



Product Manual 54065
(Revision NEW)
Original Instructions

PGA-EG, PGG-EG, PGM-EG 200/300/500
Governor/Actuator

Installation Manual



General Precautions

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

Practice all plant and safety instructions and precautions.

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



Revisions

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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.

PGA-EG, PGG-EG, PGM-EG Governor/Actuator Installation

Introduction

Receiving, storage, and installation requirements for the PGA-EG, PGG-EG, and PGM-EG 200/300/500 ft-lb (271/407/678 J) governor/actuators are covered in this manual. Hereafter, these units will be referred to as PG-EG governor/actuators.



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.

Be careful when handling and installing the governor/actuator. Do not hit the drive shaft and output shaft. Rough handling can cause damage to seals, parts, and adjustments.

Receiving

The PG-EG governor/actuator has been calibrated at the factory to exact specifications, then drained of oil. A light film of oil covers the internal parts to help prevent rust. Calibration or internal cleaning is not needed before installation and operation.

Installation Requirements

See outline drawings, Figures 2A and 2B, for the following:

- Location of hydraulic and electrical connections
- Location of optional mode select valve
- Hydraulic fitting sizes
- Output and drive shaft dimensions

Maintain clearance for removal and servicing of the governor. The governor oil drain should be easily accessible.

Installation

Install the PG-EG governor/actuator on the engine accessory drive pad. A gasket may be used between the governor and the mounting pad. The drive shaft must slip into the accessory drive or mating coupling without force. Be careful not to push the drive shaft into the governor. Improper alignment or too tight a fit between any of the parts can result in part wear or seizure. This can also cause jiggle in the governor output.

NOTICE

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

Fuel System Linkage

Align and install the linkage between the fuel system and the governor/actuator. Refer to Figure 1, Recommended Output Shaft Travel. The linkage must move freely and not have excessive backlash. Use approximately 2/3 governor output travel (26 degrees) between idle and full fuel. Permit enough overtravel so the governor can cause complete shutdown and give full fuel at full load.

