

Product Manual 36603 (Revision B) Original Instructions



PG-35 and PG-50 Governors

Operation Manual



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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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.



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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.

	The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against	
Overspeed / Overtemperature / Overpressure	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.	
	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	

Personal Protective Equipment

- Eye Protection
- Hearing Protection
 - Hard Hat
- Gloves

limited to:

- 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.



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

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.

Battery Charging Device

Electrostatic Discharge Awareness

NOTICE	Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:
Electrostatic Precautions	 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 and Operation

Introduction

PG-35 and PG-50 governors are modified versions of conventional model PG governors having differential servomotors. They offer greater work outputs than are available from standard PG governors.

The greater work output of the PG-35 and PG-50 governors is achieved by increasing the pressure of the oil which moves the governor power piston. Operating pressure of a PG-35 governor is 350 psi (2413 kPa); operating pressure of a PG-50 is 600 psi (4137 kPa). Because this higher oil pressure is not required in other hydraulic circuits within the governor (for example, the hydraulically operated speed setting servomotor or the load control system), a pressure reducing valve is incorporated within the governor to maintain pressure oil to these other circuits at 100 psi (690 kPa), the operating pressure of standard PG governors. Except for the areas affected by or related to the higher oil pressure, the operation and construction of a PG-35 and PG-50 governor are the same as the operation and construction of a conventional PG governor equipped with a differential servomotor.



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. Schematic Diagram, PG Governor with Oil Cooler

Drive Requirements

Each PG-35 and PG-50 governor contains its own oil pump. Because of the higher oil pressures these oil pumps produce, the governor drive shaft requires a 1 hp (746 W) drive to rotate it at 1000 rpm under normal operating conditions.

Parts Differences

The exploded views in Figures 2 and 3 show the differences between the basic elements of a PG-35 or PG-50 governor and the basic elements of a standard PG governor as shown in manual 36602. Other portions of the governor are not affected. (A PG-35 governor differs from the equivalent PG-50 model only in the actuator springs used in the governor power case.)

Operation

Except as noted in this discussion, operation of the basic elements of the PG-35 end PG-50 governors is identical to the operation of the basic elements of a standard PG governor as described in manual 36602. The text which follows presumes your are familiar with manual 36602.

Refer to Figure 1. The drive shaft rotates the drive gear and rotating bushing. As the rotating drive gear turns an idler gear, oil is drawn from the oil sump and is carried in the space between the gear teeth end the wall of the gear pockets to the discharge side of the pump. The output from the gear pump flows through the oil cooler en route to other oil passages within the governor. When these passages are filled, oil flows in past the accumulator plug, and under the accumulator piston. Oil pressure forces the piston up, overcoming the downward force of the accumulator spring.

When the piston moves up enough to uncover the bypass hole, oil passing through the pump returns to sump.

Operation of the governor flyweight head/pilot salve assembly, the differential power piston, and the compensating system is identical to the description given in manual 36602. The PG-35 or PG-50 governor power piston is similar to that shown in Figures 2 and 4 of manual 36602.

Pressure oil used in the governor for purposes other than moving the power piston is reduced as it passes through the pressure reducing valve en route to the other circuits. The plunger in the pressure reducing valve controls the flow of oil through the reducing valve. The spring under the plunger tends to push the plunger up, thereby uncovering the port through which oil enters the reducing valve. Oil pressure atop the plunger pushes the plunger down in the direction to decrease or dose the port opening. The opposing spring and oil pressure forces position the plunger to maintain the pressure at the outlet side of the reducing valve at 100 psi (690 kPa).

Chapter 2. Replacement Parts

This chapter provides replacement parts information for the PG power case and power cylinders.

When ordering replacement parts, include the following information:

- Governor serial number and part number shown on nameplate
- Manual number (this is manual 36603)
- Parts reference number in parts list end description of part or part name

Figures 2 and 3 illustrate and list all the replaceable auxiliary parts for PG-35 and/or PG-50 governor. The numbers assigned are used as reference numbers and are not specific Woodward part numbers. Woodward will determine the exact pars number for your particular governor.

