TOYOTA

Starting, Charging and Parasitic Draw Tests

Quick Training Guide – QT611B

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Toyota Starting, Charging and Parasitic Draw Tests
Quick Training Guide QT611B

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Starter Current Draw Test

Preparation

- Using an approved battery tester, test the battery to verify it is serviceable and fully charged. Charge the battery if necessary
- Turn all accessories off.

Tools

- DMM with accessory current clamp **rated to at least 300 amps**
- Additional DMM to monitor battery voltage

Procedure

1. Setup a DMM with high current clamp and place the current clamp on the negative battery cable with the correct polarity.
   - Be sure to follow the manufacturer's instructions for calibrating and zeroing the clamp before use.
2. Set up a second DMM to monitor battery voltage and connect the leads to the positive and negative battery posts.
3. Disable spark or fuel supply to keep the engine from starting.
   - Refer to the ENGINE: ON-VEHICLE INSPECTION document in the Repair Manual for the "Inspect Compression" procedure for instructions to disable the engine from starting.
   - Do Not remove the spark plugs.
4. Crank the engine for **not more than ten seconds** and record the meter readings.

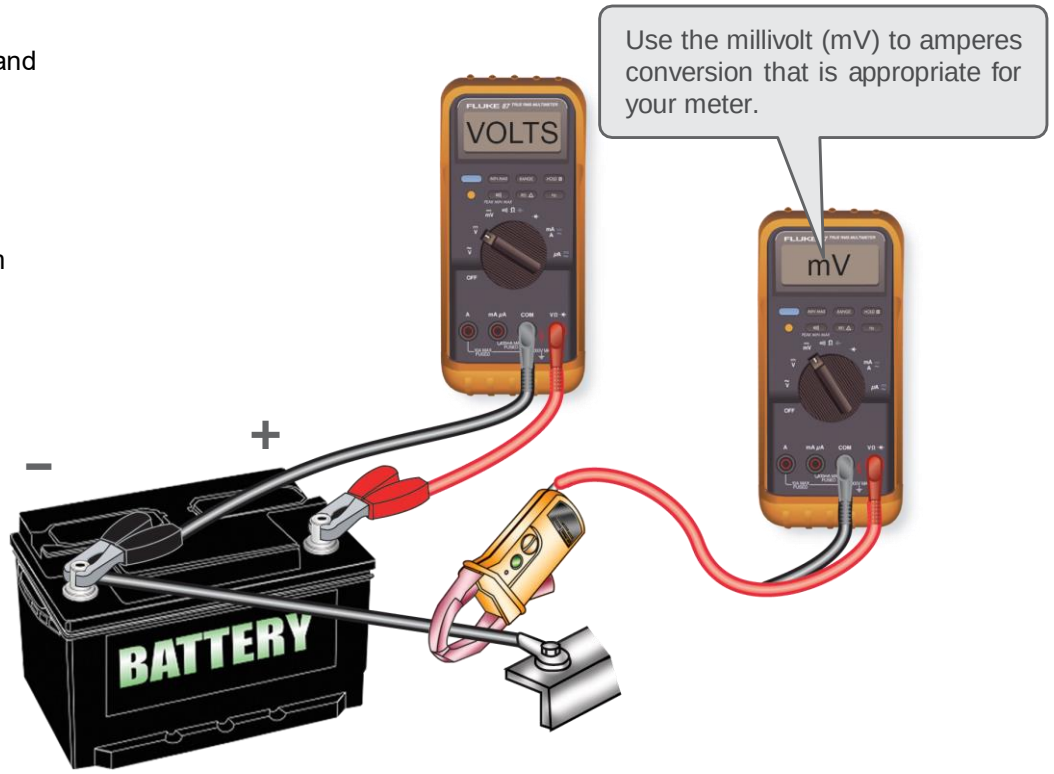
Specifications

- Current less than 200 A (approximately 200A for a V8 engine, 150 amps for a 6 cylinder and 125A for an L4 engine)
- Voltage above 10 volts

HINT: To use a current clamp from the PicoScope kit with your DMM, a BNC to banana jack adapter is needed. Make sure that the adapter is installed with the correct polarity before making any measurements.

