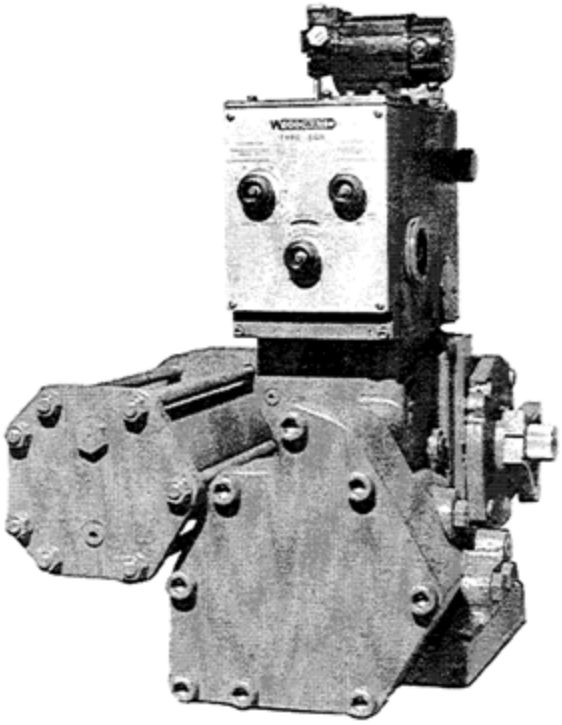
WOODWARD

Product Manual 37740
(Revision NEW)
Original Instructions



EGB-500P (Proportional) Governor/Actuator

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

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

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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 Out-of-date translations are marked with ⚠.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.

Contents

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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.

Chapter 1.
General Information

Description

This manual describes the EGB-500P case, accumulator, and power cylinder operation. The EGB-500 consists of an EGB-2P governor/actuator and a 500 foot-pound (678 J) hydraulic amplifier. Refer to manual 82570 (EGB-2P) for details on operation, setup, and maintenance of the EGB-2P actuator and governor.

The EGB Governor is an electrically controlled actuator with proportional output and an integral backup mechanical (centrifugal) governor. It is normally used with a Woodward 2301A integrating electric control unit to form a complete governing system. A proportional-actuator output shaft assumes a position in direct proportion to the magnitude of the input signal to the actuator, as determined by the fuel required to maintain the desired engine speed under varying loads.

The EGB-500P is in effect, two governors in one:

- An electric actuator which provides governor function in combination with an electronic control signal
- A mechanical governor

Each governor is capable of positioning the output shaft. During normal operation, the electric governor controls fuel or steam to the prime mover. The mechanical governor is used as a "backup" governor to prevent an overspeed should the electric control fail in such a manner as to call for maximum fuel or steam. The speed of the mechanical governor is set about five percent higher than the electric governor. Should engine speed reach the level of the mechanical governor, this section will assume and maintain control of the prime mover. Speed can be reduced, if desired by lowering the speed setting of the mechanical governor.

The EGB-500P can be factory equipped with a governor which will move to maximum on loss of the electronic control signal. This reverse-acting governor will provide mechanical governor control rather than shutdown, should the electronics fail and call for minimum actuator signal.

⚠WARNING

The engine must be equipped with an overspeed shutdown device that is completely separate from the EGB-500 governor or the electronic control. Do not depend on the mechanical governor side of the EGB for overspeed protection. A system failure that caused the loss of governor control and an overspeed condition could also leave the governor incapable of preventing an overspeed. Overspeed can cause massive physical damage to the engine and the driven load, and personal injury or even death.

IMPORTANT

The mechanical governor will not be able to maintain the exact speed that was held by the electronic control. Mechanical considerations in the governor require that the ballhead speed reference be higher than the electronic speed reference. Should the electronics fail in the maximum speed direction the ballhead governor will operate the engine at a speed at least 5 percent higher than did the electronic control.

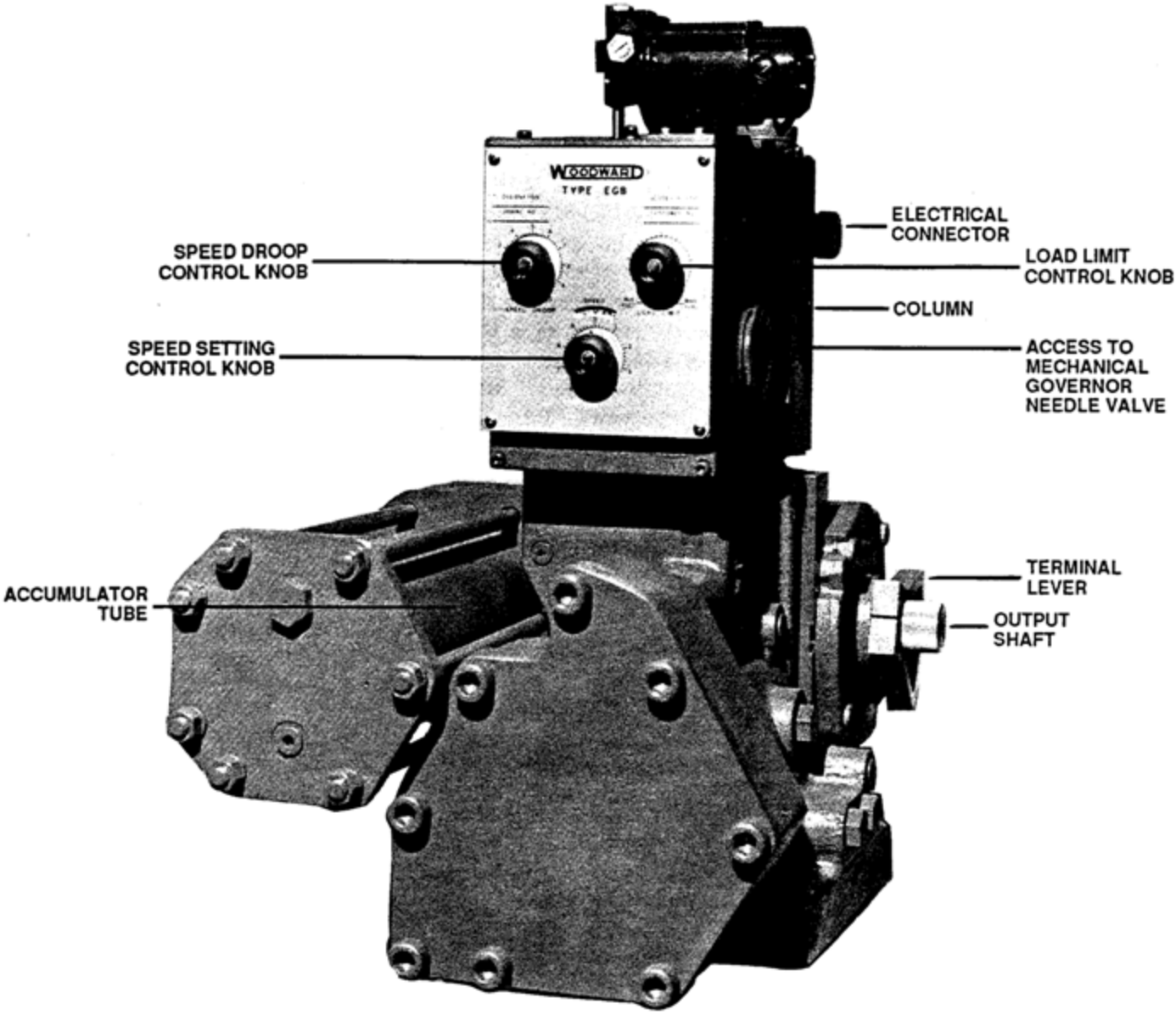

Figure 1-1. Front View of the EGB-500 Governor/Actuator

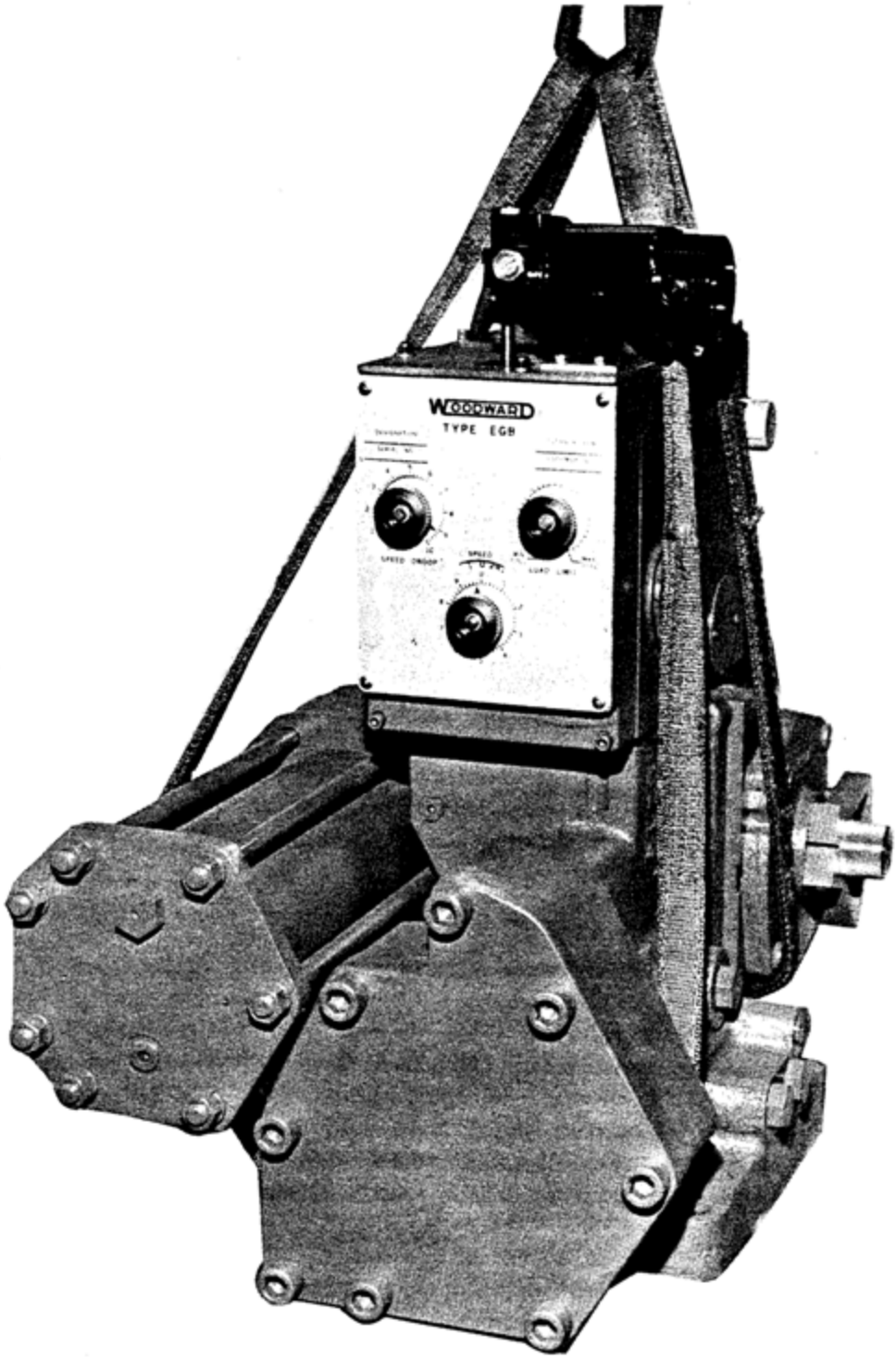

Figure 1-2. Lifting Sling for the EGB-500P Governor/Actuator
(Unit weighs about 500 pounds (227 kg), depending on auxiliary equipment)

Operating Units

For convenience of description the EGB-500P can be divided into three main sections:

- The uppermost actuating section
- The center intermediate relay section
- The lower power output section

Refer to schematic Figure 4-1.

Actuating Section

The electric actuator is controlled through a solenoid which drives the pilot-valve plunger (upper right of Figure 4-1). The pilot valve controls pressure oil to the electric actuator power piston which controls the loading piston.

The mechanical governor side of the actuating section operates as a backup governing system to prevent overspeed under certain types of electric control failure and as a start up governor control. The mechanical governor pilot valve is driven by the flyweights and speeder spring (upper left of Figure 4-1). Oil flow from the mechanical governor pilot valve moves the mechanical governor power piston and likewise the loading piston.

The two actuators have independent servos, attached to the floating lever which positions the loading piston. They form a low-signal selector so the actuator with the lowest output always controls.

Intermediate Relay Section

The output from the loading piston operates an intermediate relay pilot valve plunger that controls the location of the intermediate relay servo piston. Position feedback causes the intermediate relay servo piston to assume a position proportional to the actuator output.

Power Output Section

Linkage from the intermediate relay servo piston moves a large relay pilot valve which controls the flow of pressure oil to the main output servo. Position feedback from this servo to the relay pilot valve causes the servo to assume a position proportional to the intermediate relay servo piston, and consequently to the EGB sub-governor output. The engine or turbine fuel linkage attaches to the EGB-500P output shaft.

Hydraulic Oil

Pressure oil is supplied by an integral pump and accumulator for the amplifier section of the actuator. A pressure reducing valve supplies oil at a reduced pressure to the intermediate relay pilot valve and piston. The EGB sub-governor has its own pump which is supplied from the main oil sump.

References

The Woodward product literature listed contains addition information for parts associated with the EGB-500P. These publications are available on the Woodward website (www.woodward.com).

Publication	
25071	Oils for Hydraulic Controls
25075	Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls
36641	Governor Oil Heat Exchanger
36684	Booster Servomotor
82340	EGB Proportional Governor/Actuator
82570	EGB-1P-2P Governor/Actuator

WARNING

Overcurrent to the actuator (12 volts or more applied to actuator terminals) can cause a calibration shift of the actuator toward maximum fuel. The calibration shift can cause engine overspeed and resulting damage to the engine and possible personal injury or loss of life. SHOULD AN OVERCURRENT OCCUR, EVEN WHILE THE ENGINE IS SHUT DOWN, DO NOT USE THE ACTUATOR UNTIL IT HAS BEEN TESTED OFF THE ENGINE TO THE ACTUATOR SPECIFICATIONS.

Accessories

The optional accessories listed here may be used with an EGB-500P to provide special starting or operating features.

EGB Governor Heat Exchanger (remote only)

The heat exchanger is used to lower governor oil temperature when the governor operates in a high ambient temperature. It should be used whenever the temperature of the oil goes above 200 °F (93 °C) maximum operating temperature. When a governor heat exchanger is needed it can be added without change or conversion the EGB-500P.

Booster Servomotor

The booster servomotor may be used with the governor to help the engine start quickly by moving the governor output toward the maximum fuel position before cranking starts. A high volume booster with a 3:1 pressure ratio is needed when used with an EGB-500P.

Speed Setting Motor

The speed-setting motor permits changes in the speed setting of the mechanical governor section to be made from a remote location. The motor is mounted externally on top of the actuator (see Figure 1-3) with its output shaft connected to the manual speed-adjusting screw through a friction clutch. The clutch allows speed-setting changes to be made either remotely or at the actuator via the manual speed-setting control knob. Limit switches can be actuated by the dial stops on the manual speed-adjusting mechanism and may be connected to limit the travel of the speed-setting motor at the desired minimum or maximum speed. Refer to Woodward manual 03505 for maintenance and parts information.

