

LQ25T and LQ Bypass Valve Actuator Assemblies

Installation and Operation Manual



General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.



Revisions

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Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.



Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual **26311**, *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with . Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Woodward reserves the right to update any portion of this publication at any time. Information provided by Woodward is believed to be correct and reliable. However, no responsibility is assumed by Woodward unless otherwise expressly undertaken.

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Warnings and Notices

Important Definitions



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

WARNING

**Overspeed /
Overtemperature /
Overpressure**

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

WARNING

**Personal Protective
Equipment**

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- Eye Protection
- Hearing Protection
- Hard Hat
- Gloves
- Safety Boots
- Respirator

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

WARNING

**Automotive
Applications**

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE**Battery Charging
Device**

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE**Electrostatic
Precautions**

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual **82715**, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
 - Do not touch any part of the PCB except the edges.
 - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
 - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Regulatory Compliance

European Compliance for CE Marking:

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

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
Moody International Certificate 90 174

The following listing is limited only to those units bearing the LCIE ATEX 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 T3

The following listing is limited only to those units bearing only the Category 3, Group II G 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.
Zone 2, Category 3, Group II G, EEx nA IIB 160 °C

IMPORTANT

Use supply wire suitable for at least 90 °C and 10 °C above the maximum fluid and ambient temperature.

Other European and International Compliance:

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

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

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.

North American Compliance:

These listings are limited only to those units bearing the CSA identification and the specific hazardous locations ratings.

- CSA:** CSA Certified for Class I, Division 1, Groups C & D, T3C at 103 °C Ambient and Class I, Division 2, Groups A, B, C & D, T3C at 103 °C Ambient for use in Canada and the United States.
Certificate 1421186
- 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.
Certificate 1421186

Wiring must be in accordance with North American Class I, Division 1 or 2 or European Zone 1, Category 2 or Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

Special Conditions For Safe Use:

Refer to the specifications section for the ambient operating temperature range.

Use supply wire suitable for at least 90 °C and 10 °C above the maximum fluid and ambient temperature.

Specific LQ25T and LQ Bypass valves are certified to a Zone 1, Category 2 method of protection. Wiring methods must comply with the Zone 1, Category 2 method of protection when installed in a Zone 1 classified atmosphere.

! WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division 1 or 2 or Zone 1 or 2 applications.

! AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas l'ambiance est décidément non dangereuse.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 1 ou 2 ou Zone 1 ou 2.

Chapter 1.

General Information

Introduction

The LQ25T or LQ Bypass Valve/Actuator Assemblies with the GS3/LQ Valve Driver or LQ Digital Driver integrated liquid fuel metering systems feature valve position control, all-electric actuation, fuel bypass, fuel flow regulation, and fault indication. These systems may allow multiple independent metered flow paths with a single pump.

The LQ Valve assemblies are brushless dc limited-angle torquers which position a metering port for liquid fuel control. The LQ actuators are directly coupled to both the metering port and position feedback resolvers (single or dual). There are no intervening gears, linkages, or flex couplings. The high torque actuator and shearing action of the shoe on the rotor valve provide a high degree of contamination resistance.



WARNING

The controlling device, not the Driver(s) or Valve(s), sets turbine stability and response. Follow the instructions for the controlling device while setting up the turbine control system. Failure to follow instructions can cause personal injury and/or property damage.

Turbine manufacturer's requirements for fuel flow to the turbine can vary considerably depending on fuel pressures, fuel types, fuel and ambient temperatures, turbine size, etc. Contact Woodward for information on predicting fuel flow through the LQ Valves as a function of command input signal from the driver. This fuel flow information may be critical to the proper operation of your gas turbine and may be required information for the electronic control system to accelerate and/or decelerate the turbine properly.

IMPORTANT

For complete information on drivers, see manual 26159 for the digital driver and manual 40175 for the analog driver.

System Accuracy

Total positioning accuracy depends on the calibrated stroke as follows:

Analog Driver

The positional accuracy of the analog driver is 0.7 degrees including temp drift. The accuracy of the 4–20 mA feedback is 0.2 mA (1% of full scale).

Digital Driver

The positioning accuracy of the digital driver using the RS-485 (digital) demand input is 0.1 degree including temp drift. The positioning accuracy of the digital driver using the analog (4–20 mA) demand input is $0.1 + (0.0179 \times \text{span}^*)$. The rotary valve travel for the LQ25T and LQ25 Bypass is 66 degrees, giving a positional accuracy of 1.281 degrees.

*—span = range of travel in angular degrees

System Position Bandwidth And Damping

Digital Driver

System bandwidth is 40 rad/s (6.4 Hz). The frequency response mimics a two-pole linear system, with the bandwidth corresponding to -6 dB gain. The damping factor is set to 1. Equivalent dead time does not exceed 20 ms, which includes all effects, such as communications, processing time, mechanical times, etc.

LQ25T Fuel Metering Valve

The LQ25T Liquid Fuel Valve has all-electric actuation. The actuation, metering, and feedback are integrated on the motor rotor. Feedback is given by either one single-speed resolver, one three-speed resolver, or dual three-speed resolvers. Regulation is achieved through an integral, single stage, throttling differential pressure regulator.

The valve is intended for use on industrial gas turbines in the 6000 to 42 000 kW power range. Specifically, this design will operate in conjunction with any type of "pressure source" fuel system (centrifugal type pump or bypassing system on a positive displacement pump that controls inlet pressure to this valve). Flow metering is implemented with the use of an electrically actuated rotary plate and shoe-type valve with electrical dual-position feedback. There are three port sizes for the LQ25T: the 65 mm² (0.1 in²) port is designed for maximum fuel flows of 1814 to 3402 kg/h (4000 to 7500 lb/h), the 129 mm² (0.2 in²) port is designed for maximum fuel flows of 3742 to 6804 kg/h (8250 to 15 000 lb/h), and the 194 mm² (0.3 in²) port is designed for maximum fuel flows of 8165 to 9979 kg/h (18 000 to 22 000 lb/h). The minimum metered flow of the LQ25T is 45 kg/h (100 lb/h). These flows assume a specific gravity of 0.77. All materials of the LQ25T are corrosion resistant or protected against corrosion.

The valve is designed to automatically purge trapped air or fuel vapor within the internal passages. No provision for manual bleeding of the valves is required. The valve is self-cleaning, with a shear action metering section.

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

The LQ25T will be commanded to a minimum flow position in the event of a detected failure within the valve or driver assemblies. Loss of electrical power results in the valve moving towards the minimum flow or full closed position or holding at the last commanded position.

Operation Of The LQ25T Valve

The LQ25T Liquid Fuel Metering Valve meters fuel as a function of the angular position of its ported metering sleeve/shaft. The metering sleeve/shaft is positioned by the integrated, brushless, dc, limited angle torquer motor (LAT). A resolver or dual resolvers, mounted directly on the shaft of the valve, provide valve position feedback.

To accurately meter fuel, the valve maintains a constant pressure drop across the fuel metering port in the metering sleeve/shaft. The valve regulates the intermediate pressure to (P2) to maintain this constant pressure differential by positioning the throttling regulator piston.

Given the constant pressure differential within the fuel valve, the fuel flow through the metering port is always proportional to the area of the port opening. Fuel flow through the metering port of the valve is described by the following equation:

$$MassFuelFlow = k \times Area \times \sqrt{\Delta P \times SG}$$

Under operating conditions, fuel at the system pressure (P1) flows to the metering sleeve/shaft and to one side of the regulator piston. Metered fuel at the intermediate pressure (P2) is directed to the regulator metering ports and through a damping orifice (P2d) to the other side of the regulator piston. The regulator metering ports' effective area is such that the metered flow is throttled from the intermediate pressure (P2) to the outlet pressure (PN).

The piston takes a position at which the force from pressure P1 acting on the piston's effective area is equal to the sum of the forces from the pressure P2d acting on the piston's effective area and the force from the delta P spring. When the balance of forces has been established, the difference between the spring force acting on the piston is equal to the difference between the pressures (P1–P2d) acting on equal effective areas, and the pressure drop across the regulator metering ports is the difference between P2 and PN.

By varying the force of the ΔP spring, the pressure difference (typically 345 kPa/3.45 bar/50 psid) can be adjusted to suit the requirements of a particular application.

As long as the inlet pressure (P1) is sufficiently high (typically greater than 827 kPa/8.27 bar/120 psid), the intermediate pressure (P2) is maintained and the metered flow is unaffected by the valve downstream pressure (PN).

