

# Chapter 9






## Electrical system

Refer to the beginning of Chapter 1 for model identification details

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### Degrees of difficulty

<b>Easy</b> , suitable for novice with little experience 	<b>Fairly easy</b> , suitable for beginner with some experience 	<b>Fairly difficult</b> , suitable for competent DIY mechanic 	<b>Difficult</b> , suitable for experienced DIY mechanic 	<b>Very difficult</b> , suitable for expert DIY or professional 
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### Specifications

#### Battery

##### Capacity

50 cc two-stroke models . . . . .	12 V, 4 Ah (9 Ah on later models)
50/100 cc four-stroke models . . . . .	12 V, 9 Ah
80 cc models . . . . .	12 V, 5 Ah
125/200 cc models	
Typhoon, Sfera, ET4, Hexagon, Skipper, Skipper ST, Liberty, Zip, Fly, LX4 . . . . .	12 V, 9 Ah (Euro 3 models 10 Ah)
Super Hexagon, B125, X8, X9, GT125/200 . . . . .	12 V, 12 Ah (Euro 3 models 10 Ah)
GTS, GTV, S, LXV . . . . .	12 V, 10 Ah
Specific gravity (all models)	
Fully charged . . . . .	1.26 to 1.28
Uncharged . . . . .	0.84
Charging rate (all models) . . . . .	0.5 A for 6 to 8 hrs

**Alternator**

## Unregulated voltage output

Typhoon 50/80, Sfera 50/80/125, ET2, ET4, Zip, Zip SP/RS, Zip 50, NRG (all models), Liberty 50, Liberty 125 (non-LEADER), LX 50, LXV50, Fly 50, S50 .....	25 to 30V (ac) at 3000 rpm
ET4 50, Liberty 50 4T, Zip 50/100 4T, LX4 50, Fly 50/100 4T.....	25 to 35V (ac) at 2000 rpm
Typhoon 125, Hexagon/Super Hexagon, Skipper, Skipper ST, Zip 125 .....	27 to 31V (ac) at 2000 rpm
Charging coil resistance – Liberty 125 (LEADER), B125, X8, X9, LX125, LXV125, Fly 125, S125 and all GT models.....	0.7 to 0.9 ohms

**Regulator/rectifier**

## Regulated current output

Typhoon 50/80, Sfera 50/80/125, ET2, Zip, Zip SP/RS, Zip 50, NRG (all models), Liberty 50, LX 50, LXV50, Fly 50, LX4 50, S50 ..	1.5 to 2.0A at 3000 rpm
ET4 50, Liberty 50 4T, Zip 50/100 4T, Fly 50/100 4T .....	4.5A at 4000 rpm
Skipper ST 125, Liberty 125 (non-LEADER), ET4, Zip 125 .....	above 1.8A at 3000 rpm
Typhoon 125, Hexagon, Skipper .....	8.5A at 2000 rpm
Regulated voltage output – Liberty 125 (LEADER), B125, X8, X9, LX125, LXV125, Fly 125, S125 and all GT models.....	14.0 to 15.2V

**Fuses**

**Note:** Use the information on the fusebox lid or in the owners handbook if it differs from that given below.

Typhoon 50/80, Sfera 50/80/125, NRG (all models), Zip, Zip SP/RS, Zip 50, Liberty 50, ET2, Fly 50, LX2 50, LXV50, S50 .....	7.5A
ET4, ET2 (with immobiliser) .....	7.5A
Typhoon 125, Skipper, Super Hexagon, Liberty 125, Zip 125, ET4 50, Liberty 50 4T, Zip 50/100 4T, Fly 50, Fly 50/100 4T, LX4 50 ..	10A
Fly 125, LX 125, Liberty 125 Euro 3 .....	15A, 7.5A
B125, X9 .....	15A, 10A, 7.5A, 4A
B125 Euro 3 .....	15A, 10A, 7.5A, 4A, 3A
X9 Euro 3 .....	15A, 10A, 7.5A
X8, GT125/200, GTV125 .....	15A, 10A, 7.5A, 5A
X8 Euro 3, GTS125.....	15A, 10A, 7.5A, 5A, 3A
Skipper ST .....	15A, 7.5A, 5A
Hexagon .....	25A, 10A, 7.5A, 4A

**Bulbs**

## Headlight (main/dipped)

50/80/100 cc models .....	35/35W
Super Hexagon, B125, X8, X9 .....	55/55W
All other models .....	60/55W

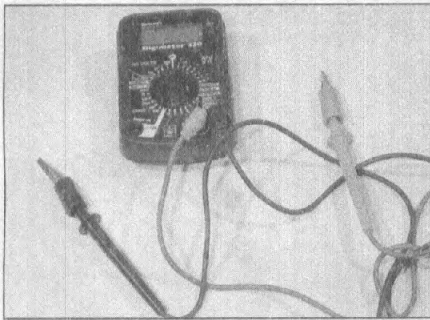
## Sidelight

NRG Power DT and DD models .....	3W
All other models .....	5W

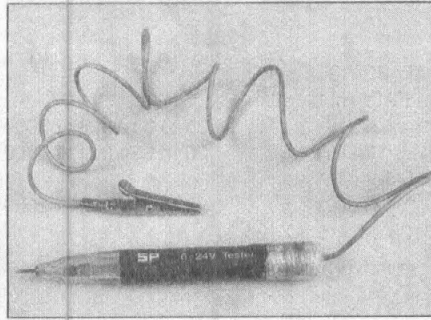
## Brake/tail light

Combined brake/tail bulb .....	12/5W
Separate bulbs	
B125 .....	10W and 3W
X8 .....	10W and 5W
X9, GTS and GTV125 .....	5W and 2.3W
NRG Power DT and DD models .....	LEDs
Number plate light (where fitted) .....	5W
Turn signal lights .....	5W or 10W
Instrument and warning lights .....	1.2W and/or 2.0W
Storage compartment light .....	5W

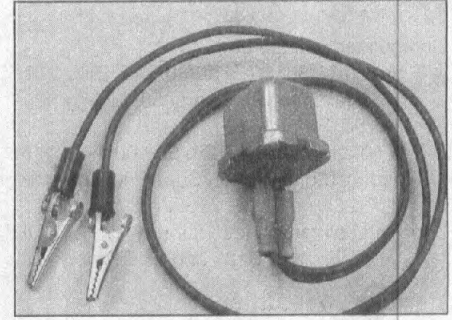




2.5 A multimeter is capable of reading ohms, amps and volts



2.6a A simple test light . . .



2.6b . . . or a buzzer can be used for simple voltage checks

## 1 General information

All models have a 12 volt electrical system charged by a three-phase alternator with a separate regulator/rectifier.

The regulator maintains the charging system output within the specified range to prevent overcharging, and the rectifier converts the AC (alternating current) output of the alternator to DC (direct current) to power the lights and other components and to charge the battery. The alternator rotor is mounted on the right-hand end of the crankshaft.

All models are fitted with an electric starter motor. The starting system includes the motor, the battery, the relay and the various wires and switches.

**Note:** *Keep in mind that electrical parts, once purchased, cannot be returned. To avoid unnecessary expense, make very sure the faulty component has been positively identified before buying a new part.*

## 2 Electrical system – fault finding



**Warning:** *To prevent the risk of short circuits, the ignition (main) switch must always be OFF and the battery negative (-ve)*

*terminal should be disconnected before any of the bike's other electrical components are disturbed. Don't forget to reconnect the terminal securely once work is finished or if battery power is needed for circuit testing.*

### Tracing faults

1 A typical electrical circuit consists of an electrical component, the switches, relays, etc, related to that component, and the wiring and terminals that connect the component to both the battery and the frame. To aid in locating a problem in any electrical circuit, refer to the wiring diagrams at the end of this Chapter.

2 Before tackling any troublesome electrical circuit, first study the wiring diagram thoroughly to get a complete picture of what makes up that individual circuit. Trouble spots, for instance, can often be narrowed down by noting if other components related to that circuit are operating properly or not. If several components or circuits fail at one time, chances are the fault lies in the fuse or earth connection.

3 Electrical problems often stem from simple causes, such as loose or corroded connections or a blown fuse. Prior to any electrical fault finding, always visually check the condition of the fuse, wires and connections in the problem circuit. Intermittent failures can be especially frustrating, since you can't always duplicate the failure when it's convenient to test. In such situations, a good practice is to clean all connections in the affected circuit, whether or not they appear to be good. All of the connections and wires should also be wiggled to check for looseness which can cause intermittent failure.

4 If testing instruments are going to be utilised, use the wiring diagram to plan where you will make the necessary connections in order to accurately pinpoint the trouble spot.

### Using test equipment

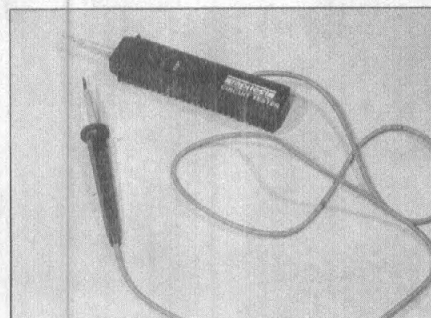
5 The basic tools needed for electrical fault finding include a battery and bulb test circuit, a continuity tester, a test light, and a jumper wire. A multi-meter capable of reading volts, ohms and amps is also very useful as an alternative to the above, and is necessary for

performing more extensive tests and checks (see illustration).

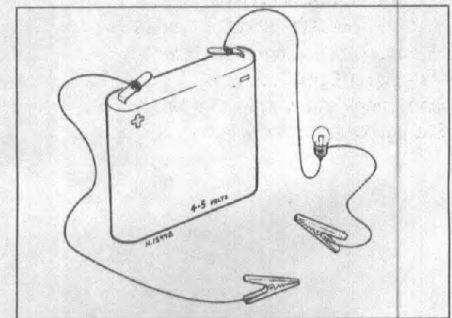
6 Voltage checks should be performed if a circuit is not functioning properly. Connect one lead of a test light or voltmeter to either the negative battery terminal or a known good earth (see illustrations). Connect the other lead to a connector in the circuit being tested, preferably nearest to the battery or fuse. If the bulb lights, voltage is reaching that point, which means the part of the circuit between that connector and the battery is problem-free. Continue checking the remainder of the circuit in the same manner. When you reach a point where no voltage is present, the problem lies between there and the last good test point. Most of the time the problem is due to a loose connection. Keep in mind that some circuits only receive voltage when the ignition is ON.

7 One method of finding short circuits is to remove the fuse and connect a test light or voltmeter in its place to the fuse terminals. There should be no load in the circuit (it should be switched off). Move the wiring harness from side-to-side while watching the test light. If the bulb lights, there is a short to earth somewhere in that area, probably where insulation has rubbed off a wire. The same test can be performed on other components in the circuit, including the switch.

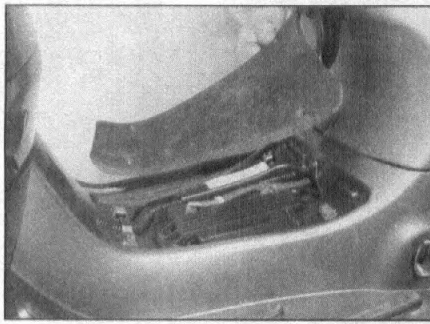
8 An earth check should be done to see if a component is earthed properly. Disconnect the battery and connect one lead of a self-powered test light (continuity tester) to a known good earth (see illustrations). Connect the other lead to the wire or earth connection



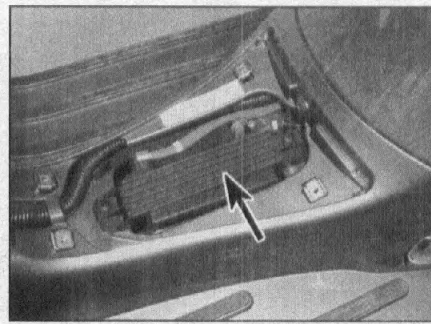
2.8a Continuity can be checked with a battery-powered tester . . .



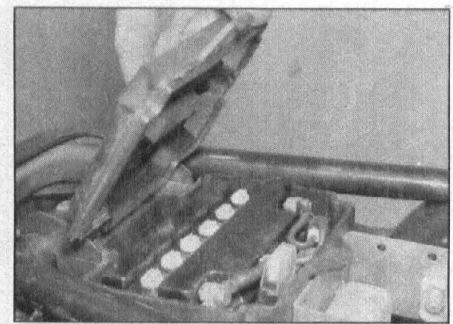
2.8b . . . or a battery and bulb circuit



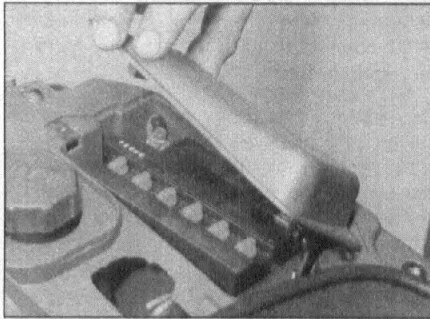
3.1a On GT models, first remove the centre mat . . .



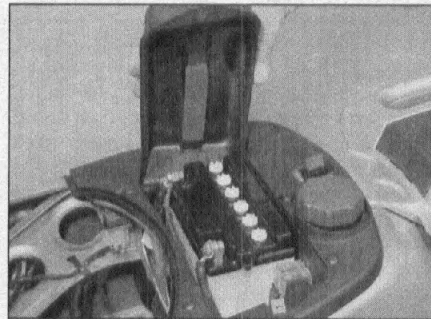
3.1b . . . then remove the battery cover (arrowed)



3.1c Removing the battery cover - Hexagon



3.1d Removing the battery cover - Typhoon



3.1e Removing the battery cover - ET2 and ET4



3.1f Removing the battery cover - X8

being tested. If the bulb lights, the earth is good. If the bulb does not light, the earth is not good.

9 A continuity check is performed to see if a circuit, section of circuit or individual component is capable of passing electricity through it. Disconnect the battery and connect one lead of a self-powered test light (continuity tester) to one end of the circuit being tested and the other lead to the other end of the circuit. If the bulb lights, there is continuity, which means the circuit is passing electricity through it properly. Switches can be checked in the same way.