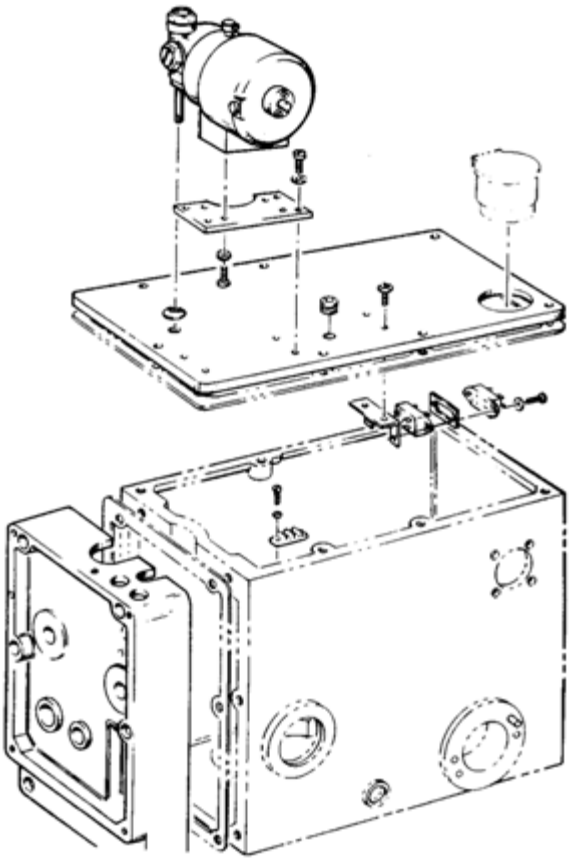

Figure 1-3. Speed Setting Motor

Shutdown Solenoid

The shutdown solenoid is used in applications where automatic shutdown of the engine is desired in the event of loss of lubricator oil pressure, excessive operating temperatures, loss of vacuum, etc. The solenoid is mounted internally within the actuator column (see Figure 1-4). It is hydraulically connected to the upper side of the dashpot land on the relay-valve plunger in the hydraulic-amplifier section. When the solenoid is energized, oil pressure on the upper side of the dashpot land is dumped. This allows the oil pressure acting on the under side of the dashpot land to raise the relay-valve plunger which, in turn, dumps the trapped oil under the power piston. The oil pressure acting on top of the power piston then forces the piston to move to the shut-down or minimum-fuel position.

⚠WARNING

The shutdown solenoid must NOT be used for OVERSPEED SHUTDOWN. Use only to shut down from low-oil pressure, high oil or water temperatures, etc. To avoid possible overspeed and resulting physical damage, personal injury, or death install an emergency shutdown that is completely separate from the EGB-500P so that shutdown will occur even if the entire governor system becomes inoperable.

The shutdown solenoid can and should be used for normal shutdown of the engine. Use of the solenoid for this purpose provides a relatively constant test that the solenoid is capable of providing the engine protection for which it was installed.

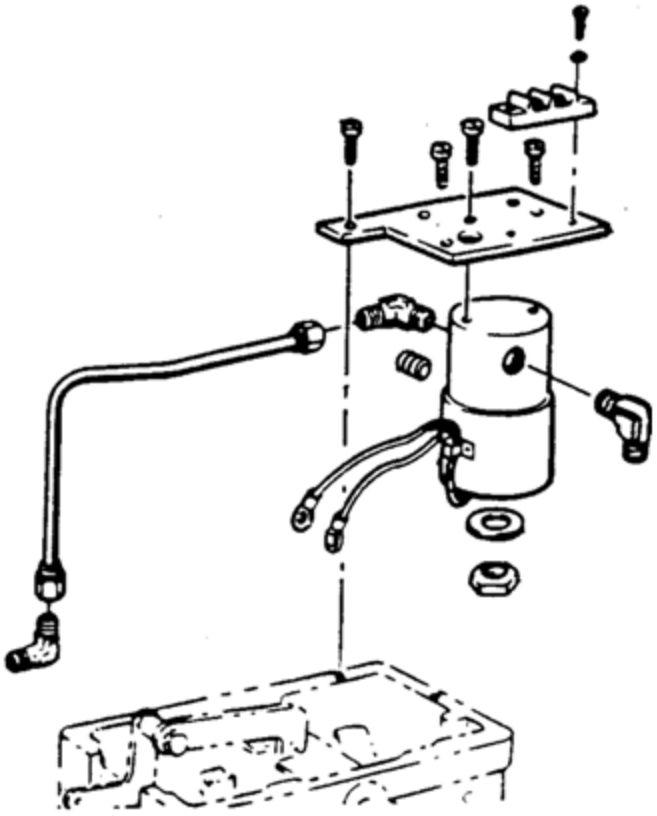

Figure 1-4. Shutdown Solenoid

Starting Devices

Installations which lack an electric signal when the engine is not running may be fitted with a starting device, either manual or pneumatic. The starting device is a plunger with a spring return. It is mounted in the governor cover directly over the actuator pilot-valve plunger. When the starting plunger is pushed down on the actuator pilot-valve plunger the oil pressure generated at cranking speed will cause the terminal shaft to move in the increase direction so the engine will start under control of the mechanical governor side of the EGB-500P. After the engine is running and electrical power to the governor system is available the starting device is released and the electrical control will take over engine operation at a speed lower than the ballhead control.

Starting devices are available for either manual or pneumatic actuation. The pneumatic starting device is designed for use with air pressures of 100 to 240 psi (690 to 1655 kPa).

Starting devices are not needed on reverse acting units.

Mode Switch

A mode switch may be installed on the EGB-500 to provide a visual indication of whether the electrical actuator or the mechanical governor is controlling. The installation consists of a microswitch actuated by the mechanical governor side of the control when the mechanical side is inactive. The switch assembly is mounted on top of the sub-governor case.

Spring Driven, Oil Damped Ballhead

A spring driven, oil damped flyweight head is available for use in the EGB-500P where it is necessary to dampen undesirable torsional vibrations transmitted through or from the engine accessory drive to the speed-sensing flyweight head of the mechanical governor.

⚠WARNING

It is important to regularly check the high-speed stop on the speed-setting knob. The operation of the electrical actuator will not be affected should this setting be changed to a higher speed. Should the speed-setting knob be changed to a higher speed, and should the electric actuator or electronic control fail and call for maximum fuel a dangerous overspeed could occur with resulting property damage, personal injury, or death.

Chapter 2. Installation

Introduction

Be careful when handling and installing the EGB-500P Governor/Actuator. Do not hit the drive shaft or output shaft. Rough handling can cause damage to seals, parts, and adjustments.

Receiving

The governor/actuator is shipped from the factory in a vertical position, bolted to a wooden platform. The unit has been calibrated at the factory to exact specifications, then drained of oil. A light film of oil covers the internal parts to help prevent rust. Calibration and internal cleaning is not needed before installation and operation. The drive shaft and output shafts are covered with a light film of oil, or a soft-seal preservative can be applied at the customer's request. The seal preservative is removed with a cloth and mineral spirits before installation of the unit.

Storage

The EGB-500P may be stored in a dry location for some time after it is received. If storage is to be for more than 9 months or if storage is in a less than excellent location, see Woodward Manual 25075, *Commercial Preservation Packaging for Storage of Mechanical-Hydraulic Controls*.

Installation Requirements

See Figure 2-3 for overall dimensions, location of installation holes, hydraulic fitting sizes, output and drive shaft dimensions, and adjustment locations. The governor needle valve access hole and the oil level dipstick must both be accessible after installation. The needle valve access hole will have to be accessed with the engine running at operating temperature.

Enough clearance must be given for installation, removal, and servicing of the governor. The governor oil drain should be easily accessible.

Installation

Install the EGB-500P Governor/Actuator on the engine governor drive pad. Use a gasket between the governor and the drive pad. The drive shaft must slip into the mating coupling without force. Be careful not to push the drive shaft into the governor. Improper alignment, or too tight a fit between any of the parts can result in wear or seizure. Vibration or other irregularities caused by uneven gear teeth, shaft run-out, etc. transmitted to the actuator can cause erratic governing.

NOTICE

Damage to the drive shaft, drive shaft seal, or other parts of the governor/actuator may occur is the unit is dropped or set on the drive shaft or drive coupling.

The linkage between the EGB-500P and the fuel or steam control should be adjusted to use a minimum of 27 degrees (about 2/3) of the actuator output shaft travel from rated speed "no load" to rated speed "full load." The linkage must be adjusted so the fuel rack will be in shutdown position before the governor/ actuator is at minimum position. The fuel rack should provide the minimum stop before the governor reaches its minimum position.

Linkage must operate freely with a minimum of backlash. If there is a collapsible member in the linkage, it must not yield during normal governing action or under conditions of rapid output shaft movement. A collapsible link should not be attached directly to the output shaft as the added weight and inertia at this point can cause undesirable wear of governor parts.

Hydraulic and Electrical Connections

Make all hydraulic, pneumatic, and electrical connections which may be required for the particular EGB-500P being installed. Use the correct Woodward manuals to ensure correct hookup of electrical connections.

Booster Servomotor

The booster servomotor is remotely located form the governor. Make all hydraulic connections from the booster to the governor. See Manual 36684, *Booster Servomotor*. A high-ratio (3:1) booster will be needed if used. Because of the large volume of oil needed to move the EGB-500P servo, the booster-limit screw should be adjusted to permit maximum booster-servo output.

Heat Exchanger

The heat exchanger is remotely located from the governor. Make all hydraulic connection for the heat exchanger to the governor., See Manual 36641, *Governor Oil Heat Exchanger*.

Should the installation not call for a heat exchanger special care should be taken in the selection of the oil used in the EGB-500P to make sure that it will stand up to the operating temperatures which can be expected.

Oil Supply

Until the governor has been run and the accumulator filled, about 4 liters of oil will fill the governor. Governor oil capacity is about 6.5 liters, and it will be necessary to add oil after the governor is first started in order to restore oil to the full mark on the dipstick.

Check the oil level with the governor running. Use care while checking the oil level. Oil will splash from the test location during major governor transients.

Oils for Hydraulic Controls

This information is provided as a guide in the selection of lubricating/hydraulic oil for governor use. Oil grade selection is based on viscosity change over the temperature range of the governor. The information also provides an aid in recognizing and correcting common problems associated with oil used in the EGB-500P. It is not intended to suggest the selection of lubrication oil for the engine.

Use of the same grade and type of oil used in the engine is often possible. The governor has a completely separate sump and requires clean, uncontaminated oil. Do not place used engine oil in the governor as it will cause control problems and perhaps damage the governor. Use clean containers when transferring oil to the governor.

Oil that has been carefully selected to match the operating conditions and compatible with governor components should give long service between oil changes. Under ideal conditions (minimum exposure to dust and water and within the temperature limits of the oil) time between changes can be extended.

The recommended continuous operating temperature of the oil is 60 to 93 °C (140 to 200 °F). Measure the temperature of the governor oil directly through the dipstick-filler cap while the governor is running in a steady state condition. Do not put the temperature probe too deeply into the governor or the probe, the governor or both may be damaged.

Any persistent or recurring oil problems should be referred to a qualified oil specialist for solution.

Governor oil lubricates and provides hydraulic power. The oil must have a viscosity index that allows it to perform over the operating temperature range and it must have the proper blending of additives to cause it to remain stable and predictable over this range. Governor fluid must be compatible with seal materials (nitrile, polyacrylic, and fluorocarbons). Many automotive and gas engine oils, industrial lubricating oils, and other oils of mineral or synthetic origin meet these requirements. Woodward governors are designed to give stable operation with most oils, if the fluid viscosity at the operating temperature span is within a 50 to 3000 SUS (Saybolt Universal Seconds) range. Ideally, at between 100 and 300 SUS. Poor governor response or instability usually is an indication that the oil is too thick or too thin.

Excessive component wear or seizure in a governor indicates the possibility of:

1. Insufficient lubrication caused by:
   a. An oil that flows slowly, either when it is cold or during start-up.
   b. An oil line restriction, an obstruction in, or bends in the line.
   c. No oil in the governor or governor oil level too low.

2. Contaminated oil caused by:
   a. Dirty oil containers.
   b. A governor exposed to heating and cooling cycles, creating condensation of water in the oil.

3. Oil not suitable for the operating conditions.

4. An improper oil level which creates foamy, aerated oil.

Operating a governor continuously beyond the high limit temperature of the oil will result in oil oxidation identified by varnish or sludge deposits on the governor parts. To reduce oil oxidation, lower the governor operating temperature with a heat exchanger or other means, or change to an oil more oxidation resistant at the operating temperatures.

⚠WARNING

A loss of stable governor control and possible prime mover overspeed may result if the viscosity exceeds the 50 to 300 SUS range. Overspeed can cause property damage, personal injury or death.

Specific oil viscosity recommendations are given on the chart. Select a readily available, good brand of oil, either mineral or synthetic, and continue using it. Do not mix different classes of oils. Oil that meet the API (American Petroleum, Institute) engine service classification in either the "S" group or the "C" group, starting with "SA" and "CA" through "SF" and "CD" is suitable for governor service. Oils meeting performance requirements of the following specifications are also suitable: MIL-L-2104A, MIL-L-2104B, MIL-L-2104C, MIL-L-46152, MIL-L-46152A, MIL-L-46152B, MIL-L-45199B.

Replace the governor oil if it is contaminated, or if it is suspected of contributing to governor instability. With the engine shut down drain the governor while the oil is hot and agitated. Flush the governor with a clean solvent having some lubricity before refilling with new oil. If drain time is insufficient for the solvent to completely drain or evaporate, flush the governor with the same oil it is to be refilled with to avoid dilution and possible contamination of the new oil. To avoid contamination, replacement oil must be free of dirt, water, and other foreign material. Use clean containers to store and transfer oil.

⚠WARNING

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.

Prime Mover Operation

When starting the engine, an electrical signal must be provided to the actuator so the pilot valve in the electric governor will move in the increase fuel direction. This allows the oil pressure generated at cranking speed to rotate the output shaft and open the fuel control sufficiently to start.

When a battery or other independent power supply is available to provide power to the electrical control unit, the control unit will transmit a signal in the range of 8 to 9 Vdc to the actuator for starting. If a source of electrical power is not available, the actuator may be equipped with a pneumatic or manual starting device.

⚠WARNING

Be sure that mechanical speed setting is in a safe range before starting an engine under ballhead governor control. Overspeed is possible.

Do not use in excess of 9 volts across the actuator terminals. Excessive voltage can cause a calibration shift in the electrical side of the governor.