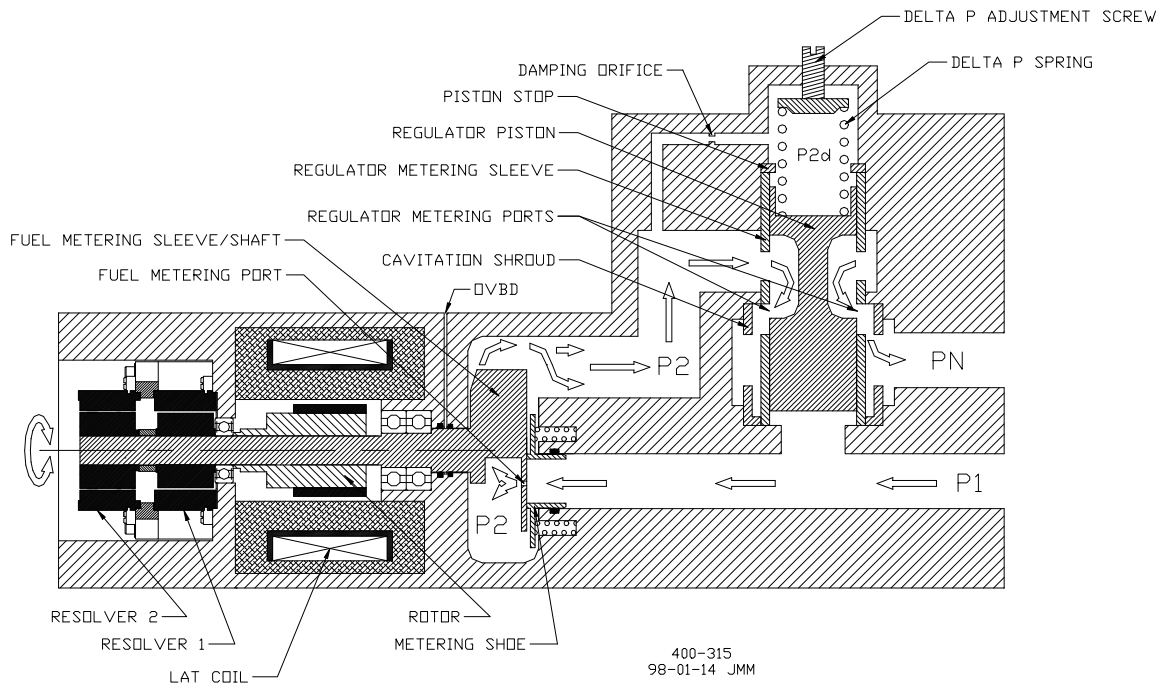


Figure 1-1. LQ25T Valve Schematic

LQ Bypass Valve

The LQ Bypass Valve is an electrically-actuated fuel flow-throttling valve. This modulating, two-way valve assembly is used to control the discharge pressure of a positive displacement fuel pump by bypassing flow to a low-pressure volume. It is used in conjunction with an electronic pressure control system and fuel pressure transducers (not included) to enable pump pressure to be accurately scheduled as a function of other system parameters. The actuation, metering, and feedback are integrated on the motor rotor. Flow direction is reversed through the LQ Bypass Valve to reduce cavitation erosion damage within the valve.

The valve is intended for use on industrial gas turbines in the 1000 to 42 000 kW power range. Flow metering is implemented with the use of an electrically actuated rotary plate and shoe-type valve with electrical dual position feedback.

The valve is designed to automatically purge trapped air or fuel vapor within the internal passages. No provision for manual bleeding of the valves is required. The valve is self-cleaning, with a shear action metering section.

The Bypass Valve is commanded to maximum flow position whenever possible in the event of a detected failure within the valve or driver assemblies. Loss of electrical power will result in the bypass valve moving towards the maximum flow or full open position, or holding at the last commanded position.

Operation of the LQ Bypass Valve

Flow direction is reversed in the LQ Bypass valve as compared to the LQ25T, and there is no ΔP section as metering accuracy is not as critical. A cavitation shield is included to reduce cavitation erosion damage within the valve.

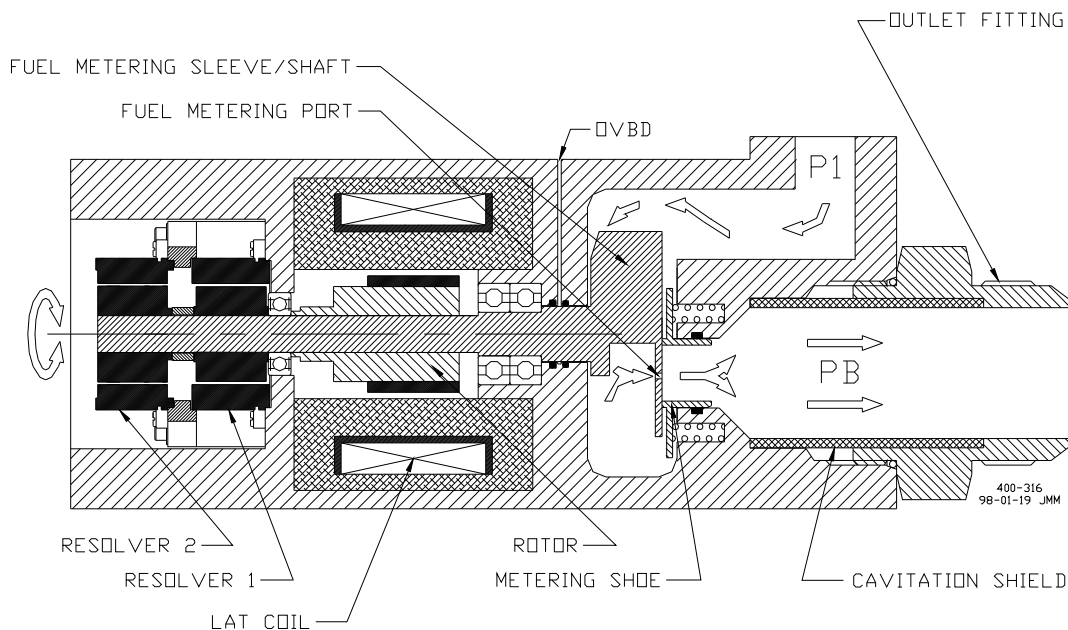


Figure 1-2. LQ Bypass Valve Schematic

Chapter 2. Installation

Terminal Blocks

Terminal blocks are used on all LQ valves. These terminal blocks are top load, cage clamp style, and are actuated by inserting a DIN 5264 screwdriver into the opening behind the wire slot. Once the cage clamp has been opened, the wire can be inserted and the screwdriver removed. Please see the illustration and instructions below:

- The screwdriver is inserted into the operating slot up to the stop.
- The screwdriver blade holds the clamping spring open automatically so that the conductor can be introduced into the clamping unit.
- The screwdriver is withdrawn. The conductor is automatically clamped.

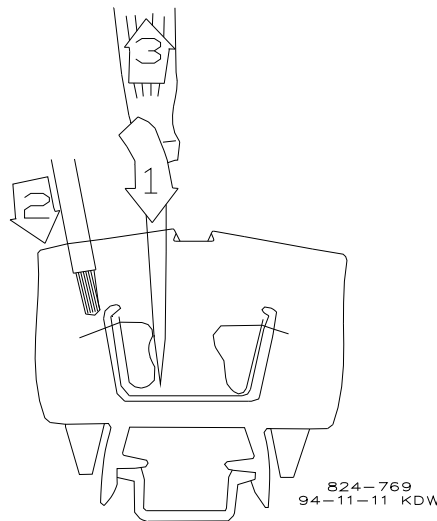


Figure 2-1. WAGO 264 Series Terminal Block

LQ Valve Unpacking

Use care when unpacking the LQ Valve. Abuse can damage seals, installation surfaces, and factory adjustments. Notify the shipper and Woodward if damage is found.

CAUTION

Due to typical noise levels in turbine or engine environments, hearing protection should be worn when working on or around the LQ25T or LQ Bypass valves.

CAUTION

The surface of this product can become hot enough or cold enough to be a hazard. Use protective gear for product handling in these circumstances. Temperature ratings are included in the specification section of this manual.

CAUTION

Do not lift or handle the valve by any conduit. The use of a strap suitable for lifting 22 kg (49 lb) is recommended for handling the LQ25T and LQ Bypass valves.

WARNING

External fire protection is not provided in the scope of this product. It is the responsibility of the user to satisfy any applicable requirements for their system.

NOTICE

Take care not to damage the cover seal, the cover surface, or the actuator surface while removing or replacing the cover.

IMPORTANT

For Zone 1 / Division 1 products: Proper torque is very important to ensure that the unit is sealed properly.

Damage to sealing surfaces may result in moisture ingress, fire, or explosion. Clean the surface with rubbing alcohol if necessary. Inspect the conduit and joint surfaces to ensure that they are not damaged or contaminated.

For Zone 1 valves: The LQ25T and LQ Bypass valves are certified to a Zone 1, Category 2 method of protection. Wiring methods must comply with the Zone 1, Category 2 method of protection when installed in a Zone 1 classified atmosphere.

WARNING

Due to the hazardous location listings associated with this product, proper wire type and wiring practices are critical to operation.

NOTICE

Do not connect any cable grounds to “instrument ground”, “control ground”, or any non-earth ground system. Make all required electrical connections based on the wiring diagrams (Figures 2-4 through 2-9).

LQ25T Valve Mounting

The valve should be mounted as close to the turbine as practical in order to minimize the volume of fuel between the valve and the turbine. Ensure that the valve is not mounted in an area that would exceed the temperature limits specified in Chapter 3: Detailed Specifications. The LQ25T valve should be mounted to a thermally conductive surface to conduct heat away from the actuator and maintain proper coil temperature.

See Figure 2-2 for dimensions of the LQ25T mounting hole pattern. The valve should be securely attached to a clean, flat, rigid surface that will not exceed the vibration limits specified in Chapter 3: Detailed Specifications.

Connect inlet, outlet, and overboard lines to the valve. The inlet port receives pressurized fuel from the pump. The outlet line should be attached to the fuel line(s) going to the turbine combustors. The bypass line must be connected back to the fuel storage tank. The overboard (OVBD) drain port depicted in Figure 2-2 is a vent between dual redundant shaft seals. It must be connected by means of rigid steel piping to a fuel collection, purge, vent, or flare off system so as not to be exposed to danger of obstruction, physical damage, or back pressure in excess of 69 kPa (0.69 bar/10 psig).

