Chapter 5 Part D: Starting and charging systems

Contents

| Alternator - brush and voltage regulator renewal | 8 | Battery - charging | 3 |
|--|---|--|---|
| Alternator - removal and refitting | 7 | General information and precautions | 1 |
| Alternator - testing | 6 | Starting motor - brush renewal | 1 |
| Alternator drivebelt - inspection and adjustment | 5 | Starting motor - removal and refitting | 0 |
| Battery - removal and refitting | 4 | Starting motor - testing | 9 |
| Battery - maintenance | 2 | | |

Degrees of difficulty

Easy, suitable for novice with little experience



Fairly easy, suitable for beginner with some experience



Fairly difficult, suitable for competent



Difficult, suitable for experienced DIY mechanic



Very difficult, suitable for expert DIY or professional

Specifications

System

Type 12 volt, negative earth

Battery

Rating . . . 36 Ah or 45 Ah Minimum voltage (under load) 9.6 volts at 110 amps

Alternator

Bosch or Motorola 55, 65 or 90 amp 5.0 mm Rotor winding resistance (ohms): **Bosch** Motorola 55 amp 3.1 to 3.3 2.9 to 3.2 2.8 to 3.1 3.9 to 4.1 90 amp 3.0 to 4.0

Starter motor

Type Pre-engaged Application/VW part No: 036 911 023 G 1.3 litre 036 911 023 H 1.6 litre: Manual gearbox 055 911 023 G 055 911 023 A Automatic transmission 027 911 023

| Nm | lbf ft |
|----|---------------------------|
| | |
| 20 | 15 |
| 60 | 44 |
| 20 | 15 |
| | |
| 40 | 30 |
| 45 | 33 |
| 45 | 33 |
| 25 | 18 |
| | Nm 20 60 20 40 45 45 25 |

General information and precautions

General information

The starting and charging system is of a 12 volt negative earth type. The battery is charged by a belt-driven alternator which incorporates a voltage regulator. The starter motor is of pre-engaged type, incorporating a solenoid which moves the drive pinion into engagement with the flywheel/driveplate ring gear before the motor is energised.

An automatic stop-start system is fitted as optional equipment to some models and is a fuel economy device. Activated by a control switch, the system automatically switches off the engine when the vehicle is stationary during traffic delays.

The system is switched on and off by means of a switch on the dash insert between the instrument panel and the heater/fresh air control panel. A warning light in the switch advises when the system is switched on.

The system should only be used when the vehicle has reached its normal operating temperature. When activated, the system will automatically stop the engine when the vehicle speed drops below 3.1 mph (5 kph) and has run at its normal idle speed for a period of at least 2 seconds. In addition the vehicle must previously have been driven at a speed in excess of 3.1 mph (5 kph).

When traffic conditions permit, the engine can be restarted by depressing the clutch pedal and moving the gear lever fully to the left in neutral. Once the engine has restarted, gear engagement can be made in the normal manner. If for any reason the engine stalls or stops after restarting, the restart procedure should be repeated but the gear lever must be moved back into neutral within 6 seconds.

Precautions

It is necessary to take extra care when working on the electrical system to avoid damage to semi-conductor devices (diodes and transistors) and to avoid the risk of personal injury. In addition to the precautions given in the "Safety first!" Section at the beginning of this Manual, take note of the following:

- a) Before disconnecting any wiring or removing components, always ensure that the ignition is switched off.
- b) Disconnect the battery leads before using a mains charger.
- c) Do not reverse the battery connections. Components such as the alternator or any other having semi-conductor circuitry could be irreparably damaged.
- d) If the engine is being started using jump leads and a slave battery, connect the batteries positive to positive and negative to negative. This also applies when connecting a battery charger.

- e) Never disconnect the battery terminals or alternator multi-plug connector when the engine is running.
- f) The battery leads and alternator multiplug must be disconnected before carrying out any electric welding on the vehicle.
- g) Never use an ohmmeter of the type incorporating a hand cranked generator for circuit or continuity testing.
- h) When carrying out welding operations on the vehicle using electric welding equipment, disconnect the battery and alternator.

The following precautions should be taken when using the automatic stop-start system:

- a) Do not use the system when the engine temperature is below 55°C or when the ambient temperature is very low as the engine will take longer to warm up
- b) Do not allow the vehicle to roll when the engine is switched off, check that the handbrake is fully applied
- c) During extended delays, switch the engine off in the normal manner with the ignition key as electrical accessories will otherwise be left on and the battery run down
- d) If leaving the vehicle for any length of time, switch off the system and always take the ignition key with you
- 2 Battery maintenance

Refer to "Weekly Checks".

