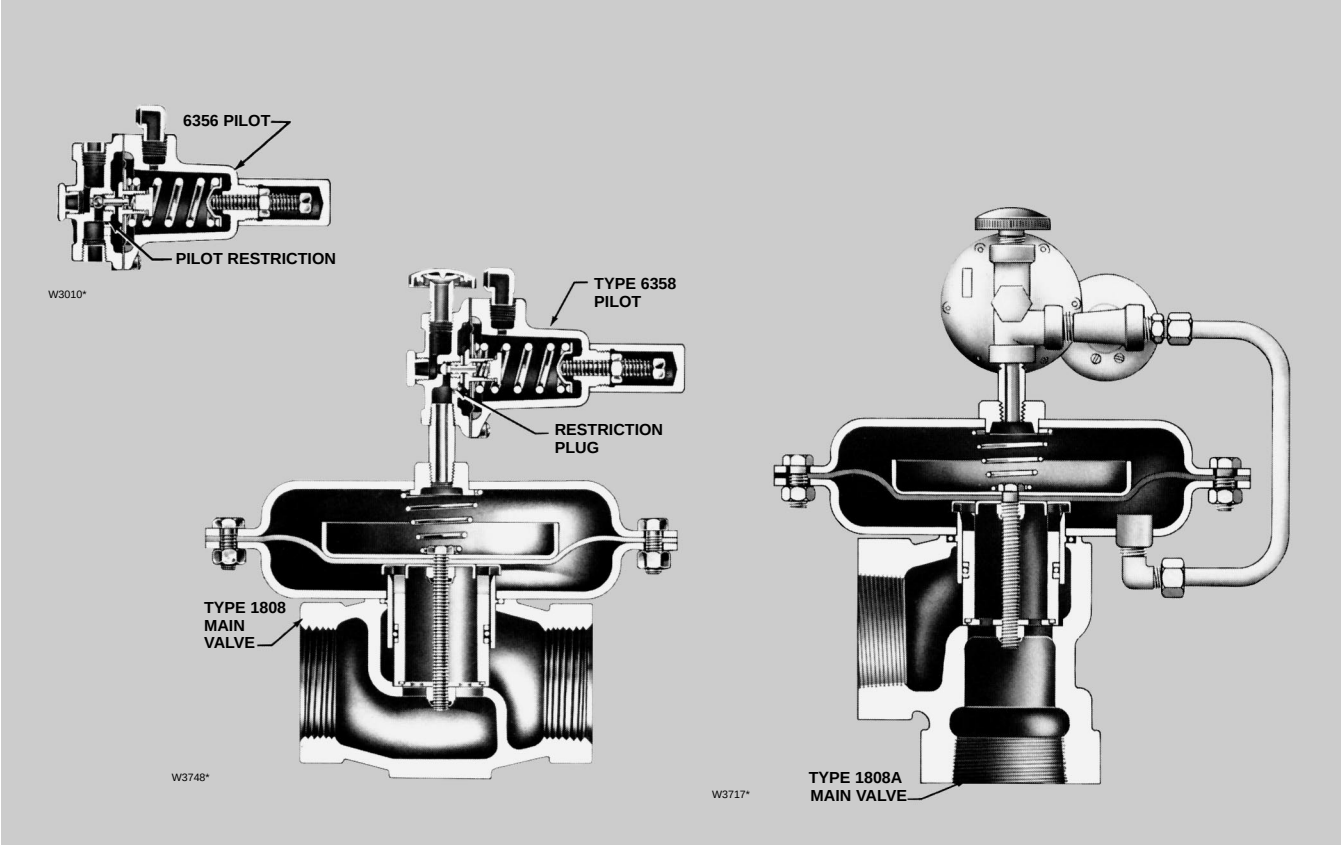

Figure 2. *Sectional Details*

Table 1. *Flow Capacities of a Type 1808-6356 Unit in Thousands of Scfh of 0.6 Specific Gravity Natural Gas**