### 3 Battery - removal, installation and checks

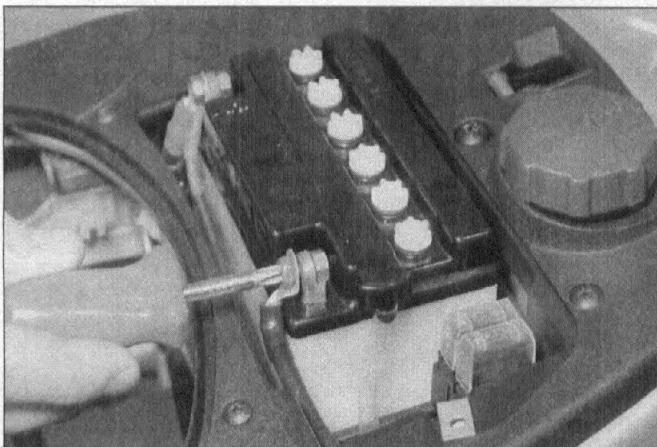
**Caution:** *Be extremely careful when handling or working around the battery. The electrolyte is very caustic and an explosive gas (hydrogen) is given off when the battery is charging.*

#### Removal and installation

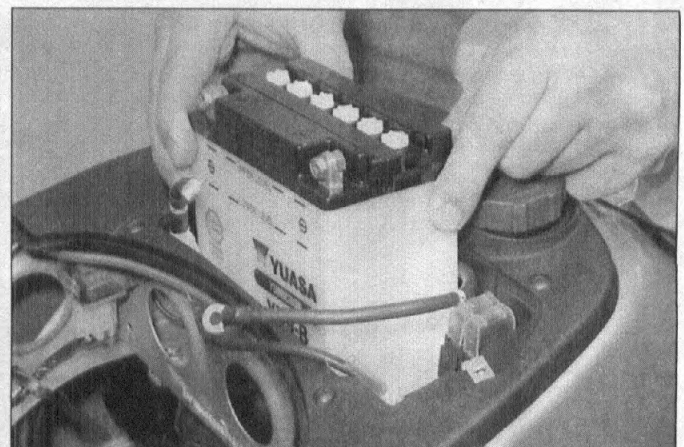
1 On all GT models, the battery is located between the left and right-hand floor panels - undo the four screws securing the centre mat

and lift it off, then remove the screws securing the battery cover and lift the cover off the battery (see illustrations). On all other models, the battery is located under the seat; on Hexagon models, remove the seat (see Chapter 7), on all other models, unlock the seat and raise it upright. Remove the screw or screws securing the battery cover and lift the cover off the battery (see illustrations).

2 Unscrew the negative (-ve) terminal bolt first and disconnect the lead from the battery, then unscrew the positive (+ve) terminal bolt and disconnect the lead (see illustration). Lift the battery from its holder (see illustration).

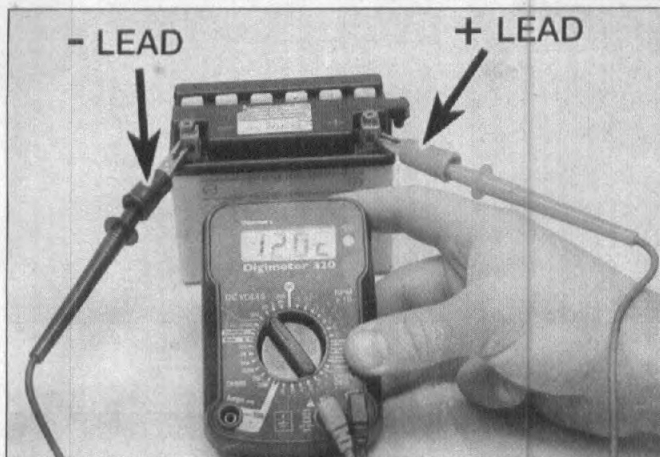


3.2a Disconnect the negative (-ve) lead first, then the positive (+ve) lead . . .



3.2b . . . and remove the battery





3.11 Measuring battery open-circuit voltage

3 On installation, clean the battery terminals and lead ends with a wire brush or knife and emery paper. Reconnect the leads, connecting the positive (+ve) terminal first.

4 Fit the battery cover and install or lower the seat.

### Inspection and maintenance

#### Conventional battery

5 The battery fitted as standard to most models is of the conventional lead-acid type, requiring regular checks of the electrolyte level (see Chapter 1) in addition to those detailed below.

6 Check the battery terminals and leads for tightness and corrosion. If corrosion is evident, unscrew the terminal bolts and disconnect the leads from the battery, disconnecting the negative (-ve) terminal first, and clean the terminals and lead ends with a wire brush or knife and emery paper. Reconnect the leads, connecting the negative (-ve) terminal last, and apply a thin coat of petroleum jelly to the connections to slow further corrosion.

7 The battery case should be kept clean to prevent current leakage, which can discharge the battery over a period of time (especially when it sits unused). Wash the outside of the case with a solution of baking soda and water. Rinse the battery thoroughly, then dry it.

8 Look for cracks in the case and renew the battery if any are found. If acid has been spilled on the battery holder or surrounding bodywork, neutralise it with a baking soda and water solution, dry it thoroughly, then touch up any damaged paint.

9 If the scooter sits unused for long periods of time, disconnect the cables from the battery terminals, negative (-ve) terminal first. Refer to Section 4 and charge the battery once every month to six weeks.

10 The condition of the battery can be assessed by measuring the specific gravity of the electrolyte. To do this an hydrometer is needed. Remove the cell caps from the battery. Insert the hydrometer nozzle into each

cell in turn and squeeze the hydrometer pump to draw some electrolyte from the cell. Check the reading on the float at the level of the electrolyte and compare it to the Specifications at the beginning of the Chapter. If necessary, remove the battery and recharge it as described below in Section 4.

11 The condition of the battery can also be assessed by measuring the voltage present at the battery terminals. Connect the voltmeter positive (+ve) probe to the battery positive (+ve) terminal, and the negative (-ve) probe to the battery negative (-ve) terminal (see illustration). While Piaggio provide no specifications, when fully-charged there should be more than 12.5 volts present. If the voltage falls below 12.0 volts the battery must be removed, disconnecting the negative (-ve) terminal first, and recharged as described below in Section 4. **Note:** Before taking the measurement, wait at least 30 minutes after any charging has taken place (including running the engine).

#### Maintenance-free battery

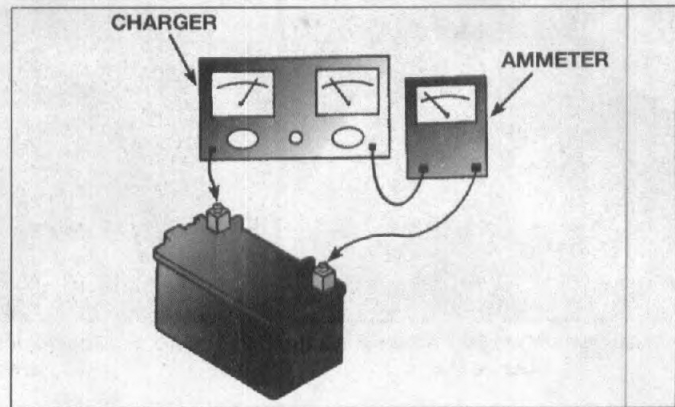
12 Several later models are fitted with an MF battery as standard. Maintenance-free batteries require little in the way of regular checks and are of sealed construction. All that is required is a check of terminal condition and the battery case as described above in Steps 6 to 9.

13 The specific gravity cannot be measured due to its sealed construction, although voltage can be checked as described in Step 11.

## 4 Battery – charging

**Caution:** Be extremely careful when handling or working around the battery. The electrolyte is very caustic and an explosive gas (hydrogen) is given off when the battery is charging.

1 Remove the battery (see Section 3).



4.2 If the charger doesn't have ammeter built in, connect one in series as shown. DO NOT connect the ammeter between the battery terminals or it will be ruined

Connect the charger to the battery, making sure that the positive (+ve) lead on the charger is connected to the positive (+ve) terminal on the battery, and the negative (-ve) lead is connected to the negative (-ve) battery terminal.

2 Piaggio recommend that the battery is charged at a maximum rate of 0.5 amps for 6 to 8 hours. Exceeding this figure can cause the battery to overheat, buckling the plates and rendering it useless. Few owners will have access to an expensive current-controlled charger, so if a normal domestic charger is used check that after a possible initial peak, the charge rate falls to a safe level (see illustration). If the battery becomes hot during charging stop. Further charging will cause damage. **Note:** In emergencies the battery can be charged at a higher rate of around 3.0 amps for a period of 1 hour. However, this is not recommended and the low amp charge is by far the safer method of charging the battery.

3 Note that when charging an MF battery make sure that you use a regulated battery charger. If using a constant voltage charger, ensure that the voltage does not exceed 15.2 V otherwise the battery could be ruined.

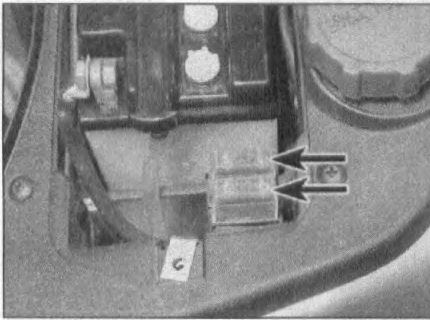
4 If the recharged battery discharges rapidly if left disconnected it is likely that an internal short caused by physical damage or sulphation has occurred. A new battery will be required. A sound item will tend to lose its charge at about 1% per day.

5 Install the battery (see Section 3).

6 If the scooter sits unused for long periods of time, charge the battery once every month to six weeks and leave it disconnected.

## 5 Fuses – check and renewal

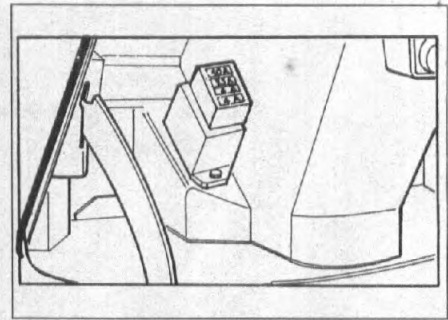
1 The electrical system is protected by a fuse or fuses of different ratings (see Specifications). On models with only one fuse, and on ET2 and ET4 models, the fuse(s) is/are



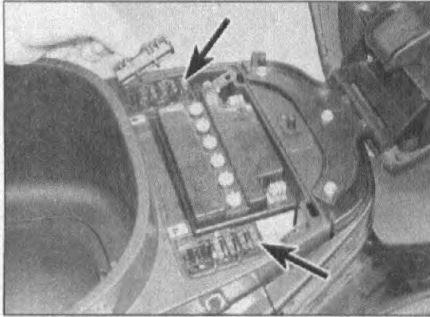
5.1a Fuseholders (arrowed) – ET2 and ET4



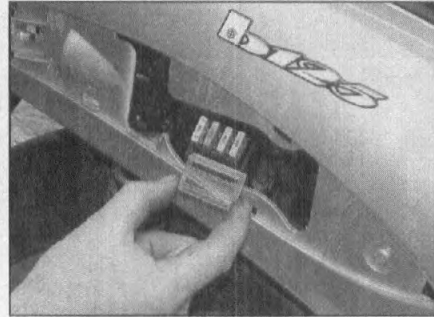
5.1b Fuseholder (all except main fuse) – Hexagon



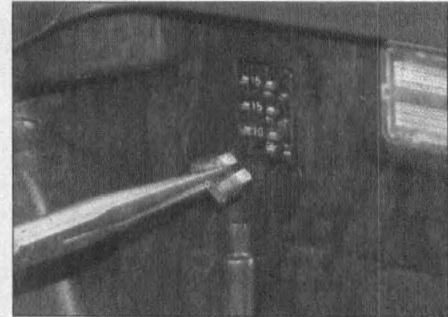
5.1c Fuseholder – Skipper



5.1d Fuseholders (arrowed) next to the battery – X8



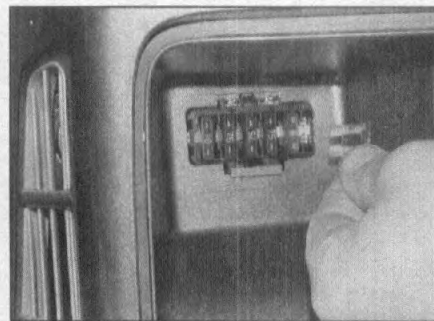
5.1e Fuseholder – B125



5.1f Fuseholder – X9



5.1g Location of main fuse (arrowed) ...



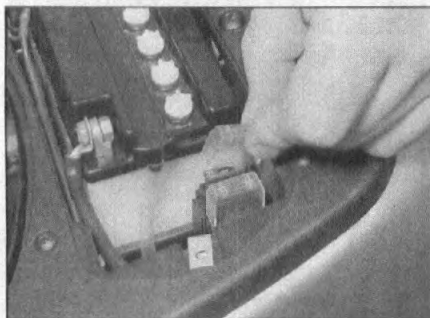
5.1h ... and multiple fuseholder on GT models

located in a holder next to the battery (see illustration). On most other models with multiple fuses, the main fuse is located in a holder next to the battery and all other fuses are located in a holder located behind the

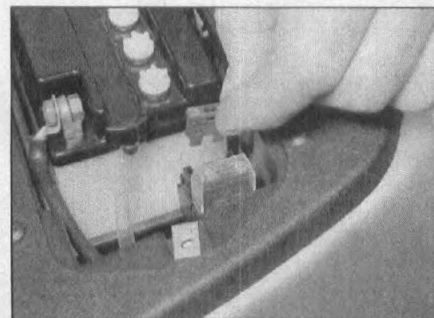
access panel in the right-hand side of the kick panel on the Typhoon 125, behind the access panel in the left-hand side of the kick panel on the Hexagon (see illustration), or inside the glove compartment on the Skipper (see

illustration). On the X8 all the fuses are located in holders next to the battery (see illustration). On the B125 the fuses are located inside the glove compartment and behind the right-hand side panel trim (see illustration). On the X9 the fuses are located inside the glove compartment and at the back of the storage compartment (see illustration). On all GT models the main fuse is located inside the bodywork underneath the seat hinge – lift up the seat and lift out the storage compartment to access the fuse (see illustration); all other fuses are located inside the glove compartment (see illustration).

