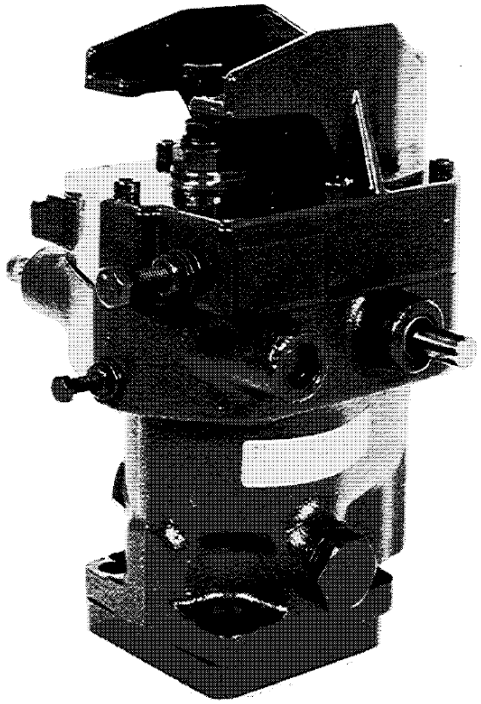
WOODWARD

Product Manual 54035
(Revision A, 8/2004)

Original Instructions



SG Governor

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

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

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Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

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

Manual 54035

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.

SG Governor Installation

Introduction

These instructions apply to three types of SG governors differentiated by their speed settings:

- Lever
- Pneumatic
- Electric

Additional considerations for governors with pneumatic or electric speed setting are listed under respective headings.

Direction of Rotation

Rotation of governor drive shaft as viewed from the top of the governor must be the same as that of the engine drive when looking down on the mounting pad.

When the governor is to be rotated clockwise (when viewed from above) the governor relief valve assembly must, when viewing the governor from the nameplate end, be on the left.

When the governor is to be rotated counterclockwise (when viewed from above), the governor relief valve assembly must, when viewing the governor from the name plate end, be on the right.

NOTICE

Be sure engine mounting-pad drive and governor drive rotation are the same. Incorrect drive rotation will cause the governor to become inoperative and may cause governor damage.

Place a gasket between the base of the governor and the engine mounting pad. Mount the governor square with the engine drive and in line with the linkage. The splined drive shaft must fit the engine drive freely with no tightness. Do not force the governor onto the mounting pad.

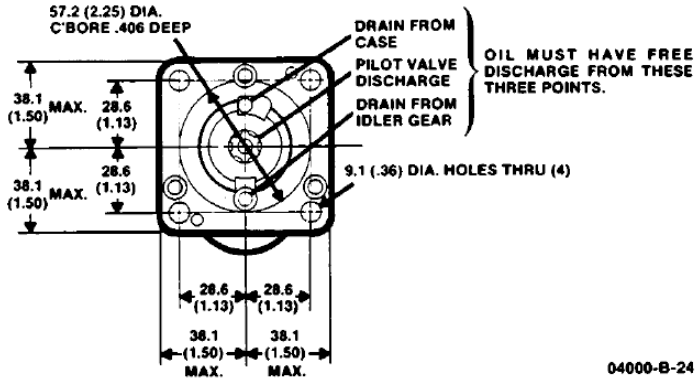

Figure 1. SG Drain Holes in Base

NOTICE

Be sure the gasket does not block off the three drain holes in the base. See Figure 1.

Oil Supply

Connect a 0.250 inch (6.35 mm) ID oil supply line to the 0.125 inch (3.18 mm) pipe-tapped hole in the relief valve. Oil from the engine must supply a minimum of 5 psi (34 kPa) to the governor.

Use a 2 US gal/min (7.6 L/min), 40 µm filter in the oil supply line. In suction lift applications, the filter must not be in series with the inlet line to the governor. Keep oil lines as short as possible.