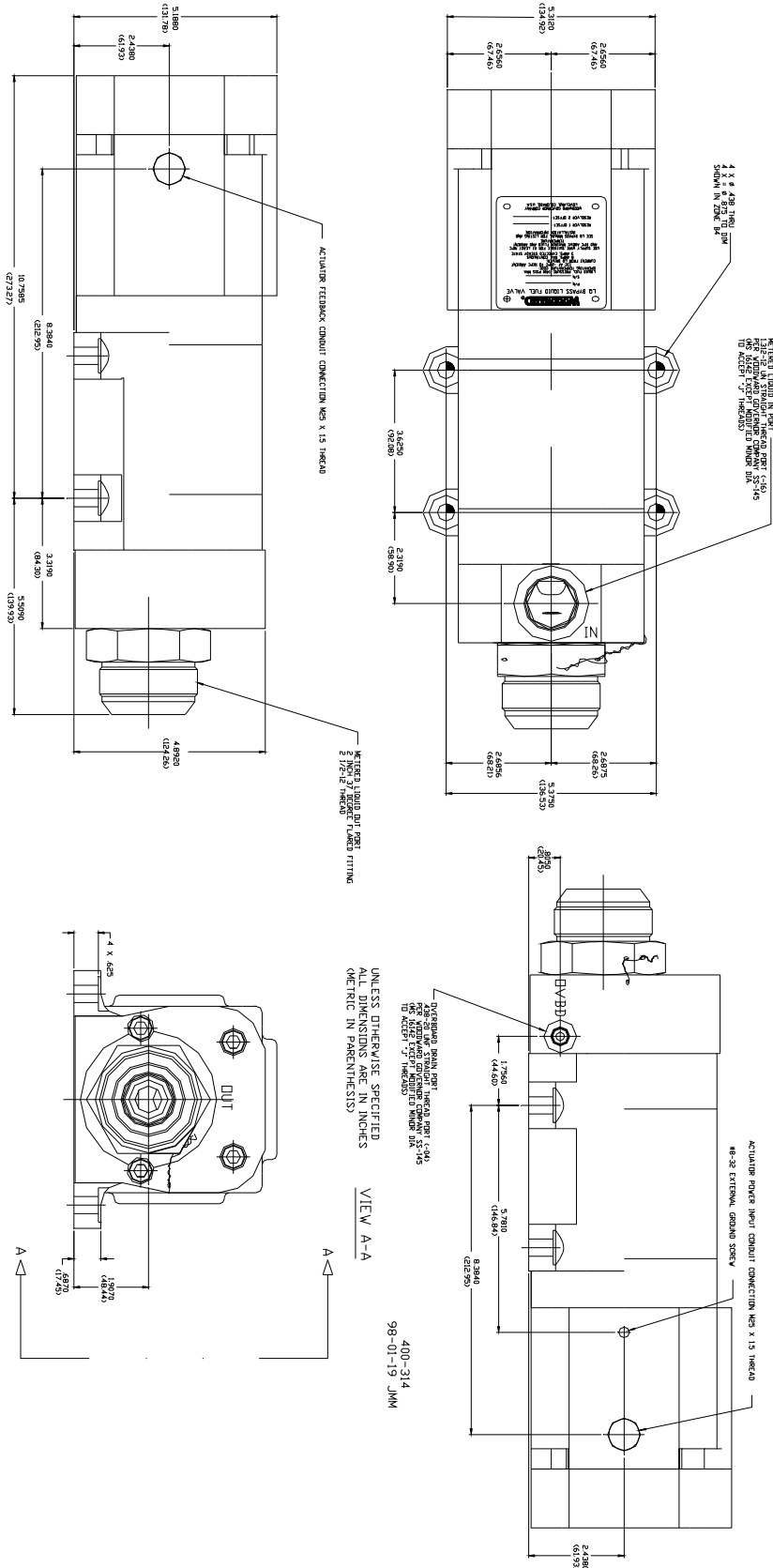


Figure 2-3. LQ Bypass Outline Drawing

! WARNING

Do not plug the overboard drain as this may cause fuel to enter the LQ25T actuator, resulting in a hazardous condition with the potential to cause personal injury and/or damage to the actuator.

The overboard drain piping must be sufficiently sloped to eliminate the possibility of stagnant water which could freeze and plug the drain, resulting in a hazardous condition with the potential to cause personal injury and/or damage to the valve.

IMPORTANT

Leakage exceeding 20 cm³/min from the overboard drain line indicates a worn or damaged shaft seal in the LQ25 valve and should be investigated immediately. Special tooling is required to replace the shaft seal. Contact Woodward for service.

Fuel Connections

Inlet	1.625-12 SAE Straight Thread Port (-20)
Outlet	1.625-12 SAE Straight Thread Port (-20)
OVBD	0.438-20 SAE Straight Thread Port (-04) (Overboard Drain Port)

Cable Connections

Wiring for the driver power output to the actuator must be suitable for at least 90 °C, and 10 °C above maximum fluid and ambient temperature.

Resolver wiring is non-incendive and may be installed in accordance with wiring methods suitable for ordinary locations.

Actuator	M25 x 1.5
Resolver	M25 x 1.5 (three shielded, twisted pairs or one shielded, twisted, six-conductor cable)
External Grounding Stud	Suitable for wire size 10 mm to 4 mm (8 to 12 AWG)

LQ25T Wiring

The driver must be mounted close enough to the LQ25T valve and the driver power supply to meet wire length requirements specified in the driver manual.

Make electrical connections between the valve and driver according to the LQ25T wiring diagram (Figure 2-4 for dual resolvers to a digital driver, Figure 2-5 for single resolver to digital driver, or Figure 2-6 for single resolver to analog driver).

Connect the ground terminal of the actuator to earth ground. This is to be the same grounding system as the driver's earth ground.

! WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

The LQ25T has a green lead wire, which must be connected, to earth ground. This may be connected to the terminal provided on the driver (TB1-8). In the event of a fault in the actuator, this terminal may be used to carry fault currents through the chassis of the LQ Driver and out the PE terminal to earth.

All shielded cable must be twisted conductor pairs with either a foil or a braided shield. All signal lines should be shielded to prevent picking up stray signals from nearby equipment. Connect the shields as shown in the Plant Wiring Diagram (Figures 2-7 through 2-9—for single resolver, resolver 2 is not connected). Wire exposed beyond the shield must be as short as possible.

IMPORTANT

Connect cable shields to earth ground. Do not connect any cable shields to “instrument ground”, “control ground”, or any non-earth ground system.

For best noise immunity, run power wires and shielded signal wires in separate conduits or cable trays. See Woodward Manual 50532, *EMI Control in Electronic Governing Systems*, for more information.

LQ Bypass Valve Mounting

The valve should be mounted as close to the pump between the valve and the engine’s fuel metering valves as is practical. The bypassing outlet of the valve should be connected to 51 mm (2 inch) diameter steel or stainless steel pipe having a minimum straight length of 1.2 m (4 feet). Ensure that the valve is not mounted in an area that would exceed the temperature limits specified in Chapter 3: Detailed Specifications. The LQ Bypass valve must be mounted to a thermally conductive surface to conduct heat away from the actuator and maintain proper coil temperature.

See Figure 2-3 for dimensions of the LQ Bypass mounting hole pattern. The valve should be securely attached to a clean, flat, rigid surface that will not exceed the vibration limits specified in Chapter 3: Detailed Specifications.

Connect inlet, outlet, and overboard lines to the valve. The inlet port receives pressurized fuel from the pump. The outlet line must be connected back to the fuel storage tank with 51 mm (2 inch) diameter pipe having a minimum straight length of 1.2 meters (4 feet). This pipe must have between 690 and 1380 kPa (6.9 and 13.8 bar/100 and 200 psig) of back pressure whenever the bypass valve is flowing in order to reduce the risk of cavitation erosion. The overboard (OVBD) drain port depicted in Figure 2-3 is a vent between dual redundant shaft seals. It must be connected by means of rigid steel piping with a downward slope to a fuel collection, purge, vent-off, or flare-off system so as not to be exposed to danger of obstruction, physical damage, or back pressure in excess of 69 kPa (0.69 bar / 10 psig).

WARNING

Do not plug the overboard drain as this may cause fuel to enter the LQ Bypass actuator, resulting in a hazardous condition with the potential to cause personal injury and/or damage to the actuator.

The overboard drain piping must be sufficiently sloped to eliminate the possibility of stagnant water which could freeze and plug the drain, resulting in a hazardous condition with the potential to cause personal injury and/or damage to the valve.

WARNING

The fuel exiting the LQ Bypass Valve will be at high velocity and may cause cavitation erosion in the downstream piping, resulting in a major fuel leak and the associated environmental and fire/explosion hazards. The 690 to 1380 kPa (6.9 to 13.8 bar/100 to 200 psig) back pressure and outlet fitting are specifically designed to minimize this cavitation erosion potential. The 1.2 m (4 foot) straight length of 51 mm (2 inch) diameter steel or stainless steel pipe is required to minimize this erosion, but the pipe must be regularly inspected to ensure its integrity.

IMPORTANT

The 49 000 cm³ (49 L/3000 in³) volume between the LQ Bypass Valve and the engine's fuel metering valves is required to ensure accurate system pressure control and subsequent fuel control.

