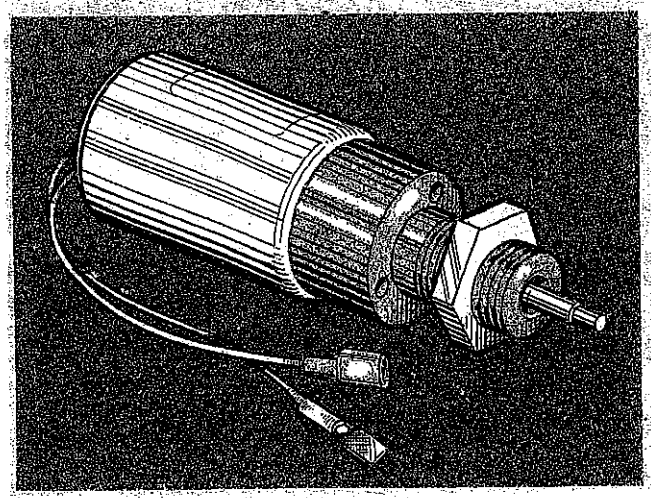
ELECTRONIC GOVERNORS

ANALOG DIESEL MODELS

ADJUSTMENTS / CALIBRATION AND COMPONENT TROUBLESHOOTING GUIDE



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JULY 2013

WESTERBEKE

member NMMA

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THE ELECTRONIC GOVERNOR (BARBER COLMAN)

GENERATOR MODELS TO JUNE 2004

DESCRIPTION

A generators engine must run at a constant speed to enable the generator to produce the stable AC power (hertz) required.

The Electronic Governor consists of three components, the **CONTROLLER**, a pc board installed in the control panel. A **MAGNETIC PICK-UP** (MPU) installed in the bellhousing over the engine flywheel and the linear **ACTUATOR** mounted on the engine and attached by linkage to the injection pump throttle control.

The Electronic Governor regulates the engine speed by sensing the engine's RPM with the magnetic pick-up at the flywheel. The governor's controller continuously monitors the engines speed and if there is any discrepancy, the controller signals the actuator and the actuator adjusts the engine to the desired speed electronically.

CONTROLLER ADJUSTMENT

The controller has two adjustments: the **SPEED** adjustment is used to increase or decrease the the engine's speed to the desired hertz. The **GAIN** adjustment affects the reaction time of the actuator to the generator load changes.

NOTE: *A high gain adjustment can induce an oscillating of the actuator producing a hunting mode. In such cases, lessen the gain adjustment.*

CALIBRATION

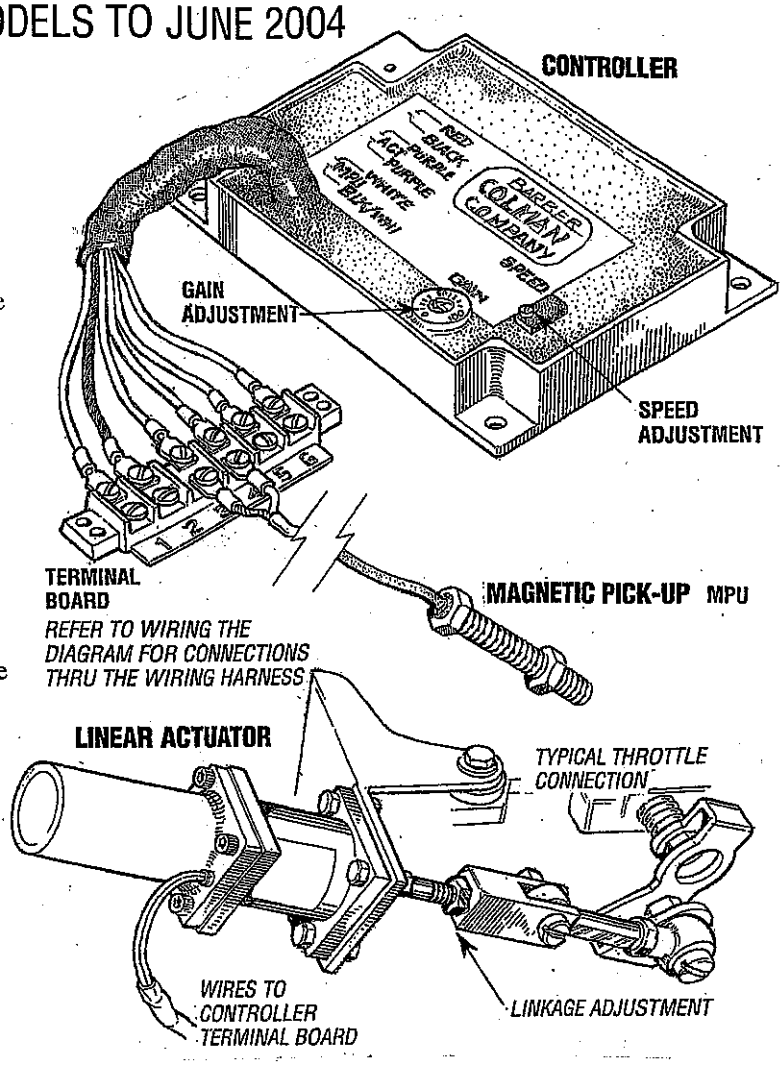
1. With no power to the governor (engine not running), adjust the **GAIN** potentiometer to 9:00 o'clock.
2. Start the engine and adjust the speed by turning the speed pod clockwise to desired speed.

