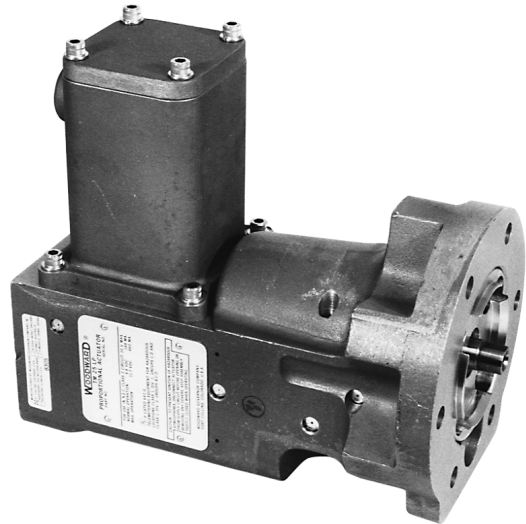




Installation and Operation Manual



TM-25LP, TM-200LP Actuators

Manual 82450 (Revision L)

WARNING—DANGER OF DEATH OR PERSONAL INJURY



WARNING—FOLLOW INSTRUCTIONS

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.



WARNING—OUT-OF-DATE PUBLICATION

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the Woodward website:

www.woodward.com/pubs/current.pdf

The revision level is shown at the bottom of the front cover after the publication number. The latest version of most publications is available at:

www.woodward.com/publications

If your publication is not there, please contact your customer service representative to get the latest copy.



WARNING—OVERSPEED PROTECTION

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—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.

CAUTION—POSSIBLE DAMAGE TO EQUIPMENT OR PROPERTY



CAUTION—BATTERY CHARGING

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.



CAUTION—ELECTROSTATIC DISCHARGE

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.

IMPORTANT DEFINITIONS

- A **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
- A **CAUTION** indicates a potentially hazardous situation which, if not avoided, could result in damage to equipment or property.
- A **NOTE** provides other helpful information that does not fall under the warning or caution categories.

Revisions—Text changes are indicated by a black line alongside the text.

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Contents

REGULATORY COMPLIANCE.....	II
CHAPTER 1. GENERAL INFORMATION.....	1
Description.....	1
References	1
Direction of Output.....	1
Single or Dual Coil.....	1
CHAPTER 2. INSTALLATION.....	2
Introduction.....	2
Receiving.....	3
Storage	3
Installation	3
CHAPTER 3. INITIAL OPERATION OF THE ACTUATOR.....	10
Initial Operation	10
Adjustments.....	10
CHAPTER 4. PRINCIPLES OF OPERATION	11
Introduction.....	11
Operation.....	11
CHAPTER 5. MAINTENANCE	13
Introduction.....	13
Filter Cleaning	13
Troubleshooting.....	14
CHAPTER 6. REPLACEMENT PARTS	15
Introduction.....	15
Replacement Parts Information.....	15
CHAPTER 7. SERVICE OPTIONS	18
Product Service Options.....	18
Returning Equipment for Repair.....	19
Replacement Parts	20
How to Contact Woodward.....	20
Engineering Services	21
Technical Assistance.....	22
DECLARATIONS	24

Illustrations and Tables

Figure 2-1. TM-25LP/TM-200LP Actuator (New Style).....	6
Figure 2-2. Dual Coil TM-25LP/TM-200LP Actuator with Position Feedback.....	7
Figure 2-3. Single Coil Wiring.....	8
Figure 2-4. Dual Coil Wiring	9
Figure 4-1. Single/Dual Coil Schematic, TM-25LP/TM-200LP Actuator	12
Figure 6-1. TM-200LP Exploded View	17

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 02 ATEX 6221 X
Zone 1, Category 2, Group II G, EEx e II T3 X

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.

**Pressure Equipment
Directive:**

Compliant as “SEP” per Article 3.3 to Pressure Equipment Directive 97/23/EC of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment.

NOTE: This listing is limited to units bearing the TIIS certification labeling.

TIIS: The TM-25LP Single Coil Actuator is certified for use in Japanese hazardous locations per TIIS Certificate TC17927 as Ex e II T3 (155 °C).

NOTE: This listing is limited to units that are CE Marked as Zone 1, Category 2 compliant.

KGS: The TM-25LP Single Coil Actuator is certified for use in Korean hazardous locations per KGS Certificate 06-2-045-Q1 as Ex e II T3 30V.

North American Compliance:

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

CSA: CSA Certified for Class I, Division 1, Groups C & D, Class I, Division 2, Groups B, C, & D, for use in Canada.
Certificate LR 79726-4

UL: UL Listed for Class I, Division 1, Groups C and D, Class 1, Division 2, Group B, for use in the United States.
UL File E158654

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

The TM-25LP and TM-200LP 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 2 classified atmosphere.

Special Conditions for Safe Use:

Each torque motor must be provided with a 900 mA maximum fuse to be installed before the torque motor.

Voltage to the torque motor must be limited to a nominal voltage of 30 V with a switch-off voltage of 480 V.

Field wiring must be suitable for at least 90 °C and 10 °C above the ambient operating temperature.

Connect ground terminal to earth ground.



WARNING—EXPLOSION HAZARD

Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

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



AVERTISSEMENT—RISQUE D'EXPLOSION

Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous vous situez bien dans une zone non explosive.

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

Chapter 1.

General Information

Description

The TM-25LP and TM-200LP actuators are electric-hydraulic, proportional actuators designed for use with Woodward 43027 and 2301 electric controls and may interface with an adapter directly to a fuel flow control valve. They have an aluminum case with through-hardened stainless steel internal parts.

In the actuator, a torque motor servovalve is energized by the electric control to generate a pressure differential applied to the ends of, and to operate, the second stage spool valve. Supply pressure is regulated by the spool valve to move a double acting servo piston and provide 25 mm (1 inch) of linear output shaft travel. Internal mechanical feedback is standard. The actuator is calibrated at the factory for bias in the minimum fuel direction in the event of a loss of input current.

Hydraulic fluid is sealed from the torque motor by a preformed packing ring between the armature and the servovalve housing, eliminating the accumulation of magnetic contaminants. A 40 µm nominal/70 µm absolute filter fitting is provided at the hydraulic supply port for protection in the event of an upstream filter failure.

References

Product Specification 82451 about the TM-25LP and TM-200LP is available on our website (www.woodward.com).

Direction of Output

TM-25LP and TM-200LP actuators are available either to extend the terminal shaft as the actuator signal increases or retract the terminal shaft as the actuator signal increases. The reaction to signal change is a factory modification.