SET PRESSURE (WHEN P_2 = 0) OR △P (WHEN OTHER THAN 0)		BUILDUP OVER SET PRESSURE						
Psig	**Bar**	**2 Psig (0.14 Bar)**	**6 Psig (0.41 Bar)**	**10 Psig (0.69 Bar)**	**15 Psig (1.0 Bar)**	**20 Psig (1.4 Bar)**	**25 Psig (1.7 Bar)**	**30 Psig (2.1 Bar)**
5	0.34	32	46	54	60	71	80	89
12	0.83	41	55	64	73	84	93	103
20	1.4	56	73	80	89	103	108	116
30	2.1	67	89	98	107	116	126	135
40	2.8	85	105	120	126	135	144	153
50	3.4	94	120	137	144	153	162	171
60	4.1		135	152	162	171	181	191
70	4.8		150	168	183	191	200	207
80	5.5		161	180	196	207	218	227
90	6.2		170	192	213	227	236	246
100	6.9		183	209	231	246	256	264
110	7.6		197	223	246	263	274	284
125	8.6		201	241	267	284	298	

*See Capacity Information section for conversion to equivalent capacities of other gases, Type 1808A backpressure regulator or relief valve capacities, and/or normal m^3/hr.
- shaded capacities are those with main valve wide open.
- shaded area indicates where maximum relief (inlet) pressure (including buildup is exceeded.
- shaded area indicates where buildup is insufficient to provide capacities that can be consistently predicted.

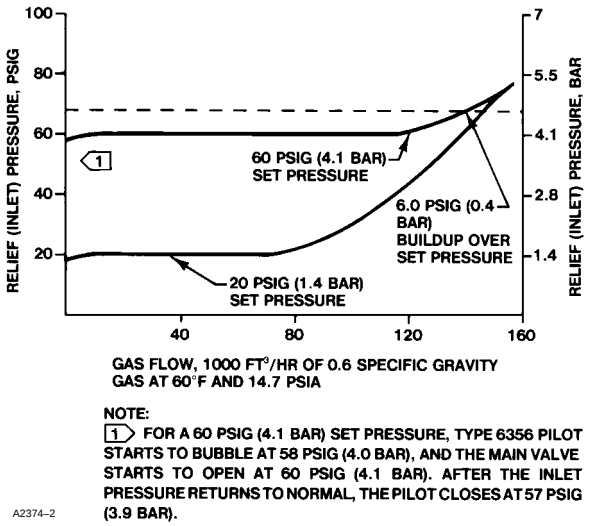

Figure 3. Typical Performance Curves for Type 1808 Backpressure Regulator or Relief Valve

Capacity Information

Gases

Table 1 gives relief capacities at selected set pressures for the Type 1808 backpressure regulator or relief valve. Flows are in thousands of scfh (60°F and 14.7 psia) of 0.6 specific gravity gas at 60°F. To determine equivalent capacities for air, propane, butane, or nitrogen, multiply the table 1 capacity by the following appropriate conversion factor: 0.775 for air, 0.628 for propane, 0.548 for butane, or 0.789 for nitrogen. For gases of other specific gravities, multiply the given capacity by 0.775, and divide by the square root of the appropriate specific gravity. Then, if capacity is desired for the Type 1808A backpressure regulator or relief valve, multiply by 1.27; or, if capacity is desired in normal cubic meters per hour at 0°C and 1.01325 bar, multiply scfh by 0.0268. Typical performance curves are shown in figure 3.

To determine capacities at set pressures or buildups not given in table 1, use the following formula, and convert according to the factors in the preceding paragraph if necessary:

$$Q = (P_1 + \text{buildup})_{abs}\ C_g \sqrt{\frac{520}{GT}}$$

where,

Q = flow capacity in scfh

$(P_1 + \text{buildup})_{abs}$ = set pressure (gauge in psi + buildup in psi + 14.7 psi to determine absolute pressure)

C_g = gas sizing coefficient from Specifications table

G = gas specific gravity (air = 1.0)

T = absolute temperature of gas in degrees Rankin (degrees Rankin = degrees Fahrenheit +460)

If pressure drops will be lower than critical (absolute outlet pressure greater than one-half the absolute inlet pressure), use the sizing slide rule or the sizing nomographs in Catalog 10. When using the slide rule or nomographs to determine maximum flow, be sure to add pressure buildup to the pressure setting to determine inlet pressure.