   NOTE: *Controllers are factory adjusted to minimum RPM. However, for safety, one should be capable of disabling the engine if an overspeed should exist.*
3. At no load, turn the **GAIN** potentiometer clockwise until the engine begins to hunt. If the engine does not hunt, physically upset the actuator linkage.
4. Turn the **GAIN** potentiometer counterclockwise until engine runs stable.

   NOTE: *Controllers are available in 12 and 24 VDC models. The operating voltage range is + or - 20%. If the voltage varies above or below this range, the controller will not operate and the engine will run in the idle mode until proper DC voltage is supplied to the controller.*

ELECTRONIC GOVERNOR ADJUSTMENTS

The controller has two adjustment pods. You need a mini screw driver to adjust these. One is speed and one is gain. These are noted on the drawing of the controller.



Start the engine. The speed should be in the low idle range 600-700 rpm. If the engine speed is higher than this idle range, shut the engine down. Check the linkage between the actuator and throttle arm. The throttle arm stop should be about touching the open idle stop screw boss. Adjust the linkage to position the throttle lever. Restart the engine and using the speed adjustment buttons bring the engine speed to 1800 rpm (60Hz), 1500 rpm (50Hz). Momentarily push the actuator linkage towards the actuator and release. The actuator should quickly regain proper speed. If there is any hunting, adjust the gain towards zero (0) until this hunting is removed.

When the gain is adjusted, you may need to re-adjust the speed at no load, shut the generator down.

Start the generator.

Check speed (hertz) set at 50Hz/60Hz.

Load the generator.

If the governor is slow to react and maintain 50Hz/60Hz, adjust the gain clockwise. Again you may need to adjust the speed at no load.

You will find the governor will maintain set engine RPM ± 0.5 Hz right up to the full rated amperage output for the generator.