Diagnosis

- If the engine cranks slowly with the current above specification and the voltage below 10 volts, check for unwanted mechanical resistance (e.g. engine damage (engine seized) or a defective starter).
- If a defective starter is suspected, perform a no-load performance test.
- If the engine cranks slowly with low current and voltage over 10 volts, check for unwanted electrical resistance in the starter circuit with a voltage drop test.
- If voltage is below 9.6 volts and current is low, the battery may be faulty.



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Starter Voltage Drop Test

Preparation

- Using an approved battery tester, test the battery to verify it is serviceable and fully charged. Charge the battery if necessary
- Turn all accessories off.

Tools

- DMM

Procedure

1. Set the DMM to measure DC voltage
2. Place the black lead on the ground side of the circuit segment you're measuring
3. Place the red lead on the positive side of the circuit segment
4. Crank the engine and observe the voltage reading
    - Disable the fuel or ignition system so the engine will not start and run.
    - Refer to the ENGINE: ON-VEHICLE INSPECTION document in the Repair Manual for the Compression test procedure for instructions to disable the engine from starting.
    - Do Not Remove the spark plugs.
    - Do **NOT** crank the engine for more than ten seconds.

HINT: Vehicles with Cranking Hold Feature will crank the engine for approximately 2-25 seconds and then stop.

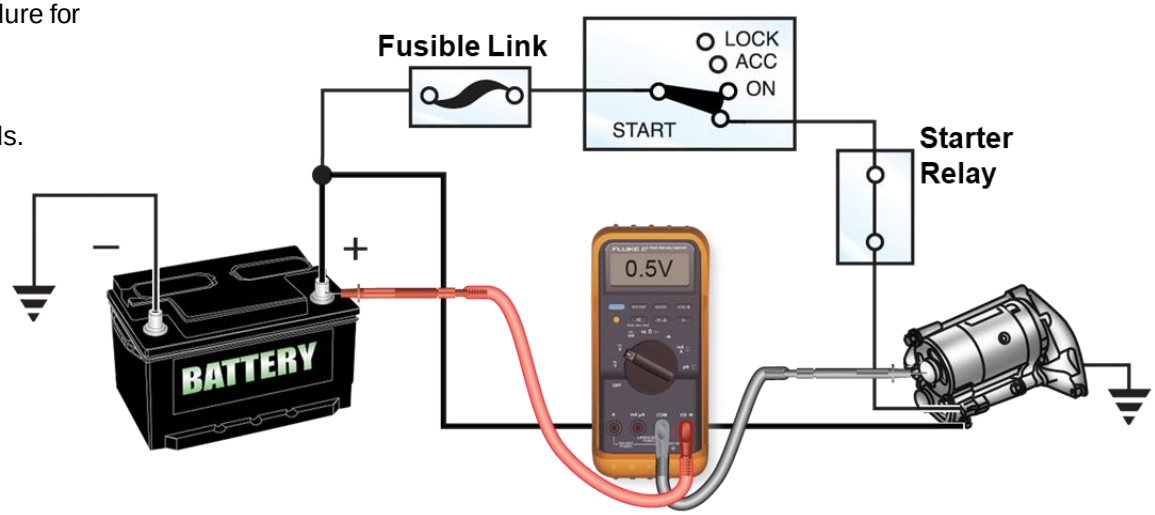
- Press the power button or turn the key off to stop cranking the engine.

Specifications

- Less than 0.5 V drop across the positive side of the circuit (from the positive battery post to starter terminal C)
- Less than 0.2 Volts across any connection and across the ground side of the circuit (from the negative battery post to the starter chassis)
- Less than 0.3 V drop across the magnetic switch (from the starter terminal 30 to starter terminal C)

Diagnosis

- If the voltage drop reading on the starter terminal C to the positive battery post is above specified, continue voltage drop testing for poor connections and for damaged or corroded wires between the starter and at the battery.
- If the voltage drop reading from the starter case to the negative battery post is higher than specified, continue voltage drop testing for poor connections or damaged cables between the battery and chassis ground and from the starter frame to engine ground.



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Charging System Output Test (non-hybrid vehicles)

Preparation

- Using an approved battery tester, test the battery to verify it is serviceable and fully charged. Charge the battery if necessary
- Most Ammeters are not rated for over 100A, use a current clamp instead of a DMM for the current measurement.

