Contents

Battery Charging Conditions

The following conditions may be observed during cold-start voltage tests until temperatures of electrical system components stabilize. The time it takes to reach optimum voltage and amps will vary with engine speed, load, and ambient temperature.

Maintenance/Low Maintenance Lead-Acid Battery:

Traditional lead acid batteries require lowest charge voltage of all vehicle battery chemistries. Battery cells must be maintained by periodically topping off with distilled water as required.

Maintenance-free Lead-Acid Battery:

Maintenance-free batteries are similar to Maintenance/Low Maintenance batteries, but may require slightly higher charge voltage.

Deep-cycle/Marine Maintenance-free Battery:

Charge acceptance of these batteries may display characteristics similar to maintenance-free batteries and may charge faster due to generally lower capacity relative to size.

AGM (Absorbed Glass Mat) Maintenance-free Battery:

These dry-cell batteries respond better than standard maintenance-free batteries. If battery state of charge (SOC) drops to 75% or less, batteries should be recharged to 95% or higher separately from engine charging system to avoid damaging charging system components and to provide best overall performance. Charge acceptance of these batteries may display characteristics similar to maintenance batteries, but may require higher charge voltage and will draw significant current (<100 amps) when under 50% SOC.

Lithium Battery:

Lithium batteries have unique charging characteristics that differ from lead acid. These batteries require charging systems configured specifically for lithium battery chemistries. Contact CEN for more information on lithium battery charging systems and components.

Testing Guidelines

Professional service technicians rely on the following guidelines when testing electrical components:

Voltage testing:

- Set meter to proper scale and type (AC or DC).
- Be sure to zero the meter scale or identify the meter burden by touching meter leads together. Meter burden must be subtracted from final reading obtained.
- Be sure the meter leads touch source area only. Prevent short circuit damage to test leads or source by not allowing meter leads to touch other pins or exposed wires in test area.
- Be sure to use CEN tools designed especially for troubleshooting CEN alternators when available.

Resistance (ohm) testing:

- Set meter to proper scale.
- Be sure to zero the meter scale or identify the meter burden by touching meter leads together. Meter burden must be subtracted from final reading obtained.
- Be sure meter leads touch source area only. Allowing fingers or body parts to touch meter leads or source during reading may alter reading.
- Be sure reading is taken when source is at 70°F. Readings taken at higher temperatures will increase the reading. Conversely, readings taken at lower temperatures will decrease the reading.
- Be sure to test directly at the source. Testing through extended harnesses or cable extensions may increase the reading.
- "OL" as referenced in this document refers to open circuit: "infinite" resistance, typically in very high kilo- or megaohm range depending on meter and settings.

Diode testing:

- Diodes allow current to flow in one direction only. Typical voltage drop in forward bias can range from 0.1-0.85V. Meter should read OL in reverse bias. Check meter user manual for meter-specific testing guidelines.

Voltage drop testing:

- Measure voltage between B+ on alternator or power source and B- (ground) on alternator or source. Record reading. Move to batteries or other power source and measure again between B+ and B- terminals on battery or other power source. The difference between the two readings represents voltage lost within circuit due to, but not limited to, inadequate cable gauge or faulty connections.
- Voltage drop measurements must be taken with all electrical loads or source operating.

Dynamic/Live testing (connecting power and ground to component to test operation/function out of circuit):

- Connect jumper leads directly and securely to power source contacts of component being tested.
- Make any connection to power and ground at power supply or battery source terminals. Do not make connection at component source terminals, as that may create an arc and damage component source terminals.

N2105-2 Automatic Throttle Control Description and Operation

The CEN model N2105-2 is an Automatic Throttle control system comprised of N2106 Throttle Control Module, N7512 Automatic Throttle Controller with bracket and cable, and N7474 Switch/Plate assembly.

When connected to compatible CEN regulator with N7504 communication harness, N2105-2 can automatically control idle speed as required to eliminate overloading of charging system when vehicle is parked and idling. This will improve charging system performance at idle and extend the life of batteries and other charging system components.

With N2105-2, throttle control can be switched to a fixed-high idle speed, automatically variable idle speed (dependent on electrical load), or normal low-idle speed (OFF position).

