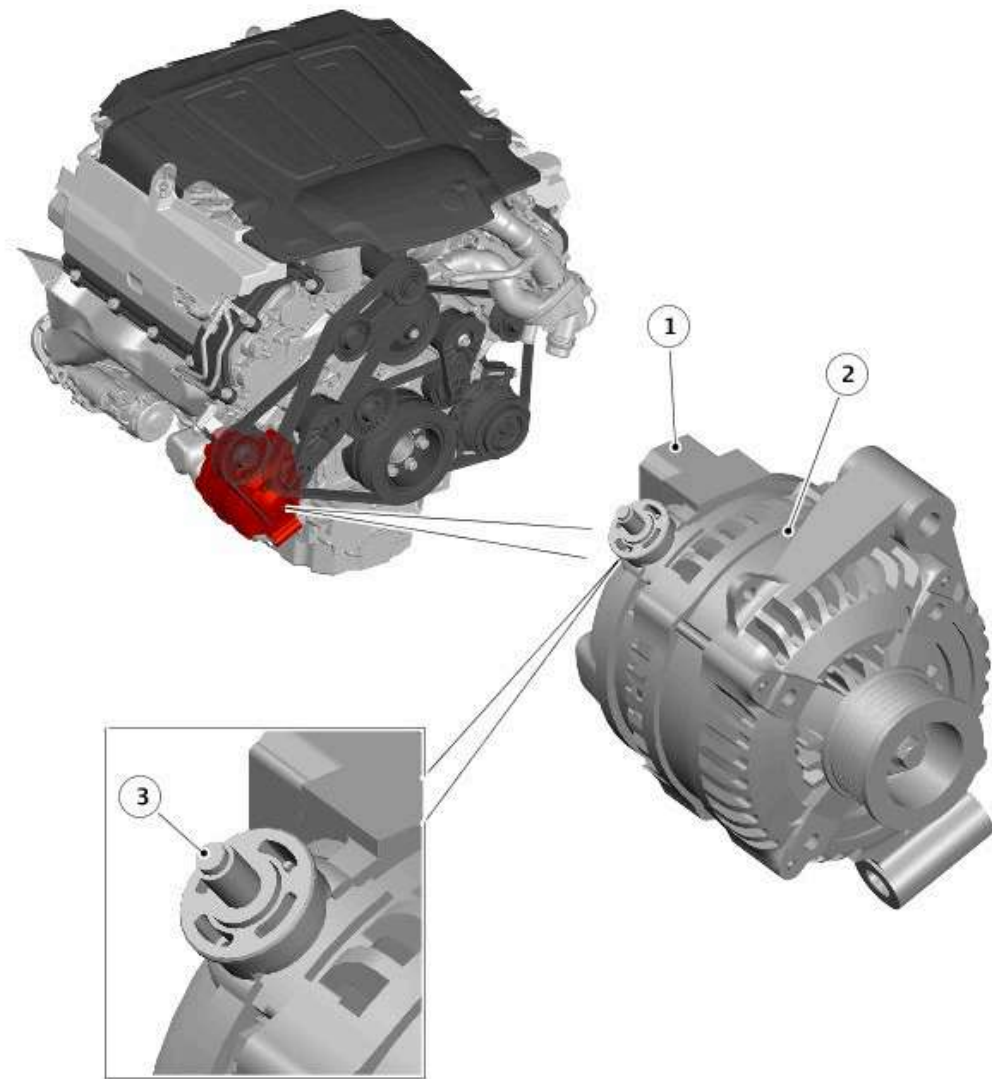


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GENERATOR AND REGULATOR - V6 S/C 3.0L PETROL GENERATOR [G1851494]

DESCRIPTION AND OPERATION

COMPONENT LOCATION



E173379

ITEM	DESCRIPTION
1	Local Interconnect Network (LIN) bus connection

ITEM	DESCRIPTION
2	Generator
3	Battery positive connection

OVERVIEW

A single self-exciting generator is located at the front of the engine on the right side of the cylinder block, and is driven at approximately three times engine speed by the primary drive belt.

When the engine is running the generator produces an Alternating Current (AC), which is converted to a Direct Current (DC) internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the battery positive cable through the Battery Junction Box (BJB).

DESCRIPTION

GENERATOR AND REGULATOR

The generator comprises the following major components:

- Stator
- Rotor
- Rectifier pack
- Regulator.

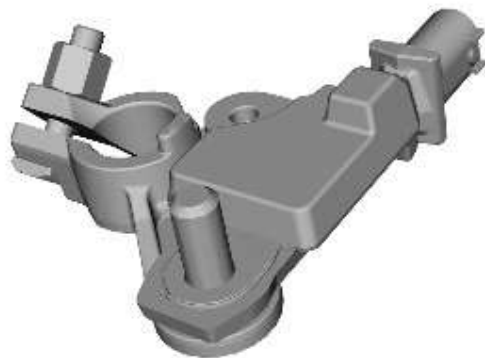
The stator consists of a flat core pack into which the stator wires are pressed.