Tools

- DMM with accessory current clamp **rated to at least 200 amps**
- Additional DMM to monitor battery voltage

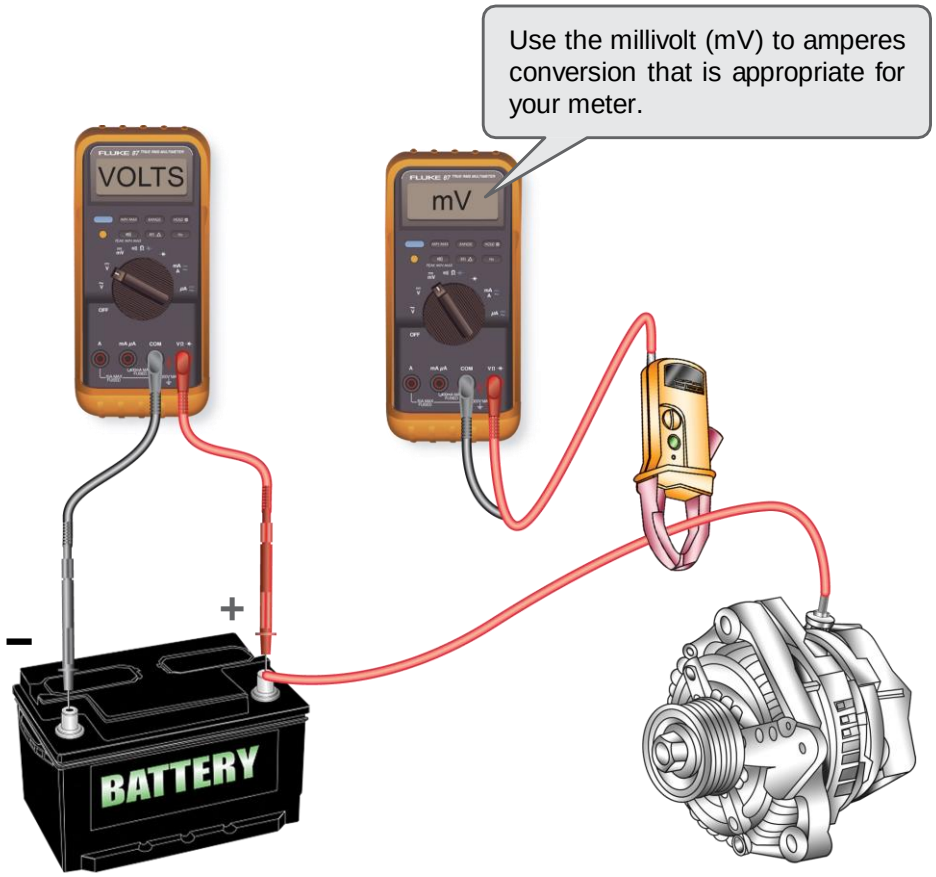
Procedure

1. With the ignition on and the engine off, verify that the charge light in the combination meter is illuminated. If it is inoperative, repair the indicator light circuit before proceeding.
2. Locate the wire connecting generator Terminal B to the battery positive terminal. Setup a DMM with high current clamp and place the current clamp on this wire with the correct polarity.
   - Be sure to follow the manufacturer's instructions for calibrating and zeroing the clamp before use.
3. Set up a second DMM to monitor battery voltage and connect the leads to the positive and negative battery posts.
4. **TEST WITHOUT LOAD:** Start the engine and maintain an engine speed of 2000 rpm with all accessories off. Verify that the voltage and amperage meet the specification listed in the Repair Manual
5. **TEST WITH LOAD**: With the engine running at 2,000 rpm, turn the high beam headlights ON and turn the heater blower switch to the "HI" position. Verify that the voltage and amperage meet the specification listed in the Repair Manual.

HINT: To use a current clamp from the PicoScope kit with your DMM, a BNC to banana jack adapter is needed. Make sure that the adapter is installed with the correct polarity before making any measurements.

Diagnosis

- If the readings are below specification
  - Check for insufficient drive belt tension.
  - Measure voltage drop in the charging system cables and connections.
  - If voltage drops are within specification, check for a defective generator.



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Charging System Voltage Drop Test (non-hybrid vehicles)

Preparation

- Using an approved battery tester, test the battery to verify it is serviceable and fully charged before beginning the test.
- Charge the battery if necessary.