If mounted horizontally, the terminal shaft must also be horizontal and a 3/8-inch (9.5 mm) external drain line provided to connect to a 1/4-inch (6.35 mm) pipe-tapped hole in the lower end of the governor cover. See Figure 2 for connection of the drain on the new style cover when the governor is mounted horizontally.

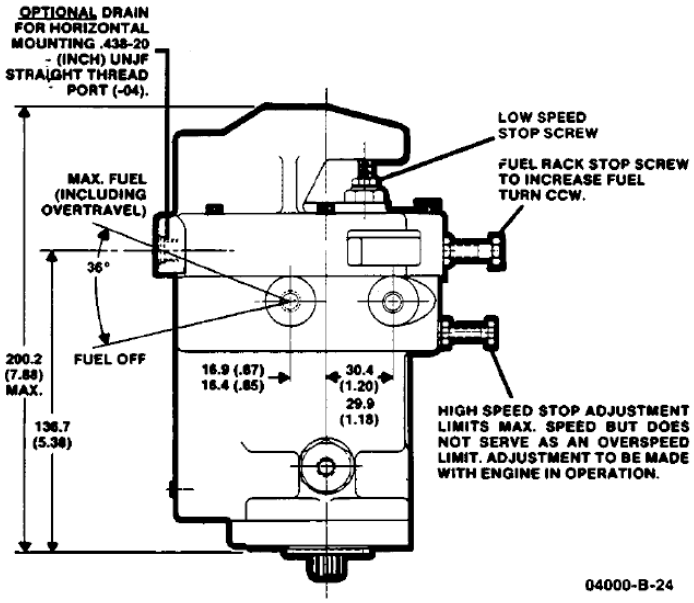

Figure 2. SG with Terminal Shaft and New Style Cover

If a separate sump is used, the distance the governor must lift the oil should not exceed 12 inches (30 cm), and a foot valve with a capacity of 2 US gal/min (7.6 L/min) must be used.

NOTICE

Most problems of mechanical-hydraulic governors occur because of dirty oil. Be sure to use clean oil in separate sump installations. The oil recommended for the engine will almost always be satisfactory for use in a separate sump.

Quick Starts

Use a supply system similar to Figure 3 for applications requiring quick starts.

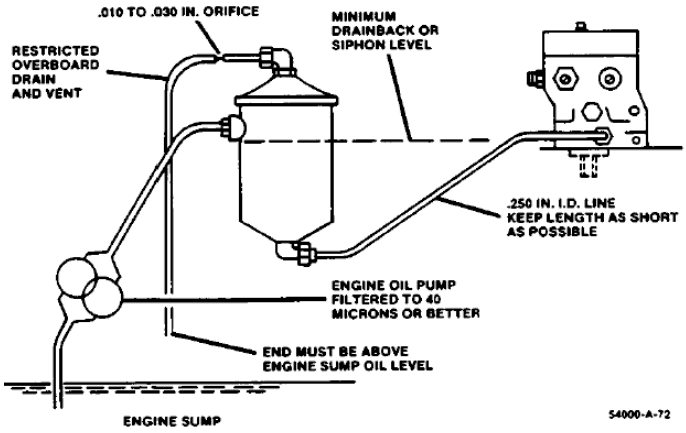

Figure 3. Recommended Engine Oil System for Quick Starts

Keep the end of the overboard drain line above the oil level in the engine sump. Most standard 1 to 2 quart or 1 to 2 liter housings with filter omitted can be adapted for the system.

Speed Setting

Pneumatic Speed Setting

There are two types of speed setting. The reverse acting increases speed with a decrease in air pressure, while the direct acting increases speed with an increase in air pressure.

