WOODWARD

Product Manual 37708
(Revision J)

Original Instructions

EGB-10C 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:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

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 Out-of-date translations are marked with ⚠.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

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

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

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

⚠WARNING

Overspeed / Overtemperature / Overpressure

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

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

⚠WARNING

Personal Protective Equipment

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

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

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

⚠WARNING

Start-up

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

⚠WARNING

Automotive Applications

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

NOTICE

Battery Charging Device

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

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

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

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

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

Follow these precautions when working with or near the control.

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

Chapter 1.
General Information

Introduction

The EGB-10C governor/actuator, (Figure 1-1) has a stalled work capacity of 10 ft-lb (14 J), a useful work capacity of 6.0 ft-lb (8.1 J), and its stalled work rating is 13 lb-ft (18 N·m) transmitted through an output shaft travel of 45°. It also contains a mechanically driven ballhead assembly for use as a back-up governor.

Used with the EG control box, the EGB-10C governor/actuator provides, in effect, two governors in one: an electric governor system and a mechanical governor, each independently capable of positioning the terminal (output) shaft. During normal operation, the electric governor controls fuel to the engine or turbine (hereinafter called the “prime mover”) through the actuator. The standard actuator is adjusted so that, if the electric control signal is interrupted, the electric section moves the fuel linkage to maximum fuel. When the speed reaches the level for which the mechanical governor is set—always slightly higher than that for which the electric actuator is set—the mechanical governor assumes and maintains control of the prime mover. Speed can then be reduced, if desired, by lowering the speed setting of the mechanical governor.

The EGB-10C governor/actuator is adjusted internally to move the fuel linkage to the “maximum fuel” position if the electric signal from the control box is interrupted.

Upon special request, the actuator can be adjusted to move the linkage to the “fuel off” position. If for some reason the EG control box does not emit a continuous signal calling for a decrease in fuel, the actuator will move the fuel linkage to the “fuel off” position.

Linkage between the governor/actuator’s terminal shaft and the prime mover should be designed to use at least 27° rotation of the actuator terminal shaft from the no load to full load fuel positions.

The EGB-10C governor/actuator contains its own oil sump, and uses approximately 1.5 US qt (1.4 L) of oil.

Adjustment Features

Three operating control knobs are located on the front panel of the EGB-10C governor/actuator.

- Speed setting adjustment control knob, used to set the speed at which the mechanical governor will control.
- Speed droop control knob, used to permit load division and parallel operation of units when controlled by the mechanical governor.
- Load limit control knob, used to limit maximum prime mover load whether the unit is controlled by the mechanical or the electric governor/actuator.

Access is provided externally to the electric actuator needle valve and the mechanical governor needle valve. The needle valves are used to match the operation of the electric governor/actuator and mechanical governor to the operating characteristics of the prime mover and load being controlled. Once set, the electric actuator needle valve usually requires no further adjustment. The mechanical governor needle valve is opened to bleed air from the oil passages each time oil is changed in the governor/actuator and must be reset.

Governor Drive

Since the governor in the EGB-10C governor/actuator has a centrifugal speed-sensing flyweight head, the governor drive shaft must be driven directly by the prime mover. Design the drive from the prime mover to rotate the drive shaft in the range of 900 to 1100 rpm at normal speed, It requires 1/2 hp (373 W) to drive it at 1000 rpm under normal operating conditions.

Auxiliary Features

Speed-Adjusting Motor—A speed-adjusting motor is available for the EGB-10C governor/actuator. This motor permits changing the speed setting of the mechanical governor section from a remote location. The speed-adjusting motor is used only with the mechanical governor. It is used to match the frequency of an alternator with that of other units or a system before synchronizing, or to change load distribution after synchronizing.

The speed-adjusting motor is a split field, series wound, reversible motor. It is available in all standard voltages.

A manual speed-adjusting knob with a friction clutch assembly is included on units fitted with a speed adjusting motor. Also included are two pairs of switch contacts which may be used for remote indication of maximum or minimum speed setting of the mechanical governor.

Spring-Driven Ballhead—A spring-driven ballhead assembly is available to filter undesirable torsional vibrations transmitted from the prime mover drive to the centrifugal speed-sensing flyweight head.

Solenoid Valve—An optional solenoid valve is mounted on a bracket inside the governor/actuator housing. The solenoid controls a valve in the oil pressure supply from the pump to the actuator pilot valve plunger. When the solenoid coil is energized (de-energized in some applications) from an external source, the valve opens. Pressure oil is allowed to escape through a bleeder bolt and attached tubing, through the open valve out to sump. As long as the coil is energized (or in some applications de-energized), no oil pressure is available to the power servo, so the actuator goes to minimum fuel position.

⚠WARNING

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.

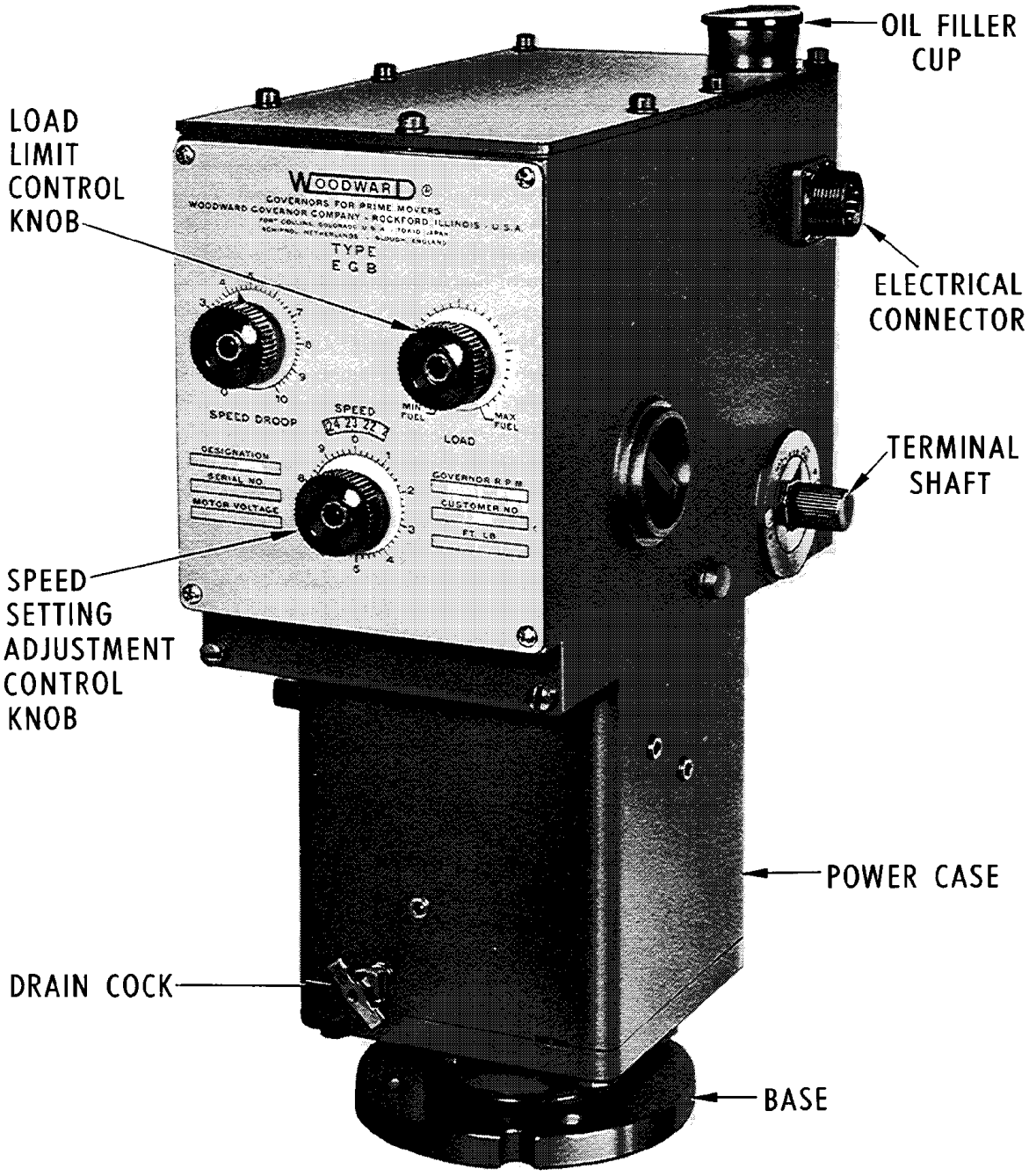


Figure 1-1. EGB-10C Governor/Actuator, External View

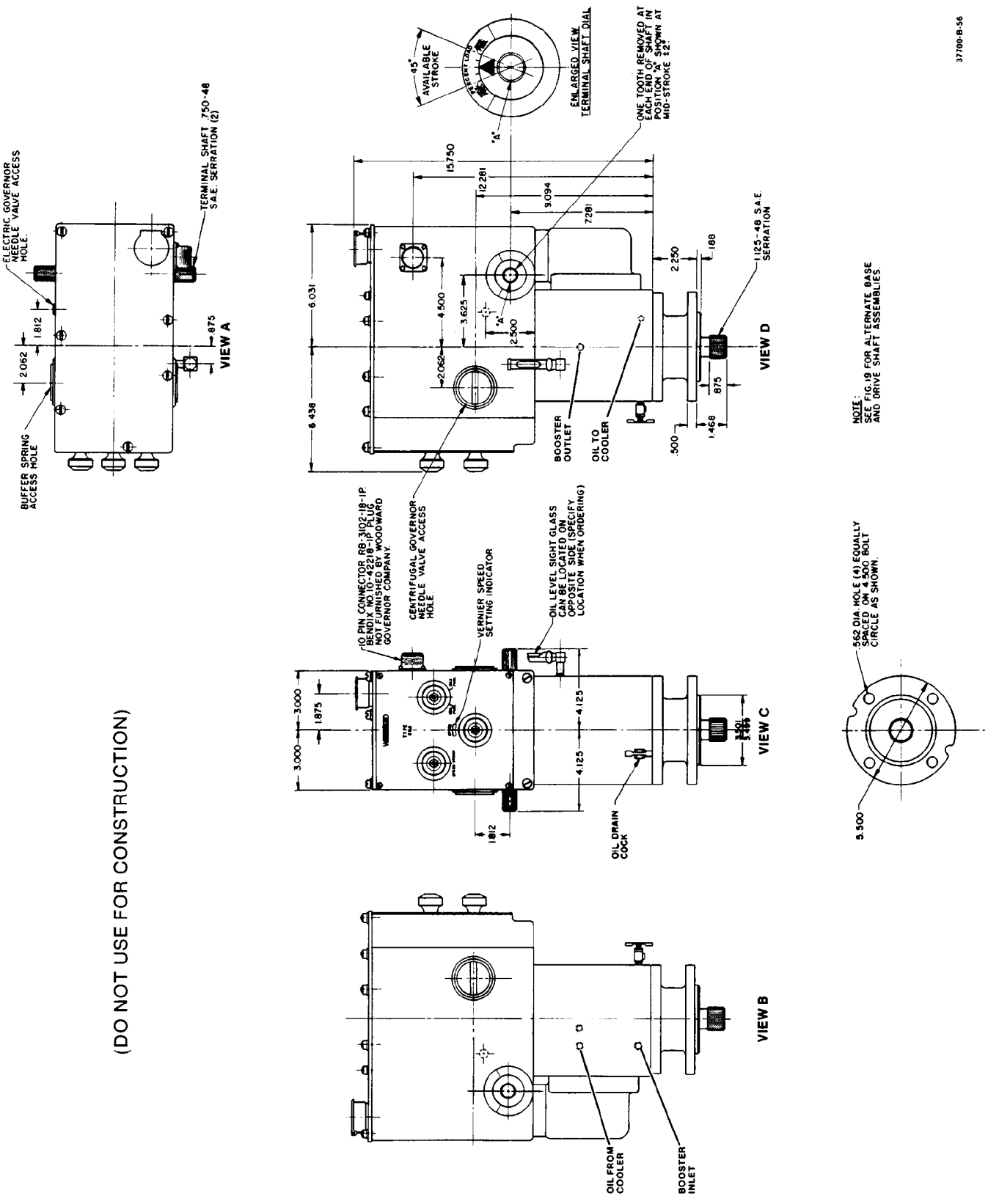
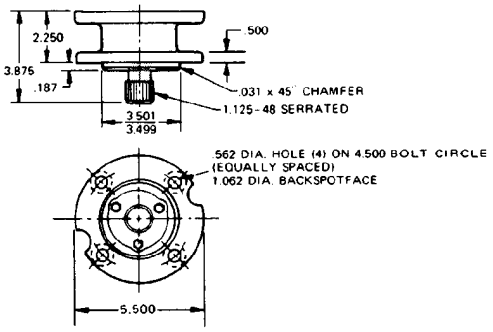


Figure 1-2. Outline Drawing of EGB-10C Governor/Actuator

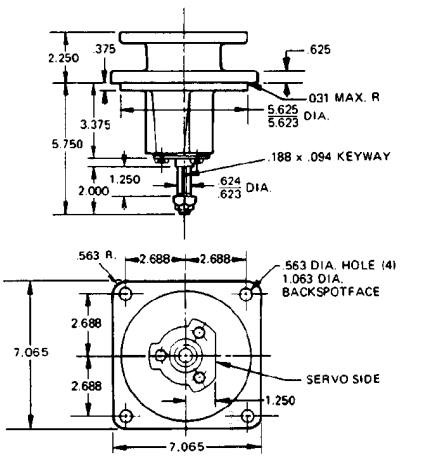


STANDARD PG BASE ASSEMBLY

(SERRATED DRIVE SHAFT-STANDARD,
SPLINED DRIVE SHAFT-SPECIAL)

36600-A-128

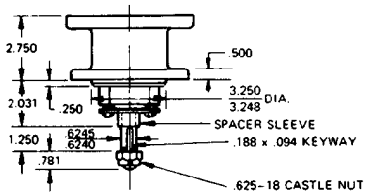
KEYED DRIVE SHAFT ONLY



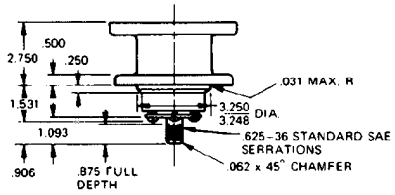
PG EXTENDED SQUARE BASE ASSEMBLY

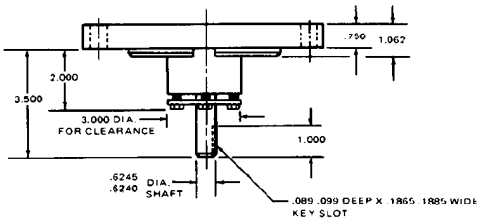
36600-A-128

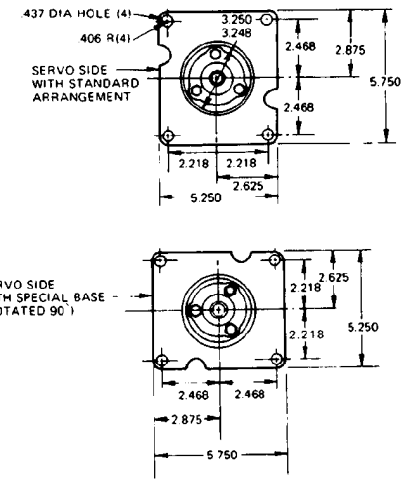
KEYED DRIVE SHAFT



SERRATED DRIVE SHAFT

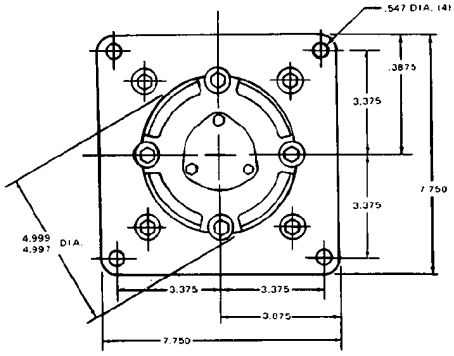






PG-UG8 AND PG-UG8-90° BASE ASSEMBLY

36600-A-128



PG-UG40 BASE ASSEMBLY

37700-A-101

Figure 1-3. Outline Drawing of Bases

Chapter 2.
Installation and Adjustments

Installation

Take care to mount the actuator square with the prime mover linkage and in line with the drive to the actuator. Place a gasket between the base of the actuator and the base mounting pad.

