WOODWARD

**Product Manual 54069**
**(Revision NEW)**
**Original Instructions**

# PGA-EG, PGG-EG, PGM-EG 12/29/58 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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**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**

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

# 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

In this manual, we will refer to all PGA-EG, PGG-EG, and PGM-EG units as PG-EG governor/actuators.

**⚠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.**

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 the outline drawings, Figures 3a and 3b, for the following:

- Location of hydraulic and electrical connections
- Location of Mode Select Valve
- Hydraulic fitting sizes
- Output and drive shaft dimensions

Allow clearance for installation, 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. It also can 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.

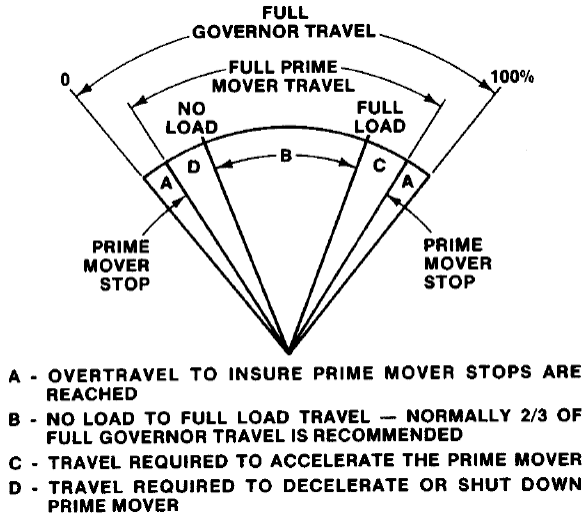



Figure 1. Recommended Output Shaft Travel

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**

**The optional compensation cutoff region is near the minimum-fuel position. For this reason, it is necessary to adjust the governor output linkage to use no less than 5 degrees travel between zero fuel position and idle fuel position on the governor. For linear servos, adjust linkage so that idle fuel position is no less than 0.125 inch (3.18 mm) from the minimum (zero) governor fuel position.**

## Hydraulic and Electrical Connections

Refer to Figures 3a and 3b, 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.

## 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 3a and 3b, 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 3a and 3b, 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 actuator troubles. Use only new oil to fill the governor. Containers used for filling the actuator must be clean and should be rinsed with a light grade of the same oil before use.**

The governor/actuator oil supply is self-contained. Sump capacity is approximately 1.5 quarts (1.4 L) and it may be necessary to add oil after the governor is first started in order to restore oil to the proper level on the sight gauge. Proper level is between the high and low marks on the sight glass.

**NOTICE**

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

Whenever the governor/actuator is filled, always check oil level after starting, especially when a booster or heat exchanger is used. If the oil level as seen in the sight glass is high, oil should be drained. If the oil level is low after the unit is in operation, add new, clean oil to bring the level up.

Refer to Woodward manual 25071 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 should have a high viscosity index, within the range of 100 to 300 SUS (Saybolt Universal Seconds) at governor operating temperatures. 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 93 °C). Measure the temperature of the governor or actuator on the outside lower part of the case. The actual oil temperature will be warmer by about 10 °F (6 °C).

Figure 2 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.

