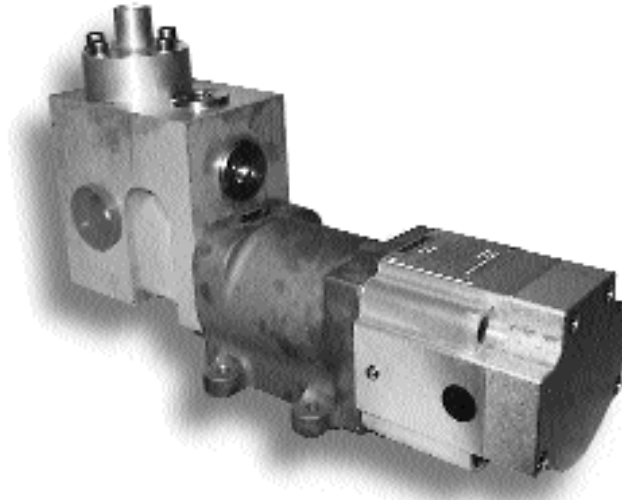


# LQ25T

## Liquid Fuel Metering Valve

### Applications

Woodward's LQ25T liquid fuel metering valve is designed for use on industrial and aero-derivative gas turbine engines in the 6000 kW to 42 000 kW output power range. The valve is a two-way flow control valve utilizing a throttling type delta P regulator. This allows the valve to control pressure drop across the metering port without bypassing fuel, making it ideal for centrifugal or other pressure source type fuel pumping systems. The assembly provides a reliable, cost-effective interface between electronic engine control systems and gas turbines used in power generation, mechanical drive and marine applications. The LQ25T valve utilizes corrosion-resistant, shear-type metering components that are positioned by a high-torque actuator to assure extended operation in all types of liquid fuel service. The LQ25T valve is compatible with diesel fuels, JP series, naphthas, kerosenes, gasolines, and other distillates conforming to nationally or internationally recognized standards for utility, marine and aviation gas turbine service.



### Description

Precise flow control is achieved by the use of a rotary plate valve integral with an electric actuator and a non-contacting position sensor. The use of rare earth permanent magnets in a highly efficient electromagnetic circuit minimizes package size. The integral brushless dc actuator and valve design eliminates the backlash associated with geared motors and avoids the resolution and cycle oscillation problems incurred with stepping motors. Each valve requires a remote electronic interface unit (the LQ driver, supplied separately) which accepts a 4 to 20 mA position command signal and operates with an 18 to 32 Vdc power supply. This controller also provides a 4 to 20 mA output proportional to the actual valve position.

The LQ25T rotary plate valve achieves a self-cleaning, shear-type metering action. The valve metering sleeve is integral with the actuator rotor, resulting in fuel metering with a single moving part. Optimal flow versus input signal characteristics are achieved on each valve by precision EDM manufacturing of the valve metering port. The LQ25T valve can achieve flow turn down ratios in excess of 100 to 1.

- Contaminant resistant
- All-electric actuation
- Models are available with certification for North American Hazardous Locations
- Models are available compliant with the applicable CE Directives—ATEX, Pressure Equipment, Machinery, and EMC
- Vibration tolerant, wide temperature range
- Fast response
- No field adjustments or calibration
- Standard 4–20 mA interface
- precision fuel metering
- Single terminal block wiring interface

### Optional LQ25T Features:

- Dual feedback resolvers
- High accuracy digital driver

The GS/LQ valve driver (supplied separately) performs the following functions:

- Fast and accurate closed loop position control of the liquid metering valve in response to a 4 to 20 mA input command signal
- Valve position indication output signal (4 to 20 mA)
- Remote shutdown command input
- Valve/Driver Fault output

The GS/LQ driver may be located up to 100 meters from the valve assembly to avoid exposure to hazardous atmospheres and harsh environments.