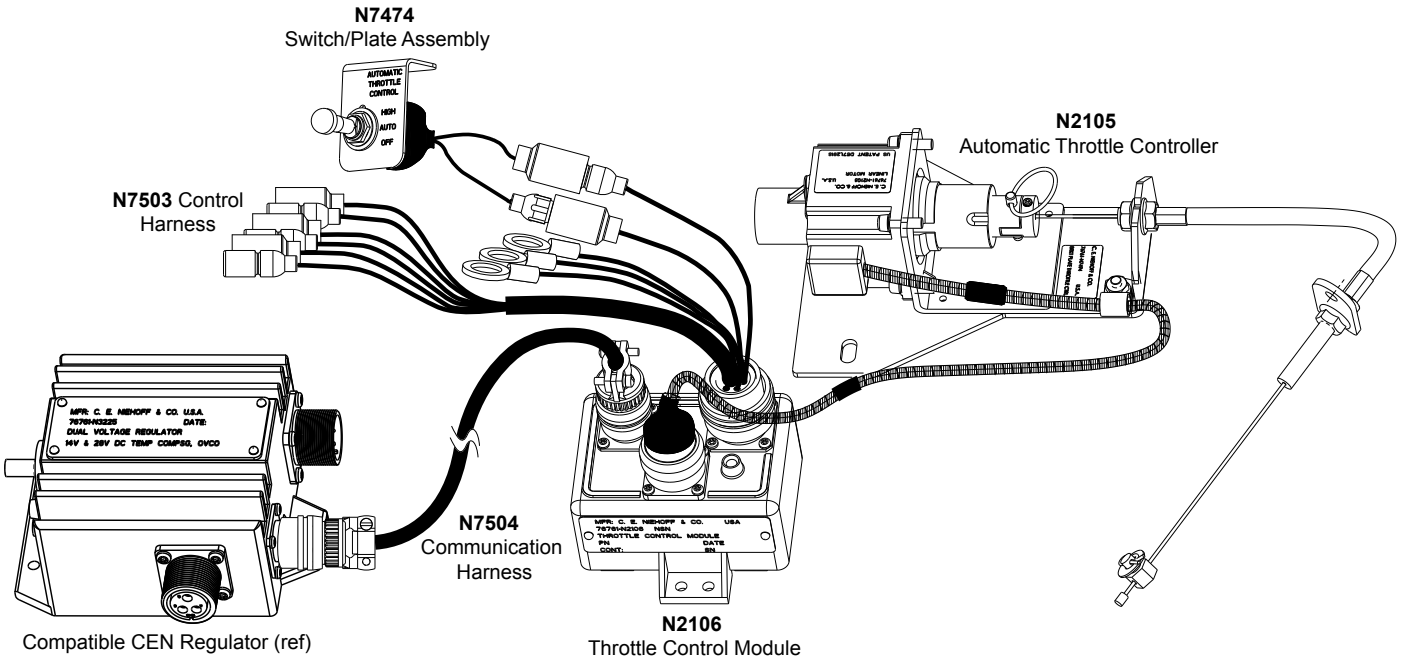

Figure 1: Automatic Throttle Controller (ATC) System Components

(See component- specific characteristics drawing for detailed notes and information)

