

Point-MAN

RV GENERATOR SERVICE TOOL MODEL 361



OPERATORS MANUAL



FLIGHT SYSTEMS

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Note: Many of the tests you can perform with the **Point-MAN** require a **multi-meter** that has *diode*, *capacitance* and *frequency* (Hz) ranges.

Almost all RV and Generator Service shops use these; if you do not have a multi-meter, they can be purchased at most electronics distributors.

Rt: *Point-MAN* being used in conjunction with a *Fluke Multi-meter* (not supplied)



RV GENERATOR TROUBLESHOOTING with the Point-MAN

HOW DOES MY RV GENERATOR WORK?

What the Engine Control Board Does

Please refer to “Generic” wiring diagrams. The engine control board or module controls the ignition, fuel pump, fuel solenoid (if equipped), field flash and starter. On LP models, it controls the flow of LP gas to the throttle body. Some models prevent the engine from starting if there is insufficient oil quantity. Some models prevent continued running if there is insufficient oil pressure. See test information chart. NOTE: On models equipped with electronic governors (BGM, NHM Spec. B and later, 300-3764 control board), the oil pressure signal to the control board comes from the governor module. Additionally, most models require a voltage from the generator to keep the engine running once it has started. See test information chart. All controls terminate cranking and lock out the starter after the engine has started. The battery charging circuit, when equipped, is part of the control board on some models, and external on others.

NOTE: The controls used on Models KY (Spec. J), KYD (Spec. A), HGJAB and HGJAC are microprocessor-based and combine the functions of the engine control and regulator in one module (300-5046, 327-1413 and 300-5374). Because these modules are complex and difficult to access without special tools and adapters, they are not covered in these instructions.

What the Regulator Does

Please refer to “Generic” wiring diagrams. When the generator is first started, the control board sends the field flash voltage (12 VDC) to the regulator on PIN 7 which applies it to the generator field (rotor) to initiate AC voltage buildup in the stator. The field flash voltage also initially powers the circuitry in the regulator before there is any AC voltage being generated. After the voltage builds up, the regulator is powered by the quadrature stator winding (140-150 VAC). The regulator then maintains the generator output nearly constant (within a few volts of 120 VAC) under conditions of varying load. It does this by sensing the 120 volts (PIN 2) and constantly adjusting the DC field (rotor) voltage (PINS 9 and 10) up or down, as needed. For example, if you turn on a light, the regulator would respond by increasing the field voltage only slightly to compensate for the added load. If you turn on a microwave oven or an air conditioner, the regulator would increase the field voltage by a much larger amount, in proportion to the heavier load. The regulator has a built-in protection circuit that reduces the output voltage of the generator if the engine is running too slow. The purpose of this feature is to protect your appliances from receiving full voltage at the lowered frequency, as this can cause damage to motors and transformers.

Normal Starting Sequence

This is what normally happens when you start your genset. Pressing and holding the start switch causes the control board to send 12 volts to the ignition, fuel pump, choke heater, start solenoid and field flash circuits. The engine then cranks and starts. Oil pressure and generator voltage build up within 1-2 seconds. This causes the control board to keep sending 12 volts to the ignition, fuel pump and choke heater while cutting off 12 volts to the starter solenoid and field flash circuits. The start switch can then be released and the engine keeps running. Some models differ slightly in operation. On models equipped with magneto ignition (KV, Spec. C-F; KY, Spec. A-E), the control board un-grounds the magneto kill circuit. Model KY, Spec. B-E uses a fuel solenoid in addition to the fuel pump. Models fueled by LP gas use a fuel shutoff solenoid valve instead of a fuel pump. Several conditions can prevent the engine from starting/running and are covered under “Troubleshooting Using the Point-MAN” below.

Normal Stopping Sequence

This is what happens when you stop your genset. Pressing and holding the stop switch for a few seconds causes the control board to cut off the 12 volts to the ignition and fuel pump (and/or fuel solenoid valve) causing the engine to stop. On models equipped with magneto ignition, the control board grounds the magneto kill circuit. Several conditions can cause the engine to stop by itself and are covered in the troubleshooting procedures below.

TROUBLESHOOTING USING the Point-MAN

The Model 361 Point-MAN can be used with most popular Onan® RV generators (see Point-MAN Application List below) and provides easy access to the eight key regulator circuits needed for troubleshooting (see “Regulator Pin Functions” below). The Point-MAN simply plugs in between the generator and the regulator. To get started, refer to “Generic” wiring diagrams and the test information chart for information specific to the control board part number on your generator. If you don’t know the control board part number, check the board itself and/or consult the Application Chart. Although a fair amount of troubleshooting can be done with access to the regulator only, a few tests require probing of other circuits.

The Point-MAN can be used with the following Onan® RV and Commercial generator models:

Emerald Series, Model BGE, Spec. F and later
Emerald Series, Model BGEL, Spec. E and later
Emerald Series, Model NHE, Spec. D and later
Emerald Series, Model NHEL, Spec. D and later
Marquis Series, Model BGM, Spec. A and later
Marquis Series, Model NHM, Spec. A and later
Microlite Series, Model KV, Spec A and later
Microlite Series, Model KY, Spec A thru H
Camp Power Series, Model KVC, Spec A
Camp Power Series, Model KVD, Spec A
Emerald Commercial Series, Model BGD, Spec. A thru H
Emerald Commercial Series, Model BGD, Spec. J and later (requires adapter kit)
Emerald Commercial Series, Model NHD, Spec. A thru H
Emerald Commercial Series, Model NHD, Spec. J and later (requires adapter kit)

Please note: Our **G-MAN** service tool is much more comprehensive and allows troubleshooting of the entire system (generator, control board, regulator and more) and includes a built-in megger for insulation testing.

This troubleshooting guide assumes that the person doing the work has basic mechanical skills and is familiar with electrical troubleshooting procedures using a multi-meter. Having a practical knowledge of RV generators is helpful, but not absolutely necessary.

CAUTION: *Dangerous voltages (up to 200V) are present at the test jacks on the front of the Point-MAN when the generator is running. Take suitable precautions.*

DISCLAIMER: *Generator servicing can present certain hazards such as cuts, burns, electric shock, fire, and exposure to exhaust fumes. Take suitable precautions. Flight Systems will not assume any liability for personal injury or damage to equipment or property as a result of using this Troubleshooting Guide or the Point-MAN service tool.*

Getting the Engine Running

Before proceeding with any evaluation of the controls, regulator or generator, the Onan® engine must have oil and fuel, be in running condition and the 12-volt battery charged. The electronic governor, 151-0752, on Models BGM and NHM, Spec B and later, must be functioning properly. This guide does not cover engine maintenance and repair procedures (please refer to the applicable Onan® Service Manual for this information). The most common engine problems are caused mainly by lack of use and/or lack of regular monthly exercise and include the following:

- Low battery voltage because of insufficient charge, worn out battery, faulty cables (partly broken or corroded) or poor connections, resulting in slow cranking and hard starting.
- Old or contaminated fuel that has gummed up the lines, fuel filter and carburetor. This can cause clogged jets (mixture too lean) and/or a stuck carburetor float resulting in an improper mixture (too rich or too lean) or flooding.
- Weak spark and/or fouled spark plug(s) causing hard starting and rough running.
- Stuck automatic choke causing an excessively rich mixture and smoking.
- Stuck oil pressure switch causing shutdown as soon as the start button is released.
- Dirty air filter, causing an excessively rich mixture and smoking.
- Low oil level preventing starting on models equipped with low oil level switch.
- Wiring harness damage from rodents chewing on the wires.
- Corrosion of control board or connections from salty air or road chemicals.

FOLLOW THESE STEPS:

1. **CHECK OIL** Check engine oil level before starting.
2. **GAIN ACCESS** Remove panel or cover to gain access to the control board. Some disassembly may be required. The exact procedure depends on the model.
3. **CHECK BATTERY VOLTAGE** Connect the negative voltmeter lead to GROUND and the positive lead to the positive battery cable on the starter solenoid and read the battery voltage. The same reading should be obtained at the BATTERY POSITIVE pin of the control board. A fully charged battery in good condition should read 12.6 to 12.8 VDC. Charge the battery if necessary.
4. **CHECK CRANKING** Try to start the engine. If it does not crank, check the control fuse (5A Slo Blo, except models with electronic governor 10A). If the fuse is good, jumper the positive battery post to the coil terminal on the start solenoid. If the engine cranks, there is a poor connection, wiring damage or the control board is defective. If the engine cranks when the BATTERY POSITIVE pin is jumpered to the START SOLENOID pin on the control board, the board is defective.
NOTE: The battery voltage should not go below 9.5 VDC during cranking.
5. **CHECK SPARK** If the engine cranks but does not start, remove a spark plug and check for spark during cranking (spark plug must be grounded). Temporarily jumper the ignition coil positive to the starter solenoid positive terminal, or jumper the BATTERY POSITIVE pin to the IGNITION pin on the control board. If you now have spark, there is a poor connection, wiring damage or the control board is defective. To determine if it is the control board, check for 12 volts at the IGNITION pin during cranking. Other problems such as dirty /worn points or a defective coil can cause loss of spark. On models where the oil level switch is hard-wired to the magneto (KV Spec. C-F, KVC and KVD), low oil level or a stuck switch will inhibit the spark and prevent starting. On these models, it may be necessary to temporarily disconnect the oil level switch if it is stuck closed and not opening. To check the level switch, unplug the control board and verify that the MAGNETO KILL circuit on the control harness is not grounded. Refer to the **Troubleshooting Chart**.