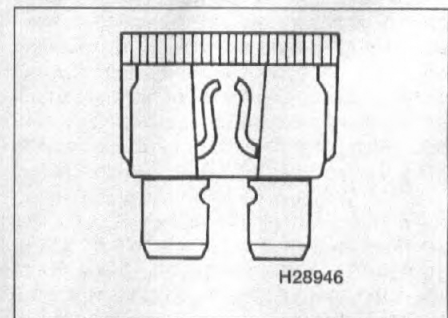
2 The fuses can be removed and checked visually. Remove the fuseholder cover, then pull out the fuse (see illustrations). If you can't pull it out with your fingers, use a pair of suitable pliers. A blown fuse is easily identified by a break in the element (see illustration). Each fuse is clearly marked with its rating and



5.2a Remove the cover ...

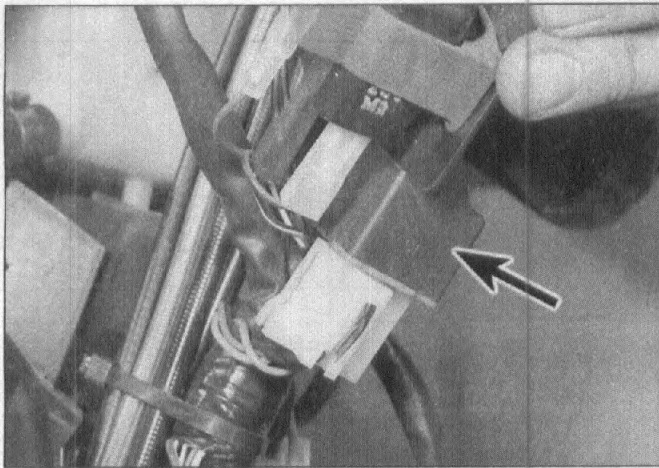


5.2b ... and pull out the fuse

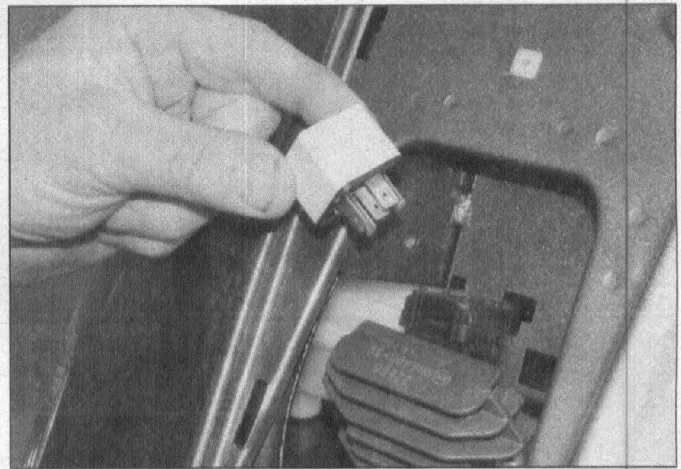


5.2c A blown fuse can be identified by a break in its element





6.3a Headlight relay (arrowed) – Hexagon



6.3b Headlight relay – GT models

must only be substituted by a fuse of the correct rating. It is advisable to carry a spare fuse of each rating on the scooter at all times.



**Warning: Never put in a fuse of a higher rating or bridge the terminals with any other substitute, however temporary it may be. Serious damage may be done to the circuit, or a fire may start.**

**3** If a fuse blows, be sure to check the wiring circuit very carefully for evidence of a short circuit. Look for bare wires and chafed, melted or burned insulation. If the fuse is renewed before the cause is located, the new fuse will blow immediately.

**4** Occasionally a fuse will blow or cause an open circuit for no obvious reason. Corrosion of the fuse ends and fuseholder terminals may occur and cause poor fuse contact. If this happens, remove the corrosion with a wire brush or emery paper, then spray the fuse end and fuseholder terminals with electrical contact cleaner.

## 6 Lighting system – check



**1** The battery provides power for operation of the headlight, tail light, brake light and instrument cluster lights. If none of the lights operate, always check battery voltage before proceeding. Low battery voltage indicates either a faulty battery or a defective charging system. Refer to Section 3 for battery checks and Sections 30 and 31 for charging system tests. Also, check the condition of the fuse(s).

### Headlight

**2** If the headlight fails to work, first check the fuse (see Section 5), and then the bulb (see Section 7). If they are both good, the problem lies in the wiring or one of the switches in the circuit. Refer to Section 21 for the switch testing procedures, and also the wiring diagrams at the end of this Chapter.

**3** Hexagon, B125, X8, X9, and all GT models are fitted with a headlight relay, located behind the front panel and mounted to the frame on a bracket (see illustrations). Remove the front panel for access to the relay (see Chapter 7). There are no test details for checking the relay; if it is suspected of being faulty, substitute it with another relay, although it is worth checking the power supply to and from the relay beforehand.

**4** Check the power supply to the relay by checking for battery voltage at the No. 30 terminal of the relay. If no voltage is present, check the wiring between the relay and the fuse (see wiring diagrams at the end of the Chapter). If the wiring is good, check for voltage at the No. 87 terminal on the relay with the ignition and lighting switches ON. If voltage is present, the relay is functioning correctly and the fault must lie in the wiring between the relay and the dip switch, or between the dip switch and the headlight. If no voltage is shown at terminal No. 87, either the relay is faulty or there is a fault between the relay and the lighting switch or between the lighting switch and the ignition switch.

### Tail light

**5** If the tail light fails to work, first check the bulb and the bulb terminals (see Section 9). **Note:** On NRG Power models, the brake/tail light consists of a number of LEDs in a sealed unit – when a single LED fails it cannot be renewed, but the failure of one LED will not affect the function of the others. Next check the fuse (see Section 5), then check for battery voltage at the terminal on the supply side of the tail light. If voltage is present, check the earth (ground) circuit for an open or poor connection.

**6** If no voltage is indicated, check the tail light wiring circuit (see wiring diagrams at the end of the Chapter).

### Brake light

**7** If the brake light fails to work, check the bulb and the bulb terminals first (see Section 9), then

the fuse (see Section 5), then check for battery voltage at the terminal on the supply side of the brake light, with the brake lever pulled in. If voltage is present, check the earth (ground) circuit for an open or poor connection.

**8** If no voltage is indicated, check the brake light switches (see Section 14), then the brake light wiring circuit (see wiring diagrams at the end of the Chapter).

### Instrument and warning lights

**9** See Section 17 for instrument and warning light bulb renewal.

### Turn signal lights

**10** See Section 11 for the turn signal circuit check.

## 7 Headlight bulb and sidelight bulb – renewal



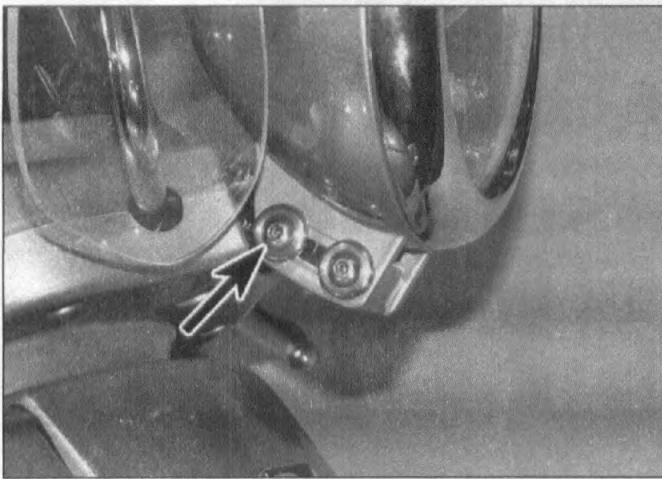
**Note:** If the headlight bulb is of the quartz-halogen type, do not touch the bulb glass as skin acids will shorten the bulb's service life. If the bulb is accidentally touched, it should be wiped carefully when cold with a rag soaked in methylated spirit and dried before fitting.



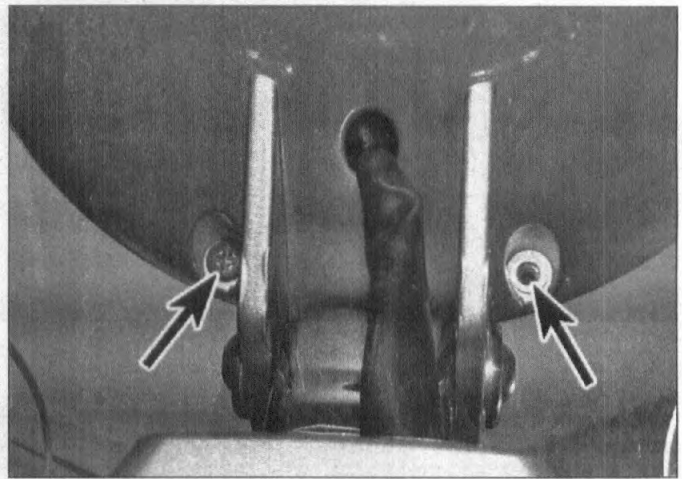
**Warning: Allow the bulb time to cool before removing it if the headlight has just been on.**

### Headlight

**1** On NRG models, remove the grille and, where fitted, the air duct in the front panel. On other models with the headlight mounted in the front panel, remove the headlight (see Section 8). On models with the headlight mounted on the handlebar, remove or displace the handlebar covers (see Chapter 7). On LXV models the headlight is mounted to a bracket which extends from the handlebar; remove the rearmost of the two mounting screws, then tilt the headlight forwards so that you can access the two rim retaining screws from the



7.1a On LXV models, remove the rear screw (arrowed) from the bracket slot . . .



7.1b . . . then pivot the shell forwards to access the two screws (arrowed) . . .



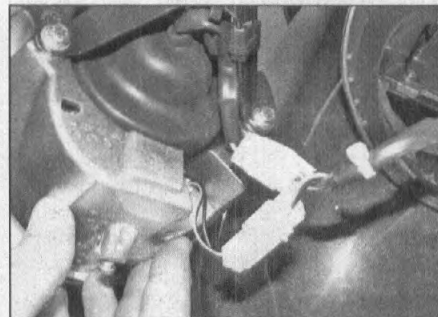
7.1c . . . and disconnect the wiring to free the headlight from the shell



7.1d On GTV models, unscrew the domed nut, . . .



7.1e . . . retrieve the collar . . .



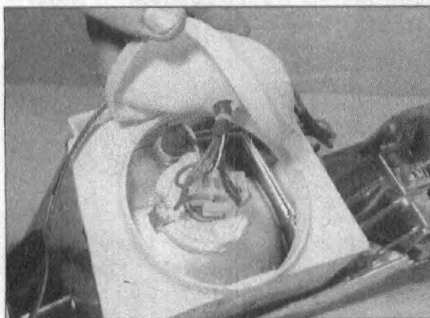
7.1f . . . withdraw the headlight unit and disconnect its wiring

base of the shell (see illustrations). Support the rim and lens as the wire connectors for the headlight and sidelight are disconnected (see illustration). On GTV models (headlight mounted on front mudguard) unscrew the domed nut and retrieve the shouldered collar from the back of the headlight shell, then withdraw the headlight unit and disconnect the wire connectors to the headlight and sidelight bulbs (see illustrations).

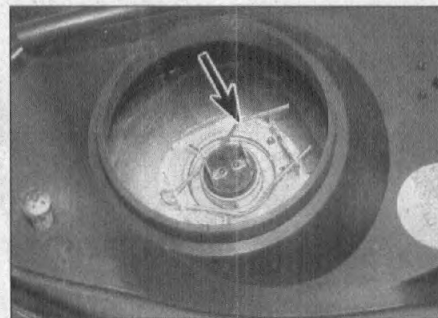
**2** Where fitted, remove the rubber dust cover and disconnect the electrical connector from the bulb (see illustration). Either twist the bulbholder anti-clockwise and draw it out of the headlight, or release the bulb retaining clip (see illustration). Remove the bulb, noting how it fits.

**3** On all other models, twist the bulbholder anti-clockwise and draw it out of the headlight, then push the bulb in and twist it anti-clockwise to release it from the holder (see illustrations).

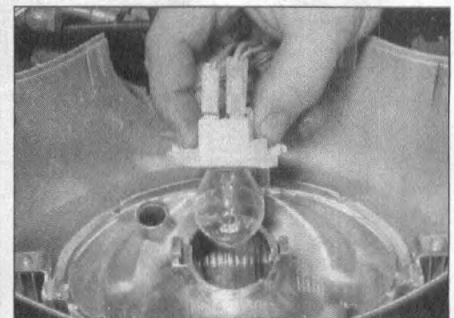
**4** Fit the new bulb and install the holder, bearing in mind the information in the **Note** (see illustration). Make sure the pins on the bulb fit correctly in the slots in the bulbholder. The bulb types and wattage differ between the Piaggio models – refer to the Specifications at the beginning of this Chapter or note the wattage marked on the cap of the original



7.2a Lift the rubber cover to access the connector and bulb

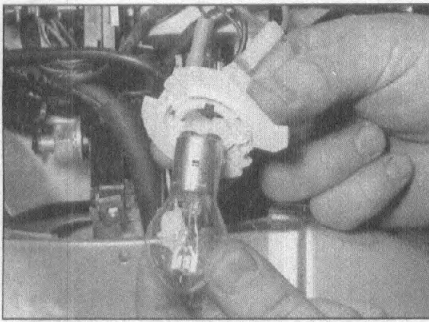


7.2b Release the wire clip (arrowed)

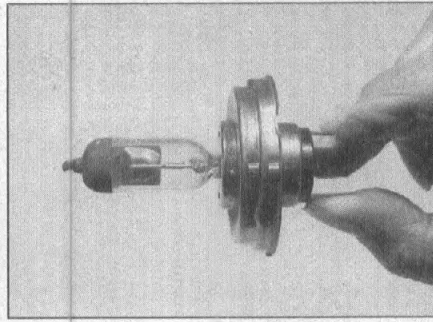


7.3a Remove the bulbholder . . .