Tools

- DMM

Procedure

Use a DMM to perform a voltage drop test on the positive side of the charging circuit as follows:

1. Connect the red meter lead to Terminal B on the generator.
2. Connect the black meter lead to the positive battery terminal.
3. Start the engine; adjust engine speed to 2,000 RPM. Turn the high beam headlights ON and turn the heater blower switch to the ”HI” position.
4. Note the voltage reading.

Test for voltage drop on the ground side of the charging circuit as follows:

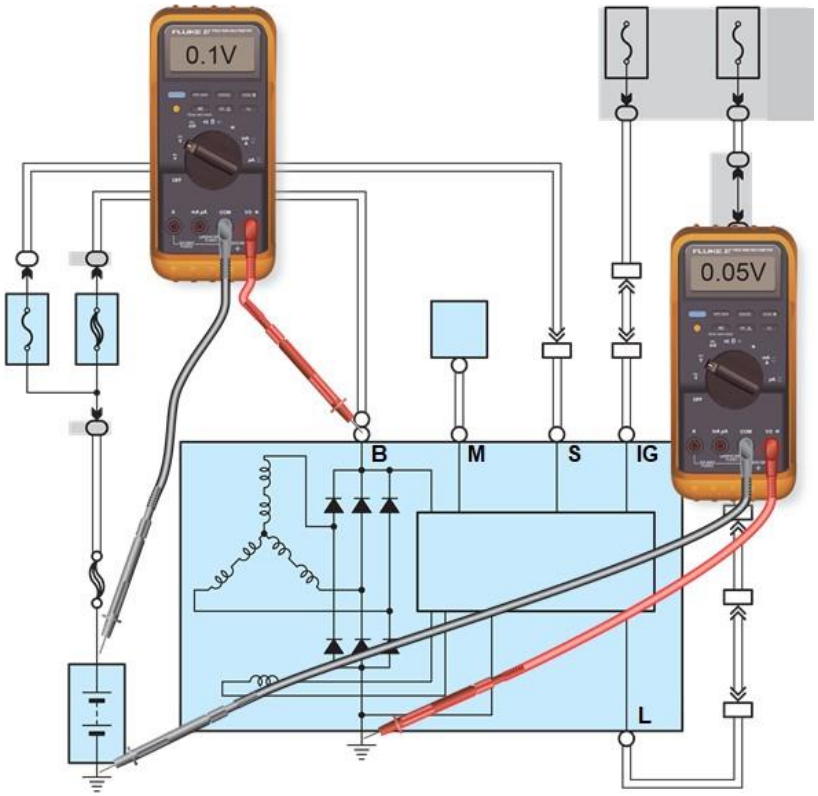
1. Keep the engine running at 2,000 RPM. Keep the lights on and blower in the HI position.
2. Connect the black meter lead to the negative (ground) battery terminal.
3. Connect the red meter lead to the generator frame.
4. Note the voltage reading.

Specifications

- Less than 0.2 Volts across any connection and across the ground side (from the generator case to the negative battery post)
- Less than 0.5 Volts across the positive side of the circuit (B+ wire from the generator to the positive battery post)

Diagnosis

- If the voltage drop reading on the B+ wire from the generator to the positive battery post is above specified, continue voltage drop testing for poor connections and for damaged or corroded wires at the generator and at the battery.
- If the voltage drop reading from the generator case to the negative battery post is higher than specified, continue voltage drop testing for poor connections or damaged cables between the battery to chassis ground and from the generator frame to ground.



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Charging System AC Ripple Test (non-hybrid vehicles)

Preparation

- Using an approved battery tester, test the battery to verify it is serviceable and fully charged before beginning the test.
- Charge the battery if necessary.