6. CHECK FUEL SYSTEM If the engine cranks and has spark but does not start, the problem is likely fuel related. This can be confirmed by injecting a small amount of starting fluid into the air intake. If the engine fires and tries to run, it is starving for fuel. Listen for the fuel pump running during cranking. Check for 12 volts at the FUEL PUMP pin on the control board during cranking. If there is no voltage, the control board is defective. The pressure and flow of the fuel pump (and fuel filter) can be checked by temporarily disconnecting the fuel line to the carburetor and jumpering the FUEL PUMP pin on the control plug to battery positive. Take adequate precautions when handling fuel. If pressure and flow are normal, reconnect fuel line. Note: If the generator has not been run for several months, the carburetor float may be stuck closed and /or the jets and needle valves may be gummed up by old fuel that has turned to varnish. These conditions interfere with normal fuel delivery. The automatic choke may be stuck closed or binding so that it does not open as the choke heater warms up. On Models BGM and NHM spec. B and later, make sure that the electronic governor goes to full throttle one second after cranking begins. Any of these conditions will prevent the engine from starting or running smoothly and must be corrected before proceeding.

7. CHECK IF ENGINE KEEPS RUNNING The most common complaint is that the engine starts but will not keep running when the START switch is released. This happens because the control board will not allow the engine to continue running if the generator is not producing voltage or if the oil pressure signal is not present. See CONDITIONS REQUIRED TO KEEP RUNNING on the test information chart for your model. If the engine will not keep running, refer to “Test Procedures Using the Point-MAN” below and do the following:

A1. Generator AC Output Use the Point-MAN to check the generator AC output voltage as soon as the engine starts (TEST 14). Models showing “B1-B2 Volts” or “L1 AC Volts” under CONDITIONS REQUIRED TO KEEP RUNNING need this AC voltage at the control board terminals to keep running. Read between the points shown on the test information chart. If AC voltage is at least being produced at start up, proceed directly to “B” below.

A2. Field Flash If there is no AC voltage, use the Point-MAN to check for field flash voltage (TEST 9). If the field flash voltage is not present, the control board or wiring could be defective. To eliminate the wiring, check continuity between the FIELD FLASH pin of the control board (see Pin Assignment Chart) and pin 7 of the regulator. If the wiring is good, the control board is defective. If the field flash voltage is present, the problem is in the regulator or field circuit.

A3. Field Circuit Use the Point-MAN to check the field circuit resistance and isolation (TEST 1 and TEST 4) Also note “Special Rotor Resistance Tests” (TEST 8). If these reading are all good, the regulator is likely defective.

A4. External Field Flash To confirm that the regulator is defective, turn off the generator’s AC circuit breaker(s) and perform the external field flash test (TEST 10). If the generator voltage builds normally when the voltage is applied to PIN 7, the problem is still in the control board or wiring and the regulator is OK. If not, perform TEST 11 where the field flash voltage is applied at PIN 9 **through a diode**.

CAUTION: DO NOT attempt this test without the diode. If you do, there will be fireworks! Remove the 12 volts within 1-2 seconds after the engine starts. If the genset now continues to run and produces normal AC voltage, the generator is OK and the regulator is defective. If the genset does not continue to run but produces about 40-50 VAC, again the generator is OK and the regulator is defective. The generator may be checked alone without the regulator connected (TEST 12). The quadrature stator voltage may also be checked under conditions of external excitation (TEST 16) except the voltage will only be 55-60 VAC. If little or no AC voltage is produced, the generator may have a problem that is beyond the scope of this troubleshooting guide. Re-check all wiring for security and signs of damage. Perform resistance tests (TESTS 1 through 8). It may be necessary to take the unit to a qualified repair shop.

B. Check the oil pressure switch as soon as the engine starts. Models showing “LOP to GND” under CONDITIONS REQUIRED TO KEEP RUNNING need the oil pressure switch to be closed to ground when running. If the voltage on the LOL/LOP SW pin of the control board does not go to near zero, the switch is not closing. These switches sometimes stick open if the generator has not been used or exercised often enough. Multiple start/stop cycles and/or tapping on the oil pressure switch will sometimes fix it. It may be necessary to temporarily jumper the switch to ground to keep the engine running. This can be done at the switch or at the OIL LOL/LOP SW pin on the control board. Models showing “LOP Open” under CONDITIONS REQUIRED TO KEEP RUNNING have electronic governors and require the low oil pressure switch to be closed at starting but open during running. When the switch opens, the governor module places a ground on the oil pressure input of the control board (P1-5). It is OK to temporarily ground P1-5 on this model to keep the engine running. NOTE: See chart for oil pressure and oil level switch locations.

C. If there is AC voltage present on B1-B2 or L1 AC, as applicable, and the correct oil pressure/level signal is present at the OIL LOL/LOP SW input of the control board, and the engine will not keep running, the control board is defective.

8. CHECK REGULATOR RESPONSE TO LOAD After the engine is running properly and stays running, check the regulator field voltage output as load is added (TEST 13). A proper response to this test is necessary to pass TEST 14. Also, if the frequency (proportional to RPM) is not being held nearly constant from no-load to full load, check the governor (see 11 below).

9. CHECK VOLTAGE/FREQUENCY ROLL-OFF If all other regulator functions are working properly, chances are very good that the voltage/frequency roll-off is also working. However, it is a good idea to check it (TEST 15).

10. CHECK AUTOMATIC CHOKE After the engine has been running for several minutes, the electric choke heater should begin to open the choke (observe the position of the linkage). The choke will take longer to open fully in cold weather. If the choke does not open, it is either stuck or the choke heater is not working. The choke mechanism can be freed up and maintained with a high temperature penetrating lubricant such as “Mouse Milk.” If the choke heater is not working, the problem is most likely a high resistance due to corrosion, a poor connection, a damaged wire or an open heater element. Remove the round plastic cover and notice if the choke heater has one wire or two. If it has one wire, remove it and measure the resistance at the heater terminal to ground or the frame. This should be 15-20 ohms. Also, the wire going to the choke heater should have 12 VDC whenever the engine is running. If not, check the wiring. If the heater has two wires (BGE prior to spec K), remove one wire and measure the resistance between the two heater terminals. This should be 15-20 ohms. With both wires connected to the choke heater and the engine running, there should be 16-18 VAC between the terminals. If not, check the wiring.

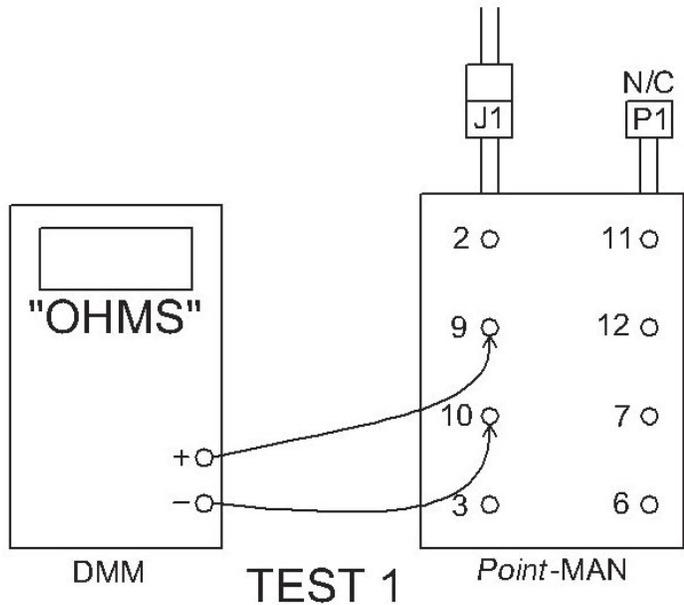
11. CHECK GOVERNOR If the engine surges or “hunts” (does not stay at a constant RPM), the cause is likely a gummed-up carburetor or an improperly adjusted governor. If the generator is “high time”, the surging could be caused by excessive wear in the governor linkage. These conditions should be corrected. Refer to the appropriate Onan Service Manual for repair procedures. If your multi-meter has a “Frequency” or “Hz” range, you can check the RPM by measuring the frequency of the 120 VAC on the Point-MAN, PIN 2 and 3 (TEST 14), or at an AC outlet. It should be 60-62 Hz at no-load and not fall below 58 Hz at full load. The electronic governor (Marquis only) should hold the frequency close to 60 Hz under all conditions.

Test Procedures Using the Point-MAN (referred to above)

Generator Winding Resistance Tests

TEST 1 Field (rotor) Resistance

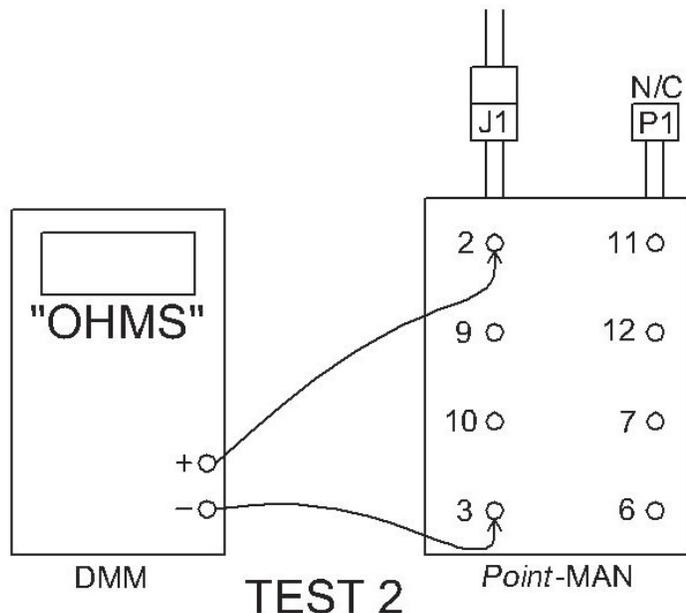
Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected. Measure the resistance between PIN 9 and PIN 10. This reading includes the resistance of the rotor itself, the brushes, slip rings and wiring and should be between 22 and 28 ohms (slightly higher when hot). A much lower resistance indicates a partially shorted rotor. This is serious, as the rotor will have to be replaced. A much higher resistance indicates dirty slip rings and/or brush problems. A reading of several meg ohms or “infinity” indicates an open rotor, a stuck or worn out brush, or a damaged wire (likely from chewing rodents). A high resistance reading (up to 200-300 ohms) is most common and is usually corrected by simply cleaning the slip rings. This is done with the generator running using a tool such as the Slick Stick. Maintaining proper field circuit resistance is very important. A high resistance will cause the regulator to work harder and may result in its premature failure. Also, the slip rings will run hotter which will result in further deterioration of their contact surfaces.