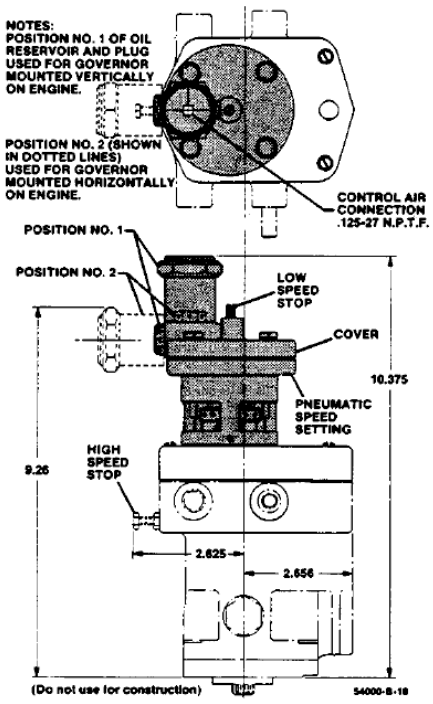

Figure 4. SG Governor Outline with Direct Pneumatic Speed Setting

The pneumatic speed-setting cover has two tapped holes for the oil reservoir. Use one of the two holes for the reservoir and plug the other. Always mount the oil reservoir with the hole for the air connection up. Be sure the other hole is plugged. See the outline drawing, Figure 4 or 5. Install the governor on the engine. Fill the oil reservoir to approximately 3/8 inch (10 mm) from the top using a funnel and the hole for the air connection in top of the reservoir.

Attach the air signal pressure line to the hole in top of the oil reservoir.

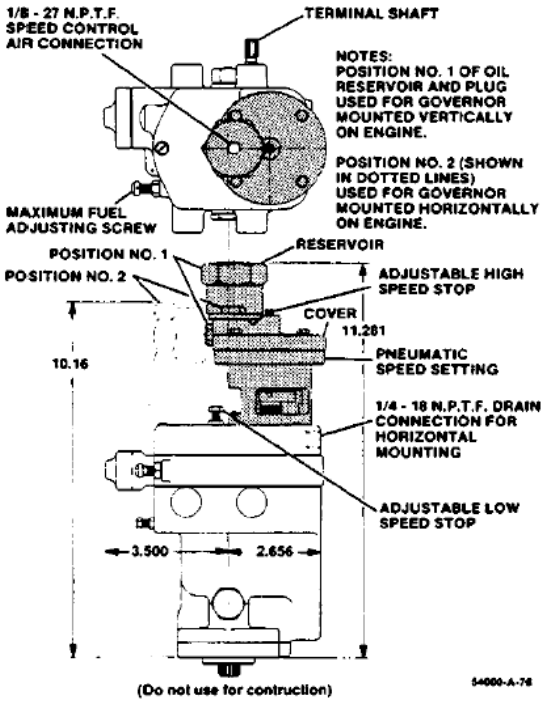

Figure 5. SG Governor Outline with Reverse Pneumatic Speed Setting

Electric Speed Setting

The Bodine motor (Figure 6) and the PM motor (Figure 7) are coupled to the governor speed-setting mechanism through a friction clutch. If the operator runs the speed adjustment to its limit, the clutch is set to slip, thereby protecting the speed-adjusting motor.