Adjust the fuel linkage to use at least 27° travel of the actuator terminal shaft from the no-load to full-load fuel positions. Leave some overtravel on each end for positive control.

Be sure the prime mover linkage is free of binding but without backlash. If there is a collapsible member in the linkage, it must not yield under normal governing action.

Place the governor/actuator onto its mounting pad without any force being applied. Fit the spline drive into the drive with a free slip fit. No tightness is permitted.

Oil Specifications

In general, the oil used in the prime mover will be satisfactory for use in the governor.

The governor/actuator oil supply is self contained. Sump capacity is 2 US qt (1.9 L). The governor requires about 2.5 US qt (2.4 L) to fill it when completely empty. Whenever the governor/actuator is filled, always check oil level after starting, especially when a starting booster or remote cooler is used. If the oil sight glass shows a high level, oil should be drained. If the glass shows low level after the unit is in operation, add new, clean oil to bring the level up.

Proper selection of the oil used in the actuator is necessary to realize best governor performance and maximum service life. The oil should have a minimum tendency to foam or retain air, form sludge, or deposit varnish. It should protect actuator parts from corrosion and not be detrimental to oil seals or paint. Refer to Woodward manual 25071 for more complete information on selection of oils for use in hydraulic actuators (governors).

The oil selected should haves a high viscosity index, within the range of 100 to 300 SUS at normal operating temperatures. Only oils of the grade specified for a particular temperature range should be used.

Figure 2-1 shows the viscosity of oils at the different operating temperatures. Operating the governor with oil which does not fall in the acceptable operating range on the chart can cause erratic governor operation and possible damage to the governor.

NOTICE

Oil contamination is the major cause of actuator troubles. Use only new oil or filtered oil. Containers used for filling the actuator must be clean and should be rinsed with a light grade of the same oil before use.

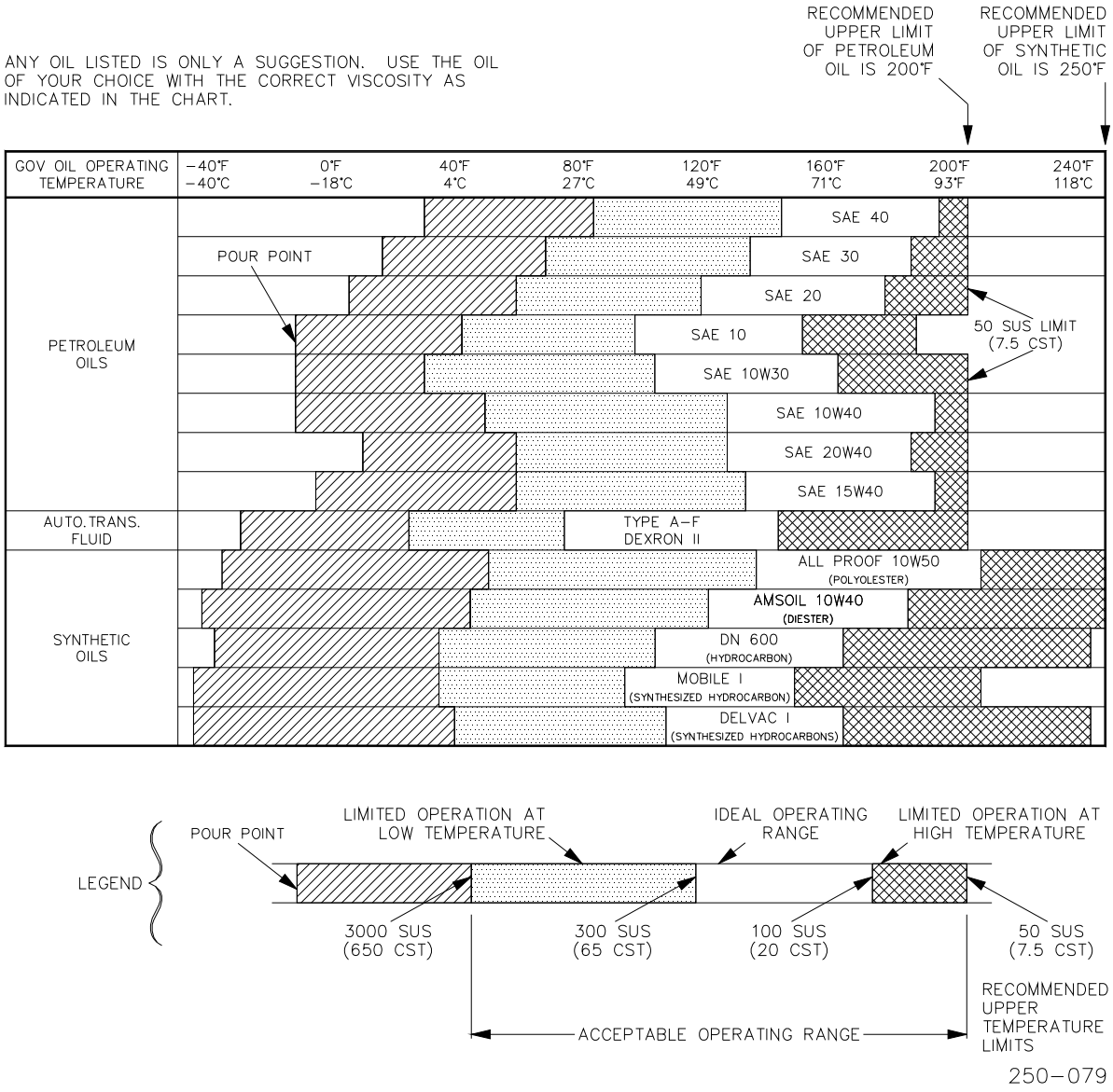


Figure 2-1 Oil Viscosity Chart

Starting the Prime Mover for the First Time

Before starting the prime mover for the first time, disconnect the input terminals indicated below:

EG-A Control Box
Disconnect terminals 1 through 10 at the control box (Figure 2-2).

EG-M Control Box
1. Disconnect terminals 1, 2, and 3 at the control box (Figure 2-3).

2. Disconnect terminals 1 through 10 at the load signal box, if used (Figure 2-4).

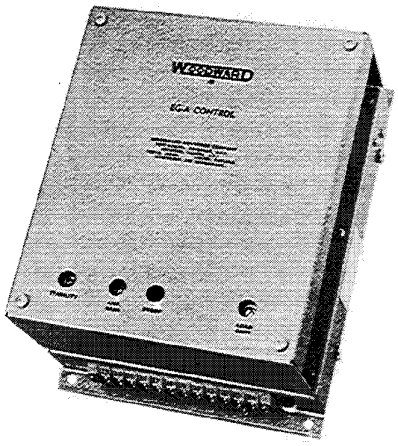


Figure 2-2. EG-A Control

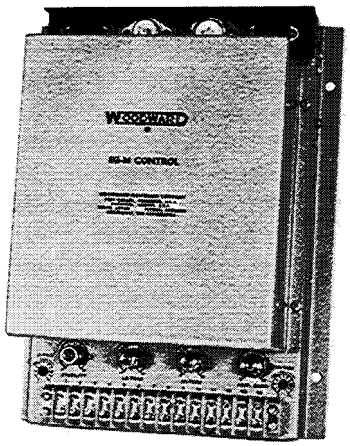


Figure 2-3. EG-M Control

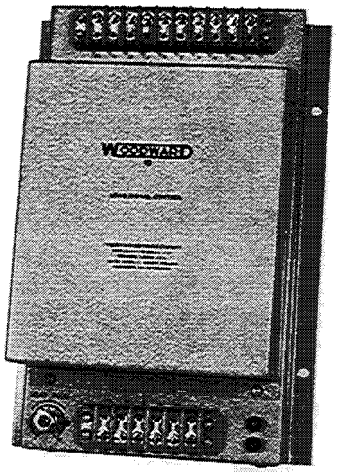


Figure 2-4. Load Signal Control

Mark the wires so that they can be correctly reconnected later. Fasten the disconnected wires to a spare terminal block for later electrical checks, or, if a spare terminal block is not available, separate and tape the wires to a wooden board or a piece of cardboard.

Start the prime mover. Use the load limit control knob to limit fuel to the speed-no-load value. The mechanical governor controls speed at the level established by the speed-setting adjustment control knob. Turn the knob clockwise to increase the speed setting and counterclockwise to decrease the speed setting.

Needle Valve Adjustment—Mechanical Governor

When starting the prime mover for the first time, it is necessary to eliminate any trapped air from the oil passages.

Open the needle valve (Figure 2-5) until the unit hunts or surges. After a half minute, gradually close the needle valve until the prime mover speed just settles out. Closing the needle valve further than necessary makes the governor slow to return to normal speed after a load change. Never close the needle valve tight.

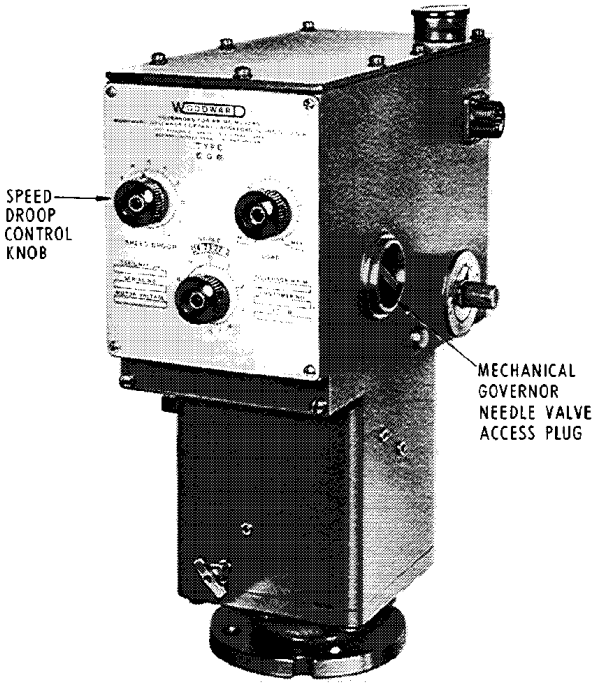


Figure 2-5. EGB-10C Governor/Actuator

Test the governor's action by manually disturbing the governor's speed. The unit should promptly return to its original steady-state speed with only a small overshoot or undershoot.

Speed Droop Adjustment

The speed droop control knob on the EGB-10C governor/actuator is usually set for 3% droop when the electric governor is controlling the prime mover. Three percent droop is normally obtained when the speed droop dial pointer is set between 2 and 3. Check the actual droop by noting the speed at no-load and again at full load. Calculate the droop by dividing the observed speed change by the no-load speed.

When the mechanical governor is controlling, the droop control knob is set at a position other than zero except when the unit is maintaining frequency of paralleled alternators or is operating as a single, isolated unit. In either of these latter cases, set the control knob at "zero" droop. In a system of paralleled alternators with prime movers controlled by mechanical governors, operate only one governor on 'zero" droop.

Electrical Checks

With the unit running without load and at approximately normal speed under control of the mechanical governor, make these electrical checks before reconnecting the wires from the generator leads to the control box and (if used) the load signal box.

EG-A Control Box

1. Check that the voltage between the wires normally connected to terminals 1 and 2, 2 and 3, and 1 and 3 is approximately 120, 208, or 240 volts as marked on the control box nameplate.

2. Check shut there is no voltage at no-load between the wires to terminals 5 and 6, 7 and 8, and 9 and 10 of the control box.

EG-M Control Box, AC Power Supply, Single Phase
Check that the voltage between wires to terminals 1 and 2 is 120 V.

When the indicated readings are obtained, shut down the system and reconnect the wires to the terminal blocks.

Electric Control Box

Before restarting the prime mover, recheck that all electrical connections to the control box, the load signal box (if used), and the electric actuator are made in accordance with the wiring diagram furnished for the installation. Then set the control box adjustments as follows.

EG-A Control Box
Place a jumper between terminals 23 and 24 for 60 Hz operation, and remove it for 50 Hz operation.

Amplifier Gain Adjustment—Turn to extreme counterclockwise position.

Stability Adjustment—Turn no extreme clockwise position.

Droop Adjustment—Set in mid-position.

Load Pulse Adjustment (if the box /s equipped with this adjustment)—Turn to extreme counterclockwise position; then turn clockwise 1/4 turn.

De-Droop Adjustment (if the box is equipped with this adjustment)—Turn to extreme counterclockwise position.

EG-M Control Box with Load Signal Box

Control Box
Amplifier Gain Adjustment—Turn to extreme counterclockwise position.

Stability Adjustment—Turn to extreme clockwise position.

Load Signal Box
Droop Adjustment—Sec in mid-position.

Load Pulse Adjustment—Turn to extreme counterclockwise position, then turn clockwise 1/4 turn.

Load Gain Adjustment—Set in mid-position.

EG-M Control Box without Load Signal Box
Amplifier Gain Adjustment—Turn to extreme counterclockwise position.

Stability Adjustment—Turn to extreme clockwise position.

Running the Prime Mover under Governor Control for the First Time

With the electric control box adjusted as previously outlined and before starting the prime mover, set the electric governor needle valve (Figure 2-6) 5/8 turn open.

Sec the droop control knob on the front of the actuator for 3% droop. This is between the 2 and 3 on the knob.

Set the speed-adjusting knob on the front of the actuator at approximately normal speed.

Set the speed-setting potentiometer for the electric governor at maximum speed position (full clockwise). Start the prime mover in accordance with the prime mover manufacturer's instructions. The mechanical governor will control speed during starting.

If the speed settles at a lower value than the mechanical governor setting, turn the speed setting potentiometer counterclockwise. If the speed increases, shut the prime mover down and interchange the wires to terminals 13 and 15 of the EG-A control box or to terminals 6 and 8 of the EG-M control box. Again set the speed potentiometer at the maximum speed position.

Start the prime mover again and adjust the mechanical governor speed setting to be approximately 4-1/2 percent above rated speed at no-load. The effect of the governor droop will reduce the speed to approximately 1-1/2 percent above rated speed as the centrifugal governor power piston moves so the full-load position.

Now use the speed setting potentiometer to decrease the electric governor speed setting. When the speed setting is less than that of the mechanical governor, the electric governor assumes control of the prime mover. Continue turning the speed setting potentiometer control knob counterclockwise to reduce prime mover speed to normal.