Single or Dual Coil

TM actuators are available with either single or dual coil torque motors. The dual coil option provides redundant electrical channels in the torque motor. In the dual coil models, the coils can be used independently or together to load share.

Chapter 2. Installation

Introduction

Receiving, storage, and installation for the actuator are covered in this chapter. See the outline drawing, Figure 2-1.

**WARNING—OVERSPEED PROTECTION**

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—NOISE**

Due to typical noise levels in turbine environments, hearing protection should be worn when working on or around the TM Actuator.

**WARNING—BURN HAZARD**

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—FIRE PROTECTION**

Explosion Hazard—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.

**WARNING—EXPLOSION HAZARD**

Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

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

**AVERTISSEMENT—RISQUE D'EXPLOSION**

Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous vous situez bien dans une zone non explosive.

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

Be careful when installing the actuator. Do not damage the output shaft. Abuse of the actuator can damage seals, installation surfaces, and alter the calibration of the unit. Protect the hydraulic connections with plastic shipping caps when the actuator is not connected to the normal piping.

Receiving

The actuator is calibrated and drained of calibration fluid at the factory. It is then placed in a cardboard container filled with urethane foam for delivery to the customer. Additional cleaning or calibration is not necessary before installation or operation.



WARNING—LIFTING

To avoid personal injury from improper lifting or from dropping the actuator, be sure to use appropriate equipment and safe-lifting techniques when handling the actuator. Dry weight of the actuator is approximately 9 kg (20 lb).

Storage

The actuator may be stored as received from the factory for a period of time before installation.

Installation

See the outline drawing, Figure 2-1, for:

- overall dimensions
- installation hole locations
- hydraulic fitting sizes
- output shaft dimensions

Proper filtration of the hydraulic supply is extremely important. A metal element, 10 µm (nominal) filter must be installed in the supply to the actuator within 1 meter of the supply port. If a Woodward HPU supply system is installed, the distance from the filter to the actuator is not important. It is necessary to keep the immediate area and equipment clean and free of dirt and contaminants while working on and connecting the hydraulic lines.

The attitude in which the actuator is installed does not affect the performance of the actuator.

Connect all hydraulic lines to the actuator. Supply pressure for the TM-25LP or TM-200LP actuator can be from either positive displacement or centrifugal type pumps. Woodward recommends the use of a pressure switch to be sure that correct supply pressure is established before start-up and maintained continually thereafter.

It is very important that the linkage between the actuator output and the fuel system be of correct relationship for proper operation. Use as much of the 25 mm (1 inch) output travel as possible between minimum and maximum flow points.

Use the correct Woodward control manual when making all electrical connections. A plant wiring diagram will be supplied upon request. In applications where the actuator is not used with a Woodward electric control, electrical input requirements will also be supplied upon request.



NOTE

The TM-25LP and TM-200LP 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 2 classified atmosphere.

**CAUTION—TORQUE MOTOR**

Each torque motor must be provided with a 900 mA maximum fuse to be installed before the torque motor. Voltage to the torque motor must be limited to a nominal voltage of 30 V with a switch-off voltage of 480 V.

**CAUTION—WIRING**

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

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 2-3 & 2-4).

Supply Characteristics

TM-25LP

Fluid Types:	Mineral or synthetic based oils, diesel fuels, kerosenes, gasolines, or light distillate fuels
Specific Gravity:	0.6 to 1.0
Recommended Viscosity:	0.6 to 400 centistokes 150–200 SSU ISO 32 Grade
External Filter:	10 µm nominal
Supply Pressure:	Any nominal level between 552 and 2586 kPa (80 and 375 psig)
Ambient Temperature Range:	–40 to +121 °C (–40 to +250 °F)
Hydraulic Fluid Temperature Range:	16 to 79 °C (60 to 175 °F)
Hydraulic Cleanliness Level	ISO 4406 20/18/15 minimum

TM-200LP

Fluid Types:	Mineral or synthetic based oils, diesel fuels, kerosenes, gasolines, or light distillate fuels
Specific Gravity:	0.6 to 1.0
Recommended Viscosity:	0.6 to 400 centistokes 150–200 SSU ISO 32 Grade
External Filter:	10 µm nominal
Supply Pressure:	Any nominal level between 2758 and 8274 kPa (400 and 1200 psig)
Ambient Temperature Range:	–40 to +121 °C (–40 to +250 °F)
Hydraulic Fluid Temperature Range:	16 to 79 °C (60 to 175 °F)
Hydraulic Cleanliness Level	ISO 4406 20/18/15 minimum

Flow Requirements

TM-25LP

Supply Pressure	Steady State Flow	Max. Transient Flow	Rated Max. Work
Single Coil or Dual Coil			
552 kPa 80 psig	3.8 L/min 1.0 US gal/min	18.9 L/min 5.0 US gal/min	15 J 11 ft-lb
2586 kPa 375 psig	3.8 L/min 1.0 US gal/min	18.9 L/min 5.0 US gal/min	72 J 53 ft-lb

TM-200LP

Supply Pressure	Steady State Flow	Max. Transient Flow	Rated Max. Work
Single Coil or Dual Coil			
2758 kPa 400 psig	3.8 L/min 1.0 US gal/min	18.9 L/min 5.0 US gal/min	76 J 56 ft-lb
8274 kPa 1200 psig	3.8 L/min 1.0 US gal/min	18.9 L/min 5.0 US gal/min	231 J 170 ft-lb

Electrical Characteristics

TM-25LP

Input Current Range: 20 to 200 mA
 Coil Resistance: 26 Ω at 21 °C (70 °F) single coil, 40 Ω dual coil
 Maximum Coil Current: 250 mA

TM-200LP

Input Current Range: 20 to 200 mA
 Coil Resistance: 26 Ω at 21 °C (70 °F) single coil, 40 Ω dual coil
 Maximum Coil Current: 250 mA