ELECTRONIC GOVERNOR

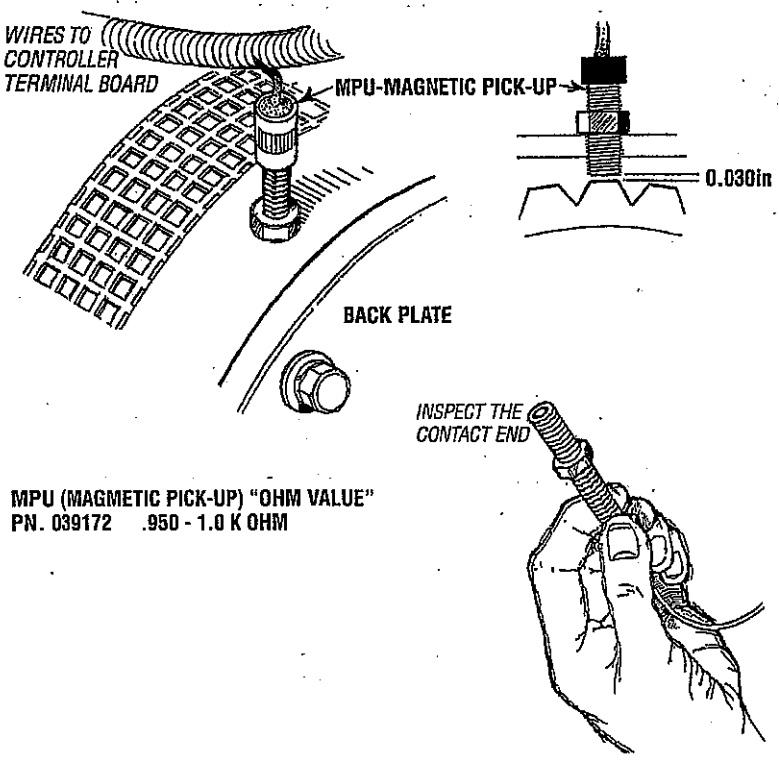
MAGNETIC PICK-UP [MPU] INSTALLATION

The MPU is installed in the threaded opening on the side of the flywheel bell housing. This positions the MPU over the teeth of the flywheel ring gear.
Viewing through this opening, manually rotate the engine crankshaft so as to position the flat of one of the ring gear's teeth directly under the opening. Thread the MPU into the opening until it gently contacts the flat of this tooth (Thread is 3/8" x 24). Back the MPU out of the opening one turn and then lock it in this position with the jam nut. This will position the end of the MPU approximately 0.030 inches away from the flats of the ring gear teeth.

To ensure the MPU is positioned correctly, slowly rotate the crankshaft by 360° by hand to assure there is no physical contact between the MPU and the ring gear teeth.

If contact is felt between the MPU and the flywheel teeth, the MPU may be damaged. Remove the MPU and inspect it. Replace if necessary and repeat the above installation procedure.

NOTE: *If replacing the Magnetic Pick-Up (MPU) it MUST be replaced without cutting and splicing into the existing wiring cable. Doing so will cause a erratic AC signal to the controller.*



MPU (MAGMETIC PICK-UP) "OHM VALUE"
PN. 039172 .950 - 1.0 K OHM

GOVERNOR CIRCUIT VOLTAGES

Below are the voltages normally found in the governor ircuit when the system is functioning normally. These voltages are an approximate and should be of help in troubleshooting a system that is not functioning correctly.

DC Voltage into Controller
Bat + to Bat - (battery charging voltage 13.5 - 14.5 VDC)
(Terminal Block #1 and #2)

DC Voltage to Actuator
ACT to ACT (5,5 - 6.5 VDC)
(Terminal block #5 and #6)

AC Voltage from MPU into Controller
MPU to MPU (2.5 - 7.0 VAC)
(Terminal block 3# and #4)

This voltage spread is the result of the distance the MPU is positioned from the flat of the flywheel ring gear tooth. The closer to the tooth, the higher the AC signal. The further away, the lower the AC signal.

ACTUATOR "OHM VALUES"

12 Volt	PN 044990	3.0 - 3.1 OHM
	PN 303007	2.0 - 2.1 OHM
24 Volt	PN 044991	10.7 - 10.8 OHM
	PN 039746	7.5 - 7.6 OHM

ELECTRONIC GOVERNOR TROUBLESHOOTING (BARBER COLEMAN)

Problem	Test/Check	Correct
System appears dead. Engine runs, but at idle speed	**1.** Check DC voltage present at terminal block. Battery voltage should be present at #1 and #2.	**1.** Inspect the DC circuit back to the source.
	2. Inspect external linkage for binding or sticking.	**2.** Free up the linkage and clean and lubricate the linkage.
	3. Check AC signal from MPU at terminal block #2 and #3. AC voltage 1.5 - 2.5 VAC.	**3.** Inspect MPU circuit. Check MPU coil resistance and condition. No damage to tip.
	4. Check DC voltage at actuator connections on terminal block. #5 and #2, #6 and #2 VAC. 12 VDC should be present.	**4.** Check actuator circuit. If battery voltage is not present, replace the controller.
	5. Battery voltage present between #5 and #2, #6 and #2.	**5.** Check actuator directly with 12 VDC. Check winding. Replace actuator if needed.
External Actuator goes into full extension when preheat is depressed and stays extended.	**1.** Check the controller by lifting the actuator leds, one at a time off the terminal block and depress pre-heat.	
	a. Actuator goes to full extension.	**a.** Check for shorted led to actuator.
	b. Actuator does not extend	**b.** Replace controller.
External Actuator hunts during normal operation.	**1.** Linkage are sticking or binding.	**1.** Lubricate or replace.
	2. Improper controller adjustment.	**2.** Re-adjust the calibration and lower the GAIN adjustment.
	3. Low DC voltage to controller.	**3.** Check the DC voltage at the terminal block #1 and #2. Charging voltage should be present. 24 VDC min is 19.2 VDC 12 VDC min is 9.6 VDC
	4. MPU is positioned to far from the flywheel ring gear or tip of MPU is contaminated.	**4.** Check MPU.

