WOODWARD

Product Manual 54042
(Revision D, 3/2000)
Original Instructions

UG-5.7, UG-8, UG10 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 Out-of-date translations are marked with ⚠.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.

Manual 54042

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.

UG Governor Installation

General

Mounting base dimensions for the UG-5.7, UG-8, or UG-10 Dial or Lever Governors are identical. See Figure 1 for mounting base dimensions.

Place a gasket between the base of the governor and the engine mounting pad. Mount the governor squarely on its mounting pad and in line with the drive. Torque the mounting bolts evenly. There must be no movement or rocking of the actuator on the engine mounting pad.

Use the correct coupling between the governor and the prime mover drive. Be sure there is no binding, excessive side loading of the governor drive shaft, or looseness in the coupling. There must be no force pushing the governor drive shaft into the governor.

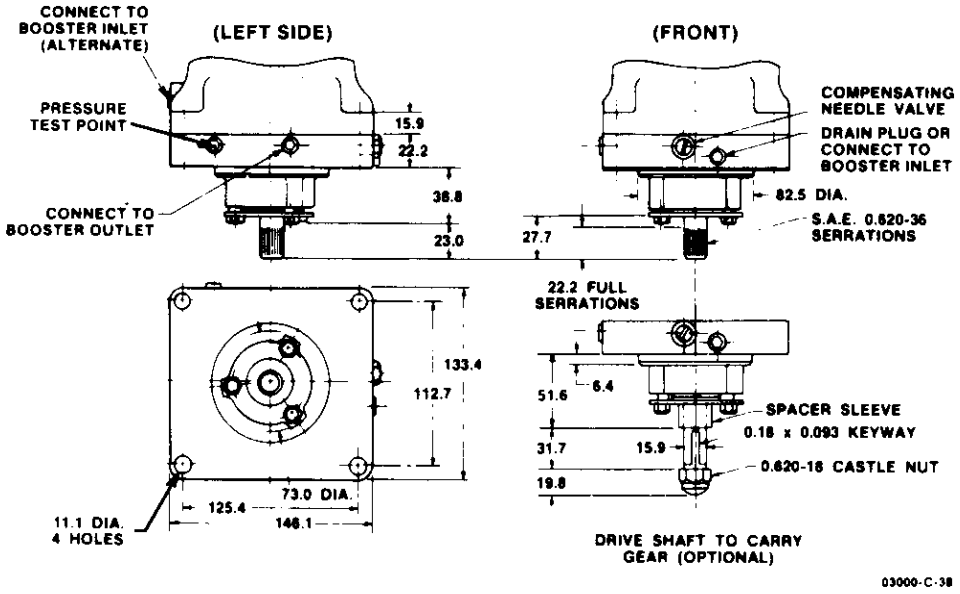

Figure 1. Mounting Base Dimensions

A misaligned drive shaft could break and could cause an overspeed condition or runaway engine.

If the engine drive pad is at an angle (from 0 degrees to 45 degrees maximum), the governor must be installed with the front panel in the upper position.

If an optional keyed drive is used when installing the governor, avoid rough gear teeth and incorrect backlash. Refer to the prime-mover manufacturer's specifications for the correct amount of backlash and adjustment procedure.

Linkage

Refer to the prime-mover manufacturer's manual for the correct linkage selection, installation, and adjustment. Be sure there is no lost motion or binding in the linkage. Correct locking methods must be used on the linkage connections.

See Figure 4 for recommended output shaft travel.

Use a linear linkage for diesel engine applications. See Figure 2. For applications involving a butterfly valve, such as on a gas engine, use a non-linear linkage. See Figure 3.

IMPORTANT **Be sure to allow sufficient overtravel at each end of output shaft travel so the governor can shut down the prime mover and also give maximum fuel when required.**

When installing a non-linear linkage, be sure the two following conditions are attained when the linkage is in the zero governor travel position:

1. 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 (see Figure 3).
2. When the butterfly valve is closed, the butterfly valve lever must be at 90 degrees with the connecting link.