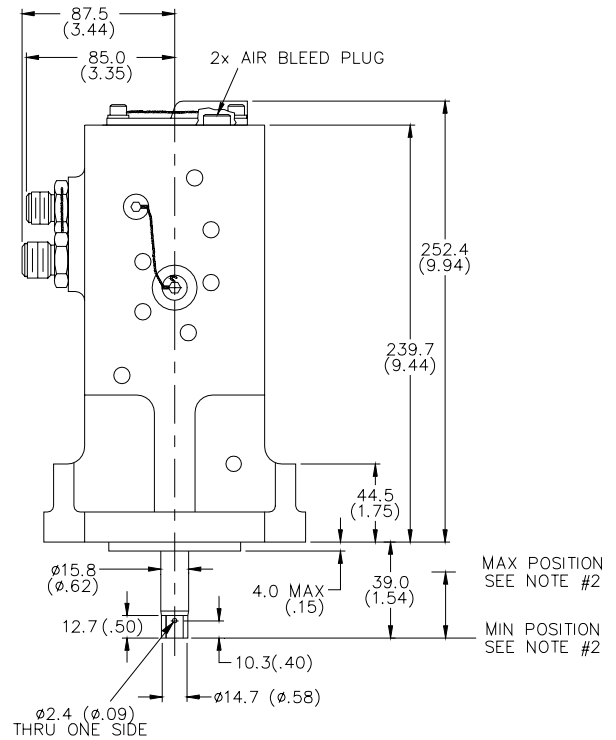
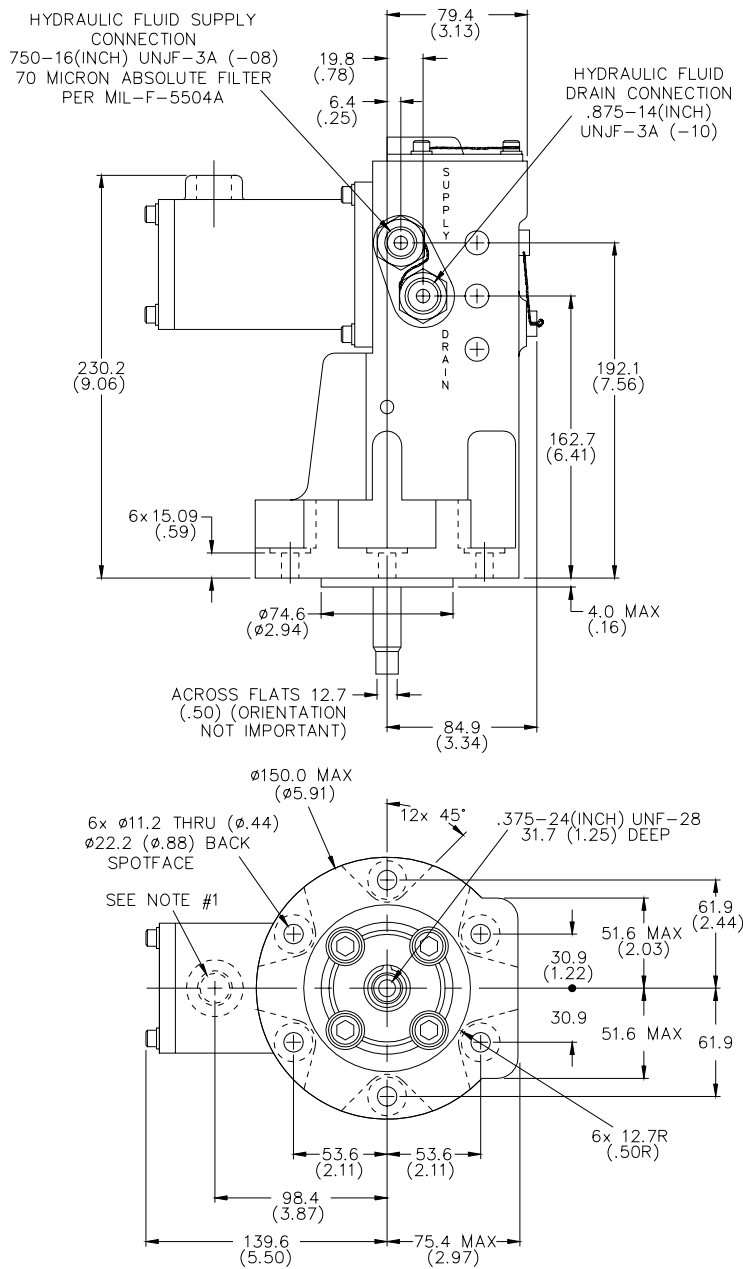
Output Characteristics

TM-25LP

Linear Stroke: 25 mm (1.0 inch)
 Output Force: 605 N (136 lb) maximum at 552 kPa (80 psig)
 2833 N (637 lb) maximum at 2586 kPa (375 psig) (both directions)

TM-200LP

Linear Stroke: 25 mm (1.0 inch)
 Output Force: 3025 N (680 lb) maximum at 2758 kPa (400 psig)
 9074 N (2040 lb) maximum at 8274 kPa (1200 psig) (both directions)



NOTES:

1. 0.500-14 (INCH) NPTF RIGID CONDUIT CONNECTION. ACTUATOR ELECTRIC INPUT SIGNAL, 18 AWG WIRE (2) EXTENDS APPROX 914 MM FROM OPENING.
2. 25 MM STROKE AVAILABLE. RECOMMENDED STROKE BETWEEN NO LOAD AND FULL LOAD IS 17.
3. PISTON RETRACTS TOWARD MAX POSITION WITH CURRENT INCREASE.
4. INCHES SHOWN IN PARENTHESIS.

METRIC

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05-12-15

Figure 2-1. TM-25LP/TM-200LP Actuator (New Style)