NOTE: *There are other special rotor resistance tests that are performed under certain conditions with the generator running. These are covered below under “Special Rotor Resistance Tests”*

TEST 2 Main Stator Resistance

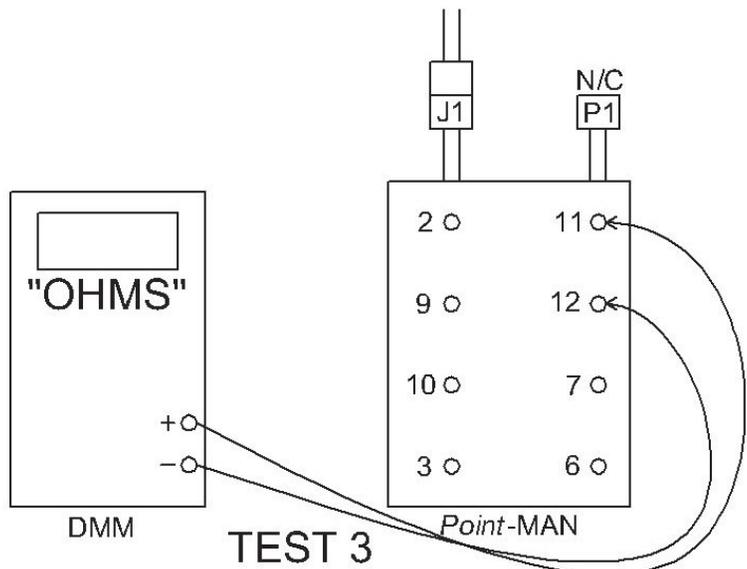
Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected. Measure the resistance between PIN 2 and PIN 3. This reading includes the resistance of the stator itself and the wiring and should be between 0.0 and 0.2 Ohms. Note: It is difficult to obtain an accurate reading with a resistance this low. Make sure that your meter reads “zero” when the test leads are touched together. If not, note the test lead resistance and subtract it from your readings. A high resistance reading can be caused by a poor connection or a damaged wire.



NOTE: A partial short in the main stator winding is nearly impossible to detect with a multi meter.

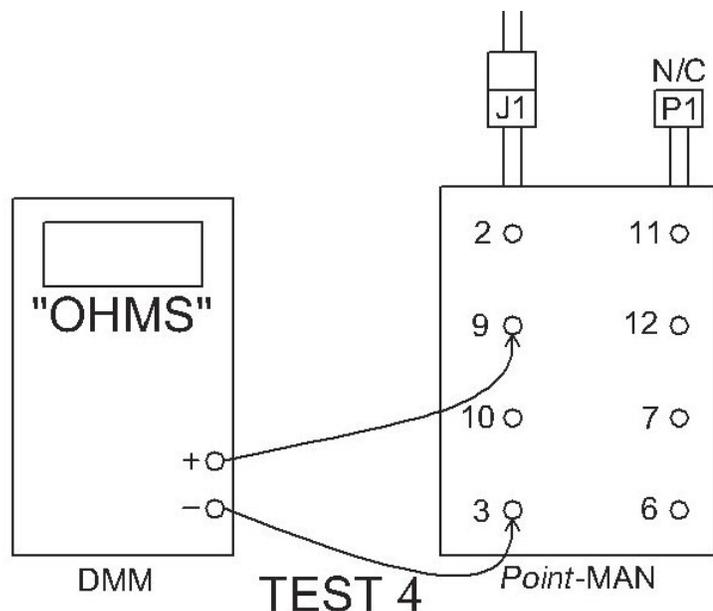
TEST 3 Quadrature Stator Resistance

Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected. Measure the resistance between PIN 11 and PIN 12. This reading includes the resistance of the stator itself and the wiring and should be between 2.2 and 2.5 Ohms. Note: It is difficult to obtain an accurate reading with a resistance this low. Make sure that your meter reads “zero” when the test leads are touched together. If not, note the test lead resistance and subtract it from your readings. A high resistance reading usually means there is a poor connection or a damaged wire. A poor connection or damaged wire can get very hot when a load is placed on the generator, and could present a fire hazard.



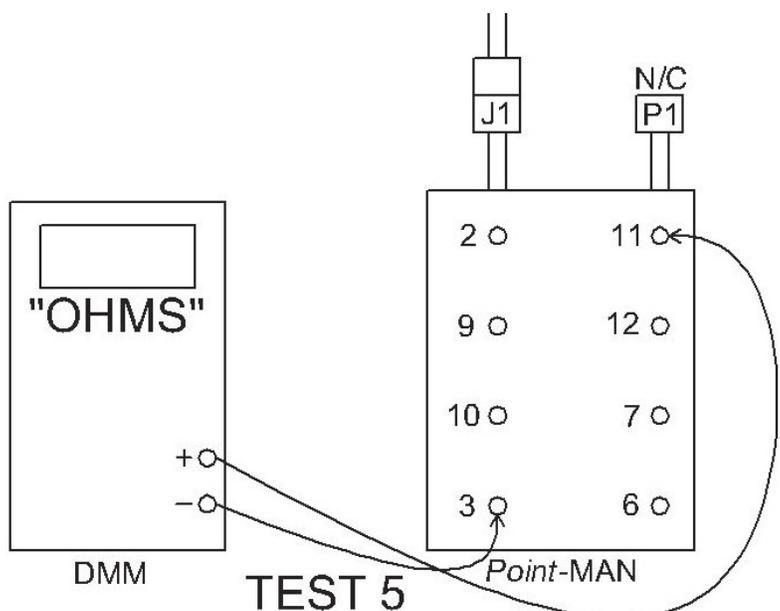
TEST 4 Field (rotor) Ground Fault

Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected. Measure the resistance between PIN 9 and PIN 3. This reading should be several megohms or “infinity.” If not, it is possible that an insulation fault (a ground) exists in the rotor between the windings and the shaft. It may be necessary to remove the rotor, clean it, dry it and re-test it. If the fault is still present, replace the rotor.



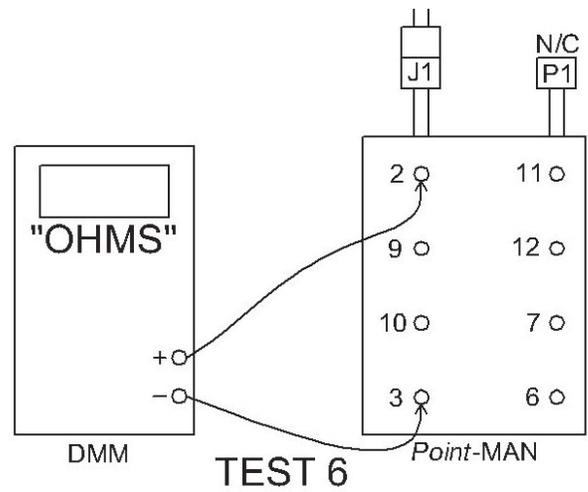
TEST 5 Quadrature Stator Ground Fault

Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected. Measure the resistance between PIN 11 and PIN 3. This reading should be several megohms or “infinity.” If not, it is possible that an insulation fault (a ground) exists between the windings and the frame. It may be necessary to remove the generator, clean it, dry it and re-test it. If the fault is still present, replace the stator assembly.



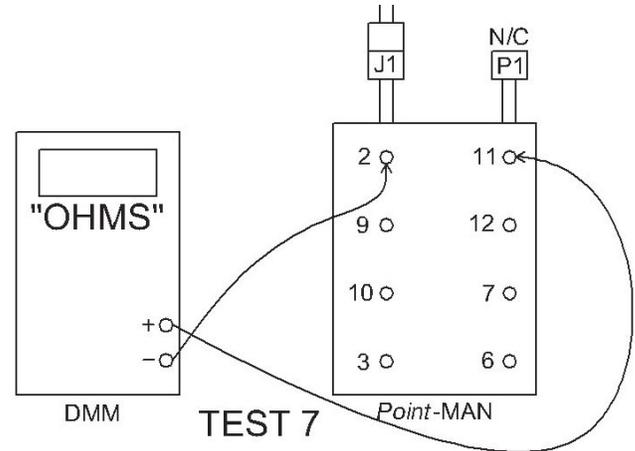
TEST 6 Main Stator Ground Fault

Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected, T3 and T4 stator terminals disconnected from ground block and AC circuit breaker(s) open. Measure the resistance between PIN 2 and PIN 3. This reading should be several megohms or “infinity.” If not, it is possible that an insulation fault (a ground) exists in the stator between the windings and the frame. It may be necessary to remove the generator, clean it, dry it and re-test it. If the fault is still present, replace the stator assembly.