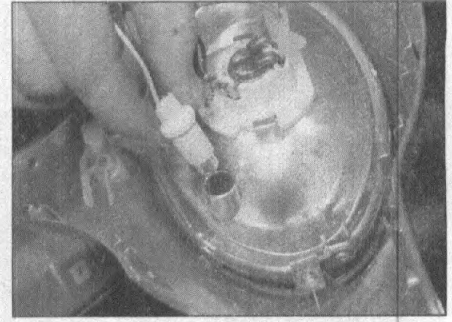




7.3b ... then the bulb



7.4 Handle quartz halogen bulbs by their wire terminals only – do not touch the glass



7.8a Remove the sidelight bulbholder ...

bulb, and fit a bulb of the same type and wattage.

5 If applicable, connect the wiring connector and install the dust cover, making sure it is correctly seated (see illustration 7.2a).

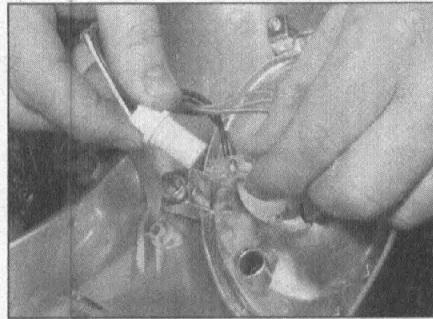
6 Check the operation of the headlight.

### Sidelight

7 On NRG models, remove the grille and, where fitted, the air duct in the front panel. On other models with the headlight mounted in the front panel, remove the headlight (see Section 8). On models with the headlight mounted on the handlebar, remove or displace the handlebar covers (see Chapter 7).

8 Pull the bulbholder out of its socket in the headlight, then carefully pull the bulb out of the holder (see illustrations). **Note:** The type of bulb commonly used is capless and is a push-fit – if a bayonet type bulb is encountered (pins on the bulb cap), the bulb is pushed gently into its holder and turned anti-clockwise to release it.

9 Carefully press the new bulb into the bulbholder, then install the bulbholder by



7.8b ... and gently pull out the capless bulb

pressing it in. If a rubber cover is fitted ensure it is correctly seated.

10 Check the operation of the sidelight.

## 8 Headlight assembly – removal and installation

### Removal

#### Handlebar-mounted headlight

1 Remove or displace the handlebar covers (see Chapter 7). Either disconnect the headlight wiring connectors, or remove the bulbholder by twisting it anti-clockwise (see illustration 7.3a). Also pull the sidelight bulbholder out of

its socket (see illustration 7.8a). Remove the screws securing the headlight to the front cover or to the handlebars and remove the headlight (see illustration).

#### Front panel-mounted headlight

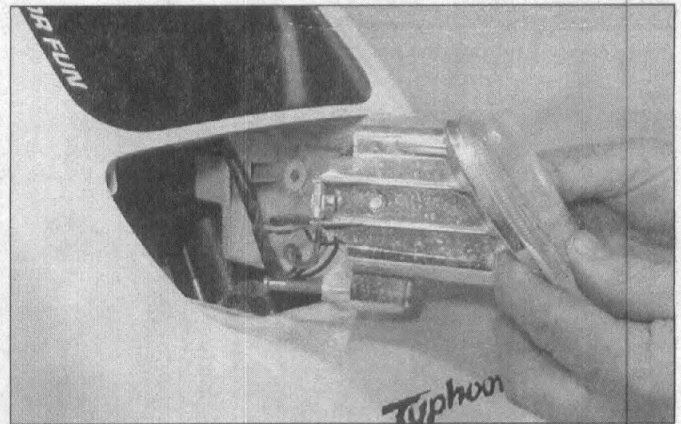
2 On the Typhoon the headlight is secured by the two screws in the kick panel; remove the screws and draw the headlight assembly out of the front panel (see illustrations). On the Sfera and early Zip SP the headlight it is secured by two screws inside the glove compartment, and on the Hexagon it is secured by a screw located behind each access panel in the kick panel. Remove the screws and draw the headlight assembly out of the front panel, then disconnect the wiring connector(s) when accessible (see

**HAYNES**  
**HINT**

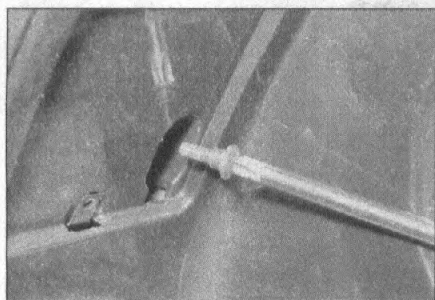
Always use a paper towel or dry cloth when handling new bulbs to prevent injury if the bulb should break and to increase bulb life.



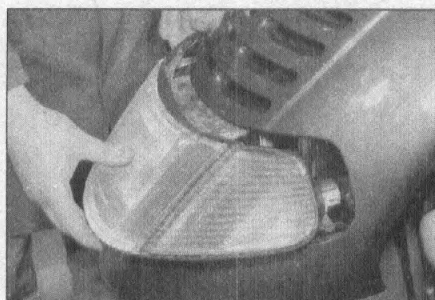
8.2a On the Typhoon, remove the screws ...



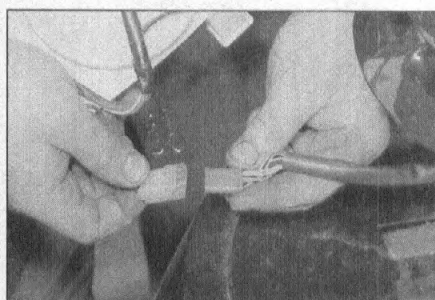
8.2b ... then withdraw the headlight and disconnect the wiring connectors



8.2c On the Hexagon, remove the screws ...



8.2d ... withdraw the headlight assembly ...



8.2e ... and disconnect the wiring connector

illustrations). On the Sfera and Hexagon, separate the turn signal units from the headlight if required. On the B125 the headlight is secured by four screws inside the glove compartment (see Chapter 7). On Liberty Sport models, first remove the centre panel from the front panel (screw is behind badge), then remove the four headlight screws located inside the glovebox..

3 On NRG MC<sup>2</sup> and MC<sup>3</sup> models, remove the front panel, then disconnect the wiring connectors (see Chapter 7). Either remove the screws securing each headlight to the bracket and remove the headlights separately, or remove the screws securing the bracket and remove the complete assembly. On NRG Power DT and DD models, remove the front panel, then disconnect the wiring connectors (see Chapter 7). Remove the screws securing the headlight assembly and lift it off (see illustration). On X8 models, first remove the front insert panel (see Chapter 7). Undo the screws securing each turn signal

assembly, then disconnect the assembly wiring connectors and lift them off (see illustrations). Undo the three screws securing the headlight assembly and draw it forward, then disconnect the assembly wiring connector (see illustrations). On the X9 remove the front insert panel to access the three headlight retaining screws (see Chapter 7).

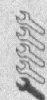
4 On GTV125 models the headlight unit is mounted on the front mudguard. Remove the headlight from its shell as described in Section 7, Step 1. If removal of the headlight shell is required, remove the front wheel (see Chapter 8) for full access to the shell mounting bracket.

5 On LXV50 and 125 models the headlight is mounted on the handlebar. Remove the headlight lens from the shell as described in Section 7, Step 1. To remove the shell, the wiring must be threaded out of the hole in the back of the shell and the remaining mounting screw removed.

### Installation

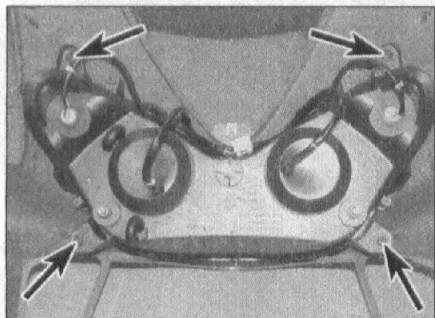
6 Installation is the reverse of removal. Make sure all the wiring is correctly connected and secured. Check the operation of the headlight and sidelight. Check the headlight aim (see Chapter 1).

### 9 Brake/tail light bulb – renewal

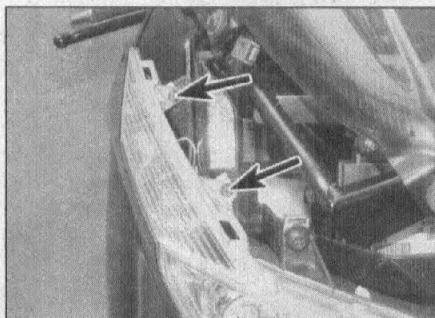


**Note 1:** It is a good idea to use a paper towel or dry cloth when handling new bulbs to prevent injury if the bulb should break and to increase bulb life.

**Note 2:** On NRG Power models, the brake/tail light consists of a number of LEDs in a sealed unit – when a single LED fails it cannot be renewed, but the failure of one LED will not affect the function of the others. When sufficient LEDs have failed so as to impair the



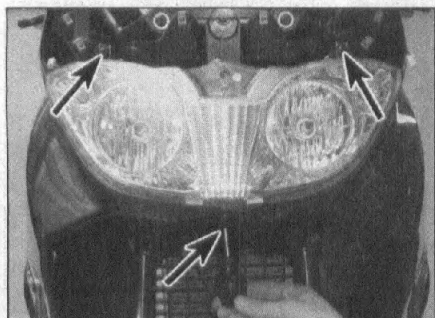
8.3a Headlight assembly is secured by four screws – NRG Power models



8.3b On X8 models, remove the screws securing each turn signal assembly ...



8.3c ... and disconnect the wiring connectors



8.3d Remove the screws securing the headlight assembly ...

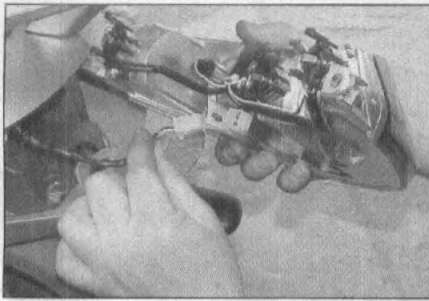


8.3e ... then draw it forward ...

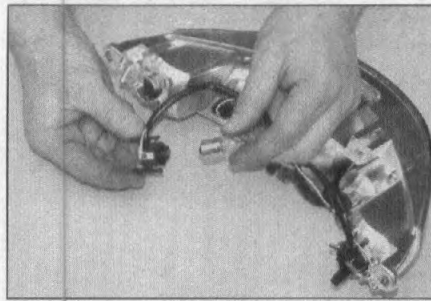


8.3f ... and disconnect the wiring connector

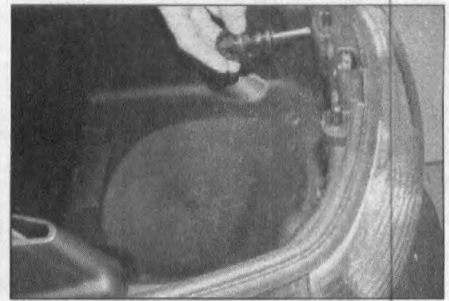




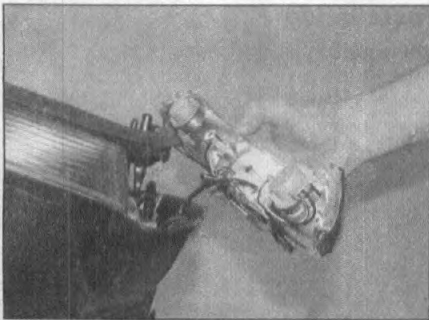
9.1a Disconnect the light unit wiring connector – B125



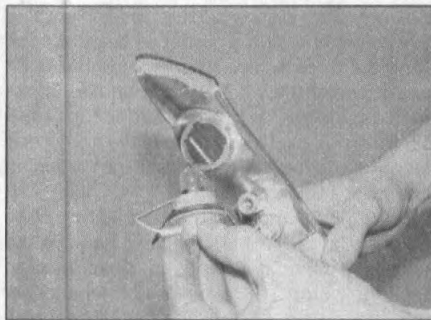
9.1b Remove the bulbholder and bulb as described



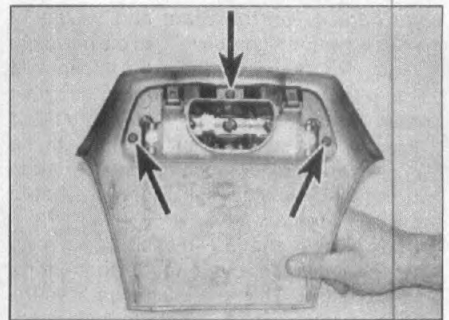
9.2a Undo the screws ...



9.2b ... and draw out the tail light assembly – X8 models



9.2c Remove the bulbholders and bulbs as described



9.3a Brake light unit is secured by three screws – X9

safe operation of the scooter, renew the tail light assembly (see Step 10).

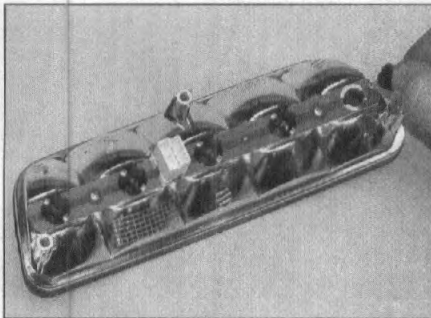
**1** On the B125, undo the screws securing the tail light/turn signal unit (see Chapter 7, Section 21). Remove the unit and disconnect the wiring connector (see illustration). Press the tabs on the bulbholder and pull it out of the light unit, then push the bulb into the holder and twist it anti-clockwise to remove it (see illustration). Check the socket terminals for corrosion and clean them if necessary. Line up the pins of the new bulb with the slots in the socket, then push the bulb in and turn it clockwise until it locks into place. **Note:** The pins on the bulb are offset so it can only be installed one way.

**2** On the X8, open the boot lid and undo the screws securing the tail light assembly, then draw the assembly out (see illustrations). The two centre bulbs are the tail light bulbs – pull the bulbholder out of the assembly then push the bulb into the holder and twist it anti-clockwise to remove it. The two outer bulbs

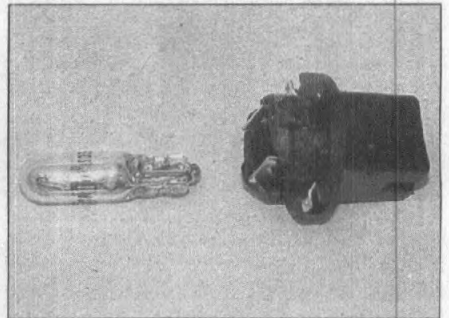
are the brake light bulbs – twist the bulbholder anti-clockwise to remove it (see illustration).

