

# Engine Electrical System

**STARTING SYSTEM..... EE-2**

**CHARGING SYSTEM..... EE-8**

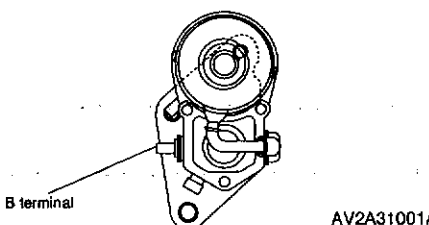
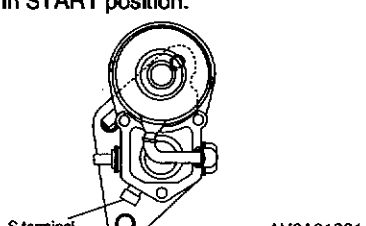


# SYMPTOM-RELATED DIAGNOSTIC PROCEDURE

## Starter Symptom guide

No.	Items
1	Will not crank-starter motor does not operate
2	Will not crank-starter motor spins
3	Cranks slowly
4	Generator warning light illuminates with engine running
5	Discharged battery

### Symptom troubleshooting

1 Will not crank-starter motor does not operate			
Step	Inspection		Action
1	Check if engine cranks with fully charged battery.	Yes	Check charging system.
		No	Go to next step.
2	Check if battery voltage is supplied at B terminal. 	Yes	Go to next step.
		No	Check wiring harness.
3	Check if battery voltage is supplied at S terminal with clutch pedal depressed (M/T), car in PARK (A/T), and ignition switch in START position. 	Yes	Replace starter unit.
		No	<ul style="list-style-type: none"> <li>• Check transaxle range switch (A/T) (Refer to, Auto transaxle)</li> <li>• Check ignition switch</li> <li>• Check wiring harness</li> </ul>

2 Will not crank-starter motor spins			
Step	Inspection		Action
1	Check if drive pinion is pulled out while cranking. (Click heard when pulled out.)	Yes	Remove starter and check flywheel ring gear teeth and starter drive pinion teeth.
		No	Check solenoid. Repair or replace as necessary.

**SYMPTOM-RELATED DIAGNOSTIC PROCEDURE**

**EE-3**

<b>3 Cranks slowly</b>			
<b>Step</b>	<b>Inspection</b>		<b>Action</b>
1	Check if engine cranks normally when fully charged.	Yes	Check charging system.
		No	Go to next step.
2	Check starter cable connection for looseness and corrosion.	Yes	Repair or replace connection.
		No	Check for seized motor armature. Repair or replace as necessary.

<b>4 Alternator warning lamp illuminates with engine running</b>			
<b>Step</b>	<b>Inspection</b>		<b>Action</b>
1	Check for correct battery voltage at idle.  Specification: 14.1~14.7V	Yes	Check wiring harness between Alternator L terminal and generator warning lamp.
		No	Check charging system.

<b>5 Discharged battery</b>			
<b>Step</b>	<b>Inspection</b>		<b>Action</b>
1	Check charging system.	Yes	Turn ignition switch ON and check dark current as shown.  Dark current: Below 20mA
		No	Repair or replace parts as necessary .