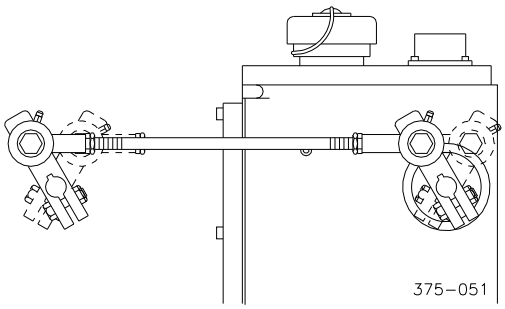

Figure 2. Linear Linkage Arrangement

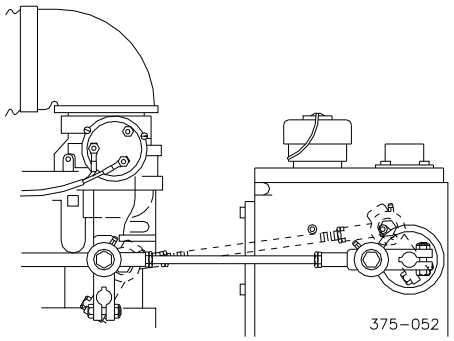

Figure 3. Non-linear Linkage Arrangement

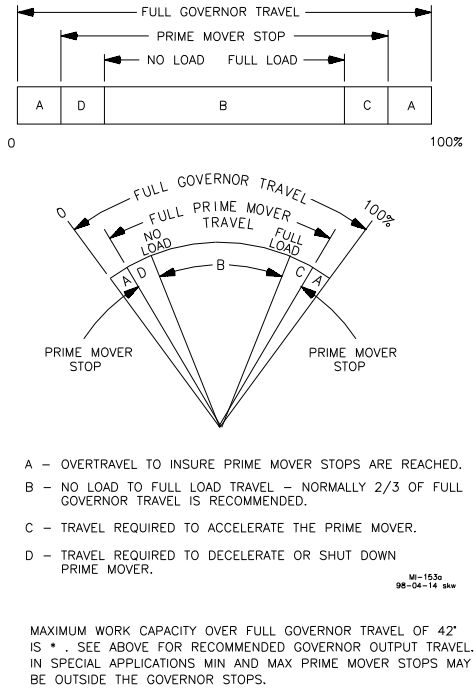

Figure 4. Recommended Output Shaft Travel

Oil Supply

Be sure to use only clean oil. The source of most troubles in any hydraulic governor is dirty, contaminated, or oxidized oil.

Governor oil viscosity at operating temperature must stay within the 50 to 3000 SUS (Saybolt Universal Seconds) range. Ideal oil viscosity at operating temperature is between 100 to 300 SUS.

WARNING

A loss of stable governor control and possible engine overspeed may result if the viscosity is not within the 50 to 3000 SUS range. Overspeed can cause personal injury or death.

The recommended continuous operating temperature of the oil is 60 to 93 °C (140 to 200 °F). The ambient temperature limits are –29 to +93 °C (–20 to +200 °F.

Use Tables 1 and 2 as a guide in the selection of a suitable lubricating hydraulic oil.

Measure the temperature of the governor on the outside lower part of the case. The actual oil temperature will be slightly warmer by approximately 6 Celsius degrees (10 Fahrenheit degrees).

Fill the governor with the selected oil to the mark on the oil sight glass. Oil must be visible in the glass under all operating conditions.