**3** On the X9, first remove the brake light panel (see Chapter 7). To renew the brake light bulbs, undo the three screws securing the brake light unit and remove it (see illustration). Twist the bulbholder and remove it from the unit, then carefully pull the bulb out of the holder (see

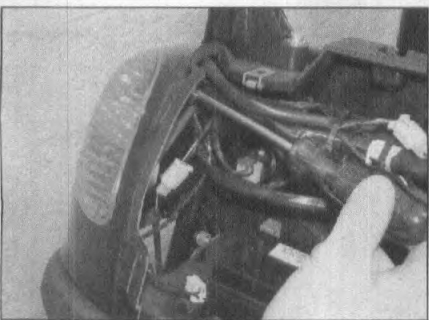
illustrations). **Note:** The bulb used is of the capless type. To renew the tail light bulbs, undo the screw securing the light unit and remove it, noting how the tabs locate in the side panel (see illustrations). Press the tabs on the bulbholder and pull it out of the light unit, then push the bulb into the holder and twist it anti-clockwise to remove it (see illustration).



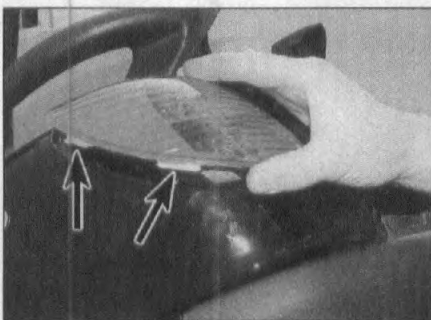
9.3b Twist the bulbholder to remove it ...



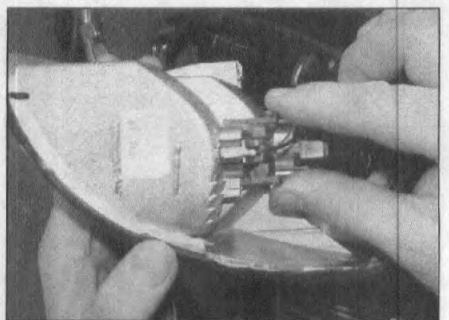
9.3c ... then pull out the capless bulb



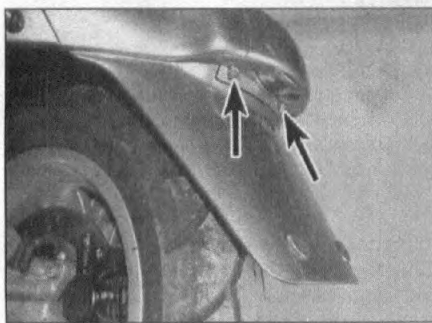
9.3d Undo the tail light unit screw ...



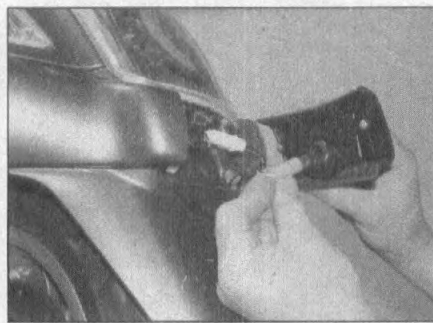
9.3e ... and lift off the light unit noting the tabs (arrowed) – X9



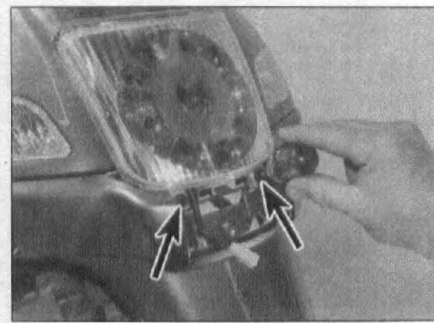
9.3f Press the tabs to release the bulbholder



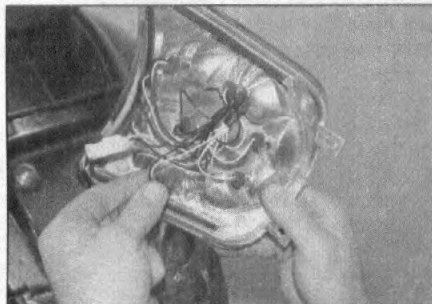
9.4a Number plate light is secured by two screws – GT models



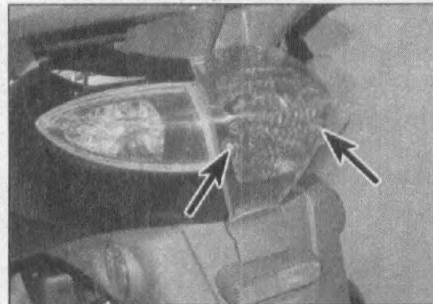
9.4b Bulbholder is a push fit in the unit



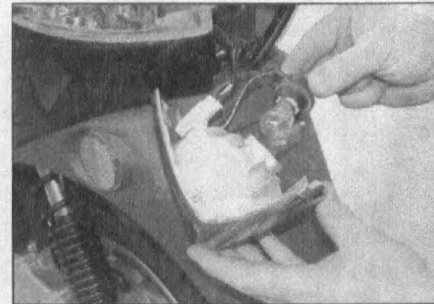
9.4c Remove the screws securing the tail light assembly ...



9.4d ... and pull the bulbholders out carefully



9.6a On Fly models, undo the screws (arrowed) ...



9.6b ... then remove the bulbholder

4 On GT125/200 models, first remove the screws securing the number plate light (see illustration). Either pull the bulbholder out of the light unit or disconnect the wiring connector and remove the unit (see illustration). Remove the screws securing the tail light assembly and lift it off – the bulbholders are a push fit in the assembly (see illustrations). The bulbs used are the capless type – pull them out of the bulbholders carefully. To remove the tail light assembly from the scooter, disconnect the single assembly wiring connector.

5 On the Skipper, raise up the seat, then remove the two screws securing the cover above the tail light and slide the cover up until its tabs disengage from their slots. Remove the cover, noting how it locates. Remove the two screws securing the tail light and draw the light out of its housing. Remove the lens.

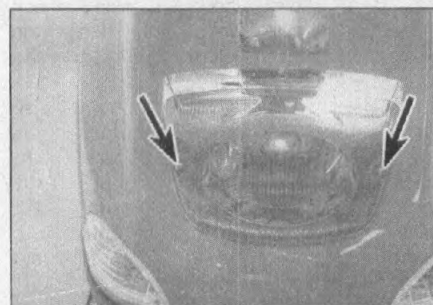
6 On Fly and LX models, remove the screws securing the tail light unit and lift it off, then twist the bulbholder anti-clockwise to remove it (see illustrations). Push the bulb, into the holder and twist it anti-clockwise to remove it.

Check the socket terminals for corrosion and clean them if necessary. Line up the pins of the new bulb with the slots in the socket, then push the bulb in and turn it clockwise until it locks into place. **Note:** The pins on the bulb are offset so it can only be installed one way.

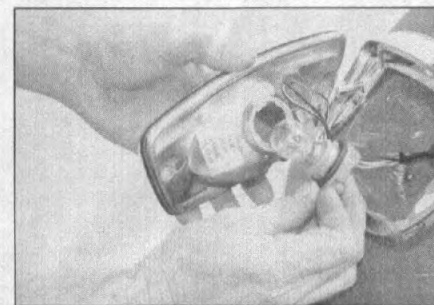
7 On GTS125 and GTV125 models remove the single screw at the base of the tail light

lens, then remove the lens. Access can now be gained to the tail light bulbs, brake light bulb and licence plate light bulb.

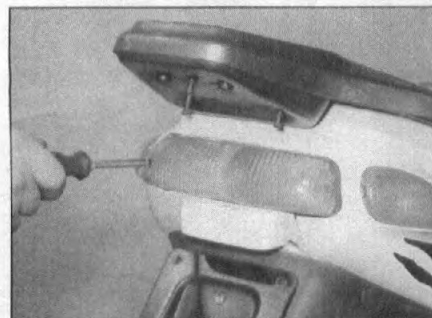
8 On all other models, remove the screws securing the tail light lens and remove the lens, noting how it fits (see illustrations). Push the bulb into the holder and twist it anti-clockwise to remove it (see illustration).



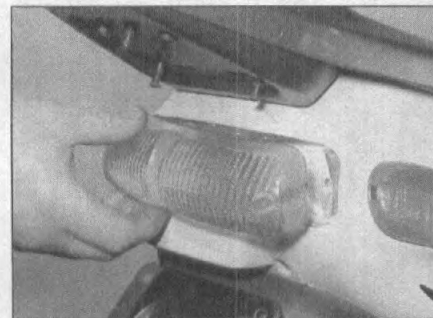
9.6c On LX models, undo the screws (arrowed) ...



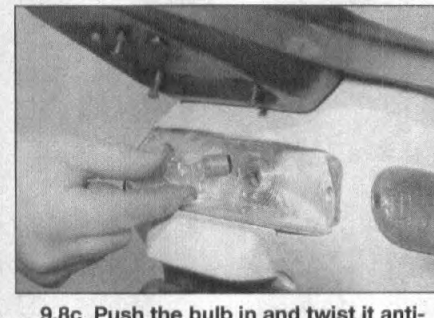
9.6d ... then remove the bulbholder



9.8a Remove the screws ...

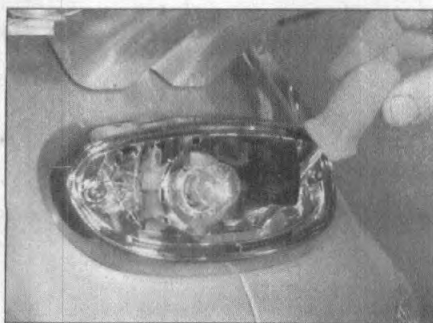


9.8b ... and take off the tail light lens



9.8c Push the bulb in and twist it anti-clockwise to remove it





10.3a Remove the screws . . .

10.3b . . . then remove the bulbholder/  
reflector unit and disconnect the wiring  
connector

Check the socket terminals for corrosion and clean them if necessary. Line up the pins of the new bulb with the slots in the socket, then push the bulb in and turn it clockwise until it locks into place. **Note:** The pins on the bulb are offset so it can only be installed one way.

### 10 Tail light assembly – removal and installation



#### Removal

**1** On B125, X8, X9, GT, Fly and LX models, follow the procedure in Section 9 to remove the tail light assembly. On Zip 50 and Zip 125 models, follow the procedure in Chapter 7 to remove the tail light panel. On NRG Power models, follow the procedure in Chapter 7 to remove the number plate unit, then remove the screws securing the tail light to the unit.

**2** On Skipper models, raise up the seat, then remove the two screws securing the cover above the tail light and slide the cover up until its tabs disengage from their slots. Remove the cover, noting how it locates. Remove the two screws securing the tail light and draw the light out of its housing, disconnecting the wiring connector when accessible.

**3** On all other models, remove the screws securing the tail light lens and remove the lens (see illustrations 9.7a and 9.7b). On many models, these screws also secure the tail light bulbholder/reflector, so it can be drawn away, then removed after disconnecting the wiring. Otherwise, remove the screws securing the bulbholder/reflector and disconnect the wiring (see illustrations). Where the turn signals are

integral with the tail light, also remove the turn signal lenses and disconnect the wiring.

#### Installation

**4** Installation is the reverse of removal. Check the operation of the tail light and the brake light.

### 11 Turn signal circuit – check



**1** The battery provides power for operation of the turn signal lights, so if they do not operate, always check the battery voltage first. Low battery voltage indicates either a faulty battery or a defective charging system. Refer to Section 3 for battery checks and Sections 28 to 31 for charging system tests. Also, check the fuse (see Section 5) and the switch (see Section 21).

**2** Most turn signal problems are the result of a burned out bulb or corroded socket. This is especially true when the turn signals function properly in one direction, but fail to flash in the other direction. Check the bulbs and the sockets (see Section 12).

**3** Note that some Piaggio/Vespa models use a conventional turn signal system, where the turn signals are operated by a separate relay, whereas on others the turn signal relay is combined in the regulator/rectifier unit. Refer to the wiring diagram for your machine to establish which type is fitted and test according to the relevant procedure.

#### With a turn signal relay

**4** If the bulbs and sockets are good, using a

multi-meter set to the 0 to 20 DC volts range, check for voltage at the B terminal on the turn signal relay with the ignition ON. Battery voltage should be shown. Turn the ignition OFF when the check is complete.

**5** If no power was present at the relay, check the wiring from the relay to the ignition (main) switch for continuity.

**6** If power was present at the relay, using the appropriate wiring diagram at the end of this Chapter, check the wiring between the relay, turn signal switch and turn signal lights for continuity. If the wiring and switch are sound, renew the relay.

#### Without a turn signal relay

**7** If the bulbs and sockets are good, using a multi-meter set to the 0 to 20 DC volts range, check for voltage at terminal No. 5 of the regulator/rectifier unit with the ignition ON. Battery voltage should be shown. Turn the ignition OFF when the check is complete.

**8** If no power was present at the regulator/rectifier, check back through the wiring from the regulator/rectifier to the ignition (main) switch for continuity.

**9** If power was present at terminal No. 5 of the regulator/rectifier, check for voltage at terminal No. 7 with the ignition ON. The voltage should fluctuate around 6 V, although this may vary depending on the tester used. The important factor is that the voltage is supplied in pulses. Turn the ignition OFF when the check is complete.

**10** If no voltage is indicated at terminal No. 7, the regulator/rectifier should be renewed. If the voltage reading produces the expected result and the turn signals still do not work, then the fault must lie in the turn signal switch or the wiring between terminal No. 7 of the regulator/rectifier and the switch.

### 12 Turn signal bulbs – renewal



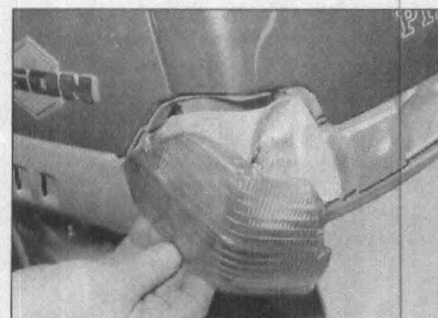
**1** On Sfera and Hexagon models, to access the front turn signal bulbs, remove the headlight (see Section 8). To access the rear turn signal bulbs, remove the screws securing the tail light lens, then remove the tail light lens followed by the turn signal lens, noting how they fit (see illustrations).