3 Battery - charging



Warning: The battery will be emitting significant quantities of (highly-inflammable) hydrogen gas during charging and for

approximately 15 minutes afterwards. Do not allow sparks or naked flames near the battery or it may explode.

Caution: Specially rapid "boost" charges which are claimed to restore the power of a battery in 1 to 2 hours are not recommended as they can cause serious damage to the battery plates through overheating

Caution: If the battery is being charged from an external power source whilst the battery is fitted in the vehicle, both battery leads must be disconnected to prevent damage to the electrical circuits.

1 In winter when heavy demand is placed on the battery (starting from cold and using more electrical equipment), it is a good idea occasionally to have the battery fully charged from an external source. The charge rate will depend on battery type. For most owners however, the best method will be to use a trickle-charger overnight, charging at a rate of 1.5 amps.

- 2 Rapid boost' charges which are claimed to restore the power of the battery in 1 to 2 hours are not recommended, as they can cause serious damage to the battery plates through overheating and may cause a sealed battery to explode.
- 3 Ideally, the battery should be removed from the vehicle before charging and moved to a well-ventilated area.
- 4 Continue to charge the battery until all cells are gassing vigorously and no further rise in specific gravity or increase in no-load voltage is noted over a four-hour period. When charging is complete, turn the charger off before disconnecting its leads from the battery.

4 Battery - removal and refitting



Caution: When reconnecting the battery, always connect the positive lead first and the negative lead last.

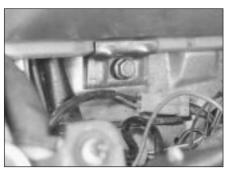
Note: If renewing the battery, a centralised ventilation type battery is recommended rather than one with ventilation plugs. If a battery with ventilated plugs is fitted, it will be necessary to fit a protective cover over the battery to prevent water spray entering and causing it to be over-filled, which would cause the acid level within the battery to overflow and damage surrounding components

Removal

- **1** The battery is located in the engine compartment on the left-hand side.
- 2 Loosen the battery terminal clamp nuts and disconnect the negative lead followed by the positive lead (see illustration).
- **3** Unscrew the bolt and remove the battery retaining clamp (see illustration).
- 4 Lift the battery from its platform whilst taking care not to spill any electrolyte on the bodywork.



4.2 Battery positive terminal connection



4.3 Battery retaining clamp and bolt

Refitting

- 5 Refitting is a reversal of removal. Note the following:
- a) Ensure that the leads are fitted to their correct terminals
- b) Do not overtighten the lead clamp nuts or battery retaining clamp bolt
- c) Smear a little petroleum jelly on the terminals and clamps
- 5 Alternator drivebelt inspection and adjustment





7.2 Lead multi-plug and retaining clip (arrowed) - Bosch alternator

6 Alternator - testing



- 1 Accurate testing of the alternator is only possible using specialised instruments and is therefore best left to a qualified electrician.
- **2** If the alternator is faulty, the condition of all brushes, soldered joints, etc., can be checked.
- **3** If no fault is found, refit the alternator and have it checked professionally.
 - 7 Alternator removal and refitting



Removal

- 1 Disconnect the battery negative lead.
- 2 Release the clip and pull the multi-plug from the rear of the alternator (see illustration).
- 3 Loosen the pivot and adjustment bolts (see illustration) then push the alternator in towards the engine and slip the drivebelt from the alternator.
- 4 Remove the adjustment link nut and washer.
- 5 Support the alternator then remove the pivot bolt and withdraw the unit from the engine.



7.3 Alternator pivot bolt and bracket – 1.3 litre

Refitting

- **6** Refitting is a reversal of removal. Before fully tightening the pivot and adjustment bolts, tension the drivebelt.
 - 8 Alternator brush and voltage regulator renewal



Bosch

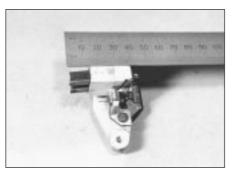
- 1 Disconnect the battery negative lead.
- **2** Wipe clean the exterior surfaces of the alternator around the voltage regulator.
- **3** Remove the two screws and withdraw the voltage regulator and brush assembly from the rear of the alternator (see illustration).
- 4 Check that the length of the carbon brushes is not less than the minimum amount specified (see illustration).
- **5** If the brushes are serviceable, clean them with a solvent-moistened cloth.
- **6** Check that brush spring pressure is equal for both brushes and holds the brushes securely against the slip rings. If in doubt about the condition of the brushes and springs, compare them with new items.
- 7 If the brushes are over worn, unsolder the brush leads and remove the brushes. Clean the housing, insert the new brushes and solder the new leads into position.
- **8** Clean the slip rings with a solvent-moistened cloth, then check for signs of scoring, burning or severe pitting. If worn or damaged, the slip rings should be attended to by an auto-electrician.
- **9** Reassembly is a reversal of the dismantling procedure.