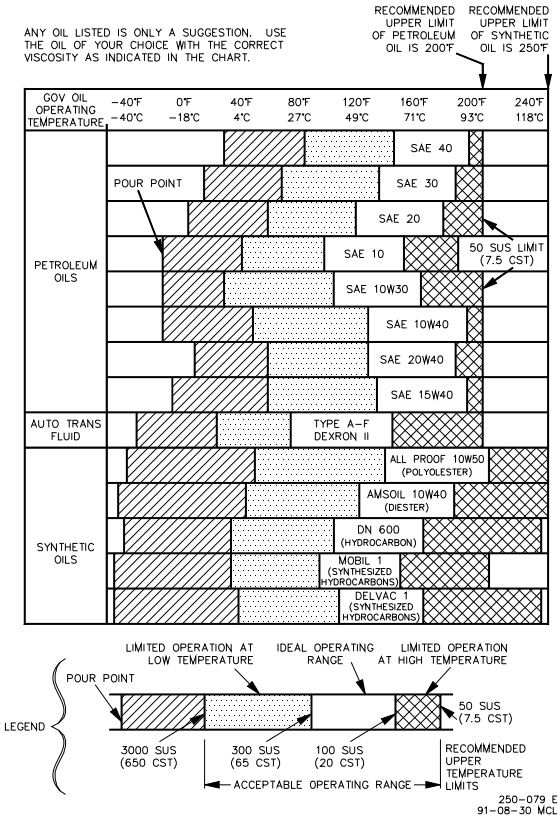

Table 1. Oil Chart

VISCOSITY COMPARISONS				
CENTISTOKES (CST, CS, OR CTS)	SAYBOLT UNIVERSAL SECONDS (SUS) NOMINAL AT 100 DEGREES F	SAE MOTOR (APPROXIMATE)	SAE GEAR (APPROXIMATE)	ISO
15	80	5W		15
22	106	5W		22
32	151	10W	75	32
46	214	10	75	46
68	310	20	80	68
100	463	30	80	100
150	696	40	85	150
220	1020	50	90	220
320	1483	60	115	320
460	2133	70	140	460

250-087
97-11-04 skw

Table 2. Viscosity Comparisons

Adjustments

Starting the Prime Mover for the First Time

Remove the needle valve access plug and seal washer. Close the needle valve carefully clockwise (cw) using a Phillips screwdriver, then open it counterclockwise (ccw) 1/2 to 3/4 of a turn. Loosen the nut holding the compensation adjusting pointer and set the pointer in the center of the scale. Tighten the nut.

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.

Start the engine as instructed by the engine manufacturer. For a safe start-up, adjust the speed setting knob on the governor for a reduced speed and allow the engine to warm up.

Once the governor has reached its operating temperature, make the following compensation adjustments without load on the prime mover:

1. Bleed trapped air from the governor oil passages using the following procedure:

Loosen the nut holding the compensation adjusting pointer and set the pointer as far as it will go towards maximum compensation. Tighten the nut.
Open the needle valve two turns ccw.
Allow the prime mover to hunt for approximately 30 seconds to bleed trapped air.

2. Loosen the nut holding the compensation pointer and set the pointer as far as it will go towards minimum compensation. Tighten the nut again.
3. Gradually close the needle valve until hunting stops. If hunting does not stop, open the needle valve three to five turns from the closed position, and move the compensation pointer up by two marks on the front panel indicator scale. Again, gradually close the needle valve until hunting stops. If hunting does not stop, repeat this procedure.
4. Check governor stability by manually disturbing the governor speed setting. The compensation adjustment is satisfactory when the governor returns to speed with only a slight overshoot or undershoot.
5. The needle valve must not be closed completely, normal position is from 1/2 to 3/4 turn open. Closing the needle valve more than necessary makes the governor slow to return to normal speed after a load change. It is also desirable to have as little compensation as possible. Once the needle valve adjustment is correct, it is not necessary to change the setting except for large changes in temperature which affect governor oil viscosity.
6. When the compensation adjustment is correct, tighten the compensation pointer, and install the needle valve access plug and seal washer.

UG Dial Speed Droop Adjustment

Single Engine Operation

For operation of units running alone, set droop at zero. Zero droop allows the unit to change load without changing speed (isochronous operation).

Units Connected in Parallel or to a Common Shaft
For ac generating units tied in with other units, set droop from reference number 30 to 50 on the governor reference dial to prevent interchange of load between units. Increase droop to resist picking up or dropping off load, and decrease droop to facilitate picking up or dropping off load.