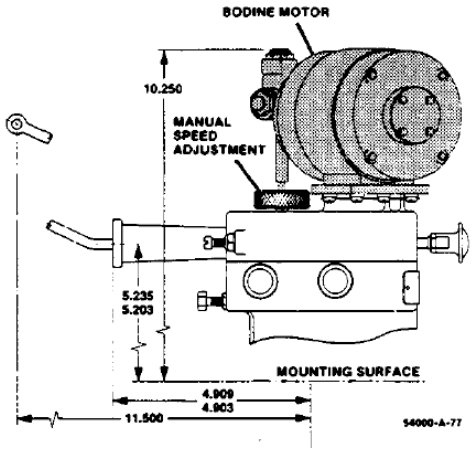

Figure 6. SG with Fuel Rod and Bodine Electric Motor for Speed Setting

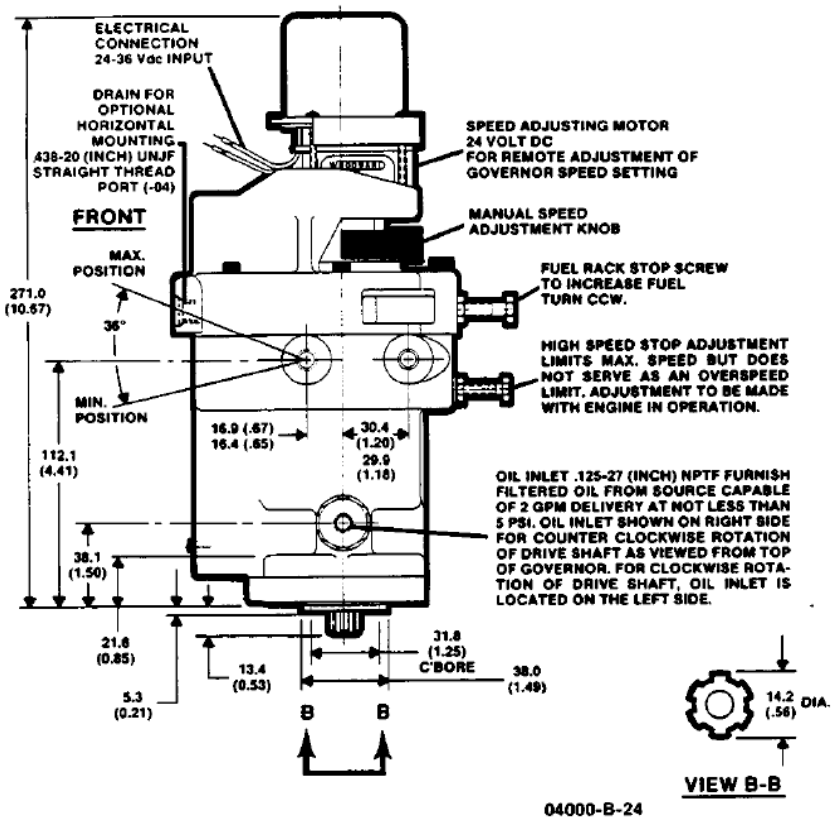

Figure 7. SG Governor with PM Motor and Fuel Rack Stop Screw

Connect the electric speed setting as shown in Figure 8 or 9. Figure 8 is for the Bodine motor, and Figure 9 is for the PM motor. Voltage for the Bodine motor is shown on the motor.

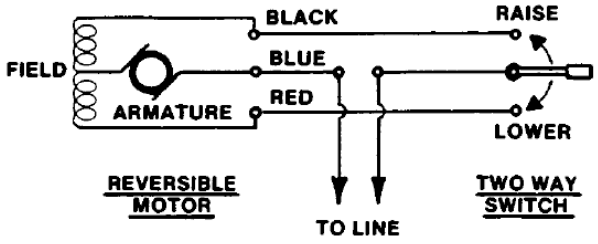

Figure 8. Wiring Diagram for Bodine Motor (Switch not furnished)

NOTICE

The permanent magnet motor operates on dc power. If a 115 or 230 Vac power source is used, convert the power source to a 24 to 32 Vdc current. A converter can be ordered from Woodward. Connect to correct voltage.

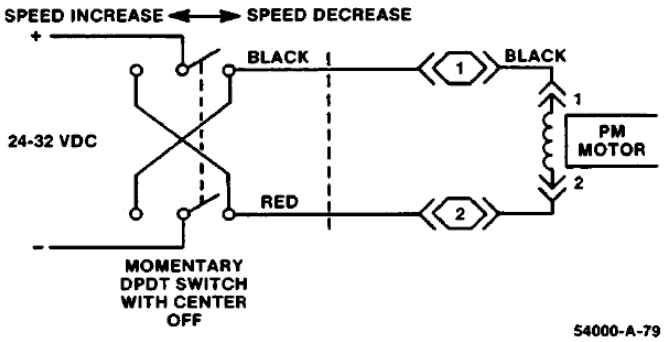

Figure 9. Wiring Diagram for PM Motor (switch not furnished)

If the cover and PM motor are ordered separately for use on an existing governor, all that is required for the installation of the new cover is to remove the old cover before setting the new assembly in place on the governor. Some adjustment for mounting may be necessary. Loosen the screws holding the PM motor in place and align the motor shaft with the clutch. Retighten the screws.