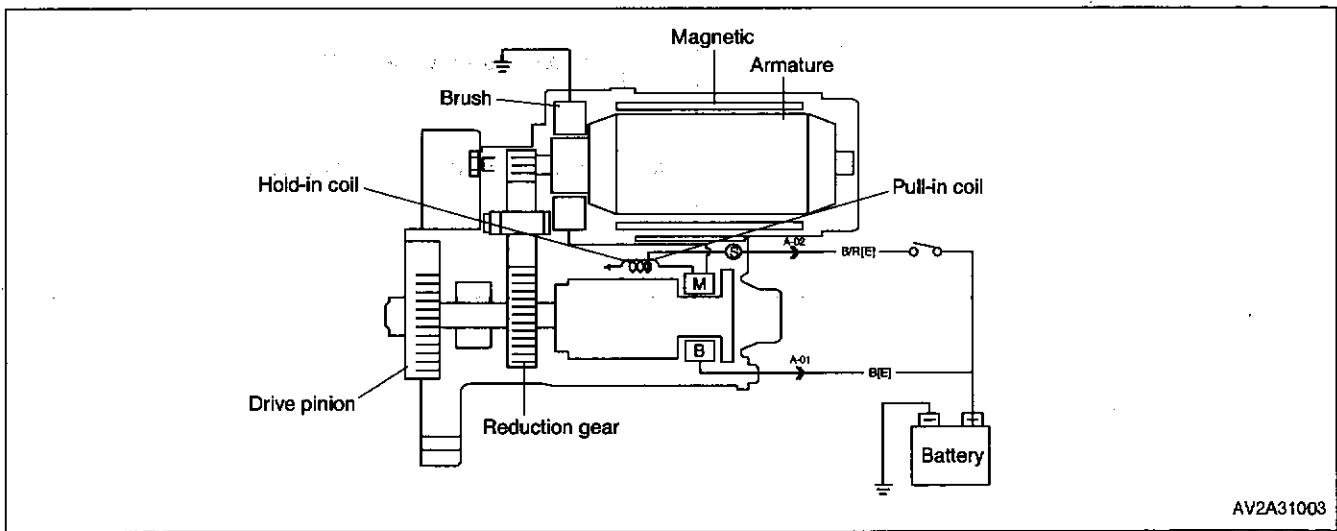
# SPECIFICATION

## Starter motor Specification

Engine / Transaxle		J3 COMMON RAIL SYSTEM	
		M/T	A/T
Starter motor	Type	Pre-engaged drive	
	Output (V-KW)	12-2.2	

# DESCRIPTION AND OPERATION

## Starter motor Structural view



AV2A31003

## ON-VEHICLE SERVICE PROCEDURES

### Starter motor

#### Pull in voltage

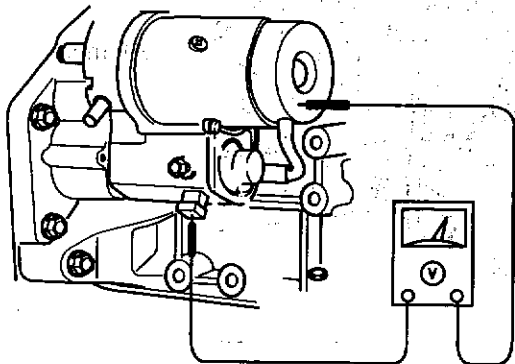
1. Inspect the battery voltage.

**Voltage: above 12.4V**

2. After starting the engine, check if the starter rotates smoothly.
3. If the starter does not rotate, check the "S" terminal voltage during cranking engine.

**Voltage: above 8V**

- Above 8V: Inspection the starter
- Below 8V: Inspect wiring (main fuse, ignition switch and transaxle range switch(A/T))



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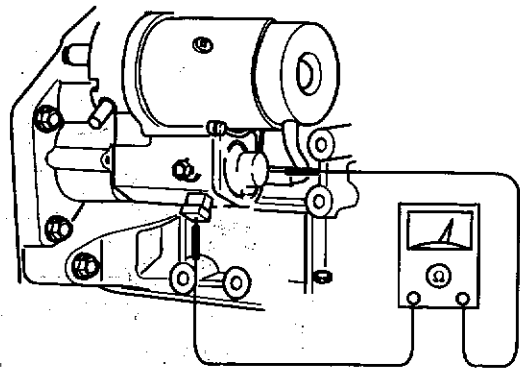
### Solenoid

#### Pull-in coil

\* **Notice**

- a) Remove the battery negative cable.
- b) Remove the "M" terminal of starting motor.