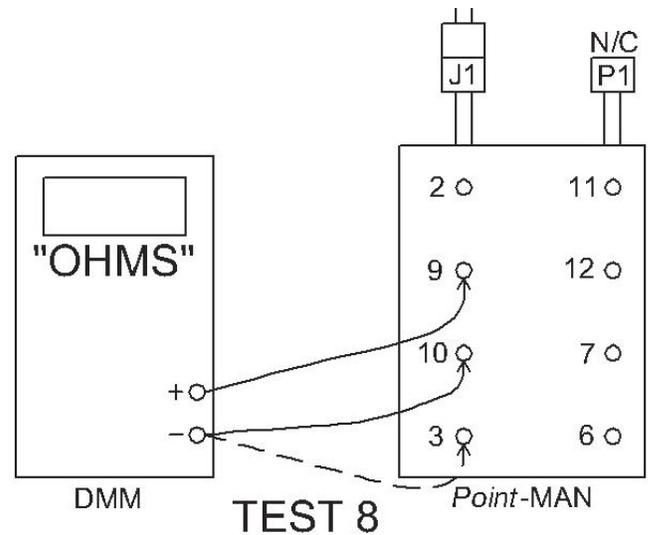
TEST 7 Main Stator Isolation

Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected, T3 and T4 stator terminals disconnected from ground block and AC circuit breaker(s) open. Measure the resistance between PIN 2 and PIN 11. This reading should be several megohms or “infinity.” If not, it is possible that an insulation fault exists in the stator between the main windings and the quadrature winding. It may be necessary to remove the generator, clean it, dry it and re-test it. If the fault is still present, replace the stator assembly.



TEST 8 Special Rotor Resistance/Isolation

It is possible for an insulation fault to develop between turns of the rotor winding (partial short) or from the winding to the shaft (ground) that only shows up when the rotor is spinning. These faults are called “flying shorts” and “flying grounds”, respectively. The rotor can also become open when spinning (“flying open”). These types of faults can be further influenced by temperature changes. Fortunately, their occurrence is rare, but when they do occur, troubleshooting them can be quite difficult. Setup: Generator stopped. Point-MAN connected to generator harness only, regulator disconnected. Using an analog type meter (VOM) such as a Simpson 260, connect the positive meter lead to PIN 9 and the negative lead to PIN 10. Make sure the meter is properly zeroed and measure the resistance. This reading includes the resistance of the rotor itself, the brushes, slip rings and wiring and should be between 22 and 28 ohms (slightly higher when hot). Using an analog meter is a must because a digital multi-meter will give false readings due to the small voltage induced in the rotor windings during the spinning part of this test. Start the generator and note any change of resistance, up or down. A significant drop in resistance indicates a flying short, especially if it is repeatable. A high reading or “infinity” indicates a flying open.



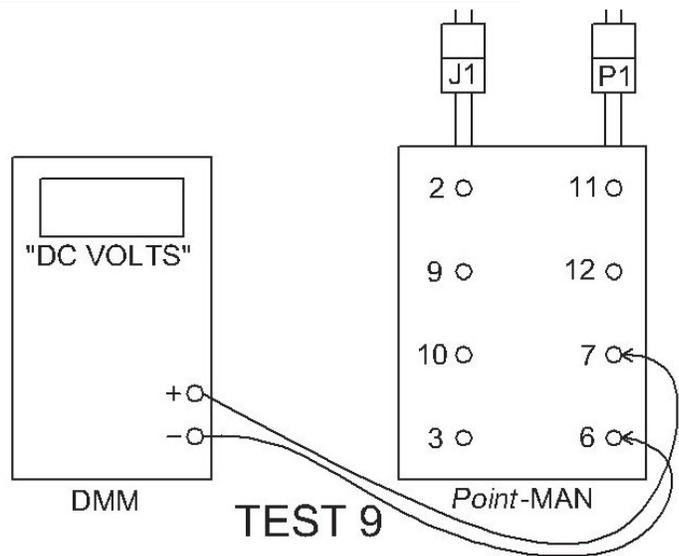
A slight apparent rise (1-3 ohms) is normal and is due to the small induced voltage in the rotor influencing the VOM. Repeat the test with the positive lead on PIN 9 and the negative lead on PIN 3. The meter should read “infinity” with the generator stopped or running. If the resistance drops below one megohm with the generator running, a flying ground condition may exist. A defective rotor must be repaired or replaced

Generator Voltage and Field Flash Tests

CAUTION: To prevent possible damage to external circuits or appliances, **MAKE SURE** that **AC CIRCUIT BREAKER IS OFF** during control and generator testing as generator output voltage could rise significantly above normal.

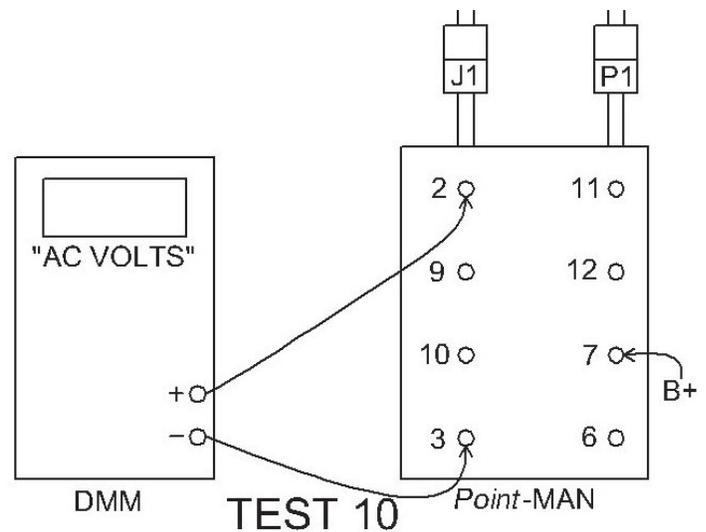
TEST 9 Field Flash Voltage

Setup: Generator stopped. Point-MAN connected to regulator & generator harness. Set the DMM for DC Volts and connect the positive lead to PIN 7 and the negative lead to PIN 6. Press the start switch. During cranking and as the generator starts and builds voltage, the field flash voltage should be 10-11 VDC momentarily. Disregard this voltage after the generator is running. If the field flash voltage does not appear at least momentarily, the control board is faulty or there is an open circuit between the control board field flash output pin and the regulator PIN 7. This may be confirmed by providing field flash voltage externally.



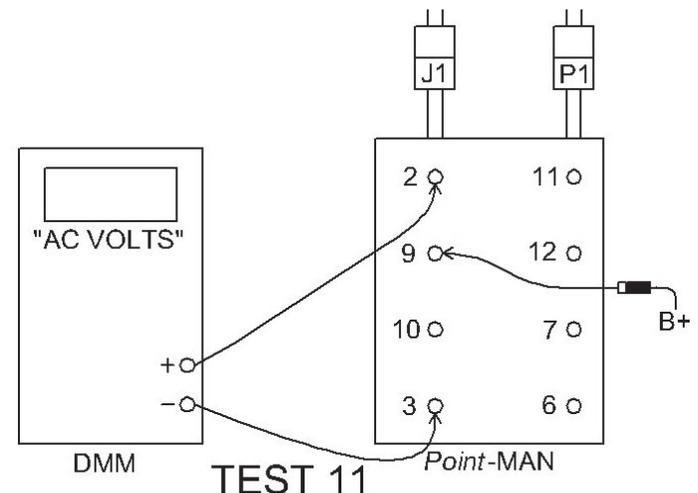
TEST 10 External Field Flash via Pin 7

Setup: Generator stopped. Point-MAN connected to regulator & generator harness. Set the DMM for AC Volts and connect the positive lead to PIN 2 and the negative lead to PIN 3. Connect a test lead (24" to 48") to PIN 7. NOTE: Most models (see chart) require the generator to be producing voltage in order to remain running when the start switch is released. Therefore, the external field flash voltage needs to be supplied as the generator is being cranked and removed as soon as voltage builds. Press the start switch and at the same time touch the test lead to the positive battery terminal on the start solenoid or other convenient source of 12 VDC. If the generator starts, builds voltage and continues to run when external field flash is momentarily applied but not otherwise, then it may be concluded that the regulator is OK and is not getting field flash on PIN 7. The cause could be a faulty control board or wiring. If field resistance tests (see above) are satisfactory and voltage does not build, then it is likely that the regulator is faulty.



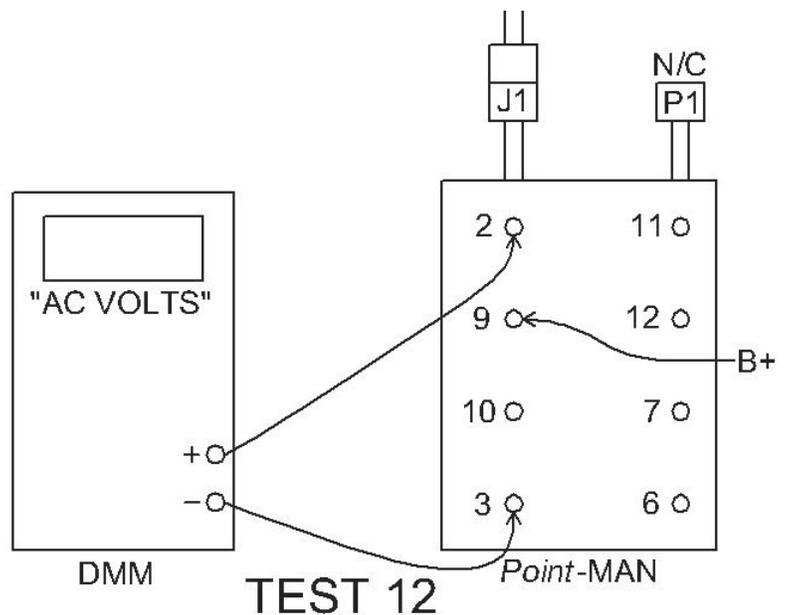
TEST 11 External Field Flash via Pin 9

To confirm a faulty regulator proceed as above except apply the field flash voltage to PIN 9 (Field +) through a diode instead of directly to PIN 7. The diode should be rated at 1 Amp, 400V minimum (1N4004 or better) and make sure its banded end (cathode) is toward PIN 9. **DO NOT ATTEMPT THIS TEST WITHOUT THE DIODE!** If the generator now builds voltage, the regulator is definitely faulty.