Leakage exceeding 20 cm³/min from the overboard drain line indicates a worn or damaged shaft seal in the LQ Bypass valve and should be investigated immediately. Special tooling is required to replace the shaft seal. Contact Woodward for service.

Fuel Connections

Inlet	1.312-12 SAE Straight Thread Port (-16)
Outlet	2 inch 37° flared fitting with 2.5-12 Thread Port (-32)
OVBD	0.438-20 SAE Straight Thread Port (-04) (Overboard Drain Port)

Cable Connections

Wiring for the driver power output to the actuator must be suitable for at least 90 °C, and 10 °C above maximum fluid and ambient temperature.

Resolver wiring is non-incendive and may be installed in accordance with wiring methods suitable for ordinary locations.

Actuator	M25 x 1.5
Resolver	M25 x 1.5 (three shielded, twisted pairs or one shielded, twisted, six-conductor cable)
External Grounding Stud	Suitable for wire size 10 mm to 4 mm (8 to 12 AWG)

LQ Bypass Wiring

The driver must be mounted close enough to the LQ Bypass valve and the driver power supply to meet wire length requirements specified in the driver manual.

Make electrical connections between the valve and driver according to the LQ Bypass wiring diagram (Figure 2-4, 2-5, or 2-6).

Connect ground terminal of actuator to earth ground. This must be the same grounding system as the driver's earth ground.

WARNING

EXPLOSION HAZARD—Do not connect or disconnect while circuit is live unless area is known to be non-hazardous.

AVERTISSEMENT

RISQUE D'EXPLOSION—Ne pas raccorder ni débrancher tant que l'installation est sous tension, sauf en cas d'ambiance est décidément non dangereuse.

The LQ Bypass has a green lead wire, which must be connected, to earth ground. This may be connected to the terminal provided on the driver (TB1-8). In the event of a fault in the actuator, this terminal may be used to carry fault currents through the chassis of the LQ Driver and out the PE terminal to earth.

All shielded cable must be twisted conductor pairs with either a foil or a braided shield. All signal lines should be shielded to prevent picking up stray signals from nearby equipment. Connect the shields as shown in the Plant Wiring Diagram (Figure 2-7, 2-8, or 2-9). Wire exposed beyond the shield must be as short as possible.

IMPORTANT Connect cable shields to earth ground. Do not connect any cable shields to “instrument ground”, “control ground”, or any non-earth ground system.

For best noise immunity, run power wires and shielded signal wires in separate conduits or cable trays. See Woodward Manual 50532, *EMI Control in Electronic Governing Systems*, for more information.

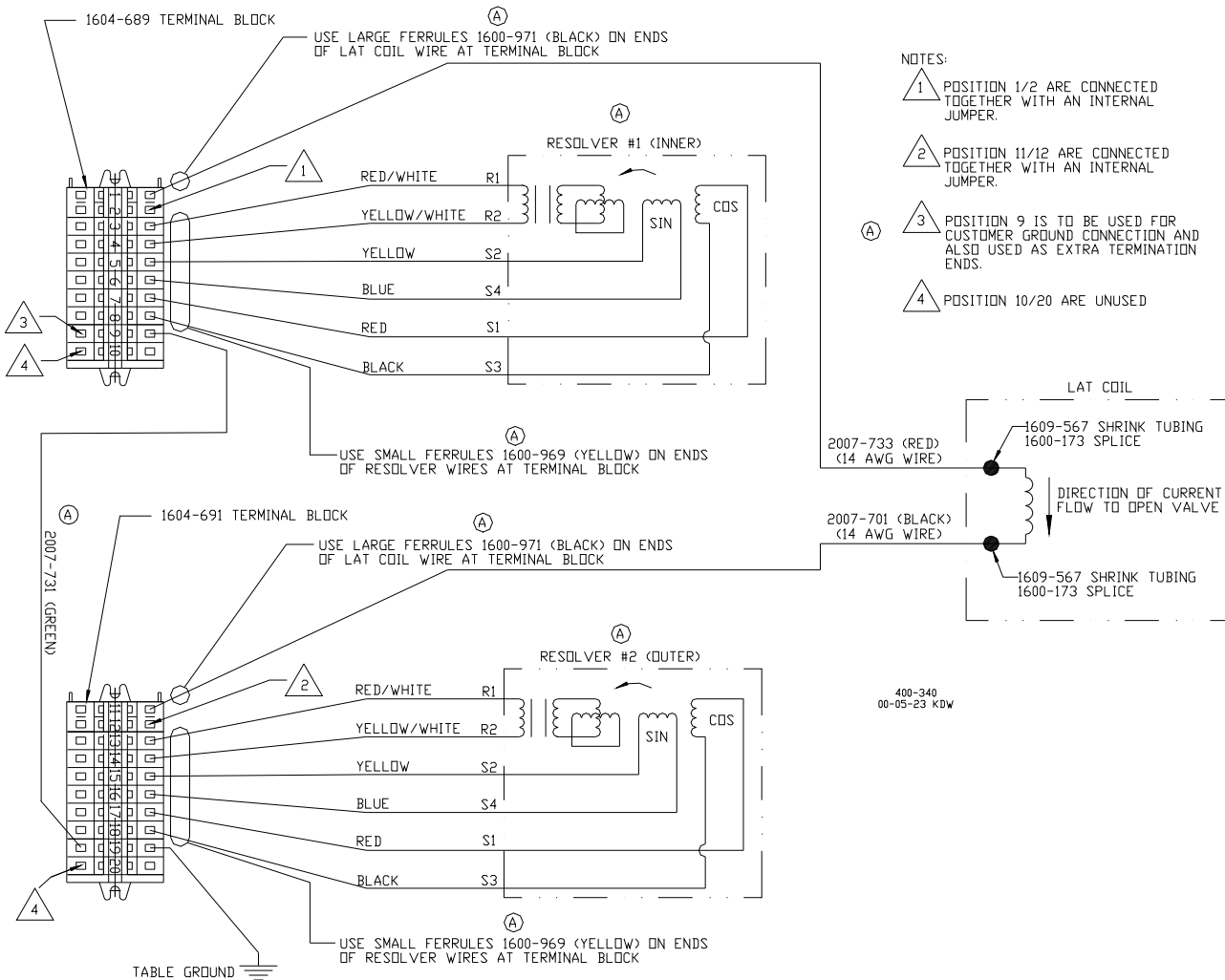


Figure 2-4. LQ25T and LQ Bypass Valve Wiring with Dual 3-speed Resolver (used with digital driver only)

