THE CHARGING SYSTEM

Start With A Review ... What you’ve learned in the classroom is just the start. Here’s your chance to show what you know in the shop. To meet your learning objectives, there are six “jobs” to perform on The Charging System. This page reviews some key concepts.
Identify Charging System Components And Their Functions

YOUR JOB  (READ ALL INSTRUCTIONS BEFORE STARTING!)

1. Refer to page 139 in your workbook.

2. Identify the numbered charging system components by placing the correct number next to the component name below.

   ______ Alternator    ______ Warning Lamp    ______ Fuses
   ______ Battery      ______ Fusible Links   ______ Relay
   ______ Ignition Switch

3. Then, place the number of the correct component next to the phrase that best describes its function in the charging system.

   ______ Used to energize charging circuit.
   ______ May be used to control a warning lamp.
   ______ Indicates alternator failure.
   ______ Protect the system from overloads.
   ______ Protect the ignition, charging, and engine circuits.
   ______ Stores generated energy.
   ______ Uses electromagnetism to change mechanical energy into electrical energy.

4. Complete this job within 5 minutes.

Stop here and have instructor signoff.
Job 1 complete: ___________________
Identify Alternator Parts And Their Functions

YOUR JOB (READ ALL INSTRUCTIONS BEFORE STARTING!)

1. Refer to page 141 in your workbook.

2. Identify the numbered starter motor parts by placing the correct number next to the part name below.

   — Brush
   — Slip Ring
   — Rotor
   — Stator
   — Pulley
   — Bearing
   — Cooling Fan

3. Then, place the number of the correct part next to the phrase that best describes its function in the alternator.

   — Supports the rotor shaft.
   — Delivers mechanical energy.
   — Conducts current from battery to slip rings.
   — Conducts current from brushes to rotor windings.
   — Rotates to induce an oscillating voltage.
   — Expels generated heat.
   — Has three windings in which an oscillating voltage is induced.

4. Complete this job within 5 minutes.

Stop here and have instructor signoff.
Job 2 complete: ____________________________
Conduct A Visual Inspection Of A Charging System

YOUR JOB (READ ALL INSTRUCTIONS BEFORE STARTING!)

1. Inspect the charging system on the assigned vehicle.
   - Follow the check/test instructions.
   - Record your findings as indicated below.

2. Refer to page 147 in your workbook.

3. Refer to the proper Toyota Repair Manual for specifications.

4. Complete this job within 15 minutes.

TEST RESULTS

<table>
<thead>
<tr>
<th>Visual Check</th>
<th>Condition</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fuses/Fusible Links</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Battery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Alternator Wires</td>
<td></td>
<td></td>
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<tr>
<td>4. Warning Lamp</td>
<td></td>
<td></td>
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<tr>
<td>5. Drive Belt</td>
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<td></td>
</tr>
</tbody>
</table>

Performance Check

<table>
<thead>
<tr>
<th>Specification</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Belt Tension</td>
<td></td>
</tr>
</tbody>
</table>

Operating Check

**CAUTION: Wear safety glasses while performing these tests.**

With the engine running, carefully perform the following tests:

1. Use the stethoscope to listen to the front and rear alternator bearings. Can you detect any problems?

2. Place the screwdriver against the rear end cover of the alternator. Can you detect any magnetism? Turn on the headlights (create a load) and try it again. Why is this test useful?

Stop here and have instructor signoff.
Job 3 complete: ________________________________
Perform An Alternator Output Test

CAUTION: Wear safety glasses while doing this job.

YOUR JOB  (READ ALL INSTRUCTIONS BEFORE STARTING!)

1. Measure the alternator output, with and without a load, on the assigned vehicle.
   - Follow the Performance Procedures.
   - Record your findings on the next page.

2. Refer to page 148 in your workbook.

3. Refer to the proper Toyota Repair Manual for specifications.

4. Complete this job within 15 minutes.

TOOLS/EQUIPMENT

1. VAT-40 Tester
2. Screwdriver (small)
3. Vehicle
4. Safety Glasses

PERFORMANCE PROCEDURES

1. Prepare VAT-40 tester according to manufacturer’s instructions.
2. Connect VAT-40 to battery terminals. [Red to (+) and Black to (-).]
3. “Zero” ammeter; connect amps pickup clamp around negative battery cable(s).
4. Set Test Selector Switch to “Charging” position.
5. With the engine running at 2000 rpm, adjust the Load Increase control to obtain the highest ammeter reading possible without causing the voltage to drop lower than 12 volts.
6. Read the ammeter.
   NOTE: The reading should be within 10% of the alternator’s rated output. If it is less, the alternator requires further testing or replacement.
7. If there is no output, ground the alternator field terminal “F” and check the voltmeter reading. This bypasses the regulator, so do not exceed 1200 rpm test speed. If the reading is still less than specified, check the alternator. If the voltage is above 13V, replace the regulator. Refer to the troubleshooting chart.
8. Remove ground from terminal “F.”