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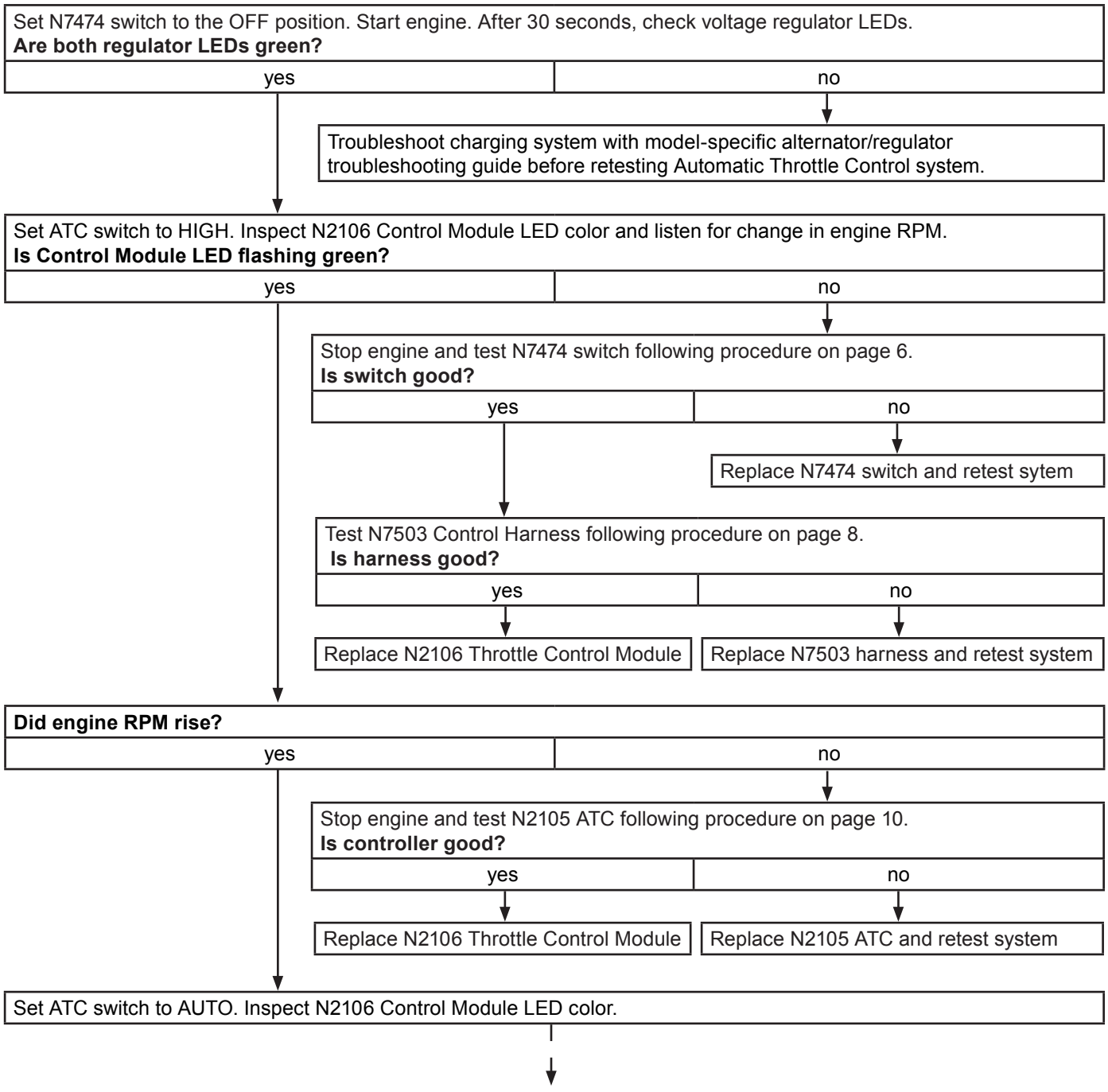
N2105-2 Automatic Throttle Controller (ATC) System Troubleshooting

- **REFER TO VEHICLE-SPECIFIC TROUBLESHOOTING GUIDE FOR WIRING AND COMPONENT TESTING BEYOND CEN ALTERNATOR AND REGULATOR TESTS BELOW.**
- BEFORE STARTING DIAGNOSTIC SEQUENCE, VERIFY THE FOLLOWING AND REPAIR/REPLACE IF NOT TO SPEC:
  - BATTERIES FOR STATE-OF-CHARGE (25.0-28.0 V), CONDITION, AND SECURE CONNECTIONS.
  - MASTER BATTERY SWITCH FOR FUNCTION.
  - VEHICLE IS IN PARK AND PARKING BRAKE IS APPLIED.