Make additional adjustments at this time. The objective of this procedure is to set the AMPLIFIER GAIN adjustment as far in the clockwise direction as possible while at the same time opening the electric actuator needle valve as far as possible. A recording frequency meter is a valuable aid in judging the effect of the various adjustments, If a recording frequency meter is not available, a voltmeter across terminals 17 and 18 on an EG-A control box or across terminals 4 and 5 on the EG-M control box will be useful in judging the effect of the adjustments.

Proceed in this manner:

A. If the unit is stable—

1. Turn the AMPLIFIER GAIN adjustment clockwise until the unit begins to hunt. Now turn the STABILITY adjustment counterclockwise to stabilize the unit.

   If the unit cannot be stabilized by turning the STABILITY adjustment, reset the STABILITY adjustment to its maximum clockwise position, and turn the AMPLIFIER GAIN ADJUSTMENT counterclockwise until the unit becomes stable.

   Reset the speed setting potentiometer to obtain rated speed.

When the unit is stable, disturb the system by changing the load on the prime mover, by making a quick speed setting change, or by moving the prime mover fuel racks or control valve. Observe the speed change.

2. Now open the electric actuator needle valve in 1/8 turn increments until the unit again begins to hunt. Next turn the STABILITY adjustment to achieve stability.

   If the unit will not settle down, reset the STABILITY adjustment to its maximum clockwise position and close the electric governor needle valve 1/8 turn. Use STABILITY adjustment (if necessary) to stabilize the unit.

   Repeat the process of opening the electric actuator needle valve until a slight hunt develops, then turn the STABILITY adjustment to stop the hunting until no further improvement in transient response is achieved. As mentioned previously, use of a recording frequency meter is recommended when making these adjustments. Do not open the needle more than 1-1/2 to 2 turns.

   Typical final settings are: AMPLIFIER GAIN mid-position to maximum clockwise; STABILITY mid-position to maximum clockwise; needle valve, 3/4 to 1 turn open.

B. If the unit is unstable—

1. Close the actuator's needle valve until the unit becomes stable.
   a. When the unit becomes stable, follow the adjustment procedure outlined in step "A".
   b. If the unit does not stabilize, the cause of the problem likely lies outside of the control box and actuator.

Check to see that:

- The linkage is arranged to use at least 60% of the available output of the actuator;
- The linkage is not sloppy or binding;
- The oil supply to the governor is not filled with air bubbles;
- The unit voltage regulator is functioning properly;
- The voltage supply is correct;
- The speed signal supplied to an EG-M control box is correct.

The AMPLIFIER GAIN, STABILITY, and electric actuator needle valve should require no further adjustment. Make additional checks as listed below on units equipped with an EG-A control box or an EG-M control box with a load signal box.

EG-A Control Box

Insert a dc voltmeter into the test jacks on the control box. The red jack is positive. Use a voltmeter with a minimum rating of 10 000 Ω/V. Load the unit as near to 100% as possible. Balance the phase loading within 10%. At 100% load, the load voltage on control boxes having red and black test jacks is adjustable from ±0.5 to 6 V, and at 50% load it is adjustable to 3 V, etc.

On control boxes with red and white test jacks, the load voltage is adjustable from ±0.6 to 9 V at full load, 4.6 V at 50 percent load, etc. If polarity is reversed but the voltage amplitude is correct, reverse each of the three pairs of current inputs at the control box, terminals 5 and 6, 7 and 8, and 9 and 10, to get the correct polarity. For proper load sharing, paralleled EG-A control boxes are set at the same voltage as the same percentage of full load based on 6 to 9 volts, as noted above, at full load.

⚠WARNING **HIGH VOLTAGE—Do not disconnect any wires at the resistor box. The current transformer can develop dangerously high voltage when open-circuited.**

If the above voltages cannot be obtained, check the phase relationships. Proceed in this manner:

1. Disconnect the load signal resistor leads at the control box, terminals 5 through 10. (Observe the warning note above.)

2. Set the LOAD GAIN adjustment on the control box to maximum counterclockwise position.

3. If there is a LOAD PULSE adjustment on the control box, see it fully counterclockwise.

4. Load the unit to rated load or as much load as is available. Be sure the load has a power factor greater than 0.9 and all phases are equal within 5%.

5. Measure the ac voltage across the load resistors at the control box end of the leads. These voltages must be equal within 10%. At 100% load, the voltage varies from 0.75 V to a little over 2 V. These voltages are directly proportional to the phase loads. For example, at 50% load the range is half as much. Keep the load constant during the phase checking procedure.

6. Touch the pair of wires from one of the load resistors to terminals 7 and 8 on the control box and observe the dc voltage at the test jacks. If polarity is reversed, reverse the wires and observe the voltage.

7. Repeat step 6 with the pairs of wires from each of the other load resistors; observe the dc voltage at the test jacks.

8. Of the three load resistors, one yields a dc voltage larger than the other two. Connect this resistor to terminals 7 and 8 permanently. Maintain the correct polarity.

9. Touch the wires from a second load resistor to terminals 5 and 6 and then to 9 and 10. Connect these wires to the terminals that yield the highest dc voltage.

10. Connect the remaining two wires to the remaining terminals to give the maximum dc voltage across the test jacks.

11. The LOAD GAIN should now be adjustable from ±0.5 to 6 V or more at full load on boxes with red and black test jacks, or ±0.5 to 9 V or more at full load on boxes with red and white test jacks. If it is, proceed to step 14; if it is not, proceed with step 12.

12. In step 9, the difference in voltage between touching the resistor leads to terminals 5 and 6 and 9 and 10 is always small. Because of this small difference, the pairs of wires to terminals 5 and 6 and 9 and 10 may be connected to the wrong terminals. If they are not connected correctly, the voltages in step 11 cannot be obtained. To correct the wiring, return the LOAD GAIN adjustment so maximum and proceed to step 13.

13. Reconnect the wires from terminals 9 and 10 to terminals 5 and 6. Reconnect the wires from terminals 5 and 6 to terminals 9 and 10. In each case make the connections to give the maximum dc voltage across the test jacks.

14. The load gain is now adjustable as outlined in step 11, and the proper setting may now be made.

EG-M Control Box with Load Signal Box

Insert a dc voltmeter into the test jacks on the load signal box. (The red jack is positive.) Use a voltmeter with a rating of 10 000 Ω/V. Load the unit as near to 100% load as possible. Balance the phase loading within 10%. At 106% load, the load voltage is adjustable from 0 to 9 V, and at 50% load it is adjustable to 4.5 V, etc. If polarity is reversed, but the voltage amplitude is correct, reverse each of three pairs of current inputs at the control box terminals 5 and 6, 7 and 8, and 9 and 10. This gives the correct polarity.

For proper load sharing, paralleled EG-M load signal boxes are set at the same voltage at the same percentage of full load based on 9 V as full load.

IMPORTANT

When paralleling a unit equipped with an EG-A control box having red and black test jacks to a unit having an EG-A control box with red and white test jacks or an EG-M control box with load signal box, the load voltage on the EG-A control box having red and black test jacks is set at a value based on 6 V at full load, while load voltage on the other EG-A box or on the load signal box is set at a value based on 9 Volts at full load.

⚠WARNING

HIGH VOLTAGE—Do not disconnect any wires at the resistor box. The current transformer develops dangerously high voltage when open-circuited.

If she above voltages cannot be obtained, check the phase relationships. Proceed in this manner:

1. Disconnect the load signal resistor leads at the control box, terminals 5 through 10. (Observe the warning note above.)

2. Set the LOAD GAIN adjustment on the load signal box to the maximum clockwise position.

3. If there is a LOAD PULSE adjustment on the load signal box, set it fully counterclockwise.

4. Load the unit to rated load or as much load as is available. Be sure the load has a power factor greaser than 0.9 and all phases are equal within 5%.

5. Measure the ac voltage across the load resistors at the load signal box end of the leads. These voltages must be equal within 10%, At 106% load, the voltage varies from 0.75 V to a little over 2 V. These voltages are directly proportional to the phase loads. For example, at 50% load, the range is half as much. Keep the load constant during the phase checking procedure.

6. Touch the pair of wires from one of the load resistors to terminals 5 and 6 on the load signal box and observe the dc voltage at the test jacks. If the polarity is reversed, reverse the wires and observe the voltage.

7. With the same pair of wires, repeat step 6 on terminals 7 and 8 and on 9 and 10.

8. Of the three pairs of terminals, one pair yields a larger dc voltage than the other two. Connect the wires to this pair.

9. Touch the pair of wires from a second load resistor to each of the two pairs of terminals remaining. Connect to the pair yielding the largest dc voltage.

10. Connect the remaining pair of wires to the remaining terminals to give the maximum dc voltage across the test jacks.

11. The load gain is now adjustable from zero to at least 9 V at full load, and the proper setting may now be made.

Chapter 3.
Principles of Operation

Introduction

This chapter describes the principles of operation of both the mechanical and electrical sections of the EGB-10C governor/actuator. It also includes information for making operating adjustments.

Operation

The EGB-10C governor/actuator consists of three distinct but interconnected sections: (1) an electric actuator section; (2) a centrifugal governor section; and (3) a hydraulic amplifier section which amplifies the force output of the other sections. The amplifier section also provides a source of pressure oil for the actuator.

The three sections are interconnected through the loading piston. The loading piston position determines the actuator's output shaft position. Either the electric governor section or the centrifugal governor section can control the positioning of the loading piston.

Hydraulic Amplifier

Refer to Figure 3-1. The EGB-10C column contains its own oil sump and pump to provide pressure oil required by the hydraulic amplifier. A second pump in the sub-section maintains the pressure needed for that area. The drive shaft, driven at a speed proportional to prime mover speed, rotates the pump drive gear and relay valve bushing. The idler gear is the other pump component. Oil is carried in the space between the gear teeth around the outside of the gears to the pressure side of the pump. The enmeshing of the gears provides a barrier against pressure oil returning to the low pressure area. A similar action occurs in the sub-governor pump with the gear on the governor's pilot valve bushing driving an idler gear (parts 276 and 278 of Figure 5-3).

Assume that all governor control valves are closed. Oil deposited on the discharge side of the pump first fills the various oil passages within the governor/actuator, and then forces the accumulator pistons up against the downward force of the accumulator springs. When pressure forces the pistons up sufficiently far, one piston uncovers a bypass hole through which excess oil from the oil pump returns to sump. The accumulators provide a reservoir for pressure oil and also act as a relief valve to limit maximum pressure in the hydraulic circuit.

The arrangement of the four check valves on the suction and discharge sides of the oil pump permits the actuator drive shaft to be rotated in either direction without any changes being made in or to the governor. The direction of pump rotation does not affect the oil pressure system or actuator operation. Were the pump gears rotated in directions opposite those shown in Figure 3-1, the open check valves would be closed and the closed check valves open.

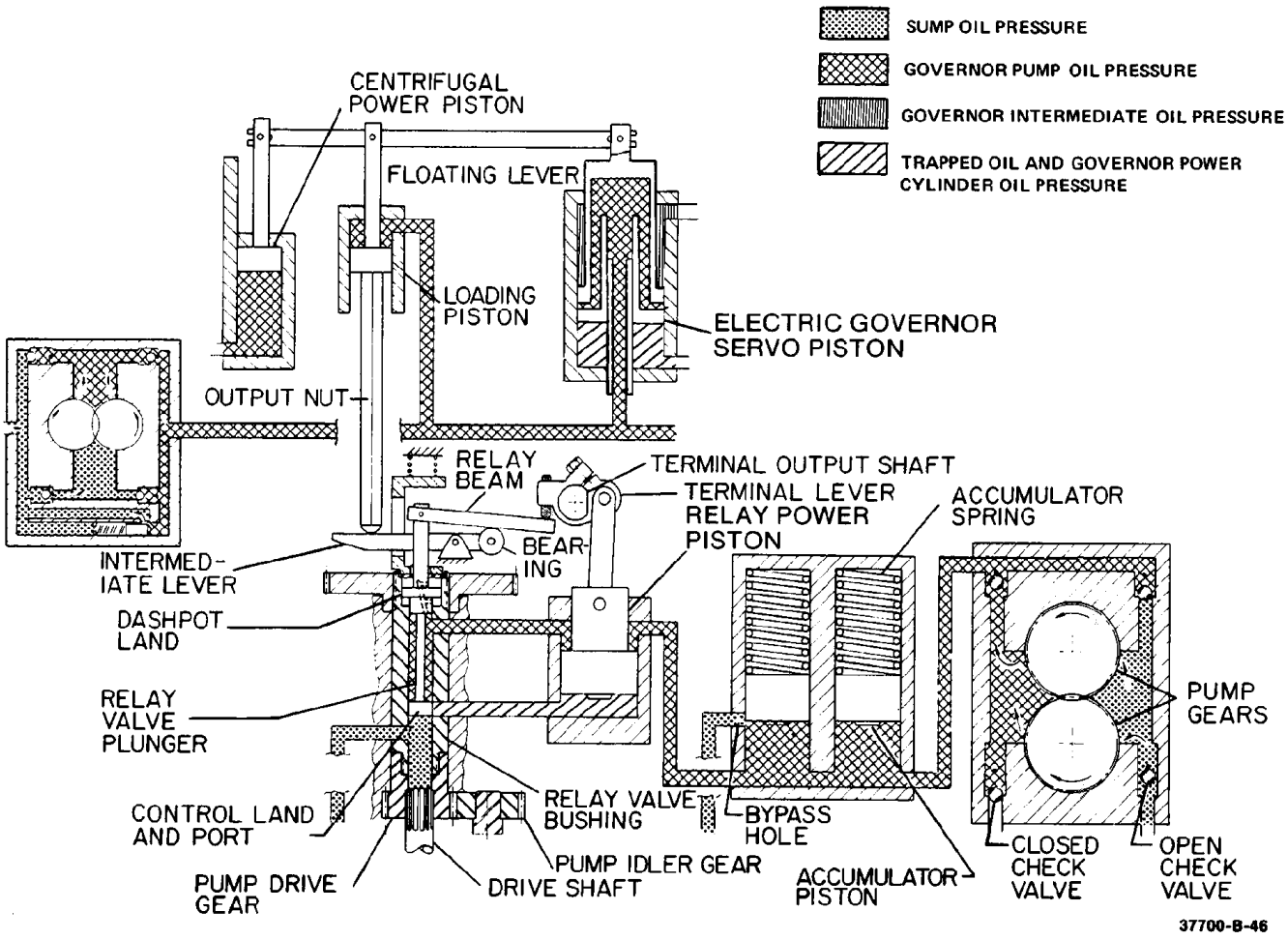


Figure 3-1. EGB-10C Amplifier Section, Schematic Diagram

The relay servo piston is connected through the terminal lever to the actuator terminal (output) shaft. The terminal shaft position establishes the fuel rack, fuel valve, or steam valve opening. The relay servo piston position establishes the terminal shaft position.

The relay valve plunger in the rotating bushing controls the flow of oil to and from the underside of the relay servo piston. If the plunger is “centered” in the bushing (its control land exactly covers the control port in the rotating bushing), no oil flows to or from the piston. Pressure oil continually urges the piston down in the direction to decrease prime mover fuel. However, the piston cannot move down to decrease fuel unless the oil trapped between the underside of the piston and the relay valve plunger control land escapes to sump. This trapped oil escapes only if the relay valve plunger is raised. If the relay valve plunger is lowered, pressure oil is directed to both the underside and the upper side of the piston. Because the pressure acts upon a greater area on the lower side of the piston, the resulting net force is in the direction to push the piston up to increase fuel.