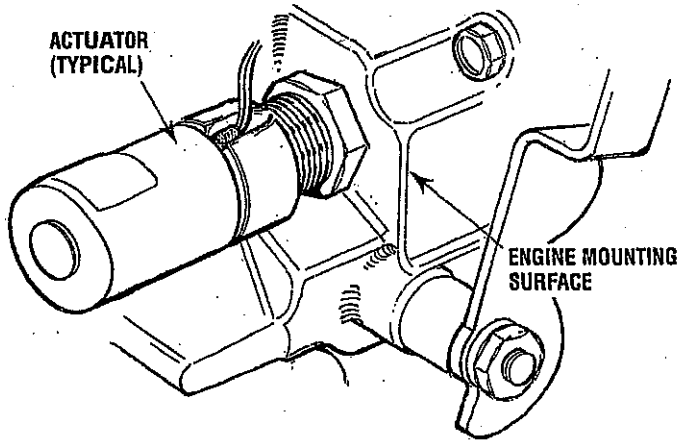
INTERNAL ACTUATOR TROUBLESHOOTING
THREAD IN TYPE

DESCRIPTION

The actuator is threaded into the engine block behind the engines fuel injection pump. The operator can not seeseen visually. When static, the actuator plunger is extended and keeping the fuel injection pump's fuel rack in the no fuel delivery position.
An engine cranking with no start can be the result of the actuator not functioning due to a faulty actuator or the actuator not receiving DC voltage from the controller to draw its plunger away from the fuel rack.

Troubleshooting

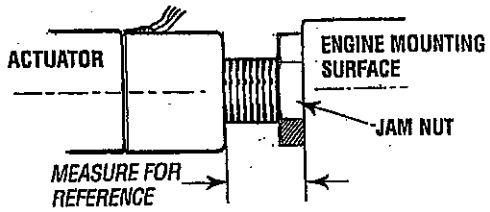
1. Cranking with no start.
   1. Check for fuel delivery to the injectors.
   2. Check DC voltage to the actuator while cranking. Terminal blocks #5 to #6 *0.5 - 1.0 VDC.*
   3. No DC voltage faulty controller, DC voltage, Faulty actuator. Remove and test externally.



ADJUSTMENTS

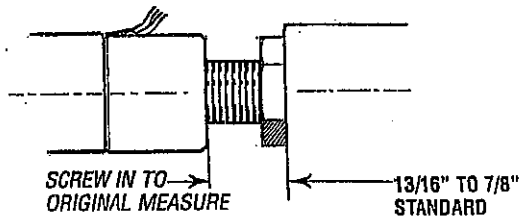
The following instructions are for adjusting or replacing the actuator.

1. Shut-off the DC power to the generator.
2. Disconnect yhe actuator wires from the wiring harness.
3. Measure the distance between the actuator and the engine mounting surface as shown.



4. Back-off the 1 7/16" jam nut and unscrew the actuator.
5. Test the actuator by applying 12 VDC across its two electrical connections. Plunger should be fully in.
6. To replace/re-install the actuator. Apply a small amount of liquid Teflon sealant to the threads ahead of the jam nut and thread the actuator into the block. Maintain the same distance as in step #3 (standard distance 13/16" to 7/8"). Secure the actuator with the jam nut.
7. Re-connect the actuator wires to the harness and test run the generator.

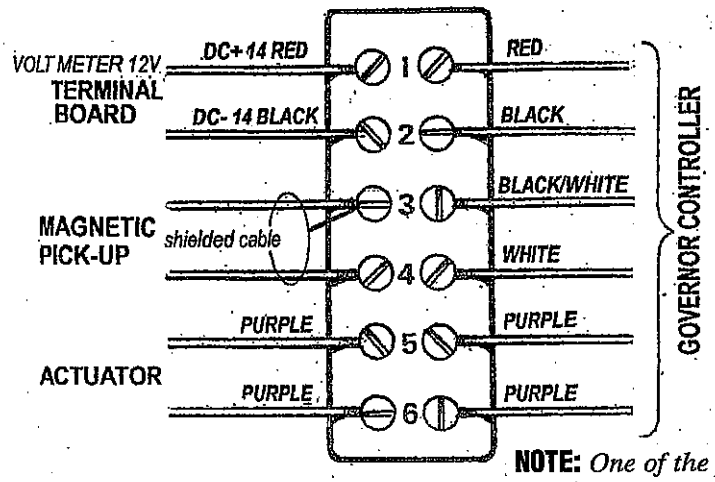
NOTE: *If the unit does not shut down properly (goes to low idle), loosen the jam nut and turn the actuator in 1/8-1/4 of a turn until the proper shut-down is achieved.*