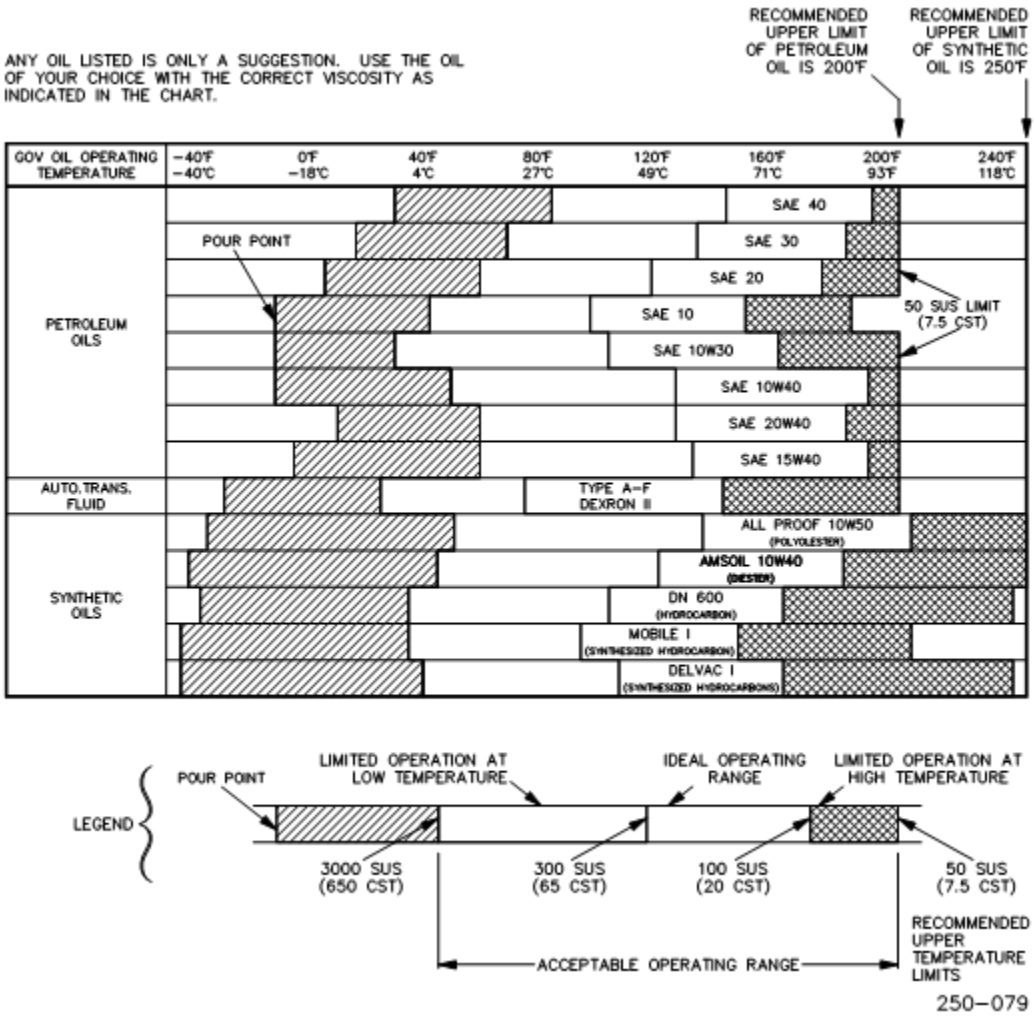

Figure 2-1. Oil Selection Chart

VISCOSITY COMPARISONS				
CENTISTOKES (CST, CS, OR CTS)	SAYBOLT UNIVERSAL SECONDS (SUS) NOMINAL AT 100 DEGREES F	SAE MOTOR (APPROXIMATE)	SAE GEAR (APPROXIMATE)	ISO
15	80	5W		15
22	106	5W		22
32	151	10W	75	32
46	214	10	75	46
68	310	20	80	68
100	463	30	80	100
150	696	40	85	150
220	1020	50	90	220
320	1483	60	115	320
460	2133	70	140	460

250−087
97−11−04 skw

Figure 2-2. Viscosity Comparisons

Where neither a source of electric or pneumatic power is available, or in the event of electrical control unit failure, a 9 volt battery may be connected across pins A (+) and B (–) of the actuator receptacle to provide the necessary electrical signal for starting. This method may also be used in the event of control unit failure or loss of electrical power to force the electric governor to assume a simulated overload condition and to permit continued operation of the prime mover under control of the mechanical governor in the actuator.

Units wired for reverse acting control will automatically go to mechanical control upon loss of electric signal and do not need an electrical signal in order to start operation. It is important that the mechanical speed setting not be too high when starting a reverse acting control system.

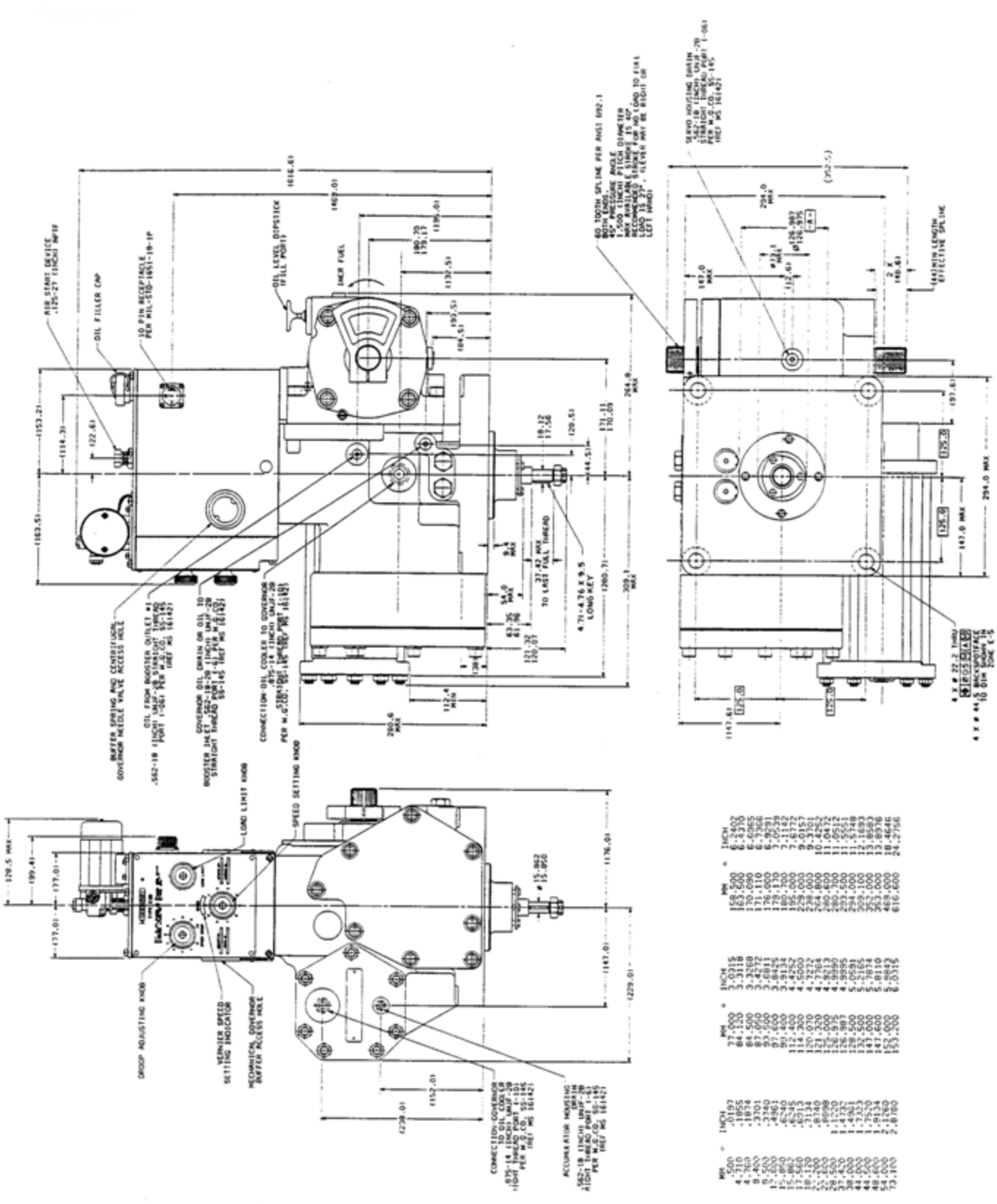

Figure 2-3. Outline Drawing of the EGB-500P Governor/Actuator

Chapter 3.
Operation and Adjustment

Initial Operation

Before the first start up of the EGB 500 be sure all steps in Chapter 2 have been done and are correct.

⚠WARNING

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, the only requirements for putting a governor into service are filling the unit with oil and adjusting the compensation needle valve to get maximum stability. All other operating adjustments are made during factory calibration to the engine maker's specifications. Additional adjustment should not be needed. Do not make an internal adjustment of the EGB 500 unless completely familiar with the correct procedure.

Mechanical Governor Needle Valve Adjustment

The compensation needle valve is an adjustable part of the compensation system. Its setting, which affect mechanical governor stability, is made according to individual characteristics of the engine. Use a screwdriver to adjust the needle valve. Turn the needle valve clockwise to close and increase stability, counter-clockwise to open and improve response in the mechanical governor side. Do not operate with the needle valve completely closed.

When starting the engine for the first time, it is necessary to eliminate any air which may be trapped in the actuator passages. First lower the mechanical speed setting to minimum, then raise the electrical actuator to maximum fuel position as described elsewhere in this manual. Then, with the mechanical governor controlling, open the needle valve until the governor begins to hunt. Let the governor hunt several minutes to remove trapped air in the hydraulic circuits.

IMPORTANT

If the mechanical governor portion of the control has droop set into it the governor may not hunt, even with the needle valve open. In almost every case the governor will hunt long enough to expel all of the air from the system. In some cases it may be necessary to upset engine speed momentarily to cause the governor to hunt.

Close the needle valve slowly until hunting just stops. Keep the needle valve open as far as possible to prevent slow governor response. The needle-valve setting can be from 1/16 to 2 turns open.

Test the setting by manually disturbing engine speed or the mechanical speed setting of the governor. The engine should return to steady-state speed with only a small overshoot or undershoot.

The electric governor section of the actuator has no external operating adjustment. For other adjustments of the EGB governor refer to manual 82340, *EGB Proportional Governor Actuator*.

Operating Control Adjustments

Three operating control knobs are located on the front panel of the EGB 500 Governor/Actuator (see Figure 1-1).

1. Speed setting control knob, used to set the speed at which the mechanical governor will control.

2. Speed droop control knob, used to permit load division and parallel operation of actuators controlled by the mechanical governor.

3. Load limit control knob, used to limit maximum prime mover load, whether the actuator is controlled by the electric or mechanical governor.

IMPORTANT **The following adjustments are factory set and normally need checking only after disassembly. The adjustments should be made with the EGB 500 on a test stand.**

Terminal Shaft Travel Adjustment

Turn the load limit control knob fully clockwise. Turn screw (23, Figure 6-1) ccw until the control knob can be rotated 1/8 turn ccw before the load limit strap (24, Figure 6-1) begins to rise. Again turn the control knob fully clockwise.

Adjust screw (85, Figure 6-1) to permit full travel of the terminal shaft (from minimum-fuel to maximum-fuel positions as shown on the fuel indicator). Turn the screw ccw to increase terminal-shaft travel in the maximum-fuel direction.

Load Limit Adjustment

Turn the load-limit control knob fully cw.

With the actuator running and the terminal shaft just at the end of its travel in the maximum fuel direction, turn screw (23, Figure 6-1) cw until the terminal shaft just starts to move in the minimum fuel direction. Then turn the screw ccw 1/4 turn.

Turn the load-limit control knob ccw until the terminal shaft is at the midpoint of its travel (as shown by fuel indicator). Loosen nut (12) and position pointer disk (14) at "5". Tighten nut to lock pointer in position.

Speed Droop Adjustment

If the governor/actuator has been disassembled, reset the droop linkage to zero. Use items one through seven to completely recalibrate the droop linkage. Use items four through seven for normal droop setting.

Perform steps one through three with the test stand or engine not running and the governor/actuator cover removed. For steps four through seven replace the cover and operate the test stand or engine unloaded.

1. Set the droop knob all the way ccw to zero.

2. Place a dial indicator on top of the speeder spring (245, Figure 6-3).

3. Manually lift the power piston (295) and check the dial indicator for movement. Zero to plus 0.003 movement indicates "0" droop. The speeder spring should not move down when the power piston is raised.

If there is not zero droop, reposition link (62, Figure 6-1) until the pin in the link is on the same axis immediately above the pivot pin (208, Figure 6-3).

Some units have an eccentric pivot pin (62, Figure 6-1) and some have a plain pivot pin. Turn an eccentric pin until is in the center of its movement.

NOTICE

Do not release the tension on crank (68) while screw (65) is loose.

Loosen screw (65) and manually move link (63) until its pin lines up on an axis above the pivot pins (208). Tighten screw (65). If pin (62) is an eccentric, make fine adjustments by loosing the nut and turning the eccentric until "0" droop is present. Remove the dial indicator.

⚠WARNING

Before starting the engine make sure the high-speed stop has not slipped and that the mechanical governor speed setting is within the normal operating range. Having the mechanical governor set too high can allow overspeeds and resulting physical damage and/ or personal injury and possible loss of life.

4. Operate the engine unloaded. Be sure the speed-droop control knob is all the way ccw, on zero droop.

5. Increase the electronic control speed until the mechanical governor controls the prime mover.

6. With the mechanical governor controlling adjust the mechanical governor speed-setting knob to 60 Hz.

7. Load the engine to maximum.

8. Check for zero droop by watching the frequency meter, which should not vary from 60 Hz. If the frequency meter does vary, shut down the engine, check and adjust for zero droop as outlined in steps 1 through 3. If the frequency meter does not vary from 60 Hz. the mechanical governor is set at zero droop.

9. After achieving zero droop, unload the engine.

10. Turn the droop knob to about 3 on the dial.

11. Load the engine to maximum and check the frequency meter. Droop should be at three percent. The frequency meter should read 58.2 Hz. Make minor adjustments to the droop setting if necessary to achieve the desired droop level.

12. Unload the engine

13. Adjust the speed setting knob until the frequency meter reads 62.5 to 63 Hz.

14. Adjust the electronic control to 60 Hz.

The mechanical governor is now set the correct amount of droop and just high enough that it will not interfere with the electric actuator which is now in control of engine speed.

IMPORTANT

A major cause of trouble with EGB units is having the mechanical speed set too close to the electronic speed reference. Having the mechanical full-load droop speed too low can prevent the governor from reaching full load and can also cause instability under load as the two governing units trade control.

Speed Setting Stop Adjustment

Remove the dial plate (8, Figure 6-1). Remove the speed setting control knob (13) and pointer disc (14). Loosen three screws (15). Put control knob back on the speed-adjusting shaft.

⚠WARNING

It is important to regularly check the high-speed stop on the speed-setting knob. The operation of the electrical actuator will not be affected should this setting be changed to a higher speed. Should the speed-setting knob be changed to a higher speed, and should the electric actuator or electric control fail in such a way as to call for maximum fuel, a dangerous overspeed with property damage, personal injury, or death could occur.

Turn the speed-setting control knob ccw until specified low speed is reached. Rotate a dial stop (19) nearest the control knob ccw until it reaches the stop pin (48). Be sure the actuator terminal shaft is not at the end of its travel when low speed is reached.

Rotate dial stop (19) farthest from the control knob until it is about even with the low-speed stop. Tighten three screws (15).

Turn speed setting control knob cw until specified high speed is reached. (This speed is usually about 5 percent above rated speed.)

Loosen three screws (15) and rotate dial stop (19) farthest from the knob until it is against the stop.

Tighten screws (15). Recheck speed setting and readjust stops as necessary.

Turn the control knob to the low-speed setting. Remove knobs. Put pointer disc (14) on shaft assembly so the pointer is at the top or "0" position. When properly set the "0" on the speed-setting dial behind the dial plate, the "0" on the dial plate, and the pointer should be aligned at low speed. Put control knob back on and tighten nut (12).

Magnet Adjustment (Centering Pilot Valve Plunger)

The following adjustments are best made on a test stand. Actuator adjustments can be extremely difficult on the engine.

⚠WARNING

When blocking governor output or operating the hand throttle, the system is not under governor control, and extreme caution must be taken to prevent overspeed. Overspeed can cause property damage, personal injury, and death. Do not attempt if overspeed trip device is not functioning.

Initial adjustment of the actuator consists of physically centering the magnet (240, Figure 6-3) between the coils of the solenoid when the control land on the pilot valve plunger is centered over the control port in the pilot valve bushing. This minimizes the effect of temperature drift when changes occur in the operating temperature of the actuator and provides a more balanced load division when the actuator is used in tandem (droop) applications. In applications where load division is not a factor, centering is not critical and the centering screw need only be backed out 1 to 1.250 turns after bottoming to provide acceptable operating characteristics.

Center the magnet (pilot valve plunger) as follows:

1. Connect the test circuit to the terminal block on the actuator as shown in Figure 3-1. Set the test switch to OFF. Remove the fuel linkage to the engine or test stand.

IMPORTANT

The test circuit must be connected to the Jones plug inside the governor case, not to the terminal plug on the outside of the case. The only electrical test possible from the outside terminal plug is to check continuity of the circuit through the transducer coils. Note Figure 5-1, Actuator Wiring Diagrams, that circuits are jumpered between the Jones plug and the receptacle. The test circuit must operate with these circuits open.