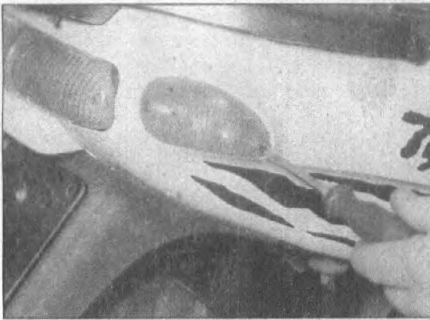
12.1a Remove the screws . . .



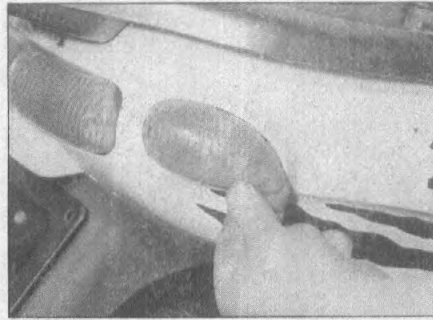
12.1b . . . the tail light lens . . .



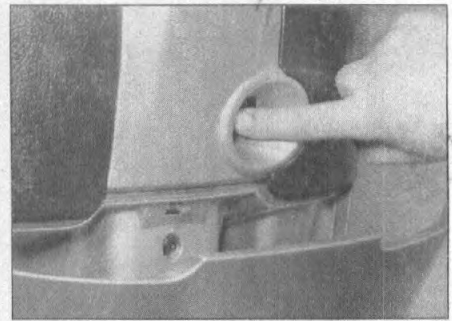
12.1c . . . and then the turn signal lens



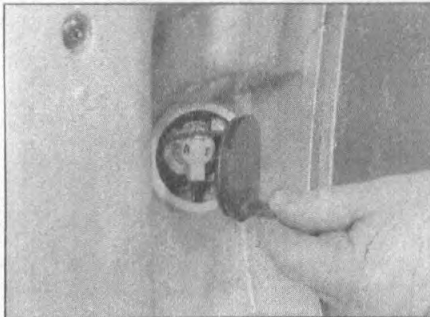
12.2a Remove the screw ...



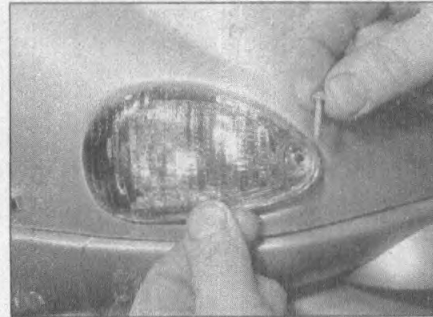
12.2b ... and detach the lens



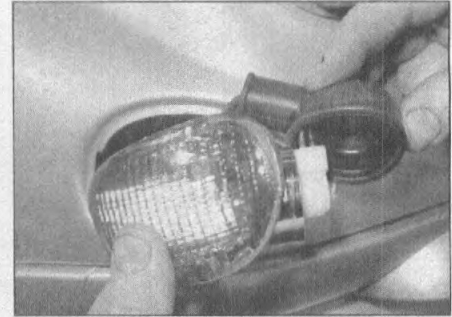
12.3a Open the glove compartment ...



12.3b ... and take off the cover



12.3c Remove the screw and detach the lens ...



12.3d ... then pull back the cover

**2** On Typhoon, Zip SP/RS, Zip 50, Zip 125, Liberty and NRG models, remove the screw securing the turn signal lens and remove the lens (**see illustrations**), noting that on Zip SP models at the rear it is the screws securing the tail light lens that must be removed.

**3** On ET2 and ET4 models, to access the front turn signal bulbs, open the glove compartment and remove the cover from the back of the turn signal (**see illustrations**). To access the rear turn signal bulbs, remove the screw(s) securing the lens and remove the lens, then pull back the bulb cover (**see illustrations**).

**4** On the Skipper model, to access the front turn signal bulbs, remove the two screws

securing the grille in the front panel and remove the grille. Then remove the screw securing the turn signal assembly. To access the rear turn signal bulbs, carefully lever off the inner section of the lens using a small flat-bladed screwdriver inserted in the notch in its base. This provides access to the screw securing the turn signal.

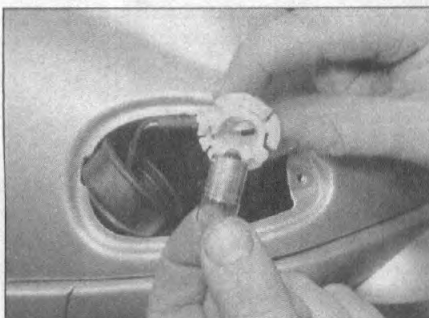
**5** On B125 models, to access the front turn signal bulbs, remove the headlight assembly (**see Section 8**). To access the rear turn signal bulbs, remove the tail light assembly (**see Section 10**).

**6** On X8 models, to access the front turn signal bulbs, follow the procedure in Section 8 to remove the appropriate signal assembly (**see illustration 8.3a and 3b**). Pull the

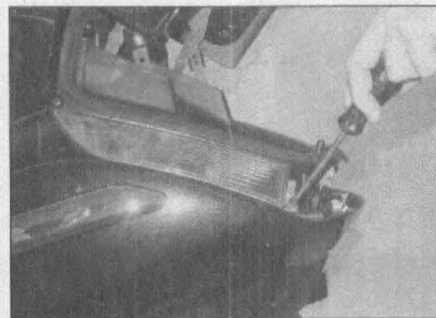
bulbholder out of the assembly and pull the bulb out of the bulbholder (**see illustration**). To access the rear turn signal bulbs, follow the procedure in Section 9 and remove the tail light unit. Undo the screw securing the signal assembly and lift it out, then pull the bulb out of the bulbholder (**see illustrations**).

**7** On X9 models, to access the front turn signal bulbs, remove the screw securing the turn signal lens and remove the lens. To access the rear turn signal bulbs, follow the procedure in Section 9 and remove the tail light unit. Press the tabs on the bulbholder and pull it out of the light unit.

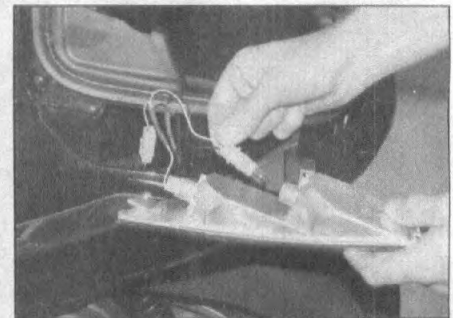
**8** On Fly models, to access the front turn signal bulbs, undo the screw securing the turn



12.6a Pull the bulbholder out of the turn signal assembly - X8 models



12.6b Remove the turn signal assembly ...

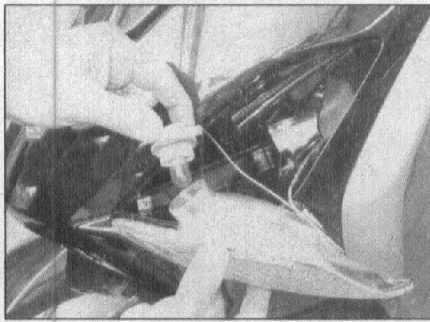


12.6c ... and pull the bulbholder out





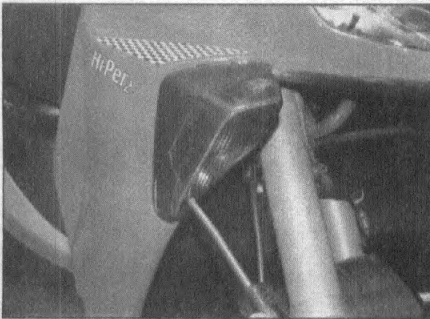
12.8a On Fly models, undo the screw . . .



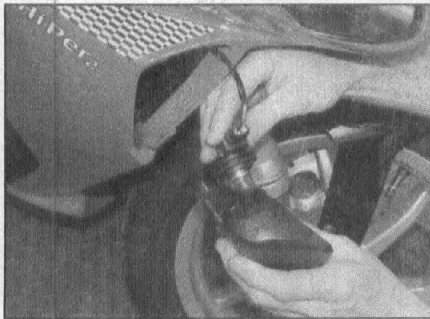
12.8b . . . and displace the signal assembly to access the bulb



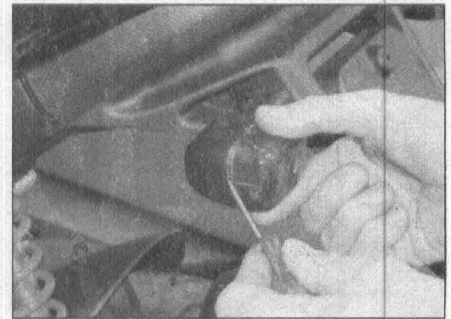
12.8c Turn the bulbholder anti-clockwise to remove it



12.9a On NRG Power models, undo the screw . . .



12.9b . . . and lift out the signal assembly to access the bulb



12.9c Lever the lens off carefully . . .

signal assembly and lift it out, then turn the bulbholder anti-clockwise and withdraw it from the assembly (**see illustrations**). To access the rear turn signal bulbs, follow the procedure in Section 9 and remove the tail light unit, then lift out the turn signal assembly. Turn the bulbholder anti-clockwise and withdraw it from the assembly (**see illustration**).

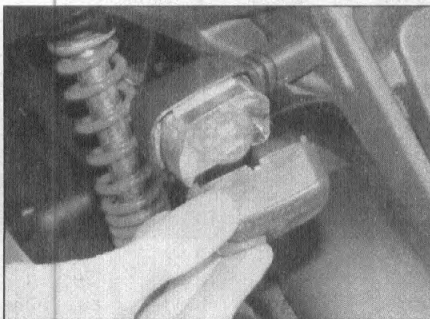
**9** On NRG Power models, to access the front turn signal bulbs, undo the screw securing the turn signal assembly and lift it out, then turn the bulbholder anti-clockwise and withdraw it from the assembly (**see illustrations**). To access the rear turn signal bulbs, carefully lever off the lens using a small, flat-bladed screwdriver, then ease the cover off the bulb (**see illustrations**).

**10** On all GT and LX models, the front and

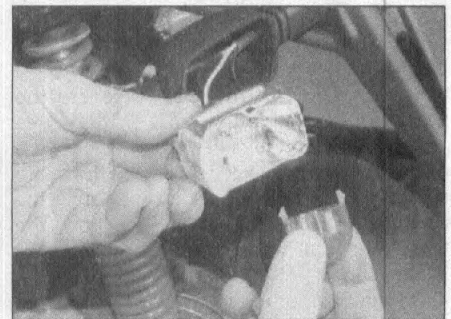
rear turn signal assemblies are each secured by a single screw; undo the screw and lift out the assembly, then turn the bulbholder anti-

clockwise and withdraw it from the assembly (**see illustrations**).

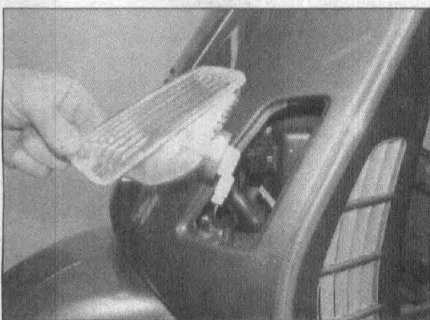
**11** Where appropriate, turn the bulbholder



12.9d . . . noting how it fits . . .



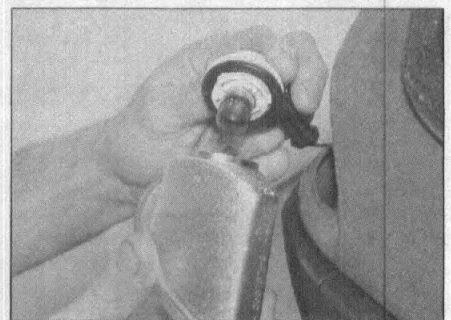
12.9e . . . then release the tabs on the bulb cover



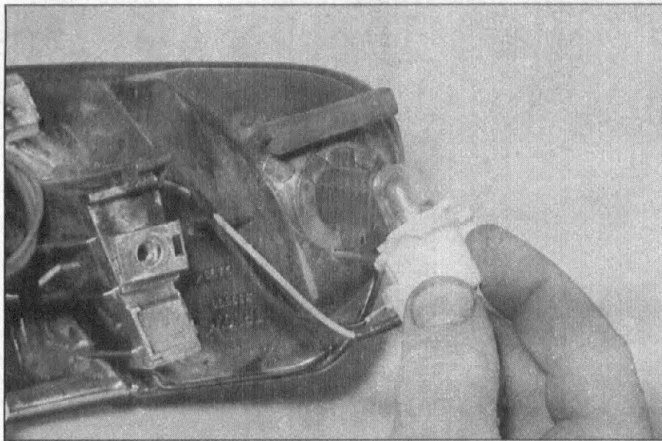
12.10a Removing the front turn signal assembly - GT models



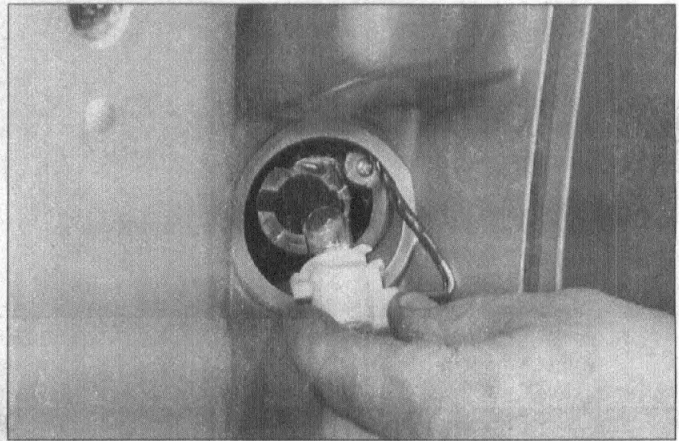
12.10b On LX models remove the screw (arrowed) . . .



