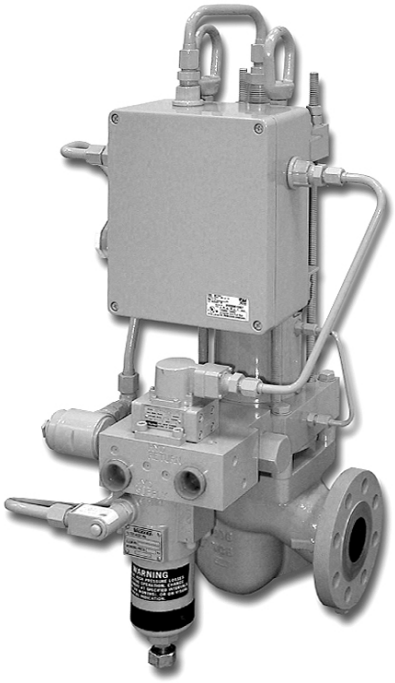
Hydraulic Globe Valves

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

All fault indications are available through the DeviceNet connection or through an RS-232 or RS-485 connection when using an analog control interface.

The valve actuator may also be interfaced with servo position controllers supplied by other qualified suppliers.

Metering Port Sizes

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

Valve Size	Max. Effective Port Area	Maximum C_v
2” 51 mm	1.6 in² 1032 mm²	60
3” 76 mm	2.40 in² 1548 mm²	73
4” 102 mm	4.8 in² 3097 mm²	160

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.

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.

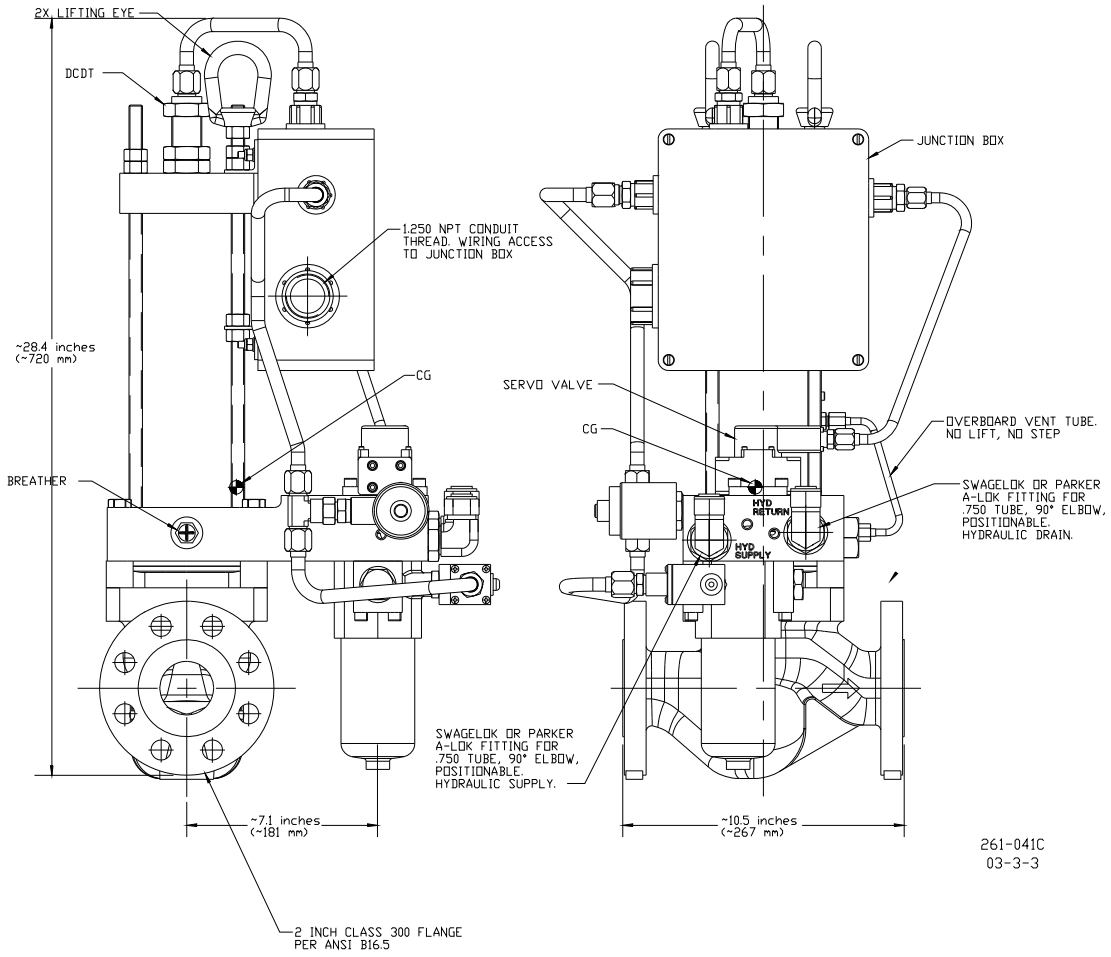
DC Powered LVDT (DCDT) Position Feedback Sensor
The Gas Fuel Throttle valves use a DCDT feedback device with integral excitation and demodulation circuitry. The device uses a dc supply voltage to generate a feedback signal which spans a 0–10 Vdc nominal range from minimum to maximum travel (10 Vdc at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

Regulatory Compliance

ETL (DCDT):	ETL Approved for Class I, Division 2, Groups A, B, C, D, for use in Canada and the United States
ETL (servovalve):	ETL Approved for Class I, Division 2, Groups B, C, D, for use in Canada and the United States
CSA (trip relay):	CSA Certified for Class I, Division 2, Groups C & D for use in Canada and the United States CSA File 049650
UL (diff. press. switch):	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
UL (wiring box):	Certification of the wiring junction box for Class I, Zone 1: Aex e II, Ex e II, T6. UL File E203312

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)

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