When the cover is used without the PM motor, a screw is placed in the hole where the motor drive shaft normally fits. This screw is then used as a low-speed stop. The cover also houses a vertical return spring when one is used.

Linkage

Governor output can be with either terminal shaft or with fuel rod: connect linkage accordingly. Some sub caps with a fuel rod have a knob which can be pushed in to open the fuel racks when starting an engine, or pulled out to close the fuel racks and stop the engine.

Linear Linkage

Use a linear linkage for diesel engine applications. (Governor output-shaft motion Is directly proportional to changes in the flow of fuel to the engine.) Adjust the fuel linkage to provide control of engine fuel from “MINIMUM PRIME MOVER STOP” to “MAXIMUM PRIME MOVER STOP” within the limits of the governor output-shaft travel. We recommend using two-thirds or more output shaft travel between NO LOAD and FULL Load positions (see Figure 10).

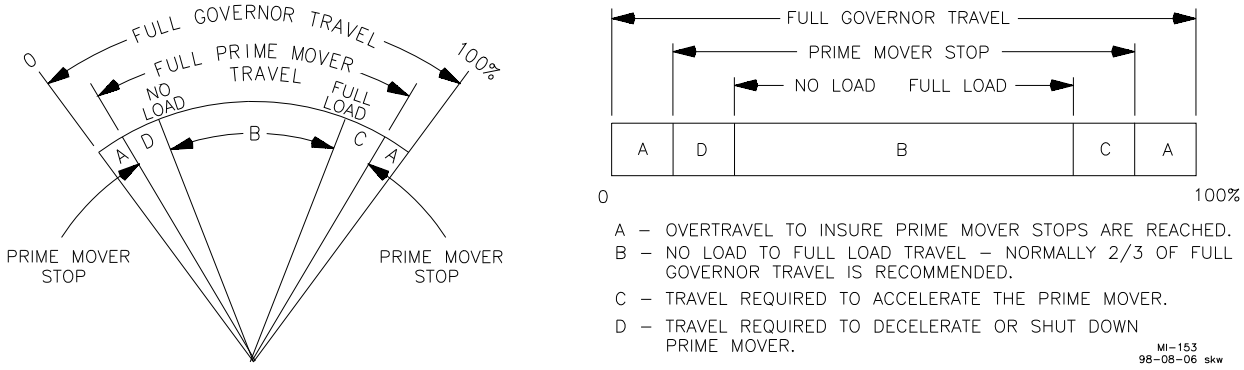

Figure 10. Recommended Governor Terminal Shaft Travel

Attach the fuel rack linkage to the governor output shaft. Be sure there is no lost motion or binding in the linkage.

Be sure to allow sufficient overtravel at each end of the terminal-shaft travel so the governor can shut down the engine and also give maximum fuel when required.

Non-Linear Linkage

Applications involving a butterfly valve, such as on a gas engine, require a non-linear linkage. Figure 11 illustrates the relationship between governor output and butterfly obtained with simple linkage of maximum non-linearity.

When installing this linkage, make sure that the following conditions are attained when the linkage is in the no-load position:

- The lever which is attached to the governor and the connecting link is in line with the governor output shaft and the point of attachment of the connecting link to the butterfly lever.
- The butterfly lever must be at 90 degrees with the connecting link.