The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The rotor is housed within the stator and mounted on bearings to provide smooth running and support, due to the side loading applied by the drive belt tension.

The rectifier contains 6 pairs of diodes (six on the positive plate and six on the negative plate) mounted on a heat sink. The heat sink dissipates the resultant heat created in the electrical conversion process. The rectifier converts the AC produced in the stator coils into DC that is required by the vehicle electrical system.

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. B+ terminal supplies the rectified and regulated DC from the generator via a large diameter cable to the battery positive terminal. The second terminal provides the Local Interconnect Network (LIN) bus connection between the regulator and the Body Control Module / Gateway Module (BCM/GWM) assembly.

BATTERY MONITORING SYSTEM [BMS]



E133518

The Battery Monitoring System (BMS) control module is located on the battery negative terminal, and connected to the BCM/GWM assembly via a LIN bus connection. The BMS module contains software maps that provide a mathematical model of battery conditions, and constantly receives information from the BCM/GWM assembly regarding the vehicle state and electrical loading.

The BMS control module monitors various battery parameters, which are directly measured and predictive values:

- Battery current and voltage are the result of direct measurement;
- While state of charge, state of function and electrolyte temperature are predicted values.

These signals are used by both the charging system and the stop/start system to ensure the vehicle functions are optimized. The measurement is autonomous and happens in all states to enable an accurate condition of the battery to be assessed at all times. Software based values are calculated and used as a backup in the event of a system fault condition. If any of the measured/predicted values do not meet the necessary thresholds, the stop/start feature will be suspended until the thresholds are met. In the case of a fault condition, the stop/start system will be disabled for the duration of the particular drive cycle. Diagnostic Trouble Codes (DTC)'s relating to faults will be stored in the BCM/GWM assembly.

The BMS control module also has a hardwired connection to the battery positive terminal. This connection is used to avoid any potential voltage drop in the circuit which results incorrect information received by the BMS control module. If this connection becomes open, the BCM/GWM assembly detects a communication loss with the BMS control module. Then the BCM/GWM assembly default to a fail-safe fixed charging voltage of 14 Volts, stores a related DTC, and sends a message to the Instrument Cluster (IC) via the High Speed (HS) Controller Area Network (CAN) comfort systems bus to illuminate the charge warning indicator. For additional information, refer to: [Instrument Cluster \(413-01 Instrument Cluster, Description and Operation\)](#).

OPERATION

The charging system consists of a generator and regulator assembly and the Body Control Module / GateWay Module (BCM/GWM) assembly. The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the battery in a charged state. The rate of charge for the battery is controlled by the BCM/GWM assembly. For additional information, refer to: [Battery and Cables](#) (414-01 Battery, Mounting and Cables, Description and Operation).

The regulator is connected via the Local Interconnect Network (LIN) bus to the BCM/GWM assembly, the Battery Monitoring System (BMS) control module is also connected via the LIN bus to the BCM/GWM assembly. The BCM/GWM assembly receives information from the BMS regarding battery conditions. The BCM/GWM assembly uses the information from the BMS control module to set the target voltage via the LIN bus then the BCM/GWM assembly sends it via the LIN bus to the generator. The charging voltage range is 12.3V to 14.8V (at the battery). The LIN bus is also used to communicate a mechanical failure, or fault in the wiring and connections from the generator to the BCM/GWM assembly. A Diagnostic Trouble Code (DTC) is stored in the BCM/GWM assembly and if necessary, the charge warning indicator lamp is illuminated in the Instrument Cluster (IC) after a short delay.

During engine starting the charge warning indicator lamp is illuminated in the IC when the ignition is energized, and is extinguished when the engine starts and the BCM/GWM assembly detects a generator output voltage.