The relay valve plunger movement is controlled by the output nut attached to the loading piston. Assume that with the relay valve plunger centered, the loading piston and output nut move down. Either the electric governor section or the mechanical governor section is capable of controlling the loading piston position. This downward movement of the piston and nut pushes the left end of the intermediate lever down. As the right end of the intermediate lever moves up, the left end of the relay beam is raised (the beam pivots about the screw in the end of the terminal lever). The relay valve plunger is lifted above center, and the servo piston, acting through the terminal lever, rotates the terminal shaft in the decrease fuel direction.

As the terminal lever rotates the terminal shaft to decrease fuel, the screw in the left end of the lever is raised. This permits the oil pressure on top of the dashpot land to push the relay plunger down, pivoting the relay beam about the bearing in the right end of the intermediate lever. The dashpot land is, in effect, a "differential piston" with the area on the upper side of the land greater than the area on the lower side. The oil pressure continually acting on both sides of the land produces a net force in the downward direction. As the relay valve plunger reaches its centered position, flow of oil from under the relay servo piston is stopped, thereby stopping the terminal shaft movement.

Assume now that, with the relay valve plunger centered, the loading piston and output nut move up. Oil pressure on the upper side of the dashpot land now pushes the relay plunger down. At the same time, the right end of the intermediate lever is pushed down, thereby keeping the left end of the lever in contact with the output nut.

With the relay valve plunger below center, pressure oil flows to the lower side of the relay servo piston and pushes the piston up. The terminal lever rotates the shaft in the increase fuel direction. As the terminal lever rotates, the screw in the end of the lever pushes the right end of the relay beam down. The relay beam pivots about the roller bearing in the right end of the intermediate lever, lifting the relay valve plunger back to its centered position and stopping further movement of the terminal shaft.

Electric Actuation Section

Refer to Figure 3-2. Consider the operation of the actuator when the electric governor is controlling (the normal mode of operation). At this time, the mechanical governor's power piston is at the top of its stroke.

The electric actuator's pilot valve plunger controls the flow of oil to and from its power piston. The pilot valve plunger is connected to an armature magnet which is spring-suspended in the field of a two-coil polarized solenoid. The output signal from the EG control box is applied to the polarized coil, and produces a force, proportional to the current in the coil, which moves the armature magnet—and pilot valve plunger—up or down. The pilot valve plunger is lowered by the control box signal resulting from a decrease in prime mover speed or an increase in speed setting of the control box. It is raised by the signal resulting from an increase in prime mover speed or a decrease in speed setting. The centering springs return the armature magnet and pilot valve plunger to their steady-state, centered positions when the electric control signal returns to its on-speed voltage value.

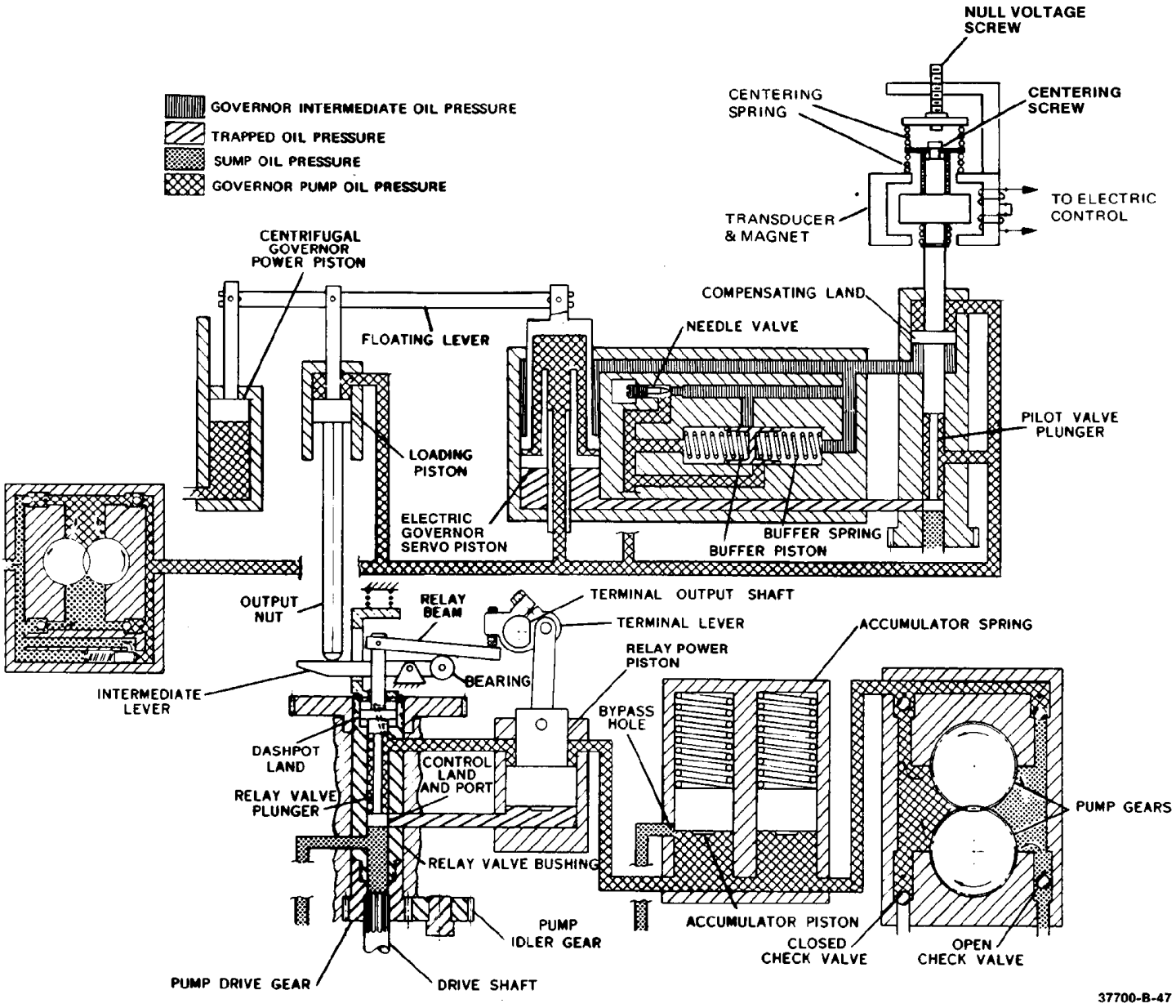


Figure 3-2. EGB-10C Electric Actuator Section, Schematic Diagram

When the pilot valve plunger is centered, no oil flows to or from the power piston. If the pilot valve plunger is lowered below its centered position, pressure oil flows to the area under the power piston. The force pushing the power piston up is sufficient to overcome the force continually urging the loading piston down. Consequently, the loading piston is moved upward in the direction to increase fuel as the floating lever pivots about its connection to the mechanical governor's power piston. If the pilot valve plunger is raised above its centered position, the oil under the electric actuator's power piston is connected to sump. The constant oil pressure on top of the loading piston then moves the loading piston down in the "decrease fuel" direction, forcing the power piston down as it does so.

Stability of a system controlled by the electric actuator is enhanced by the use of a temporary negative feedback signal which biases the speed and load signal to the pilot valve plunger. The temporary feedback signal is in the form of a pressure differential applied across the compensating land of the pilot valve plunger. The pressure differential is derived from the buffer system, and is allowed to fade away as the prime mover returns so speed.

Oil from the constant pressure source is directed to the upper side of the pilot valve plunger compensating land. Oil from this same source is also directed to the left side of the buffer piston. The right side of the buffer piston is connected to the passageway joining the lower side of the compensating land and the upper side of the power piston. Therefore the pressures on opposite sides of buffer piston are transmitted to opposite sides of the compensating land. During periods of steady-state operation, the pressures on each side of the buffer piston, and hence the compensating land, are equal.

The effect of the pressures on opposite sides of the buffer piston and the compensating land is seen by following the sequence of movements when a small load is added to the prime mover while it is running on-speed under steady-state conditions. The signal from the electric control box moves the pilot valve plunger below its centered position and the power piston moves up. The oil displaced above the power piston forces the buffer piston to the left. As the buffer piston moves so the left, the compression of the buffer spring on the left of the piston is increased; the compression of the spring on she right of the piston is decreased. A slight difference in oil pressures on the two sides of the buffer piston is thereby established, the higher pressure being on the side from which the buffer piston moves (in this instance, the right side). This higher pressure—often termed a “compensating force”—acts also on the lower side of the compensating land of the pilot valve plunger. The pressure differential is dependent on the buffer piston displacement and the buffer spring rate.

As the power piston and loading piston move up to the positions corresponding to the fuel required for the new load, the hydraulic force pushing up on the compensating land nullifies the effect of the electric signal tending to move the pilot valve plunger below center. The pilot valve plunger is re-centered, thereby stopping further movement of the power piston, even though the prime mover is still accelerating to, but has not yet reached, the set speed. As the prime mover continues to accelerate to the set speed, the magnitude of the electric signal tending to lower the pilot valve plunger decreases. To keep the pilot valve plunger “centered” during this interval, it is necessary that the compensating force be decreased at a rate proportional to the decrease in electric signal, the latter a function of prime mover speed. As prime mover speed reaches the set speed, the compensating force is reduced to zero. The rate at which the compensating force is reduced to zero depends on the needle valve setting. The needle valve opening determines the rate at which the pressures on each side of the buffer piston are equalized. As the pressures are equalized, the buffer spring on the left returns the buffer piston to its normal, central position.

These movements within the governor/actuator occur almost simultaneously rather than in the step-by-step manner described.

When a relatively small load is removed from the prime mover while it is running on-speed under steady-state conditions, the sequence of movements is similar but in the opposite direction. The signal from the electric control box moves the pilot valve plunger above its centered position. The oil pressure above the loading piston moves the loading piston and power piston down, As the power piston moves down, the oil pressure to the left of the buffer piston pushes the buffer piston to the right. The increase in compression of the right hand buffer spring and decrease of compression of the left hand buffer spring creates a slight pressure differential on the two sides of the buffer piston. As before, the higher pressure is on the side from which the piston moves—in this case, to the left of the piston. The higher pressure is now on the upper side of the compensating land.

As the power piston and loading piston move down to the positions corresponding to the fuel required for the new load, the hydraulic force pushing down on the compensating land nullifies the effect of the electric signal tending to lift the plunger above center. The pilot valve plunger is re-centered, and further movement of the power piston is stopped even though the prime mover is still decelerating to the set speed.

As the prime mover continues to decelerate to the set speed, the magnitude of the electric signal tending to lift the pilot valve plunger decreases. As in the previous example, the pilot valve plunger is kept in the “centered” position during this interval by decreasing the compensating force at a rate proportional to the decrease in electric signal. The needle valve setting determines the rate at which the compensating force is reduced to zero, As the pressures on opposite sides of the buffer piston are equalized, the spring on the right returns the piston to its normal, centered position.

Bypass passages are provided in the buffer cylinder to facilitate large corrective movements of the power piston. A large increase or decrease in speed setting, or a large increase or decrease in load, requires a correspondingly large movement of the power piston to make the necessary fuel correction. At such times, the buffer piston moves far enough—in whichever direction it is moving—to uncover the bypass port.

The bypass ports permit the power piston to move quickly in response to large changes in load or speed setting. Since the pressure differential across the compensating land of the pilot valve plunger does not continue to increase, the speed more than returns to normal (or to the new speed setting). This “overshoot” in speed is not large, and is tolerated in order to get the desired fast response. As soon as the speed changes beyond the desired point, normal governor action reverses the power piston movement, and stable operation is quickly established.

Mechanical Governor Section

Refer to Figure 3-3. When the electric actuator is, for any reason, not receiving a signal from the electric control, the electric actuator’s power piston moves to, and remains at, the maximum fuel end of its stroke. The mechanical governor now controls speed.

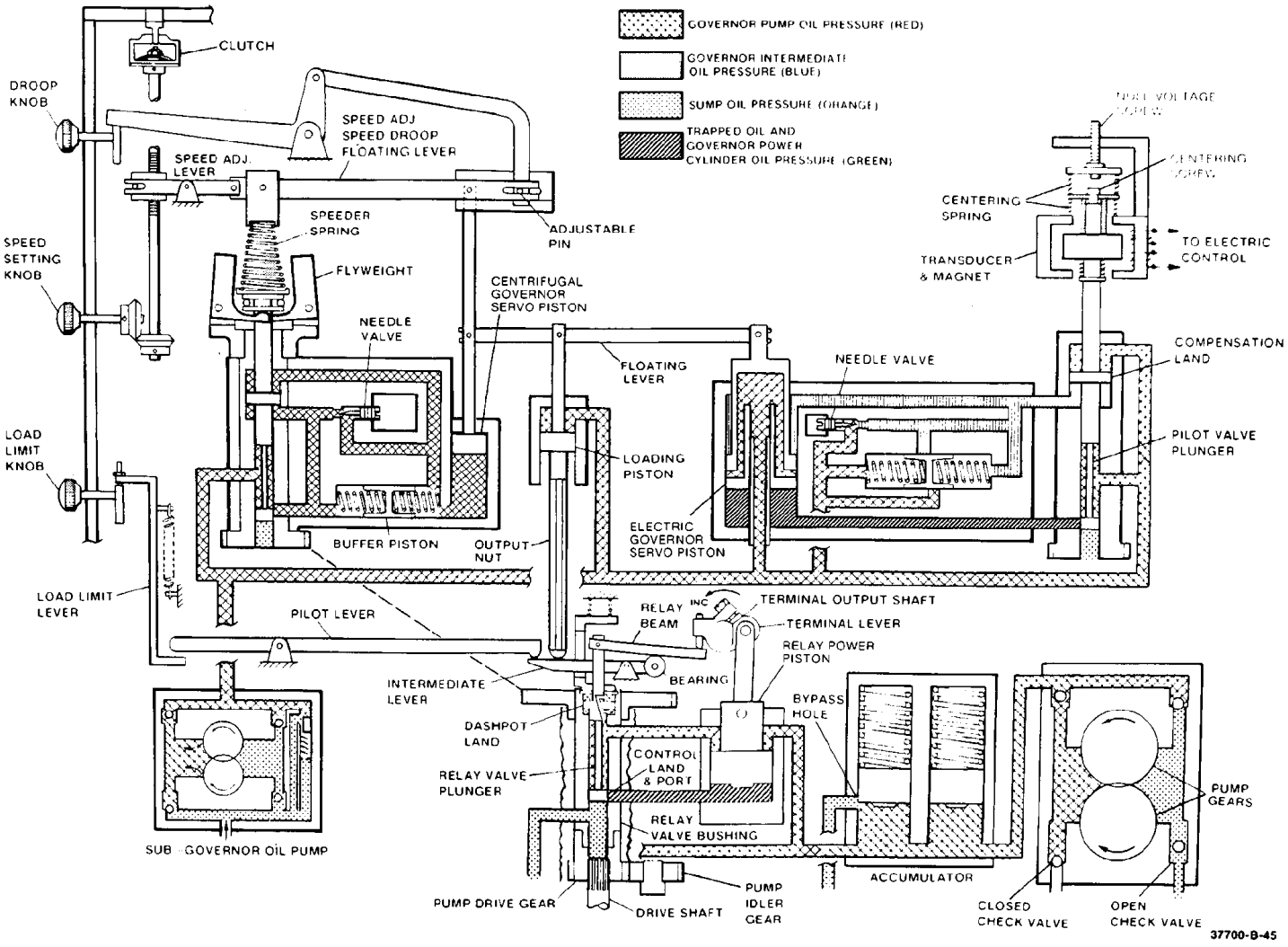


Figure 3-3. EGB-10C Schematic Diagram

The mechanical governor's pilot valve plunger controls the flow of oil to its power piston. If the plunger is centered, no oil flows past the pilot valve plunger, and the power piston is stationary. The greater of two opposing forces moves the pilot valve plunger: (1) the force from the speeder spring tends to push it down; (2) the centrifugal force developed by the rotating flyweights is translated into an upward force and attempts to raise the plunger. When the pilot valve plunger is centered, the centrifugal force of the flyweights is equal but opposite to the speeder spring force.