Tools

- DMM

Procedure

The AC Ripple test checks the integrity of the Rectifier Bridge. Use a DMM to perform an AC Ripple test on the charging circuit as follows:

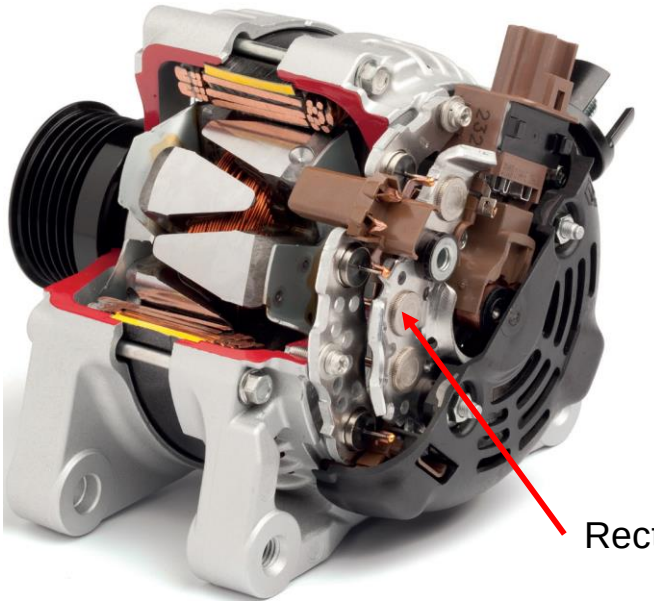
1. Connect the red meter lead to Terminal B on the generator.
2. Connect the black meter lead to the negative battery terminal.
3. Set the DMM to measure AC Voltage.
4. Start the engine; adjust engine speed to 2,000 RPM. Turn the high beam headlights ON and turn the heater blower switch to the ”HI” position.
5. Note the AC voltage reading.

Specifications

- Less than 0.50 Volts AC

Diagnosis

- A voltage reading above specification indicates that the AC voltage output of the generator stator is not being rectified into DC voltage before entering the voltage regulator.



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Parasitic Draw Test

Preparation

- Using an approved battery tester, test the battery to verify it is serviceable and fully charged before beginning the test.
- Charge the battery if necessary.

Tools

- DMM capable of measuring up to 10 amps DC

Procedure

1. Loosen the negative battery cable so it will be easy to remove for the test.
2. Lock the hood latch using a screwdriver (**see illustration**) and roll the driver's window down.

Lock the Hood Latch



This closes the hood latch switch and enables the theft deterrent in case it is the source of the parasitic draw.

3. Turn the ignition on, operate all accessories and then turn the ignition off.
4. Turn off all electrical loads, close and lock the doors, then remove the Smart Key transmitter (key fob) from the detection area (if equipped).

Procedure (cont'd)

5. Wait for the ECUs to go into sleep mode. This may take anywhere from 10 minutes to 2 hours dependent upon which vehicle is being serviced and what equipment is installed in the vehicle.

HINT: Amperage can be measured with a high-resolution amperage clamp or with a DMM ammeter connected in series.

6. To use a DMM, connect to the 10A connection first to avoid blowing a fuse if a draw is present. Check the DMM fuse(s) prior to measuring.
7. Attach the negative lead of the ammeter to the negative battery post and the positive lead of the ammeter to the negative battery cable end. (**See photos below**.)
   - If the ammeter leads become disconnected from the battery post or battery cable during the test, ECUs may wake up. Reconnect the battery and restart the test from step 3.
8. Remove the negative battery cable without breaking the circuit between the battery and vehicle and record the meter reading.



Place leads without disconnecting battery cable.



Disconnect battery cable and record reading.

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Parasitic Draw Test (continued)

Specifications

- Less than 50 milliamps (0.050 amp)

Diagnosis

- If current is higher than 50 milliamps and all ECUs have gone into sleep mode (may take up to two hours), a parasitic draw exists.
- If a parasitic draw is present, check the battery for surface discharge.
- To identify the circuit with the parasitic draw, remove individual fuses one- by-one until the parasitic draw goes away. Note the circuits controlled by that fuse.
    - The parasitic draw will be found on the circuit powered through the fuse noted in the preceding step.

HINT: Pulling fuses may wake up ECUs and increase current draw. After pulling a fuse, you may have to wait for ECUs to return to sleep mode.

Battery Surface Discharge Test

Tools

- DMM

Procedure

1. Set the DMM up to measure DC volts.
2. Place the negative lead on the negative battery terminal and touch the red lead tip to the top of the battery case at various locations.



Battery surface discharge test

Specifications

- Reading should be 0.5 Volts or less dropped across the battery case.

Diagnosis

- If voltage is measured, a surface discharge draw is present.
- If surface discharge is present, clean the top of the battery and recheck.

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