NOMINAL CIRCUIT VOLTAGES

TERMINAL BOARD NUMBERS 1 THRU 6

PREHEATING:	**TERMINAL #1 TO #2**	**12.5 VDC** (Battery Voltage)
	TERMINAL #5 TO #6	**0.5 VDC**
CRANKING:	**TERMINAL/VOLTAGE VDC**	
	TERMINAL #1 TO #2	**11.5 VDC** (Battery Voltage)
	TERMINAL #3 TO #4	**1.5 - 2.5 VAC**
	TERMINAL #5 TO #6	**0.5 VDC**
RUNNING: (Normal RPM)	**TERMINAL #1 TO #2**	**13.5 - 14.1 VDC** (System Charging Voltage)
	TERMINAL #3 TO #4	**4 – 7 VAC**
	TERMINAL #5 TO #6	**5.0 - 7.0 VDC**



NOTE: *One of the purple leads from the governor controller may have a white stripe.*

ELECTRONIC GOVERNOR
WOODWARD MODEL

DESCRIPTION

A generators engine must run at a constant speed to enable the generator to produce the stable AC power (hertz) required.

The Electronic Governor consists of three components, the **CONTROLLER**, a pc board installed in the control panel. A **MAGNETIC PICK-UP** (MPU) installed in the bellhousing over the engine flywheel and the linear **ACTUATOR** mounted on the engine and attached by linkage to the injection pump throttle control.

The Electronic Governor regulates the engine speed by sensing the engine's RPM with the magnetic pick-up at the flywheel. The governor's controller continuously monitors the engines speed and if there is any discrepancy, the controller signals the actuator and the actuator adjusts the engine to the desired speed electronically.

CONTROLLER ADJUSTMENT

The controller has two adjustments: the **SPEED** adjustment is used to increase or decrease the the engine's speed to the desired hertz. The **GAIN** adjustment affects the reaction time of the actuator to the generator load changes.

NOTE: *A high gain adjustment can induce an oscillating of the actuator producing a hunting mode. In such cases, lessen the gain adjustment.*

CALIBRATION

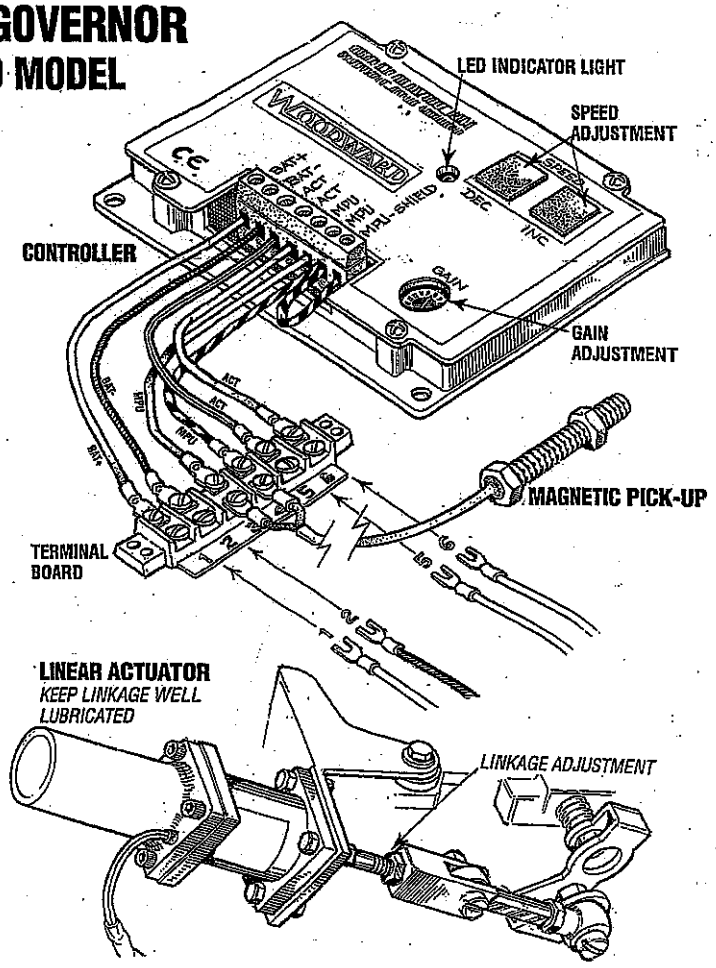
1. With no power to the governor (engine not running), adjust the **GAIN** potentiometer to 9:00 o'clock.
2. Start the engine and adjust the speed by turning the speed pod clockwise to desired speed.