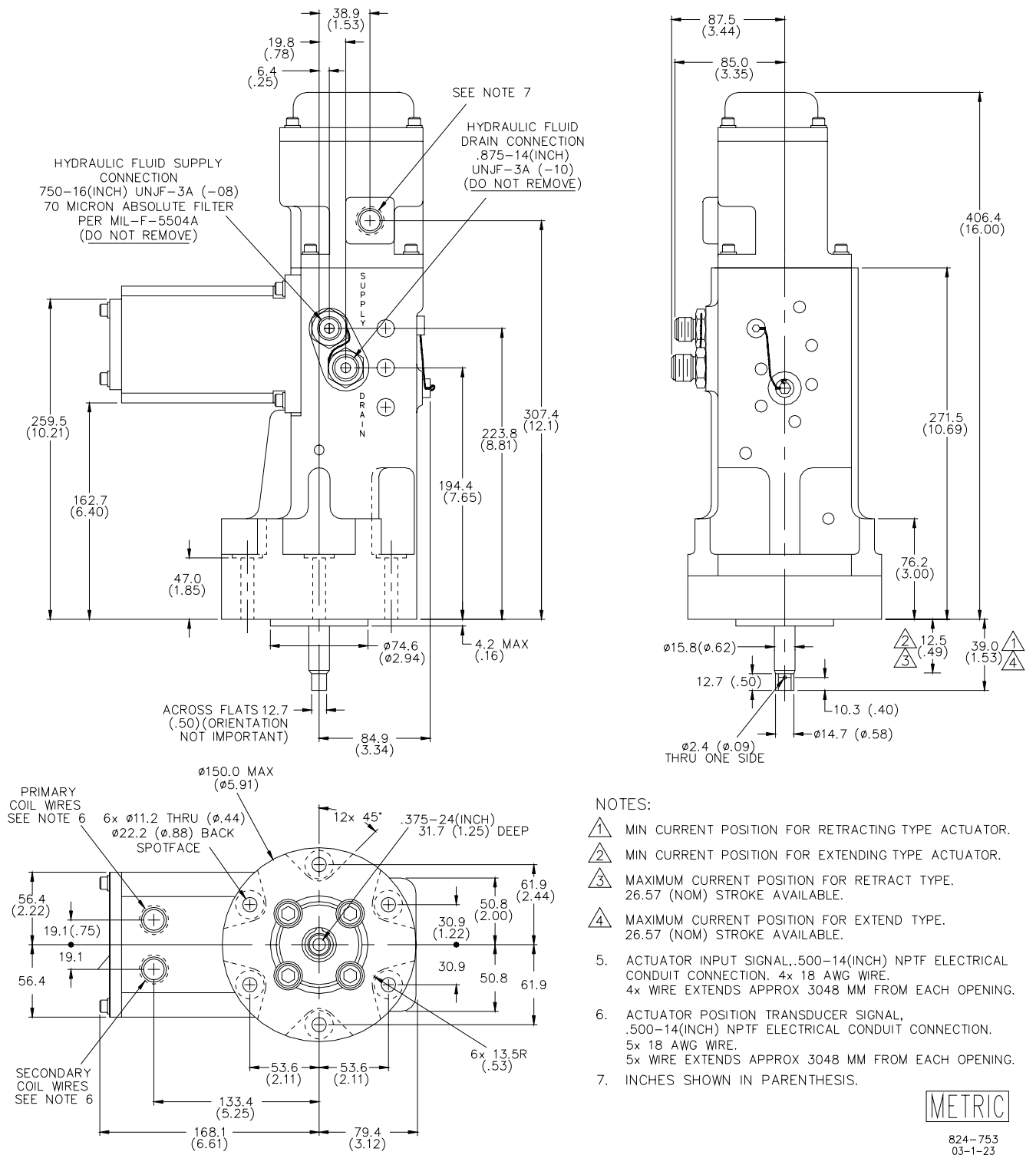


Figure 2-2. Dual Coil TM-25LP/TM-200LP Actuator with Position Feedback

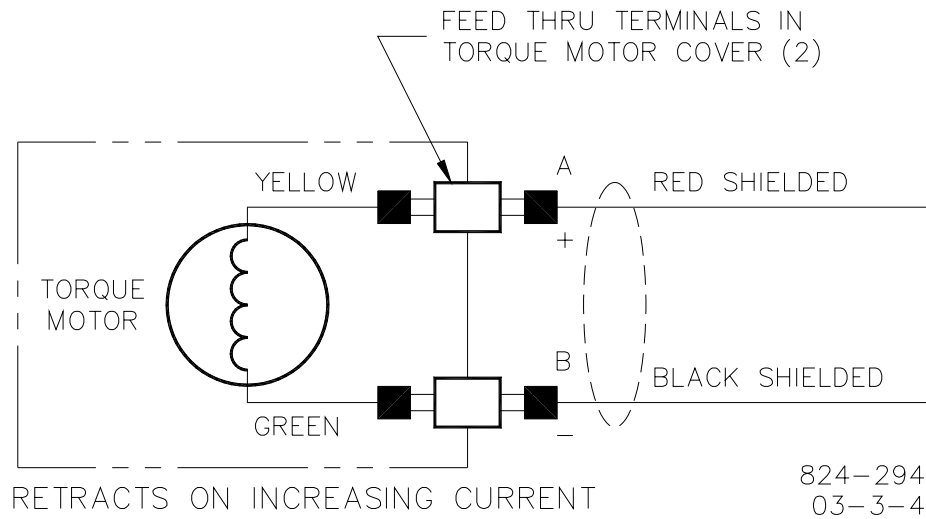
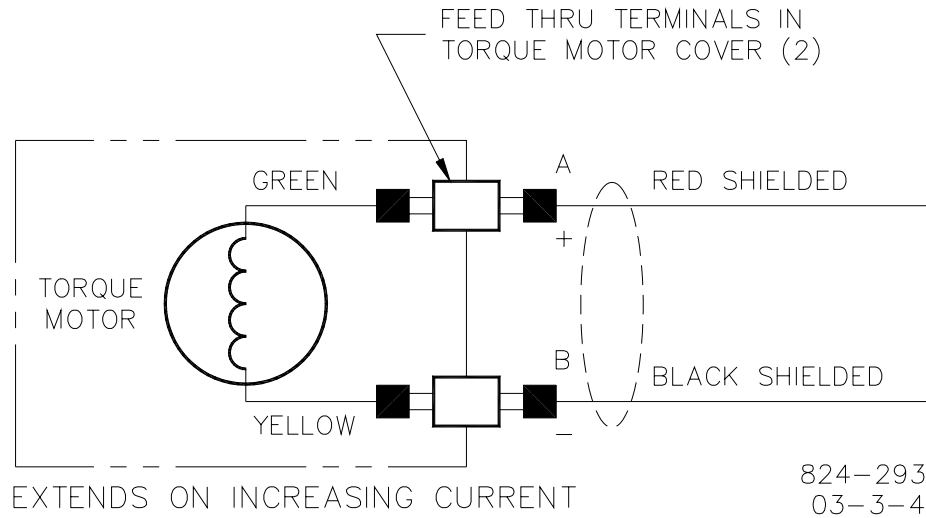
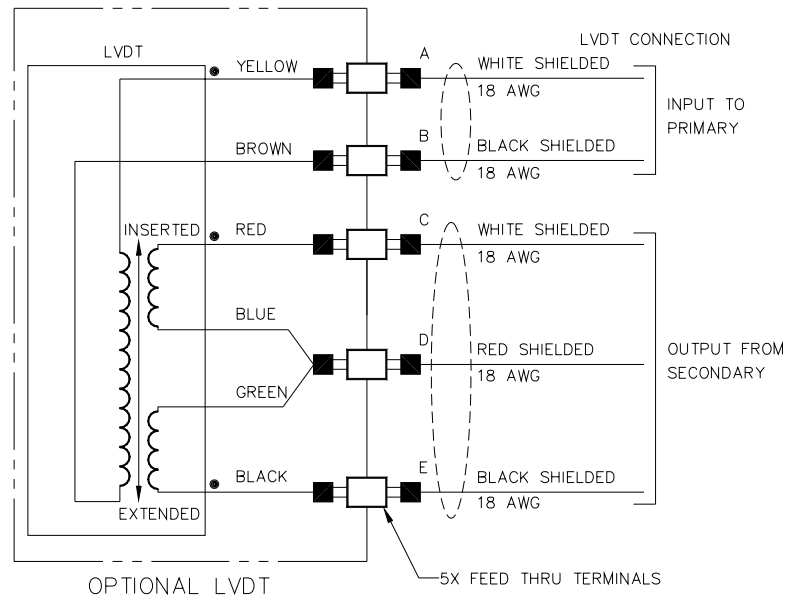
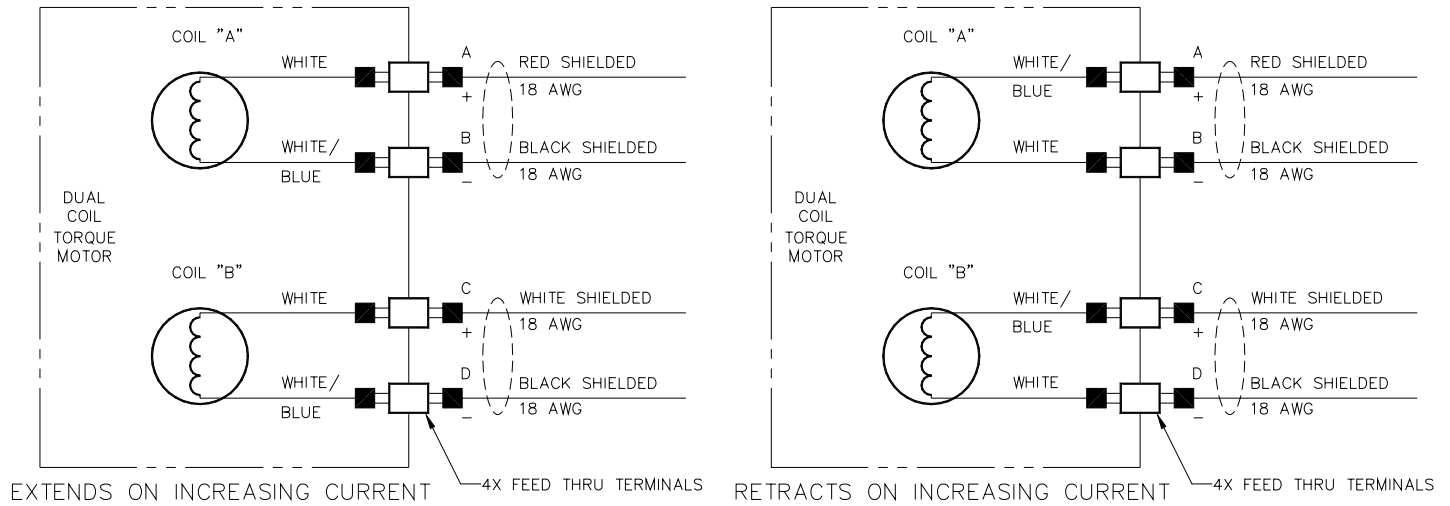