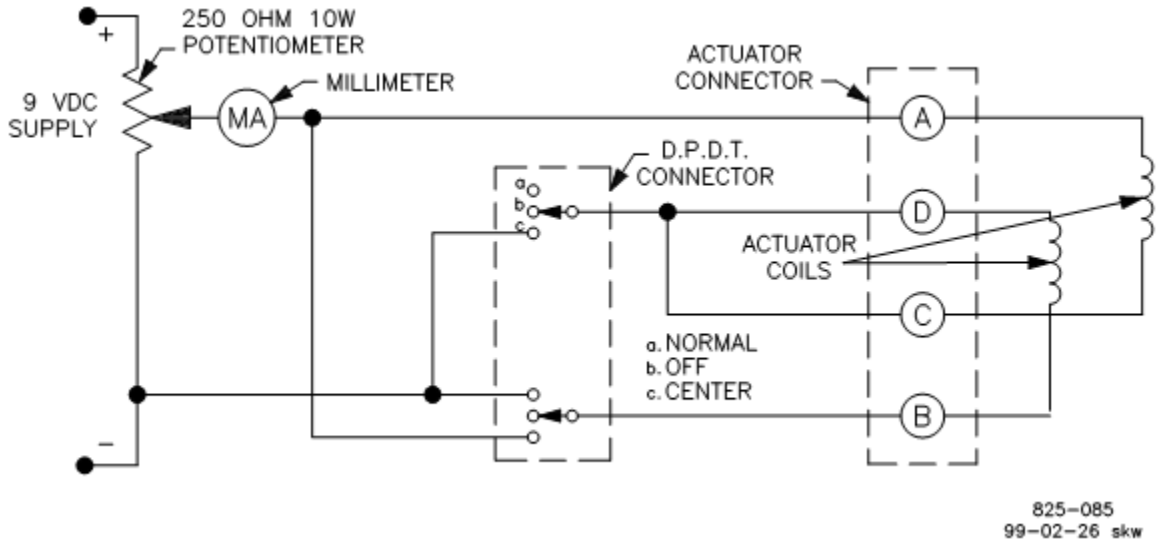

Figure 3-1. EGB Electrical Test Circuit

2. Install a protractor over the actuator output shaft and secure in position. Install the actuator output lever, if not already in place, for use as an indicator. Rotate the output shaft over its full range of travel. Note or mark the minimum and maximum shaft position on the protractor. The total output shaft travel should be 42 degrees.

3. Insert a 7/64-inch Allen wrench through the clearance hole in the transducer lever, through the hollow center of the adjustable spring seat (226, Figure 6-3), and engage the pilot valve centering screw. Turn the centering screw in until it bottoms, then turn out 1 to 1-1/4 turns to establish an initial starting position.

4. Set the test switch to CENTER and adjust the potentiometer to 400 mA on the millimeter. Set the test switch to OFF.

5. Insert a 1/8-inch Allen wrench through the clearance hole in the stop-screw plate and engage the adjustable spring seat. Center the output shaft at the approximate midpoint of its travel. Turn the seat cw to move the shaft to increase fuel or ccw to move the shaft to decrease fuel. Note the exact position of the shaft for future reference.

6. Set the test switch to CENTER and observe the output shaft for rotation. If the output shaft remains stationary, the magnet (pilot valve plunger) is centered and no further adjustments are required. If the output shaft moves to another position, note the direction of movement and then set the test switch to OFF.

7. If the output shaft movement was to increase fuel, turn the pilot valve centering screw cw a small amount using the 7/64-inch Allen wrench. If the movement was to decrease fuel, turn the centering screw ccw. The output shaft will assume a new position after making an adjustment to the centering screw. Note the new position of the shaft for reference if further adjustment is required.

8. Repeat steps 6 and 7 until a point is found at which no movement of the output shaft occurs when the test switch is moved from OFF to CENTER.

9. Set the test switch to OFF and turn the potentiometer full ccw (decrease).

Adjust the travel of the actuator output shaft as follows:

1. Set the test switch to normal. Adjust the potentiometer for minimum current according to the test specification.

2. Using a 1/8-inch Allen wrench, turn the adjustable spring seat ccw until the actuator output lever is at its minimum position, then turn the seat cw until the shaft moves 1 to 2 degrees from its minimum position.

3. Adjust the potentiometer for the maximum specification current. The output shaft should move an additional 39 (±1/2) degrees in the increase fuel direction. Shift the clamping plate so the pivot pin moves toward the output shaft to decrease shaft travel.

4. Repeat the adjustments at minimum and maximum mA alternately until no further adjustment is required at either point.

5. Disconnect the test circuit and the oil supply line if used. Remove the protractor.

IMPORTANT **Terminal shaft movement will be the opposite of that described above for reverse acting units.**

Chapter 4.
Principles of Operation

Introduction

The EGB-500 governor/actuator (see schematic, Figure 4-1) has two distinct controls in the actuating section: and electric actuator and a mechanical governor. A hydraulic amplifier in the intermediate section amplifies the product of the control section calling for the least fuel and the EGB-500 then uses this amplified product to control the fuel rack or steam valve of the engine or turbine.

The control sections are interconnected through the loading piston. The loading-piston position determines the position of the actuator output shaft.

Hydraulic Systems

The EGB-500 Governor/Actuator contains two separate hydraulic circuits served by a common sump. Each hydraulic circuit is served by its own oil pump and relief valve system. The lower, actuator portion of the EGB-500 operates at 300 psi (2068 kPa) pressure. The upper control portion of the EGB-500 operates at 100 psi (690 kPa) pressure.

Hydraulic Amplifier System

The actuator drive shaft rotates the accumulator pump drive gear and rotating bushing. As the inner pump drive gear turns the outer gear, oil from the sump is drawn by the gear teeth to the discharge side of the pump.

Four check valves, two on the suction and two on the discharge side of the pump, permit the drive shaft to rotate in either direction without changing the PG-500 operation. If the pump gears were rotated in the opposite direction, the open check valves would close and the closed check valves would open.

Oil on the discharge side of the pump pushes the accumulator piston against the accumulator spring. When piston movement uncovers the bypass port, excess pressure oil from the pump is returned to the sump through the pressurizing valve or heat exchanger. The accumulator is a reservoir for pressure oil and operates as a relief valve to provide at least 300 psi (2068 kPa) in this part of the hydraulic circuit.

Power Servo

The relay valve controls the flow of 300 psi (2068 kPa) oil to the power-servo assembly. The power piston, working through connecting linkage, controls the engine or turbine.

The differential power piston requires pressure oil to move in either the increase or decrease-fuel direction. The differential piston has pressure oil continually directed to the small-area side. The constant pressure tries to move the piston in the decrease-fuel direction, but the piston cannot move to decrease fuel until oil in the passages between the relay valve and the large-area side of the servo piston is released to sump. Oil is connected to the sump only when the relay valve plunger is below its centered position.

If the relay-valve plunger is above the centered position, oil flows to the control (large area) side of the servo piston. The force that results form oil pushing on the large surface area, which is greater than the constant force on the loading (small area) side, moves the piston in the increase fuel direction.

When the EGB-500 is used with the optional heat exchanger, oil flows through the heat exchanger from the accumulator bypass. If the oil flow through the exchanger becomes restricted, and the pressure reaches 25 psi, the pressurizing valve opens and directs bypass oil back to sump. Many EGB-500 units operate with the heat exchanger to prevent damage to the hydraulic oil being used in the system.

Electric Actuator Section

During the normal mode of operation of the actuator the electric actuator (see Figure 4-1) will be controlling and the mechanical-governor power piston will be at the top of its stroke.

Pressure oil for the electrical- and mechanical-governor sections is provided by the sub-governor oil pump. The pump relief-valve plunger, acting against the relief-valve spring, maintains the oil pressure required in these sections. Because the oil volume required is these sections is relatively small, no accumulator is required. The sub-governor oil pump consists of a two-gear pump located in the base of the sub governor and driven by the pilot-valve bushing. The pilot-valve bushing is driven by the engine drive and also becomes and integral part of the ballhead used to sense speed for the mechanical side of the control system.

The electric actuator pilot-valve plunger controls the flow of oil to and from its servo piston. The pilot-valve plunger is connected to a magnet which is spring-suspended in the field of a two-coil polarized solenoid. An output signal from an electric control unit is applied to the polarized coil and produces a force, proportional to the current in the coil, which tends to pull down the magnet and attached pilot-valve plunger.

A combination of the restoring-spring and centering-spring force tends always to raise the magnet and balance the pilot-valve plunger. When the actuator is running under steady-state conditions, these opposing forces are equal and the pilot-valve plunger is "centered" (the control land of the plunger exactly covers the control port in the pilot-valve bushing). With the pilot-valve plunger centered, no oil flows to, or from, the servo piston.

If the signal from the electronic control decreases (due to an increase in engine or turbine speed or a decrease in unit speed setting), an unbalanced force results. The combination of the restoring spring and centering spring force, now relatively greater, raises the pilot-valve plunger. Oil under the electric-actuator servo piston is thus connected to sump. The oil pressure constantly applied to the upper side of the loading piston and electric-actuator power piston now forces the pistons down, as the floating lever pivots about its connection to the mechanical-governor servo piston. The loading piston causes the terminal shaft to rotate in the "decrease" direction.

As the electric actuator power piston moves down, it lowers the left end of the first restoring lever. The clamping plate, attached to the first restoring lever, pushes down on the second restoring lever. (The restoring levers and spring are not identified in Figure 4-1 but are shown connecting the electric-actuator power piston to the electrical solenoid at the upper right of the illustration.) The loading on the restoring spring is thereby increased and lowers the pilot-valve plunger. The loading piston and electric-actuator servo piston move down until the increase in restoring-spring force is sufficient to offset the increased force resulting from the decrease in the electric signal. When the pilot-valve plunger is pushed back to its centered position, movement of the power piston, loading piston and terminal shaft stop.

The position of the actuator shaft is proportional to the electrical input signal to the actuator. If the electrical input signal increases, the pilot-valve plunger will be lowered, pressure oil will flow to the underside of the servo piston and push the piston up; the loading piston will be raised, rotating the terminal shaft in the "increase" direction. At the same time, the upward movement of the servo piston, acting through the restoring lever, decreases the restoring-spring force so the pilot-valve plunger will re-center to stop movement of the terminal shaft.

Mechanical Governor Section

The mechanical governor (see Figure 4-1) controls the prime mover during starting and also functions as a backup governor to prevent runaway should the electric control unit fail and call for maximum fuel or steam. The mechanical control must be able to increase the speed above the electrical-control speed or the unit will call for maximum fuel in an attempt to increase the speed to the mechanical speed setting. The mechanical governor pilot-valve plunger controls the flow of oil to its power piston. If the plunger is centered, no oil flows through the pilot valve and the servo piston is stationary. The greater of the two opposing forces moves the pilot-valve plunger: The speeder-spring force tends to push it down, the centrifugal force developed by the rotating flyweights is translated into an upward force which attempts to raise the plunger. With the pilot-valve centered, there is but one speed at which the centrifugal force of the flyweights is equal and opposite to the speeder-spring force.

With the speed setting of the mechanical governor set slightly higher than the electrical actuator, the centrifugal force of the rotating flyweights is not sufficient to lift the pilot-valve plunger to its centered position. Consequently, with the electrical actuator controlling, pressure oil is continually directed to the underside of the mechanical governor servo piston, to hold it up against its stop. With the actuator running on speed, while the mechanical governor is controlling, the pilot-valve plunger is centered. If a load is added to the engine and governor speed decreases, the pilot-valve plunger is lowered by the speeder-spring force, which will be greater than the lessened centrifugal force of the flyweights. Pressure oil flows to the buffer piston and moves it towards the servo piston.

The oil displaced by the buffer piston forces the servo piston upward, the loading piston is raised and the terminal shaft rotated in the direction to provide the fuel needs to the new load.

The movement of the buffer piston toward the servo piston partially relieves the compression of the left buffer spring and increases the compression of the right buffer spring. The force of the right buffer-spring movement results in a slightly higher oil pressure on the left side of the buffer piston than on the right. The pressure on the left of the buffer piston is transmitted from the underside of the compensation land of the pilot-valve plunger to the upper side of the compensation land. The difference in pressure produces a force which acts to push the pilot-valve plunger back to its centered position.

When the terminal shaft has been rotated far enough to satisfy the new fuel requirement, the force of the pressure differential on the compensation land plus the centrifugal force of the rotating flyweights will have re-centered the pilot-valve plunger, even thorough engine speed is not yet completely back to normal. The servo piston and terminal shaft movement is thereby stopped. The continued increase of speed to normal results in continued increase in centrifugal force developed by the rotating flyweights. This increase of speed to normal does not cause the flyweights to lift the pilot-valve plunger above center because the leakage of oil through the needle valve orifice equalizes the pressure above and below the compensation land at a rate proportional to the return of the engine speed to normal.

With the pressures above and below the compensation land equalized, the buffer springs return the buffer piston to its normal, central, position.

Were the engine load to decrease, the resultant increase in governor speed would cause the flyweights to move outward and raise the pilot-valve plunger. With the pilot-valve plunger raised, the area to the left of the buffer piston would be connected to sump. The loading piston, continually being urged downward by oil pressure from the sub-governor pump, would move down and force the servo piston down. The movement should reduce the fuel to meet the new requirement. Again, differential pressure across the compensation land would assist in re-centering the pilot-valve plunger, and keep the pilot-valve ports closed while speed decreases to normal.

The speed at which the mechanical governor controls the engine is determined by the loading or compression of the speeder spring which opposes the centrifugal force of the flyweights. This setting, or compression of the speeder spring, is known as the mechanical reference speed.

Speed droop is used in mechanical governors to automatically divide and balance load between engines or turbines driving the same shaft or paralleled in an electrical system. (Speed droop is defined as a decrease in governor speed reference as its output (fuel setting) increases. How far the governor speed reference decreases for a given stroke, determines the amount of droop.)

Speed droop is incorporated in the EGB 500 mechanical governor through linkage which varies the loading on the speeder spring as a function of the servo-piston position. The change in speeder-spring force for a given movement of the servo piston is determined by the location of pivot pin. If the pin is on the same centerline as the speed-droop-lever pivot arm, there is no change in the speeder-spring force as the servo piston moves and the mechanical governor responds as an isochronous (constant speed) control. The farther the adjustable pin is moved away from the pivot-arm centerline, the greater is the change in compression of the speeder spring for a given servo-piston movement.

With the actuator operating under control of the electric-actuator section, the speed droop feature is, in effect, inoperative. This is because during such operation the mechanical governor servo piston remains in the same position for all engine or turbine loads. Thus, the speed-droop linkage does not alter the speeder spring compression when the electric governor section of the actuator is controlling.

Speed droop is an integral part of the speed reference setting of the mechanical side of the governor/actuator. Notice in the schematic that when the electric governor is controlling the mechanical power piston is at the top of its stroke and likewise maximum droop is effecting the speed reference. This means that the mechanical speed setting must be set above the electronic speed setting by slightly more than the maximum amount of droop in the governor to avoid interfering with the electronic control of engine or turbine speed/load.