Liquids

To determine relief capacities in U.S. gallons per minute, use the Catalog 10 liquid sizing procedures in conjunction with the appropriate liquid sizing coefficient (C_v) and recovery coefficient (K_m) from the Specifications table. Then, if capacity is desired in cubic meters per hour, multiply U.S. gallons per minute by 0.2271.

Principle of Operation

Refer to figure 4, which shows a unit with a Type 6358 pilot. The operation of the Type 6356 and 6358 pilots is similar, except that the Type 6356 pilot has a restriction (figure 2) to allow inlet pressure into the main valve above the diaphragm.

Inlet pressure registers on the underside of the diaphragm of the main valve and enters the pilot through the control line tubing, where it registers on the underside of the pilot diaphragm. As long as the inlet pressure is lower than the set pressure, the pilot control spring pushes the pilot valve plug down, closing the exhaust. With the Type 6358 pilot, inlet pressure passes between the diaphragm assembly and the upper portion of the pilot valve plug and into the hollow stem to load the main valve above the diaphragm, keeping it closed. With the Type 6356 pilot, inlet pressure enters the main valve through the pilot restriction.

When the inlet pressure is at set pressure, the diaphragm assembly in the Type 6358 pilot moves upward enough to close off the inlet pressure path into the hollow stem; the exhaust port remains closed by the lower portion of the valve plug. Thus pressure is unable to enter or leave the space above the main valve diaphragm.

As the inlet pressure rises above set pressure, the pilot diaphragm continues to move upward, opening the exhaust port and allowing pressure on the top of the main valve diaphragm to bleed to atmosphere. The inlet pressure on the bottom of the main valve diaphragm then overcomes the main valve spring force, and the main valve opens, reducing the inlet pressure to set pressure. The pilot spring closes the exhaust, and inlet pressure loads the main valve diaphragm casings above and below the diaphragm, allowing the main valve spring to close the main valve.

Keep in mind that, while the main valve is throttling, the Type 6358 pilot keeps the exhaust port closed. The Type 6358 pilot bleeds only when it repositions the main valve plug.

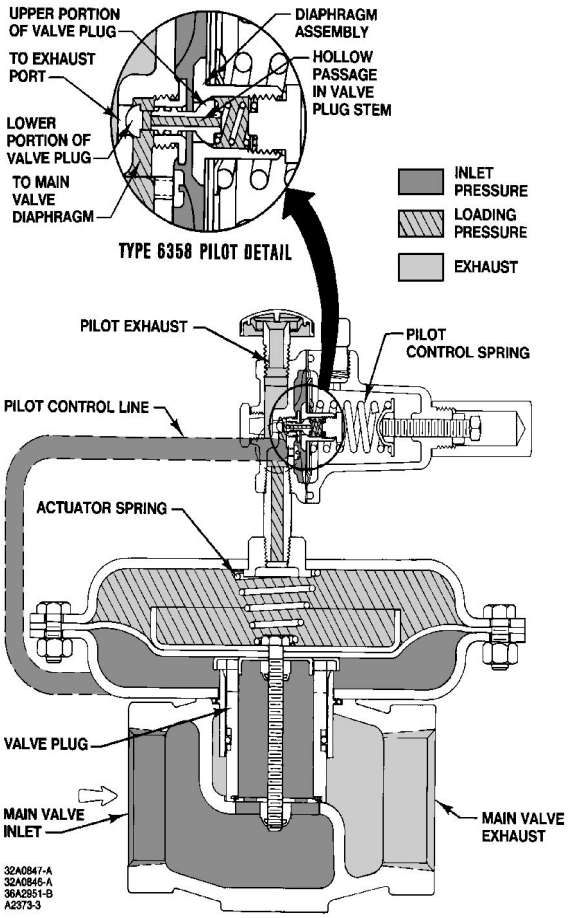

Figure 4. Schematic of Type 1808 Pilot-Operated Backpressure Regulator or Relief Valve

Installation

Type 1808 and 1808A backpressure regulators or relief valves may be installed in any position as long as the flow through the main valve corresponds with the flow arrow on the main valve body (Type 1808) or runs in through the bottom connection and out through the side connection (Type 1808A).