SMART REGENERATIVE CHARGING

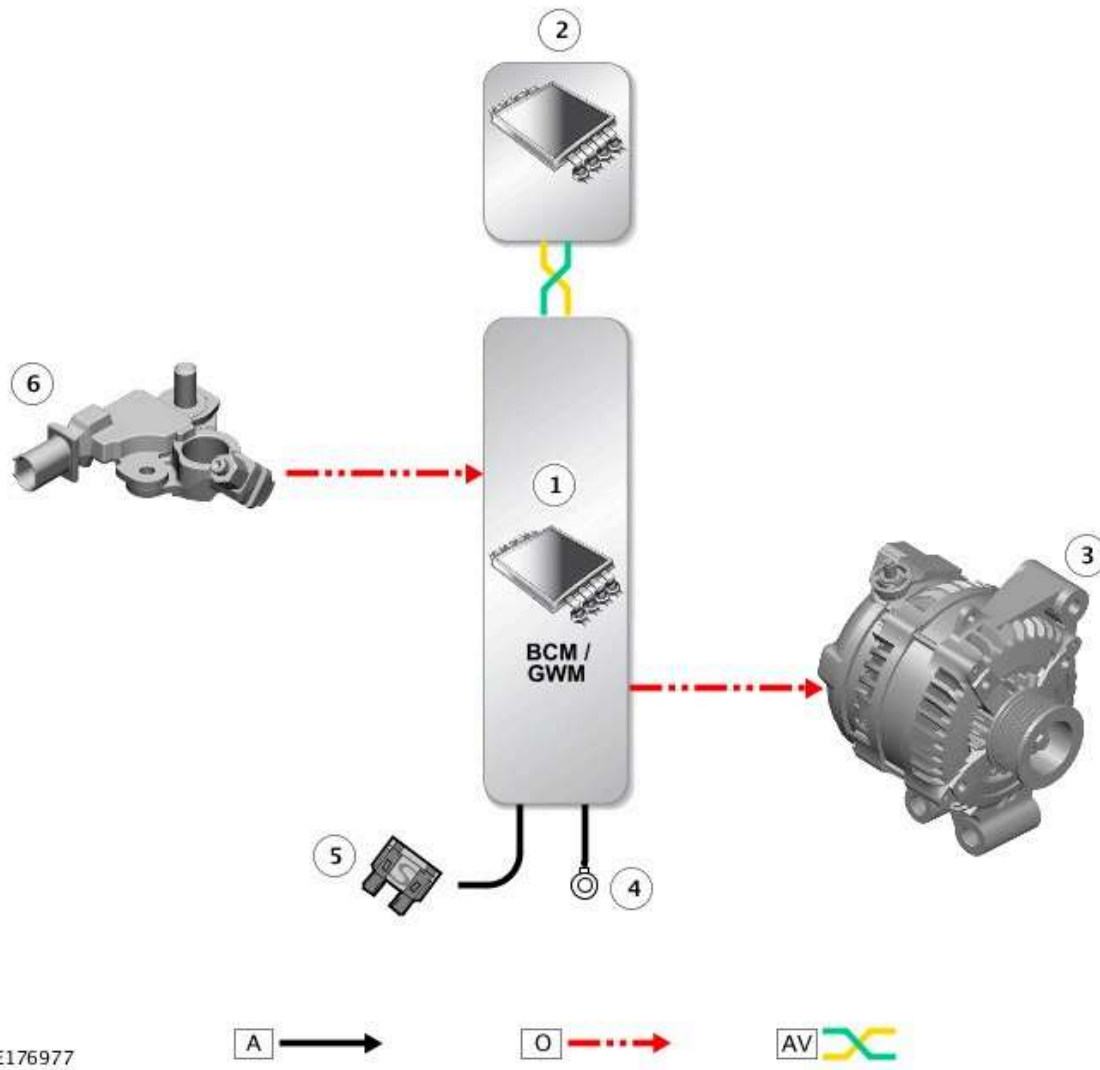
A smart regenerative charging system increases the alternator output when the vehicle brakes or decelerates. This converts the kinetic energy of the vehicle into electric energy without having to use additional fuel.

The smart regenerative feature is allowed to operate within certain environmental constraints to ensure the feature delivers the greatest benefit possible whilst maintaining system integrity.

The 'free' electric energy is captured by charging the battery above the target level. This energy can be used by the electrical systems at a later stage. This could be when the engine is switched off during a stop-phase, but can also be when the generator is operating in a less efficient mode.

The battery state of charge can be corrected both up and down to achieve the most appropriate level to maximize the benefit of the smart regenerative charging feature. If the BCM/GWM assembly decides there is recoverable energy available, then the alternator charge setpoint will be overridden and the extra system voltage will allow the battery to consume a proportion of the recoverable energy. If the battery is at a high state of charge, then some of the additional energy can be used to contribute by means of load reduction when there is a significant torque demand on the engine. By monitoring which loads are active and altering both the ultimate voltage levels and the rate at which they are changed any visible effects of the feature operating are minimized.

CONTROL DIAGRAM



A = HARDWIRED; O = LOCAL INTERCONNECT NETWORK [LIN] BUS; AV = HIGH SPEED [HS] CONTROLLER AREA NETWORK [CAN] COMFORT BUS.

ITEM	DESCRIPTION
1	Body Control Module / Gateway Module (BCM/GWM) assembly
2	Instrument Cluster (IC)
3	Generator
4	Ground
5	Fuse
6	Battery Monitoring System (BMS) control module

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