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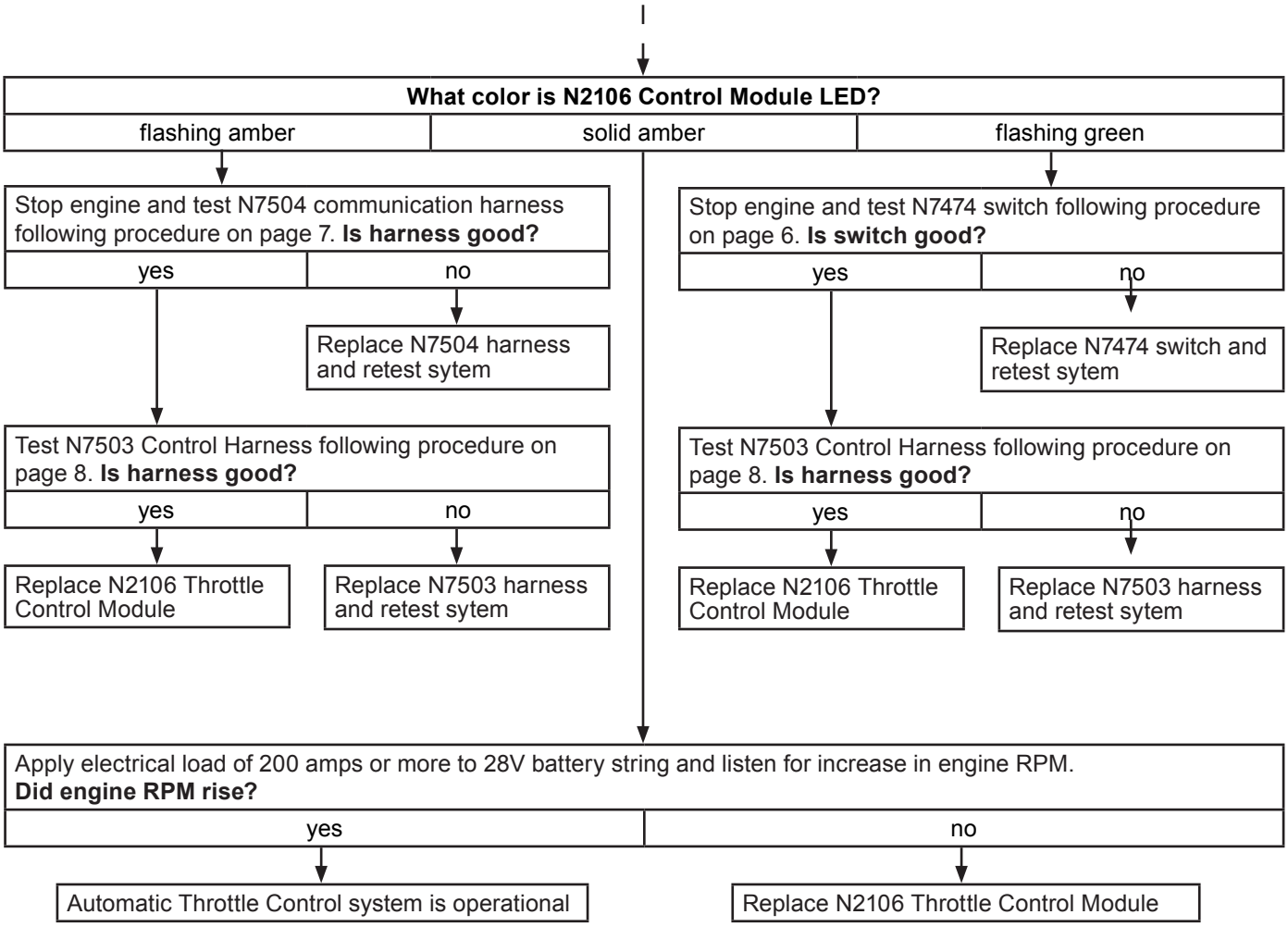


N7474 Automatic Throttle Control Switch Static Testing

To test N7474 switch:

1. Stop engine. Disconnect the two wires from N7474 switch to the vehicle.
2. Set DMM to ohms scale and measure resistance in all three switch positions as shown in Figure 2 below. If one or more of the following tests are out of specification, switch is faulty and should be replaced:
   - Switch position on HIGH: Meter should read about 10 k ± 100 Ω between both switch leads.
   - Switch position on AUTO: Meter should read OL (open) between both switch leads.
   - Switch position on OFF: Meter should read about <1 Ω (short) between both switch leads.