With the speed setting of the mechanical governor set slightly higher than the electric actuator, the centrifugal force developed by the rotating flyweights is not sufficient to lift the pilot valve plunger to its centered position. Consequently, with the electric actuator controlling, pressure oil is continually directed to the lower side of the mechanical governor's power piston to hold it up against its stop. It is for this reason that the power piston of the mechanical governor is at the upper end of its stroke when the electric actuator is controlling.

However, if, the mechanical governor is controlling and the unit is running on-speed with the pilot valve plunger centered, and a load is added to the prime mover, the prime mover and governor speeds decrease. The pilot valve plunger is lowered by the spring force which is now greater than the centrifugal force developed by the flyweights.

Pressure oil flows to the buffer piston and moves it towards the power piston. The oil displaced by the buffer piston forces the power piston upward, raising the loading piston to provide the additional fuel needed for the new load.

Stability of a system controlled by the mechanical governor section is achieved by a temporary negative feedback signal. This signal biases the speed signal to the pilot valve plunger to permit the plunger to be re-centered before the unit is back to the set speed.

The movement of the buffer piston towards the power piston partially relieves the compression of the left-hand buffer spring and increases the compression of the right-hand buffer spring. The force of the right-hand buffer spring tending to resist this 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 to the lower side of the compensation land of the pilot valve plunger; the pressure on the right of the buffer piston is directed to the upper side of the compensation land. The difference in pressures on the two sides of the compensation land produces a force which acts to push the plunger back to its centered position.

When the terminal shaft rotates 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 re-centers the pilot valve plunger, even though prime mover speed is not yet completely back to normal. The power piston and loading piston movement is stopped. The continued increase of speed to normal results in continued increase in the centrifugal force developed by the rotating flyweights. However, 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 prime mover speed to normal. Consequently, as the centrifugal force increases, the compensating force decreases.

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

When the prime mover load is decreased, the increase in governor speed causes the flyweights to move outward and raise the pilot valve plunger, connecting the area to the left of the buffer piston to sump. The loading piston, continually being urged downward by oil pressure from the governor pump, moves down and forces the centrifugal governor power piston down. This movement reduces the fuel to meet the new requirement. As before, differential pressure across the compensation land assists in re-centering the pilot valve plunger, closing the ports while speed decreases to normal.

The speed at which the mechanical governor controls the prime mover is determined by the compression of the speeder spring which opposes the centrifugal force of the flyweights. The compression of the speeder spring is increased or decreased by turning the manually operated speed setting adjustment control knob on the front panel of the governor/actuator. Turning the knob rotates the speed adjusting screw and moves the speed adjusting block up or down. If the block moves up, the right end of the speed-adjusting lever and left end of the speed-adjusting speed droop floating lever move down, increasing the compression of the speeder spring. If the block moves down, the left end of the floating lever moves up, reducing the compression of the speeder spring.

The friction clutch at the upper end of the speed-adjusting screw prevents vibration from causing unwanted speed setting changes to the mechanical governor section.

Speed droop is used in mechanical governors to automatically divide and balance load between prime movers driving alternators or a common shaft. Speed droop is defined as the decrease in governor speed as its output connection to the prime mover fuel linkage moves from its extreme minimum to extreme maximum positions. Speed droop is incorporated in the EGB-10C governor/actuator through linkage which varies the compression of the speeder spring as a function of the mechanical governor power piston, The change in speeder spring force for a given movement of the power piston is determined by the position of the adjustable pin in the linkage between the power piston and speeder spring. If the pin is on the same centerline as the speed droop lever pivot arm, there is no change in speeder spring force as the power piston moves up and down. The mechanical governor then responds as an isochronous (constant speed) control. The further the adjustable pin is moved away from the pivot arm centerline, the greaser is the change in compression of the speeder spring for a given power piston movement.

Position the adjustable pin by the speed droop control knob on the front panel of the actuator.

When the actuator operates under control of the electric governor section, the speed droop feature is, in effect, inoperative. During such operation, the mechanical governor’s power piston remains in the position for all prime mover loads (except possibly momentarily during transients). The speed droop linkage does not alter the speeder spring compression when the electric actuator section of the actuator is controlling.

The load limit control knob on the front panel of the actuator positions the load limit lever. Acting through the pivot lever, the load limit lever restricts the upward travel of the left end of the intermediate lever. It limits the maximum fuel (and hence, load) allowed the prime mover.

Operating Adjustments

The LOAD GAIN, AMPLIFIER GAIN, and STABILITY settings should not require adjustments other than those made during initial start-up.

Leave the LOAD PULSE adjustment at the original setting before the unit was started. This adjustment controls the load pulse decay time, and is used to improve transient performance. Use a recorder when establishing the optimum setting for the load pulse adjustment. Make this adjustment only after the LOAD GAIN adjustment is made.

Use the DROOP adjustment to parallel a unit with an infinite bus, or with dissimilar units. Place the droop switch in the correct position to complete the droop circuit in the control box. See the plant wiring diagram in the EG Control manual.

When operating in parallel, turn the SPEED SETTING adjustment clockwise (increase speed direction) to increase the load on the unit. Turning the DROOP adjustment clockwise increases droop, thereby improving paralleled stability.

To set the DE-DROOP adjustment (if on your unit), check the prime mover rpm or alternator frequency at no load. Load the alternator to as near full load as possible (do not put onto an infinite bus) and recheck the speed or frequency. If it has changed, adjust the potentiometer shaft clockwise and recheck the speed or frequency until no difference between no-load and full load is detected.

Chapter 4. Maintenance

Introduction

This chapter provides information for storage, troubleshooting, disassembly procedures, reassembly, and adjustments.

Storage

Protect all units against rust and contamination if stored more than 90 days before installing. Fill the governor/actuator to the top with lubricating oil and replace shipping plugs before storing. Drain and refill it to the proper level when installing it.

Troubleshooting

Governor faults are usually revealed in speed variations of the prime mover, but it does not necessarily follow that all such speed variations indicate governor faults. Therefore, when improper speed variations appear, proceed as follows.

1. Check the load to be sure that the speed changes observed are not the transient result of continuing load changes.

2. On a diesel or gas engine, check the engine operation to be sure that all cylinders are firing properly, and that the injectors or spark plugs are in good operating condition.

3. See that the operating linkage between the governor/actuator and prime mover is free from binding or lost motion.

4. Check the voltage regulator to be sure it is functioning properly. If these checks do not reveal the cause of the speed variation, the cause may be in the governor.

5. With the unit set for isochronous operation and governing at normal speed, check the voltage input to the electric actuator, and adjust if necessary.

   A. If the governor is of the type adjusted to go to maximum fuel when the electric signal to the actuator is interrupted, do the following:
      1) If using an EG-A box, connect the positive meter lead to terminal 18, and the negative meter lead to terminal 17.

OR

      If using an EG-M box, connect the positive meter lead to terminal 4, and the negative meter lead to terminal 5.

      2) The voltage reading will be between +0.7 and +0.9 V. If it is not, insert a 1/8 inch hex wrench into the null voltage screw (236. Figure 5-3) and slowly adjust the voltage until the reading is between +0.7 and +0.9 V.

         The above procedure connects the meter so that a negative (–) output from the control box will read a positive (+) on the meter.

B. If the governor is of the type adjusted to shut down the prime mover when the electric signal to the actuator is interrupted, do the following:
   1) If using an EG-A box, connect the positive meter lead to terminal 17, and the negative meter lead to terminal 18.

OR

   If using an EG-M box, connect the positive meter lead to terminal 5, and the negative meter lead to terminal 4.

   2) The voltage reading will be between +0.7 and +0.9 V. If it is not, insert a 1/8 inch hex wrench into the null voltage screw (236, Figure 5-3) and slowly adjust the voltage until the reading is between +0.7 and +0.9 V.

      The above procedure connects the meter so that a positive (+) output from the control box will read positive (+) on the meter.

   3) When the voltage has been adjusted as directed, go to step 5C below.

IMPORTANT **If the voltage cannot be adjusted to the value specified, the control box may be defective. See the applicable control box manual for further electrical checks, or replace the entire box.**

C. The dc voltage readings should not fluctuate more than 0.25 V.
   1) If it does not, proceed to step 8 below.

   2) If it does, reset the AMPLIFIER GAIN and STABILITY adjustments as outlined in the EG Control Box section under the section entitled Running the Prime Mover under Control of the Electric Governor for the First Time".
      a. When the fluctuations are within the range specified, proceed to step 6 below.
      b. If the fluctuations cannot be reduced to the range given, check the control box. See the applicable control box manual for further electrical checks, or replace the entire box.

6. If the droop switch is set in the normal or isochronous position, and the trouble is reflected by a change in unit steady-state speed as load is changed, take two dc voltage readings across terminals 17 and 15 of an EG-A control box or terminals 4 and 5 of an EG-M control box under different load conditions.

   A. If the voltage is the same at each of these readings, the control box may be defective. See the applicable control box manual for further electrical checks or replace the entire box.

   B. If the voltage readings differ by more than 0.2 Vdc, the trouble lies within the actuator. Replace or repair the actuator.

General Information

The source of most troubles in any hydraulic actuator or governor stems from dirty oil. Grit and other impurities are introduced into the governor with the oil, or are formed when the oil begins to break down (oxidize) or become sludgy. The moving parts within the governor/actuator are continually lubricated by the oil within its case. Grit and other impurities cause excessive wear of valves, pistons, and plungers, causing these parts to stick and even “freeze” in their bores.

It is virtually impossible to re-center the armature magnet—and hence, pilot valve plunger—without the use of special equipment. Unless such equipment is available, we do not recommend that any attempt be made to service the electric actuator section. Those having a governor test stand can likely adapt their stand for testing and setting governor/actuators. Write to Woodward for complete information regarding the test stand adaptation and new auxiliary test equipment needed. We will also supply at that time the necessary instructions for properly centering the armature magnet. Overhaul the mechanical governor section if necessary.

NOTICE **Do not attempt to overhaul the electric section of the sub-governor if the special test equipment mentioned above is not available.**

Most of the repair work consists of cleaning and polishing of the governor/actuator parts. All pistons, plungers, valves, and rods must move freely without binding or catching.

Do not attempt to polish the lands of the pilot valve plungers. If the plungers are nicked, scratched or corroded, replace them.

If a solvent is used to clean parts, it must be a type which does not damage oil seals or gaskets. Thoroughly remove solvents from parts before reassembly, to avoid contaminating the oil supply.

Governor/Actuator Disassembly

Cleanliness of tools and work space is essential. If possible provide a work bench, vise, arbor press, speed lathe, air line, and containers for cleaning solvents. The usual small hand tools are required, and a few special Woodward tools are desirable if sub-assemblies are to be disassembled.

The numbers in parentheses in the following disassembly procedures refer to the identification numbers shown in Figures 5-1, 5-2, 5-3, and 5-4.

1. Remove cover screws (1) and washers (2). Lift off cover (4) and gasket (6).

2. Remove dial plate screws (18) and dial plate (19).

3. Remove dial panel screws (20) and washers (21).

4. Pull dial panel (22) forward to remove dial panel assembly consisting of items (7) through (17) and items (24) through (53). Remove gasket (23).

5. Remove screws (252). Separate connector socket (253), spacer plate (254), and connector plug (255).

6. Remove nut (292), screw (290), and washer (291).

7. Lift sub-governor case (267) and components assembled to and within the case (items 54 through 63 and 200 through 297).

NOTICE

Be careful that pinion (117) does not drop out when the sub-governor is removed. Remove pinion (117). See "Sub-governor Disassembly" below for disassembly of the sub-governor.

8. Remove shaft bearing retainer assemblies (111) and washers (110). Take out shaft assembly (103) with bearing (102) and pin (101) attached.

9. Lift out relay beam (106), relay valve plunger (116), and assembled parts (items 106, 107, 109. 113, 114, and 115).

10. Loosen set screw (65). Remove terminal lever pin (69).

11. Remove three screws (66) and washers (67). Lift off column (70) and assembled column components (items 68, 71, 76, etc). Remove gasket (112).

12. Lift out relay valve bushing/gear assembly (118).

13. Remove screws (162) and washers (161) to detach the relay power cylinder (163) and its assembled components (items 152 through 160). Remove gasket (164).

14. Remove lockwire (148). Remove screws (147) and retainer (146). Take out drive shaft (145) with bearing (144) and snap ring (143) attached. Remove oil seal retainer (141), oil seal (142), and gasket (140).

15. Remove screws (139) and washers (138). Remove base (137) and seal ring (135).

NOTICE

Be careful that idler gear (133) and drive gear (234) do not fall when the base is removed. Remove gears 133 and 134). See below for disassembly of power case assembly.

Power Case Disassembly

1. Place power case (127) in an arbor press or small drill press (end of case with idler stud (132) to be "down"). Place a rod against spring seat (120) to compress accumulator springs (121 and 122) to permit removal of snap ring (119) (see Figure 4-1).

2. Slowly relieve compression of springs. Remove spring seat (120). springs (121 and 122), and accumulator piston (131).

3. Invert power case (127) and remove lower snap ring (119).

4. If necessary to remove check valve assembly (129), proceed in this manner. Press ball through and out of check salve case. Use a 1/4"-28 tap to put a thread on the inside of the valve case. Then, using a 1/4"-28 bolt with a small plate as a jack, poll the valve case out of the power case (see Figure 4-2).

5. If necessary to remove check valve assembly (130), proceed in this manner. Pry the retainer plate from the check valve assembly and remove the spring and check ball. Use a 1/4”-28 tap to thread the inside of the valve case. Then use a 1/4”-28 bolt and plate to pull the valve case out of the power case (see Figure 4-2).