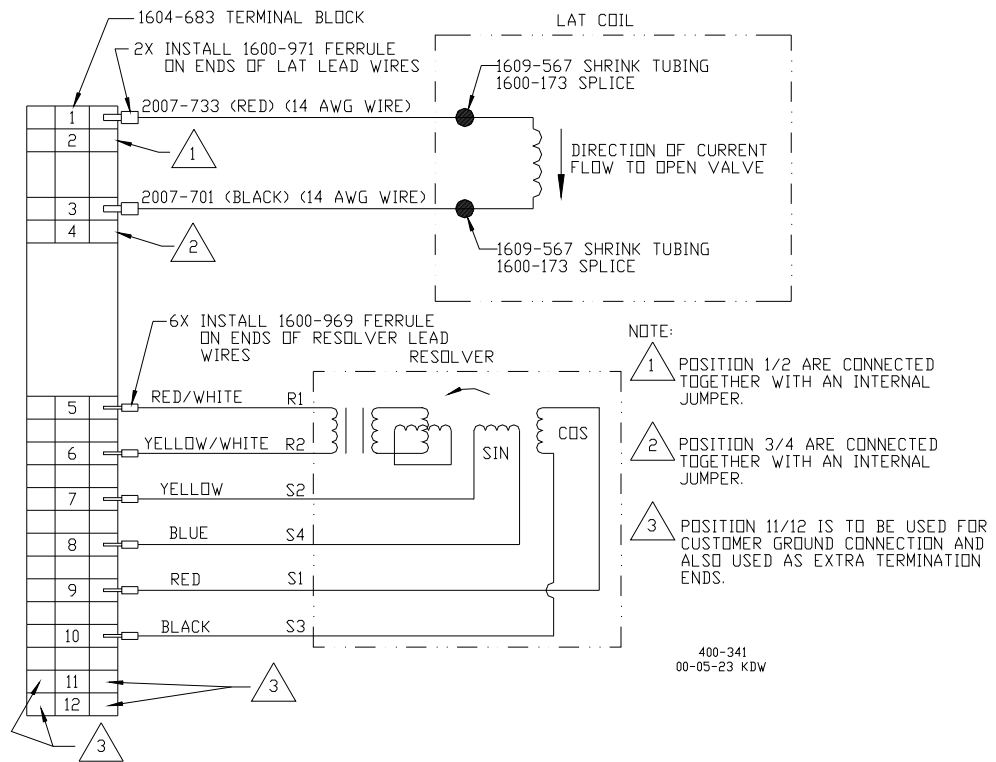
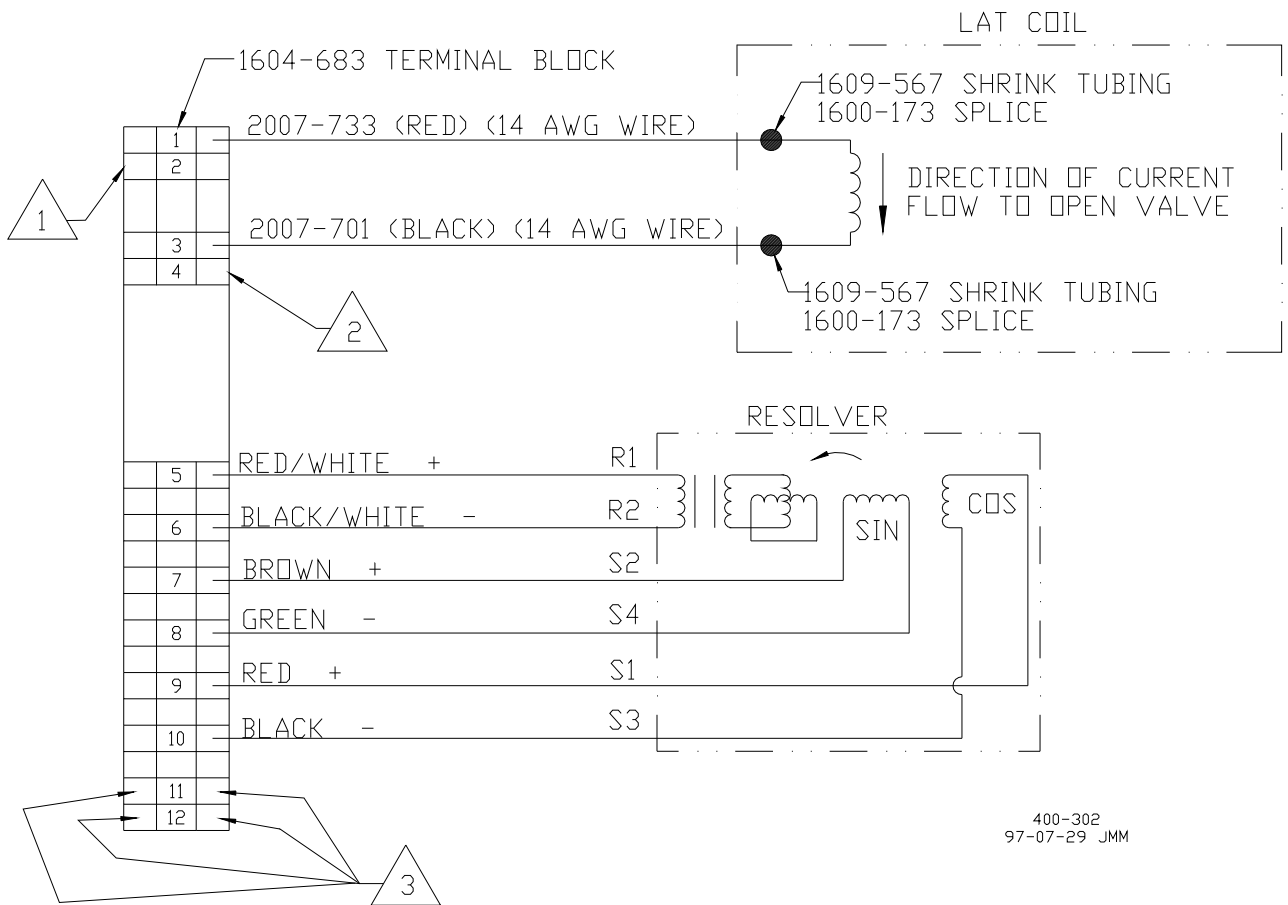


Figure 2-5. LQ25T and LQ Bypass Valve Wiring with Single 3-speed Resolver (used with digital driver only)



IMPORTANT

1. Positions 1/2 are connected together with an internal jumper.
2. Positions 3/4 are connected together with an internal jumper.
3. Positions 11/12 are to be used for customer ground connection and also used as extra termination ends.

Figure 2-6. LQ25T and LQ Bypass Valve Wiring with Single 1-speed Resolver (used with analog driver only)

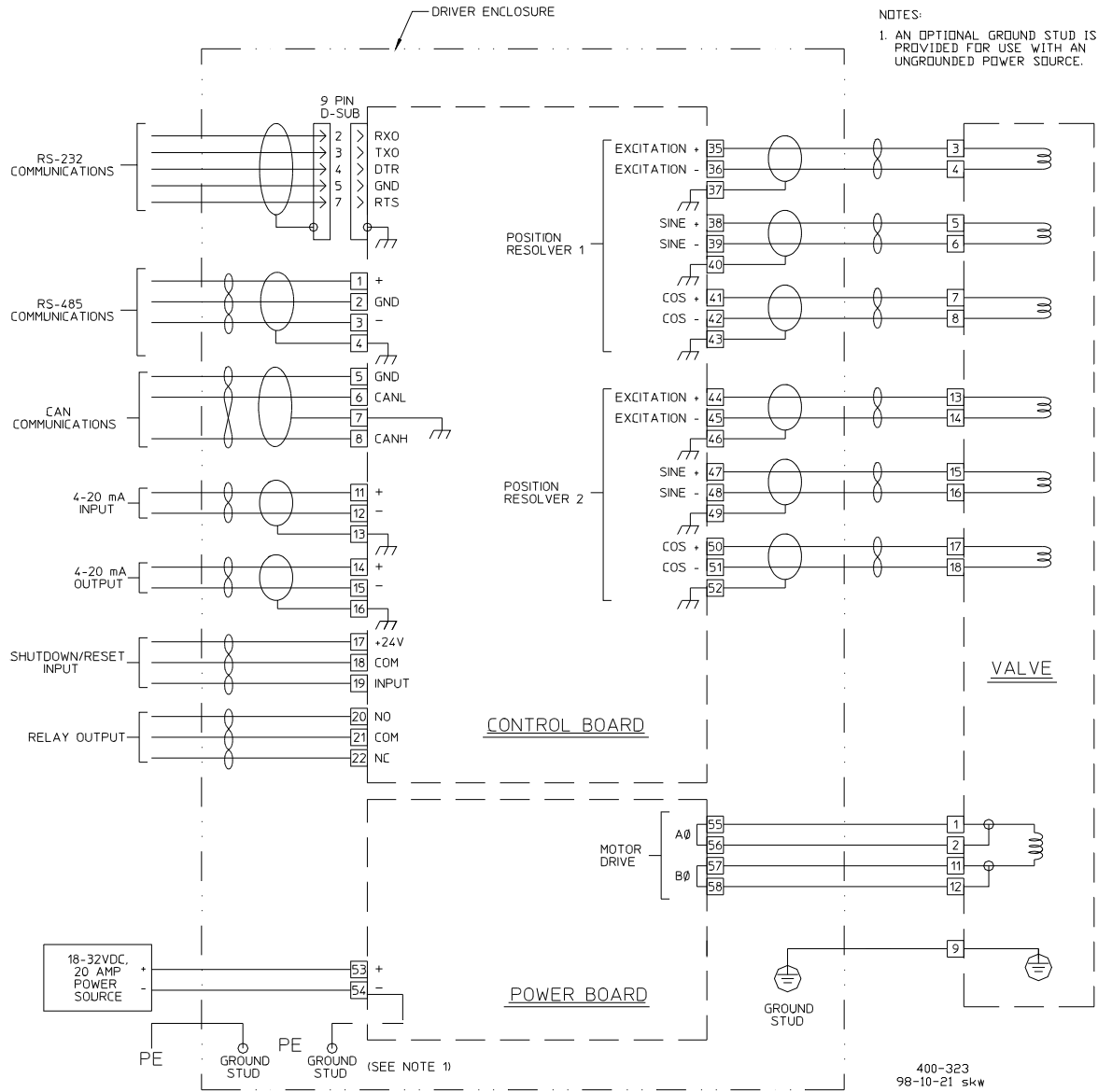


Figure 2-7. LQ25T and LQ Bypass Plant Wiring Diagram with Dual 3-speed Resolver to Digital Driver

