# ENGINE ELECTRIC DEVICES

1452-01

## GENERAL

## 1. GENERAL SPECIFICATIONS

| Application | | | Unit | Gasoline Engine |
|---|---|---|---|---|
| Starter | Type | | - | PG170S |
| | Output power | | Kw | 1.8 |
| | No load test @ 12 volts | | A | 98 |
| | Drive pinion speed at no load | | rpm | 2,600 |
| | Drive pinion speed at load | | rpm/A | 1,087/380 |
| | Brush length | | mm | 16.1 |
| | Armature diameter | | mm | 54.1 |
| | Armature run-out | | mm | 0.08 |
| | Segment groove depth | | mm | 19.6 |
| Alternator | Type | | - | SG135 |
| | Output voltage / current | | V/A | 14/115 |
| | Regulator type | | - | HYBRID |
| | Regulating voltage | | V | 14.7 |
| | Brush | Length | mm | 18.5 |
| | | Quantity | - | 2 |
| | | Abrasion limit | mm | 13.5 |
| Battery | Type | | - | MF |
| | Capacity | | AH | 75 |
| | Reserve capacity | | RC | 130 |
| Ignition coil | Type | | - | DIS |
| | Primary coil resistance | | W | 0.3 ~ 0.9 |
| | Secondary coil resistance | | KW | 6 ~ 8.5 |
| Spark plug | Type | | - | WR8DC |
| | Clearance | | - | 0.8 ~ 0.9 |
| High tension cable | Resistance | | KW/m | 1.9 |

# 2. FASTENER TIGHTENING SPECIFICATIONS

| Application | Nm | Lb-Ft | Lb-In |
|---|---|---|---|
| Batter cable nut | 12 ~ 18 | 9 ~ 13 | - |
| Battery cable nut on starter | 12 ~ 15 | 9 ~ 11 | - |
| Batter mounting bracket nut | 12 ~ 18 | 9 ~ 13 | - |
| Engine electric wire nut on starter | 6 ~ 7 | - | 53 ~ 62 |
| Alternator combination bolt | 42 ~ 50 | 31 ~ 37 | - |
| Alternator terminal b+ nut | 14 ~ 18 | 10 ~ 13 | - |
| Alternator terminal d+ nut | 4 ~ 5 | - | 35 ~ 44 |
| Ignition cable cover bolt | 9 ~ 11 | - | 80 ~ 97 |
| Ignition coil bolt | 9 ~ 11 | - | 80 ~ 97 |
| Spark plug | 25 ~ 30 | 15 ~ 22 | - |
| Starter mounting bolt | 35 ~ 48 | 26 ~ 35 | - |



| | |
|---|---|
| Modification basis | |
| Application basis | |
| Affected VIN | |

# OVERVIEW AND OPERATION PROCESS

## 1. CHARGING SYSTEM OPERATION

Alternators use a new type of regulator that incorpo-rates a diode trio. A Delta stator, a rectifier bridge, and a rotor with slip rings and brushes are electrically similar to earlier alternators.
A conventional pulley and fan are used. There is no test hole.

### 1) CHARGING TIME REQUIRED

The time required to charge a battery will vary depending upon the following factors:

▶ Size of Battery
- A Completely discharged large heavy-duty battery required more than twice the recharging time as a completely discharged small passenger car battery.

▶ Temperature
- A longer time will be needed to charge any battery at −18°C (0°F) than at 27°C (80°F). When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first. The battery will accept a higher current rate as the battery warms.

▶ Charger Capacity
- A charger which can supply only 5 amperes will require a much longer charging period than a charger that can supply 30 amperes or more.

▶ State-of-Charge
- A completely discharged battery requires more than twice as much charge as a onehalf charged battery. Because the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the current accepted by the battery is very low at first. Later, as the charging current causes the electrolyte acid content to increase, the charging current will likewise increase.

## 2. STARTING SYSTEM OPERATION

The engine electrical system includes the battery, the ignition, the starter, the alternator, and all the related wiring. Diagnostic tables will aid in troubleshooting system faults. When a fault is traced to a particular component, refer to that component section of the service manual. The starting system circuit consists of the battery, the starter motor, the ignition switch, and all the related electrical wiring. All of these components are connected electrically.

# 3. IGNITION SYSTEM OPERATION

This ignition system does not use a conventional distributor and coil. It uses a crankshaft position sensor input to the Engine Control Module (ECM).
The ECM then determines Electronic Spark Timing (EST) and triggers the electronic ignition system ignition coil.
This type of distributorless ignition system uses a "waste spark" method of spark distribution. Each cylinder is paired with the cylinder that is opposite it (2.3L DOHC: 2 - 3 or 1 - 4, 3.2L DOHC: 1 - 6 or 2 - 5 or 3 - 4).
The spark occurs simultaneously in the cylinder coming up on the compression stroke and in the cylinder coming up on the exhaust stroke.
The cylinder on the exhaust stroke requires very little of the available energy to fire the spark plug.
The remaining energy is available to the spark plug in the cylinder on the compression stroke. These systems use the EST signal from the ECM to control the EST.
The ECM uses the following information: Engine load (mass air flow sensor, manifold air pressure sensor).
Engine coolant temperature.
Intake air temperature.
Crankshaft position.
Engine speed (rpm).