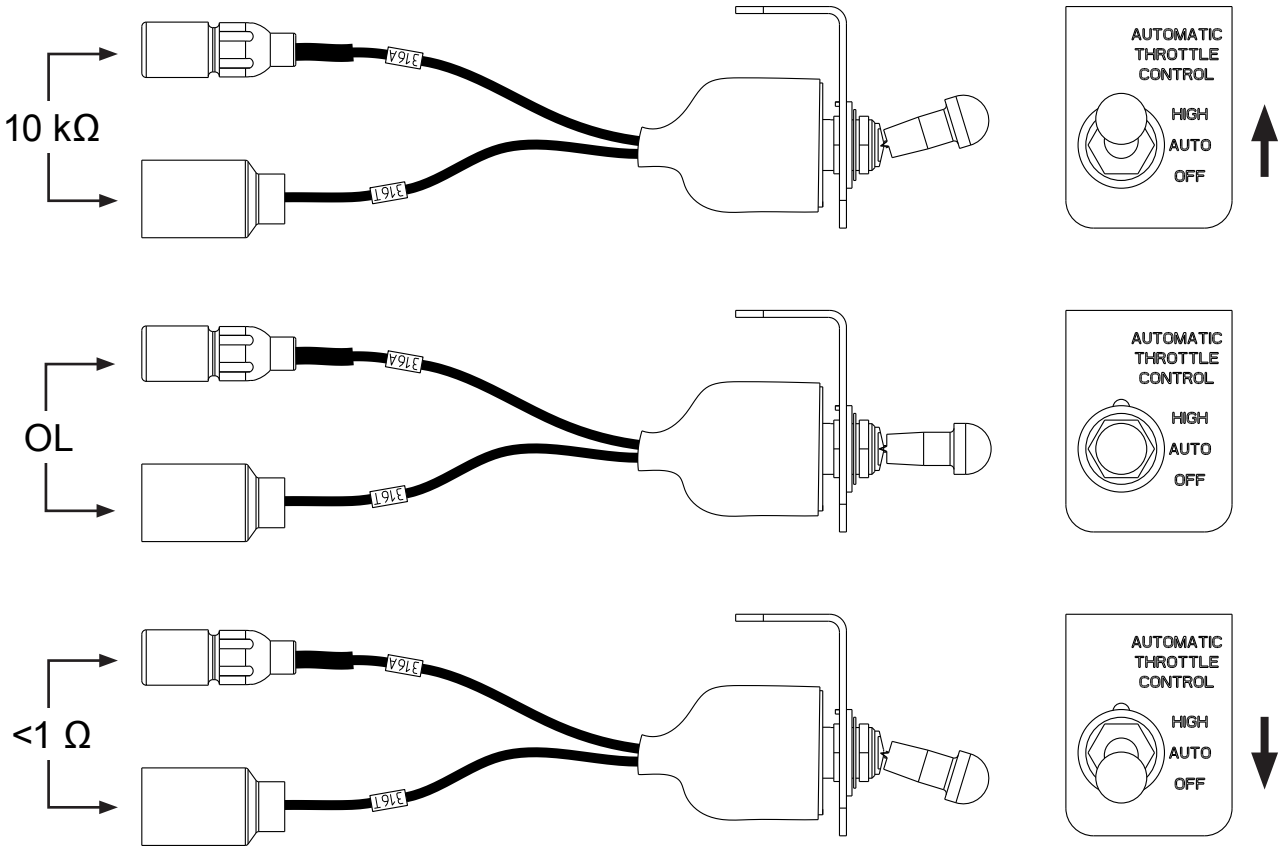
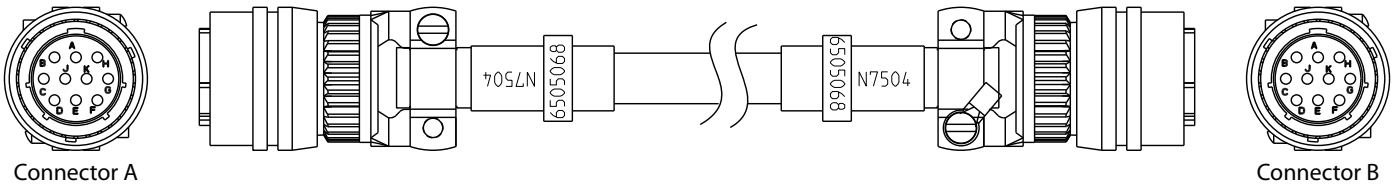


Figure 2: N7474 Switch Positions

N7504 Communication Harness Static Testing

To test N7504 Communication Harness:

1. Stop engine. Disconnect N7504 communication harness from voltage regulator and N2106 Throttle Control Module.
2. Set DMM to ohms scale and measure resistance between connector pins as shown in Figure 3 below. If one or more of the following tests are out of specification, harness is faulty and should be replaced:
   - Measure CAN High resistance/continuity between Pin A from Connector A and Pin A from Connector B: meter should read <1 Ω.
   - Measure CAN Low resistance/continuity between Pin B from Connector A and Pin B from Connector B: meter should read <1 Ω.
   - Measure Shield resistance/continuity between Pin C from Connector A and metal backshell of Connector B: meter should read <1 Ω.
   - Measure terminating resistor resistance between Pin A from Connector A and Pin B from Connector A: meter should read 60 ±5 Ω.