An upstream control line is not required because of the integral pilot supply tubing; however, this tubing may be disconnected for upstream registration, and the main valve diaphragm casing tapping plugged. For liquid service, the pilot exhaust must be piped to the downstream line. For gas service, the pilot must be piped to a safe area because, in enclosed conditions such as inside installations, exhausting gas can accumulate causing a danger of explosion. A vent line or stack must be located to avoid venting gas near buildings, air intakes, or other hazardous locations, and the line or stack opening must be protected against anything that might clog it. The jet thrust effect of a venting relief valve must be considered when designing piping and anchoring.

To ensure safety during shutdown, vent valves are required immediately upstream and downstream of the main valve on backpressure or bypass installations.

Note that Type 1808 and 1808A units are throttling relief valves, not to be confused with safety relief valves as defined in the ASME Boiler and Pressure Vessel Code. Check all applicable codes prior to installation.

Dimensions are shown in figure 5.

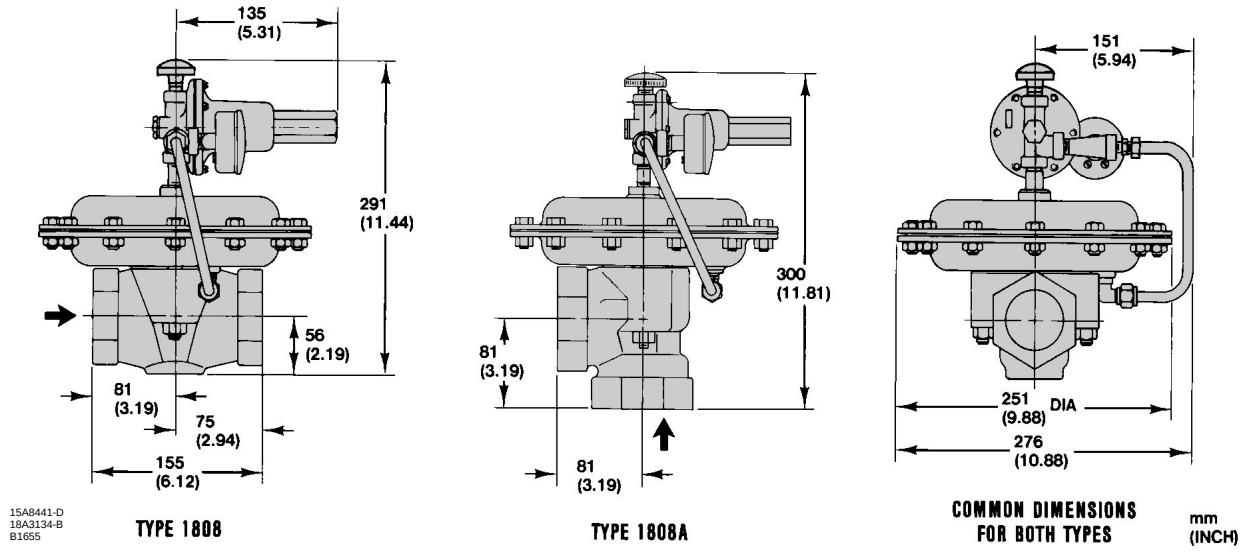

Figure 5. *Dimensions*

Ordering Information

Application

When ordering, specify:
1. Type of service—relief or backpressure regulation; liquid or gas
2. Nature and specific gravity of controlled fluid (including chemical analysis if possible)
3. Fluid temperature
4. Range of flowing inlet pressures and pressure drops
5. Desired set pressure
6. Flow rates
   a. Minimum controlled flow
   b. Normal flow
   c. Maximum flow
7. Line size

Construction

Refer to the specifications table on page 2. Carefully review the description to the right of each specification and in the referenced tables; specify the desired selection wherever there is a choice to be made.

Always specify the type numbers of other desired equipment as well as the main valve and pilot.

Fisher Controls

For information write:
P.O.Box 190, Marshalltown, Iowa 50158, U.S.A.
or Brenchley House, Maidstone, Kent ME 14 1UQ, England