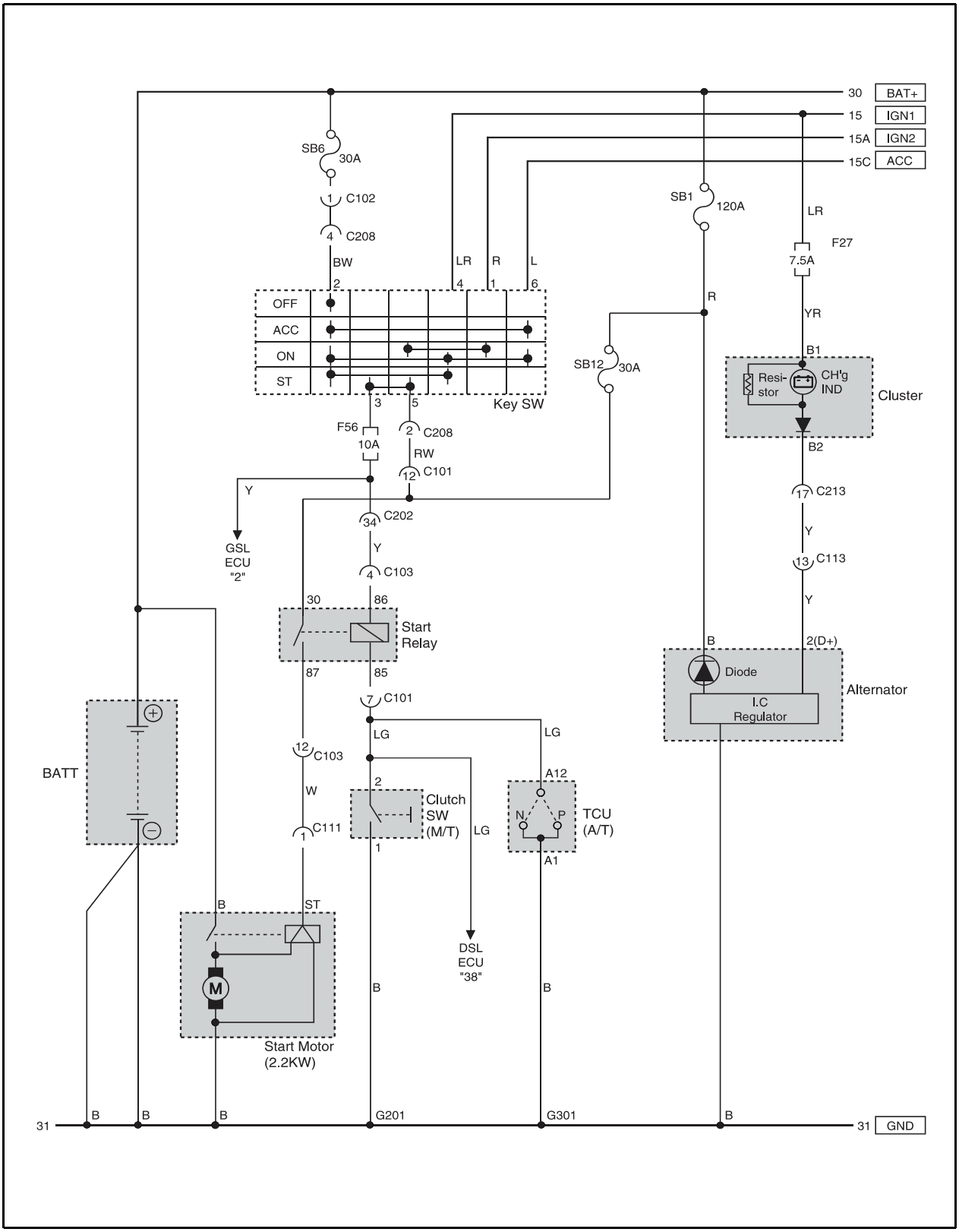
## 1) Electronic Ignition System Ignition Coil

The Electronic Ignition (EI) system ignition coil is located on the cylinder head cover.
The double ended coils re ceive the signal for the ECM which controls the spark advance.
Each EI system ignition coil provides the high voltage to two spark plugs simultaneously;
3.2L DOHC
T1/1: cylinder 2 and 5
T1/2: cylinder 3 and 4
T1/3: cylinder 1 and 6
The EI system ignition coil is not serviceable and must be replaced as an assembly.



| | |
|---|---|
| Modification basis | |
| Application basis | |
| Affected VIN | |

# 4. STARTING AND CHARGING SYSTEM (GASOLINE ENGINE) CIRCUIT




| | |
|---|---|
| Modification basis | |
| Application basis | |
| Affected VIN | |