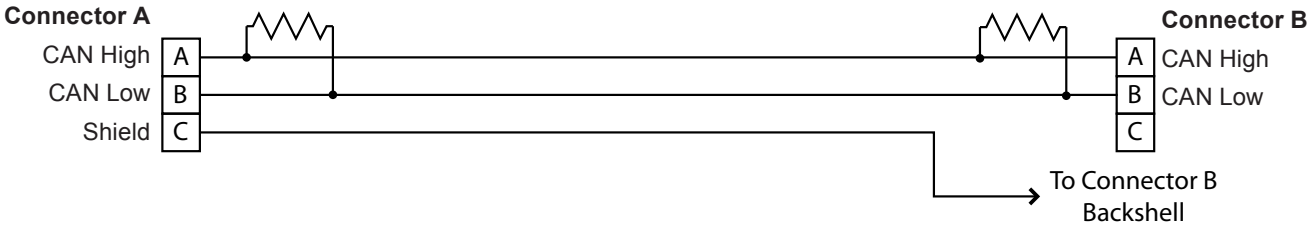


Figure 3: N7504 Communication Harness and Schematic

N7503 Control Harness Static Testing

To test N7503 Control Harness:

1. Stop engine. Put vehicle **in park and apply parking brake.**
2. Disconnect N7503 Control Harness from N2106 Throttle Control Module.
3. Carefully perform the following tests to check each circuit from harness connector. Replace harness or specified component if any test fails. Refer to Figure 4 on the page 9 for reference.

NOTICE ***MAKE SURE METER PROBES DO NOT TOUCH OTHER PINS/SOCKETS AND CAUSE AN ARC THAT MAY DAMAGE PINS/SOCKETS AND HARNESS WIRING.***

Test Transmission Sense Circuit 1: Set DMM to ohms test. Test for continuity between Pin F and vehicle ground. **Is resistance less than 20 Ω?**

- yes → **Test Transmission Sense Circuit 2:** Set DMM to ohms test. Unplug terminal from wires 14J and 14P. Test for continuity between Pin H and terminals 14J and 14P. **Is resistance less than 1 Ω at both locations?**
  - yes → **Test 14V Power Circuit:** Set DMM to VDC test. Test for +14V battery voltage between Pin B and vehicle ground. **Is voltage between 12-14 VDC?**
    - yes → **Test 28V Ignition Circuit:** Set DMM to VDC test. Start engine. Test for +28V battery voltage between Pin C and vehicle ground. **Is voltage between 26-29 VDC within 30 seconds?**
      - yes → **continued on page 9...**
      - no → With engine still running, test for battery voltage between wire 568N terminal and vehicle ground. **Is voltage between 24-29 VDC?**
        - yes → Replace N7503 harness
        - no → Test vehicle +28V Ignition wiring
    - no → Test for battery voltage between wire 68F terminal and vehicle ground. **Is voltage between 12-14 VDC?**
      - yes → Replace N7503 harness
      - no → Test vehicle +14V circuit wiring
  - no → Replace N7503 harness
- no → Unplug terminal from wires 14G and 14H. Test for continuity between Pin H and terminals 14G and 14H. **Is resistance less than 1 Ω at both locations?**
  - yes → Test vehicle Neutral Safety Switch
  - no → Replace N7503 harness

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Test Harness Ground Circuit: Stop engine. Set DMM to ohms test. Test for continuity between Pin D and vehicle ground. **Is resistance less than 20 Ω?**

- yes
- no → Inspect wire 7C terminal and ensure that it is properly fastened, and free of corrosion. Clean/tighten as necessary and retest. **Is resistance less than 20 Ω the second time?**
  - yes
  - no → Replace N7503 harness