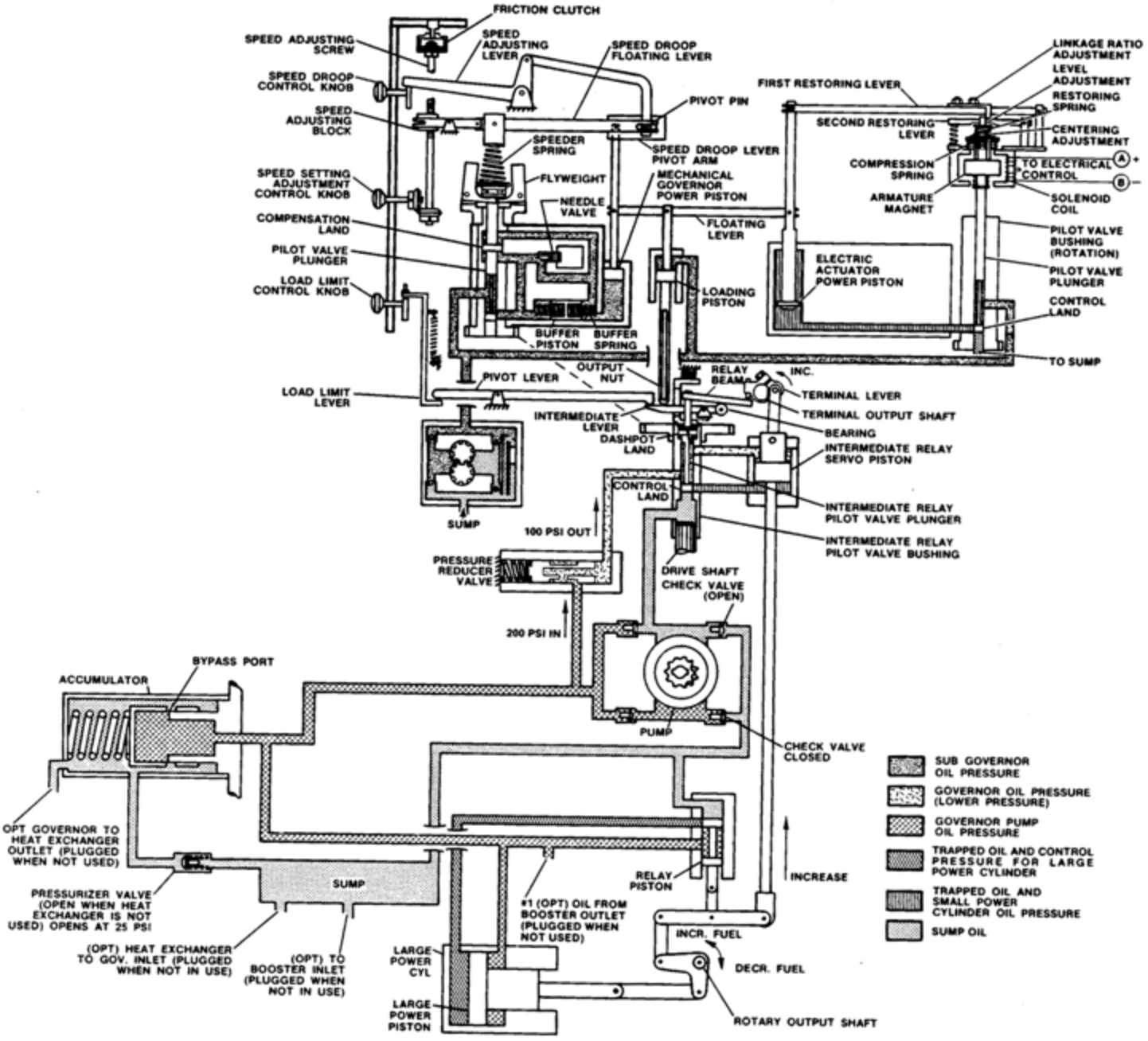

Figure 4-1. Schematic of the EGB-500 Proportional Governor Actuator

Chapter 5. Maintenance

Hydraulic Oil Care

Use NEW OIL to fill the governor. Be sure that all containers used for governor oil storage are clean. Contaminated governor oil will cause early wear of plungers, bushings, gears, bearing, etc., and can cause rust and corrosion on springs and other internal parts.

Under normal operating conditions oil should be changed every 18 months. Oil must be changed more often if the unit operates under unusual temperature or dirt conditions. Excessive heat can cause premature deterioration of the hydraulic oil. The EGB-500 is not designed to operate with excessive oil pressures and likewise overheating of the units is rare.

After the governor is put in service the oil condition should be carefully monitored until a length of service can be established. A careful check of oil condition is suggested at least every three months until length of service is established. Any time the oil looks dirty or appears to be breaking down from contamination or high temperature, drain the governor oil while it is hot. Flush with the lightest grade of the same oil and refill the governor with new oil of the correct viscosity. See oil viscosity table, Figure 2-2 or refer to Woodward manual 25071, *Oils for Hydraulic Controls*.

Troubleshooting

When governor problems are suspected in engine or turbine operations the first step should be to isolate the trouble area.

The following checklist is suggested as an aide in isolating the problem before initiation of corrective action.

⚠WARNING

When blocking governor output or operating the hand throttle, the system is not under governor control, and extreme caution mast be take to prevent overspeed. Do not attempt if overspeed trip device is not functioning.

1. Check the load to be sure the problem is not changes beyond the capacity of the engine or turbine.

2. Remove the linkage between the governor output shaft and the engine or turbine. Operate the engine or turbine manually, both free and under load, at recommended speeds. Should this correct the problem carefully check against linkage binding or other linkage malfunction before proceeding to step 3.

3. Using the electrical bypass method described in Chapter 3 under Prime Mover Operation isolate the electrical actuator so the mechanical governor controls. Should this correct the problem the electrical integrating control is causing the engine or turbine problem and should be corrected according to the supplier's specifications. If the problem remains it can be presumed that the EGB control system is malfunctioning.

EGB Control Problems

If the problem is found to be in the EGB governor is probably due to the hydraulic oil supply or condition. Check the oil level, viscosity and condition carefully. If the oil is found to be contaminated the governor can be flushed with kerosene or fuel oil while cycling the actuator using the load limit knob. This procedure is difficult to accomplish on a governor that is mounted on an engine and is not recommended until all other procedures have been tried.

A final check of the prime mover drive to the actuator should be made before determining that the problem is in the governor itself. Excessive backlash or a tight meshing of gears driving the actuator may be the cause of erratic, but small, speed variations. If the speed variation is erratic and large and cannot be corrected by adjustments the actuator should be repaired or replaced.

⚠WARNING

Routinely check the mechanical speed setting on the EGB-500. This setting can be moved to a faster speed without affecting the routine operation of the electronic governor, which normally operates the engine. However, should the electronics fail the engine will operate at the mechanical speed setting, and should this be too fast a dangerous overspeed could occur, with possible damage to the engine and even personally injury or death.

⚠WARNING

Overcurrent to the actuator (12 volts or more applied to actuator terminals) can cause a calibration shift of the actuator toward maximum fuel. The calibration shift can cause engine overspeed and resulting damage to the engine and possible personal injury or loss of life. SHOULD AN OVERCURRENT OCCUR, EVEN WHILE THE ENGINE IS SHUT DOWN, DO NOT USE THE ACTUATOR UNTIL IT HAS BEEN TESTED OFF THE ENGINE TO THE ACTUATOR SPECIFICATIONS.

Governor Repair

In many cases, repair of the governor should not be attempted but the unit should be sent to a qualified repair facility.

Governor Wear

Governor wear can sometimes be detected by checking oil pressure in the lower sections of the governor. Pressure in the power section of the EGB-500 may be checked with an oil pressure gauge capable of checking pressures to 500 pounds. The upper port in the lower section as shown in Figure 6-4 is removed and the pressure gauge installed with an SAE 6 fitting. Pressure at this point should be at 300 psi (2068 kPa) with ±10 psi (±69 kPa) permissible.

Low pressure can be corrected only by extensive governor overhaul or replacement.

Dial Panel

Take care when reinstalling the dial panel to the front of the governor to assure that the lugs in the speed-adjusting nut accurately engage the slots in the speed-adjusting levers. The speed-adjusting nut must be turned toward the dial panel (the lugs turned away from the governor) when replacing the dial panel on the governor.

Repair and Disassembly

A governor can operate several years before it will need an overhaul, if the oil is kept clean and if the drive from the prime mover is smooth and does not have torsional vibration.

Should disassembly and repair become necessary the work must be done by personnel trained in the correct repair procedures.

⚠WARNING **The accumulator spring (605, Figure 6-8) is compressed and held in the accumulator assembly. Personal injury or damage to the equipment can result from careless disassembly of this unit.**

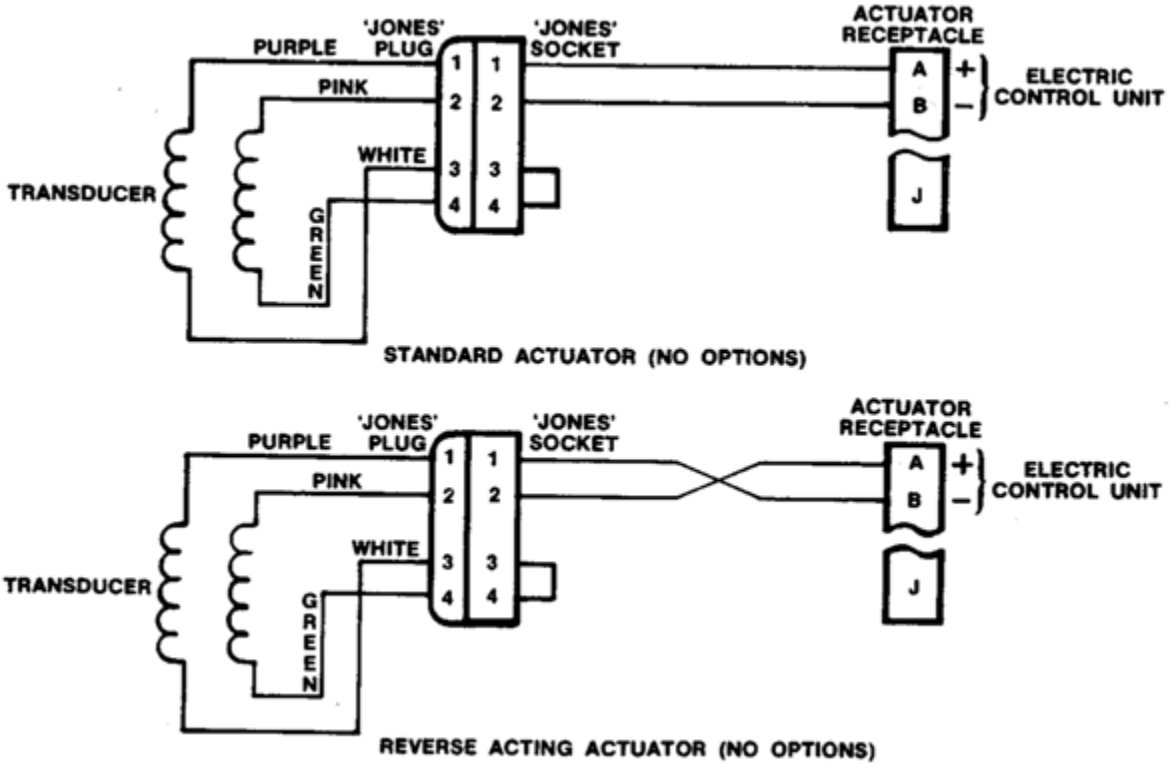

Figure 5-1. Typical Schematic Wiring Diagram of EGB-500 Governor/Actuator

Chapter 6.
Repair Parts

Parts Information

When ordering replacement parts, include the following information:

- Governor serial number and part number shown on the nameplate
- Manual number (this is manual 37740)
- Parts reference number and part name from parts list

WARNING **Injury may result if compressed springs are released suddenly. Use the proper equipment to remove springs and spring covers.**

Parts List For Figure 6-1

Ref. No.	Part Name	Quantity
37740-1	Screw, fil hd, .250-28 x .625 in.	7
37740-2	Lockwasher, split, .250 x .280 in. ID	7
37740-3	Clutch Pin	1
37740-4	Oil Cup	1
37740-5	Cover	1
37740-6	Cover Gasket	1
37740-7	Screw, 8-32 x .375 in., binder hd., Phillips	4
37740-8	Dial and name plate	1
37740-9	Screw, .250-28 x 1.750 in.	6
37740-10	Lockwasher, split, .250 ID x .078 in. thick	6
37740-11	Panel Gasket	1
37740-12	Locknut, thin, .250-20 inch	3
37740-13	Knob	3
37740-14	Pointer Disk	3
37740-15	Screw, flat head, 10-32 x .375 inch	3
37740-16	Dial Locating Plate	1
37740-17	Speed Setting Dial	1
37740-18	Spacer	2
37740-19	Dial Stop	2
37740-20	Load Limit Spring	1
37740-21	Locknut, thin, 10-32	1
37740-22	Screw, special 10-32 x 1 inch	1
37740-23	Set Screw, socket hd, oval pt, 6-32 x .625 in.	1
37740-24	Load Limit strap assembly	1
37740-25	Locknut, .375-24 thin	2
37740-26	Spring washer	2
37740-27	Speed droop cam	1
37740-28	Load limit cam	1
37740-29	Roll pin, .094 x .500 inch	1
37740-30	Retaining ring, internal	1
37740-31	Friction drive cover	1
37740-32	Locknut, .250-28, thin	1
37740-33	Friction drive spring	1
37740-34	Friction drive case	1
37740-35	Roll pin, .094 x .500	1
37740-36	Friction drive plate	1
37740-37	Speed adjusting nut	1
37740-38	Friction drive shaft	1
37740-39	Speed adjusting level gear	1
37740-40	Plain washer, .328 ID x .625 OD by .050 inch	1
37740-41	Retaining ring, external	1

37740-42	Dial stop gear	1
37740-43	Speed adjusting shaft	1
37740-44	Roll pin, .016 x .500 inch	1
37740-45	Intermediate gear	1
37740-46	Roll pin, .156 x .625 inch	1
37740-47	Pinion	1
37740-48	Plug	1
37740-49	Pinion Bushing	1
37740-50	Shaft bushing	1
37740-51	Screw bushing (upper)	1
37740-52	Screw bushing (lower)	1
37740-53	Screw, rd. hd., 6-32 x .500 inch	2
37740-54	Lockwasher, split, No. 6	2
37740-55	Locating pin	2
37740-56	Dial Panel	1
37740-57	Lock nut .312-24 inch	1
37740-58	Screw, .312-24 x 2.5 inch	1
37740-59	Lockwasher, split, .312 ID	1
37740-60	Spring	1
37740-61	Lock nut, 10-32, thin	2
37740-62	Pivot pin	1
37740-63	Speed droop link	1
37740-64	Spacer	2
37740-65	Screw, soc. hd. cap, 10-32 x .625	1
37740-66	Lockwasher, split, No. 10	1
37740-67	Speed droop cam lever	1
37740-68	Speed droop crank	1
37740-69	Spring pin	1
37740-70	Gasket	1
37740-71	Screw, fil. hd., 6-32 x .438 inch	4
37740-72	Lockwasher, split, No. 6	4
37740-73	Electrical connector receptacle	1
37740-74	Receptacle gasket	1
37740-75	Not used	
37740-76	Terminal shaft pin	1
37740-77	Screw, hex hd. .312-24 x 1 inch	5
37740-78	Lockwasher, split, .312 inch	5
37740-79	Not Used	
37740-80	Not Used	
37740-81	Oil seal	2
37740-82	Roller bearing	2
37740-83	Terminal shaft (output)	2
37740-84	Terminal lever	1
37740-84A	Pin retainer bracket	1
37740-85	Setscrew, slotted hd., rd. pt. .312-24	2
37740-86	Screw, truss hd., 6-32 x .250 inch	2
37740-87	Cover	2
37740-88	Not Used	
37740-89	Barrel plug	2
37740-90	Plug, sq. hd. pipe, .250-18 NPTF	1
37740-91	Oil level decal	2
37740-92	Not used	
37740-93	Stud, .312-18 x .312-24 x 2 inch	1
37740-94	Column	1