   NOTE: *Controllers are factory adjusted to minimum RPM. However, for safety, one should be capable of disabling the engine if an overspeed should exist.*
3. At no load, turn the **GAIN** potentiometer clockwise until the engine begins to hunt. If the engine does not hunt, physically upset the actuator linkage.
4. Turn the **GAIN** potentiometer counterclockwise until engine runs stable.

   NOTE: *Controllers are available in 12 and 24 VDC models. The operating voltage range is + or - 20%. If the voltage varies above or below this range, the controller will not operate and the engine will run in the idle mode until proper DC voltage is supplied to the controller.*

ELECTRONIC GOVERNOR ADJUSTMENTS

Pressing the pre-heat switch, the LED Indicator Light (green) on the controller will start to blink indicating the controller has the proper DC voltage to operate.



Depressing the Start switch and the starter cranks the engine, the MPU sends a low AC signal to the controller and the controller in turn sends a DC voltage to the actuator moving the throttle arm (external) or plunger away from the fuel rack (internal) allowing for fuel delivery to the injectors and a start. Engine speed will increase until the set AC voltage signal from the MPU is achieved and the controller will then vary the DC voltage to the actuator increasing or decreasing fuel delivery to maintain this MPU AC signal under all load conditions.

With the installation of a new replacement controller, the programmed speed at start up will be in the 1000-1500 rpm range. The speed can then be adjusted as needed by momentary depression of the Speed Buttons to increase or decrease speed as needed.

Once the proper rpm/hertz is achieved, external actuators, bump the linkage towards the actuator, internal actuators put an amperage load on the generator and take it off.

If there is any hunting induced by doing this, adjust the GAIN towards zero (0) until this hunting is removed. When the gain is adjusted, you may need to re-adjust the speed at no load, shut the generator down.

Start the generator.

Check speed (hertz) set at 50Hz/60Hz.

Load the generator.

If the governor is slow to react and maintain 50Hz/60Hz, adjust the gain clockwise. Again you may need to adjust the speed at no load.

ELECTRONIC GOVERNOR

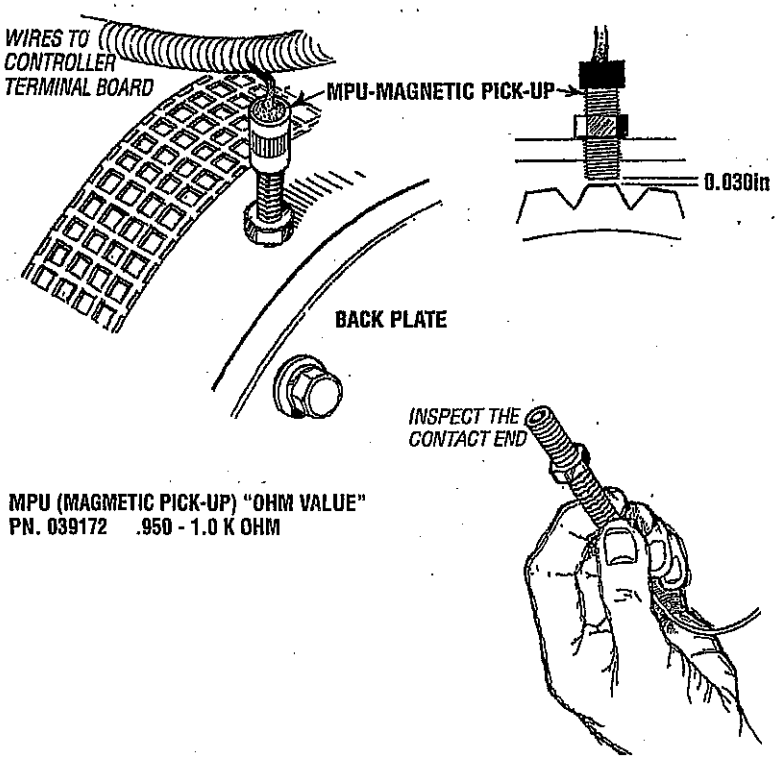
MAGNETIC PICK-UP [MPU] INSTALLATION

The MPU is installed in the threaded opening on the side of the flywheel bell housing. This positions the MPU over the teeth of the flywheel ring gear.
Viewing through this opening, manually rotate the engine crankshaft so as to position the flat of one of the ring gear's teeth directly under the opening. Thread the MPU into the opening until it gently contacts the flat of this tooth (Thread is 3/8" x 24). Back the MPU out of the opening one turn and then lock it in this position with the jam nut. This will position the end of the MPU approximately 0.030 inches away from the flats of the ring gear teeth.