12.10c . . . then turn the bulbholder anti-clockwise to remove it



12.11a Removing the front turn signal bulbholder – Hexagon



12.11b Removing the front turn signal bulbholder – ET2 and ET4

anti-clockwise and withdraw it from the lens (see illustrations).

12 Push the bulb into the turn signal or bulbholder and twist it anti-clockwise to remove it (see illustration). Check the socket terminals for corrosion and clean them if necessary. Line up the pins of the new bulb with the slots in the socket, then push the bulb in and turn it clockwise until it locks into place.

13 Installation is the reverse of removal.

**13 Turn signal assemblies – removal and installation**



**Removal**

1 On models where the turn signals are integral with either the headlight or tail light, refer to Section 8 or 10 as appropriate for removal of those assemblies. If applicable, separate the front turn signals from the headlight unit, noting how they fit.

2 On models with separate turn signals, follow the procedure in Section 12 for accessing the bulb, then remove the screw securing the bulbholder if necessary and/or disconnect the wiring connector. On X9 models, the front turn signals are separate units secured in the front panel. Follow the procedure in Chapter 7 to

remove the panel, then undo the screw securing the unit and remove it.

**Installation**

3 Installation is the reverse of removal.

**14 Brake light switches – check and renewal**



**Circuit check**

**Note:** On some later models, the brake switch is part of the safety circuit which prevents the engine from starting unless the side stand is up and the brake lever is pulled in. If the starter circuit is faulty, follow the procedure in Steps 2 and 3 to check the switch. If the switch is good, check the starter circuit relay (Section 25) and other components in the starter circuit as described in the relevant Sections of this Chapter. If all components are good, check the wiring between the various components (see wiring diagrams at the end of this Chapter).

1 Before checking any electrical circuit, check the bulb (see Section 9) and fuse (see Section 5).

2 Remove the front handlebar covers (see Chapter 7) and disconnect the wiring connectors from the switch (see illustration). Using a continuity tester, connect a probe to

each terminal. With the brake lever at rest, there should be no continuity. Pull the brake lever in – there should now be continuity. If not, renew the switch.

3 If continuity is shown with the lever pulled in, the switch is functioning correctly and the fault must lie elsewhere in the circuit. Using a multi-meter or test light connected to a good earth, check for voltage at the brake light switch wiring connectors with the ignition ON (one of them should show battery voltage). If there's no voltage present, check the wire between the switch and the ignition switch (see the wiring diagrams at the end of this Chapter).

4 If both continuity and voltage are obtained, the switch and its power supply are proved good. Go on to check the wiring between the switch and the brake light bulb (see the wiring diagrams at the end of this Chapter).

**Switch renewal**

5 The switches are mounted in the brake lever brackets. Remove the handlebar covers (see Chapter 7), then disconnect the wiring connectors from the switch (see illustration 14.2). Using pliers on the knurled section of the switch, unscrew it from the lever bracket.

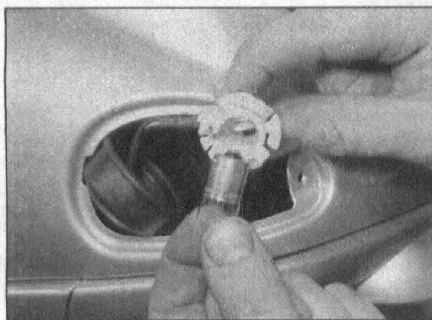
6 Installation is the reverse of removal. The switch isn't adjustable.

**15 Instrument cluster – check, removal and installation**

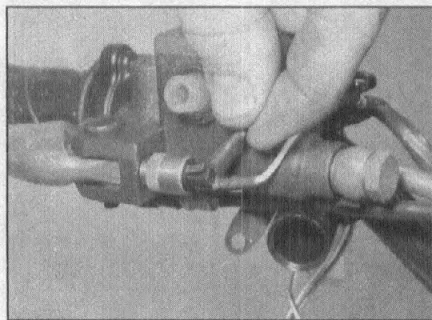


**Check**

1 Special instruments are required to properly check the operation of the speedometer. If it is believed to be faulty, take the scooter to a Piaggio dealer for assessment, although check first that the drive cable is not broken. Refer to Section 18 to check the fuel gauge. Individual components are not available, so if an instrument is faulty, the entire cluster must be renewed.

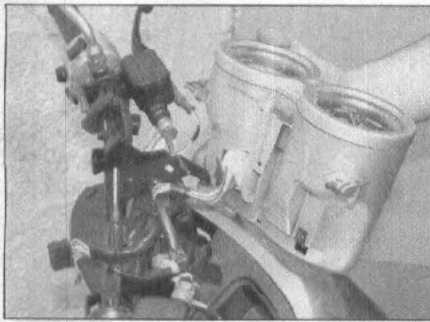


12.12 Push the bulb in and twist it anti-clockwise to release it

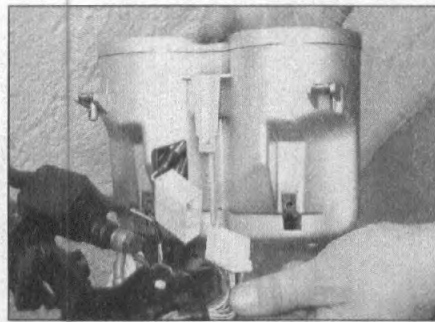


14.2 Disconnect the wiring connectors from the brake light switch

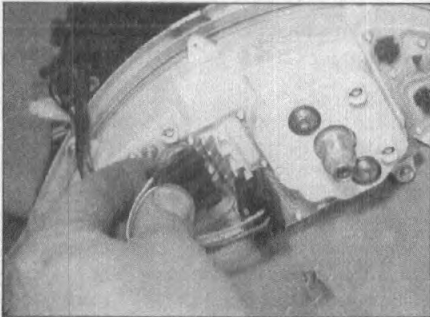




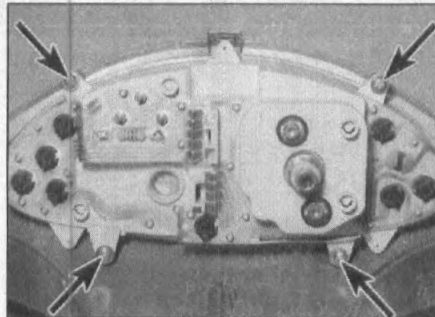
15.3a On B125 models, lift off the instrument cluster ...



15.3b ... and disconnect the wiring connector



15.4 Disconnect the instrument cluster wiring connectors

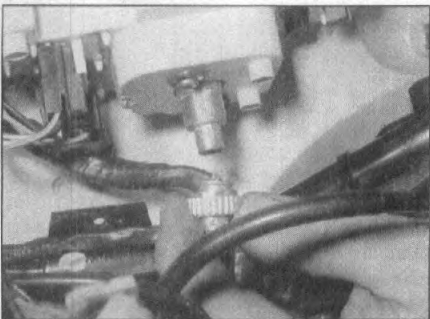


15.5 Remove the screws securing the cluster to the handlebar cover

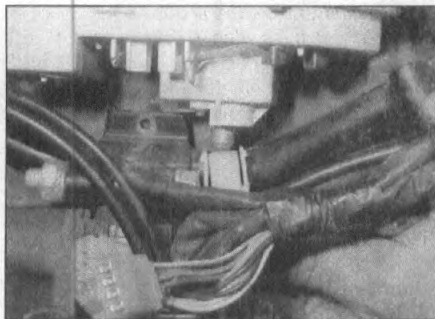
**Removal**

2 Depending on the model, the instrument cluster is secured to the front or rear handlebar cover, the top of the kick

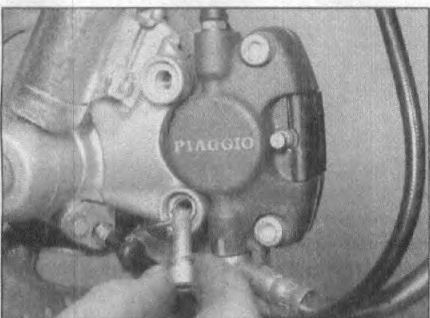
panel (X9) or the cockpit trim panel (X8). Refer to the appropriate section in Chapter 7 and remove the bodywork as required by your model.



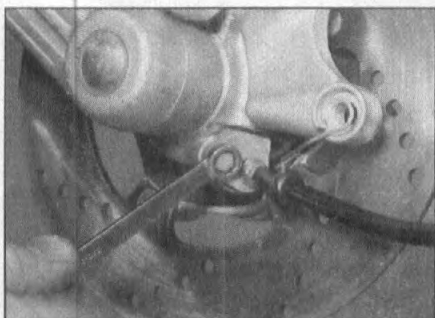
16.2a Unscrew the knurled ring ...



16.2b ... or press in the clips to detach the cable



16.3a Remove the caliper lower mounting bolt ...



16.3b ... then slacken the retaining plate bolt ...

3 On B125 models, the instrument cluster is secured to the handlebars by the front cover screws. Lift off the cluster and disconnect the wiring connector (see illustrations).

4 If not already done, disconnect the instrument cluster wiring connectors (see illustration). Also unscrew the knurled ring or release the clip securing the speedometer cable to the back of the speedometer and detach the cable (see illustrations 16.2a and 16.2b).

5 Remove the screws securing the instrument cluster to the handlebar cover or body panel and carefully lift the cluster away (see illustration).

**Installation**

6 Installation is the reverse of removal. Make sure that the speedometer cable and wiring connectors are correctly routed and secured.

**16 Speedometer cable – renewal**

*Note: Some models are fitted with an electronically-operated speedometer – the 'cable' is a wire connecting the drive housing to the speedometer. Do not try to disconnect the cable from the drive gear housing.*

**Removal**

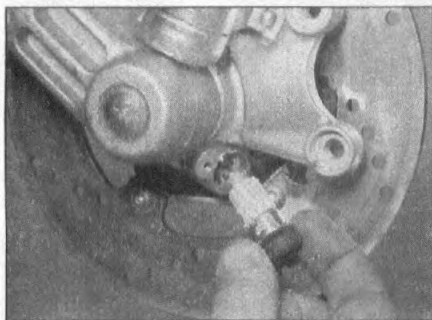
1 Remove the bodywork as required by your scooter to gain access to the underside of the instrument cluster (see Chapter 7).

2 Unscrew the knurled ring or release the clip securing the speedometer cable to the back of the speedometer and detach the cable (see illustrations).

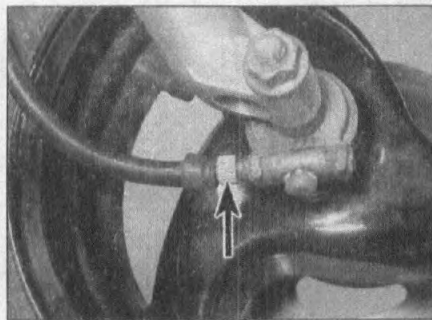
3 On models with monoshock front suspension, first remove the brake caliper lower mounting bolt, which also secures the cable guide, noting the washer behind it (see illustration). Now fully slacken the bolt securing the cable retaining plate, then draw the cable out of the rubber grommet (see illustrations). There is no need to remove the retaining plate unless necessary. If required, remove the plate, then lever out the rubber grommet and withdraw the drive gear for



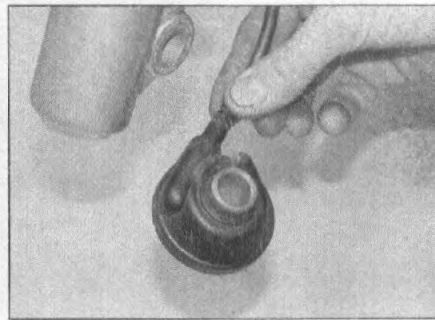
16.3c ... and withdraw the cable



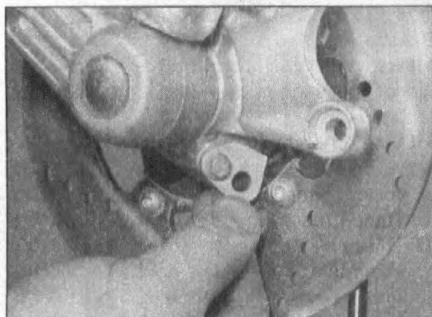
16.3d Remove the drive gear and regrease it



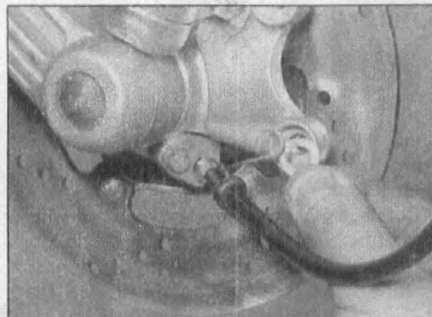
16.4a Draw back the rubber boot and unscrew the knurled ring (arrowed)



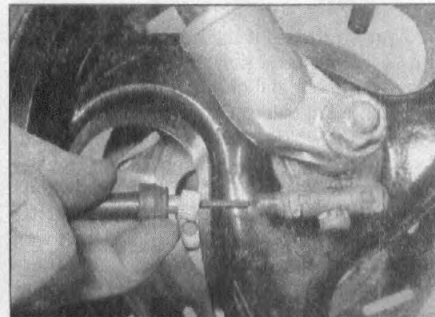
16.4b Drive gear housing for electronically-operated speedometer



16.8a Fit the retaining plate loosely



16.8b Fit the caliper bolt washer behind the cable guide



16.9a Insert the cable and tighten the ring

regreasing (see illustration). Renew the grommet if it is damaged or deteriorated.

4 On models with telescopic forks, pull back the rubber boot on the bottom of the cable, then unscrew the knurled ring and draw the cable out of the housing (see illustration). On models with electronically-operated speedometers do not try to disconnect the cable (see illustration).

5 Withdraw the cable, releasing it from its guides, and remove it from the scooter, noting its correct routing.

### Installation

6 Route the cable up through its guides to the back of the instrument cluster.

7 Connect the cable upper end to the speedometer and tighten the retaining ring or fit the clip (see illustrations 16.2a or 16.2b).