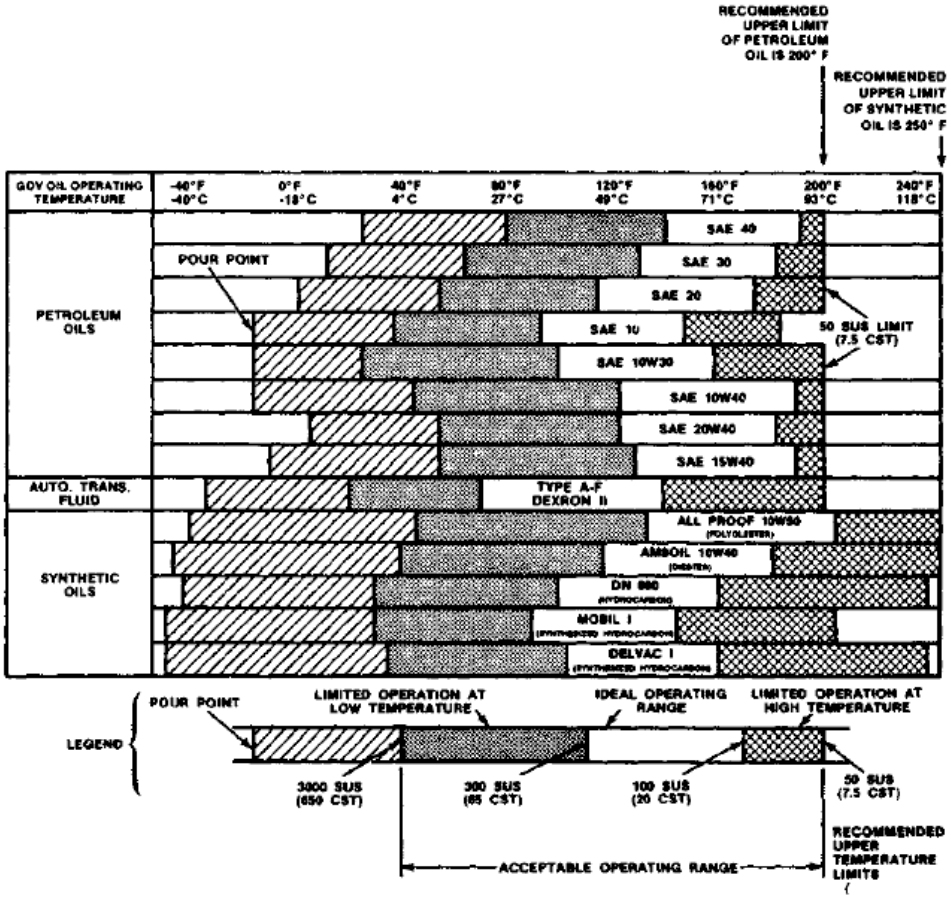



Figure 2. Viscosity and Operating Temperature of Oils

## 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 3a), set at 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, 0.5 A) or de-energize to set PG Mode. See the 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 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.**

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 manually 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 (0.87 A) depending on the specified requirements for your unit.
- **Pneumatic**—0 psi (0 kPa).
- **Manual**—Set knob to the “EGB Mode”.

## Pressure

The following oil pump pressure should be present at operating speed:

- PG-EG 12 100 psi (690 kPa)
- PG-EG 29 100 psi (690 kPa)
- PG-EG 58 200 psi (1379 kPa)

To check the internal pressure, attach a pressure gauge in the 0.562-18 straight-thread port indicated as oil from booster outlet number 1 in Figure 3b.

