



Chapter 5 Part A: Starting and charging systems

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Degrees of difficulty

Easy, suitable for novice with little experience



Fairly easy, suitable for beginner with some experience



Fairly difficult, suitable for competent DIY mechanic



Difficult, suitable for experienced DIY mechanic



Very difficult, suitable for expert DIY or professional



Specifications

System type	12-volt, negative earth
Battery	
Type	Low maintenance or 'maintenance-free' sealed for life
Charge condition:	
Poor	12.5 volts
Normal	12.6 volts
Good	12.7 volts
Alternator	
Type	Valeo or Mitsubishi (depending on model)
Starter motor	
Type	Valeo or Bosch (depending on model)

Torque wrench settings

At the time of writing, no torque wrench settings were available.

1 General information and precautions

General information

The engine electrical system consists mainly of the charging and starting systems. Because of their engine-related functions, these components are covered separately from the body electrical devices such as the lights, instruments, etc (which are covered in Chapter 13). On petrol engine models refer to Part B for information on the ignition system, and on diesel models refer to Part C for information on the preheating system.

The electrical system is of the 12-volt negative earth type.

The battery is of the low maintenance or 'maintenance-free' (sealed for life) type and is charged by the alternator, which is belt-driven from the crankshaft pulley.

The starter motor is of the pre-engaged type incorporating an integral solenoid. On starting, the solenoid moves the drive pinion into engagement with the flywheel ring gear before the starter motor is energised. Once the engine has started, a one-way clutch prevents the motor armature being driven by the engine until the pinion disengages from the flywheel.

Precautions

Further details of the various systems are given in the relevant Sections of this Chapter. While some repair procedures are given, the usual course of action is to renew the component concerned. The owner whose interest extends beyond mere component renewal should obtain a copy of the *Automobile Electrical & Electronic Systems Manual*, available from the publishers of this manual.

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 *Safety first!* at the beginning of this manual, observe the following when working on the system:

Always remove rings, watches, etc before working on the electrical system. Even with the battery disconnected, capacitive discharge could occur if a component's live terminal is earthed through a metal object. This could cause a shock or nasty burn.

Do not reverse the battery connections. Components such as the alternator, electronic control units, or any other components having semi-conductor circuitry could be irreparably damaged.

If the engine is being started using jump leads and a slave battery, connect the batteries positive-to-positive and

negative-to-engine earth (see *Booster battery (jump) starting*).

Never disconnect the battery terminals, the alternator, any electrical wiring or any test instruments when the engine is running.

Do not allow the engine to turn the alternator when the alternator is not connected.

Never test for alternator output by flashing the output lead to earth.

Never use an ohmmeter of the type incorporating a hand-cranked generator for circuit or continuity testing.

Always ensure that the battery negative lead is disconnected when working on the electrical system.

Before using electric-arc welding equipment on the car, disconnect the battery, alternator and components such as the fuel injection/ignition electronic control unit to protect them from the risk of damage.

The radio/cassette unit fitted as standard equipment by Citroën is equipped with a built-in security code to deter thieves. If the power source to the unit is cut, the anti-theft system will activate. Even if the power source is immediately reconnected, the radio/cassette unit will not function until the correct security code has been entered. Therefore, if you do not know the correct security code for the radio/cassette unit do not disconnect the battery negative terminal of the battery or remove the radio/cassette unit from the vehicle. Refer to the Radio/cassette unit anti-theft system precaution Section for further information.

2 Electrical fault finding - general information

Refer to the information given in Chapter 13.

3 Battery - testing and charging

Standard and low maintenance battery - testing

1 If the vehicle covers a small annual mileage, it is worthwhile checking the specific gravity of the electrolyte every three months to determine the state of charge of the battery. Use a hydrometer to make the check and compare the results with the following table.

	Above 25°C	Below 25°C
Fully-charged	1.210 to 1.230	1.270 to 1.290
70% charged	1.170 to 1.190	1.230 to 1.250
Discharged	1.050 to 1.070	1.110 to 1.130

2 If the battery condition is suspect, first check the specific gravity of electrolyte in

each cell. A variation of 0.040 or more between any cells indicates loss of electrolyte or deterioration of the internal plates.

3 If the specific gravity variation is 0.040 or more, the battery should be renewed. If the cell variation is satisfactory but the battery is discharged, it should be charged as described later in this Section.

Maintenance-free battery - testing

4 In cases where a 'sealed for life' maintenance-free battery is fitted, topping-up and testing of the electrolyte in each cell is not possible. The condition of the battery can therefore only be tested using a battery condition indicator or a voltmeter.