Test Parking Brake Circuit: Set DMM to VDC test. Test for voltage between Pin E and vehicle ground. **Does DMM read OL?**

- yes
- no → Unplug terminal from wires 67A and 67T. Set DMM to ohms test. Test continuity between Pin H and terminals 67A and 67T. **Is resistance less than 1 Ω at both locations?**
  - yes → Test vehicle Parking Brake Sensor/Switch
  - no → Replace N7503 harness

Test High Idle Switch Circuit: Set DMM to ohms test. Unplug terminals from wires 316C and 316E from vehicle. Plug wires 316C and 316E together. Test for continuity between Pin A and Pin G. **Is resistance less than 1 Ω?**

- yes → N7503 Control Harness is functional
- no → Replace N7503 harness

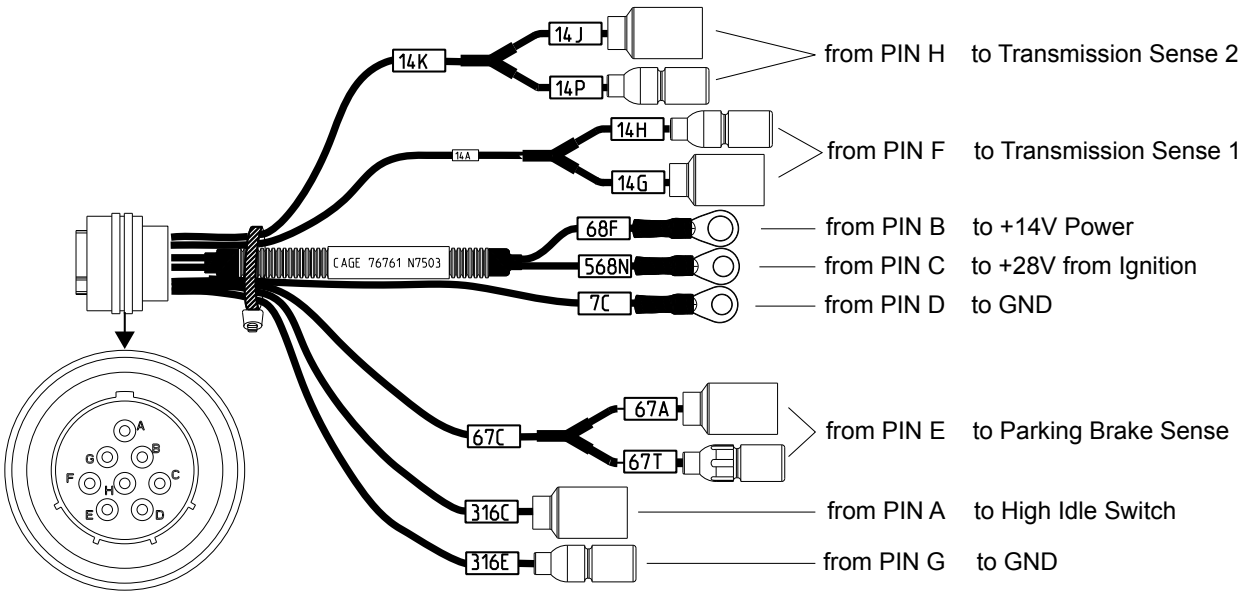

Figure 4: N7503 Control Harness Pin Designations

N2015 Automatic Throttle Controller (ATC) Static Testing

To test N2105 Automatic Throttle Controller:

1. Stop engine. Disconnect the 5-pin connector from N2105 ATC to N2106 Throttle Control Module.
2. Set DMM to ohms scale and measure resistance between connector pins as shown in Figures 5 and 6. If one or more of the following tests are out of specification, motor is faulty:
   - Measure resistance of motor phase 1 winding: meter should read 3.85 ±0.2 Ω from pin A to Pin B.
   - Measure resistance of motor phase 2 winding: meter should read 3.85 ±0.2 Ω from pin C to Pin D.
   - Measure isolation between phase 1 winding and phase 2 winding: meter should read OL from Pin A to Pins C and D. Meter should also read OL from Pin B to Pins C and D.
   - Measure isolation between phase windings and chassis: pins A, B, C, and D should read OL to motor chassis.
3. Remove coupling pin from motor assembly and move throttle cable back and forth to make sure it is not seized. If seized, spray penetrating oil between metal braided cable and sleeving and continue to move cable to loosen any rust or debris that may be present.