Liquid fuel flow control is achieved by a combination of accurately scheduling the metering valve port area and regulating the differential pressure across the metering port. Factors such as fuel properties (specific gravity, viscosity, etc.), as well as fuel pressure and temperature all play a part in determining the accuracy of flow metering. The LQ25T valve is designed so that the effect of these factors on flow metering is minimized as much as possible. The inclusion of the throttling regulator allows the LQ25T valve to be used with centrifugal or other pressure source type fuel pumps.

## Valve Sizes

The LQ25T valve is suitable for use on gas turbines in the 6000 kW to 42 000 kW output power range, depending on available fuel properties and conditions. There are three port sizes for the LQ25T:

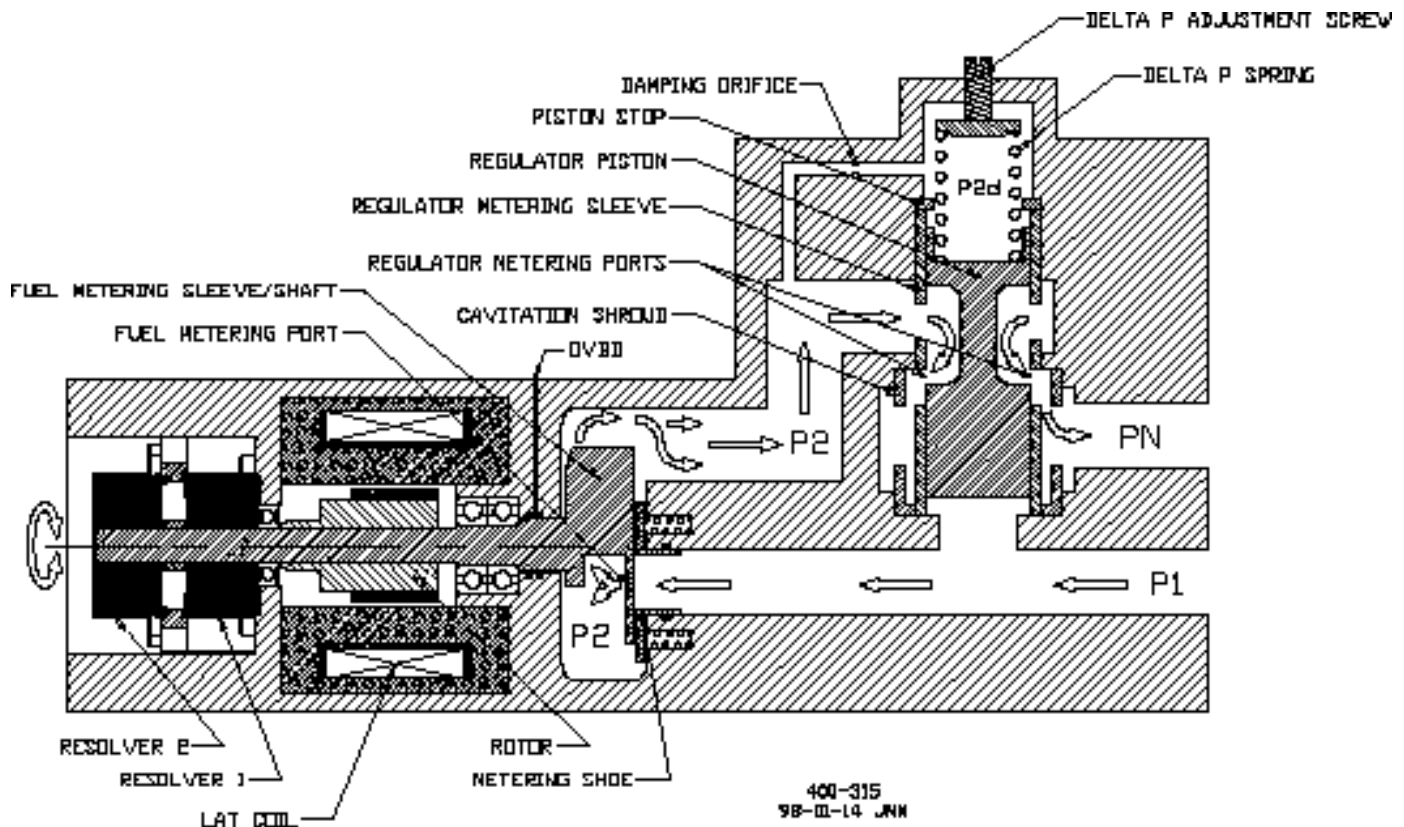
- The 0.1 in<sup>2</sup> (65 mm<sup>2</sup>) port is designed for maximum fuel flows of 4000 to 7500 lb/h (1814 to 3402 kg/h).
- The 0.2 in<sup>2</sup> (129 mm<sup>2</sup>) port is designed for maximum fuel flows of 8250 to 15 000 lb/h (3742 to 6804 kg/h).
- The 0.3 in<sup>2</sup> (194 mm<sup>2</sup>) port is designed for maximum fuel flows of 18 000 to 22 000 lb/h (8165 to 9979 kg/h).