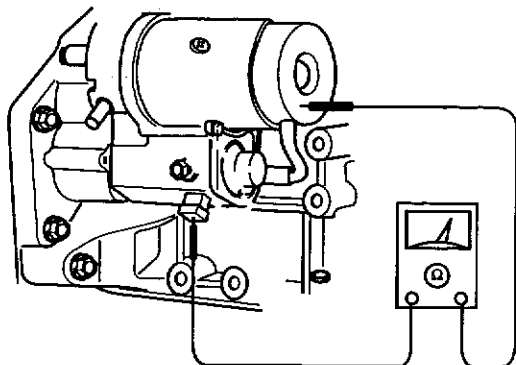
1. Do the continuity test between "S" and "M" terminal.
2. If it is opened, replace the solenoid.



AV2A31005B

#### Hold-in coil

1. Do the continuity test between "S" and solenoid body.
2. If it is opened, replace the solenoid.



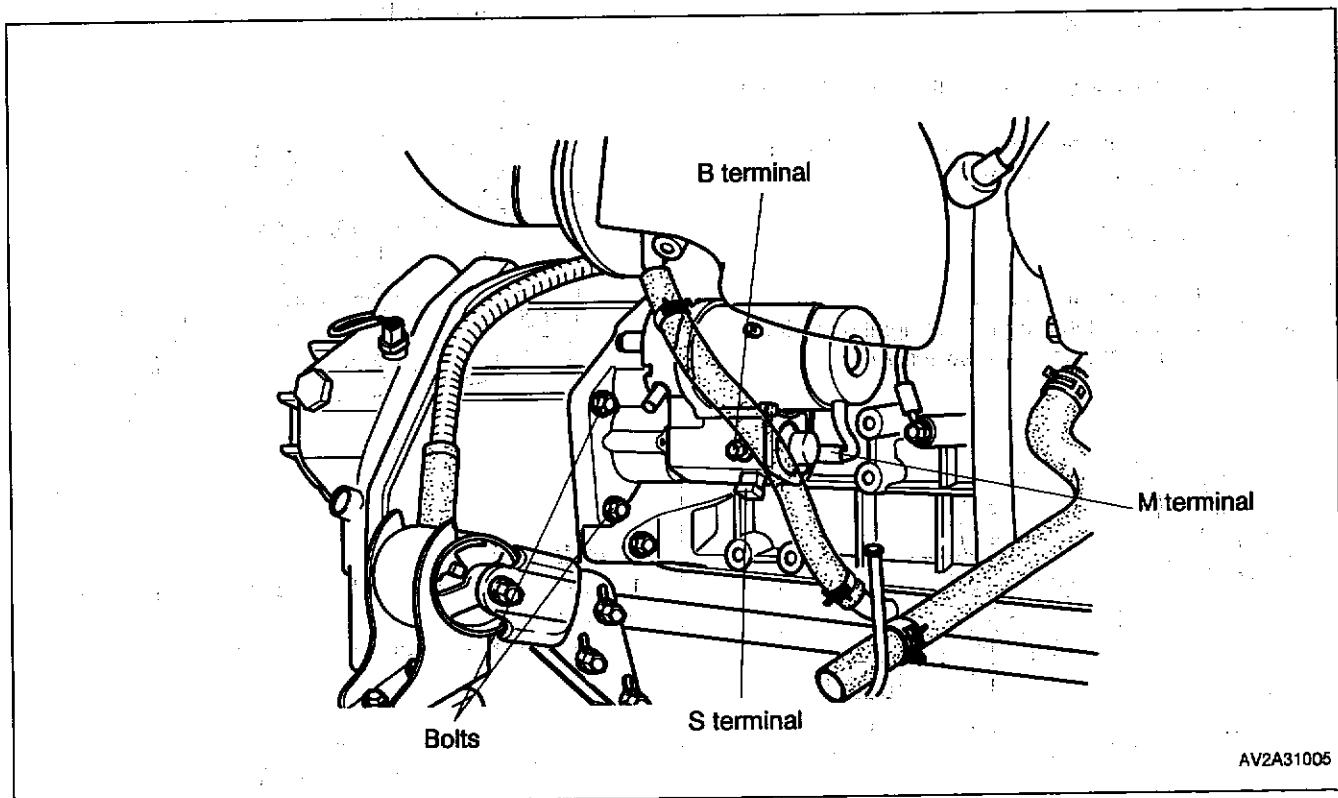
AV2A31005A

## REMOVAL AND REPLACEMENT PROCEDURES

### Starter

#### Removal and replacement

1. Remove the battery negative cable.
2. Inspect the parts, replace and repair as necessary.
3. Install in the reverse order of removal.



**Inspection**

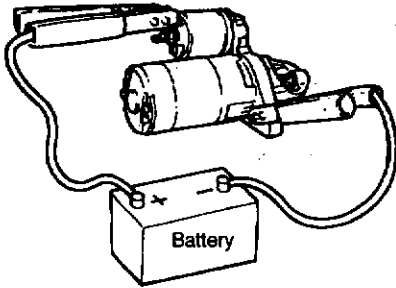
**Solenoid**

**Pull-out test**

**\* Notice**

Be careful not to let electricity flow continuously for more than 10 seconds.

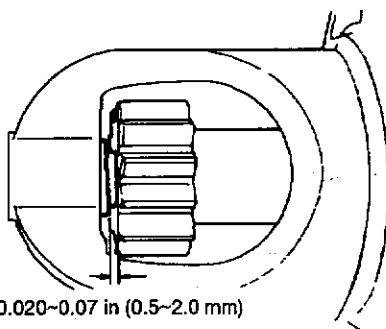
1. Apply battery power to the "S" terminal and ground starter motor body. Pinion will eject outward and the stop.



AT30031007

2. Measure clearance (pinion gap) between pinion and stopper.

**Pinion gap: 0.020~0.079 in (0.5~2.0 mm)**



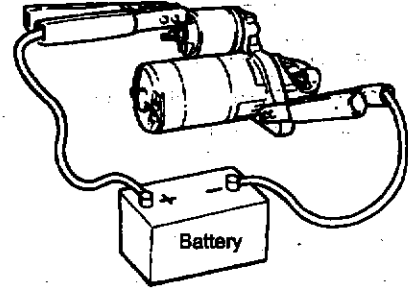