Figure 2-3. Single Coil Wiring
(Shields to be grounded at electronic control end only)



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06-6-20

Figure 2-4. Dual Coil Wiring
(Shields to be grounded at electronic control end only)

Chapter 3.

Initial Operation of the Actuator

Initial Operation

Before the initial operation of the actuator, be sure that all previous installation and hookup procedures are accomplished and all linkages (if any), electrical connections, and hydraulic fittings are secure and properly connected.

Be sure that the correct hydraulic supply pressure to the actuator is established before start-up. Trapped air within the hydraulic system may cause momentary erratic behavior of the actuator at the initial operation. Use the correct Woodward manual for the Woodward electric control to begin prime mover operation.

Null current shifts of up to $\pm 4\%$ of maximum rated current (200 mA) can occur due to variations in the following parameters:

- hydraulic supply and return pressures
- hydraulic fluid temperature
- servovalve and actuator wear

Due to the inherent null shifts and position drift of all hydraulic servovalves and proportional actuators, engine control applications must be designed with these errors in mind.

Woodward recommends that adequate dither be used on all hydraulic actuators to minimize mA threshold and hysteresis which can result from second stage static friction or hydraulic contamination.

Dither is a low amplitude, relatively high frequency periodic signal that is superimposed on the servovalve input current signal. A typical dither signal generated by a Woodward control is:

- 25 Hz, 0–10 mA (tunable) amplitude
- 25% duty cycle, bipolar, square wave

Adequate dither is defined as that amount which produces no more than 0.013 mm (0.0005 inch) total oscillation in output shaft position.



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.

Adjustments

Normally, all operating adjustments are made to the actuator during factory calibration according to specifications provided by the customer and should not require further adjustment. Do not attempt adjustments to the actuator unless thoroughly familiar with the proper procedures.

Chapter 4.

Principles of Operation

Introduction

This chapter describes the operation of TM-25LP and TM-200LP actuators. A schematic drawing, Figure 4-1, illustrates the working relationship of the various parts.