The minimum metered flow of the LQ25T is 100 lb/h (45 kg/h). These flows assume a specific gravity of 0.77. All materials used in the LQ25T are corrosion resistant, or protected against corrosion.

## LQ25T Options

In addition to the base metering valve, the LQ25T has a dual resolver option and a high-accuracy digital driver option. The dual resolver option provides redundant feedback devices in order to have a backup if a resolver fails.

Using the high-accuracy digital driver will provide flow accuracies of  $\pm 2.5\%$  of flow point or  $\pm 15$  lb/h ( $\pm 6.8$  kg/h) (which ever is greater) when used with a LQ25T. These accuracies make the LQ25T ideal for DLE applications where high accuracy is needed.



LQ25T Valve Schematic

## LQ25T Valve Specifications

Liquid flow range	100 to 22 000 lb/h (45 to 9979 kg/h)
Maximum fuel inlet pressure	1400 psig (9653 kPa)
Regulated differential pressure	50 psid (345 kPa) nominal
Fuel Type	The valve is compatible with most types of diesels, kerosenes, gasolines, heavy and light distillates including naphtha, gas turbine fuels and fuel oils, and other liquid fuels such as biodiesel that are compatible with fluorocarbon (FKM) type elastomers and conform to international standards for utility, marine, and aviation gas turbine service. Ultra low sulfur diesels are also acceptable with proper lubricity additives. Other fuels such as ethanol or methanol may be acceptable with internal seal compound substitutions. Contact Woodward for these and other special fuel applications.
Fuel Viscosity	Fuel viscosity must be between 0.5 and 12.0 centistokes.
Fuel Cleanliness	Liquid fuel must be filtered to limit particulate size to 20 µm or smaller. Water content must be limited to 0.1% by volume. Solids, sediment, and particulates must be limited to 1.0 mg per liter of fuel.
Metering ports available <sup>1</sup> (maximum area)	0.1, 0.2, 0.3 in <sup>2</sup> (65, 129, 194 mm <sup>2</sup> )
Liquid fuel inlet and ambient temperature options	−18 to +217 °F (−28 to +103 °C) or −40 to +217 °F (−40 to +103 °C)
Accuracy (% of port area)	±5% of actual or ±0.5% of maximum (greater of)
Metering valve full travel slew time (closed loop position control)	< 0.100 second
Metering valve shutdown slew time (at 24 Vdc to driver)	< 50 ms
Position loop bandwidth <sup>2</sup>	35 rad/s (typical)
Fuel connections <sup>3</sup>	All ports: SAE J1926/1: 1-5/8-12
Overboard vent connection <sup>3</sup>	SAE J1926/1: 7/16-20
Electrical connections	2X M25 1.5 for conduit
Assembly weight	49 lb (22 kg)
Vibration	US MIL-STD-810-C, procedure 1, Table 514.2II, figure 514.2-2, curve J (5 g)
Shock	US MIL-STD-810-C Method 516.2, Procedure 1, 20 g, 11 ms, sawtooth wave form

<sup>1</sup> Power ratings are based on typical diesel fuel with a lower heating value (LHV) of 18 400 BTU/lbm and a simple cycle gas turbine thermal efficiency of 30%. At 40% thermal efficiency and with typical liquid fuels, the LQ25T can fuel 50 000+ kW engines.