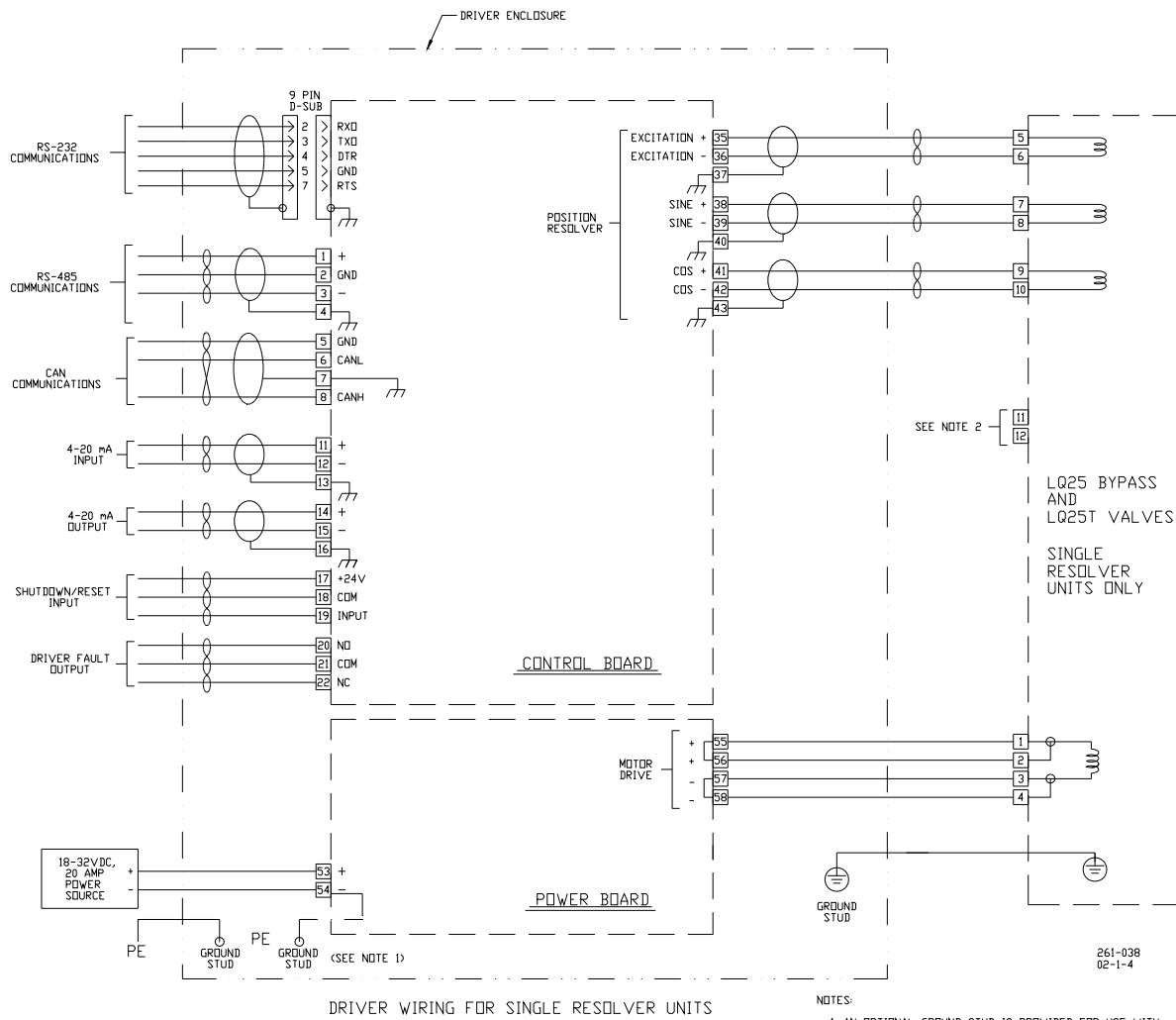


Figure 2-8. LQ25T and LQ Bypass Plant Wiring Diagram with Single 3-speed Resolver to Digital Driver

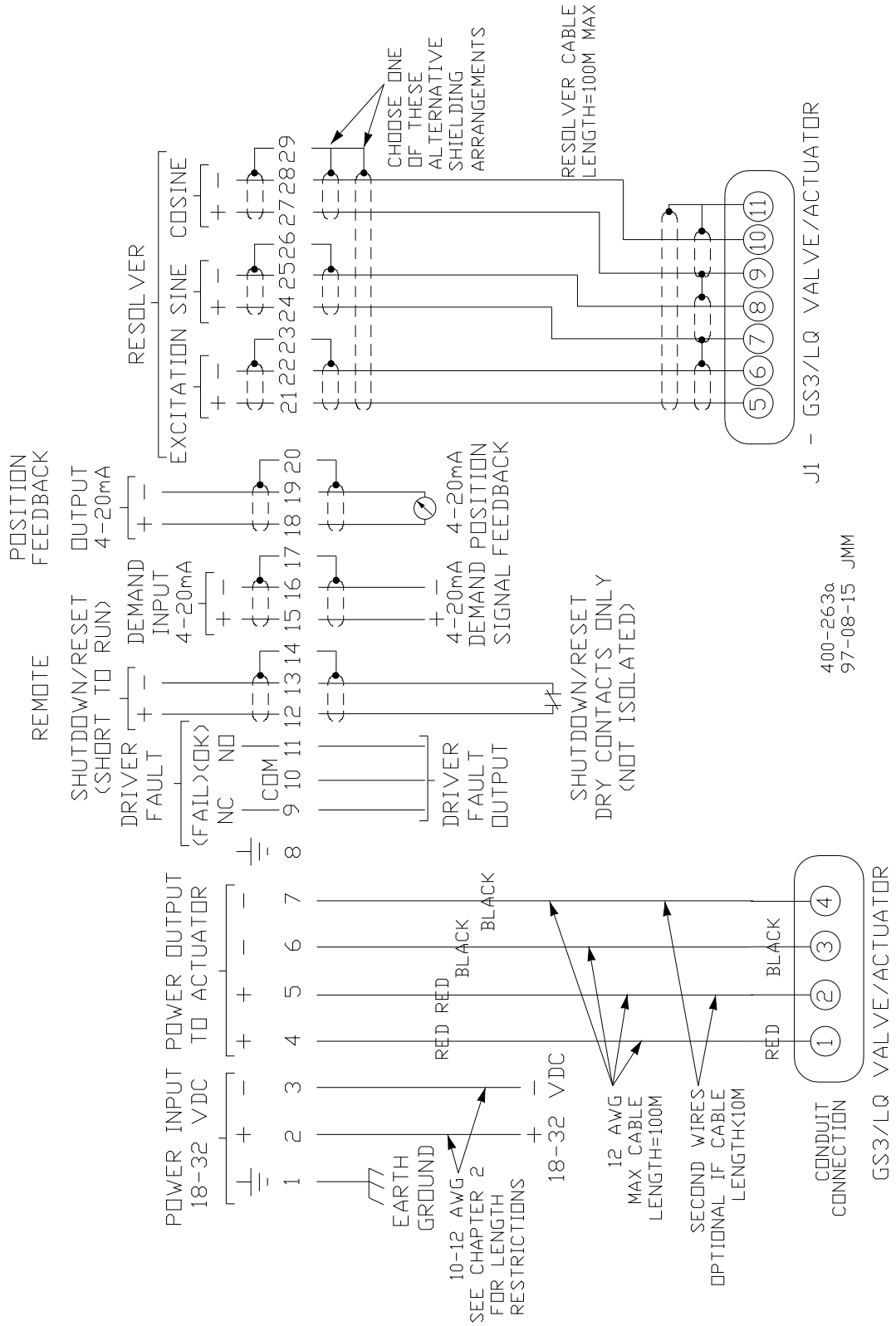


Figure 2-9. LQ25T and LQ Bypass Plant Wiring Diagram with Single 1-speed Resolver to Analog Driver

Chapter 3. Detailed Specification

LQ25T Valve Specifications

Environmental Specifications

Operating Temperature:	Units are available with the following operating temperature ranges: –28 to +103 °C (–18 to +217 °F) –40 to +103 °C (–40 to +217 °F)
Storage Temperature:	–40 to +103 °C (–40 to +217 °F)
Vibration:	US MIL-STD-810C, Procedure 1, Table 514.2-ii, Figure 514.2-2, Curve J (5g)
Shock:	US MIL-STD-810C, Method 516.2, Procedure 1, 20 g, 11 ms, sawtooth wave form
Valve Weight:	22 kg (49 lb)
Air born Noise:	Ear protection must be worn while Valve is operating

Electrical Characteristics

Dielectric Withstand:	1064 Vac from motor phases to Protective Earth (PE) ground; 500 Vac from all I/O to PE ground
Coil—	
Coil resistance:	0.54 W \pm 10% at 20 °C
Coil inductance:	20 mH at 60 Hz
Insulation resistance:	> 50 m Ω after dielectric test
Actuator Voltage:	18–32 Vdc
Actuator Current:	3 A steady state, 8 A max. Expected transient current may be up to 20 A with a maximum of 20% duty cycle
Feedback Device (analog driver)—	
Type:	Frameless resolver (single-speed)
Excitation:	4 Vac at 5000 Hz
Return:	2 Vac at 5000 Hz
Feedback Device (digital driver)—	
Type:	Frameless resolver (three-speed)
Excitation:	7 Vac at 4000 Hz
Return:	3.5 Vac at 4000 Hz

Steady State Performance Characteristics

Range of Maximum Metered Flows:	1814 to 9979 kg/h (4000 to 22 000 lb/h)
Range of Minimum Metered Flows:	27 to 454 kg/h (60 to 1000 lb/h)
Fuel Supply Pressure Range—	
Normal Operation:	1034 to 9653 kPa (10.3 to 96.5 bar/150 to 1400 psig)
Max Inlet (Proof Pressure):	19 MPa (193 bar/2800 psig)
Min Burst Pressure:	48 MPa (483 bar/7000 psig)
Max Internal Fuel Leakage:	27 kg/h (60 lb/h)
Nominal Diameter:	41.3 mm (1.625 inches)

Fuel Pressure Differentials

Nominal Regulated	
Metering Valve ΔP :	345 kPa (3.45 bar/50 psid)
Δ Pressure Droop:	± 6.9 kPa (± 0.069 bar/ ± 1.0 psid) w/ droop compensations in control
Total Differential Pressure:	P1 to PN 827 to 9653 kPa (8.3 to 96.5 bar/120 to 1400 psid) For dynamic response, P1 to PN must be at least 1380 kPa (13.8 bar/200 psid).
Chip Shearing Force Capability:	134 N (30 lb force) minimum at the metering port edge
Flow Metering Accuracy:	Greater of $\pm 5.0\%$ of point or $\pm 0.5\%$ of maximum flow using 4–20 mA input Greater of $\pm 2.5\%$ of point, or 0.1% of maximum flow, or 6.8 kg/h (15 lb/h), using RS-485 and droop compensation in control (including all effects—valve position, ΔP , temperature)
Valve Positioning Stability:	Oscillations $< \pm 0.05\%$ of full stroke
Metered Flow Dynamic Response:	> 25 rad/s bandwidth (for $\pm 2\%$ of stroke)
Max Slew Time:	0.100 s (measured from 10 to 90% or 90 to 10%)