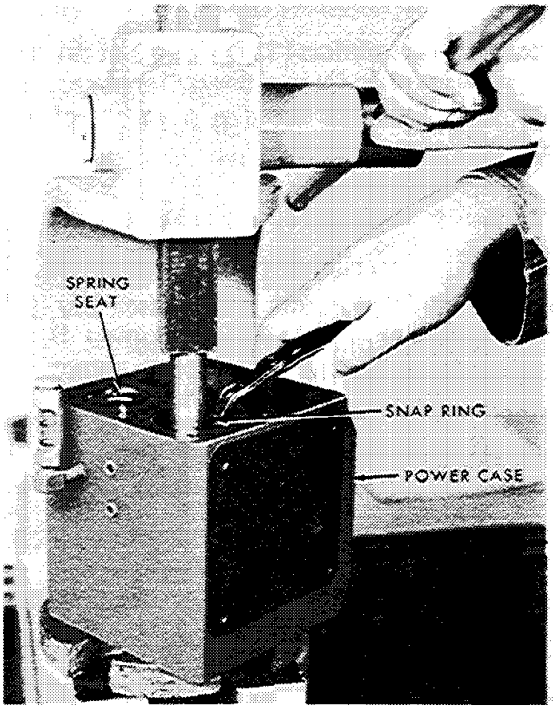


Figure 4-1. Accumulator Disassembly

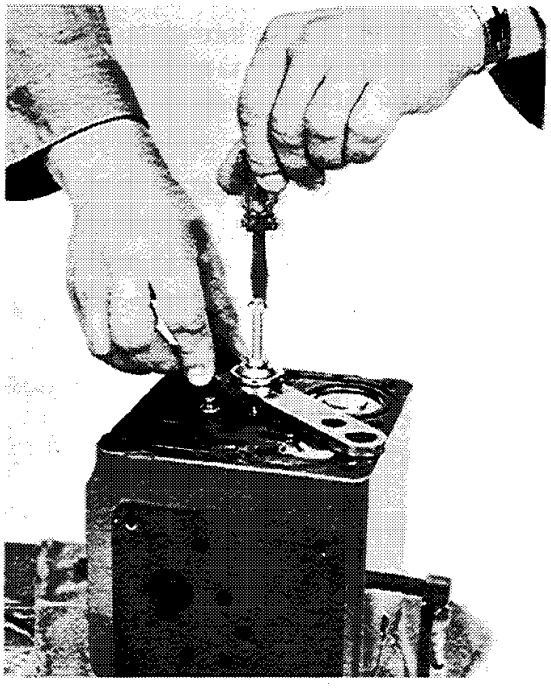


Figure 4-2. Check Valve Removal

Column Disassembly

1. Loosen two screws (66). Turn a 10-24 screw into the tapped hole between the screws (66) to relieve slightly the “clamping” effect of the terminal lever (68) about the terminal shaft (76).

2. Remove snap ring (80) from one end of terminal shaft (76).

3. Using a soft (rubber, plastic, etc.) hammer on the end of the terminal shaft (76) from which the snap ring was removed, drive out bearing (77) and oil seal (76) on the opposite side of the column.

Sub-Governor Disassembly

NOTICE

Do not perform steps 7 through 11 unless absolutely necessary to replace parts in the electric actuator section. If it is necessary, get instructions from Woodward for resetting the transducer, before disassembly.

1. Remove cotter pin (222) and pin (223). Remove retaining rings (245) and pivot pins (246). Take out droop lever (219).

2. Remove spring (62). Loosen screw (54) and slide lever (56) off lever assembly (58).

3. Remove nut (57) and pivot pin (59). Remove lever assembly (58).

4. Remove link assembly (60) and spacers (61).

5. Remove cotter pin (201) and pin (202). Remove nut (205), levers (204), and spacer (203). Take out lever post (244).

6. Remove floating levers (206).

7. Insert a 3/32” Allen wrench through the hole in screw (236) and unscrew socket head screw (234) to release is from the electric governor pilot valve plunger (265).

8. Remove screws (230) and washers (231). Lift off transducer bracket (232) with the adjusting screw (236) intact.

9. Lift out coil cover assembly (237). The socket head screw (234) and washer (235) will come out with the coil cover assembly if they were not removed in step 7.

10. Lift out temperature compensating ring (241) and transducer assembly (240). Magnet assembly (235) and washer (239) will come out with transducer assembly.

11. Remove spring (242).

12. Separate the speeder spring (299) from spring seat (210) by “leaning” the spring in the direction of the open end of the bottom coil while at the same time “unscrewing” the spring from the seat.

IMPORTANT **Use special wrench—Woodward tool 370109—to hold seat (210) while loosening spring.**

Remove spring (299) and upper spring seat assembly (207).

13. While holding spring collar (210) (use special wrench—Woodward tool 370109), loosen and remove nut (209). Remove spring collar (210) and thrust bearing (211).

14. Remove spring ring (214). Lift off the flyweight head assembly (consisting of items 212, 213, 215, and 216). Disassemble the flyweight head assembly by first removing retaining ring (212).

15. Remove pins (228 and 222). Remove pins (268 and 222). Remove link (224). Lift “free” end of lever (225) and tip the case to allow piston pin (229) to slide out.

16. Remove snap ring (247) to gain access so centrifugal governor buffer parts (items 248, 249, 250, and 251).

IMPORTANT **These buffer parts are not interchangeable with the electrical governor buffer parts.**

17. Remove snap ring (262) to gain access to the electric governor buffer parts (items 258, 259, 260, and 261).

IMPORTANT **These buffer parts are not interchangeable with the centrifugal governor buffer parts.**

18. Remove needle valves (256) and O-rings (257).

19. Turn case (267) upside down and remove base screws (287, 288, 289, and 296) and washers (298). Remove base (286).

NOTICE **Be careful that none of the gears or other parts are pulled from the case and fall when the base is taken off.**

20. Remove idler gear (278).

21. Remove centrifugal governor pilot valve bushing (276) with pilot valve plunger (275) inside. Take out snap ring (217) to remove compensating bushing (218) and pilot valve plunger (275).

22. Remove electric governor pilot valve bushing (266) with pilot valve plunger (265) inside. Take out snap ring (263) and remove compensating bushing (264) to pilot valve plunger (265).

23. Remove O-ring (270). Remove piston assembly (269).

24. Remove oil tube (284), O-ring (285), and spring washer (283). Remove servo piston sleeve (280) and O-ring (282). Remove piston assembly (280) with floating lever (225) attached. Drive out pin (279) to separate lever (225) and piston assembly (280). Be careful that retaining ring (226) is not lost when pin (279) is driven out.

25. Remove output nut (274) and jam nut (273). Take off pivot (272) and return piston (271). Remove pivot link (227).

Governor Reassembly

When assembling the parts into the governor/actuator, be sure that no lint (from wiping rags) or other foreign matter is present on the parts. Assemble the actuator dry. When replacing pipe plugs which were removed, use a good joint compound on the threads of the plug—NOT IN THE HOLE. After the actuator is assembled but before replacing the cover, apply a liberal amount of clean lubricating oil over all the moving parts to ensure initial lubrication.

In general, the assembly procedure is the reverse of the disassembly sequence. All pistons, plungers, and gears must move freely without dragging or binding. Torque transducer screws (230, Figure 5-3) to 17 lb-in (1.9 N·m). During assembly, give particular attention to the areas listed below.

Sub-Governor

1. Install piston assembly (280) (sleeve (281) not yet installed). Place retaining ring (226) in the counterbore around the pin hole in floating lever (225) (a little grease on the ring will help hold it in place). Fit the lever into the slot of piston assembly (280) and install pin (279); the tapered end of the pin should be inserted in the piston hole furthest from the retaining ring; press the pin in until the retaining ring slips into the groove in the pin.

   Install piston assembly (269) and servo pin (229).

   Attach pivot link (227) to floating lever (225) using pins (228 and 222). Fit the “free” end of lever (225) over servo pin (229) while at the same time slipping the pivot link (227) into the bore in the case for the return piston (271). Do not put return piston (271), pivot (272), and jam nut (273) onto the threaded end of pivot link (227); the jam nut should be just started onto the thread.

   Install piston sleeve (281) and O-ring (262).

   Use pins (268 and 222) to attach link (224) to piston assembly (269).

   Lay the sub-governor case on its side. Lift up on floating lever (225) to raise servo pistons (269 and 280) to the upper end of their strokes. While holding the floating lever up, thread jam nut (273) up onto the pivot link until piston (269) just begins to move down; then back the nut off 1/8 turn. Lock the nut in position using output nut (274).

2. After installing the centrifugal governor pilot valve plunger (275), compensating bushing (218), and flyweight head and other components (including items 209 through 217), the pilot valve plunger must be centered.

   Proceed in this manner.

   a. Be sure lock nut (209) is not locked tight against the spring seat (210).

b. With one hand holding the bottom end of the pilot valve bushing (276) up into the case, use the other hand to posh down on the pilot valve plunger (275). Pushing down on the plunger will move the flyweights to the innermost position.

Look through the metering port (the hole below the gear) in the bushing to observe the position of the pilot valve plunger control land with respect to the port in the bushing (see Figure 4-3).

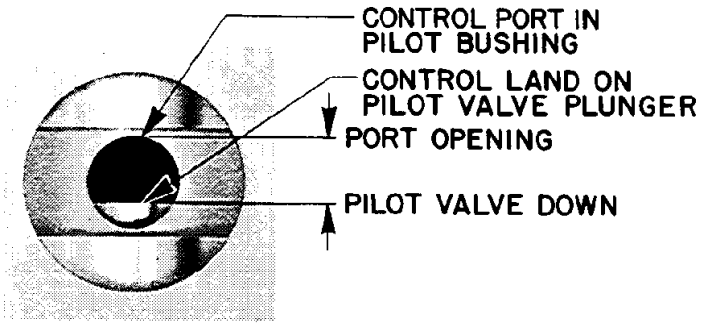


Figure 4-3. Centering P.V. Plunger

c. Holding the pilot valve plunger down against the flyweight toes, move the flyweights outward as far as they will go, and check the amount of port opening now appearing below the edge of the control land of the plunger (see Figure 4-4).

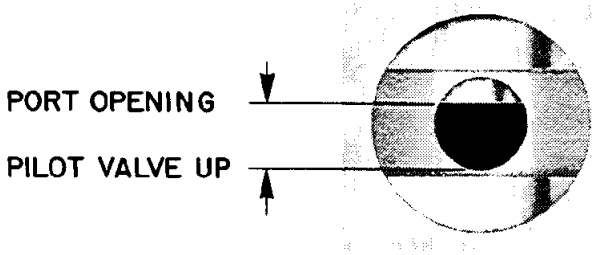


Figure 4-4. Centering Pilot Valve Plunger

d. The amount of port opening with the flyweights at extreme inner and outer positions should be equal within 0.010” (0.25 mm).

e. If the pilot valve plunger is too low, hold the spring seat stationary, and turn the pilot valve counterclockwise to raise it. If the pilot valve is too high, hold the spring seat and turn the pilot valve clockwise to lower it.

f. When the pilot valve appears to be centered, tighten the lock nut down on the spring seat, recheck the valve setting.

3. Be sure that base (286) and case (267) are properly aligned so that idler gear assembly (278) and pilot valve bushings (276 and 266) turn freely, Before tightening the base screws, slip pinion (117) onto pilot valve bushing (276) and use is to turn the bushing to see that the base and case are properly aligned. After tightening the base screws, recheck the alignment once again.

If the pilot valve bushing does not rotate freely, loosen the base screws slightly and tap the edge of the base with a soft (plastic, rubber, etc.) hammer to shift it about until the bushing turns freely. Tighten the screws and recheck.

4. Each end of speeder spring (299) must be securely attached to its mating part.

Mechanical Governor Adjustments

The following adjustments should be made if the factory settings have been disturbed. In order to set correctly, the centrifugal governor section must be in control of fuel input—not the electric actuator section. If possible, adjust while on a test stand.

Terminal Shaft Travel Adjustment

Turn the load limit control knob fully clockwise. Turn screw (35) counterclockwise until the control knob can be rotated 1/8 turn counterclockwise before the shutdown strap (37) begins to rise. Again turn the control knob fully clockwise.

Adjust screw (64) to permit full travel of the terminal shaft (from minimum fuel to maximum fuel positions as shown on the fuel indicating dial plate, 81 or 84). Turn the screw counterclockwise to lengthen the terminal shaft travel in the maximum fuel direction.

Load Limit Adjustment

Turn the load limit control knob fully clockwise. With the actuator running and the terminal shaft just at the end of its travel in the maximum fuel direction, turn screw (35) clockwise until the terminal shaft just starts to move in the minimum fuel direction. Then turn the screw counterclockwise 1/4 turn and lock in position with nut (36).

Turn the load limit control knob counterclockwise until the terminal shaft is at the mid-point of its travel (as shown by the fuel indicating dial plate). Loosen nut (7), and position pointer (9) at “5”; tighten the nut to lock the pointer in position.

Speed Droop Adjustment

Position the speed droop lever cam (56) so that, with the speed droop control knob turned fully counterclockwise, there is no change in speed as the actuator terminal shaft rotates from just off its minimum to just short of its maximum fuel position.

If the speed decreases as the terminal shaft moves from minimum to maximum positions, lower cam lever (56). If speed increases as the terminal shaft moves from minimum to maximum positions, raise the cam lever. Follow the procedure outlined below to move the cam lever.

To lower the cam lever:

Rest a screwdriver against the bowed rib in the front edge of the column to push the upper end of speed droop adjusting lever assembly (58) back slightly. While holding the lever assembly in this position, loosen socket head screw (54), allowing spring (62) to pull the cam lever (56) down. While still holding the adjusting lever in position with the screwdriver, tighten screw (54) to lock the cam lever in the new position.

NOTICE

Do not release the tension on the lever assembly while screw (54) is loose.

To raise the cam lever:

Rest a screwdriver against the bowed rib in the front edge of the column to hold the upper end of the speed droop lever in the same position while loosening screw (54). While still retaining control of lever assembly movement by means of the screwdriver, allow spring (62) to move the upper end of the lever assembly forward slightly. Hold the lever in the new position while tightening screw (54).

NOTICE

Do not allow the spring to move the lever except as allowed by the screwdriver.

Speed Setting Stop Adjustment

Remove dial plate (19). Remove speed setting adjustment control knob (8) and pointer disc (9). Loosen three flat head screws (10). Put control knob (8) back on speed setting shaft assembly (50).

Turn the speed setting adjustment control knob counterclockwise until the specified low speed is reached. Rotate dial stop (14) nearest the control knob counterclockwise until it reaches stop pin (28). Be sure the actuator terminal shaft is not at the end of its travel when low speed is reached. Position the speed setting dial plate to have “0” at the 12 o’clock position.

Now turn the control knob clockwise until the specified maximum speed setting is reached. Rotate the dial stop (14) furthest from the control knob clockwise until it touches the stop pin (28). Be sure the actuator terminal shaft is not at the end of its travel when high speed is reached.

Tighten screws (10). Recheck speed settings; readjust stops, if necessary.

Turn the control knob to low speed setting. Remove the knob. Put pointer disc (9) on the shaft assembly so that the pointer is at the 12 o’clock position. Put the control knob back on and tighten nut (7).

Adjustment of Clutch Assembly

Torque elastic nut (42, Figure 5-1) to 4 to 5 lb-in (0.45 to 0.57 N·m) against friction drive spring (43).

Chapter 5.
Replacement Parts

This chapter provides replacement parts information for the EGB-10C governor/actuator. An illustrated parts breakdown shows all replaceable parts of the governor/actuator.

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

- Actuator serial number and part number shown on nameplate
- Manual number (this is manual 37708)
- Parts reference number in parts list and description of part or part name

The parts breakdown figures illustrate and list all the replaceable parts for the EGB-10C governor/actuator. The numbers assigned are used as reference numbers and are not specific Woodward part numbers. Woodward will determine the exact part number for your particular actuator.