IMPORTANT **If the governor output shaft does not use the full 30 degrees of available travel from "NO LOAD" to "FULL LOAD" (see Figure 3), the effective droop will be reduced proportionately.**

If one unit in the system has enough generating capacity, set its governor on zero droop, and it will regulate the frequency of the prime-mover system. If its capacity is not exceeded, this unit will handle all load changes.

To adjust the system's frequency, operate the SPEED SETTING knob on the front panel of the governor with zero droop. To distribute load between units, operate the SPEED SETTINGS of the governors that have speed droop.

Be careful when setting up two units for paralleling. Response can be too fast on one governor, or too slow on the other governor. Check each governor for stability adjustment in single-engine performance. See earlier in this chapter.

Too little output-shaft travel (see Figure 4) on a governor can require too high a droop setting on that governor to obtain proper load sharing.

When UG governors are used on generator sets operating in parallel, zero droop must be set on the lead unit to maintain the frequency for which it is set, and droop must be set on the slave unit for load stability between the two units. When units are going against an infinite bus, make sure that governors are in droop.

Troubleshooting

Engine Hunts or Surges (A hunt is a rhythmic variation of speed.)
1. Adjust and align the linkage. See "Linkage".
2. Adjust compensation and needle valve.
3. Add oil up to the mark on the oil sight glass.
4. Check for weak spring on yield linkage to fuel rack.
5. Gas or steam pressure not steady on prime mover. Adjust gas or steam pressure.
6. Check voltage regulator operation. Check for load variation.
7. Check engine for misfiring. If misfiring, tune engine.

Fuel Racks Do Not Open Quickly When Cranking Engine
1. Inspect the engine-to-governor fuel linkage for binding. If the linkage is not free, adjust as required.
2. Verify that the cranking speed is not too low. Use a booster servomotor if necessary.
3. If a booster servomotor is used, check the operation of the automatic air starting valve.
4. Make sure that the oil grade selection is correct (see Tables 1 and 2).
5. Check the oil pressure in the governor. Normal operating pressure is 758 to 827 kPa (110 to 120 psi) for the UG-5.7 and UG-8, and 965 to 1034 kPa (140 to 150 psi) for the UG-10. Return the governor to the factory for repairs if oil pressure does not meet requirements.

Jiggle at Governor Output Shaft ("Jiggle" is a high-frequency vibration of the governor output shaft.)

1. Bleed any air in the governor (see “Adjustments”).
2. Inspect the drive mechanism for alignment of gears, rough gear teeth, eccentric gears, or excessive backlash.
3. Inspect gear keys and nuts or set screws holding drive gears to the shaft for looseness.
4. Inspect governor drive shaft run-out to make sure that the drive shaft has not been bent. Run-out must be less than 0.025 mm (0.001 in.) T.I.R. (Total Indicator Reading).
5. Inspect the serrated or spline coupling for wear and alignment.
6. Move the governor slightly on its mounting pad to align the drive shaft with its coupling.

Load Does Not Divide Properly On Interconnected Engines

This applies when load is increased or decreased, and speed setting is constant.

1. Readjust governor droop.
2. Readjust governor speed setting so both engines run at the same load and correct speed, and the bus is at the proper frequency.

The Engine Is Slow To Respond:

1. Adjust the compensating needle valve. Open further if possible to do so without causing instability when running without load. Be sure that the compensation pointer is not too far toward maximum.
2. Engine may be overloaded. Reduce engine load.
3. Restricted fuel supply. Clean the fuel filters.
4. Binding in governor-to-engine linkage, or nonlinear linkage. See "Linkage".

Engine Will Not Pick Up Rated Full Load

1. Adjust the LOAD LIMIT knob on the governor to increase the LOAD LIMIT setting.
2. Verify that the load indicator on the governor is not at 10: Adjust the engine-to-governor fuel linkage. Adjust the load-limiting device, or the fuel-pump stops.
3. If the fuel supply filters are dirty, clean the filters. If gas pressure or calorific value are too low, adjust as required.
4. Check the voltage regulator output, if used, and adjust or repair as required.
5. Check the engine for misfiring. Tune the engine if required.