(Go on the next page)
SPECIFICATIONS – Refer to Repair Manual – Charging System Sections.
Vehicle: ________________  Regulator Type: _____ Internal  _____ External

TEST RESULTS
Without Load: _____ amps  _____ volts  With Load: _____ amps at 12 volts
Grounded “F” Terminal: _____ amps  _____ volts at 1200 rpm

RECOMMENDATIONS:  Alternator: _____ Good condition, ready for use.
                    _____ Questionable condition, further testing required.
                    Explain: ______________________________
                    _____ Not serviceable, replace with new or rebuilt unit.

Regulator: _____ Operating properly.
           _____ Questionable condition, further testing required.
           Explain: ______________________________
           _____ Not operating properly, should be replaced.

Stop here and have instructor signoff.
Job 4 complete: ____________________________________________
Troubleshooting The Compact, High-Speed Alternator

Check Battery First!

1. Check for improper contact in alternator connectors (B, IG, S and L) or open circuit in wiring (including IG and CHARGE circuit fuses) or a short circuit.
   - YES: Repair fault and start engine. Is charge lamp turned on?
   - NO: Go to Step 4

2. Turn ignition off. Check for a short circuit in load between L and Ground. (Electric choke element, emission computer, etc.)
   - YES: Repair or replace load device between L and ground.
   - NO: Start engine and check battery voltage at engine speed of 2000 rpm. (All other electrical loads off.) Is voltage 14.5V ± 0.6V?
     - NO: Ground alternator “F” terminal and raise engine speed to 1200 rpm. Is “B” terminal voltage above 13V?
       - YES: Replace IC regulator (Tr1 open, etc.).
       - NO: Repair alternator. (Open in coil, brushes, etc.)

3. Start engine and check battery voltage at engine speed of 2000 rpm. (All other electrical loads off.) Is voltage 14.5V ± 0.6V?
   - NO: Ground alternator “F” terminal and raise engine speed to 1200 rpm. Is “B” terminal voltage above 13V?
     - YES: Replace IC regulator (Tr1 open, etc.).
     - NO: Repair alternator. (Defective diode, stator, etc.)

4. Check alternator output using a carbon pile tester. (Sun VAT-40 or equivalent.) When loaded (battery voltage no lower than 12V) is current output within 10% of alternator rated output?
   - YES: OK
   - NO: Repair alternator. (Defective diode, stator, etc.)

If charge lamp is still on, check charge lamp circuit again.
Perform Charging System Voltage-Drop Tests

CAUTION: Wear safety glasses while doing this job.

YOUR JOB  \(\text{READ ALL INSTRUCTIONS BEFORE STARTING!}\)

1. Measure the voltage drop in the charging system on the assigned vehicle.
   - Follow the Performance Procedures.
   - Record your findings as indicated below.

2. Refer to page 151 in your workbook.

3. Complete this job within 15 minutes.

**PERFORMANCE PROCEDURES**

Output Circuit:
1. Connect voltmeter; Red to alternator “B” terminal; Black to battery (\(+\)).
2. Start engine; run at about 2,000 rpm.
3. Record voltmeter reading.
4. Stop engine and disconnect voltmeter.

Ground Circuit:
1. Connect voltmeter; Red to alternator housing; Black to battery (\(-\)).
2. Start engine; run at about 2,000 rpm.
3. Record voltmeter reading.
4. Stop engine and disconnect voltmeter.

**VOLTAGE DROP TEST**

SPECIFICATIONS

Vehicle: __________________  Alternator: _____ Conventional  _____ High Speed

TEST RESULTS

Output Circuit: _____ volts  Ground Circuit: _____ volts

RECOMMENDATIONS

Output Circuit: _____ Normal  _____ Problem, will require further testing.

Ground Circuit: _____ Normal  _____ Problem, will require further testing.

Stop here and have instructor signoff.
Job 5 complete: __________________