Ref. No.	Part Name Quantity	Ref. No.	Part NameQuantity
36603-1	Snap ring2	36603-30	Oil seal1
36603-2	Spring seat2	36603-31	Cover1
36603-3	Accumulator spring (small)2	36603-32	Gasket1
36603-4	Accumulator spring (large)2	36603-33	Snap ring1
36603-5	Plug1	36603-34	Sleeve1
36603-6	Pressure reducing valve sleeve1	36603-35	Power piston assembly1
36603-7	Pin1	36603-36	Power cylinder1
36603-8	Pressure reducing valve plunger1	36603-37	Socket head screw (3/8" x 1")4
36603-9	Snap ring1	36603-38	Split lockwasher (3/8")4
36603-10	Spring	36603-39	O-ring1
36603-11	Plug1	36603-40	Needle valve1
36603-12	Accumulator piston2	36603-41	Plug1
36603-13	Accumulator plug2	36603-42	O-ring1
36603-14	Accumulator plug flange2	36603-43	Snap ring1
36603-15	Snap ring2	36603-44	O-ring
36603-16	Idler gear stud1	36603-45	Needle bearing2
36603-17	Idler gear assembly1	36603-46	Drive gear1
36603-18	Base1	36603-47	Hex hd. cap screw 1-1/4"-20 x 3/4")8
36603-19	Cotter pin1	36603-48	Shakeproof washer8
36603-20	Taper pin1	36603-49	End cap2
36603-21	Socket hd. screw (1/4"-28 x 3/4")4	36603-50	Gasket2
36603-22	O-ring1	36603-51	O-ring1
36603-23	Plug1	36603-52	O-ring1
36603-24	O-ring4	36603-53	Body1
36603-25	O-ring1	36603-54	Hex hd. cap screw (5/16"-18 x 3-1/4").4
36603-26	O-ring1	36603-55	Lockwasher (5/16")4
36603-27	Rod end1	36603-56	Heat exchanger inner body1
36603-28	Taper pin (#6/o x 1-1/4")1	36603-57	Heat exchanger outer body1
36603-29	Oil seal1		

Parts List For Figure 2





Parts List For Figure 3

Ref. No.	Part Name Quantity
36603-100	O-ring
36603-101	Seal ring1
36603-102	Spring
36603-103	Piston gap scale1
36603-104	Lockwasher (#10) 1
36603-105	Phillips head screw (#10-32 x 3/8")1
36603-106	Spring guard1
36603-107	Socket hd. screw (1/4"-28 x 1/2")4
36603-108	Lockwasher4
36603-109	Gasket 1
36603-110	Pin1
36603-111	Power piston tailrod1
36603-112	Flax-bc nut (3/8"-24)1
36603-113	Snap ring1
36603-114	Sleeve1
36603-115	Power piston assembly1
36603-116	Power cylinder assembly1
36603-117	Socket head screw (3/8" x 1")
36603-118	Split lockwasher (3/8")4
36603-119	O-ring1
36603-120	Needle valve 1
36603-121	Oil seal (inner)1
36603-122	Oil seal (outer)1
36603-123	Rod end 1
36603-124	Taper pin (#6/o x 1-1/4") 1
36603-125	Cotter pin1
36603-126	Taper pin1
36603-127	Socket hd. screw (1/4"-28 x 1/2")4

Ref. No.	Part Name	Quantity
36603-128	Power cylinder cover	1
36603-129	Sleeve	1
36603-130	Power piston assembly	1
36603-131	Terminal shaft	1
36603-132	Oil seal	1
36603-133	Needle bearing	1
36603-134	Power piston link	1
36603-135	Snap ring	2
36603-136	Snap ring	2
36603-137	Stop nut (7/16"-20)	1
36603-138	Split lockwasher (5/16")	2
36603-139	Socket hd. screw (5/16"-18 x 7	//8")2
36603-140	Gasket	1
36603-141	Cover	1
36603-142	Piston rod pin	1
36603-143	Needle bearing	1
36603-144	Terminal lever	1
36603-145	Power lever pin	1
36603-146	Split lockwasher	8
36603-147	Socket hd. screw (1/4"-28 x 3/4	4")8
36603-148	Pipe plug	1
36603-149	Sleeve	1
36603-150	Power piston assembly	1
36603-151	Bushing	1
36603-152	O-ring	1
36603-153	Washer	2
36603-154	Shakeproof washer	2
36603-155	Hex hd. cap screw (1/4"-20 x 3	/8")2
36603-156	Oil seal	1



Figure 3. Exploded View of A(ternate Power Cylinder Assemblies

Chapter 3. 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 <u>www.woodward.com/directory</u>.

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	Products Used In Engine Systems	Products Used In Industrial Turbomachinery
FacilityPhone Number	EacilityBhone Number	Systems EacilityBhone Number
Brazil+55 (19) 3708 4800	Brazil+55 (19) 3708 4800	Brazil+55 (19) 3708 4800
China +86 (512) 6762 6727	China +86 (512) 6762 6727	China +86 (512) 6762 6727
Germany:	Germany +49 (711) 78954-510	India+91 (129) 4097100
Kempen+49 (0) 21 52 14 51	India+91 (129) 4097100	Japan +81 (43) 213-2191
Stuttgart +49 (711) 78954-510	Japan +81 (43) 213-2191	Korea +82 (51) 636-7080
India+91 (129) 4097100	Korea +82 (51) 636-7080	The Netherlands- +31 (23) 5661111
Japan +81 (43) 213-2191	The Netherlands- +31 (23) 5661111	Poland+48 12 295 13 00
Korea +82 (51) 636-7080	United States +1 (970) 482-5811	United States +1 (970) 482-5811
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 <u>www.woodward.com/directory</u>.

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 36603B.



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.