Motorola

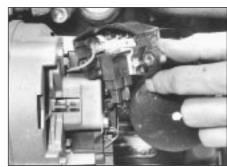
10 This procedure is similar to that described for the Bosch alternator. Identify the regulator wires for position before disconnecting them (see illustration).



8.3 Removing voltage regulator and brush assembly



8.4 Checking alternator brush length



8.10 Voltage regulator/brush unit removal



10.4 Starting motor solenoid wiring connections – 1.3 litre

9 Starting motor - testing

Note: The following test was carried out with the starter motor in the vehicle

- 1 If the starter motor fails to operate, first check the condition of the battery by switching on the headlamps. If they glow brightly, then gradually dim after a few seconds, the battery is in an uncharged condition.
- 2 If the battery is in good condition, check the wiring connections on the starter for security and also check the earth wire between the gearbox and body.
- 3 If the starter still fails to turn, use a voltmeter or 12 volt test lamp and leads to check that current is reaching the main terminal (terminal 30) on the starter solenoid.
- 4 With the ignition switched on and the ignition key in the start position, check that current is reaching the remaining terminals on the solenoid. Also check that an audible click is heard as the solenoid operates indicating that

the internal contacts are closed and that current is available at the field windings terminal.

- **5** Failure to obtain current at terminal 50 indicates a faulty ignition switch.
- **6** If current at the correct voltage is available at the starter motor, yet it does not operate, the unit is faulty and should be removed for further investigation .

10 Starting motor - removal and refitting

Removal

- ${\bf 1}\,$ Disconnect the earth lead from the battery.
- 2 Jack up the front of the vehicle and support it on axle stands (see "Jacking and vehicle support"). Apply the handbrake.
- **3** Where a heat deflector plate is fitted, undo the retaining nuts and remove the plate.
- 4 Identify the wiring for position then disconnect it from the solenoid (see illustration).
- 5 Where applicable, unbolt and detach the support bracket.
- **6** For 1.6 and 1.8 litre engines, move the steering fully to the right and if necessary detach the right-hand driveshaft at the gearbox drive flange to allow room for removal of the starter motor.
- 7 Undo the retaining bolts and withdraw the starter motor.

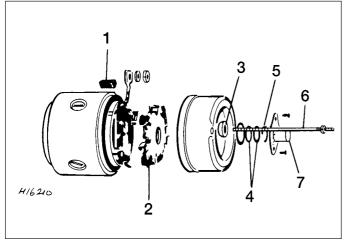
Refitting

- **8** Refitting is a reversal of removal. Tighten all bolts to the specified torque.
- **9** Where a support bracket is fitted, do not fully tighten the nuts and bolts until the bracket is correctly located and free of any tension.

11 Starting motor - brush renewal



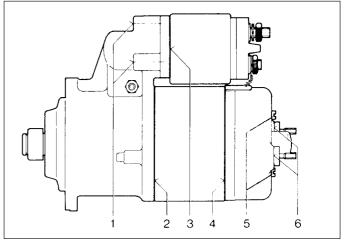
- 1 With the starter motor removed from the vehicle, wipe clean its exterior around the end cover (see illustration).
- 2 Remove the screws and lift off the end cap, then prise out the circlip and remove the shims whilst noting their fitted positions.
- **3** Unscrew the through-bolts and remove the end cover.
- **4** Lift the springs and remove the brushes from their holder.
- 5 Check each brush for excessive wear and if in doubt, renew the brushes as a set. Compare them with new items if necessary.
- 6 To renew each brush, crush it with a pair of pliers and then clean its lead. Insert the lead into the new brush and splay out its end. Solder the lead in position but grip the lead next to the brush with long-nosed pliers in order to prevent the solder penetrating the flexible section of the lead. File off any surplus solder
- 7 Clean the commutator with a solventmoistened cloth and, if necessary, use fine glass paper to remove any carbon deposits. If the commutator is worn excessively, it cannot be machined and renewal is necessary.
- 8 Reassembly is a reversal of the dismantling procedure. Note that the unit must be sealed with suitable sealant on the surfaces shown (see illustration).



11.1 Starting motor brush assembly (typical)

- 1 Brushes
- 2 Brush holder
- 3 Bush
- 4 Shims

- 5 Circlip
- 6 Through-bolt
- 7 End cap



11.8 Surfaces to be sealed when reassembling starter motor

- 1 Solenoid securing screws
- 2 Starter/mounting surface
- 3 Solenoid joint
- 4 Starter/end cap joint
- 5 Through-bolts
- 6 Shaft cover joint and screws