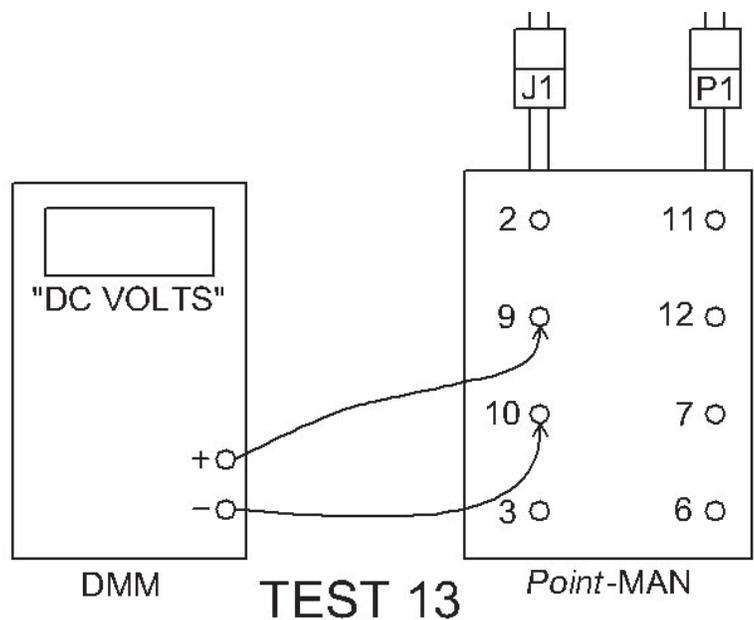
TEST 12 External Field Excitation

On Marquis BGM or NHM Spec. B-G (using control board P/Ns 300-3764, 300-5342 or 300-4902 and electronic governor P/N 151-0752), the engine will continue to run even though the generator is not producing voltage. This allows external field excitation to be applied without the regulator connected. Setup: Generator running. Point-MAN connected to **generator harness only**. Regulator disconnected. Set the DMM for AC Volts and connect the positive lead to PIN 2 and the negative lead to PIN 3. Connect a test lead (24" to 48") to PIN 9. Touch the test lead to the positive battery terminal on the start solenoid or other convenient source of 12 VDC. The generator should produce 40-50 VAC.



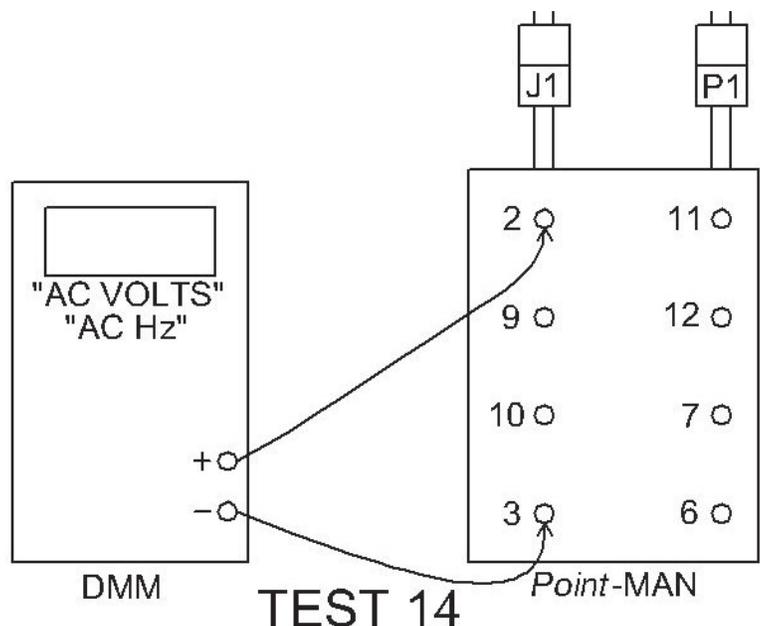
TEST 13 Regulator Field Output Voltage

Setup: Generator running. Point-MAN connected to regulator and generator harness. Set the DMM for DC Volts and connect the positive lead to PIN 9 and the negative lead to PIN 10. The field voltage should be 29-44 VDC at no load and rise to approximately 60 VDC at full load. Readings will be somewhat higher when the generator is hot. Excessively high readings indicate dirty slip rings. Check field resistance (see above).



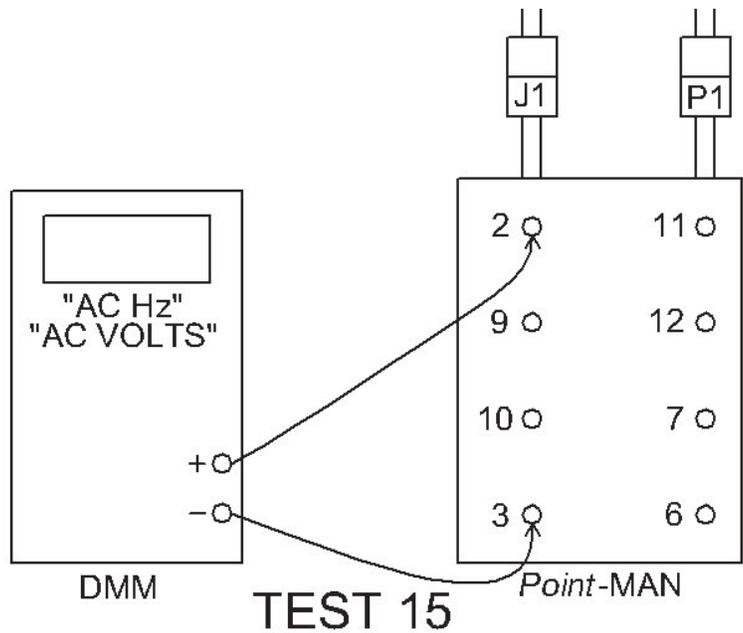
TEST 14 Generator Output Voltage and Frequency

Setup: Generator running. Point-MAN connected to regulator and generator harness. Set the DMM for AC Volts and connect the positive lead to PIN 2 and the negative lead to PIN 3. The output (main stator) voltage should be 118-126 VAC at no load and not fall below 115 VAC at full load. To measure frequency, set the DMM to "Frequency" or "Hz" and read 60-62 Hz at no load and 58-60 Hz at full load. Adjust the governor as necessary. Refer to applicable Onan service manual for your model.



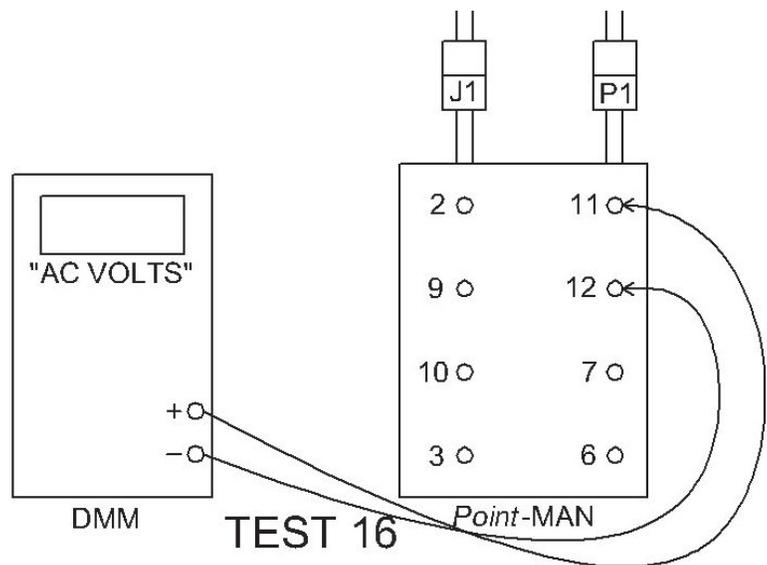
TEST 15 Regulator Voltage/Frequency Roll-off

Setup: Generator running. Point-MAN connected to regulator and generator harness. Set the DMM for AC Volts and connect the positive lead to PIN 2 and the negative lead to PIN 3. To measure frequency, set the DMM to "Frequency" or "Hz" and read 60-62 Hz at no load. Apply slight pressure to the throttle linkage so that the frequency (speed) drops below 57 Hz. Note the sound of the engine at this speed. Set the DMM to AC Volts and verify that the output voltage starts to fall off as the speed slows down below this point. The reduction of voltage with frequency or speed is a function of the regulator. Its purpose is to protect loads connected to the generator from receiving full voltage at reduced frequency.