To ensure the MPU is positioned correctly, slowly rotate the crankshaft by 360° by hand to assure there is no physical contact between the MPU and the ring gear teeth.

If contact is felt between the MPU and the flywheel teeth, the MPU may be damaged. Remove the MPU and inspect it. Replace if necessary and repeat the above installation procedure.

NOTE: *If replacing the Magnetic Pick-Up (MPU) it MUST be replaced without cutting and splicing into the existing wiring cable. Doing so will cause a erratic AC signal to the controller.*



MPU (MAGMETIC PICK-UP) "OHM VALUE"
PN. 039172 .950 - 1.0 K OHM

GOVERNOR CIRCUIT VOLTAGES

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DC Voltage into Controller
Bat + to Bat - (battery charging voltage 13.5 - 14.5 VDC)
(Terminal Block #1 and #2)

DC Voltage to Actuator
ACT to ACT (5,5 - 6.5 VDC)
(Terminal block #5 and #6)

AC Voltage from MPU into Controller
MPU to MPU (2.5 - 7.0 VAC)
(Terminal block 3# and #4)

This voltage spread is the result of the distance the MPU is positioned from the flat of the flywheel ring gear tooth. The closer to the tooth, the higher the AC signal. The further away, the lower the AC signal.

ACTUATOR "OHM VALUES"

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	PN 303007	2.0 - 2.1 OHM
24 Volt	PN 044991	10.7 - 10.8 OHM
	PN 039746	7.5 - 7.6 OHM

Press
(green
control

ELECTRONIC GOVERNOR TROUBLESHOOTING (WOODWARD)

Problem	Test/Check	Correct
System appears dead. Engine runs, but at idle speed	1. Check DC voltage present at terminal block. Battery voltage should be present. #1 and #2.	1. Inspect the DC circuit back to the source.
	2. Inspect external linkage for binding or sticking.	2. Free up the linkage and clean and lubricate the linkage.
	3. Check AC signal from MPU at terminal block #2 and #3. AC voltage 1.5 - 2.5 VAC.	3. Inspect MPU circuit. Check MPU coil resistance and condition. No damage to tip.
	4. Check DC voltage at actuator connections on terminal block. #5 and #2, #6 and #2 VAC. 12 VDC should be present.	4. Check actuator circuit. If battery voltage is not present, replace the controller.
	5. Battery voltage present between #5 and #2, #6 and #2.	5. Check actuator directly with 12 VDC. Check winding. Replace actuator if needed.
External Actuator goes into full extension when preheat is depressed and stays extended. (Actuators plunger should not extend).	1. 12 VDC between #5 and #6	1. Replace controller.
External Actuator hunts during normal operation.	1. Linkage are sticking or binding.	1. Lubricate or replace.
	2. Improper controller adjustment.	2. Re-adjust the calibration and lower the GAIN adjustment.
	3. Low DC voltage to controller.	3. Check the DC voltage at the terminal block #1 and #2. Charging voltage should be present. 24 VDC min is 19.2 VDC 12 VDC min is 9.6 VDC
	4. MPU is positioned to far from the flywheel ring gear or tip of MPU is contaminated.	4. Check MPU.

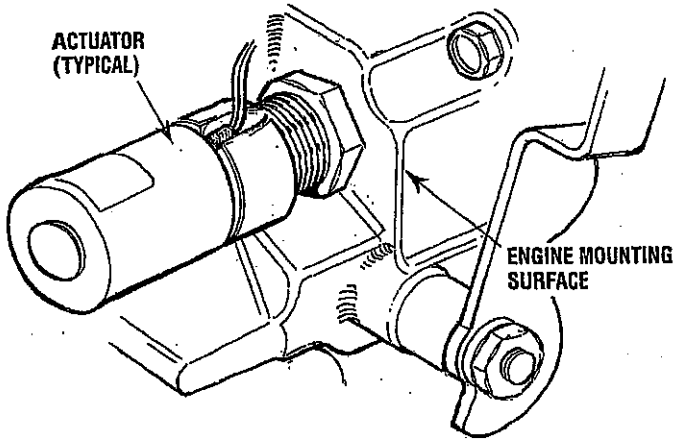
INTERNAL ACTUATOR TROUBLESHOOTING
THREAD IN TYPE

DESCRIPTION

The actuator is threaded into the engine block behind the engines fuel injection pump. The operator can not seeseen visually. When static, the actuator plunger is extended and keeping the fuel injection pump's fuel rack in the no fuel delivery position.
An engine cranking with no start can be the result of the actuator not functioning due to a faulty actuator or the actuator not receiving DC voltage from the controller to draw its plunger away from the fuel rack.