5 Certain models may be fitted with a maintenance-free battery, with a built-in charge condition indicator. The indicator is located in the top of the battery casing, and indicates the condition of the battery from its colour. If the indicator shows green, then the battery is in a good state of charge. If the indicator shows black, then the battery requires charging, as described later in this Section. If the indicator shows blue, then the electrolyte level in the battery is too low to allow further use, and the battery should be renewed. Do not attempt to charge, load or jump start a battery when the indicator shows blue.

6 If testing the battery using a voltmeter, connect the voltmeter across the battery and compare the result with those given in the Specifications under 'charge condition'. The test is only accurate if the battery has not been subjected to any kind of charge for the previous six hours. If this is not the case, switch on the headlights for 30 seconds, then wait four to five minutes before testing the battery after switching off the headlights. All other electrical circuits must be switched off, so check that the doors, boot and/or tailgate are fully shut when making the test.

7 If the voltage reading is less than 12.2 volts, then the battery is discharged, whilst a reading of 12.2 to 12.4 volts indicates a partially discharged condition.

8 If the battery is to be charged, remove it from the vehicle (Section 4) and charge it as described later in this Section.

Standard and low maintenance battery - charging

Note: The following is intended as a guide only. Always refer to the manufacturer's recommendations (often printed on a label attached to the battery) before charging a battery.

9 Charge the battery at a rate of 3.5 to 4 amps and continue to charge the battery at this rate until no further rise in specific gravity is noted over a four hour period.

10 Alternatively, a trickle charger charging at the rate of 1.5 amps can safely be used overnight.

11 Specially 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.

12 While charging the battery, note that the temperature of the electrolyte should never exceed 37.8°C (100°F).

Maintenance-free battery - charging

Note: The following is intended as a guide only. Always refer to the manufacturer's recommendations (often printed on a label attached to the battery) before charging a battery.

13 This battery type takes considerably longer to fully recharge than the standard type, the time taken being dependent on the extent of discharge.

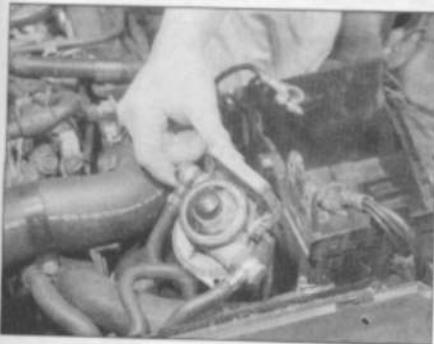
14 A constant voltage type charger is required, to be set, when connected, to 13.9 to 14.9 volts with a charger current of 5.0 amps maximum. Using this method, the battery should be charged within twenty four hours.

4 Battery - removal and refitting

Note: On models equipped with a Citroën anti-theft alarm system, disable the alarm before disconnecting the battery (see Chapter 13). If a Citroën radio/cassette unit is fitted, refer to Radio/cassette unit anti-theft system - precaution.

Removal

- 1 The battery is located on the left-hand side of the engine compartment. Where applicable, remove the plastic cover from the battery holder.
- 2 Slacken the clamp bolts and disconnect the clamp from the battery negative (earth) terminal.
- 3 Remove the insulation cover (where fitted) and disconnect the positive terminal lead(s) in the same way.
- 4 Unscrew the bolt(s) and remove the battery retaining bar.



4.5 On diesel models, detach the fuel filter/priming pump from the side of the battery holder

5 Lift the battery out of the engine compartment. If necessary, release all the relevant clips securing the wiring harness to the battery holder. Remove the screws and detach the fusebox(es) from the side of the battery tray. On diesel models, remove the screws and detach the fuel filter/priming pump and glow plug control unit from the side of the battery holder (see illustration).

6 Remove the securing bolts and lift the battery holder from the bodywork (see illustration). Where necessary, release the bonnet release cable from the battery holder, with reference to Chapter 12.

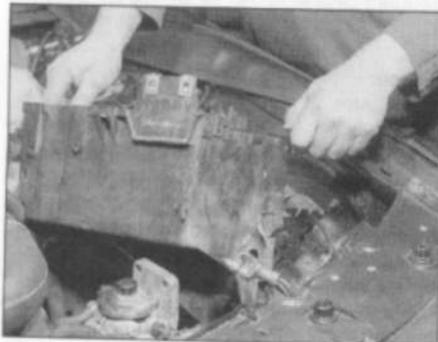
Refitting

7 Refitting is a reversal of removal, but smear petroleum jelly on the terminals when reconnecting the leads, and always reconnect the positive lead first, and the negative lead last.