Parts List for Figure 5-1

Ref. No.	Part Name	Quantity
37708-1	Fillister hd screw (1/4”-28 x 5/8”)	7
37708-2	Lockwasher	7
37708-3	Clutch stop pin	1
37708-4	Cover	1
37708-5	Oil filler cup	1
37708-6	Gasket (cover-to-column)	1
37708-7	Elastic stop nut (1/4”-28) (see Figure 5-5)	3
37708-8	Knob (see Figure 5-5)	3
37708-9	Pointer disc (see Figure 5-5)	3
37708-10	Flat hd. screw (#10-32 x 3/8”) (see Figure 5-5)	3
37708-11	Dial locating plate (see Figure 5-5)	1
37708-12	Speed setting dial plate (see Figure 5-5)	1
37708-13	Dial stop spacer (see Figure 5-5)	3
37708-14	Dial stop (see Figure 5-5)	2
37708-15	Snap ring (see Figure 5-5)	1
37708-16	Speed adjusting screw bushing (see Figure 5-5)	1
37708-17	Dial stop gear (see Figure 5-5)	1
37708-18	Phillips hd. screw (#8-32 x 3/8”)	4
37708-19	Dial plate	1
37708-20	Fillister hd. screw (1/4”-18 x 1 3/4”)	6
37708-21	Splitlock washer (1/4”)	6
37708-22	Dial panel	1
37708-23	Gasket (dial panel-to-column)	1
37708-24	Elastic stop nut (3/8”—24)	2
37708-25	Cupped spring washer	2
37708-26	Plug	1
37708-27	Pin	1
37708-28	Pin	1
37708-29	Pinion	1
37708-30	Bushing	1
37708-31	Round hd. screw (#10-32 x 1”)	1
37708-32	Speed droop cam assembly	1
37708-33	Load limit cam assembly	1
37708-34	Intermediate shaft gear	1
37708-35	Round point set screw (#6-32 x 5/8”)	1
37708-36	Hex nut (#6-32)	1
37708-37	Load limit strap	1
37708-38	Spring	1
37708-39	Elastic stop nut	1
37708-40	Snap ring	1
37708-41	Friction drive cover	1
37708-42	Kaylock nut (1/4”-28”)	1
37708-43	Friction drive spring	1
37708-44	Friction drive case	1
37708-45	Friction drive plate	1
37708-46	Pin	2
37708-47	Speed adjusting screw	1
37708-48	Bushing	1
37708-49	Speed adjusting block assembly	1
37708-50	Speed adjusting shaft assembly	1
37708-51	Speed adjusting shaft gear	1
37708-52	Washer	1
37708-53	Bushing	1
37708-54	Socket hd. screw (#10-32 x 5/8”)	1
37708-55	Splitlock washer (#10)	21
37708-56	Speed droop cam lever	1
37708-57	Elastic stop nut (#10-32)	1
37708-58	Speed droop adi. lever assembly	1
37708-59	Pivot pin	1
37708-60	Speed droop link assembly	1
37708-61	Floating lever spacer	2
37708-62	Spring	1
37708-63	Spring anchor pin	1
37708-64	Setscrew (5/16”-24 x 1 1/16”)	1
37708-65	Set screw (#6-32 x 5/16”)	1
37708-66	Hex hd, screw (5/16”-24 x 1”)	5
37708-67	Splitlock washer (21/64”)	5
37708-68	Terminal lever assembly	1
37708-69	Terminal lever pin	1
37708-70	Column	1
37708-71	Receptacle	1
37708-72	Splitlock washer (#6)	4
37708-73	Fillister hd, screw (#6-32 x 7/16”)	4
37708-74	Dowel pin (1/4”x 1 1/8”)	1
37708-75	Barrel plug	2
37708-76	Terminal shaft	1
37708-77	Needle bearing	2
37708-78	Oil seal	2
37708-79	Pointer disc	2
37708-80	Snap ring	2
37708-81	Fuel indicating dial plate	1
37708-82	Oven hd. screw (#6-32 x 1/4”)	4
37708-83	Fuel indicating dial plate	1
37708-84	Square head pipe plug (1/4” NPTF)	1
37708-85	Oil level decal	2
37708-410	Gasket	1
37708-411	Preformed Packing	2

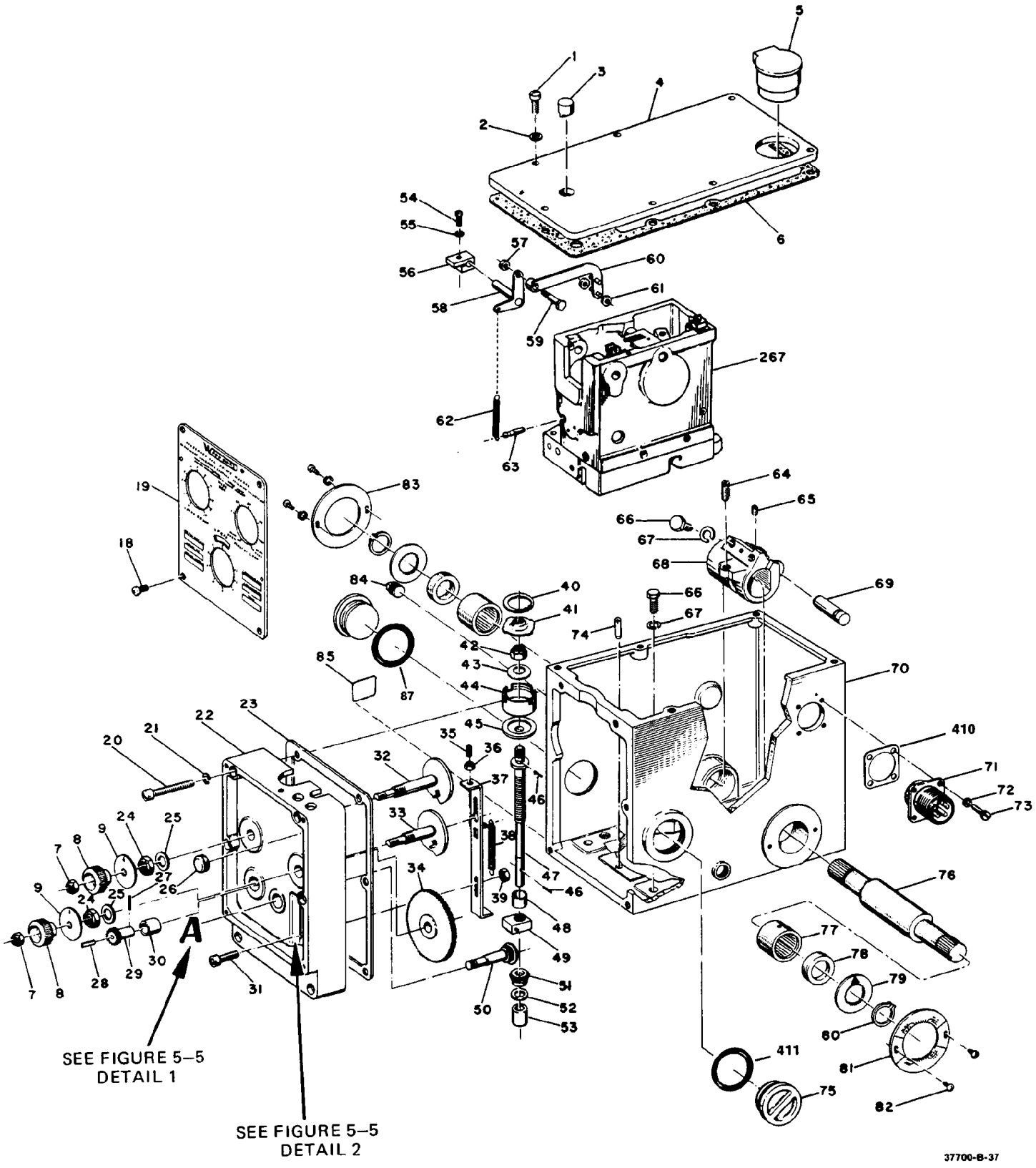


Figure 5-1. Exploded View of the EGB-10C Upper Case

Parts List for Figure 5-2

Ref. No.	Part Name	Quantity
37708-100	Stud	1
37708-101	Pin	1
37708-102	Roller	1
37708-103	Shaft assembly	1
37708-104	Pivot pin	1
37708-105	Load limit lever	1
37708-106	Pin	1
37708-107	Spring	1
37708-108	Relay beam	1
37708-109	Bushing retainer	1
37708-110	Washer	2
37708-111	Bearing retainer assembly	2
37708-112	Gasket (column-to-case)	1
37708-113	Snap ring	1
37708-114	Bushing	1
37708-115	Pin	1
37708-116	Relay valve plunger	1
37708-117	Pinion	1
37708-118	Relay valve bushing/gear assy	1
37708-119	Snap ring	4
37708-120	Spring seat	2
37708-121	Accumulator spring (small)	2
37708-122	Accumulator spring (large)	2
37708-123	Pipe plug (1/8” NPTF)	AR
37708-124	O-ring	1
37708-125	Magnetic plug	1
37708-126	Pipe plug (1/16” NPTF)	AR
37708-127	Power case	1
37708-128	Drain cock	1
37708-129	Check valve assembly	2
37708-130	Check valve assembly	2
37708-131	Accumulator piston	2
37708-132	Idler stud	1
37708-133	Idler gear	1
37708-134	Drive gear	1
37708-135	Seal ring (case-to-base)	1
37708-136	Dowel pin	4
37708-137	Base	1
37708-138	Splitlock washer (21/64”)	8
37708-139	Hex hd screw (5/16”-18 x 1”)	8
37708-140	Gasket	1
37708-141	Oil seal retainer	1
37708-142	Oil seal	1
37708-143	Snap ring	1
37708-144	Bearing	1
37708-145	Drive shaft	1
37708-146	Bearing retainer	1
37708-147	Hex hd. screw (1/4”-28 x 5/8”)	3
37708-148	Lockwire	AR
37708-149	Dowel pin	1
37708-150	Oil gauge assembly	1
37708-151	Elbow	1
37708-152	O-ring	1
37708-153	Seal ring	1
37708-154	Spring	1
37708-155	Snap ring	1
37708-156	Piston link	1
37708-157	Plug	1
37708-158	Relay power piston	1
37708-159	Piston link pin	1
37708-160	Splitlock washer (3/8”)	4
37708-161	Socket hd. screw (3/8”-16 x 1”)	4
37708-162	Power cylinder	1
37708-163	Gasket (power cyl-to-case)	1