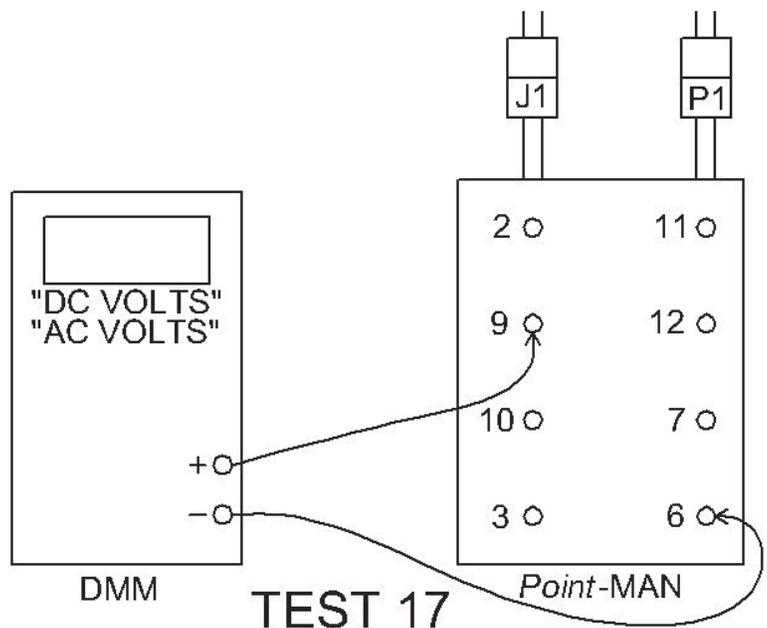
TEST 16 Quadrature Stator Output Voltage

Setup: Generator running. Point-MAN connected to regulator and generator harness. Set the DMM for AC Volts and connect the positive lead to PIN 11 and the negative lead to PIN 12. Measure 140-150 VAC. Low quadrature voltage indicates a fault in the quadrature stator winding of the generator.



TEST 17 Capacitor Voltage and Ripple Voltage

Setup: Generator running. Point-MAN connected to regulator and generator harness. Set the DMM for DC Volts and connect the positive lead to PIN 9 and the negative lead to PIN 6. Measure 190-205 VDC. This is the rectified and filtered voltage that powers the regulator. Set the DMM for AC Volts and measure the ripple voltage. This should not exceed 8.0 VAC. A high ripple voltage and/or a low capacitance value (see above) indicates a faulty regulator.

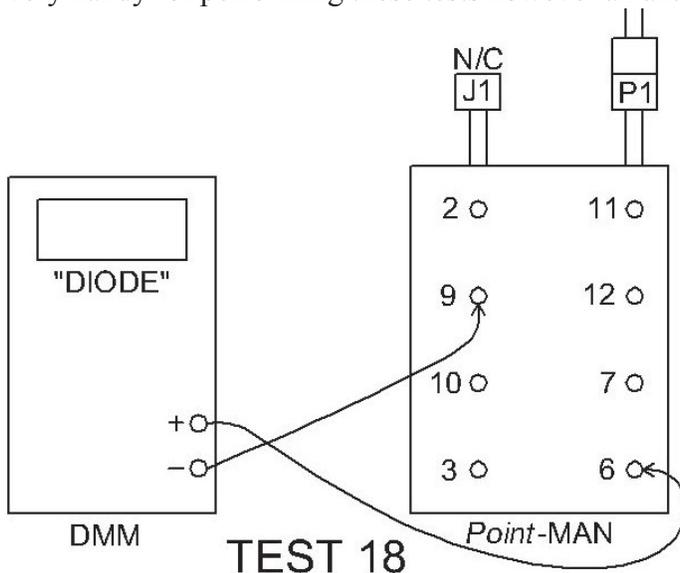


Regulator Internal Component Tests

The following tests enable you to evaluate some of the internal components of the regulator that are connected directly to its terminals. A failure of any of these tests would indicate a regulator problem (except as noted). However, passing all of these tests does not necessarily mean that the regulator is good, as only a small percentage of the unit is being tested. This group of tests is by no means a complete or a functional test. A DMM with a "Diode" and a "Capacitor" range is very handy for performing these tests however an analog VOM (such as the Simpson 260) will still give some useful information. On diode forward tests, the VOM will likely read 10 to 100 ohms, depending on the meter, and "infinity" on reverse tests.

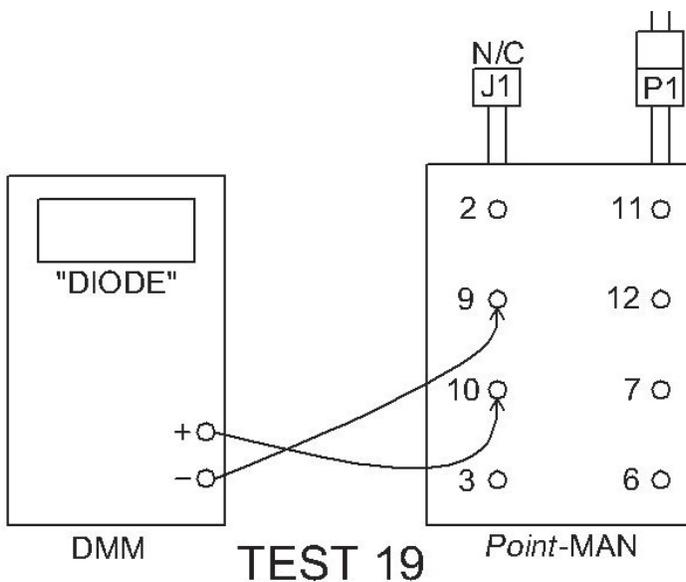
TEST 18 Output TVS Diode and Transistor

Setup: Generator stopped. Point-MAN connected to regulator only, generator harness disconnected. Set the DMM for "Diode" and connect the positive lead to PIN 6 and the negative lead to PIN 9. Read forward continuity and a voltage of approximately 0.5 VDC. Reverse the leads and read "infinity."



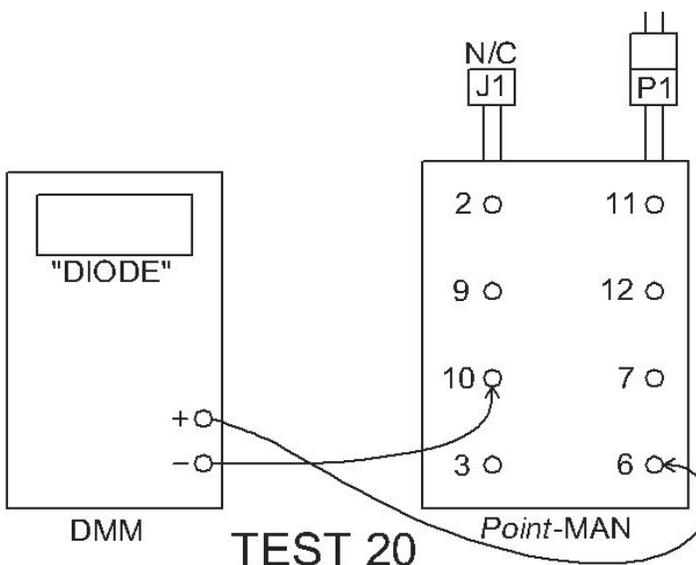
TEST 19 Field Free-wheeling Diode

Setup: Generator stopped. Point-MAN connected to regulator only, generator harness disconnected. Set the DMM for "Diode" and connect the positive lead to PIN 10 and the negative lead to PIN 9. Read forward continuity and a voltage of approximately 0.5 VDC. Reverse the leads and read "infinity."



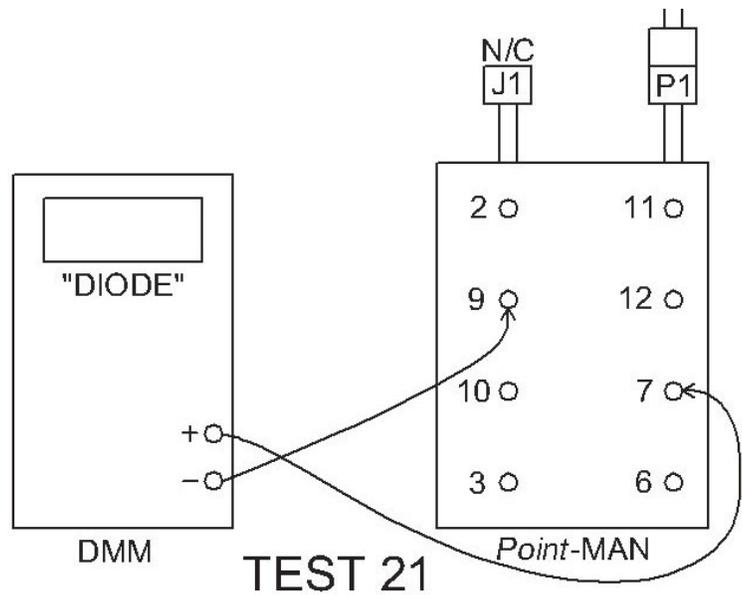
TEST 20 Field TVS Diode (Not used on all models)

Setup: Generator stopped. Point-MAN connected to regulator only, generator harness disconnected. Set the DMM for "Diode" and connect the positive lead to PIN 6 and the negative lead to PIN 10. Read forward continuity and a voltage of approximately 0.9 VDC. Reverse the leads and read "infinity."



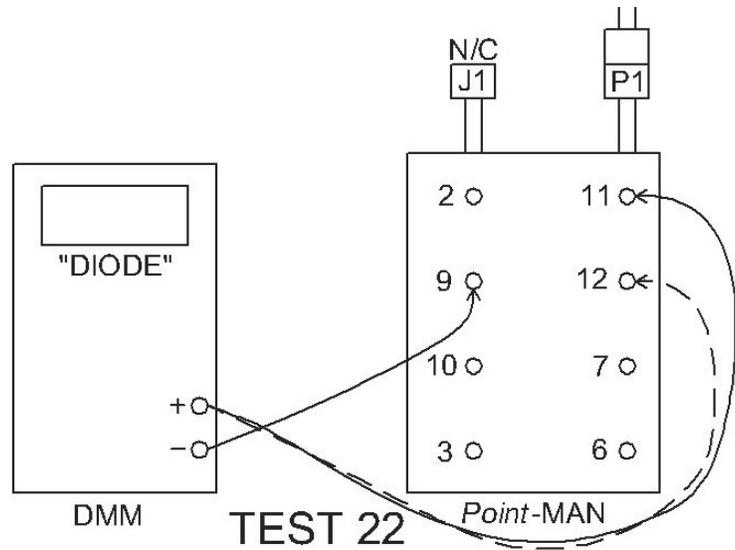
TEST 21 Field Flash Diode

Setup: Generator stopped. Point-MAN connected to regulator only, generator harness disconnected. Set DMM for "Diode" and connect the positive lead to PIN 7 and the negative lead to PIN 9. Read forward continuity and a voltage of approximately 0.6 VDC. Reverse the leads and read "infinity."



