Hydraulic Globe Valves

2”, 3”, and 4”

Applications

The Hydraulic Globe Valves (HGV) control the flow rate of natural gas fuel to various stages of an industrial gas turbine combustion system. The unique design integrates the valve and actuator into a cost-effective, compact assembly. The valve is designed to provide a highly accurate flow-versus-stroke characteristic. The integral actuator is a single-acting spring-loaded design that will quickly close the valve upon loss of electrical or hydraulic signals. An integral hydraulic filter assures the reliability of the servovalve and actuator components. The servovalve is an electrically redundant dual-coil design. A dc-powered LVDT (DCDT) provides feedback for the actuator.

Description

The HGV design incorporates a pressure balanced metering plug which is directly connected to the output rod of a single-acting hydraulic actuator. A dual or triple coil electro-hydraulic servo valve controls the pressure applied to the actuator, and an integral hydraulic fluid filter provides protection against fluid contaminants. A DC-LVDT position feedback transducer is located within the unpressurized side of the actuator and is mechanically connected to the actuator piston. Fail-safe valve operation is assured by internal loading springs. A visual stroke position indicator is provided on the actuator.

The valve stem seals achieve zero leakage of gas or hydraulic fluid from the assembly. Integrated hydraulic- or solenoid-initiated trip valves are available for fast shutdown by an independent system.

Optional features include various flow-versus-position characteristics, electric actuation, and the choice of ANSI B16.5 Class 300, 600 raised face flange or weld-neck-style connections.

Bulleted Points
- Highly accurate fuel flow metering
- Fast dynamic response
- ANSI B16.104 Class IV shut-off
- Compact integrated design
- NACE MR0175 compliant
- Disassemble for service without removal from system
- On-board driver or compatible with industrial controllers
- Digital and/or 4–20 mA interfaces
- Discrete fault output and independent shutdown
- Certified for CSA Class I, Division 1, Groups C, D, and Class I, Division 2, Groups A, B, C, D
- CE Compliant with ATEX, Pressure Equipment, and EMC
Servo Position Controller

A Woodward controller is available with analog (4–20 mA) or digital (DeviceNet) interface capabilities. The driver can be configured to accept both the 4–20 mA signal and DeviceNet position command in a redundant signal configuration. With this arrangement, if either demand signal fails, the driver will switch to the available input demand signal. The valve driver operates with an 18 to 32 Vdc power supply.

The Woodward controller performs the following functions:
- Fast and accurate closed loop position control of the valve in response to the 4–20 mA or DeviceNet input command signal
- LVDT signal conditioning
- Actual valve position indication via 4–20 mA or DeviceNet outputs
- Independent remote shutdown input
- Valve/Driver Fault indication output

The driver includes protection and alarm indications for the following faults:
- Analog input out of range
- Feedback—open wire and short
- Input power out of range
- Position error
- Internal driver faults
- Servo valve coils open/short
- Driver over-current

Trip Relay Valve Assembly
The Fuel Gas Throttle valve uses a solenoid-operated trip relay circuit to operate a high-capacity, three-way two-position, hydraulically-operated valve which quickly closes the Gas Fuel Throttle valve.

If no trip mechanism is required, a check valve replaces the trip relay valve to allow pressurization of the trip circuit at all times.

Hydraulic Filter Assembly
The valve is supplied with an integrated, high-capacity filter. The filter is supplied with a visual indicator and high-differential pressure switch, to indicate when the recommended pressure differential has been exceeded, and when replacement of the element is necessary.

DC Powered LVDT (DCDT) Position Feedback Sensor
The Gas Fuel Throttle valves use a DCDT feedback device with integral excitation and demodulation circuitry. The device uses a dc supply voltage to generate a feedback signal which spans a 0–10 Vdc nominal range from minimum to maximum travel (10 Vdc at minimum position).

Regulatory Compliance

<table>
<thead>
<tr>
<th>UL (wiring box):</th>
<th>Certification of the wiring junction box for Class I, Zone 1: Aex e II, Ex e II, T6. UL File E203312</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL (diff. press. switch):</td>
<td>UL Recognized Component for use in equipment for Class I, Division 2, Groups B, C, D. The final combination is subject to acceptance by local inspection. For use in Canada and the United States when wired in accordance with wiring instructions per the installation section of this manual. UL File E227041</td>
</tr>
<tr>
<td>CSA (trip relay):</td>
<td>CSA Certified for Class I, Division 2, Groups C &amp; D for use in Canada and the United States CSA File 049650</td>
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<tr>
<td>ETL (servovalve):</td>
<td>ETL Approved for Class I, Division 2, Groups B, C, D, for use in Canada and the United States</td>
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<tr>
<td>ETL (DCDT):</td>
<td>ETL Approved for Class I, Division 2, Groups A, B, C, D, for use in Canada and the United States</td>
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</table>