Liquid Fuel Types And Test Fluids

Operating Fuel Types:	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.
Fluid Inlet Temperature Range:	Units are available with the following fuel temperature ranges: –28 to +103 °C (–18 to +217 °F) –40 to +103 °C (–40 to +217 °F)
Fuel Specific Gravity Range:	0.650 to 0.900
Fuel Viscosity Range:	0.50 to 12.0 Centistokes
Inlet Fuel Filtration Levels:	Liquid fuel must be filtered to limit particulate size to 20 μ m or smaller. Water and sediment must be limited to 0.1% by volume. Total particulate concentration must be limited to 2.64 mg per liter of fuel.
Operating Life	
Mean Time Between Overhauls:	$> 50\,000$ operating hours
Cyclic Life:	$> 150\,000$ full stroke cycles
Total Design Life with Overhauls:	$> 150\,000$ operating hours
Storage Life:	> 10 years, non-operating

LQ Bypass Valve Specifications

Environmental Specifications

Operating	
Temperature:	–28 to +103 °C (–18 to +217 °F)
Storage	
Temperature:	–40 to +103 °C (–40 to +217 °F)
Vibration:	US MIL-STD-810C, Procedure 1, Table 514.2-ii, 20 Hz to 1000 Hz Figure 514.2-2, Curve J (5g)
Shock:	US MIL-STD-810C, Method 516.2, Procedure 1, 20 g, 11 ms, sawtooth wave form
Valve Weight:	17.7 kg (39 lb)
Air born Noise:	Ear protection must be worn while valve is operating

Electrical Characteristics

Dielectric	1064 Vac from motor phases to Protective Earth (PE)
Withstand:	ground; 500 Vac from all I/O to PE ground
Coil	
Coil resistance:	354 W \pm 10% at 20 °C
Coil inductance:	20 mH at 60 Hz
Insulation resistance:	> 50 m Ω after dielectric test
Actuator Voltage:	18–32 Vdc
Actuator Current:	3 A steady state, 8 A max. Expected transient current may be up to 20 A with a maximum of 20% duty cycle
Feedback Device—	
Type:	Frameless resolver (single-speed)
Excitation:	4 Vac at 5000 Hz
Return:	2 Vac at 5000 Hz

Steady State Performance Characteristics

Range of Bypass	
Fuel Flow:	< 45 to 13 608 kg/h (< 100 to 30 000 lb/h)
Range of Inlet	
Fuel Pressures:	1034 to 9653 kPa (10.3 to 96.5 bar/150 to 1400 psig) (normal operation)
Range of Bypass	
Fuel Pressure:	690 to 2070 kPa (6.9 to 20.7 bar/100 to 300 psig)
Maximum Differential	
Fuel Pressure:	8964 kPa (89.6 bar/1300 psig) (normal operation)
Valve Design Point	
Condition:	13 608 kg/h (30 000 lb/h) at Pinlet=1724 kPa (17.2 bar/250 psig), Preturn= 690 kPa (6.9 bar/100 psig)
Continuous Operational	
Condition:	4536 kg/h (10 000 lb/h) at Pinlet=9653 kPa (96.5 bar/1400 psig), Preturn= 690 kPa (6.9 bar/100 psig)
Port Area vs Stroke	
Characteristic:	Approximately square law (triangular porting)
Proof Pressure	
Test Level:	19 MPa (193 bar/2800 psig)
Burst Pressure	
Test Level:	48 MPa (483 bar/7000 psig)
Maximum Internal	
Leakage:	<45 kg/h (100 lb/h) at Pinlet=9653 kPa (96.5 bar/1400 psig), Preturn= 690 kPa (6.9 bar/100 psig)

Maximum Leakage to Vent Port:	< 5 cm ³ /h at any condition Based on the use of diesel fuel with a specific gravity of 0.810
Nominal Diameter:	33.3 mm (1.312 inches)
Flow Capacity:	Minimum flow < 45 kg/h (< 100 lb/h) at 8964 kPa (89.6 bar/1300 psid) Maximum flow > 13644 kg/h (>30,000 lb/h) at 1034 kPa (10.34 bar/150 psid)
Flow Versus Input	$\frac{W_{fb}}{\sqrt{P_{inlet} - P_{discharge}}} @ K_1 + K_2(x) + K_3(x)^2$
Signal Characteristics:	(as obtained from a triangular metering slot)
Pressure Loss:	At max position, the total pressure loss from inlet to outlet port connections is less than 1034 kPa (10.34 bar/150 psid) at 13 608 kg/h (30 000 lb/h) bypass flow

Liquid Fuel Types And Test Fluids

Operating Fuel Types:	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.
Test Fluid:	Calibration Fluid per US MIL-C-7024C Type II at -28 to +103 °C (-18 to +217 °F)
Fluid Inlet Temperature Range:	-28 to +103 °C (-18 to +217 °F)
Fuel Specific Gravity Range:	0.650 to 0.900
Fuel Viscosity Range:	0.50 to 12.0 Centistokes
Inlet Fuel Filtration Levels:	Liquid fuel must be filtered to limit particulate size to 20 µm or smaller. Water and sediment must be limited to 0.1% by volume. Total particulate concentration must be limited to 2.64 mg per liter of fuel.

Service Life And Reliability

Mean Time Between Overhaul (MTBO):	> 50 000 operating hours (target)
Total Operating Life With Overhauls:	> 200 000 operating hours (target)
Mean Time Between Failures:	> 50 000 operating hours (target; all defects)
Storage Life:	> 10 years, non-operating

Chapter 4. Maintenance

LQ25T Valve Maintenance

The valve assembly is designed to avoid the accumulation of air and fuel vapor in service (based on the use of diesel fuel with a specific gravity of 0.810), and does not require any action by the user to purge air or vapor from the assembly following installation or use on the engine system.

The valve is also designed such that during normal operation or storage, fuel or condensed water vapor does not accumulate within any part of the assembly in such a way as to cause damage or deterioration.

When removed from the engine system, it is possible to drain all fuel, condensed water vapor, or other contaminants from the assembly without further disassembly.

There are no field-replaceable parts on the LQ25T.

LQ Bypass Valve Maintenance

On the LQ Bypass Valve, the outlet fitting with its integrated cavitation shield and the 1.2 meter (4 ft) straight length of 51 mm (2 inch) diameter steel or stainless steel pipe (or tube) should be inspected for signs of cavitation damage at a maximum interval of 5000 hours of pump operation. Components showing significant signs of erosion should be replaced immediately and the system should be checked to ensure adequate back pressure is being maintained to the outlet of the valve.

The fitting connected to the outlet of the LQ Bypass must not be replaced with any other fitting. This fitting should be considered a part of the LQ Bypass Valve. Replacement of this fitting with a standard fitting will expose the fitting to cavitation erosion resulting in a hazardous condition with the potential to cause personal injury and/or damage to the fuel system and valve.

The valve assembly is designed so as to avoid the accumulation of air and fuel vapor in service (based on the use of diesel fuel with a specific gravity of 0.810), and does not require any action by the user to purge air or vapor from the assembly following installation or use on the engine system.

The valve is also designed such that during normal operation or storage, fuel or condensed water does not accumulate within any part of the assembly in such a way as to cause damage or deterioration.

When removed from the engine system, it is possible to drain all fuel, condensed water vapor, or other contaminants from the assembly without further disassembly.

The only field-replaceable part on the LQ Bypass Valve is the outlet fitting with integral cavitation shield.

Chapter 5. Troubleshooting

WARNING

The valve(s) may not fail shut in every situation. If the driver is unable to shut the valve in a fault situation, the valve will stay open. For safe turbine operation in fault situations, the valve must be used in conjunction with an additional high-speed shutoff valve. Also, the driver fault relay should be tied into the engine protection system.

WARNING

Before attempting any troubleshooting action, verify that the prime mover is shut down and that fuel pressure is not present to valves that may open due to actuator motion.

Valve Problems

This troubleshooting section does not give the certain cause of any problem. Nor does it cover all possible problems or all possible causes of any problem. This section will not enable a technician to locate a faulty component in the valve.

If trouble occurs, use Figure 5-1, the Troubleshooting Flowchart, as a guide to locate and repair the problem. Follow the flow chart down from the title block to the next block. Rectangular boxes contain suggestions on where to look for a problem. Diamond-shaped boxes ask you questions based on the information you have gathered. The answer to that question will guide you to the next step in the troubleshooting procedure. By following the flowchart, you should be able to identify and correct most problems that may occur with the valve. If after following these troubleshooting procedures you are unable to find the cause of a problem and repair it, contact Woodward for assistance.

If the results of these procedures indicate that the valve may be faulty, replace the suspected unit with a valve known to be good to verify that the cause of the problem is in the valve.

To verify electrical connections within the valve, disconnect the electrical cables at the driver and measure resistances between driver connector terminals. Note that the following resistances are approximate and do not include tolerances. This test is to check for open or short circuits, and to test the wiring from the driver to the valve.

For analog drivers, use resistances called out on Figure 5-1.