5 Charging system - testing

Note: Refer to Safety first! and Section 1 of this Chapter before starting work.

- 1 If the ignition warning light fails to illuminate when the ignition is switched on, first check the alternator wiring connections for security. If satisfactory, check that the warning light bulb has not blown, and that the bulbholder is secure in its location in the instrument panel. If the light still fails to illuminate, check the continuity of the warning light feed wire from the alternator to the bulbholder. If all is satisfactory, the alternator is at fault and should be renewed or taken to an auto-electrician for testing and repair.
- 2 If the ignition warning light illuminates when the engine is running, stop the engine and check that the drivebelt is correctly tensioned (see Chapter 1A or 1B) and that the alternator connections are secure. If all is so far satisfactory, have the alternator checked by an auto-electrician for testing and repair.
- 3 If alternator output is suspect even though



4.6 Lift the battery holder from the engine compartment

the warning light functions correctly, the regulated voltage may be checked as follows.

- 4 Connect a voltmeter across the battery terminals and start the engine.
- 5 Increase the engine speed until the reading stabilises; the reading should be around 12 to 13 volts, and no more than 14 volts.
- 6 Switch on several electrical accessories (eg, the headlights, heated rear window and heater blower), and check that the regulated voltage is maintained around 13 to 14 volts.
- 7 If the regulated voltage is not as stated, the fault may be due to worn brushes, weak brush springs, a faulty voltage regulator, a faulty diode, a severed phase winding or worn or damaged slip rings. The alternator should be renewed or taken to an auto-electrician for testing and repair.

6 Alternator drivebelt - removal, refitting and tensioning

Refer to the procedure given for the auxiliary drivebelt in Chapter 1A or 1B.

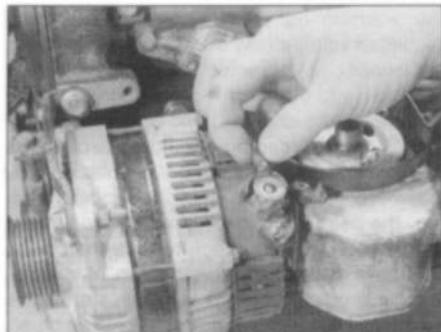
7 Alternator - removal and refitting

Removal

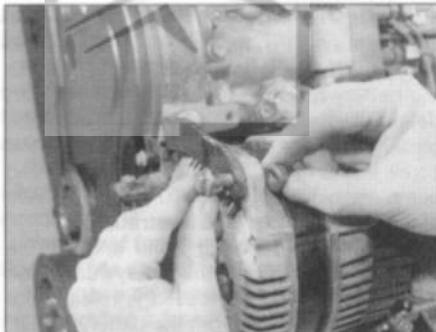
- 1 Disconnect the battery negative lead.
- 2 Slacken the auxiliary drivebelt (Chapter 1) and disengage it from the alternator pulley.
- 3 On 2.1 litre diesel models, unbolt the hydraulic system pump and move it to one side without disconnecting any hydraulic pipes or hoses (see Chapter 9).
- 4 Remove the rubber covers (where fitted) from the alternator terminals, then unscrew the nuts and disconnect the wiring from the rear of the alternator (see illustrations).
- 5 Unscrew the nut/bolt securing the alternator to the upper mounting bracket, then unscrew the lower mounting bolt. Note that, where a long through-bolt is used to secure



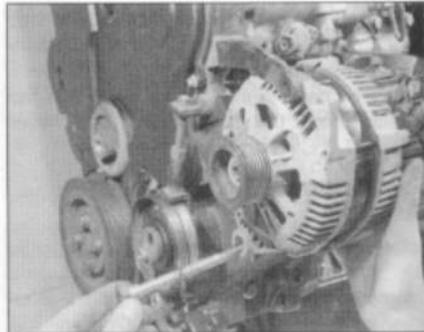
7.4a Remove the rubber covers from the alternator terminals . . .



7.4b ... then unscrew the nuts and disconnect the wiring from the rear of the alternator



7.5a Unscrew the nut and bolt securing the alternator to the upper mounting bracket ...



7.5b ... then unscrew the lower mounting bolt - 2.5 litre models shown

the alternator in position, the bolt does not need to be fully removed; the alternator can be disengaged from the bolt once it has been slackened sufficiently (see illustrations). On some models, you may need to remove the drivebelt idler/tensioner pulley to access the alternator mounting nuts and bolts (depending on model). On diesel models, prise out the cover shield fastener to allow the cover to be lifted to improve access to the upper bolt.