0.020~0.07 in (0.5~2.0 mm)

AT30031008

3. If pinion gap is not within specified range, adjust it by increasing or decreasing the number of washers used between solenoid and drive housing. The gap will become smaller if the number of washers is increased.

**Return test**

1. Disconnect the wire from the "S" terminal, and then connect the battery between the "M" terminal and the body.



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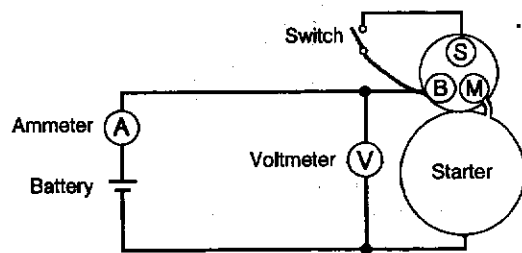
2. Pull out the over-running clutch with a flat-tip screwdriver, and then check that the over-running clutch returns to its original position when released.

**No-load test**

1. Form a test circuit with a volt meter and an ammeter.

**\* Notice**

Use wires as thick as possible and tighten each terminal fully.



AT3031010

2. Close switch to run the starter.
3. Check the following.

J3 COMMON RAIL SYSTEM		
Voltage	(V)	11.0
Current	(A)	Below 130
Gear shaft speed	(rpm)	Above 4500

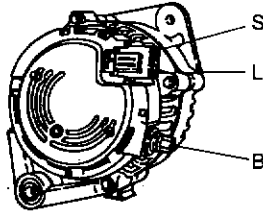
4. If any abnormality is noted, check it according to "INSPECTION".