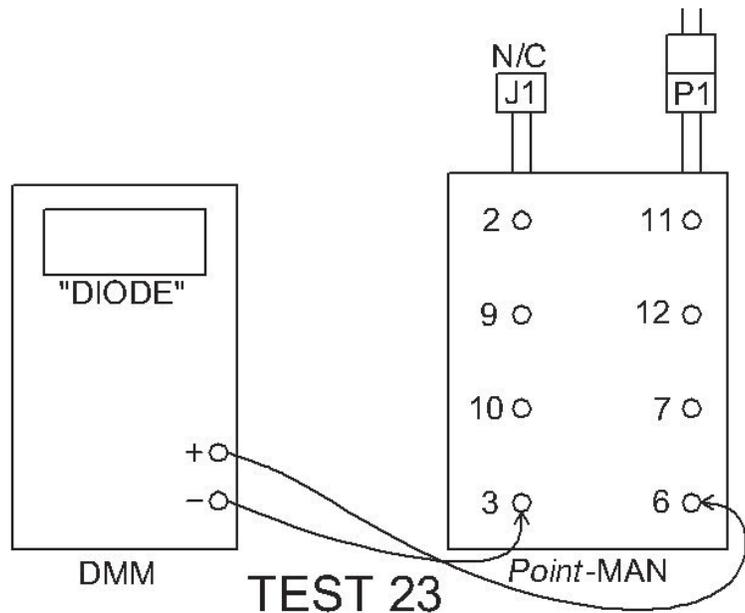
TEST 22 Bridge Rectifier

Setup: Generator stopped. Point-MAN connected to regulator only, generator harness disconnected. Set the DMM for "Diode" and connect the positive lead to PIN 11 and the negative lead to PIN 9. Read forward continuity and a voltage of approximately 0.5 VDC. Reverse the leads and read "infinity." Connect the positive lead to PIN 12 and the negative lead to PIN 9. Read forward continuity and a voltage of approximately 0.5 VDC. Reverse the leads and read "infinity."



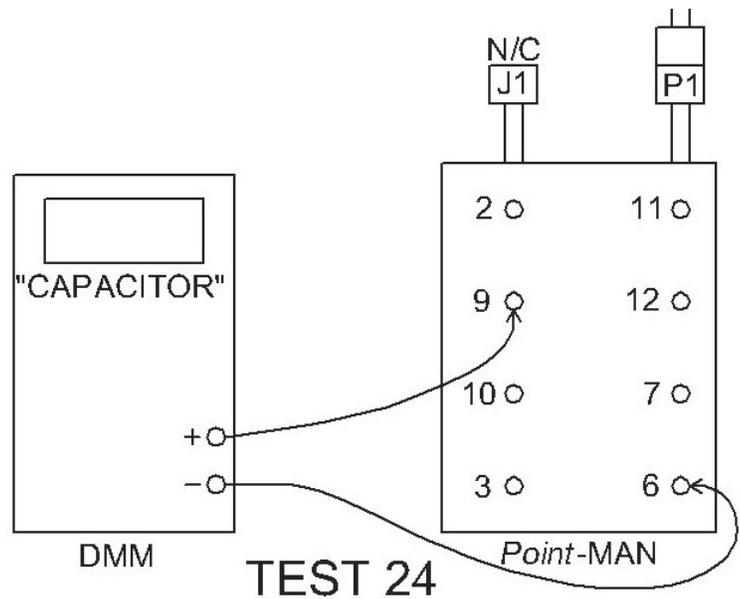
TEST 23 Ground to Capacitor (-) Diode

Setup: Generator stopped. Point-MAN connected to regulator only, generator harness disconnected. Set DMM for "Diode" and connect the positive lead to PIN 6 and the negative lead to PIN 3. Read forward continuity and a voltage of approximately 0.6 VDC. Reverse the leads and read "infinity."



TEST 24 Capacitor Value

Setup: Generator stopped. Point-MAN connected to regulator only, generator harness disconnected. Set the DMM for “Capacitor” and connect the positive lead to PIN 9 and the negative lead to PIN 6. The nominal value of the capacitor is 220 uF. Read a minimum of 175 uF. A reading higher than 220 uF is OK and is quite common. In this case, more is better!



Regulator Pin Functions

The following is a general description of the function of each of the 12 pins of the regulator and covers several models. The function of the pins is the same from model to model with the exception of PIN 1 and PIN 8. A few 60 Hz applications and many 50 Hz applications use an external potentiometer for voltage adjustment. The commercial version of the regulator (300-0911) uses a different 12-pin connector (Deutch) and requires an adapter kit.

PIN 1 is used with PIN 5 when an external voltage adjustment potentiometer is connected on regulators 305-0852 and 305-0897 *only* (primarily 50 Hz applications). When an external voltage adjustment potentiometer is not used, PIN 1 is connected directly to PIN 5. All other regulators use PIN 4 for this function (see PIN 4 below) and PIN 1 is not used and is not connected. PIN 1 is not used for troubleshooting purposes, does not appear on the Point-MAN and feeds straight through.

PIN 2 (YELLOW) is used to sense the AC output voltage of the generator. It is connected to the “hot” side (T1, T3) of the main stator. The voltage on PIN 2 is measured with respect to PIN 3 (AC LO and GND) and should be between 118 and 122 VAC. PIN 2 is also used to check stator winding resistance and isolation.

PIN 3 (BLACK) is the common connection for AC LO or neutral, battery negative and frame ground. It is the reference point for measuring the AC output voltage of the generator (see PIN 2 above). PIN 3 is also used to check stator winding resistance and isolation.

PIN 4 is used with PIN 5 for connecting an external voltage adjustment potentiometer and is used on all regulators except 305-0852 and 305-0897 (see PIN 1 above). Only a few 60 Hz regulators use an external voltage adjust potentiometer connected between PIN 4 and PIN 5. On all others, PIN 4 is connected directly to PIN 5. PIN 4 is not used for troubleshooting purposes, does not appear on the Point-MAN and feeds straight through.

PIN 5 is the internal negative for the regulator and is also common with PIN 6 and the capacitor negative terminal. PIN 5 is not used for troubleshooting purposes, does not appear on the Point-MAN and feeds straight through.

PIN 6 (BLACK) is the internal negative for the regulator and is common with PIN 5 and the capacitor negative terminal. It is the reference point for measuring the field flash and capacitor voltages.

PIN 7 (GREEN) is the input for the field flash voltage sent by the control board during cranking and until the generator builds output voltage. The field flash accomplishes two things: It initially powers the regulator's internal circuitry and it provides sufficient field excitation for the generator to build voltage to the point where field flash is no longer needed. Field flash and cranking are terminated simultaneously when the run relay in the control board energizes. The field flash voltage is measured with respect to the regulator internal negative PIN 6 above.

PIN 8 is the positive capacitor terminal on some regulator models. On other models, it is not connected. On the metal-cased regulators 305-0826 (Marquis) and 305-0911 (Commercial), PIN 8 is connected to case ground. PIN 8 is not used for troubleshooting purposes, does not appear on the Point-MAN and feeds straight through.

PIN 9 (RED) is the positive terminal of the field and the capacitor and is also common to PIN 8 on some models. The capacitor voltage is measured on PIN 9 with respect to PIN 6. The field voltage is measured on PIN 9 with respect to PIN 10. The field voltage normally varies between 30 VDC at no-load to 60 VDC at full load. PIN 9 is also used with PIN 10 and PIN 3 to check field (rotor) resistance and isolation.

PIN 10 (BLUE) is the negative terminal of the field. The average field voltage is measured on PIN 9 with respect to PIN 10.

PIN 11 (WHITE) is one terminal of the quadrature stator winding that supplies power to the regulator. PIN 11 is also used to check quadrature stator winding resistance and isolation.

PIN 12 (WHITE) is one terminal of the quadrature stator winding that supplies power to the regulator. PIN 12 is also used to check quadrature stator winding resistance and isolation.