6 Manoeuvre the alternator away from its brackets and out from the engine bay.

Refitting

7 Refitting is a reversal of removal. Tension the auxiliary drivebelt (Chapter 1A or 1B) on models with a manually adjusted tensioner, and ensure the alternator mountings are tightened.

8 Alternator - testing and overhaul

If the alternator is thought to be suspect, it should be removed from the vehicle and taken to an auto-electrician for testing. Most auto-electricians will be able to supply and fit brushes at a reasonable cost. However, check on the cost of repairs before proceeding as it may prove more economical to obtain a new or exchange alternator.

9 Starting system - testing

Note: Refer to the precautions given in Safety first! and in Section 1 of this Chapter before starting work.

1 If the starter motor fails to operate when the ignition key is turned to the appropriate position, the following possible causes may be to blame.

- The battery is faulty.
- The electrical connections between the switch, solenoid, battery and starter motor are somewhere failing to pass the necessary current from the battery through the starter to earth.

- The solenoid is faulty.
- The starter motor is mechanically or electrically defective.

2 To check the battery, switch on the headlights. If they dim after a few seconds, this indicates that the battery is discharged - recharge (see Section 3) or renew the battery. If the headlights glow brightly, operate the ignition switch and observe the lights. If they dim, then this indicates that current is reaching the starter motor, therefore the fault must lie in the starter motor. If the lights continue to glow brightly (and no clicking sound can be heard from the starter motor solenoid), this indicates that there is a fault in the circuit or solenoid - see following paragraphs. If the starter motor turns slowly when operated, but the battery is in good condition, then this indicates that either the starter motor is faulty, or there is considerable resistance somewhere in the circuit.

3 If a fault in the circuit is suspected, disconnect the battery leads (including the earth connection to the body), the starter/solenoid wiring and the engine/transmission earth strap. Thoroughly clean the connections, and reconnect the leads and wiring, then use a voltmeter or test lamp to check that full battery voltage is available at the battery positive lead connection to the solenoid, and that the earth is sound. Smear petroleum jelly around the battery terminals to prevent corrosion - corroded connections are amongst the most frequent causes of electrical system faults.

4 If the battery and all connections are in good condition, check the circuit by disconnecting the wire from the solenoid blade terminal. Connect a voltmeter or test lamp between the wire end and a good earth (such as the battery negative terminal), and check that the wire is live when the ignition switch is turned to the 'start' position. If it is, then the circuit is sound - if not the circuit wiring can be checked (see Chapter 13).

5 The solenoid contacts can be checked by connecting a voltmeter or test lamp between the battery positive connection on the starter side of the solenoid, and earth. When the ignition switch is in the 'start' position, there should be a reading or lighted bulb, as

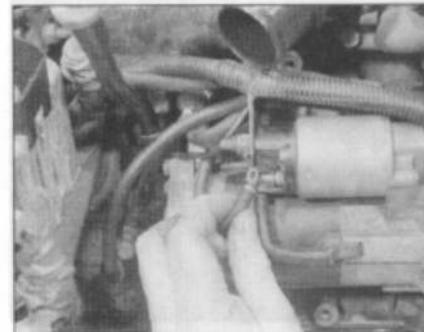
applicable. No reading nor lighted bulb means the solenoid is faulty and should be renewed.

6 If the circuit and solenoid are proved sound, the fault must lie in the starter motor. In this event, it may be possible to have the starter motor overhauled by a specialist, but check on the cost of spares before proceeding, as it may prove more economical to obtain a new or exchange motor.

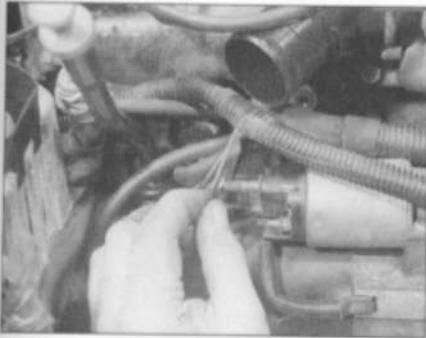
10 Starter motor - removal and refitting