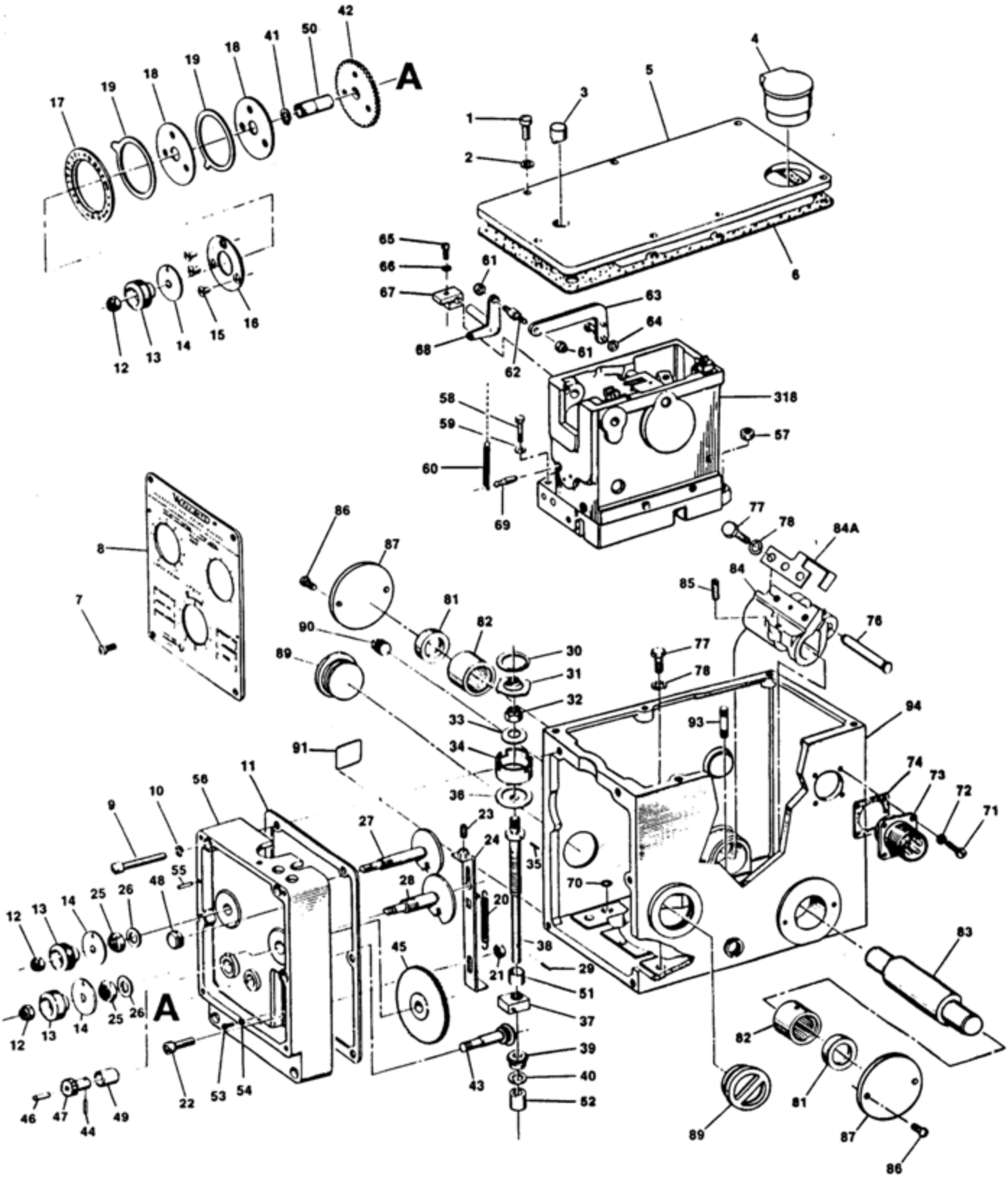

Figure 6-1. Parts for the EGB-500 Proportional Governor/Actuator

Parts List For Figure 6-2

Ref. No.	Part Name ..... Quantity
37740-101	Roller pin 1
37740-102	Roller 1
37740-103	Intermediate lever and shaft 1
37740-104	Roll Pin, .125 x .438 inch 1
37740-105	Spring 1
37740-106	Relay Beam 1
37740-107	Bushing retainer 1
37740-108	Bearing 1
37740-109	Copper Washer, .626 od x .438 id .032 thick 2
37740-110	Bearing retainer assembly 2
37740-111	Gasket 1
37740-112	Retaining Ring, internal 1
37740-113	Intermediate Relay valve bushing 1
37740-114	Intermediate Relay valve plunger 1
37740-115	Pivot Pin 1
37740-116	Pinion 1
37740-117	Intermediate Relay valve gear 1

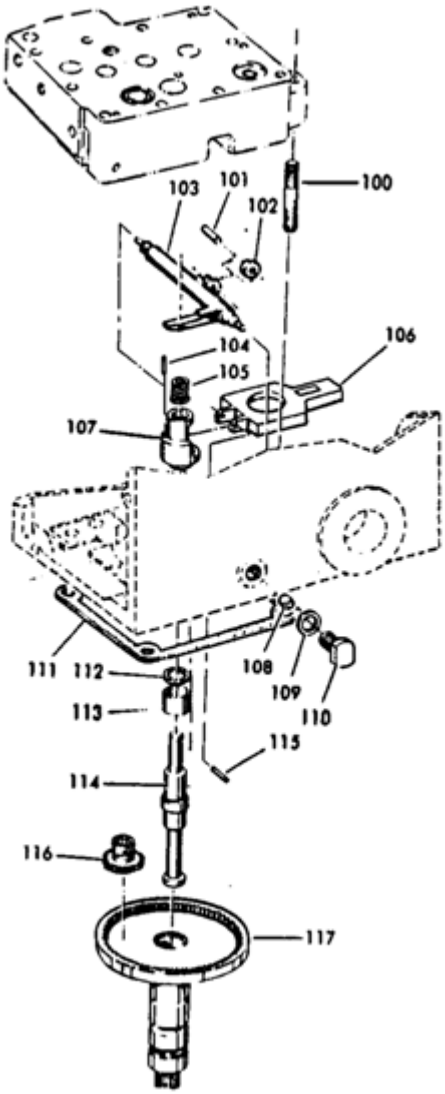

Figure 6-2. EGB-500 Relay Valve Assembly

Parts List For Figure 6-3

Ref. No.	Part Name	Quantity
37740-201	Screw, 6-32 x .500 inch w/captive lockwasher	2
37740-202	Electrical Connector Receptacle	1
37740-203	Spacer Plate	1
37740-204	Electrical Connector Plug	1
37740-205	Cotter Pin, .064 x .375 inch	4
37740-206	Headed Pin, drilled	1
37740-207	Retaining Ring, internal	2
37740-208	Pivot Pin	2
37740-209	Speed Droop Pivot Lever	1
37740-210	Cotter Pin, .032 x .625 inch	2
37740-211	Straight Pin, drilled	1
37740-212	Locknut, thin, .250-28	1
37740-213	Speed Adjusting Lever	2
37740-214	Spacer	1
37740-215	Lever Post	1
37740-216	Floating Lever	2
37740-217	Headed Pin, drilled	1
37740-218	Screw, hex. hd. cap, 10-32 x .500 inch	2
37740-219	Lockwasher, no. 10	2
37740-220	Plain Washer, .203 ID x .375 OD x .047 thick	2
37740-221	Clamping Plate	1
37740-222	Eccentric Ratio Adjustment Pin	1
37740-223	Restoring Lever	1
37740-224	Straight Pin	1
37740-225	Jam Nut, .250-28	1
37740-226	Adjustable Spring Seat	1
37740-227	Transducer Lever	1
37740-228	Load Spring	1
37740-229	Screw, self-locking, 6-32 x .375 inch	1
37740-230	Restoring Spring Assembly	1
37740-231	Cotter Pin, .032 x .25 inch	1
37740-232	Retainer Sleeve	1
37740-233	Needle Bearing	1
37740-234	Bearing Pin	1
37740-235	Screw, soc. hd. 10-32 x 1.875 inch	2
37740-236	Lockwasher, split, no. 10	2
37740-237	Clamp Bracket	1
37740-238	Roll Pin, .062 x .250 inch	1
37740-239	Transducer Cover	1
37740-240	Magnet	1
37740-241	Flat Washer, aluminum, .218 ID x .438 OD x .032 inch thick	1
37740-242	Transducer Assembly	1
37740-243	Temperature Compensation Ring	1
37740-244	Magnet spring	1
37740-245	Speeder Spring Assembly	1
37740-246	Plunger Nut, .250-28	1
37740-247	Speeder Spring Seat	1
37740-248	Thrust Bearing	
37740-249	Retaining Ring, external	1
37740-250	Retaining Ring, spiral	1
37740-251	Flyweight Pin	2
37740-252	Flyweight Assembly	2
37740-253	Flyweight Head	1
37740-254	Headed Pin, drilled	1
37740-255	Headed Pin, drilled	1
37740-256	Servo Link (Mechanical)	1
37740-257	Piston Pin	1
37740-258	Retaining Ring, internal, beryllium copper	1
37740-259	Buffer Plug	1
37740-260	O-Ring, .625 inch OD	1

37740-261	Buffer Spring	2
37740-262	Buffer Piston	1
37740-263	Retaining Ring, internal	1
37740-264	Plug	1
37740-265	O-Ring, .816 inch OD	1
37740-266	Plug	1
37740-267	O-Ring, .316 inch OD	2
37740-268	Needle Valve (Compensation)	1
37740-269	Screw, soc. hd, 10-32 x 1.125 inch	3
37740-270	Screw, soc. hd. cap, 10-32 x .875 inch	1
37740-271	Screw, soc. hd. cap, 10-32 x 1.375 inch	3
37740-272	Screw, soc. hd. cap, 10-32 x .500 inch	3
37740-273	Lockwasher, split, No. 10	10
37740-274	Relief Valve Spring	1
37740-275	Relief Valve Plunger	1
37740-276	Relief Valve Spacer	1
37740-277	Relief Valve Sleeve	1
37740-278	O-Ring, 1.062 inch OD	1
37740-179	Pivot Pin	1
37740-280	Load Limit Lever	1
37740-281	Check Valve Assembly	4
37740-282	Tape Pin, No. 2	2
37740-283	Plug	1
37740-284	Guide Pin	1
37740-285	Sub-Governor Base	1
37740-286	Idler Gear	1
37740-287	Pilot Valve Bushing (mechanical)	1
37740-288	Retaining Ring, internal	1
37740-289	Pilot Valve Plunger (mechanical)	1
37740-290	Compensating Bushing	1
37740-291	Pilot valve Bushing (electrical)	1
37740-292	Retaining Ring, internal	1
37740-293	Pilot valve Plunger (electrical)	1
37740-294	Compensating Bushing (Electrical)	1
37740-295	Servo Piston (Mechanical)	1
37740-296	Plug	1
37740-297	Not used	
37740-298	Not used	
37740-299	Not used	
37740-300	Not used	
37740-301	Plain Washer, 0.035-0.040 inch think	1
37740-302	Straight Pin	1
37740-303	Servo Link (electrical)	1
37740-304	Pivot Pin	1
37740-305A	Servo Piston (electrical)	1
37740-305B	Stop	1
37740-305C	Retaining Ring	1
37740-306	Link Pin, grooved	1
37740-307	Floating Lever	1
37740-308	Retaining Ring	1
37740-309	Output Nut	1
37740-310	Nut, hex., .250-28	1
37740-311	Pivot	1
37740-312	Pivot Link	1
37740-313	Loading Piston	1
37740-314	Lever Post Bushing	1
37740-315	Plug, soc. hd. pipe, .125 NPTF	As Reqd
37740-316	Plug, soc. hd. pipe, .062-27 NPTF	As Reqd
37740-317	Idler Gear Stud	1
37740-318	Sub-Governor Case	1

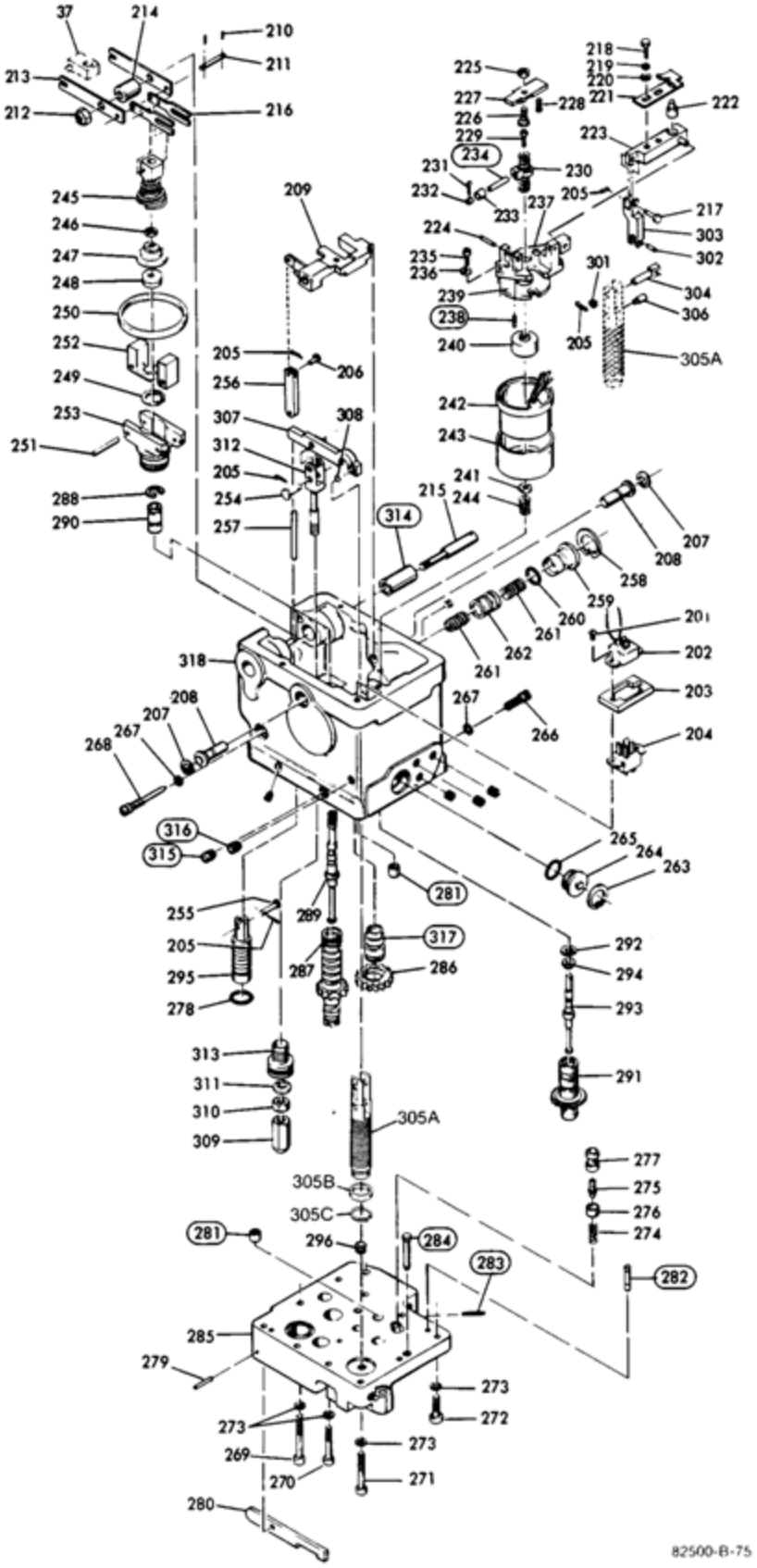

Figure 6-3. EGB-500 Parts

Parts List For Figure 6-4

Ref. No.	Part Name ..... Quantity
37740-401	Pressurizing Valve Plunger 1
37740-402	Pressurizing Valve Spring 1
37740-403	O-Ring, .801 ID x .070 inch 1
37740-404	Relief Valve Plug 1
37740-405	Retaining Ring 1
37740-406	Housing 1
37740-407	Bolt, 12.7 dia. x 356 (metric) 4
37740-408	Oil Level Gauge Assembly 1
37740-409	Not used
37740-410	Not used
37740-411	Plug 1
37740-412	O-Ring 1
37740-413	Bolt, 12.7 x 330 (metric). Screws come from .....3 inside part number 406
37740-414	Dowel Pin 2
37740-415	Gasket 1
37740-416	Case 1
37740-417	O-Ring 1
37740-418	Plug 1
37740-419	O-Ring 1
37740-420	Plug 1
37740-421	O-Ring 2
37740-422	Plug (hex head) 2
37740-423	Plug 1
37740-424	Plug 1
37740-425	Locating Pin 2
37740-426	Block, accumulator stud, if used 8