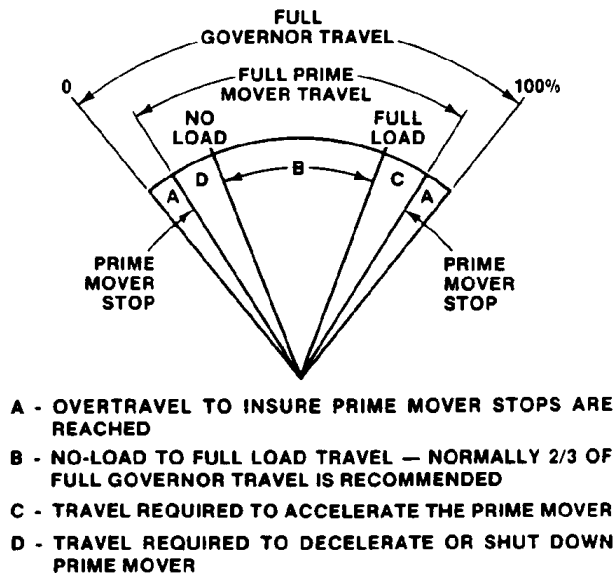


Figure 1. Recommended Output Shaft Travel

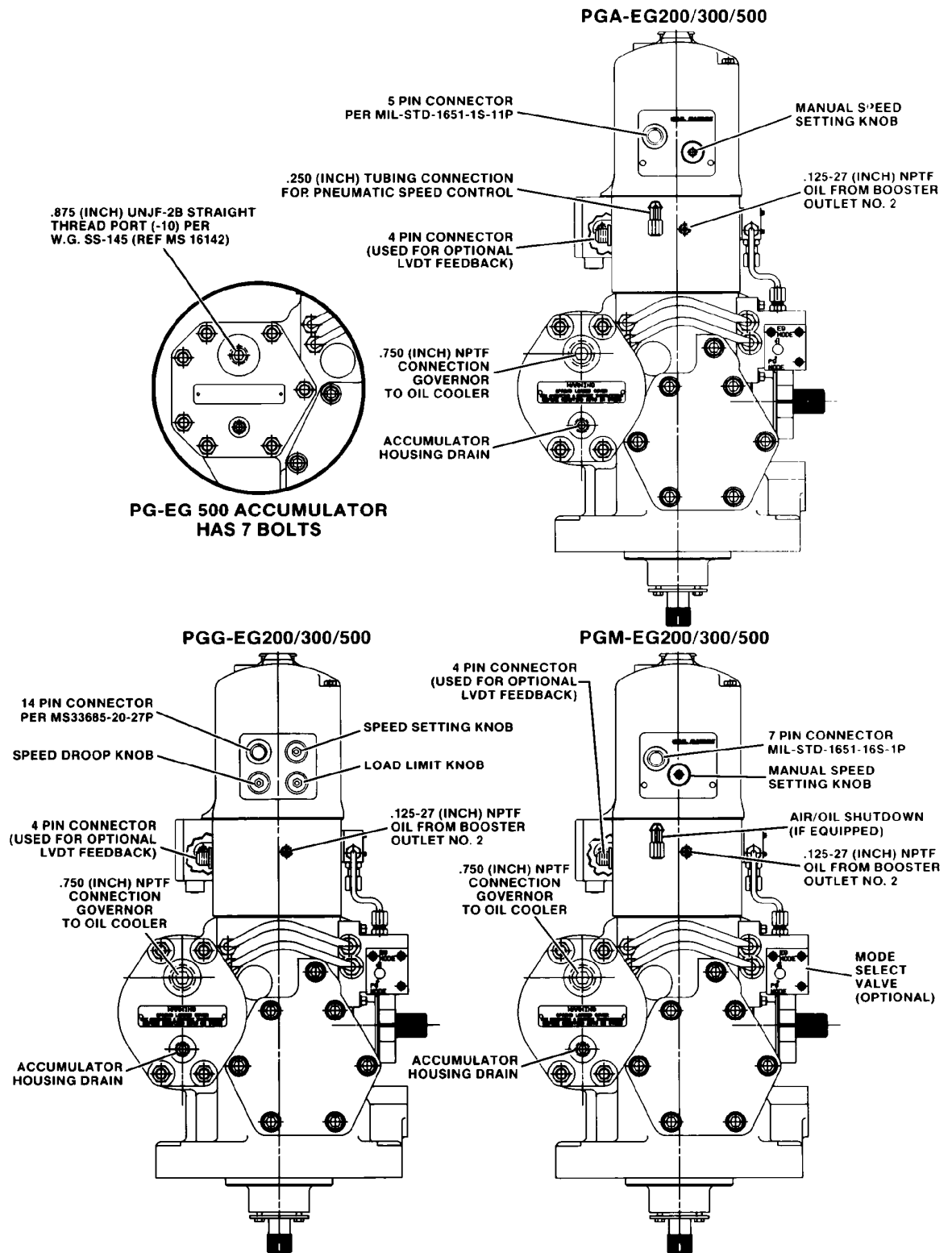
Many governors include an optional compensation cutoff, and since this option cannot be seen without disassembly of the governor, the following notice must be observed:

NOTICE

Because the optional compensation-cutoff region is near the minimum fuel position, it is necessary to adjust the governor output linkage to use no less than 5 degrees travel between zero- and idle-fuel positions on the governor.