# SYMPTOM-RELATED DIAGNOSTIC PROCEDURE

## Alternator Diagnostic guide

No.	Items
1	Being not charged
2	Engine starts-alternator warning lamp turns on
3	Discharging of battery

### Symptom troubleshooting

1		Being not charged													
Step	Inspection		Action												
1	Check the battery voltage.  Standard: about 12.4V	Yes	Go to next step.												
		No	Check the battery.												
2	Start engine and check if alternator warning lamp goes out.	Yes	Go to step 4.												
		No	Go to next step.												
3	Check if voltage at alternator terminals are correct. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Terminal</th> <th>IG: ON(V)</th> <th>Idle(V)</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>Approx. 12V</td> <td>14.1~14.7</td> </tr> <tr> <td>L</td> <td>Approx. 1V</td> <td>14.1~14.7</td> </tr> <tr> <td>S</td> <td>Approx. 12V</td> <td>14.1~14.7</td> </tr> </tbody> </table>  <p style="text-align: right; margin-right: 50px;">AT3032005</p>	Terminal	IG: ON(V)	Idle(V)	B	Approx. 12V	14.1~14.7	L	Approx. 1V	14.1~14.7	S	Approx. 12V	14.1~14.7	Yes	Check wire harness between battery and terminal "B".
		Terminal	IG: ON(V)	Idle(V)											
B	Approx. 12V	14.1~14.7													
L	Approx. 1V	14.1~14.7													
S	Approx. 12V	14.1~14.7													
No	Check wiring harness. Replace alternator.														
4	1. Connect an ammeter, (100A Max: KJ 2.9)] between terminal "B" and harness. 2. Start engine. 3. Check if engine is 2500~3000 rpm. 4. Check if ampere of load (turn more one of many electrical system on) higher than ampere of unload (Turns blower, head lamp, rear defroster, etc, off).	Yes	Charging system normal.												
		No	Go to next step.												
5	Check if drive belt tension is OK.	Yes	Replace alternator.												
		No	Check drive belt tension.												



**SYMPTOM-RELATED DIAGNOSTIC PROCEDURE**

**EE-9**

<b>2</b>		<b>Discharging of battery</b>																							
<b>Step</b>	<b>Inspection</b>	<b>Action</b>																							
<b>1</b>	Measure open circuit voltage of battery with a digital voltmeter capable of reading 0.01V.  <b>Voltage: above 12.4V</b>	Yes	Go to next step.																						
		No	Quick charge for 2 hours and recheck voltage if the voltage is below 12.4V, replace battery.																						
<b>2</b>	Apply load test to the battery by using a battery load tester.  <b>Load test</b> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: center;">Battery</th> <th style="text-align: center;">Load (A)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">PT80 - 33FL</td> <td style="text-align: center;">300</td> </tr> </tbody> </table> Quick charge and record battery voltage at the end of 15 seconds; is the voltage more than specification?  <b>Battery voltage with load</b> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: center;">Approximate battery temp. (°C)</th> <th style="text-align: center;">Minimum voltage (V)</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">21</td><td style="text-align: center;">9.6</td></tr> <tr><td style="text-align: center;">15</td><td style="text-align: center;">9.5</td></tr> <tr><td style="text-align: center;">10</td><td style="text-align: center;">9.4</td></tr> <tr><td style="text-align: center;">4</td><td style="text-align: center;">9.3</td></tr> <tr><td style="text-align: center;">-1</td><td style="text-align: center;">9.1</td></tr> <tr><td style="text-align: center;">-7</td><td style="text-align: center;">8.9</td></tr> <tr><td style="text-align: center;">-12</td><td style="text-align: center;">8.7</td></tr> <tr><td style="text-align: center;">-18</td><td style="text-align: center;">8.5</td></tr> </tbody> </table>	Battery	Load (A)	PT80 - 33FL	300	Approximate battery temp. (°C)	Minimum voltage (V)	21	9.6	15	9.5	10	9.4	4	9.3	-1	9.1	-7	8.9	-12	8.7	-18	8.5	Yes	Go to next step.
		Battery	Load (A)																						
PT80 - 33FL	300																								
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-7	8.9																								
-12	8.7																								
-18	8.5																								
No	Replace battery.																								
<b>3</b>	Measure open circuit voltage of battery.  <b>Standard: above 12.4V</b>	Yes	Battery is OK.																						
		No	Charge battery.																						