Removal

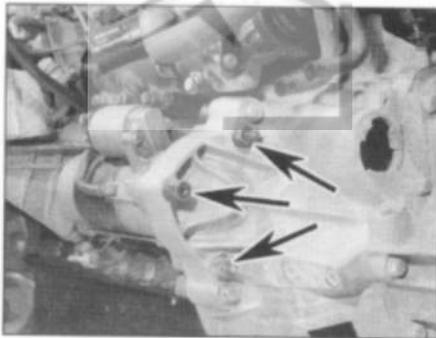
- Disconnect the battery negative lead.
- So that access to the motor can be gained both from above and below, chock the rear wheels then jack up the front of the vehicle and support it on axle stands (see *Jacking and Vehicle Support*). Where applicable, to improve access to the motor remove the air cleaner housing as described in Chapter 4A or 4B.
- On 2.5 litre turbo diesel models, carry out the following:
 - Remove the intercooler and its mounting bracket as described in Chapter 4B.
 - Remove the cooling system expansion tank, with reference to Chapter 3.
- Slacken and remove the two retaining nuts and disconnect the wiring from the starter motor solenoid. Recover the washers under the nuts (see illustrations).



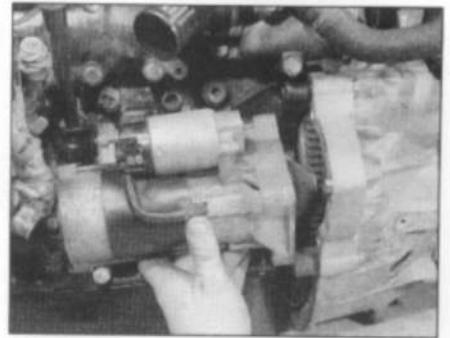
10.4a Disconnect the solenoid wiring from starter motor ...



10.4b . . . and then the main supply wiring



10.5 Undo the three starter motor mounting bolts (arrowed) - 2.5 litre diesel model shown



10.6 Removing the starter motor - 2.5 litre diesel model shown

5 Undo the three mounting bolts, supporting the motor as the bolts are withdrawn (see illustration). Recover the washers from under the bolt heads and note the locations of any wiring or hose brackets secured by the bolts.

6 Manoeuvre the starter motor out from underneath the engine and recover the locating dowel(s) from the motor/transmission (as applicable) (see illustration).

Refitting

7 Refitting is a reversal of removal, ensuring that the locating dowel(s) are correctly positioned (where applicable). Also make sure that any wiring or hose brackets are in place under the bolt heads as noted prior to removal.

11 Starter motor - testing and overhaul

If the starter motor is thought to be suspect, it should be removed from the vehicle and taken to an auto-electrician for testing. Most

auto-electricians will be able to supply and fit brushes at a reasonable cost. However, check on the cost of repairs before proceeding as it may prove more economical to obtain a new or exchange motor.

12 Ignition switch - removal and refitting

The ignition switch is integral with the steering column lock, and can be removed as described in Chapter 11.

13 Oil pressure warning light switch - removal and refitting

Removal

1 The switch is located at the front of the cylinder block, above the oil filter mounting. Note that on some models access to the switch may be improved if the vehicle is

jacked up and supported on axle stands so that the switch can be reached from below (see *Jacking and Vehicle Support*).

2 Disconnect the battery negative lead.

3 Remove the protective sleeve from the wiring plug (where applicable), then disconnect the wiring from the switch.

4 Unscrew the switch from the cylinder block, and recover the sealing washer. Be prepared for oil spillage, and if the switch is to be left removed from the engine for any length of time, plug the hole in the cylinder block.

Refitting

5 Examine the sealing washer for signs of damage or deterioration and if necessary renew.

6 Refit the switch, complete with washer, and tighten it securely. Reconnect the wiring connector.

7 Lower the vehicle to the ground then check and, if necessary, top-up the engine oil as described in "Weekly checks".

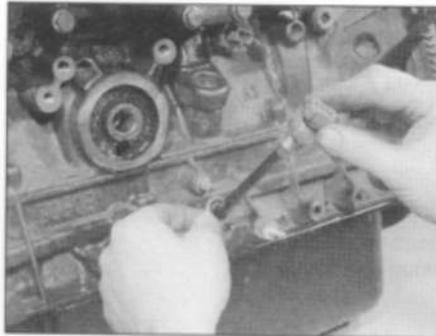
14 Oil level sensor - removal and refitting

1 On 2.5 litre turbo diesel models, the sensor is located on the front of the cylinder block, just above the sump joint face. On all other models, the sensor is located on the rear facing side of the cylinder block at the flywheel end.

2 The removal and refitting procedure is as described for the oil pressure switch in Section 13. Access is most easily obtained from underneath the vehicle (see illustrations). Withdraw the sensor from its mounting with care, as it has a long probe that can easily be damaged.



14.2a Removing the oil level sensor - 2.1 litre turbo diesel model



14.2b Removing the oil level sensor - 2.5 litre turbo diesel model