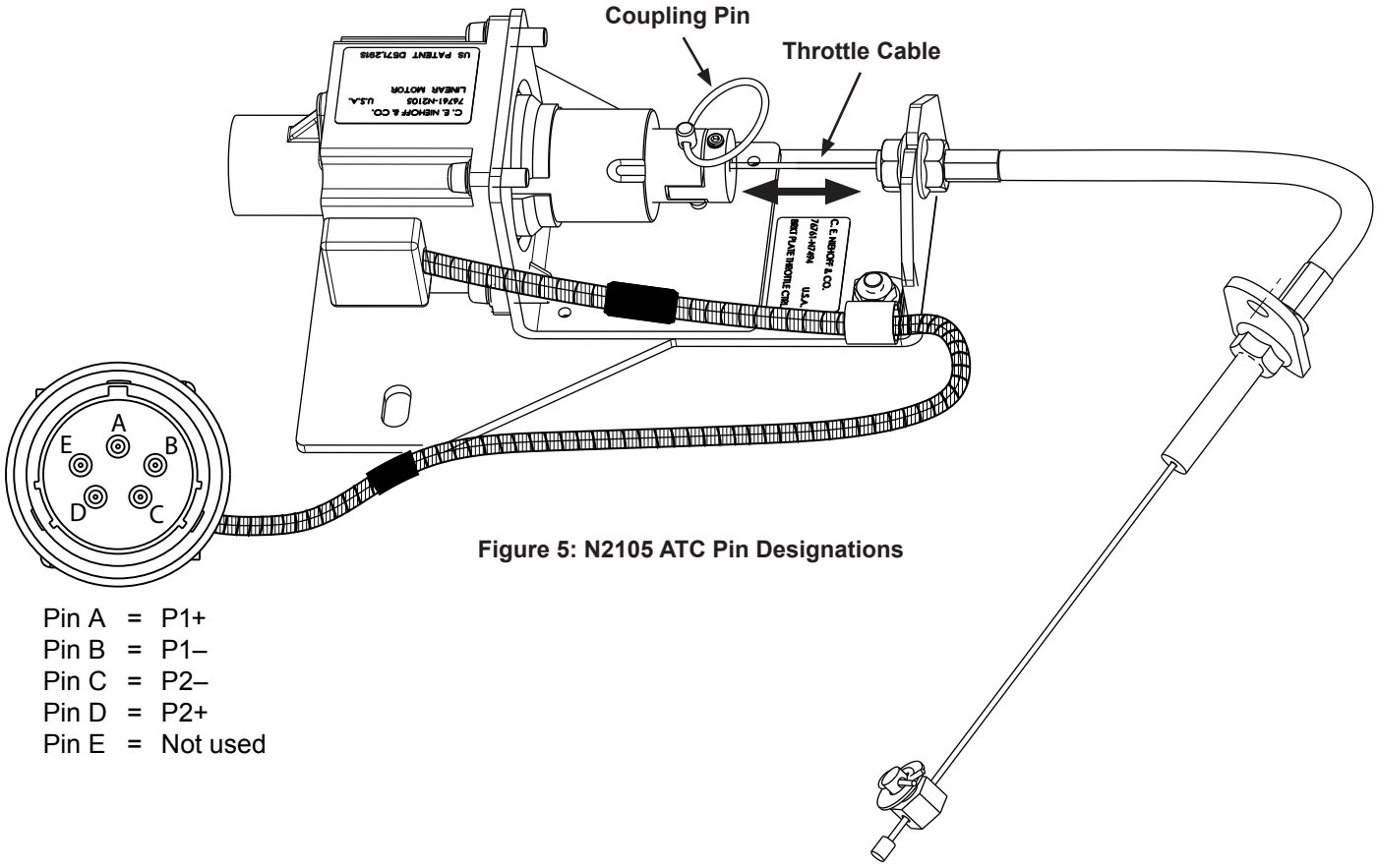

Figure 5: N2105 ATC Pin Designations

Pin A = P1+
Pin B = P1–
Pin C = P2–
Pin D = P2+
Pin E = Not used

If you have questions about your alternator or any of these test procedures, or if you need to locate a Factory Authorized Service Distributor, please contact us at:

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