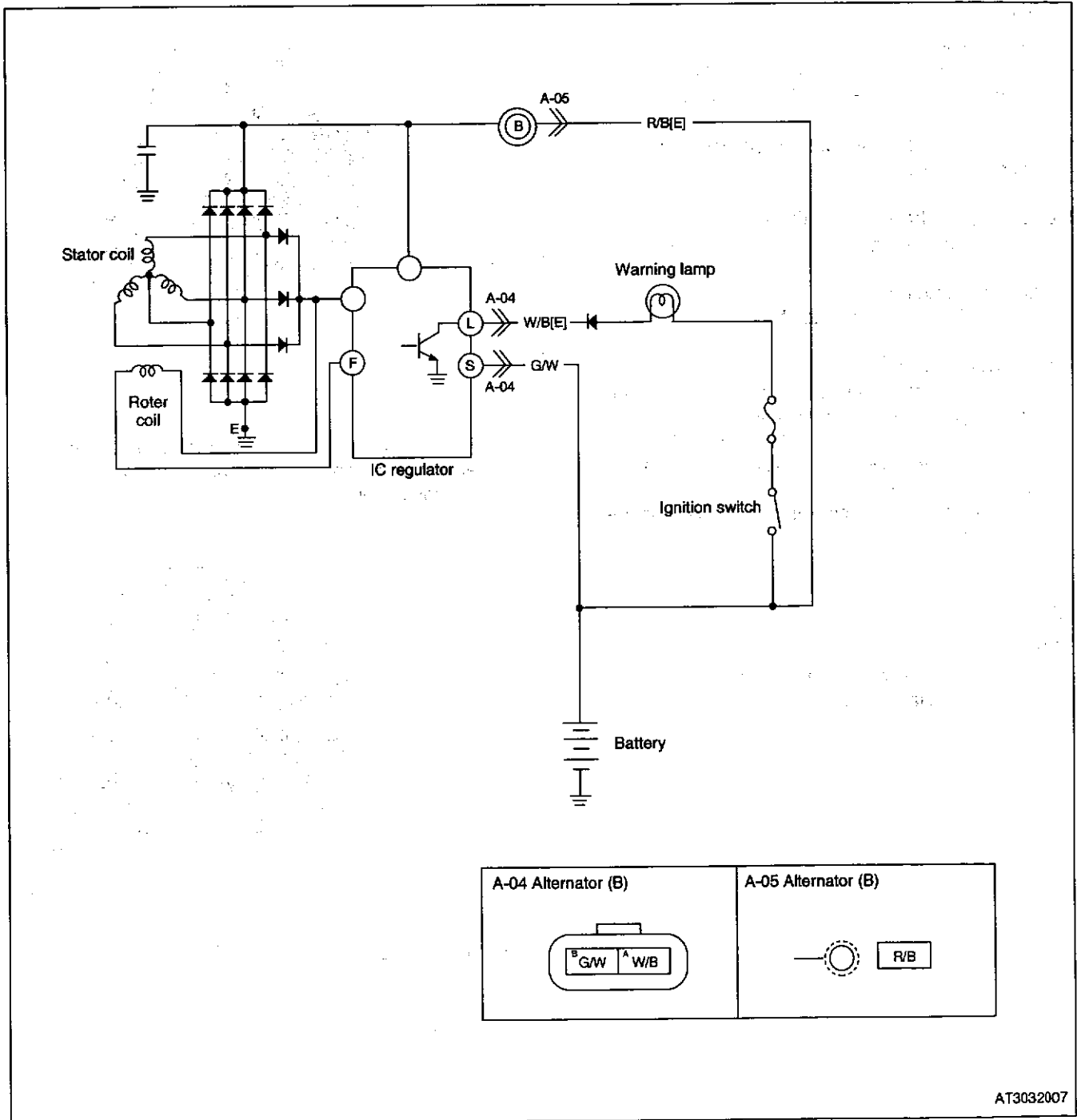
## SPECIFICATIONS

### Battery and alternator Specifications

Engine / Transaxle		J3 COMMON RAIL SYSTEM	
		M/T	A/T
Battery	Voltage (V)	12V-negative	
	Type	PT80 - 33FL MF	
	Capacity (20 hour rate) (AH)	80AH	
Alternator	Type	AC	
	Output (V-A)	12-110	
	Regulator type	Transistorized (Built - in IC regulator)	
	Regulator voltage (V)	14.1~14.7	

# DESCRIPTION AND OPERATION

## Alternator Circuit diagram



## ON-VEHICLE SERVICE PROCEDURES

### Battery

#### Inspection

##### Electrolyte level

1. Check whether or not the electrolyte level lines between "UPPER LEVEL" line and "LOWER LEVEL" line.
2. If low, add distilled water to "upper level" line. Do not overfill.

##### Specific gravity of electrolyte

1. Measure specific gravity with a hydrometer.

##### Specific gravity:

1.27~1.29 (at 77°F[25°C])