For digital drivers:

Motor Windings:

Terminals 55/56—57/58: approximately 0.525 to 0.9 Ω

Resolver Connectors—These resistances apply to either resolver connector

Terminals 35–36: approximately 36.6 to 49.4 Ω

Terminals 38–39: approximately 74.8 to 101.2 Ω

Terminals 41–42: approximately 74.8 to 101.2 Ω

Terminals 9–10: N/A

Terminals 11–12: N/A

Terminals 44–45: approximately 36.6 to 49.4 Ω

Terminals 47–48: approximately 74.8 to 101.2 Ω

Terminals 50–51: approximately 74.8 to 101.2 Ω

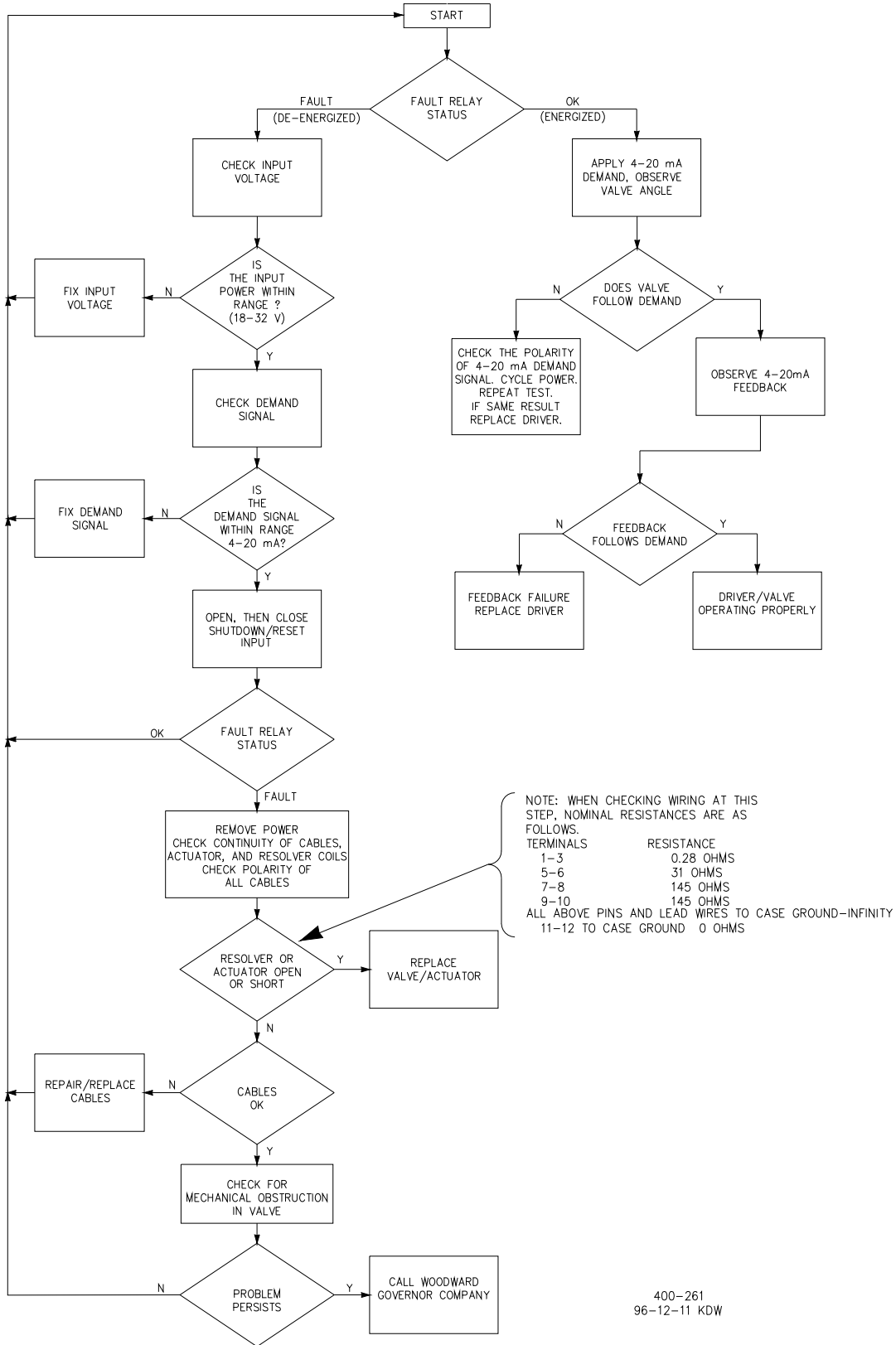


Figure 5-1. Troubleshooting Flowchart

Chapter 6. Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in “like-new” condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:

- protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website: www.woodward.com.

How to Contact Woodward

For assistance, call one of the following Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Turbine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Your Name _____

Site Location _____

Phone Number _____

Fax Number _____

Engine/Turbine Model Number _____

Manufacturer _____

Number of Cylinders (if applicable) _____

Type of Fuel (gas, gaseous, steam, etc) _____

Rating _____

Application _____

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

Revision History

Changes in Revision H—

- Updated Figure 2-2

Changes in Revision G—

- Updated fuel particulate concentration to 2.64 mg/L

Declarations

DECLARATION OF CONFORMITY

Manufacturer's Name: WOODWARD GOVERNOR COMPANY (WGC)
Manufacturer's Address: 1000 E. Drake Rd.
 Fort Collins, CO, USA, 80525

Model Name: LQ25T and LQ Bypass
Numbers: 9908-200, 9908-201 and similar

Conformance to Directive(s): 97/23/EC COUNCIL DIRECTIVE of 29 May 1997 on the approximation of the laws of the Member States concerning Pressure Equipment.
 94/9/EC 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.

Marking(s): Category 2 Group II G, EEx d IIB T3

Applicable Standards: EN50014:1998 Electrical apparatus for potentially explosive atmospheres – General requirements
 EN50018:2000 Electrical apparatus for potentially explosive atmospheres – Flameproof enclosure 'd'
 ASME B31.3b Process Piping, 2004
 ASME Boiler and Pressure Vessel Code VIII, Div. 1, 2004
 ASME Boiler and Pressure Vessel Code II, Part D, 2004
 BS EN 1503-2: 2000

Third Party Certification: LCIE 03 ATEX 6375 X
 LCIE
 Siège Social : 33, Avenue du Général Leclerc
 F92260 Fontenay-aux-Roses, France


Conformity Assessment: PED Module H – Full Quality Assurance Certificate 90 174
 ATEX Production Quality Assessment Certificate ITS05ATEXQ4211

Notified Body ATEX: Intertek (0359)
 Intertek House, Cleeve Road
 Leatherhead, Surrey, KT22 7SB UK

Notified Body For Pressure Equipment: Moody International Certification Limited (1277)
 Stephenson's Way, The Wyvern Business Park
 Derby DE21 6LY United Kingdom

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER



Signature
 Joseph Driscoll

Full Name
 Engineering Manager

Position
 WGC, Fort Collins, CO, USA

Place

 5/2/07

Date

DECLARATION OF CONFORMITY

Manufacturer's Name: WOODWARD GOVERNOR COMPANY (WGC)
Industrial Controls Group

Manufacturer's Address: 1000 E. Drake Rd.
Fort Collins, CO, USA, 80525

Model Name(s)/Number(s): LQ25T / 9907-504

Conformance to Directive(s): 97/23/EC COUNCIL DIRECTIVE of 29 May 1997 on the approximation of the laws of the Member States concerning Pressure Equipment

94/9/EC 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

Marking(s): Category 3 Group II G, EEx nA IIB 160°C


Applicable Standards: ASME B31.3 Process Piping, 2004
ASME Boiler and Pressure Vessel Code VIII, Div. 1, 2004
ASME Boiler and Pressure Vessel Code II, Part D, 2004
BS EN 1503-2 : 2000
EN60079-0, 2004: Electrical apparatus for explosive gas atmospheres – Part 0: General Requirements
EN60079-15, 2003: Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection 'n'

Conformity Assessment: PED Module H – Full Quality Assurance, Certificate 90 174

Notified Body For Pressure Equipment: Moody International Certification Limited (1277)
Stephenson's Way, The Wyvern Business Park
Derby DE21 6LY United Kingdom

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER



Signature

Joseph Driscoll

Full Name

Engineering Manager

Position

WGC, Fort Collins, CO, USA

Place

5/2/07

Date

Declaration of Incorporation

Woodward Governor Company
1000 E. Drake Road
Fort Collins, Colorado 80525
United States of America

Product: GS3 Valves 9908-250 and similar
LQ3 Valves 9908-275 and similar
LQ25T Valves 9908-200 and similar
LQ Bypass Valve 9908-201 and similar
Oil Metering Valve 9908-300 and similar

The undersigned hereby declares, on behalf of Woodward Governor Company of Loveland and Fort Collins, Colorado, that the above-referenced product is in conformity with the following EU Directives as they apply to a component:

98/37/EEC (Machinery)

This product is intended to be put into service only upon incorporation into an apparatus/system that itself will meet the requirements of the above Directives and bears the CE mark.

Manufacturer



Signature

Jim Rudolph

Full Name

Engineering Manager

Position

WGC, Fort Collins, CO, USA

Location

9/12/03

Date

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication **26162H**.



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Email and Website—www.woodward.com

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as well as authorized distributors and other authorized service and sales facilities throughout the world.

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