8 On models with monoshock front suspension, if removed, clean and regrease

the drive gear, then install the gear, its collar and the rubber grommet into the housing (see illustration 16.3d). Fit the retaining plate and loosely install the bolt (see illustration). Fit the cable end through the plate and fully into the rubber grommet, then tighten the plate bolt so that the plate compresses the grommet, thereby securing the cable (see illustration 16.3c). Locate the cable guide in the brake caliper lower mounting, then install the caliper bolt, with its washer behind the cable guide, and tighten it to the torque setting specified at the beginning of Chapter 8 (see illustration).

9 On models with telescopic forks, connect the cable lower end to the drive housing and tighten the knurled ring securely (see illustration). Where fitted, remove the cap from the grease point on the underside of the drive housing and press some grease up into it, then refit the cap (see illustrations).

10 Check that the cable doesn't restrict steering movement or interfere with any other components.

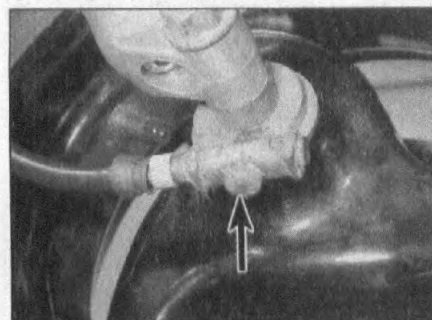
11 Install the bodywork as required by your scooter (see Chapter 7).

### 17 Instrument cluster bulbs and clock battery – renewal

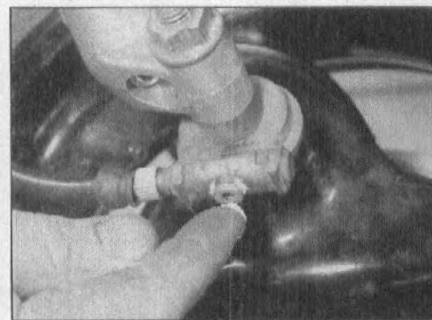


1 Remove the bodywork as required by your scooter to gain access to the underside of the instrument cluster (see Chapter 7). **Note:** Access to some bulbholders is restricted and it may be necessary to displace or remove the instrument cluster (see Section 15).

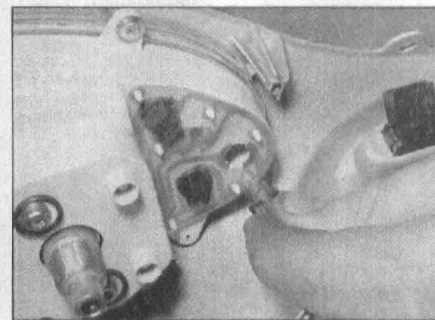
2 Twist the bulbholder anti-clockwise and draw it out of the instrument casing, then pull the bulb out of the bulbholder (see illustration). Check the wattage of the old



16.9b Remove the cap (arrowed) . . .

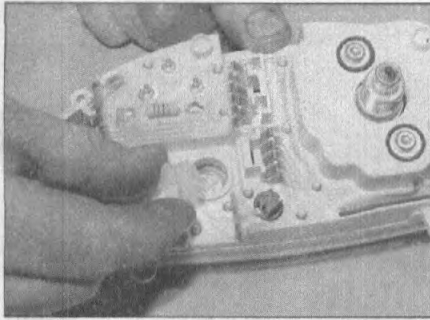


16.9c . . . and press some grease up into the housing

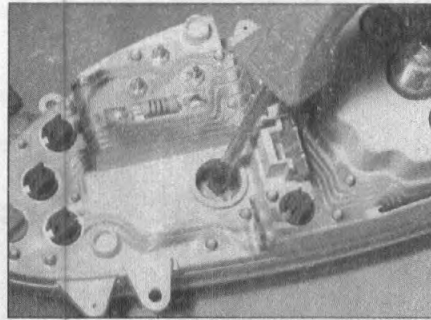


17.2 Twist the bulbholder anti-clockwise and draw it out of the casing

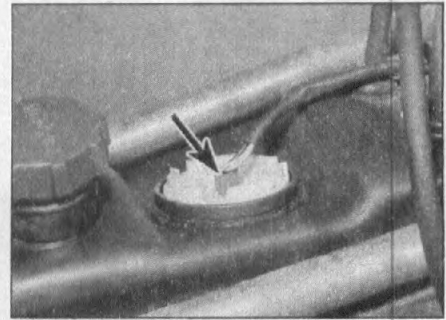




17.3a Remove the plug . . .



17.3b . . . and the cap to access the clock battery



18.1a Fuel level sender wiring connector (arrowed) – Hexagon

bulb and make sure that you fit a new one of the same wattage. If the socket contacts are dirty or corroded, scrape them clean and spray with electrical contact cleaner before a new bulb is installed. Carefully push the new bulb into the holder and install the handlebar cover.

**3** Where a clock is fitted, the battery is secured in the back of the instrument cluster by a cap. Remove the plastic plug, then turn the cap anti-clockwise using a screwdriver and remove the cap and the battery, noting which way up it fits (see illustrations). Fit the new battery, making sure it is the correct way up, then refit the cap.

### 18 Fuel gauge and level sender, and low level warning circuit – check and renewal



**Warning: Petrol (gasoline) is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a fire extinguisher suitable for a class B type fire (flammable liquids) on hand.**

### Fuel gauge

#### Check

**1** Remove the bodywork as required by your model to access the top of the fuel tank (see Chapter 7). Disconnect the wiring connector from the top of the fuel level sender (see illustrations).

**2** Connect a jumper wire between the white/green and black terminals on the wiring loom side of the connector. With the ignition switched ON, the fuel gauge should read FULL. If it doesn't, check the wiring between the connector and the gauge, and check for voltage at the supply terminal on the instrument cluster wiring connector. If the wiring is good and there is voltage at the terminal, then the gauge is confirmed faulty. The supply terminal of the instrument cluster wiring connector can be identified from the wiring diagrams at the end of this Chapter.

#### Removal and installation

**3** The fuel gauge is integral with the instrument cluster, for which no individual parts are available. If the fuel gauge is faulty, the entire cluster must be renewed (see Section 15).

### Fuel level sender

#### Check

**4** If the fuel gauge is confirmed good, the fault may lie in the level sender unit in the fuel tank. Remove the bodywork as required by your

model to access the top of the fuel tank (see Chapter 7).

**5** Disconnect the wiring connector from the top of the sender (see illustrations 18.1a and 18.1b).

**6** Using an ohmmeter set to the ohms x 100 scale, connect its probes to the white/green and black terminals on the sender. Check the resistance reading with the tank empty and full. Piaggio provide no specifications, but when the tank is full, a low resistance reading should be obtained, and when the tank is empty a higher reading should be obtained. Alternatively, remove the sender from the tank (see below) and, with the meter connected as above, manually move the float up and down to emulate the different positions.

**7** If the sender is good, check the wiring between the sender and the gauge (see wiring diagrams at the end of the Chapter).

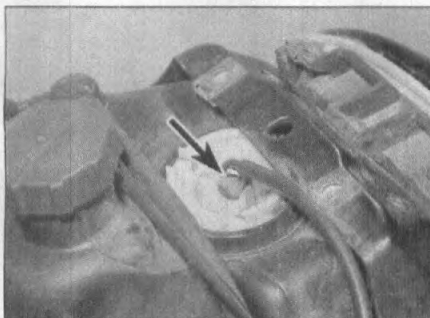
#### Removal and installation

**8** Remove the bodywork as required by your model to access the top of the fuel tank (see Chapter 7). Disconnect the wiring connector from the top of the sender (see illustrations 18.1a and 18.1b), then turn the sender anti-clockwise and withdraw it from the tank, taking care not to bend the float arm (see illustrations). Discard the O-ring, as a new one must be used.

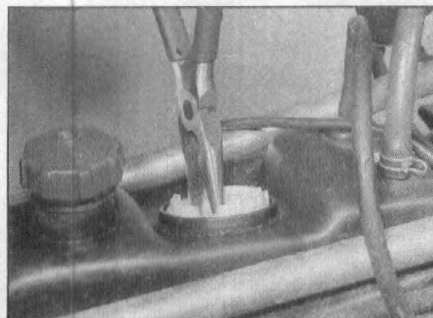
**9** Install the sender by reversing the removal process, using a new O-ring.

### Low level warning circuit check

**10** If the warning light in the instrument



18.1b Fuel level sender wiring connector (arrowed) – Typhoon



18.8a Twist the sender anti-clockwise . . .



18.8b . . . and withdraw it from the tank

cluster fails to come on when the fuel is low, first check the bulb (see Section 17). If the bulb is good, remove the sender (see above).

**11** Using a continuity tester, connect the probes between the yellow/green and black terminals on the sender. Start with the float in the full position, then slowly lower it to the empty position. There should be no continuity until the float nears the empty position, when continuity should be shown. If this is not the case, renew the sender.

**12** If the sender is good, check the wiring between the sender and the instrument cluster (see wiring diagrams at the end of the Chapter).

**19 Oil level warning circuit (two-stroke engines) - check**



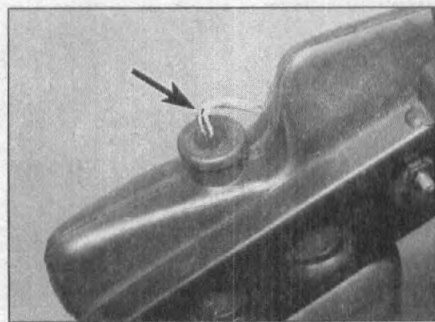
**Note:** The oil level warning circuit is fitted to all models with two-stroke engines (see Model Specifications in Chapter 1).

**1** If the warning light in the instrument cluster fails to come on when the oil is low, first check the bulb (see Section 17). If the bulb is good, remove the bodywork as required by your model to access the top of the oil tank (see Chapter 7). Trace the wiring from the top of the sensor and disconnect it at the connector (see illustration). Withdraw the sensor from the tank (see illustration).

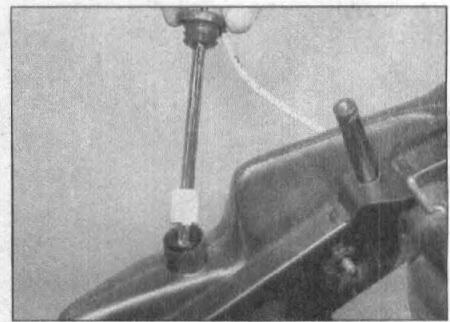
**2** Using a continuity tester, connect the probes between the two wire terminals on the sensor side of the connector. Start with the float in the full position, then slowly lower it to the empty position. There should be no continuity until the float nears the empty position, when continuity should be shown. If this is not the case, renew the sensor.

**3** If the sensor is good, check the wiring between the sensor and the instrument cluster (see wiring diagrams at the end of the Chapter).

**4** The starter motor circuit incorporates a bulb check function, which illuminates the oil level warning light when the starter button is pressed. This ensures that the bulb is sound. The light should extinguish when the starter button is released, unless the oil level is low.



**19.1a** Trace the wiring back from the sensor (arrowed) and disconnect it . . .



**19.1b** . . . then withdraw the sensor from the tank

the ignition (main) switch and disconnect it at the connector.

**2** Using an ohmmeter or a continuity tester, check the continuity of the connector terminal pairs (see the wiring diagrams at the end of this Chapter). Continuity should exist between the connected terminals when the switch is in the indicated position.

**3** If the switch fails any of the tests, renew it.

**Removal**

**4** To remove the electrical section from the back of the switch, pull back the rubber cover, then lift up the spring clip and withdraw the electrical section of the switch, noting how it fits (see illustrations).

**5** Where an immobiliser is fitted, remove the sensor ring from around the front of the switch - it is a clip-fit (see illustration). To remove the barrel of the switch, insert a small

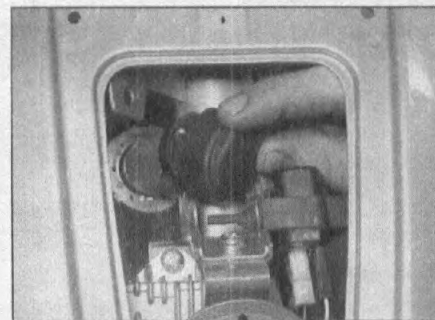
screwdriver into the hole in the housing behind the front of the switch. Push on the retaining tongue with the screwdriver and draw the barrel out of its housing.

**Installation**

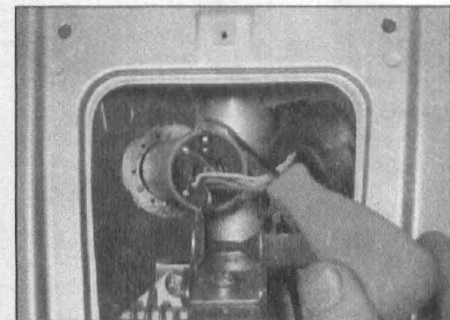
**6** Fit the key into the switch and turn it to the ON position. Offer the switch up to its housing, making sure the anchor tang faces down. Insert the switch about half-way into the housing, then simultaneously turn the key to the OFF position and push the switch fully in until the anchor tang is felt to locate.

**7** Install the electrical section and immobiliser ring (where fitted), making sure the electrical section locates correctly and is secured by the spring clip (see illustrations 20.4a, 20.4b, 20.4c and 20.5).

**8** Reconnect the battery negative (-ve) lead once all electrical connections have been made to the switch.



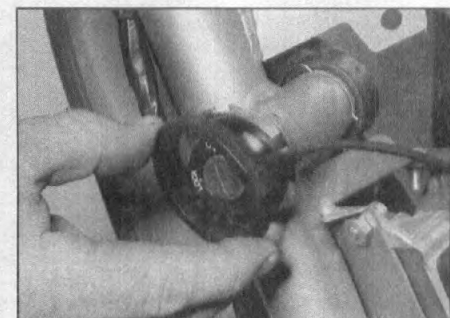
**20.4a** Pull off the rubber cover . . .



**20.4b** . . . then lift up the clip . . .



**20.4c** . . . and withdraw the electrical section



**20.5** Where fitted, unclip the immobiliser ring

**20 Ignition (main) switch - check, removal and installation**



**Warning:** To prevent the risk of short circuits, disconnect the battery negative (-ve) lead before making any ignition (main) switch checks.

**Check**

**1** Remove the front panel and kick panel and, on ET2 and ET4, the grille in the front panel (see Chapter 7). Trace the wiring back from