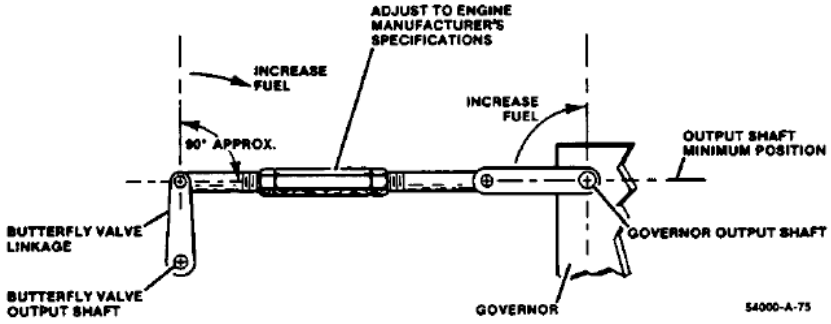

Figure 11. Non-linear Linkage Arrangement

Refer to the prime-mover manufacturer's manual for the correct linkage selection and installation.

Adjustment

Starting the Engine for the First Time

Start the engine as instructed by the engine manufacturer. For a safe start-up, adjust the governor for a reduced speed. Allow the engine to warm up.

⚠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.

IMPORTANT

Make the following adjustments to the governor only if the engine does not stabilize. The governor was adjusted at the factory and should not require any adjustment.

Speed Droop Adjustment

Single Engine Operation—If engine speed does not stabilize, shut down the engine. Increase droop slightly (approximately 0.0625 inch [1.588 mm] movement of bracket away from the governor ballhead), and restart the engine. Manually move the engine fuel linkage to cause a temporary engine speed change. Continue to increase the droop until operation is satisfactory.

If engine speed does not stabilize, shut down the engine. Decrease droop slightly, restart the engine and manually move the linkage to cause a temporary engine speed change. Set the speed-droop bracket as near minimum as possible (consistent with satisfactory performance) to have the least decrease in speed as load is added to the unit.

Operating In Parallel With Other Alternators—Increase droop to prevent interchange of load between units and to increase engine stability. Set droop high enough (towards maximum) to attain good load division between units. If total load does not divide properly, increase droop on units taking too much of the load.

IMPORTANT

The no load to full load speed change must be equal for all paralleled units.

Adjust the speed setting of SG governors or other governors with speed droop to get distribution of load between synchronized units. Increasing the speed setting of a particular unit will increase the load on that unit.

DC Generating Units Electrically Interconnected—Set droop as near minimum as possible consistent with satisfactory operation. If load does not divide as desired, increase droop on units taking too much of the load.

⚠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.

Troubleshooting

If engine hunts or surges:
1. Adjust and align linkage, check for lost motion, binding, excessive friction, and linearity of load to governor travel.
2. Increase speed droop.
3. Make sure that the ballhead cavity is not full of oil. This could be a drain problem.

If engine speed increases as load increases:
Increase droop slightly.

Load does not divide properly on interconnected engines:
This applies when load is increased or decreased, and speed setting is constant.
1. Repeat speed droop adjustment.
2. Check voltage regulator droop.
3. Adjust droop to divide load properly.
4. Increase droop to resist picking up (or dropping off) load.
5. Reduce droop to increase picking up (or dropping off) load.
6. Adjust droop and tighten screw securely.

Engine will not pick up rated full load:
1. Adjust and align fuel linkage, check for lost motion, binding, excessive friction, and linearity of load to governor travel.
2. Adjust maximum speed stop.
3. Check speed-adjusting linkage, if present, for interference.
4. Check for insufficient fuel flow.
5. If engine is at maximum fuel stop and still can not pick up rated full load, the problem is elsewhere in the system and not in the governor.

Governor oil overflows:
Make sure that oil flow through the two drain holes is not restricted by the gasket between the governor base and engine. See Figure 1 for drain holes.

If problems are encountered with the installation or operation of the SG Governor, contact Woodward or your distributor/dealer.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 54035A.

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