Operation

The actuator consists of three basic sections:

- a torque motor servovalve
- a spring-centered, four-land spool valve
- a double-sided, equal-area servo piston with a linear output shaft

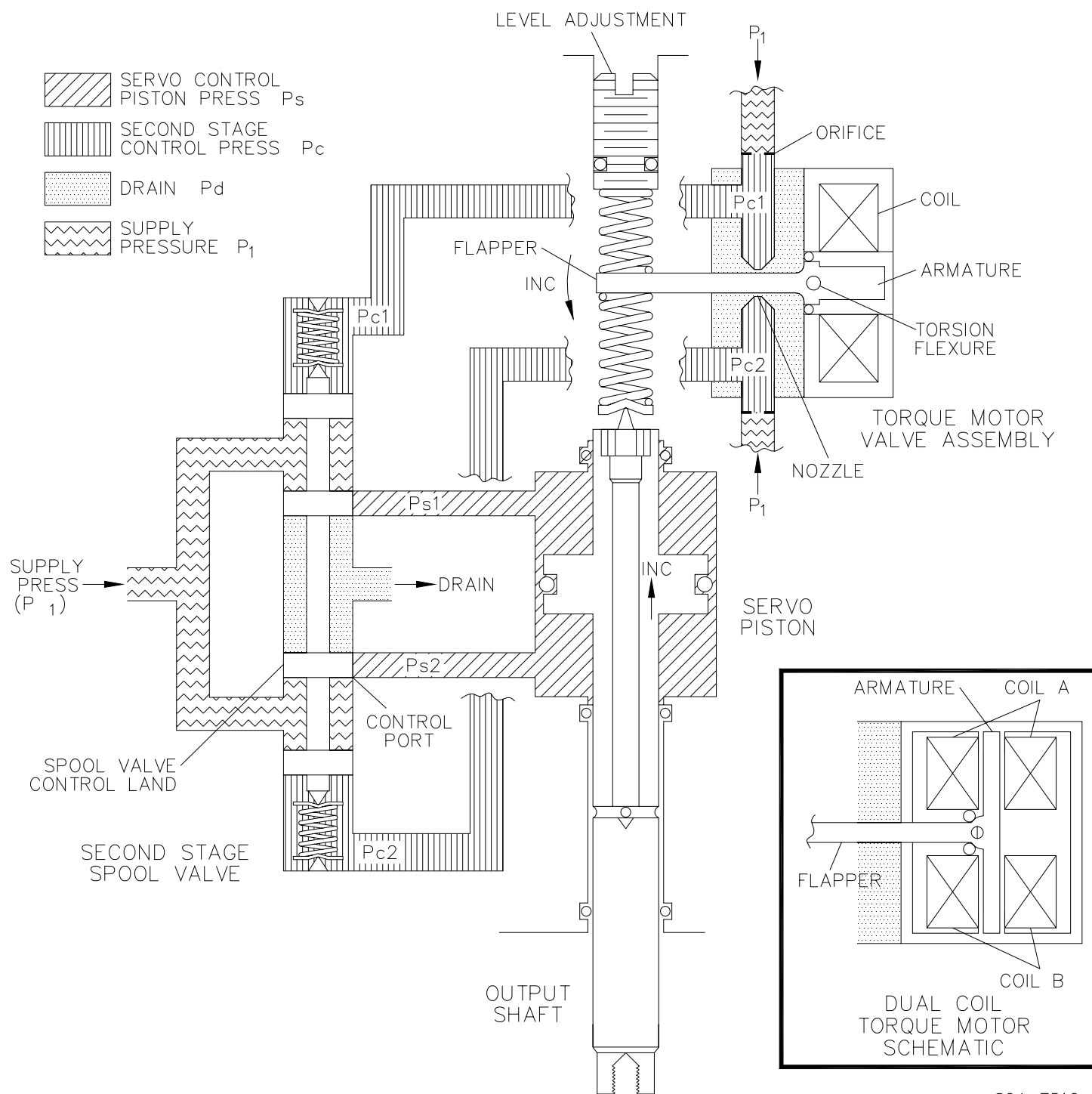
The TM-25LP and TM-200LP actuators have torque motor servovalves. They use a double nozzle and flapper to generate a differential pressure to operate the second-stage spool valve. The torque motor received dc current signals from the electric control and applies torque to the single-piece armature and flapper which is supported on a torsion flexure. The servovalve uses the flapper as a variable flow restrictor and throttles the flow of hydraulic fluid from a nozzle on each side of the flapper. The two nozzles are supplied hydraulic fluid from the actuator supply pressure inlet via separate fixed orifices. During steady state operation, the flapper is centered between the nozzles and the two pressures, P_{c1} and P_{c2} , are equal.

When input current is increased to the torque motor coil, the limited pivotal movement of the flapper to increase (counterclockwise on the schematic) restricts hydraulic flow from the lower nozzle while flow from the upper nozzle increases. The resulting differential pressure is applied to the ends of the spool valve, raising it from its spring-centered null position.

When raised, the spool valve directs supply pressure to the bottom side of the servo piston and, at the same time, vents the top side to drain at the upper control port. the servo piston then moves up, increasing actuator output shaft position. Servo piston movement also provides position feedback to the servovalve.

An extension of the flapper is held between the feedback spring and level adjusting spring. Increasing servo piston movement increases the feedback spring torque on the flapper to re-center it. When a force balance is obtained among the torque motor, level adjusting spring, and the feedback spring, the spool valve is re-centered and further servo movement is halted.

Operation of the actuator is similar in the decrease direction. Movement of the flapper restricts flow from the upper nozzle, while increasing flow of the lower nozzle. the pressure differential this time lowers the spool valve and uncovers ports to direct supply pressure to decrease actuator output position. the re-centering action is provided as servo piston movement decreases compression of the lower spring, re-centering the flapper.



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99-06-30

Figure 4-1. Single/Dual Coil Schematic, TM-25LP/TM-200LP Actuator

Chapter 5. Maintenance

Introduction

**WARNING—EXPLOSION HAZARD**

Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.

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

**AVERTISSEMENT—RISQUE D'EXPLOSION**

Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous vous situez bien dans une zone non explosive.

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

This chapter provides instructions for troubleshooting and preventive maintenance of the TM-25LP and TM-200LP actuators.

The service life of the actuator is increased with the use of clean supply flow. However, contaminant resistance of the actuator is excellent due to design features and high working forces.

Filter Cleaning

The actuators are equipped with a 40 µm nominal/ 70 µm absolute filter fitting at the supply connection. See the outline drawing (Figure 2-1) for the location of the fitting. If the filter becomes clogged, as evidenced by sluggish response of the actuator, it may be removed, cleaned ultrasonically, and back flushed with a light solvent. Be prepared to replace the O-ring (part 80, Figure 6-1) after cleaning the filter (part 79, Figure 6-1).

**CAUTION—FILTER REQUIRED**

Do not run the actuator with the inlet filter fitting or the in-line filter removed or bypassed, as extensive repairs can be made necessary by only momentary exposure of the interior of the torque motor to contaminants.

Troubleshooting

Malfunctions of the governing system are usually revealed as speed variations of the prime mover, but it does not necessarily mean that such speed variations indicate governing system problems. When improper speed variations appear, inspect all components, including the turbine, for proper operation. See the correct Woodward manual for assistance in isolating the trouble.