Troubleshooting

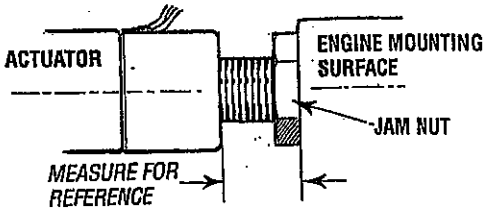
1. Cranking with no start.
   1. Check for fuel delivery to the injectors.
   2. Check DC voltage to the actuator while cranking. Terminal blocks #5 to #6 *0.5 - 1.0 VDC.*
   3. No DC voltage faulty controller, DC voltage, Faulty actuator. Remove and test externally.



ADJUSTMENTS

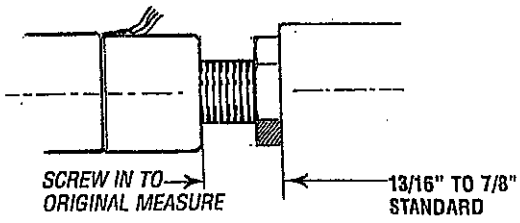
The following instructions are for adjusting or replacing the actuator.

1. Shut-off the DC power to the generator.
2. Disconnect yhe actuator wires from the wiring harness.
3. Measure the distance between the actuator and the engine mounting surface as shown.



4. Back-off the 1 7/16" jam nut and unscrew the actuator.
5. Test the actuator by applying 12 VDC across its two electrical connections. Plunger should be fully in.
6. To replace/re-install the actuator. Apply a small amount of liquid Teflon sealant to the threads ahead of the jam nut and thread the actuator into the block. Maintain the same distance as in step #3 (standard distance 13/16" to 7/8"). Secure the actuator with the jam nut.
7. Re-connect the actuator wires to the harness and test run the generator.

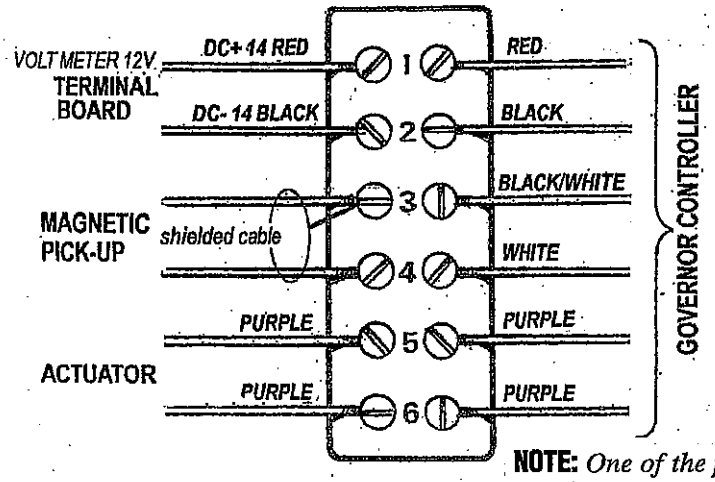
NOTE: *If the unit does not shut down properly (goes to low idle), loosen the jam nut and turn the actuator in 1/8-1/4 of a turn until the proper shut-down is achieved.*



NOMINAL CIRCUIT VOLTAGES

TERMINAL BOARD NUMBERS 1 THRU 6

PREHEATING:	**TERMINAL #1 TO #2**	**12.5 VDC** (Battery Voltage)
	TERMINAL #5 TO #6	**0.5 VDC**
CRANKING:	**TERMINAL/VOLTAGE VDC**	
	TERMINAL #1 TO #2	**11.5 VDC** (Battery Voltage)
	TERMINAL #3 TO #4	**1.5 - 2.5 VAC**
	TERMINAL #5 TO #6	**0.5 VDC**
RUNNING: (Normal RPM)	**TERMINAL #1 TO #2**	**13.5 - 14.1 VDC** (System Charging Voltage)
	TERMINAL #3 TO #4	**4 – 7 VAC**
	TERMINAL #5 TO #6	**5.0 - 7.0 VDC**



NOTE: *One of the purple leads from the governor controller may have a white stripe.*


WESTERBEKE
Engines & Generators