Metering Port Sizes

The Hydraulic Globe Valves are available with the following maximum metering port areas:

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>Max. Effective Port Area</th>
<th>Maximum $C_v$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; (51 mm)</td>
<td>1.6 in², 1032 mm²</td>
<td>60</td>
</tr>
<tr>
<td>3&quot; (76 mm)</td>
<td>2.40 in², 1548 mm²</td>
<td>73</td>
</tr>
<tr>
<td>4&quot; (102 mm)</td>
<td>4.8 in², 3097 mm²</td>
<td>160</td>
</tr>
</tbody>
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Gas flow capacities are dependent on gas operating pressures, temperatures, and properties.

The standard metering valve plungers are contoured to provide an approximately equal percentage (exponential) flow-versus-position characteristic up to about 70% of full-stroke travel. For the remainder of the stroke, the flow characteristic is linear.
Specifications

Valve Type: Two way—globe style, plug guided metering valve

Trim Configuration: Approximate Equal Percentage Flow Curve

Type of Operation: Run—valve open
Trip—valve closed

Number of Throttle Valves: 4 per engine (two 2” and two 4”)

Fluid Ports: ANSI Class 300 flanges
Size 2” (51 mm) and 4” (102 mm)

Flowing Media: Natural gas
Materials should be NACE MR0175 compatible
WCB steel bodies and stainless steel stem and trim currently used

Maximum Gas Pressure: 3792 kPa (550 psig)
(working at 3551 kPa/515 psig)

Valve Proof Pressure Level: 7757 kPa (1125 psig)
per ANSI B16.34, ANSI B16.37/ISA S75.19 (Prod Test)

Minimum Valve Burst Pressure: 23 271 kPa (3375 psig)
based on 5 times max working pressure (Proto. Test)

Gas Filtration: 25 µm absolute at 75 beta requirement

Gas Temperature: –18 to +177 °C (0 to 350 °F)

Valve Port Size and Max Cv Values (approx. equal percentage):
2” (Pilot & Stage C)—Cv Max = 60
4” (Stage A & B)—Cv Max = 161

Flow Characteristics: ±3% Cv deviation from tabulated values

Valve Ambient Temperature: –29 to +93 °C (–20 to +200 °F)

Shutoff Classification: Class IV per ANSI B16.104/FCI 70-2
(0.01% of rated valve capacity at full travel measured with air at 345 kPa/50 psid) (Prod Test)

External Leakage: None (Prod Test)
Inter-seal Vent Leakage: None (Prod Test)

Combined Influence of Hysteresis, Linearity, and Repeatability: ±0.5% of full scale with closed loop PI control (Proto. Test)

Hydraulic Fluid Type: Petroleum based hydraulic fluids as well as fire resistant hydraulic fluids such as Fyrquel

Maximum Hydraulic Supply Pressure: 5171 to 6206 kPa (750 to 900 psig)
(design at 6206 kPa/900 psig)

Production Proof Hydraulic Test Fluid Pressure Level: 9308 kPa (1350 psig) minimum per SAE J214 (Prod. Test)

Minimum Design Actuator Burst Pressure: 31 028 kPa (4500 psig) minimum per SAE J214 (Proto. Test)

Fluid Filtration Required: 10–15 µm absolute

Hydraulic Fluid Temperature: 0 to 82 °C (32 to 180 °F)

Vibration: Woodward random test profile RV5 is based on US MIL-STD-810D, Method 514.3, category 1; Shock to 30G (Proto. Test)

Trip Mechanism: Electric solenoid, 90–140 Vdc (125 Vdc nominal)
Optional: None

Trip Time: Less than 0.500 s (Prod Test)
N/A if no trip option

Slew Time: 5% to 95% in less than 1.0 s (Prod. Test)
95% to 5% in less than 1.0 s (Prod. Test)

Hazardous Locations Requirements: Listed Components will meet a minimum of:
North American Class I, Division 2, Groups B, C, D

Hydraulic Fluid Connections: Supply pressure: 0.750 tube fitting, 90° positionable elbow
Drain pressure: 0.750 tube fitting, 90° positionable elbow

Gas Fuel Vent Connection: 0.4375-20 UNF straight thd port (-4)

Sound Level: < 100 dB at full flow conditions
Hydraulic Globe Valve Outline Drawing (2" version)