The following steps describe troubleshooting the actuator:

1. If, during the starting sequence, the actuator does not respond to electric control input, check the actuator pressure supply and supply link.
2. If the actuator does not respond to electric input, disconnect the output linkage and attach a power supply and millimeter. Increase current to the actuator, and the output should follow smoothly with increasing current. DO NOT exceed 250 mA.

Disassembly of the actuator in the field is not recommended. Under unusual circumstances where field repair becomes necessary, all work and calibration should be done by personnel thoroughly trained in the proper procedures.

Refer to Chapter 7 for instructions on contacting a Woodward Service Representative or for training on this product.

When requesting information or service help from Woodward, it is important to include in your communication the part number and serial number of the actuator.

Chapter 6. Replacement Parts

Introduction

This chapter provides information for ordering replacement parts for the TM-25LP and TM-200LP actuators.

Disassembly of the actuator in the field is not recommended. Under unusual circumstances where field repair becomes necessary, all work and calibration should be done by personnel thoroughly trained in the proper procedures.

Refer to Chapter 7 for instructions on contacting a Woodward Service Representative or for training on this product.

When requesting information or service help from Woodward, it is important to include in your communication the part number and serial number of the actuator.

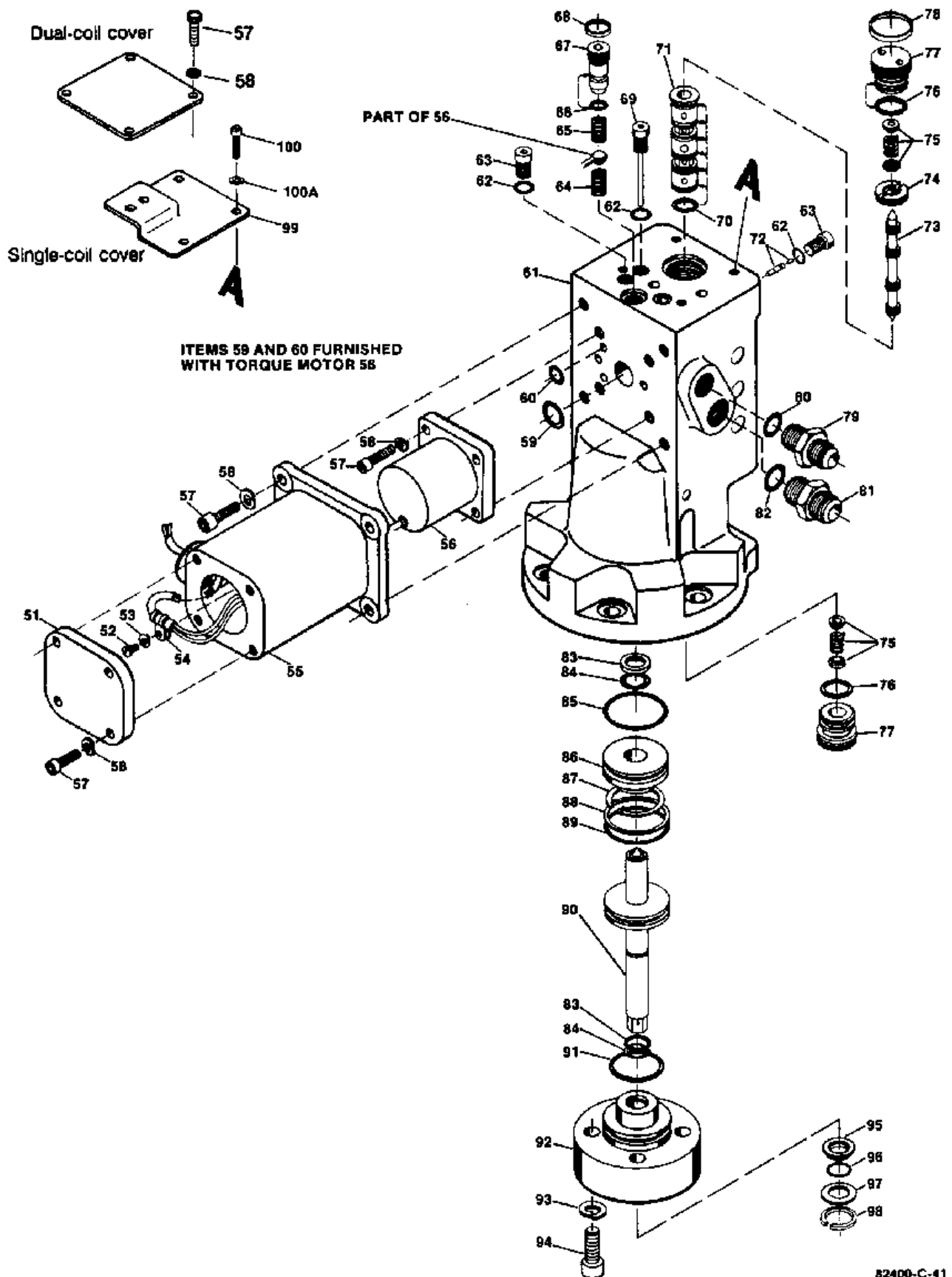
Replacement Parts Information

When ordering replacement parts, it is essential to include the following information:

- Serial number and part number shown on the nameplate of the actuator
- Manual number 82450
- Part reference numbers in parts list and description of part and part name

Figure 6-1 illustrates the parts for the actuator. The part numbers assigned are used as reference only and are not specific Woodward part numbers.