**Onan® RV Generator Troubleshooting, Application & Other Charts
found on following pages**

TEST INFORMATION FOR TROUBLESHOOTING ONAN® RV GENERATORS

CONTROL BOARD	300-2943	300-3950	300-5268	300-5342	300-4155	300-4923	300-5337	300-5276	300-5299
	300-2784	300-3056	300-3763	300-3764	300-3797	300-4320	300-4901	300-4902	300-4456
FUNCTION									
BATTERY POSITIVE	P1-6	P1-6	P1-7	P1-7	J1-10	P1-10	P1-7, 8	P1-7	P1-4
GROUND	P1-8, P2-1	P1-8	P1-11	P1-1	J1-4	P1-5, 7, 8	P1-11	P1-1	P1-7
IGNITION	P1-3	P3-3	P1-6	P1-12			P1-6	P1-12	
MAGNETO KILL					J1-6	P1-11			P2-4*
GOVERNOR 12 VDC								P1-6	
FUEL PUMP	P1-3	P3-6	P1-12	P1-4	J1-12	P1-2	P1-12	P1-4	P1-1
FUEL SOLENOID						P1-3			
START SOLENOID	P1-2	P1-2	P1-9	P1-2	J1-8	P1-6	P1-9	P1-2	P1-3
FIELD FLASH	P1-5	P1-5	P1-1	P1-3	J1-5	P1-9	P1-1	P1-3	P2-3
OIL LOL/LOP SW	P1-4	P3-4	P1-5	J3-2	J1-7	P1-12	P1-5	P1-5	P2-4*
AC HOT (L1 AC Volts)						P1-4			
LP SHUTDOWN	P2-2	P3-2	P1-10				P1-13		
B1	Bat. Chg. Res.	P1-1	P1-2		J1-9		P1-2		P2-1
B2	P1-7	P1-7	P1-4		J1-11		P1-4		P2-2
BAT. CHG. RES.	P1-1	P1-4	P1-3				P1-3		
B1-B2 or Bat. Chg. Volts Voltage Reading	P1-8 to P1-1 18-26 VAC	P1-1 to P1-7 14-16 VAC	P1-2 to P1-4 14-16 VAC	BAT+ to GND Note B+ rise	J1-9 to J1-11 14-16 VAC	BAT+ to GND Note B+ rise	P1-2 to P1-4 14-16 VAC	BAT+ to GND Note B+ rise	P2-1 to P2-2 14-16 VAC
START/STOP									
LOCAL START	P3-3	On board	On board	On board	J1-1	P1-13	On board	On board	On board
LOCAL STOP	P3-2	On board	On board	On board	J1-2	P1-1	On board	On board	On board
LOCAL RETURN	P3-1	On board	On board	On board	J1-3	P1-7	On board	On board	On board
REMOTE START	P2-3	P2-3	J2-3	J2-3	J2-3	J2-3	P1-14	P1-9	P1-6
REMOTE STOP	P2-2	P2-2	J2-2	J2-2	J2-2	J2-2	P1-10	P1-8	P1-5
REMOTE RETURN	P2-1	P2-1	J2-1	J2-1	J2-1	J2-1	P1-11	P1-1	P1-8
BAT. CONDITION METER	P2-6	P2-5	J2-5	J2-5	J2-5	J2-5	P1-16	P1-11	P1-2
TIME TOTALIZER	P2-6	P2-6	J2-6	J2-6	J2-6	J2-6	P1-15	P1-10	P1-2
CONDITIONS REQUIRED TO KEEP RUNNING	LOP to GND B1-B2 Volts	LOP to GND B1-B2 Volts	LOP to GND B1-B2 Volts	LOP Open P1-5 to GND	LOL Open B1-B2 Volts	LOL Open L1 AC Volts	LOP to GND B1-B2 Volts	LOP Open P1-5 to GND	LOL Open* P2-4* un-GND
GOVERNOR P/N	Mechanical	Mechanical	Mechanical	151-0752	Mechanical	Mechanical	Mechanical	151-0752	Mechanical
REGULATOR P/N	Transformer	305-0809-01	305-0809-01	305-0826	305-0851	305-0851	305-0809-01	305-0826	305-0897

* Low oil level switch (LOL) is hard-wired to Magneto Kill on this model.

Revised 03/27/08

APPLICATION CHART FOR 120V 60Hz ONAN® RV GENERATORS

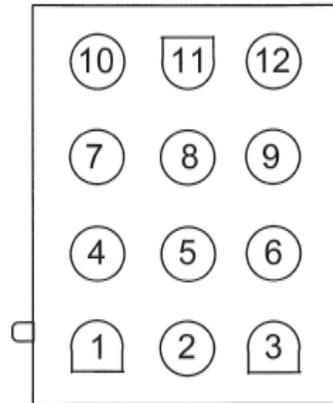
SERIES	MODEL	SPEC	KW	FUEL	CONTROL		G-MAN CONTROL		REGULATOR	GOVERNOR
					BOARD	ADAPTER	ADAPTER	ADAPTER		
Emerald	BGE	A-E	4.0	Gas	300-2784	56-A360-2784	Transformer	Mechanical		
	BGE	F,G	4.0	Gas	300-3056	56-A360-3056	305-0782	Mechanical		
	BGE	H-M	4.0	Gas	300-3763	56-A360-3763	305-0809	Mechanical		
	BGE	N & up	4.0	Gas	300-4901	56-A360-4901	305-0809	Mechanical		
	BGEL	A-D	4.0	LP	300-2943	56-A360-2784	Transformer	Mechanical		
	BGEL	E-G	4.0	LP	300-3056	56-A360-3056	305-0809	Mechanical		
	BGEL	H-M	4.0	LP	300-3763	56-A360-3763	305-0809	Mechanical		
	BGEL	N & up	4.0	LP	300-4901	56-A360-4901	305-0809	Mechanical		
	NHE	A-C	6.5	Gas	300-2784	56-A360-2784	Transformer	Mechanical		
	NHE	D-G	6.5	Gas	300-3056	56-A360-3056	305-0782	Mechanical		
	NHEL	A-C	6.3	LP	300-2943	56-A360-2784	Transformer	Mechanical		
	NHEL	D,E & G	6.3	LP	300-3056	56-A360-3056	305-0782	Mechanical		
	Marquis	BGM	A	5.5	Gas	300-3056	56-A360-3056	305-0826	Mechanical	
		BGM	A	5.5	Gas	300-3763	56-A360-3763	305-0826	Mechanical	
BGM		B-F	5.5	Gas	300-3764	56-A360-3764	305-0826	151-0752		
BGM		G	5.5	Gas	300-4902	56-A360-3764	305-0826	151-0752		
NHM		A	6.8	Gas	300-3056	56-A360-3056	305-0782	Mechanical		
NHM		A	6.8	Gas	300-3763	56-A360-3763	305-0826	Mechanical		
NHM		B-F	6.8	Gas	300-3764	56-A360-3764	305-0826	151-0752		
NHM		G	6.8	Gas	300-4902	56-A360-3764	305-0826	151-0752		
Microlite		KV	A,B	2.8/2.5	Gas/LP	None	N/A	305-0852	Mechanical	
		KV	C-F	2.8/2.5	Gas/LP	300-5299	56-A360-5299	305-0897	Mechanical	
	KY	A	4.0/3.6	Gas/LP	300-4155	56-A360-4155	305-0851	Mechanical		
	KY	B-E	4.0/3.6	Gas/LP	300-4320	56-A360-4320	305-0851	Mechanical		
	KY	F-H	4.0/3.6	Gas/LP	300-4923	56-A360-4320	305-0851	Mechanical		
	KY	J-L	4.0/3.6	Gas/LP	300-5046	56-A360-1413	300-5046	Mechanical		
	KVC	A	2.8	Gas	300-5299	56-A360-5299	305-0897	Mechanical		
	KVD	A	2.8/2.5	Gas/LP	300-5299	56-A360-5299	305-0897	Mechanical		
	KYD	A	4.0/3.6	Gas/LP	327-1413	56-A360-1413	327-1413	Mechanical		
	Mobile Genset	HGJAB	A	5.5/7.0	Gas	300-5374	56-A360-5374	300-5374	Mechanical	
HGJAC		A	5.5/7.0	Gas	300-5374	56-A360-5374	300-5374	Mechanical		

LOCATION OF OIL PRESSURE/LEVEL SWITCHES ON ONAN® RV GENERATORS

SERIES	MODEL	SPEC	LOCATION AND ACCESS OF SWITCH
Emerald	BGE	All	Oil Level switch located at base of oil filter. Remove sheet metal panel surrounding oil filter to gain access.
	BGEL	All	
	NHE	All	
	NHEL	All	
Marquis	BGM	All	
	NHM	All	
Microlite	KV	All	Oil Level switch located inside of oil pan.
	KY	All	Oil level switch located on right side of oil pan.
Camp Power	KVC	All	Oil level switch located inside of oil pan.
	KVD	All	
	KYD	All	
Mobile Genset	HGJAB	All	Oil pressure switch located on main bearing cover above oil filter.
	HGJAC	All	

**Front view (mating side) of
Regulator Connector J1.**

Also Point-MAN Connector J1



TECHNICAL ASSISTANCE

If you require assistance during operation of the Model 361, please call our Technical Service Department at 717 932 9900 from 8am to 4:30pm ET, M-F.

ONLINE TROUBLESHOOTING GUIDE

Our Onan® RV Gen Set Troubleshooting Guide can be downloaded free on our site at <http://www.flightsystems.com/pdf/onanrvtshootgd608.pdf>

REPAIR SERVICE

Should the Model 361 suffer a problem when out of warranty, repair service is available from the manufacturer at reasonable rates. Ship unit to **FLIGHT SYSTEMS, 505 Fishing Creek Road, Lewisberry, PA 17339 USA. Attn: Dock 16**

WARRANTY

The Model 361 is warranted to be free from defects in materials and workmanship for a period of two years from the date of shipment.

FLIGHT SYSTEMS' liability is limited to the repair or replacement of defective product within the warranty period, and does not cover installation or removal costs incurred or possible damage to other equipment (including generator sets and transfer switches) as a result of a malfunction of the Model 361.

If, in the opinion of FLIGHT SYSTEMS (or its authorized agent) the malfunction of the Model 361 was caused by abuse, misuse or improper installation, the warranty claim will be disallowed and established repair rates will apply.

Units should be shipped, freight charges prepaid to **FLIGHT SYSTEMS, 505 Fishing Creek Rd, Lewisberry, PA 17339, USA Attn: Dock 16**