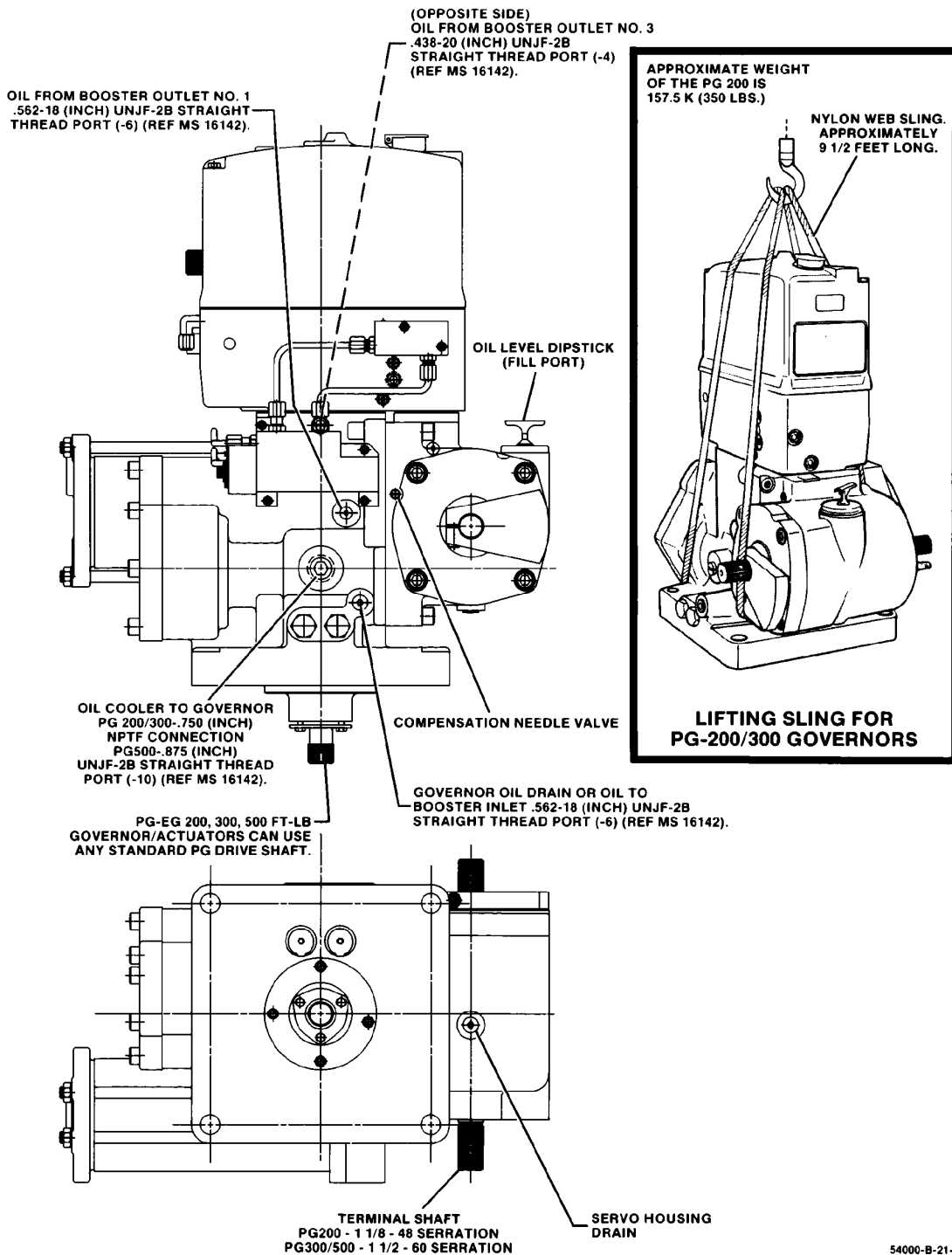
Hydraulic And Electrical Connections

Refer to Figures 2A and 2B, Outline of PG-EG Governor! Actuator, and make all required hydraulic connections. Refer to the wiring diagram provided with the unit for conformation of the mating electrical connections. The plant wiring diagram included with the electronic control will provide other details about electrical connections.



54000-B-21-1

Figure 2A. Outline Drawing of the PG-EG Governor/Actuator



54000-B-21-2

Figure 2B. Outline Drawing of the PG-EG Governor/Actuator

Booster Servomotor

Make all hydraulic Connections from the booster to the PG-EG governor/actuator (refer to manual 36684, *Booster Servomotor*). The booster servomotor assists the internal pump during starting. It provides a rapid increase in oil pressure which results in a rapid movement of the terminal shaft towards maximum. Refer to Figures 2A and 2B, Outline of the PG-EG Governor/Actuator, and make the connections from the booster outlets. Governor fuel position during start-up can be limited by the fuel limiter (if available) or the stroke-limit screw on the booster.

Heat Exchanger

Make all hydraulic connections from the heat exchanger to the governor. Refer to Figures 2A and 2B, Outline of the PG-EG Governor/Actuator and to manual 36641, *Governor Oil Heat Exchanger*. The heat exchanger should be installed as close as possible to the governor. Install it below the governor's oil level to prevent trapping air in the system. Plumbing between the heat exchanger and the governor must not restrict flow.

Oil Specifications

The same type and grade of oil used in the prime mover can be used in the governor if it meets heat and viscosity requirements.

NOTICE

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

The PG-EG oil supply is self-contained. Sump capacity is about 7 US quarts (6.6 L). Fill the sump through the dip-stick port. It may be necessary to add oil after the governor is first started to restore oil to the proper level on the dipstick. Proper level is between the "ADD" and "FULL" marks. Check the oil level with the governor running. Oil will splash from the test location during major governor transients.

NOTICE

When using a booster servomotor or heat exchanger, be sure that oil lines, booster, and the heat exchanger are full of oil before starting the prime mover.

Whenever the PG-EG is filled, always check the oil level after starting, when the unit is at rated speed, and at normal operating temperature. If the oil level is high, oil should be drained. If the dipstick shows low level, add new, clean oil.

Refer to Woodward manual 25071, *Oils for Hydraulic Controls*, for more information on selection of oils for use in hydraulic actuators (governors). Proper selection of the oil used in the actuator is necessary for the 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.

The oil viscosity index should be within the range of 100 to 300 SUS (Saybolt Universal Seconds) at governor operating temperature. Only oils of the grade specified for a particular temperature range should be used.

The recommended continuous operating temperature of the oil is 140 to 200 °F (60 to 98 °C). Measure the temperature of the governor or actuator through the dipstick port while the PG-EG is running in a steady-state condition.