Auxiliary Equipment

Refer to Product Specification 03029 for a brief description of the additional devices listed below:

Dial Or Lever Governor:

1. Shutdown Solenoid
2. Magnetic Speed Pickup
3. Manifold Pressure Fuel Limiter
4. Starting Fuel Limit
5. Booster Servomotor

Dial Governor

1. Bodine Speed Adjusting Motor (see Figure 5)
2. PM (Permanent Magnet) Speed Adjusting Motor (see Figures 6 and 7), with a Shutdown Solenoid as an option, in a weatherproof or explosion-proof housing

Lever Governor

1. Manual Shutdown

WARNING

The shutdown solenoid must not be used as an overspeed protective device. Overspeed protection must come from a unit completely separate from the UG governor to prevent possible overspeed and potential personal injury or death.

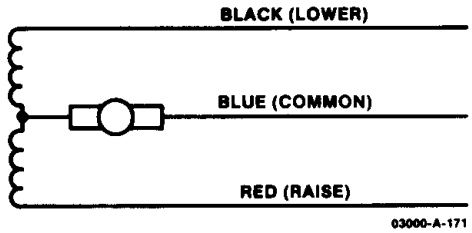

Figure 5. Wiring Schematic for the Bodine Speed Setting Motor

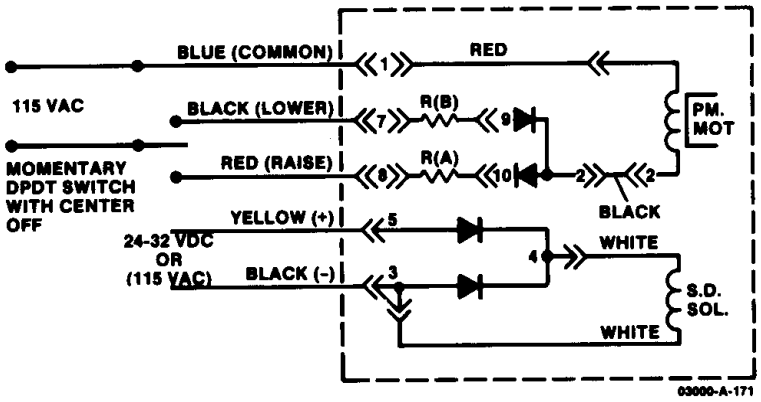

Figure 6. Wiring Schematic for the 115 Vac PM Speed Setting Motor

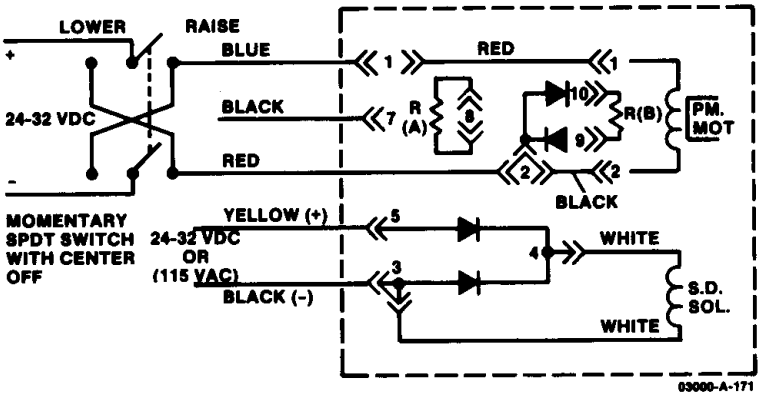

Figure 7. Wiring Schematic for the 24 and 32 Vdc PM Speed Setting Motor

If problems are encountered with the installation or operation of this governor, contact Woodward:

Facility	Phone Number
Brazil	+55 (19) 3708 4800
India	+91 (129) 230 7111
Japan	+81 (476) 93-4661
The Netherlands	+31 (23) 5661111

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