<sup>2</sup> The system dynamics are approximately second order. Bandwidth is determined by magnitude response at −6 dB, 24 Vdc to GS driver.

<sup>3</sup> Fuel connection ports will accept fittings that interface with standard SAE J1926/1 and MS16142 straight-thread ports.

### Regulatory Compliance

#### European Compliance for CE Marking:

These listings are limited only to those units bearing the CE Marking.

**ATEX – Potentially Explosive Atmospheres Directive:** Declared to 94/9/EEC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.  
LCIE 03.ATEX.6375 X, Zone 1, Category 2, Group II G, EEx d IIB 160 °C T3  
Or Zone 2, Category 3, Group II G, EEx nA IIB 160 °C  
  
Use supply wire suitable for at least 90 °C and 10 °C above maximum fluid and ambient temperature

**Pressure Equipment Directive:** Certified to Pressure Equipment Directive 97/23/EC of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment.  
Category II

#### Other European Compliance:

Compliance with the following European Directives or standards does not qualify this product for application of the CE Marking:

**Machinery Directive:** Compliant as a component with 98/37/EC COUNCIL DIRECTIVE of 23 July 1998 on the approximation of the laws of the Member States relating to machinery.

**EMC Directive:** Not applicable to this product. Electromagnetically passive devices are excluded from the scope of the 89/336/EEC Directive.

#### North American Compliance:

These listings are limited only to those units bearing the CSA or UL agency identification.

**CSA:** CSA Certified for Class I, Division 1, Groups C & D, and Class I, Division 2, Groups A, B, C, & D, T3C at 103 °C Ambient. For use in Canada and the United States.

OR

**CSA:** CSA Certified for Class I, Division 2, Groups A, B, C, & D, T3C at 103 °C Ambient. For use in Canada and the United States.

## GS/LQ Driver Specifications

Supply Voltage to Driver	18 to 32 Vdc
Maximum Transient Supply Current	10.0 A for 0.20 s
Normal Steady State Input Current	< 2.0 A
Electrical Connection	Via terminal blocks on driver assembly, stud for external ground Maximum separation of valve and driver 100 m
Valve Position Command Signal	4 to 20 mA current signal into 249 $\Omega$ impedance
Valve Indicated Position Signal	4 to 20 mA current signal into < 500 $\Omega$ impedance
Shutdown/Reset Command	Close contact to run, open to close valve
System Fault Indication Signal	1 Form C dry contact output
Ambient Temperature Capability	-4 to +131 °F (-20 to +55 °C)
Driver Dimensions	9.0 x 10.0 x 3.0 inches (229 x 254 x 76 mm)
Fault Detection Capabilities	Open or short circuit conditions within the valve assembly or wiring connections Input signal in excess of 20 mA Position loop error in excess of 10% of full scale for more than 0.50 s
Mechanical Technical Manual	26162
Analog Driver Manual	40175
Digital Driver Manual	26159

## Regulatory Compliance

### European Compliance for CE Marking:

These listings are limited only to those units bearing the CE Marking.

**EMC Directive:** Declared to 89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

**ATEX–Potentially Explosive Atmospheres Directive:** Declared to 94/9/EEC COUNCIL DIRECTIVE of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.  
LCIE 01.ATEX.6012 X, Zone 2, Category 3, Group II G, EEx nC/L IIC T4

The GS/LQ Driver must be mounted within an enclosure, which ensures an IP54 protection degree as required by the European Standard EN 50021 (1999).

### North American Compliance:

**UL:** UL Listed for Class I, Division 2, Groups A, B, C, & D, at 55 °C Ambient. For use in Canada and the United States.

**CSA:** CSA Certified for Class I, Division 1, Groups A, B, C, & D, T4A at 55 °C Ambient. For use in Canada and the United States.



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