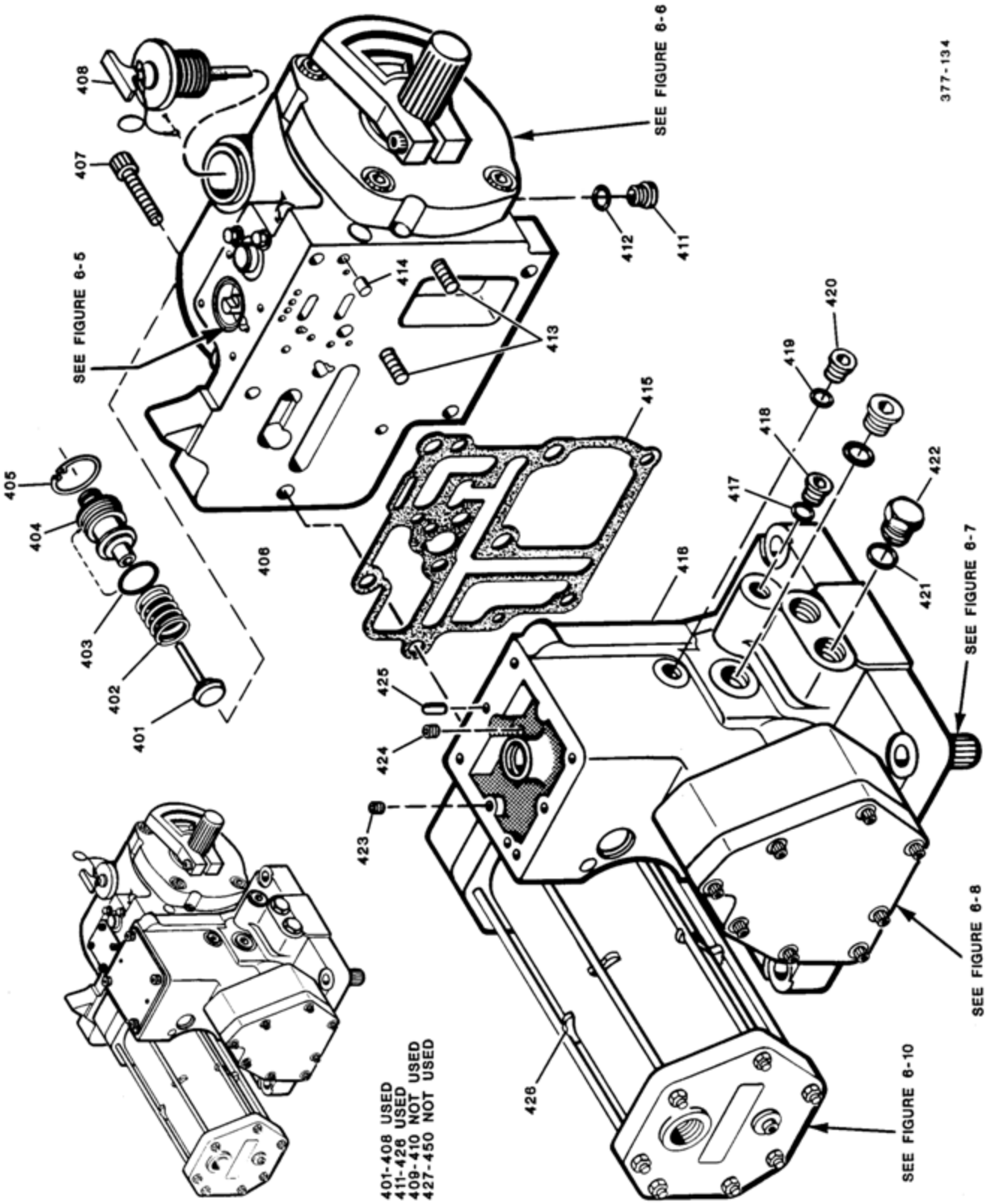

Figure 6-4. EGB-500 Actuator Parts

Parts List For Figure 6-5

Ref. No.	Part Name ..... Quantity
37740-451	Screw, .250 inch.....2
37740-452	Lockwasher, split, .250 inch 2
37740-453	Washer, .750 OD, .266 inch ID 2
37740-454	Spring Cover 1
37740-455	O-Ring, 1.239 inch ID x .070 inch 1
37740-456	Loading Spring 1
37740-457	Spring Seat 1
37740-458	Relay Valve Sleeve 1
37740-459	Relay Valve Spring.....1
37740-460	Relay Valve Plunger Assembly 1
37740-461	Relay Valve Spring Seat 1
37740-462	Relay Valve Plunger Adjuster.....1
37740-463	Relay Valve Lever Assembly
37740-464	Pin, drilled 1
37740-465	Cotter Pin 2
37740-466	Power Piston Pin.....1
37740-467	Power Piston Assembly.....1
37740-468	O-Ring.....1
37740-469	Piston Stop.....1
37740-470	O-Ring.....1
37740-471	Plate.....1
37740-472	Washer.....1
37740-473	Screw, 0.250-28 x .750 inch.....4
37740-474	Link 1
37740-475	Connecting Pin.....1
37740-475A	Snap Ring 1

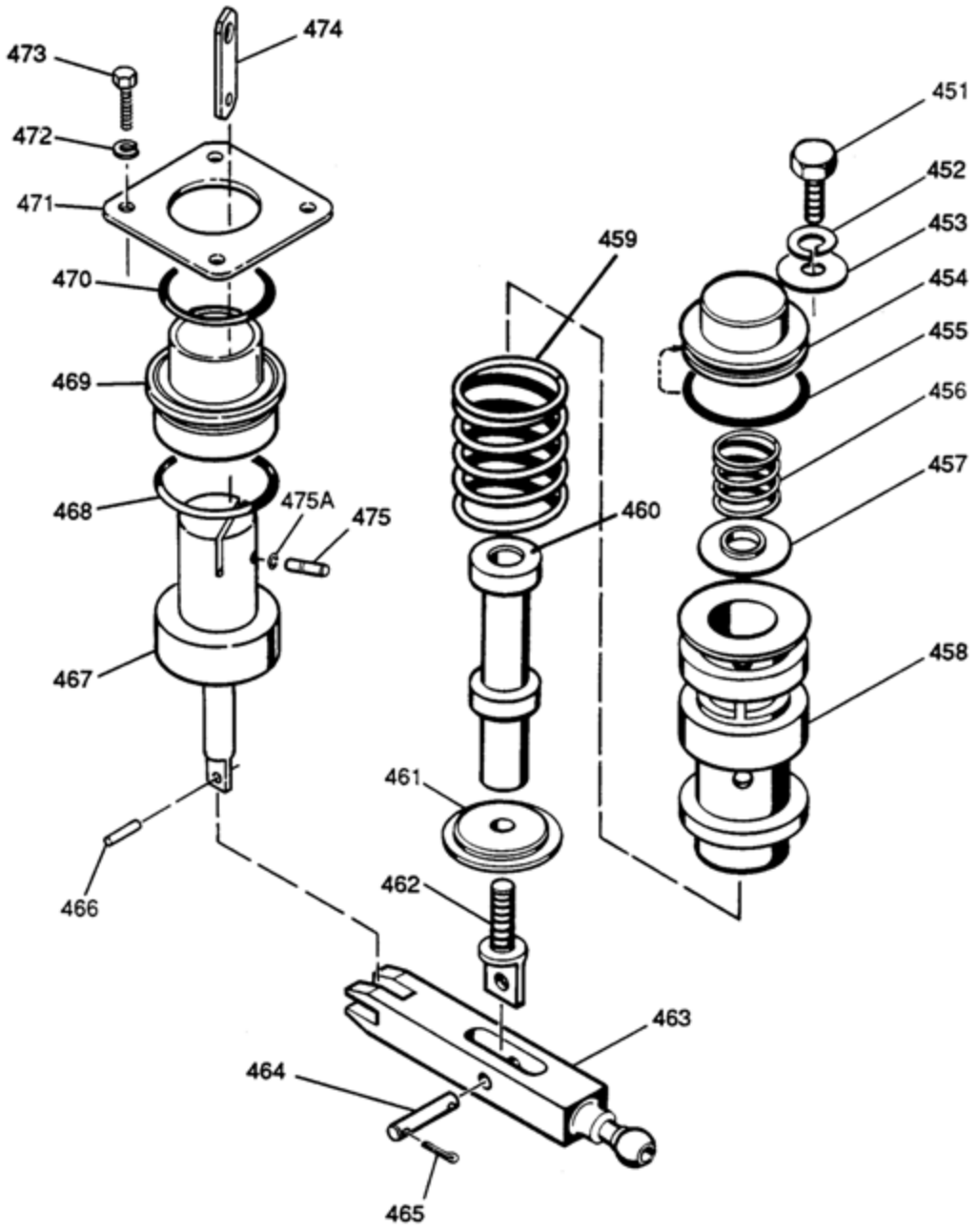

Figure 6-5. EGB-500 Actuator Parts

Parts List For Figure 6-6

Ref. No.	Part Name	Quantity
37740-476	Oil Seal	2
37740-477	Bushing	2
37740-478	O-Ring	1
37740-479	Screw	2
37740-480	Output Lever	1
37740-481	Output Shaft	1
37740-482	Cover	1
37740-483	Screw	4
37740-484	Screw	1
37740-485	Indicator	1
37740-486	Scale	1
37740-487	Drive Screw	2
37740-488	Retaining Ring	1
37740-489	Plug	1
37740-490	O-Ring	1
37740-491	Retaining Ring	1
37740-492	Spring Seat	1
37740-493	Spring	1
37740-494	Retaining Ring	1
37740-495	Reducing Valve Plunger	1
37740-496	Reducing Valve Sleeve	1
37740-497	Pin, connecting	1
37740-498	Retaining Ring	2
37740-499	Woodruff Key	1

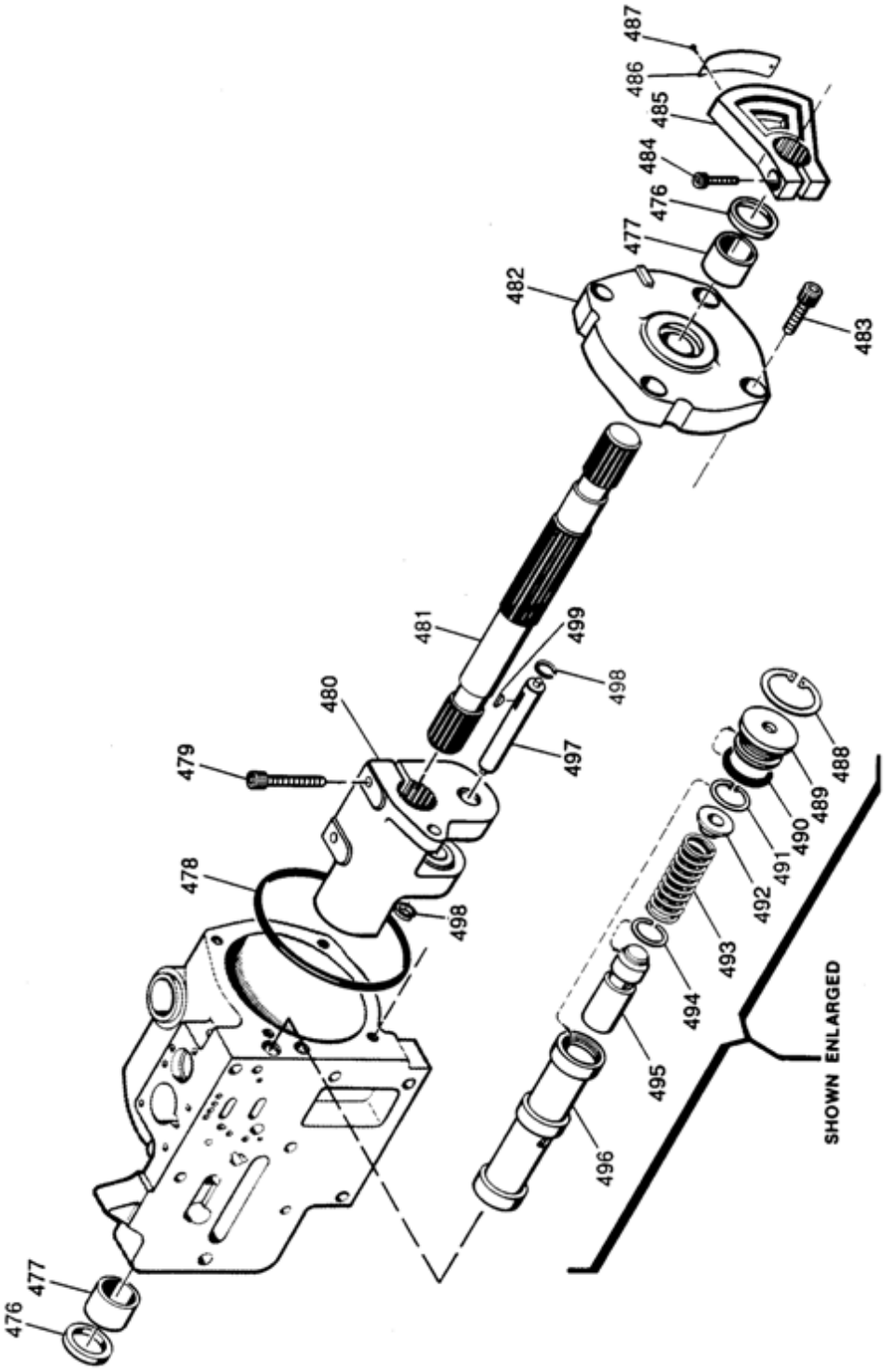

Figure 6-6. EGB-500 Actuator Parts

Parts List For Figure 6-7

Ref. No.	Part Name ..... Quantity
37740-508	Key (if used) 1
37740-509	Drive Shaft 1
37740-510	Retaining Ring 2
37740-511	Pump Element 1
37740-512	O-Ring 1
37740-513	Base 1
37740-514	Oil Seal 1
37740-515	Gasket 1
37740-516	Oil Seal Retainer 1
37740-517	Retaining Ring 1
37740-518	Bearing 1
37740-519	Lower Drive Shaft 1
37740-520	Bearing Retainer 1
37740-521	Screw 3
37740-522	Screw 4
37740-523	Lockwire, .026 (not shown) ..... As Required