##### Terminal and cable

1. Check that battery terminal connections are tight to ensure good electrical connections.
2. Check for corroded or frayed battery cables.
3. Check rubber protector on positive terminal for proper coverage.
4. Clean terminals, if necessary, and lightly coat them with grease.

### Drive belt

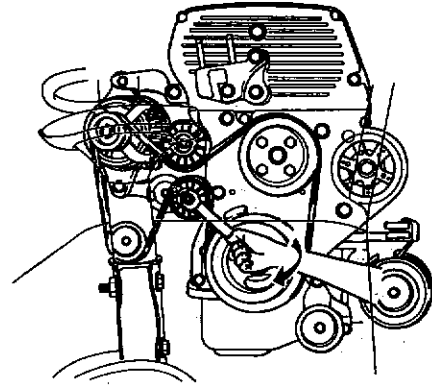
#### Inspection

1. Check drive belt and pulley for wear, cracks and prying. Replace if necessary.

### Alternator

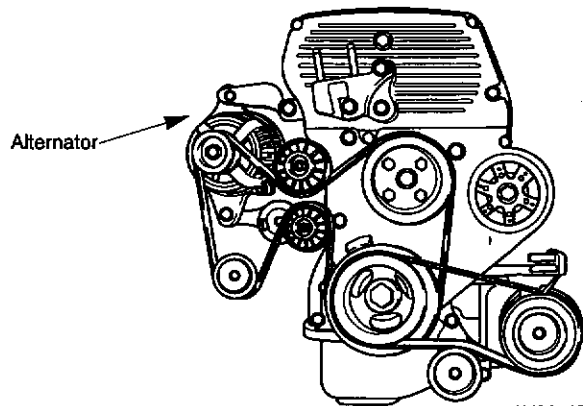
#### Removal and replacement

1. Disconnect negative battery cable.
2. Lower an auto tensioner with spanner and then remove drive belt.



AV2A10B038

3. Remove "B" terminal lead and then disconnect alternator "L" and "S" terminal connector.
4. Remove alternator.



AV2A10B002

5. Install in reverse order of removal.

##### Tightening torque:

33.2 lb-ft (45.1 N·m, 4.6 kg-m)