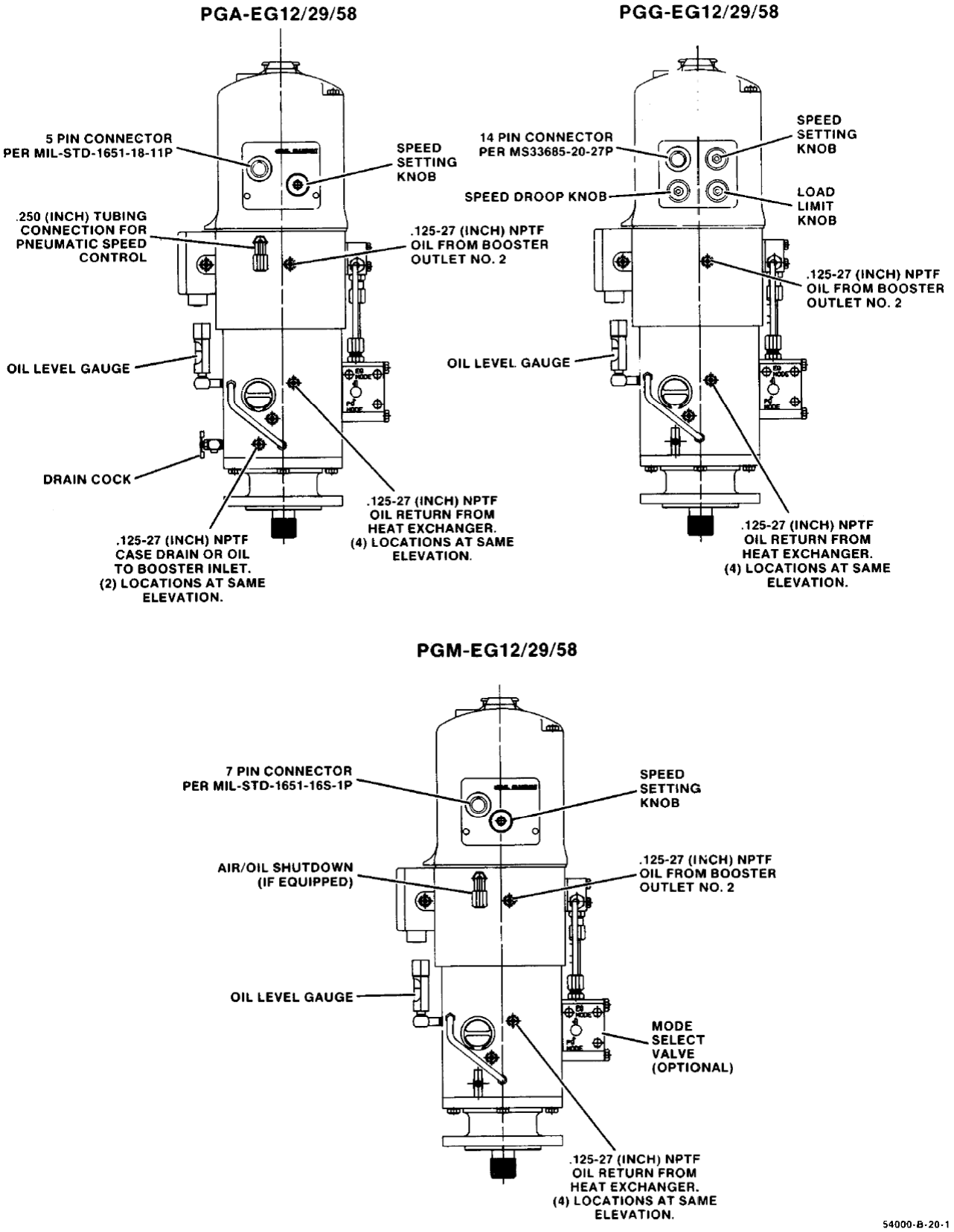
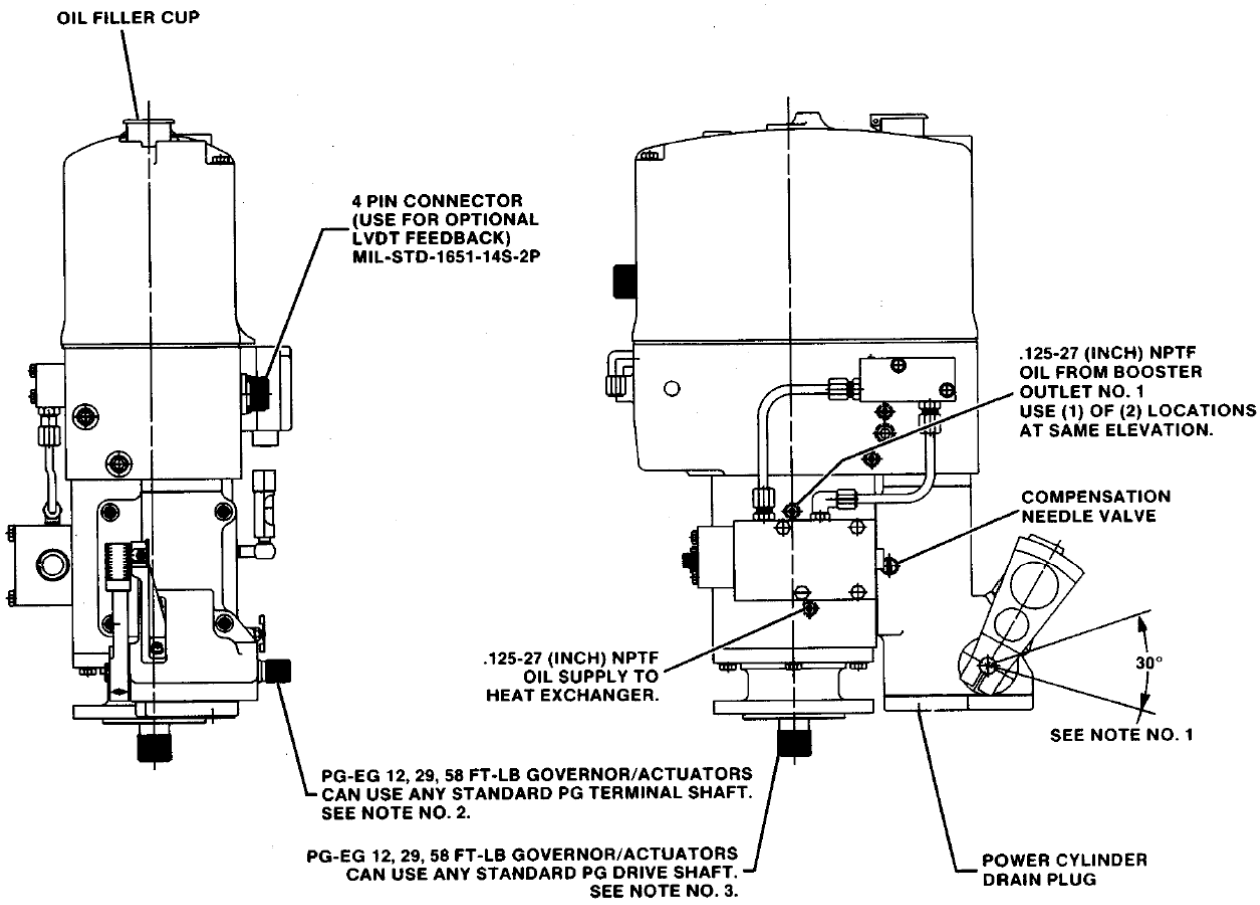



Figure 3a. Outline of PG-EG Governor/Actuator




NOTES:

1. 30° STROKE AVAILABLE. RECOMMENDED TRAVEL BETWEEN NO LOAD AND FULL LOAD IS 20°.
2. LINEAR OUTPUT SERVOS ARE AVAILABLE.
3. OTHER STANDARD BASES ARE AVAILABLE.

Figure 3b. Outline of PG-EG Governor/Actuator

**We appreciate your comments about the content of our publications.**

**Send comments to: icinfo@woodward.com**

**Please reference publication 54069.**

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2012/11/Colorado