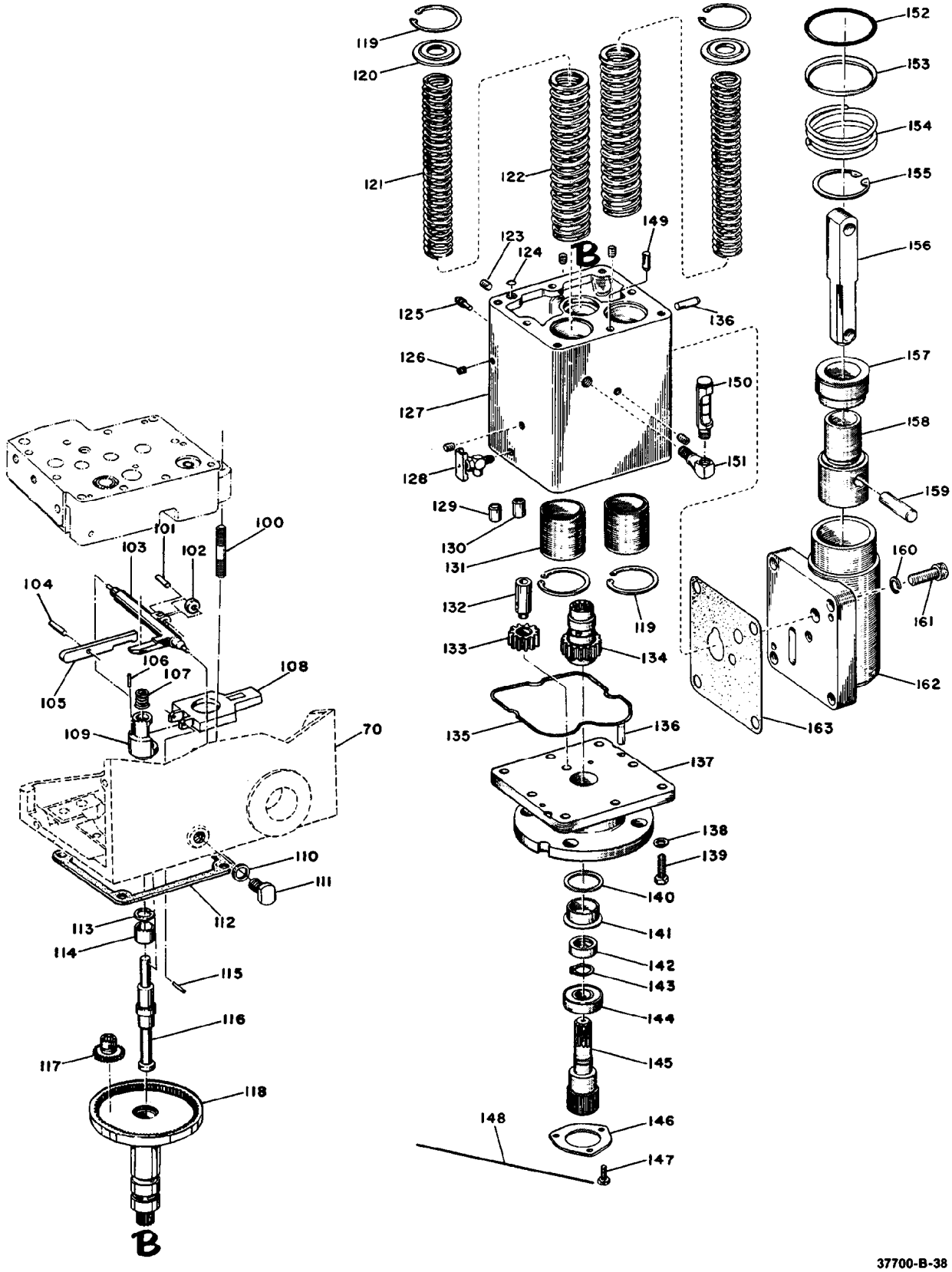


Figure 5-2. Exploded View of the EGB-10C Power Case

Parts List for Figure 5-3

Ref. No.	Part Name	Quantity
37708-201	Cotter pin (1/32" x 3/8')	2
37708-202	Pin	1
37708-203	Speed adjusting lever spacer	1
37708-204	Speed adjusting lever	2
37708-205	Elastic slop nut	1
37708-206	Floating lever	2
37708-209	Nut	1
37708-210	Lower spring seat	1
37708-211	Thrust bearing	1
37708-212	Retaining ring	1
37708-213	Flyweight & bearing assembly	2
37708-214	Snap ring	1
37708-215	Flyweight pin	2
37708-216	Flyweight head	1
37708-217	Snap ring	1
37708-218	Compensating bushing	1
37708-219	Speed droop lever	1
37708-222	Cotter pin (1/16" x 3/8")	4
37708-223	Headed pin	1
37708-224	Link	1
37708-225	Floating lever	1
37708-226	Retaining ring	1
37708-227	Pivot link	1
37708-228	Headed pin	1
37708-229	Piston pin	1
37708-230	Socket hd. screw (#10-32 x 1 7/8")	2
37708-231	Splitlock washer (#10)	2
37708-232	Bracket	1
37708-233	Pin	1
37708-234	Nyloc socket hd. centering screw (#6-32 x 3/8")	1
37708-235	Washer	1
37708-236	Null voltage screw	1
37708-237	Coil cover assembly	1
37708-238	Magnet assembly	1
37708-239	Washer	1
37708-240	Transducer assembly	1
37708-241	Temperature compensating ring	1
37708-242	Spring	1
37708-243	Quite bushing	1
37708-244	Speed adjusting lever post	1
37708-245	Retaining ring	2
37708-246	Pivot pin	2
37708-247	Snap Ring	1
37708-248	Buffer plug	1
37708-249	O-ring	1
37708-250	Buffer spring	2
37708-251	Buffer piston	1
37708-252	Fillister head screw (#6-32 x 1/2")	2
37708-253	Socket receptacle	1
37708-254	Spacer plate	1
37708-255	Socket plug	1
37708-256	Needle valve	2
37708-257	O-ring	2
37708-258	Buffer piston	1
37708-259	Buffer spring	2
37708-260	O-ring	1
37708-261	Buffer plug	1
37708-262	Snap ring	1
37708-263	Snap ring	1
37708-264	Compensating bushing	1
37708-265	Pilot valve plunger	1
37708-266	Pilot valve bushing	1
37708-267	Sub-governor case	1
37708-268	Headed pin	1
37708-269	Servo piston assembly	1
37708-270	O-ring	1
37708-271	Linkage return piston	1
37708-272	Pivot	1
37708-273	Jam nut	1
37708-274	Output nut	1
37708-275	Pilot valve plunger	1
37708-276	Pilot valve bushing	1
37708-277	Idler gear stud	1
37708-278	Idler gear assembly	1
37708-279	Pin	1
37708-280	Servo piston assembly	1
37708-281	Servo piston sleeve	1
37708-282	O-ring	1
37708-283	Spring washer	1
37708-284	Oil tube	1
37708-285	O-ring	1
37708-286	Sub-governor base	1
37708-287	Socket hd. screw (#10-32 x 1 3/8")	3
37708-288	Socket hd. screw (#10-32 x 7/8")	1
37708-289	Socket hd. screw (#10-32 x 1 1/8")	1
37708-290	Hex hd. screw (5/16-24 x 2 1/2")	1
37708-291	Splitlock washer (21/64')	1
37708-292	Nut	1
37708-293	Guide pin	1
37708-294	Plug	1
37708-295	Pipe plug (1/8" NPTF)	1
37708-296	Socket hd. screw (#10-32 x 1/2")	3
37708-297	O-ring	1
37708-298	Lockwasher	4
37708-299	Speeder spring - spring seat assembly	1
37708-400	Spacer, relief valve	1
37708-401	Spring. relief valve	1
37708-402	Plunger, relief valve	1
37708-403	Sleeve, relief valve	1
37708-404	Pipe plug, (.125-27 hex socket)	5
37708-405	Pipe plug (1/16 NPTF)	11
37708-406	Return spring	1

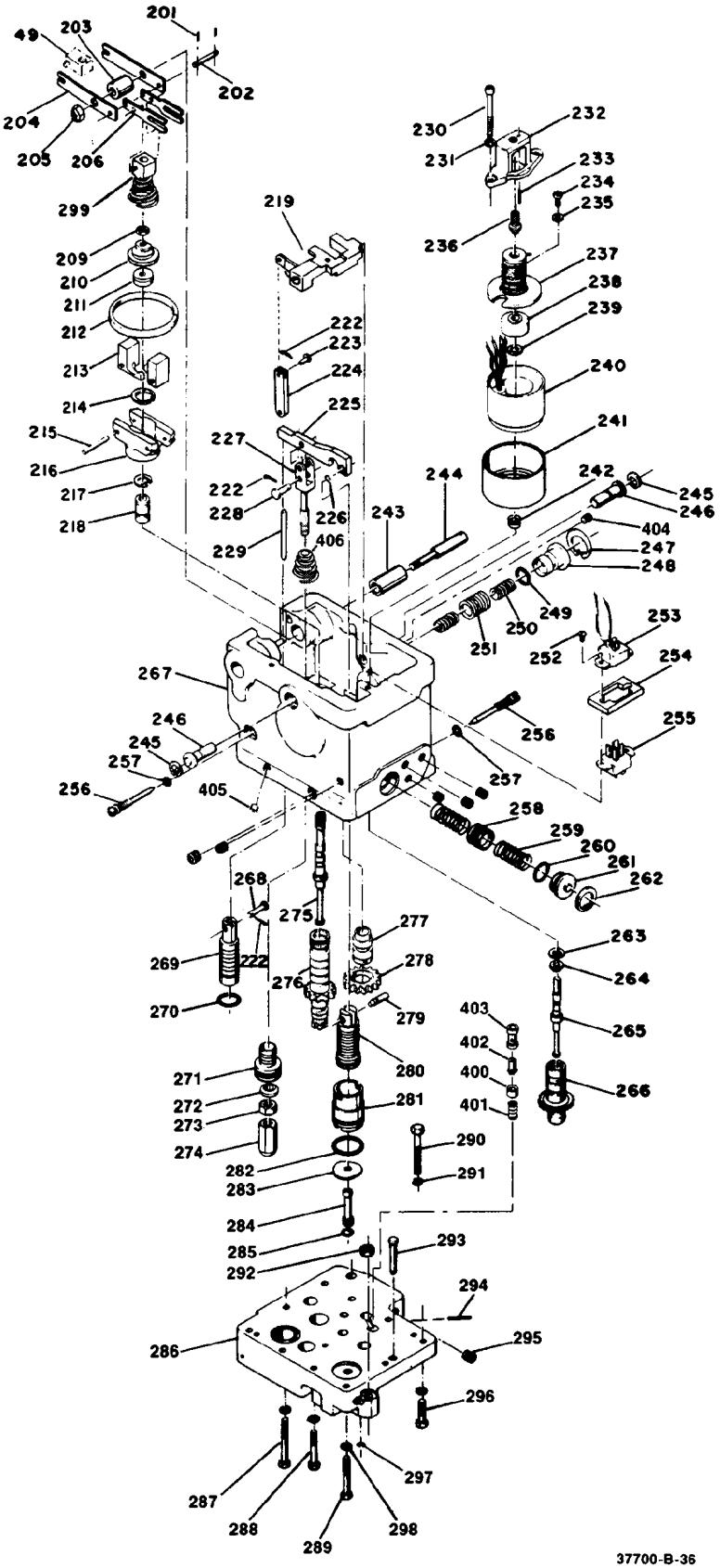


Figure 5-3. Exploded View of the EGB-10C Governor/Actuator

Parts List for Figure 5-4

Ref. No.	Part Name	Quantity
37708-300	Bleeder bolt	1
37708-301	Washer	2
37708-302	Preformed packing	2
37708-303	Terminal strip	1
37708-304	Screw	2
37708-305	Washer	2
37708-306	Mounting bracket	1
37708-307	Solenoid valve	1
37708-308	Solenoid mtg. screw	2
37708-309	Elbow	2
37708-310	Copper tube	1
37708-311	Banjo pipe fitting	1
37708-312	Motor	1
37708-313	Motor seat spring	1

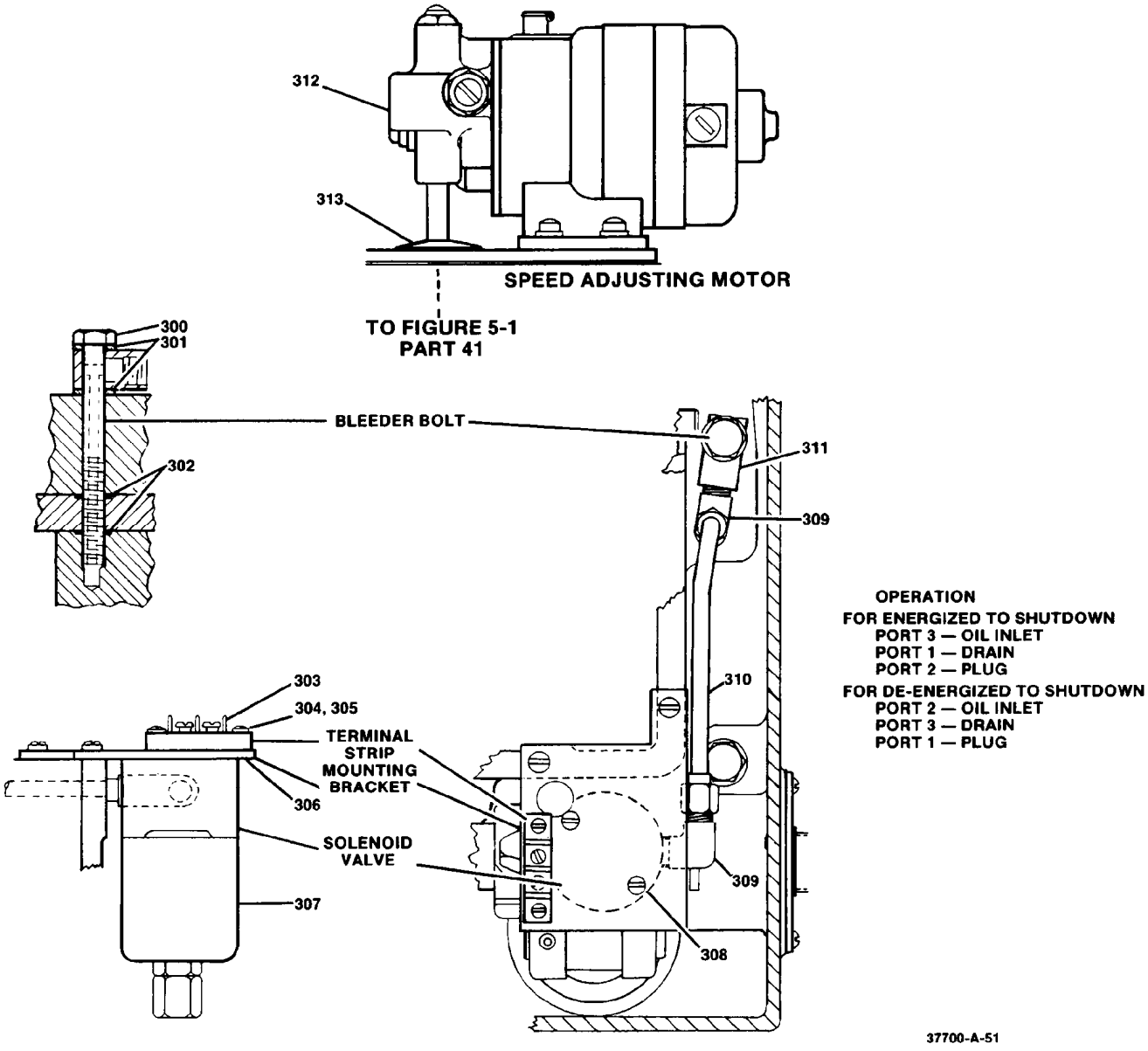


Figure 5-4. Shutdown System

Parts List for Figure 5-5

Ref. No.	Part Name..... Quantity
37708-86	Hex hd. screw, 8-32 x .375.....2
37708-87	Hex nut, 8-32.....2
37708-88	Mounting plate.....1
37708-89	Paper insulation.....2
37708-90	Micro switch.....2
37708-91	Lockwasher, No, 2, .086 ID 4
37708-92	Rd. hd, screw, 2-56 x .375.....4
37708-93	Cotter pin, .030 x 250 1
37708-94	Washer, .312 OD.....1
37708-95	Pin 1
37708-96	Switch actuator arm assembly.....1
37708-97	Screw 2
37708-98	Washer.....2

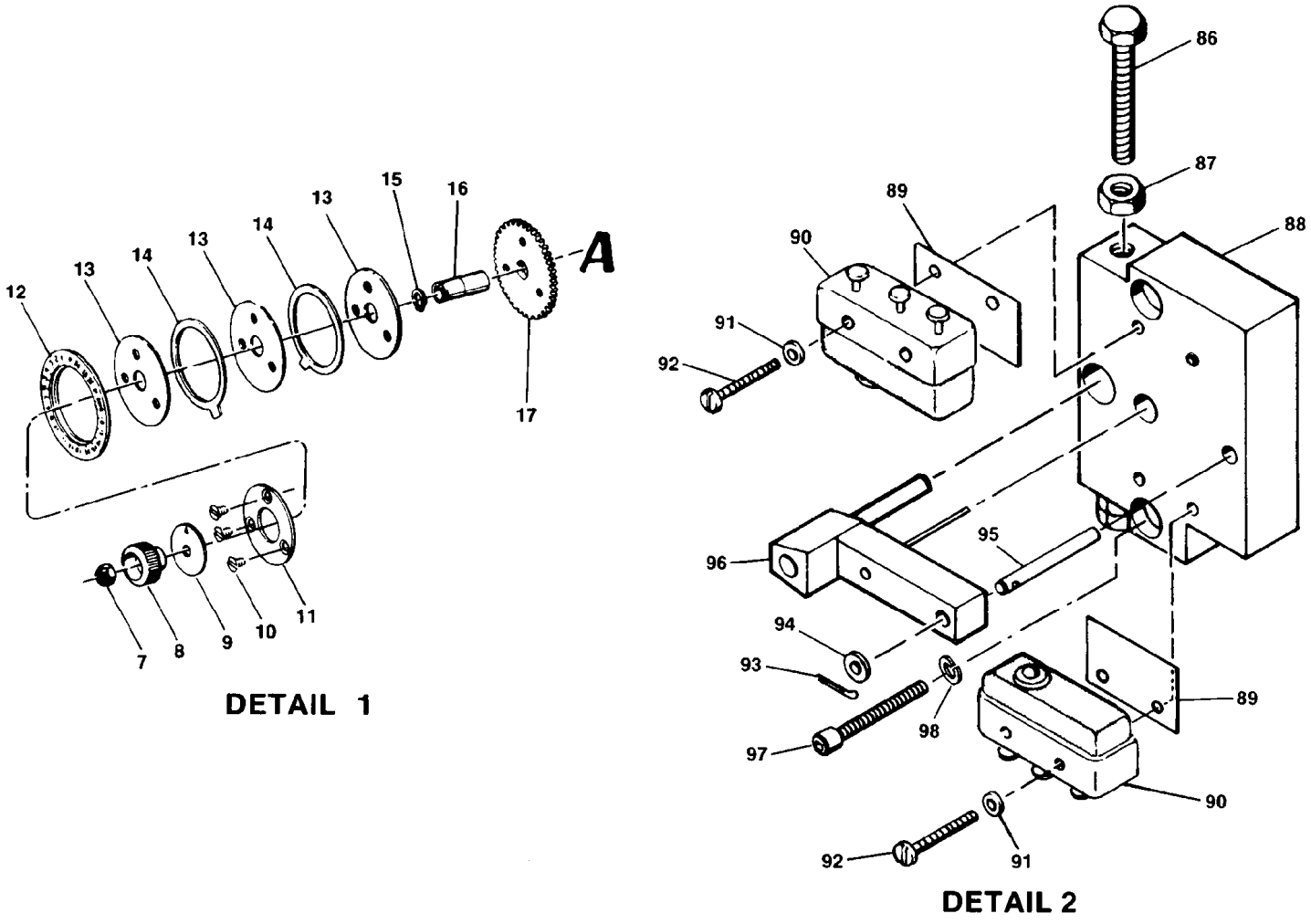


Figure 5-5. Exploded View of Speed Setting Dial Parts (Detail 1) and Limit Switch Assembly (Detail 2)

Chapter 6.
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.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 37708J.

WOODWARD

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.

2012/11/Colorado