ELECTRONIC GOVERNORS
ANALOG DIESEL MODELS
ADJUSTMENTS / CALIBRATION
AND COMPONENT
TROUBLESHOOTING GUIDE

REVISION 2
JULY 2013

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WEBSITE: WWW.WESTERBEKE.COM
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THE ELECTRONIC GOVERNOR (BARBER COLMAN)
GENERATOR MODELS TO JUNE 2004

DESCRIPTION
A generator's 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 (M PU) 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 engine's 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 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 mode 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 screwdriver to adjust these. One is speed and one is gain. These are noted on the drawing of the controller.
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.

GOVERNOR CIRCUIT VOLTAGES

Below are the voltages normally found in the governor circuit 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  030007  2.0 - 2.1 OHM

24 Volt  PN  044991  10.7 - 10.8 OHM
            PN  039746  7.5 - 7.6 OHM
<table>
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<tr>
<th>Problem</th>
<th>Test/Check</th>
<th>Correct</th>
</tr>
</thead>
</table>
| 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.  
2. Inspect external linkage for binding or sticking.  
3. Check AC signal from MPU at terminal block #2 and #3. AC voltage 1.5 - 2.5 VAC.  
4. Check DC voltage at actuator connections on terminal block. #5 and #2, #6 and #2 VAC. 12 VDC should be present.  
5. Battery voltage present between #5 and #2, #6 and #2. | 1. Inspect the DC circuit back to the source.  
2. Free-up the linkage and clean and lubricate the linkage.  
3. Inspect MPU circuit. Check MPU coil resistance and condition. No damage to tip.  
4. Check actuator circuit. If battery voltage is not present, replace the controller.  
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 leas, one at a time off the terminal block and depress pre-heat.  
   a. Actuator goes to full extension.  
   b. Actuator does not extend. | a. Check for shorted lead to actuator.  
   b. Replace controller. |
| External Actuator hunts during normal operation. | 1. Linkage are sticking or binding.  
2. Improper controller adjustment.  
3. Low DC voltage to controller.  
4. MPU is positioned to far from the flywheel ring gear or tip of MPU is contaminated. | 1. Lubricate or replace.  
2. Re-adjust the calibration and lower the GAIN adjustment.  
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. 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 see the actuator 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 the actuator wires from the wiring harness.
3. Measure the distance between the actuator and the engine mounting surface as shown.

   ACTUATOR
   MEASURE FOR
   REFERENCE
   ENGINE MOUNTING
   SURFACE
   JAM NUT

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 1/8-1/4 of a turn until the proper shut-down is achieved.

WESTERBEKE
Engines & Generators

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# NOMINAL CIRCUIT VOLTAGES
## TERMINAL BOARD NUMBERS 1 THRU 6

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<th>Connections</th>
<th>Voltages</th>
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<tr>
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<td>TERMINAL #5 TO #6</td>
<td>0.5 VDC</td>
</tr>
<tr>
<td>CRANKING</td>
<td>TERMINAL #1 TO #2</td>
<td>11.5 VDC (Battery Voltage)</td>
</tr>
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<td></td>
<td>TERMINAL #3 TO #4</td>
<td>1.5 - 2.5 VAC</td>
</tr>
<tr>
<td></td>
<td>TERMINAL #5 TO #6</td>
<td>0.5 VDC</td>
</tr>
<tr>
<td>RUNNING (Normal RPM)</td>
<td>TERMINAL #1 TO #2</td>
<td>13.5 - 14.1 VDC (System Charging Voltage)</td>
</tr>
<tr>
<td></td>
<td>TERMINAL #3 TO #4</td>
<td>4 - 7 VAC</td>
</tr>
<tr>
<td></td>
<td>TERMINAL #5 TO #6</td>
<td>5.0 - 7.0 VDC</td>
</tr>
</tbody>
</table>

**Diagram:**
- **VOLT METER 12V TERMINAL BOARD:**
  - RED: DC+14 RED
  - BLACK: DC-14 BLACK
- **MAGNETIC PICK-UP:**
  - BLACKWHITE: Shielded cable
  - WHITE: Purple
- **ACTUATOR:**
  - PURPLE: Purple

**NOTE:** One of the purple leads from the governor controller may have a white stripe.
DESCRIPTION
A generator's 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 PCB 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 engine 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 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 pot 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 readjust 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.
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 an erratic AC signal to the controller.

GOVERNOR CIRCUIT VOLTAGES

Below are the voltages normally found in the governor circuit 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"

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<th>Voltage</th>
<th>Part Number</th>
<th>Ohm Value</th>
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<tr>
<td>12 Volt</td>
<td>044990</td>
<td>3.0 - 3.1 OHM</td>
</tr>
<tr>
<td></td>
<td>303007</td>
<td>2.0 - 2.1 OHM</td>
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<td>24 Volt</td>
<td>044991</td>
<td>10.7 - 10.8 OHM</td>
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<td>039746</td>
<td>7.5 - 7.6 OHM</td>
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<td>2. Inspect external linkage for binding or sticking.</td>
<td>2. Free up the linkage and clean and lubricate the linkage.</td>
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<td>3. Check AC signal from MPU at terminal block #2 and #3. AC voltage 1.5 - 2.5 VAC.</td>
<td>3. Inspect MPU circuit. Check MPU coil resistance and condition. No damage to tip.</td>
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<td>4. Check DC voltage at actuator connections on terminal block. #5 and #2, #6 and #2 VAC. 12 VDC should be present.</td>
<td>4. Check actuator circuit. If battery voltage is not present, replace the controller.</td>
</tr>
<tr>
<td></td>
<td>5. Battery voltage present between #5 and #2, #6 and #2.</td>
<td>5. Check actuator directly with 12 VDC. Check winding. Replace actuator if needed.</td>
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<td>External Actuator goes into full extension when preheat is depressed and stays extended. (Actuators plunger should not extend).</td>
<td>1. 12 VDC between #5 and #6</td>
<td>1. Replace controller.</td>
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<td>2. Improper controller adjustment.</td>
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<td>3. Low DC voltage to controller.</td>
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<td>4. MPU is positioned to far from the flywheel ring gear or tip of MPU is contaminated.</td>
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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 see the see 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 the actuator wires from the wiring harness.
3. Measure the distance between the actuator and the engine mounting surface as shown.

   ACTUATOR
   ENGINE MOUNTING SURFACE
   MEASURE FOR REFERENCE
   JAM NUT

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.

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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: TERMINAL #1 TO #2 13.5 - 14.1 VDC (System Charging Voltage)
(Typical RPM) 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.