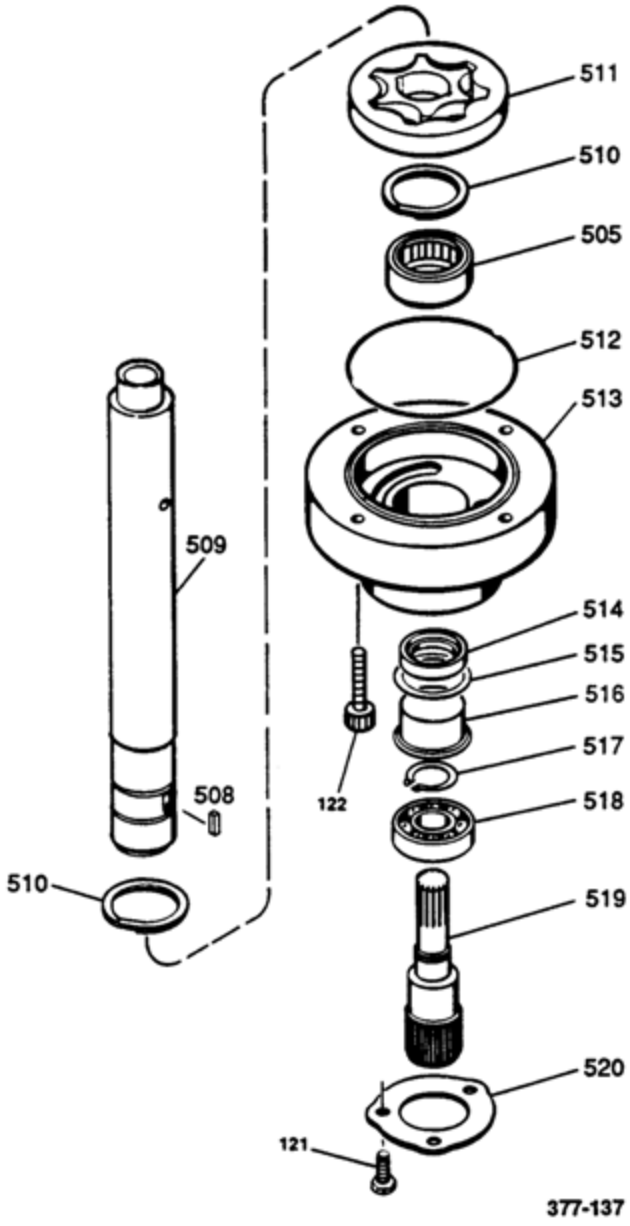

Figure 6-7. EGB-500 Actuator Parts

Parts List For Figure 6-8

Ref. No.	Part Name ..... Quantity
37740-526	Retaining Ring.....4
37740-527	Check Valve Assembly 4
37740-528	O-Ring.....4
37740-529	Not used
37740-530	Not used
37740-531	Not used
37740-532	O-Ring.....1
37740-533	Buffer Plug 1
37740-534	Retaining Ring.....1
37740-535	O-Ring.....1
37740-536	Connecting Rod 1
37740-537	Not used
37740-538	Not used
37740-539	Servo Cover 1
37740-540	Screw 8
37740-541	Servo Piston.....1
37740-542	Connecting Pin.....1
37740-543	Snap Ring 2

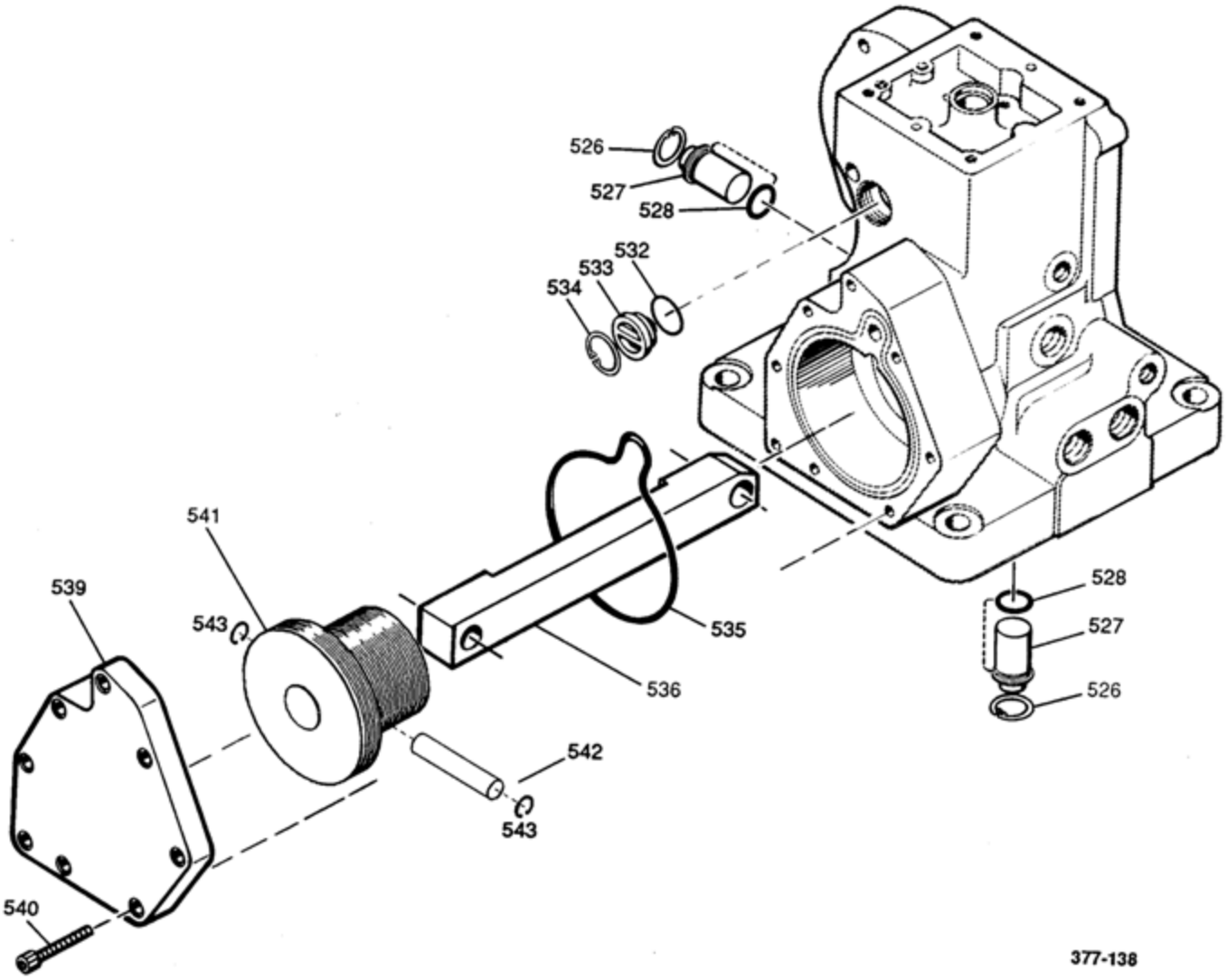

Figure 6-8. EGB Actuator Parts

Parts List For Figure 6-9

Ref. No.	Part Name ..... Quantity
37740-551	Preformed Packing....1
37740-552	Accumulator Plate....1
37740-553	O-Ring....2
37740-554	Accumulator Stud....4
37740-554A	Accumulator Stud, long....4
37740-555	Accumulator Tube....1
37740-556	Accumulator Cylinder....1
37740-557	Accumulator Spring....1
37740-558	Accumulator End....1
37740-559	Accumulator Stud Nuts....8
37740-560	O-Ring....1
37740-561	Plug....1
37740-562	Plug....1
37740-562A	O-Ring....1
37740-563	Drive Screw....2
37740-564	Warning Plate....1

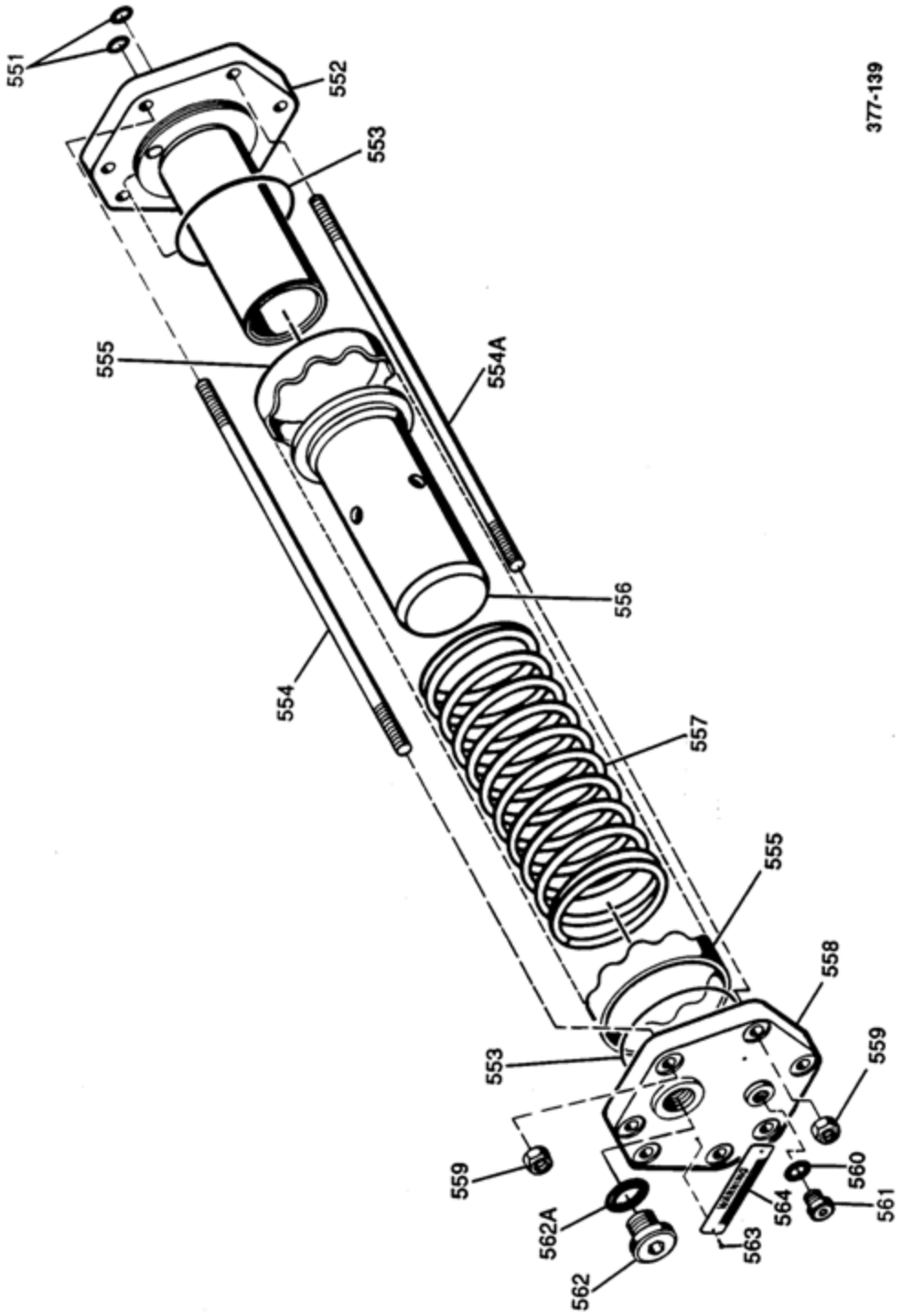

Figure 6-9. EGB-500 Actuator Parts

Parts List For Figure 6-10

Ref. No.	Part Name	Quantity
37740-551	O-Ring	2
37740-553	O-Ring	1
37740-556	Accumulator Cylinder	1
37740-557	Accumulator Spring	1
37740-560	O-Ring	1
37740-561	Plug	1
37740-562	Plug	1
37740-562A	O-Ring	1
37740-576	Accumulator Plate	1
37740-577	Flat Washer	4
37740-578	Bolt, .500-13 x 8.8 inch	4
37740-579	Socket Head Screw, .500-13 x 1.750 inch	4
37740-580	Accumulator Housing	1

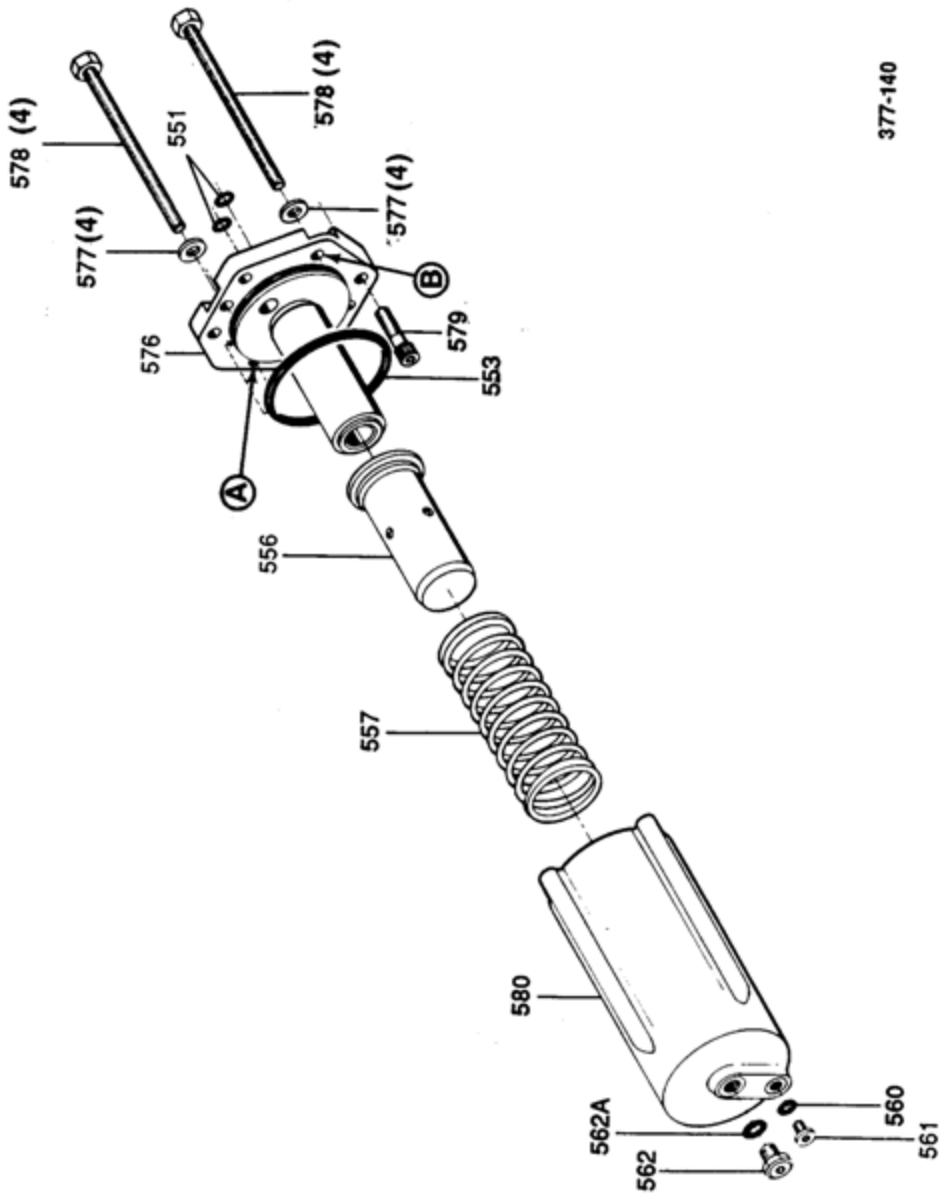

Figure 6-10. EGB-500 Actuator Parts

Chapter 7.
Product Support and Service Options

Product Support Options

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

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or 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 current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- 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 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.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic 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.

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. 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 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's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- 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.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor 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 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 one of the Full-Service Distributors listed at **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory published at **www.woodward.com/directory**.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used In Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
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

Products Used In 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

Products Used In Industrial Turbomachinery 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

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number

Prime Mover Information

Manufacturer _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.)

Control/Governor Information

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

Symptoms

Description _____

_____

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.

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