NOTICE

Do not put the temperature probe too deeply into the port or the probe, the PG-EG, or both may be damaged.

Figure 3 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.

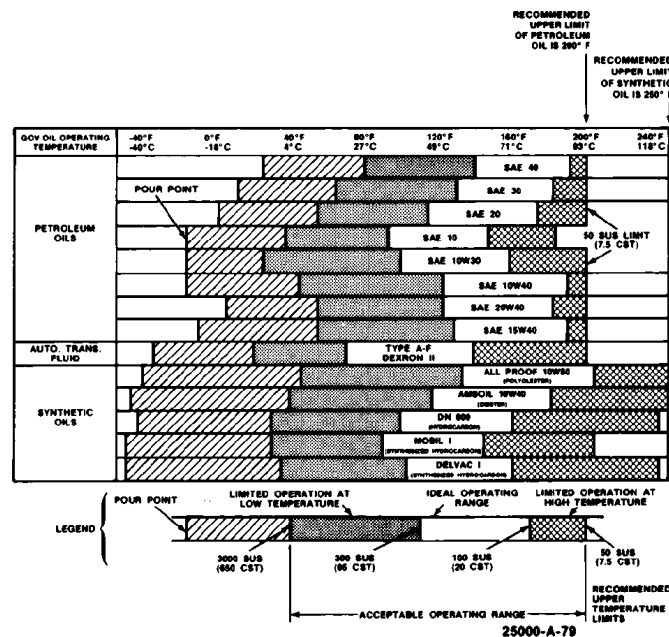


Figure 3. Viscosity and Operating Temperature of Oils

Initial Operation

Before the first start-up of the governor/actuator, be sure that all of the previous steps have been done and are correct.

WARNING

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

Adjustments to the Ballhead Governor

Use the optional “Mode Select Valve” (see Figure 2) to set to the “PG Mode” position to start the engine under control of the ballhead governor.

The valve can be set to “PG Mode” by appropriate electric, pneumatic, or manual means:

- **Electrical**—Can be either energize (24 Vdc, 0.87 A) or de-energize to set PG Mode. See specification sheet for your application.
- **Pneumatic**—60 to 75 psi (414 to 517 kPa) sets PG Mode.
- **Manual**—Set knob to PG Mode.

If the Mode Select option is not included on the governor, the PG-EG can be put under ballhead operation by running the electrical side to maximum, either through the electrical governor control, or by simulating a maximum signal at the electrical connection. (Most PG-EGs are “reverse acting” and an absence of any electrical control signal will place the ballhead in control.)

Before Start-up

1. Set the compensation needle valve to 1/8 turn open from the fully closed (clockwise) position.
2. Assure the ballhead speed setting is at the idle condition (manual speed set to idle, pneumatic speed signal at minimum speed).

To Adjust the Compensation Needle Valve after Start up:

1. With the prime mover operating at IDLE speed, open the compensation needle valve until the governor begins to hunt. Let the governor hunt for several minutes to remove trapped air in the hydraulic circuits. DO NOT allow a level of hunting which would cause damage to the prime mover.

IMPORTANT

It maybe necessary to upset the governor speed momentarily to cause the governor to hunt. (A rapid fluctuation in the speed setting of the PG-EG will usually accomplish this upset.)

2. Close the compensation needle valve slowly until hunting just stops. Do not close the needle valve completely. To prevent slow governor response, keep the needle valve open as far as possible. The needle valve setting can be from 1/16 to 2 turns open.
3. Check the stability of the governor output by disturbing the governor speed setting. The compensation adjustment is satisfactory when the governor returns to speed with only a small overshoot or undershoot. Once the needle valve adjustment is correct, it is not necessary to change the setting unless there is a change in oil viscosity. Additional adjustment may be necessary if stability problems exist at full speed-full load conditions

Adjustments to the Electric Actuator

1. The PG ballhead speed setting must be set higher than the electronic-speed setting for electric actuator operation. If so equipped, the Mode Select Valve must be set for the EG Mode.
2. Refer to the operation manual for the specific electronic control used to set gain, stability, and speed reference.

To select the EG Mode on the optional Mode Select Valve:

- **Electric**—0 Vdc or 24 Vdc (0.67 A) depending on the specified requirements for your unit.
- **Pneumatic**—0 psi (0 kPa).
- **Manual**—Set the knob to “EG Mode”.

Pressure

The following minimum oil pump pressures should be present at operating speed:

PG-EG 200	200 psi (1379 kPa)
PG-EG 300	360 psi (2482 kPa)
PG-EG 500	280 psi (1931 kPa)

To check the internal pressure attach a pressure gauge in the .562-18 straight-thread port indicated as oil from booster outlet Number 1 in Figure 2B.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 54065.



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