REF. NO.	PART NAME.....	QTY.
82450-51	Cover	1
82450-52	Screw, 6-32 x 0.250	
	—single coil.....	1
	—dual coil	2
82450-53	Washer, #6 lock washer	
	—single coil.....	1
	—dual coil	2
82450-54	Wire clamp	
	—single coil.....	1
	—dual coil	2
82450-55	Housing assembly.....	1
82450-56	Torque motor	1
82450-57	Screw, 0.250-20 x 1.000	
	—single coil.....	8
	—dual coil	12
82450-58	Washer, 0.250 lock washer	
	—single coil.....	8
	—dual coil	12
82450-59	O-ring; furnished with torque motor.....	
82450-60	O-ring; furnished with torque motor.....	
82450-61	Actuator body assembly.....	1
82450-62	Preformed packing, 0.351 x 0.072 (single coil only).....	3
82450-63	Plug, 0.438-20 (single coil only)	1-3
82450-64	Feedback spring assembly	1
82450-65	Trim spring	1
82450-66	Preformed packing (single coil only)	1
82450-67	Spring seat assembly, 0.299 ID x 0.103 (separate plug and spring seat on dual coil)	1
82450-68	Plug (single coil only)	1
82450-69	Plug assembly, 0.438-20 (single coil only)	1
82450-70	Preformed packing, 0.551 x 0.071	1
82450-71	Pilot valve bushing	1
82450-73	Pilot valve plunger.....	1
82450-74	Retainer assembly	1
82450-75	Spring assembly.....	1
82450-76	Preformed packing, /737 ID	1
82450-77	Spring support assembly.....	1
82450-78	Expansion plug	1
82450-79	Filter fitting, 0.750-16	1
82450-80	Preformed packing, 0.644 ID x 0.087	1
82450-81	Connector assembly, 0.875-14 UNF	1
82450-82	Preformed packing, 0.755 ID x 0.097	1
82450-83	Step seal	2
82450-84	Preformed packing, 0.636 ID x 0.070	2
82450-85	Preformed packing, 1.487 ID x 0.031	1
82450-86	Piston guide	1
82450-87	Retaining ring, 1.942.....	1
82450-88	Seal, 1.750 OD	1
82450-89	Preformed packing, 1.296 ID x 0.139.....	1
82450-90	Piston assembly.....	1
82450-91	Preformed packing, 1.612 ID x 0.031	1
82450-92	Cover assembly	1
82450-93	Washer, 0.375 split lock.....	4
82450-94	Screw, 0.375-24 x 1.250	4
82450-95	Rod and seal	1
82450-96	Preformed packing, 0.674 ID x 0.103.....	1
82450-97	Seal retainer.....	1
82450-98	Retaining ring, 1.111 dia	1
82450-99	Cover (see both views)	1
82450-100	1/4-28 Drilled socket head cap screw (single coil only)	3
82450-100a	Flat washers (single coil only)	3



82400-C-41

Figure 6-1. TM-200LP Exploded View

Chapter 7.

Service Options

Product Service Options

The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed:

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

If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see “How to Contact Woodward” later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

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 also a flat rate structured program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call 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 Woodward facility as explained below (see “Returning Equipment for Repair” later in this chapter).

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 to Woodward within 60 days, Woodward will issue a credit for the core charge. [The core charge is the average difference between the flat rate replacement/exchange charge and the current list price of a new unit.]

Return Shipment Authorization Label. To ensure prompt receipt of the core, and avoid additional charges, the package must be properly marked. A return authorization label is included with every Replacement/Exchange unit that leaves Woodward. The core should be repackaged and the return authorization label affixed to the outside of the package. Without the authorization label, receipt of the returned core could be delayed and cause additional charges to be applied.

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 to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the item(s), attach a tag with the following information:

- 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.



CAUTION—ELECTROSTATIC DISCHARGE

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*.

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.

Return Authorization Number

When returning equipment to Woodward, please telephone and ask for the Customer Service Department [1 (800) 523-2831 in North America or +1 (970) 482-5811]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the item(s) to be repaired. No work can be started until a purchase order is received.



NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at 1 (800) 523-2831 in North America or +1 (970) 482-5811 for instructions and for a Return Authorization Number.

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.

How to Contact Woodward

In North America use the following address when shipping or corresponding:

Woodward Governor Company
PO Box 1519
1000 East Drake Rd
Fort Collins CO 80522-1519, USA

Telephone—+1 (970) 482-5811 (24 hours a day)
Toll-free Phone (in North America)—1 (800) 523-2831
Fax—+1 (970) 498-3058

For assistance outside North America, call one of the following international 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.

<u>Facility</u>	<u>Phone Number</u>
Brazil	+55 (19) 3708 4800
India	+91 (129) 4097100
Japan	+81 (476) 93-4661
The Netherlands	+31 (23) 5661111

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (www.woodward.com) for the name of your nearest Woodward distributor or service facility.

Engineering Services

Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Contact information:

Telephone—+1 (970) 482-5811

Toll-free Phone (in North America)—1 (800) 523-2831

Email—icinfo@woodward.com

Website—www.woodward.com

Technical Support is available through our many worldwide locations or our authorized distributors, depending upon the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical support, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

Product Training is available at many of our worldwide locations (standard classes). 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. For information concerning training, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Product Training**.

Field Service engineering on-site support is available, depending on the product and location, from one of our many worldwide locations or from one of our authorized 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 field service engineering assistance, please contact us via telephone, email us, or use our website and reference **Customer Services** and then **Technical Support**.

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:

General

Your Name _____
Site Location _____
Phone Number _____
Fax Number _____

Prime Mover Information

Engine/Turbine Model Number _____
Manufacturer _____
Number of Cylinders (if applicable) _____
Type of Fuel (gas, gaseous, steam, etc) _____
Rating _____
Application _____

Control/Governor Information

Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

Woodward Part Number and Revision Letter _____

Control Description or Governor Type _____

Serial Number _____

Woodward Part Number and Revision 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.

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): TM25 and TM55 Actuators
9905-532, 9908-325 and similar

Conformance to Directive(s): 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): CE,  II 2 G, EEx e II T3

Applicable Standards: EN 50014 (1997) + amendments 1 and 2: Electrical apparatus for potentially explosive atmospheres - General requirements
EN 50019 (2000): Electrical apparatus for potentially explosive atmospheres - Increased safety 'e'

3rd Party Product Certification: LCIE 02 ATEX 6221 X

Conformity Assessment: ATEX Production Quality Assessment, ITS05ATEXQ4211

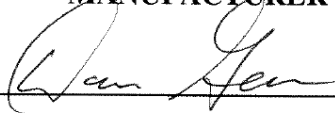
Notified Body Intertek (0359)

For ATEX: Intertek House, Cleeve Road
Leatherhead, Surrey, KT22 7SB UK

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

MANUFACTURER

Signature



Dan Gear

Full Name

Engineering Manager

Position

WGC, Fort Collins, CO, USA

Place

Date

12/5/05

Declaration of Incorporation

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

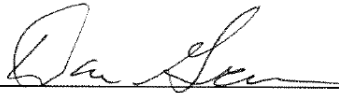
Product: TM25 and TM 55 Actuators
Part Number: 9905-352, 9908-325 and similar

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/EC (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

Dan Gear

Full Name

Engineering Manager

Position

WGC, Fort Collins, CO, USA

Place

12/5/05

Date

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please include the manual number from the front cover of this publication.



PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.